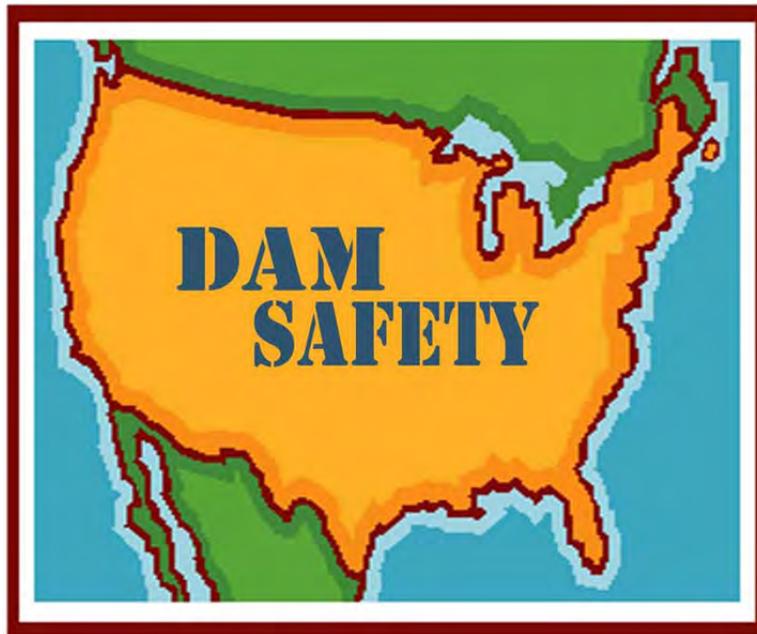


The National Dam Safety Program

Model State Dam Safety Program

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INTRODUCTION

The Association of State Dam Safety Officials' mission is to advance and improve the safety of dams by supporting the dam safety community and state dam safety programs, raising awareness of dam safety issues, facilitating cooperation, providing a forum for the exchange of information, representing dam safety interests before governments, providing outreach programs, and creating a unified community of dam safety advocates.

Goals:

- Goal #1: Improve the efficiency and effectiveness of state dam safety programs.
- Goal #2: Raise awareness of dam safety among the general public, media, state and federal governments, and other stakeholders.
- Goal #3: Facilitate interorganizational, intergovernmental and interstate cooperation.
- Goal #4: Provide the professional dam safety community with forums for the exchange of information
- Goal #5: Provide representation of dam safety interests before state legislatures, Congress and executive branches,
- Goal #6: Provide quality and effective outreach programs.
- Goal #7: Create a unified community of dam safety advocates through membership in ASDSO.
- Goal #8: Manage the association effectively through internal policies and procedures.

There is great variance in the effectiveness of the existing state dam safety programs. Some of this variance may be appropriate as each state must address its dam safety needs and responsibilities in its own way. Some state programs, however, are not considered to be adequate. Also many unsafe dams have been identified and the required remedial action has not been implemented.

In an effort to create a guide for state officials initiating or improving state programs, this "Model State Dam Safety Program" was developed originally in 1987, amended in 1997 and now updated in 2006 to reflect the experience of state programs. It is meant to outline the key components of an effective dam safety program. It does not mirror any particular state program nor does it supplant any state's existing criteria. It is hoped that it will give guidance in the development of more effective and sustainable state programs that will ultimately eliminate the unnecessary risks created by unsafe dams.

Recent enactment of the National Dam Safety Act (NDSPA) by Congress provides the opportunity for states to apply for financial assistance. The Model can provide many areas for states to request improvement of programs under the NDSPA.

The use of several key words and concepts should be addressed to clarify the intent of the Model. The words and associated concepts include:

- "Shall," "will," or "must" mean that no option in accomplishment of that item is intended for an agency or person;
- "Should" means that the accomplishment of the item is optional and strongly recommended for the agency or person; and
- "May" means that the accomplishment of the item is optional and permission to accomplish it is granted by statute or regulation.

Each state should tailor the "shall," "should," and "may" concepts according to their own circumstances or specific dams.

Appendices are provided in the Model as reference materials and as examples for the state programs. Case studies from various states, where appropriate and available, are included as specific examples.

Each state must determine which elements of this model document are appropriate for its current program.

CHAPTER I - LEGISLATION AND REGULATIONS

The foundation of any state dam safety program is the legislative authority and accompanying administrative regulations that give substance to the statutes. As such, the drafting of legislation and regulations is a critical first step in developing a strong dam safety program. Great care must be taken to include the necessary authority while avoiding the inappropriate verbiage that will direct the program away from its intended course. The authority for dam safety must be provided within a single agency to provide consistent oversight.

Some states prefer to detail specific program requirements within the statute. This approach gives the program the “weight of law.” Other states prefer to keep the authorizing legislation simple and supplement the program specifics with administrative rules and regulations. This approach provides more flexibility. In either case, certain items must be included in the authorizing statutes and/or administrative regulations to create an effective dam safety program.

Appendix A is a “Model State Law.” This model uses the detailed statute approach to establish an effective regulatory program. It provides a specific statutory guide for a state program. Corresponding Model Law sections are referenced below.

I. Legislation

Legislation must be enacted that provides state dam safety programs with comprehensive statutory authority and sufficient appropriations to regulate the design, construction, reconstruction, modification, breach, removal*, abandonment*, inspection, operation, monitoring and maintenance of any dam* determined to have a potential to cause loss of human life, economic loss (including property damage), and lifeline disruption;

The following specific items must be included:

- A. Authority to define those dams within state jurisdiction. [see Appendix A, section 1009];
- B. Authority and duty to adopt rules and regulations and establish standards. [see Appendix A, section 4410];
- C. Authority to require that the design of initial construction, reconstruction, enlargement, alteration, repair, operation, abandonment, breach, or removal of dams and supervision of construction be in the charge of an engineer* [see Appendix A, section 2030];

* See Glossary for definition.

- D. Authority to require that a permit or application approval* be obtained in writing prior to the start of any activity involving the construction, reconstruction, enlargement, alteration, modification, breach, removal, abandonment, repair and operation of a structure. [see Appendix A, section 5110 and section 5210];
- E. Authority to approve/deny the impoundment of water. [see Appendix A, Article 7200];
- F. Authority to inspect dams during construction and periodically during the life of the structure. This includes necessary authority for agency personnel to enter private lands. [see Appendix A, section 4160, section 7610 and section 8130];
- G. Authority to order repairs of a dam or modifications to a dam's operation to assure the dam's safety. [see Appendix A, sections 4170, 8130, and 10150];
- H. Authority to take such corrective action as required to carry out the purposes of the statute. [see Appendix A, section 4310];
- I. Authority to take emergency* action. [see Appendix A, sections 8210, 8220, 8230, and 8240];
- J. Penalties for non-compliance. [see Appendix A, chapter 9000];
- K. A liability disclaimer for the state and the agencies' personnel. [see Appendix A, section 2040];
- L. Responsibility for implementation of the statutory authority should be placed with one agency. [see Appendix A, section 4120];
- M. Authority to require the owner to:
 - 1. Fully comply with all state laws and regulations. [see Appendix A, Article 4300];
 - 2. Monitor, [see Appendix A, section 8120 and section 8210] operate or maintain [see Appendix A, section 8110] the dam in a safe condition and make required repairs in accordance with the regulations [see Appendix A, section 4130], terms and conditions of permits or approved applications [see Appendix A, section 5210], approved operating plans and orders of the agency issued pursuant to the statute. [see Appendix A, section 8120];

* See Glossary for definition.

3. Conduct periodic inspections [see Appendix A, section 8120] and analyses [see Appendix A, section 8130] as may reasonably be required by the agency, considering the size and hazard potential* of the dam. In addition, as required by the agency, submit certified reports on the condition of the dam to the agency, provided, that, the agency may accept reports of equivalent inspections prepared by governmental agencies. [see Appendix A, section 8120];
 4. Immediately notify the state agencies and responsible authorities in downstream communities of any condition which threatens the safety of the dam, and take all necessary actions to protect against loss of human life, economic loss (including property damage), and lifeline disruption, including any action required under an emergency action plan or agency order issued pursuant to the statute. [see Appendix A, section 4140 and section 8210]; and
 5. Retain records.
- N. Authority to establish fee structures that may include application review, and inspection of dams or annual registration fees [see Appendix A, Chapter 6000]; and
- O. Authority to require proof of financial responsibility. [See Appendix A, section 4410].

II. Regulations

The purpose of administrative rules is to establish the specific standards and criteria to be used within a state's dam safety program. In developing such regulations (rules), consideration should be given to the following items:

- A. The statutory authority for adopting rules and regulations;
- B. Definition of terms;
- C. Purposes of regulations;
 1. Provide for the comprehensive regulation and supervision of dams determined to have a potential effect upon loss of human life, economic loss (including property damage), and lifeline disruption; and
 2. Assure proper planning, design, construction, reconstruction, enlargement, repair, alteration, breach, removal, abandonment,

operation, maintenance, monitoring and supervision of dams, including such preventive measures as are necessary to provide an adequate margin of safety.

D. Scope of jurisdiction;

Jurisdiction shall be established by one or more of the following criteria:

1. Height of dam;
2. Maximum storage capacity; and
3. Hazard potential classification.

E. Classification criteria;

1. Size classification;
2. Hazard Potential Classification; and
3. Purpose.

F. Design criteria;

1. Design criteria specific to the state or region. ASDSO maintains an information clearinghouse for further information regarding specific hydrologic, hydraulic, structural, and geotechnical design criteria; and
2. The regulations should allow the agency to consider a reduced design criteria for any specific dam where it can be demonstrated that such criteria protects against loss of human life, economic loss (including property damage), and lifeline disruption.

G. Permits or application approval requirements for new construction, reconstruction, enlargement, repair, or alteration of dams;

H. Permit or application approval requirements for operation and maintenance of existing dams;

I. Permit or application approval requirements for breach, removal or abandonment of dams;

J. Construction requirements and procedures;

1. Notice in advance of start of work;
2. Approval of personnel for oversight and supervision of construction;

3. Construction reports;
 4. Prior approval by the agency of major changes to approved plans and specifications;
 5. Agency approval to impound water;
 - a. Certification of construction according to approved plans and specifications by the design engineer;
 - b. Submittal of “as built” documents; and
 - c. Submittal of a filling and monitoring schedule by the design engineer.
- K. Requirements for operation and maintenance;
1. Owner's responsibilities - The owner of any dam shall at all times operate and maintain the dam and all appurtenant works* in a safe condition in accordance with all permit or application approval terms and conditions;
 2. Regardless of the date of construction of a dam, it shall be the ongoing duty and financial responsibility of the dam owner to evaluate the safety of the dam and all appurtenant works and to modify the dam in accordance with the permit or application approval requirements (as noted above) to ensure protection against loss of human life, economic loss (including property damage), and lifeline disruption in accordance with changed conditions and current dam safety criteria;
 3. The owner of any dam shall immediately take such steps as the agency may prescribe to protect against loss of human life, economic loss (including property damage), and lifeline disruption; and
 4. The owner of any dam shall follow the method and schedule of operation of the dam, any plan for permanent monitoring of instrumentation in the dam, the emergency action plan, and the operation plan approved by the agency.
- L. Requirements for inspection by owners;
1. Requirement for owners to submit periodic inspection reports to the agency. These reports are to be prepared by an engineer. The agency

* See Glossary for definition.

will set the frequency of owner inspections based on dam size and hazard classification;

2. Requirement that owners shall retain records of their inspections, including records of actions taken to correct conditions found in such inspections. Copies of such records shall be provided to the agency; and
 3. Acceptance of reports of equivalent inspections conducted and prepared by governmental agencies (e.g., reports prepared for/or by the Federal Energy Regulatory Commission (FERC), the Natural Resources Conservation Service (NRCS), etc.), in lieu of inspections conducted by the owner. Also, the agency may accept equivalent inspection reports certified by the owner and submitted to other governmental agencies (e.g., reports to the Mine Safety and Health Administration (MSHA), etc.).
- M. Requirements for emergency action procedures. Adopted regulations should generally address what is required of the dam owner. Additional recommendations regarding emergency response for a model state program and what should be included in an Emergency Action Plan are covered in Chapter V. Example emergency action plans are included in Appendix E. What should be addressed in regulations is listed below:
1. All owners of high and significant hazard potential dams shall prepare, update, and periodically test an Emergency Action Plan. The plan must be coordinated with the local emergency services agency and be approved by the state agency. The detail and extent of the plan may vary in accordance with the dam's hazard potential classification;
 2. The owner shall provide for the immediate notification of emergency response agencies, any persons who may be endangered if the dam should fail and the state dam safety agency of any condition which threatens the safety of the dam or downstream areas; and
 3. The owner shall take all necessary actions during an emergency to protect against loss of human life, economic loss (including property damage), and lifeline disruption.
- N. Enforcement procedures;
1. Administrative actions;
 2. Judicial actions;
 3. Penalties;

4. Appeals; and
 5. Emergency Action.
- O. Fee Structures;
1. Fee structure for application/permit review. [see Appendix A - chapter 6000, Appendix B and Appendix K]; and
 2. Fee structure for inspection of dams by the state agencies' dam safety personnel and/or annual registration fee. [see Appendix A - Article 6200, Appendix B and Appendix K];
- P. Owner Financial Responsibility.
1. Authority for the agency to require, by regulation, that the permittee demonstrate proof of financial responsibility or surety assuring the proper construction, operation, maintenance and termination of any dam project which may present a substantial risk to human life, or cause economic loss (including property damage), or lifeline disruption. [see Appendix A, section 4410 F].

III. Policies and Procedures

The agency should develop policies and procedures for the implementation of the program. A detailed review and re-evaluation of the policies and procedures should be conducted every 5 years. The review should evaluate the design hydrology, hydraulics, structural, stability, and construction practices with current "State of the Practice" procedures.

CHAPTER II - PERMITTING/APPROVAL OF PLANS/AUTHORIZATION TO IMPOUND

Every state must have the authority to regulate activities that affect the safety of dams*. Authority to regulate these activities must be available through permitting, application approval, written approval of plans, certification of work, or other regulatory procedures. For convenience, within this chapter all these regulatory activities will be simply identified as “permitting.”

Many activities exist for which a dam permit is required. The information that should be included in the application for a permit varies with the type of proposed activity and the size and hazard potential of the structure in question.

This chapter discusses four basic topics. They are:

- activities that require a permit
- information to be included with the permit application
- procedures for permit application review
- grounds and procedures for permit revocation

Appendix B is a listing of typical requirements that can be included in the permit requirement section of administrative rules.

I. Activities that Require a Permit

Any activity related to the safety of dams within the jurisdiction of the legislation/regulations as established in Chapter I must be permitted prior to the start of that activity. Activities that commonly fall within this category include the following:

- construction of a new dam;
- reconstruction of an existing dam;
- enlargement* of an existing dam;
- modification or alteration* of an existing dam;
- repair* of an existing dam;
- removal* of an existing dam;

- abandonment* of an existing dam;
- operation and maintenance of an existing dam;
- impoundment of water; and
- change of ownership.

II. Information to be Included In a Permit Application

- A. For new construction, reconstruction, or modification of an existing dam, the following minimum items must be required and approved prior to the initiation of the construction:
1. Construction plans and specifications prepared by a engineer*;
 2. Hazard potential identification;
 3. Statement of ownership;
 4. Hydrologic and hydraulic design computations;
 5. Structural design computations;
 6. Geotechnical data and design computations;
 7. Instrumentation plan.
 8. Operation Plan;
 - a. During construction; and
 - b. Life of structure.
 9. Maintenance plan;
 10. Emergency action plan;
 11. Agreement to submit as-built plans certified by the design engineer;
and
 12. Statement of financial capability/performance bond in accordance with statute and regulations.

B. The Repair of Existing Dams;

The repair of existing dams must be coordinated with and approved by the state agency*. The current condition of the dam, the type of repair, and the proposed means to achieve the repair all dictate the timing and detail of review needed. Minor maintenance work should be included in the approval of the original maintenance plan. Emergency repairs will need to be addressed on a case by case basis. Pre-planned, major repairs must be reviewed and approved prior to the initiation of the activity. Information as required in II-A above shall be substituted for the repair of an existing dam as necessary. In all cases, as-built records of the completed repair should be maintained by the owner and the state agency. All construction plans and specifications must be prepared by an engineer.

C. Removal or Abandonment of an Existing Dam; and

The following items shall be required and approved prior to the initiation of the removal or abandonment of a dam:

1. Method of dewatering, including testing for environmentally sensitive discharges;
2. Method of breaching* or abandonment;
3. Means to control erosion at the site during and after the breach;
4. Means to control sediment transport from the reservoir*, including testing and control of environmentally sensitive material. Means to maintain breach area, upstream and downstream channel, and reservoir bed after the breach;
5. Time schedule and sequence of construction;
6. Requirement to submit as-built plans; and
7. Evaluation and remapping of downstream flood areas (Flood Insurance Rate Maps - FIRM), if necessary.

All construction plans and specifications must be prepared by an engineer.

- D. Details of the construction inspection program must be provided for demonstrating an adequate and qualified force for inspection of construction reconstruction, enlargement, repair, alteration, removal, maintenance, operation or abandonment of dams. The regulatory agency must not accept quality control inspection by the contractor.

III. Other Permitting Activities

A. Change in ownership;

Before transfer of ownership, the current owner must notify the agency of the proposed change in ownership in writing. Permits issued under dam safety regulations should be transferred or reissued to the new owner.

B. Operation and Maintenance of Existing Dams;

The proper operation and maintenance of existing dams not requiring modification is critical to their short and long term safety. For dams in this category, the following items must be required and approved:

1. A detailed maintenance plan;
2. A detailed operation plan;
3. An emergency action plan; and
4. Statement of financial capability.

C. Impoundment of Water;

1. Upon finding by the agency that a dam and reservoir area is acceptable to impound water, written permission to fill the reservoir must be required. The following items shall be submitted and approved:
 - a. Owner's written request for agency final construction inspection;
 - b. The design engineer's certification of compliance with approved plans and specifications;
 - c. As-built plans; and
 - d. Filling and monitoring schedule prepared by the design engineer.
2. Upon receipt and review of this material, final inspection by agency personnel shall be completed and the authorization to fill decision made by the agency.

IV. Procedures for Permit Application Review

Administrative review procedures will vary from state to state. The agency should familiarize itself with any necessary requirements with respect to public

participation and the program should address those requirements. Consideration of inter-agency review of all permit applications should also be given.

Upon receipt and approval of a complete application for permit and the resolution of all appropriate objections, a permit for construction, modification, operation, and maintenance should be issued. If an application for permit is not consistent with the requirements, the application should be denied with a listing of the reasons for denial.

V. Permit Revocation

If the conditions of a permit are not adhered to, compliance enforcement must be pursued (see Chapter IV). If compliance cannot be achieved, the permit must be revoked and enforcement should be pursued.

CHAPTER III – INSPECTIONS AND SAFETY EVALUATIONS

Inspection activities provide the basis for dam* inventories, evaluation of downstream hazards and hazard potential classification, correlation of approved construction plans with actual construction, safety evaluation of existing dams, and emergency* response planning and execution. Adequate inspection of a dam and the documentation of such inspections are necessary before enforcement can be taken.

This chapter contains a discussion of issues related to implementing a program of periodic inspections and safety evaluations. It also makes suggestions for improving existing programs.

I. Considerations for Implementing an Inspection Program

A. Staff;

Specific aspects of personnel qualifications and staffing levels can be found in Chapter VI and Appendix I. Some of the considerations in determining these qualifications and staffing levels for an inspection program include:

1. The initial task of the inspection program must be to identify, classify and evaluate the existing dams in the state. The hazard potential classification for the dams located will need to be determined during the initial inspection of all the dams in the state. An adequate number of inspectors to accomplish this task will be necessary; and
2. Inspection frequency of existing dams must be decided. Geographical areas define whether a central inspection office or a regional office approach is desirable. If inspection frequency is not set by law, annual inspections of high hazard potential dams, biennial inspections of significant hazard potential dams* and inspection of low hazard potential dams every five years are recommended. An adequate number of qualified inspectors must be available for inspections and associated enforcement work after the initial inventory is completed. Average time for inspection of permitted/approved dams including travel time, on-site inspection time, and report writing may be as much as four (4) person days for high hazard potential dams, three (3) person days for significant hazard potential dams, and two (2) person days for low hazard potential dams. A detailed inspection, analysis and evaluation of a dam with production of a detailed report may take two person-months or more. This inspection time may vary on proximity

and types of dams, etc. It is recommended that at least one engineer and one inspector comprise each inspection team both initially and with subsequent inspections.

B. Equipment;

See Chapter VI for a list of basic inspection equipment.

C. Training;

See Chapter VII for required training.

D. Periodic Inspection Standards;

To help ensure quality and consistency among inspectors, the State should develop standards, and require the use of standard inspection checklists and report formats (Appendix C contains example inspection checklists). Additional inspection form examples may be found in the Compendium of State Dam Safety Inspection Forms compiled by ASDSO or on individual State's websites. Suggested inspection standards are as follows:

1. The engineer conducting the formal periodic inspection shall do all of the following.
 - a. Review all documents, studies, plans, photos, etc. related to the dam and its appurtenances. This shall include a review of the Operation and Maintenance Plan, previous inspections, and the Emergency Action Plan (EAP).
 - b. Provide an assessment of the need for hydrologic, hydraulic, stability and structural calculations and perform them as necessary to provide an accurate assessment of the condition of the dam.
 - c. Evaluate the instrumentation data collected.
 - d. Determine if additional development has occurred within the downstream reach that may change the hazard classification or require amendments or additions to the emergency action plan.
 - e. Provide recommendations regarding the completion of an underwater inspection of relevant portions of the dam and its appurtenances. Underwater inspections are not generally required unless it is the best means to evaluate visual evidence of problems below the water level.

- f. Visually inspect outlet works and conduits if they are of adequate size and can be accomplished in conformance with OSHA's confined space requirements. Video inspection of conduits is an alternative to the visual inspection. Video inspections of conduits are not generally required unless it is the best means to evaluate other evidence of problems in the conduit.
 - g. Prepare an inspection report detailing all visual observations of the embankment, spillway, outlet, appurtenant structures and reservoir conditions at the time of inspection. The report shall include findings, recommendations, and proposed actions.
 - h. Photographs of the dam, showing specific observations or problem areas must be included in the report with site name and date.
 - i. The engineer is expected to provide recommendations for all deficiencies identified, and to direct specific attention to conditions reported in previous reports and corrections required by the dam safety program.
2. The engineer conducting the periodic inspection shall use a standard inspection report form provided by the state, and shall inspect all of the following and other items as necessary:
- a. Embankment, including stability, alignment, and seepage;
 - b. Abutments;
 - c. Concrete Dams and galleries;
 - d. Spillways and outlet works, including alignment, pipe joints, seepage, and the outlet channel (comply with OSHA confined space requirements);
 - e. Intakes;
 - f. Valves and Gates;
 - g. Instrumentation;
 - h. Concrete;
 - i. Mechanical equipment;
 - j. Trash racks;

- k. Emergency spillways;
- l. Reservoir rim;
- m. Penstocks;
- n. Other components and appurtenances.
- o. Observe an exercise of valves, gates and other operating equipment as necessary to demonstrate proper functioning.

E. Documentation;

The inspection provides the basis for enforcement action. Adequate documentation of all inspections is necessary. Documentation will be critical in assessing legal liability;

1. Written documentation of visual inspections shall be filed and provided to dam owners. Inspection reports should detail all visual observations of embankment, spillway, and reservoir conditions at the time of inspection. Any recommendations to, or verbal agreements with, the owner/operator must be documented in the written report to the file. Follow-up letters to the owner/operator should be written without delay;
2. Photographs of the dam, specific observations or problem areas must be filed with site name and date of inspection clearly marked. All digital image files or negatives must be carefully labeled and preserved in anticipation of possible enforcement action;
3. Any conversation by telephone with the owner, owner's agent, consulting engineer, attorney, or concerned citizen must be documented in a telephone log and placed in the project file;
4. Any email correspondence with the owner, owner's agent, consulting engineer, attorney, or concerned citizen must be retained either digitally, or a paper copy placed in the project file;
5. Any conversation on site or in the office with the owner, owner's agent, consulting engineer, attorney, or concerned citizen shall be documented in writing and placed in the project file; and
6. Any legal notice or order must follow all legal requirements of the dam safety statute and legal administrative procedures for the state.

F. Inventory;

The results of the beginning inspection program should be maintained in a computerized inventory, which includes basic information necessary to set priorities and goals. The dam name, owner information, specific geographic location, height, storage, hazard potential classification, general condition, and inspection dates of the dam are suggested for the inventory. This data is also used for updating the National Inventory of Dams (NID). The Corps of Engineers provides the Dam Safety Program Management Tools (DSPMT) software, an inventory and data management tool, to state dam safety programs. States beginning a new inventory should consider using the DSPMT as their database software for its ease of transfer of NID and other program performance data. The locations of inventoried dams must be plotted on US Geological Survey (USGS) topographic maps for future inspections, planning and emergency response (see Appendix H for sample database fields). It is also recommended that the dams in the inventory be spatially located using a GIS application;

G. Construction Inspections;

State inspections during construction provide verification that dams are built in accordance with approved plans and specifications. It might be argued that such inspections are unnecessary when construction sites are overrun with contractor's inspectors, owner's inspectors, and consulting engineer's representatives. In many cases, however, the contractor is disposed to cutting cost and the other on-site inspectors may look to the state for ultimate justification in following the approved plans. Some obvious but often overlooked suggestions for construction inspections include:

1. Certification in writing by the design engineer that the construction or repair* of the dam was in accordance with the approved plans and specifications. This will assure the oversight responsibility for the project;
2. Often the most vulnerable phase in the life of a structure is the construction phase. Cofferdams, diversions, and the main embankment are usually incapable of safely passing floods until sufficient dam height is achieved. An emergency action plan specific to construction activities should be approved prior to starting the project. Inspection teams should ask on-site monitoring personnel to produce copies of the plan and explain emergency procedures;
3. Inspection teams should ensure that construction personnel have copies of the approved plans and specifications, and the state permit or application approval for construction;

4. The entire site must be examined to check conformity with the approved plans and specifications, and applicable safety standards. When site personnel dismiss the need to check particular areas of construction, the inspection teams should make it a point to see these areas;
5. Documentation of inspection including photographs and written inspection reports while on site is extremely important. Legal notices of violation must conform with statutory requirements; and
6. Monitoring of a new dam should be exhaustive during a restricted filling schedule.

H. Owner Responsibilities;

A state inspection program depends on dam owners and/or their consultants to provide complimentary and necessary inspections and surveillance. The dam owner and heirs, successors, or assigns is ultimately responsible for the safety of the dam. The owner is directly responsible for the ongoing operation, maintenance, surveillance, and periodic inspection. The owner shall do all of the following:

1. Provide for on-going surveillance of the dam. The level of surveillance will depend on the size, condition and hazard classification of the dam;
2. Train their personnel in the basics of visual inspection techniques. Any person* employed by the owner who regularly visits or works at the dam should be trained to inspect part or all of the dam and to report any observed problems;
3. Measure or read appropriate instrumentation and record and evaluate the data at specified time frames;
4. Promptly notify the state dam safety program of any unusual observations. Unusual observations may be indications of distress;
5. Inspect the dam and its appurtenances:
 - a. On a regular periodic schedule based on size, condition and consequence of failure, and;
 - b. During and after any unusual loading including, but not limited to, significant storm/runoff events or earthquakes, to determine if structural or operational problems exist;

6. Maintain records for the dam, including but not limited to construction plans and documents, engineering studies, inspection reports, monitoring records, photos, the emergency action plan, and the operation and maintenance manual;
7. Obtain the services of an engineer or have qualified in-house staff to inspect the dam as required by state regulations.

II. Considerations for Implementing an Owner-Responsible Inspection Program

As outlined in Section I, periodic inspections conducted by the state provide an independent and unbiased review of the dam and are the preferred model. Shrinking state budgets and the trend toward privatization of government services have led some states to depend more heavily on inspections conducted by private consulting engineers hired and paid for by the dam owner. These types of programs, referred to here as Owner-Responsible Inspections, have more emphasis on the owner and/or their consultants as the primary source of the review and inspection. The state plays a reduced role for the periodic inspection and review of the dam, but provides direction, enforcement, quality control and policy for consistency. The state shall continue with the responsibilities for construction inspections as outlined in Section I, G.

Either model requires compliment inspections by both owners and states . This section provides guidance on how to develop an owner-responsible inspection program. An owner-responsible inspection program must clearly define the owner's responsibilities for operation, maintenance and inspection of the dam.

A. Owner Responsibilities;

In an owner-responsible program, the owner is responsible for providing in-depth inspections by either an in-house engineer or an engineer hired by the owner. This in-depth inspection is outlined in Section I, parts D and E. The owner continues to retain the tasks outlined in Section I, part H. The engineer conducting the inspections would be required to have the proper equipment and training as referenced in this model. The owner shall use standard report formats and guidelines that are developed by the state to assure consistency among owners.

B. State Responsibilities;

The State should continue to be responsible for the following: Identification of jurisdiction, inventory, assigning hazard classification and developing required frequency of inspections. Recommendations for these issues are outlined in Section I above. The State should also

develop policy, standard forms, and other dam safety standards, and conduct quality assurance as outlined below:

Quality Assurance/Quality Control. As a result of an owner-responsible inspection program, a Quality Assurance/Quality Control (QA/QC) procedure conducted by the state is important to help ensure that formal inspections are being conducted in accordance with the standards. The state should implement the following measures. Recommended staffing needs for QA/QC are presented in Appendix I.

1. The dam owner should be required to sign an annual statement indicating that the dam is being maintained in accordance with the approved maintenance plan and that the emergency action plan, if required, has been exercised and updated as necessary.
2. The state shall have the authority to make inspections and inspect records and manuals.
3. The state program should promptly review all submitted reports and requirements.
4. The state should make independent periodic field inspections of jurisdictional dams to verify the findings of the owner's inspection.
5. The state should require more frequent or follow-up inspections by the owner's engineer if conditions indicate that more frequent inspections are necessary to assure adequate protection of life and property.
6. The state should document deficiencies by letter to the owner with specified time frames for abating the deficiencies consistent with recommendations of the inspection report.

In order to ensure the effectiveness of an owner-responsible inspection program, the state dam safety program should have enforceable regulations related to performance of owner inspections (See Chapter IV).

III. Considerations for Upgrading an Inspection Program

After an inspection program is established, or when the opportunity arises to add to an existing program, advanced inspections and in-depth reviews and evaluations should be conducted. The following areas should be considered for improvement:

- A. Advanced Inventory;

An inventory verification of all dams within state jurisdiction every five years can be an effective tool for determining the overall program status and progress. Inventories should list all pertinent aspects of each dam such as height, storage, and hazard potential classification. Additionally, inventories can list permit or application approval status, inspection priority status, purpose of dam, owner information, enforcement status, and other useful information. Inspection teams must be trained to gather the information necessary from the field including use of global positioning stations to locate dams;

B. Advanced Inspections;

Inspection teams should conduct detailed inspections of dams to evaluate dam performance under normal or unusual site conditions. A detailed inspection of all outlet works should be performed a minimum of every five years. The inspection should include direct visual observation where practical and safe, or by remote cameras where necessary. Advanced inspections should take advantage of all available data such as agency and owners' records of construction, instrumentation records, and operation and maintenance records. Field inspections may include accurate measures of watershed and reservoir conditions, spillway configurations, embankment conditions, downstream hazard potential, or other specific problem areas. Wherever possible, gates and other operating equipment should be exercised to demonstrate proper functioning.

Additional unscheduled inspections should take advantage of unusual site conditions, such as a lowered or drained reservoir, or reservoir levels higher than normal. It may be useful to inspect concrete and masonry dams on a sunny day after heavy ice build-up in the reservoir. Inspections are useful also after record storms, snow melt, and earthquake events.

C. Design Reviews and Evaluations;

The agency should re-evaluate each high hazard dam every five years or when changes in the state of practice occur. This includes in-depth calculations and evaluations of hydrology, hydraulics, structural, stability, earthquake engineering and construction. Where necessary, a reanalysis employing advanced methods and modern design criteria and practices should be conducted in order to determine if the structure meets current design criteria. Specialized engineering software should be used to adequately evaluate each component of the dam for the various loading conditions expected.

D. Advanced Inspection Techniques and Equipment;

State programs may consider the use of advanced equipment either through direct purchase or cooperative agreement with other states.

CHAPTER IV - ENFORCEMENT

In order to ensure that dams* function safely, the regulatory agency* must be able to enforce its dam safety statutes and corresponding regulations quickly, uniformly and fairly. Such enforcement authority may be addressed specifically within the dam safety legislation and regulations, within general state enforcement procedures, or within a combination of these two authorities. Each state's enforcement program will be greatly affected by influences outside the dam safety program if the enforcement authority is not clear, concise and evenly practiced. This chapter will address what is needed in order to accomplish the enforcement task effectively. The following general components are addressed:

- enforceable statutes and regulations;
- authority for inspection and enforcement;
- clearly defined and responsive administrative procedures; and
- appropriate penalties.

I. Enforceable Statutes and Regulations

It is important that the laws that govern dam safety in a state be readily enforceable. To ensure that a state's laws are enforceable, it is recommended that they:

- A. Be clearly written and understandable;
- B. Be logistically plausible. They must not contradict other statutes within that state;
- C. Must include clauses that will allow for penalties in the event of infractions of the law; and
- D. Be constitutionally valid within the state.

The most effective way for these conditions to occur is to assure the fullest involvement of an agency's or state's legal counsel in the drafting and review of proposed statutes. Most state agencies must follow a set procedure within the agency for the drafting and review of legislation originating from within the agency. In the event the legislation does not originate from within the agency, the agency must provide as much technical guidance for the legislation as can be achieved and recommend changes as appropriate. The agency should establish a position on the passage of any piece of legislation affecting the dam safety statutes.

II. Clearly Defined Administrative Procedures

An essential feature of any enforcement program is clear and well defined procedures that is to be followed by the agency and its personnel. Without a clear delineation of responsibilities it is impossible for a state dam safety agency to enforce the statutes of the state. Additionally, there must be a defined appeals process for any person* who is adversely affected by an enforcement action of the state. This process must be conveyed to the affected party at the same time the action is taken. This process is usually set out in the state administrative procedures act.

The following section is organized to describe a possible process for enforcement:

- A. For most state agencies, the enforcement process will actually begin with inspection. Through the inspection process, problems, violations and inadequacies are found, recorded and reported. On-site inspections are the single most important means by which an agency can determine the level of compliance by dam owners in the maintenance and operation of their dam. On-site inspections provide the agency, on a regularly recurring basis, with an opportunity to evaluate the safety of a dam; and
- B. If a problem, violation, or inadequacy is found, a determination must be made whether or not an emergency exists. If the problem, violation, or inadequacy also constitutes an emergency, the emergency situation must be resolved before enforcement procedures begin. A non-emergency problem, violation, or inadequacy should result in a request from the agency for compliance by the owner. If an owner does not comply when requested or when a violation exists, an enforcement order must be issued which could be appealed by the dam owner. If the owner still refuses to comply, legal action must be initiated for compliance. Sometimes, the ultimate resolution to a violation or non-compliance problem is the evacuation of the reservoir and breaching of the dam by the owner or the state.

III. Penalties

Just as there is a set of actions which the state can pursue when a violation is identified, there must be a set of penalties that adequately deter violations. These penalties must be properly and clearly addressed in the dam safety statutes.

In the course of any enforcement program, there will be violations discovered which are of lesser severity than others. It should be expected that many of these violations can be disposed of in ways not involving formal hearings or

litigation, such as consent orders. However, there will also be a certain number of violations which will require a more rigorous enforcement procedure, including the state's attempt to assess civil and/or criminal penalties. These penalties may include incarceration and/or monetary judgments. Any monetary judgment should cover the cost of the enforcement procedure and penalize the owner.

Appendix D includes examples of enforcement procedures.

IV. Emergency Situations

It is imperative that the regulatory agency have clear authority to take emergency actions in life-threatening situations and that those actions remain in force until the emergency is resolved. Emergency actions can include measures for protection of life and property, lowering the reservoir level, and removal* of all or part of the dam and impoundment. Statutory authority should give the state the right to recover any costs for emergency actions from the owner of the dam by legal action in a court of appropriate jurisdiction where the dam is located or where the owner resides.

CHAPTER V - EMERGENCY RESPONSE

The state dam safety program must define the response required in the event of a dam related emergency*. An emergency or operation resulting in downstream flooding will require action by the agency as well as action by the owner and coordination with the state emergency management agency and local officials. This chapter reviews minimum requirements an agency should address and basic considerations for preparing an Emergency Action Plan. Included in Appendix E are guidelines for developing Emergency Action Plans and example Emergency Action Plans.

I. State Program Requirements

Legislation and regulation recommendations as they relate to emergency response are covered in Chapter I. Normally an agency will define the requirements of an owner and the agency's internal policies regarding emergencies. Reaction and responsibilities of local officials regarding evacuation, security, shelter and care will be established by the state and local emergency management agencies.

Suggested State program requirements are summarized below:

- A. Require that owners of high and significant hazard potential* dams prepare, update, and periodically test an Emergency Action Plan;
- B. Require that owners provide for the immediate notification of emergency response agencies, any persons who may be endangered if the dam should fail and the state dam safety agency of any condition which threatens the safety of the dam or downstream areas;
- C. Require that owners take all necessary actions during an emergency to protect life, health, and property; and
- D. Establish an internal emergency response procedure which includes coordination with the state emergency management agency.

II. Basic Considerations for Preparing an Emergency Action Plan

The following basic considerations should be utilized in developing a state program for implementing and monitoring emergency action plans:

- A. Many dam owners will have no concept about how an emergency action plan should be developed. A program will be needed to educate owners about the requirements of emergency action plan development and testing. Example plans should be available for owners and engineers to review;
- B. Each city, county, or district emergency organization is different. Local input and coordination on monitoring, communication, and evacuation procedures is essential to document how such tasks are handled downstream of each dam;
- C. The plan must be kept as simple as possible in both organization and wording. This cannot be accomplished if the plan has lengthy introductions or discussions of authority and scope. Ideally, a novice should be able to read the plan and determine necessary action in the shortest possible time. However, the process of developing an effective emergency action response will require extensive planning and coordination between the state agencies, local agencies and the owner. Training and the performance of EAP exercises is essential to assure timely response and to detect any weakness in the plan. If someone needs to read the plan before taking action, the delay may be critical;
- D. In general, the owner's first priority should be to properly operate and maintain the dam, and to implement required structural upgrades. However, it is important that a good emergency plan be available because a dam may be most vulnerable to failure when it is in need of repair and maintenance. When the dam is in good condition the basic plan can be upgraded to include, as necessary, water level monitors, warning sirens, inundation mapping, etc;
- E. Plans must be updated frequently. A list should be kept of those individuals or agencies that received an initial copy of the plan. They must be provided with all updates. The notification list should be updated as necessary, but not less than once a year. The entire plan should be updated when the required periodic inspection is performed or when the structure is modified. This will help remind the participants of their obligations;
- F. Monitoring and evacuation plans are not a substitute for necessary remedial repairs or upgrades of the dam; and
- G. Each emergency action plan should include seven basic elements. A more detailed description of these elements is provided in Appendix E.
 - 1. Emergency Notification Flowchart and Information. A notification flowchart shows who is to be notified, by whom, and in what priority.

The information on the notification flowchart is needed to ensure the timely notification of persons responsible for taking emergency actions;

2. **Statement of Purpose.** The purpose of an emergency action plan is to provide one method for reduction of the risks to loss of life and to minimize damage due to a dam failure or large spillway release;
3. **Emergency Detection, Evaluation, and Action.** Early detection and evaluation of the situation(s) or triggering event(s) that initiates or requires an emergency action is crucial. The establishment of procedures for reliable and timely action to reduce the risk to life is imperative and should ensure that the appropriate sequence of steps is taken based on the urgency of the situation;
4. **General Responsibilities.** A determination of responsibility for EAP-related tasks must be made during the development of the plan. The EAP must clearly specify the dam owner's responsibilities to ensure effective, timely action, including notification of state and local emergency management officials, should an emergency occur at the dam. The EAP must be site-specific, since conditions at and downstream of all dams are different. Dam owners are responsible for developing, maintaining, and implementing the EAP in coordination with local emergency response agencies. State and local emergency management officials are responsible for warning and evacuation notification of persons. The owner may also be responsible for notification of persons living immediately downstream of the dam when emergency authorities are unable to respond in a timely manner;
5. **Preparedness.** Preparedness actions are taken to moderate or alleviate the effects of a dam failure or operational spillway release and to facilitate response to emergencies;
6. **Inundation Maps.** An inundation map should delineate the areas that would be flooded as a result of a dam failure. An important security issue for the inundation maps is that they not be distributed as public documents. Security concerns dictate that the maps be available only to responsible entities that have a need for the information. The maps may also be developed or used to depict areas that would be flooded by unusually large spillway releases. Inundation maps are used both by the dam owner and emergency management officials to facilitate timely notification and evacuation of areas affected by a dam failure or flood conditions; and
7. **Appendix.** The appendix contains information that supports and supplements the material used in the development and maintenance of the EAP.

Other sources of information on emergency action planning are listed in Appendix E.

CHAPTER VI - PROGRAM STAFFING AND FUNDING

Staffing and funding requirements for a dam safety program depend primarily on the scope of the state's statutory authority and responsibilities. Some typical factors which also affect these needs include the following:

- A. Number, classification and location of dams* subject to state jurisdiction;
- B. Type of inspection program, i.e. inspections by state or by owner's* engineer*;
- C. Geography and topography of the state;
- D. Overall organizational structure of the state; and
- E. Related operation and equipment expenses and requirements.
- F. Population at risk.

As part of their total program budget, some states may also wish to consider financing mechanisms for public and private dam repair and rehabilitation projects. However, for any state dam safety program to be effective and accountable, the basic personnel and funding levels must be sufficient to satisfy the statutory mandates.

This chapter provides information which can be used in determining staffing and funding needs necessary to establish new state dam safety programs or expand existing ones. Areas covered include considerations in determining staffing needs, typical job classifications, budgetary considerations, program funding sources, potential funding resources for repair projects and a staffing level example program exercise to assist in budget preparations. Each state must assess its particular needs on the basis of its own set of legislative, organizational, geographic, and political constraints.

I. Staffing Considerations

For new or expanding programs, it is important to identify all factors which may influence personnel needs. Statutory requirements, including those established by administrative rules and regulations, form the basis for this determination.

- A. Identification and staffing needs:
 - 1. Statutory/administrative requirements. All aspects of the permitting and inspection activities including mandatory application* and plans review periods, enforcement actions, and legal proceedings should be

clearly identified. Requests for technical assistance, resolution of design problems, and preparation of reports often require more staff effort and time than initially projected. Case preparation and conferences with attorneys, depositions, court testimony, and other aspects of litigation should also be addressed in determining staff needs. The program administrator and possibly others in the program will likely have to devote time to personnel and budget issues, administrative paperwork, strategic planning and other issues pertaining to the overall operation of the program;

2. Inspection Requirements. An inspection team is able to inspect only a finite number of dams within a certain period of time. Because of the wide range of state laws and inspection requirements, it is difficult to identify the number of inspections that any inspection team should be expected to perform. The inspection team's degree of experience will also directly influence the capacity for performing inspections. An adequate number of qualified inspectors must be available for inspections and associated enforcement work. Average time for inspection of permitted/approved dams including travel time, on-site inspection time, and report writing may be as much as four (4) person days for high hazard potential dams, three (3) person days for significant hazard potential dams, and two (2) person days for low hazard potential dams. A detailed inspection, analysis and evaluation of a dam with production of a detailed report may take two person-months or more. This inspection time may vary on proximity and types of dams, etc. It is recommended that at least one engineer and one inspector comprise each inspection team both initially and with subsequent inspections.
 3. Logistics. The locations of the dams and the required travel time to and from the inspection sites should be considered. For states of larger geographic area and/or with complex topographic conditions, regional or field offices may be necessary; and
 4. Other staff duties. Administrative and other duties unrelated to the dam safety program will have a direct bearing on staffing requirements. The administrator may be responsible for overseeing other programs. Selected staff members may be required to devote portions of their time to other duties. An expanding staff will place an added burden on experienced supervisory personnel, particularly with respect to the training of new staff;
- B. Organizational structure;

Each state will need to assess and fit the dam safety program into the appropriate agency*/department in its overall organizational structure.

Many states include the dam safety program in water resources agencies. The scope and size of the program as well as the potential need for field offices must be considered in determining the organizational structure. Tables of two possible organizational structures are included in Appendix F;

C. Typical job classifications;

Several job classifications are considered essential to meet the various needs of a dam safety program. Recommended classifications include engineers, geologists, technicians, and other professional, technical, and clerical support staff. Although professional support staff does not necessarily need to be part of the actual program organization, clear and ready access to attorneys, computer specialists, and other professionals is an essential staffing consideration. Also, the importance of clerical and administrative support personnel should not be overlooked in assessing staff needs. These persons will contribute substantially to the program's success and effectiveness. Such job classifications may include, but are not limited to:

1. Engineers (both professional engineers and engineers-in-training). An appropriate mix of experienced and junior engineers will enhance any dam safety program. Applicable engineering disciplines include:
 - a. Water resources (hydrology and hydraulics);
 - b. Geotechnical;
 - c. Structural; and
 - d. Construction;
2. Engineering geologists;
3. Technicians;
 - a. Construction;
 - b. Inspection;
 - c. Surveying; and
 - d. Drafting;
4. Professional support;

- a. Environmental scientists;
 - b. Computer specialists;
 - c. Emergency management planners;
 - d. Soil scientists;
 - e. Remote sensing specialists;
 - f. Attorneys;
 - g. Public Information Officer
5. Clerical and administrative support.
- a. Secretaries; and
 - b. Fiscal/administrative assistants.

II. Program Funding

Funding of a regulatory dam safety program will depend significantly on its statutory requirements. In developing a new program, potential revenue sources for implementation should be analyzed and any necessary funding mechanisms such as fees should be included in the enabling legislation. Principal funding sources for dam safety programs are direct legislative appropriations and various types of fees.

The logistics for submitting an appropriation request to the administration and the legislature will vary from state to state. Usually before an appropriation is made, administrative, fiscal, and legislative entities will scrutinize and determine the need for such an appropriation. As part of the appropriation process, it will be necessary to develop a detailed program budget including appropriate justifications for identified needs. For new or existing programs, several factors must be addressed in determining financial needs and preparing an operating budget. Costs associated with personnel, equipment, facilities, training and education, supplies, and emergency actions are just a few factors which directly influence budget needs. It is important that the program's management and administrative staff be directly involved in the budget preparation to assure that all needs are addressed.

- A. Identification of funding needs; and

- B. A detailed budget should include all operating costs necessary to properly implement and enforce the statutory requirements. For any dam safety program to be effective, the level of funding must match the legal and safety mandates. The following items should be considered in developing a budget:
1. Personnel costs;
 - a. Staff costs (salaries, fringe benefits, etc.);
 - b. Consultant services - Investigations of special problems or third-party opinions may be needed in evaluating safety issues;
 - c. Utilities and rent;
 - d. Computer specialist charges;
 - e. Travel (both in-state and out-of-state); and
 - f. Miscellaneous
 2. Equipment;
 - a. Office equipment, reference books, and maps;
 - b. Four-wheel drive vehicles;
 - c. Field equipment (cameras, video equipment, first aid kits, high power lights, rain gear, global positioning system (GPS) equipment, surveying instruments, measuring devices, etc.);
 - d. Computers, including laptop computers for field work;
 - e. Communication equipment (mobile radios with emergency frequencies, cellular telephones, pagers); and
 - f. Special items (pipe inspection cameras, siphon pipe equipment).
 3. Training and education (publications, seminars, public relations material, etc.);
 - a. Staff;
 - b. Owners; and
 - c. General public.

4. Funding for emergency actions;

As a minimum, a non-lapsing source of easily accessible money should be identified. Some states have a specially designated fund for such actions. The dam safety legislation could require that a portion of civil penalties be earmarked for such a special fund. Some means of recovering the cost of an emergency action from the dam owner should also be provided;

5. General support allocation for umbrella agency.

C. A funding source needs to be identified. As previously indicated, there are two principal funding sources: direct appropriations and fees.

1. Direct appropriations are self-explanatory;

2. Fees;

- a. Application, filing, or permitting fees. These charges are typically made to cover the costs of plan review and approval, construction inspection, and associated aspects of new dam construction, reconstruction or repair. These fees may be charged as a flat rate or as a graduated schedule based on the estimated construction cost;
- b. Certificates of approval to impound*, permit-to-operate, or registration fees. These fees are usually charged on an annual basis for the continued operation of the dam. The fee may be in the form of \$X per dam dependent on hazard potential classification or \$Y per foot of height, acre-foot of storage, or other measurement; and
- c. Inspection fees -These charges are usually imposed to offset the costs of the state's periodic inspection program. The fees may be similar to the ones noted for a certificate of approval to impound or may be for the actual cost of the inspection.

3. Other sources include federal grants, direct assistance, etc.

III. Funding Resources for Repair Projects

Protection of the public from the failure of dams cannot be assured unless deficiencies and unsafe conditions identified through regulatory inspections are properly corrected in a timely manner. Funding of major dam repair and

rehabilitation projects can be a difficult problem in both the public and private sectors.

A large percentage of the high hazard potential dams are owned by federal, state, or local governments. Many high and significant hazard potential private-sector dams are owned by industrial and commercial entities, by homeowners' associations and by private owners. For large and moderate sized dams, repairs can cost in the hundreds of thousands or millions of dollars. Such costs may well exceed the financial capability of almost any governmental unit or private entity.

Infrastructure deterioration and funding problems have gained a great deal of attention throughout the nation (See appendix I).

CHAPTER VII - PROGRAM STAFF AND DAM OWNER - EDUCATION AND TRAINING

Education and training of the agency* staff and the dam owner* are important elements of any program. Newer staff needs training focused on dam safety engineering. Because state-of-the-practice technology for dam* design, construction, and inspection activities is constantly changing, even experienced professional and technical staffs must be continually educated in these new techniques and trained in their use. Various levels and types of education and training can be employed to keep staff personnel up to date in their particular areas of expertise. Likewise, there are different vehicles and resources available for informing the dam owner about the proper techniques of maintenance and operation of their dams.

I. Staff Education and Training Needs

In both new and well-established dam safety programs, it is of paramount importance that professional and technical staff possess the necessary skills to investigate and assess the safety of dams, and manage a dam safety program. For new programs, these are particularly critical considerations. Ideally, a state dam safety program will encourage its staff to improve their skills through pursuit of continuing educational opportunities and advanced degrees, attendance at seminars, short courses and conferences, and participation in professional societies and associations. States are strongly encouraged to provide opportunities as well as funding for staff to enhance their engineering and other skills through ongoing educational efforts.

Education and training can be provided to staff in different forms and through various media. These include:

- on the job training;
- continuing education and graduate-level programs at universities;
- seminars, short courses, workshops, and conferences;
- federal and state dam safety training programs; and
- film and video training sessions.

Often underestimated and overlooked, on-the-job training constitutes the best form of education and training that program staff can receive. Knowledge and expertise shared by experienced engineers* through field and office activities are invaluable to the successful training and professional development of new staff. Program managers are encouraged to develop in-house training sessions which

may include presentations by staff and outside consultants on the hydrologic, hydraulic, geotechnical, and structural engineering aspects of dam safety, emergency actions, legal and enforcement proceedings, and other elements of dam safety practices.

Seminars, short courses, workshops, and conferences are significant sources of information on new and innovative programs and techniques being developed or employed by the public and private sectors. Additionally, conferences provide staff with the opportunities to meet persons in similar positions in other states or agencies and to discuss and share experiences and learn about state-of-the-practice methods. Professional contacts made at these meetings may be useful in helping to resolve future dam safety problems.

There are a variety of organizations that offer training specific to dams or other areas closely related to dam safety. Some of these organizations include Association of State Dam Safety Officials (ASDSO), United States Society of Dams (USSD) and American Society of Civil Engineers (ASCE). Federal agencies such as the U.S. Army Corps of Engineers (COE), Department of Interior - Bureau of Reclamation (BUR), Department of Agriculture, Natural Resources and Conservation Service (NRCS), Mine Safety and Health Administration (MSHA), Federal Energy Regulatory Commission (FERC) and the Federal Emergency Management Agency (FEMA) have also developed training programs and resources which are available to state dam safety personnel. These training opportunities include classroom-type courses, films, and video instructional materials. A listing of available training courses is included in Appendix G.

Topics which must be included in a training program include: hydrology; hydraulics; soil mechanics, including slope stability; seepage analysis; concrete design; geology; emergency action planning, and response; erosion and sedimentation control; field safety; dam security; public relations and computer literacy.

Specific areas of training for a beginning program include:

A. Legal entry;

The legal requirements and limitations of entry to property must be clearly understood by the inspection team. Each inspection team must have a full understanding of the dam safety statute, rules and regulations for dam safety, and legal liability concerns;

B. Records;

The inspection teams must know how and where to obtain existing records of dams. If state files do not have current owner* information, the

inspection team will need to know how to check courthouse records to determine ownership;

C. Field measurement techniques;

The inspection team must know practical methods for determining if the state has jurisdiction over the dam. Location of critical measuring points (such as the downstream toe, or the natural stream bed, or the low point of the crest of the dam) may appear straightforward when reading the law, but may be difficult to locate in the field. Determining dam height, reservoir storage, surface area, hazard potential classification, and other measurements should be demonstrated in the field as part of the training regime;

D. Visual inspection techniques;

The inspection teams must be proficient in hydrology, hydraulics, and slope stability to better evaluate what is routinely seen in the field. Visual inspection of spillway inlet and outlet works, embankment seepage or piping, alignment of structures, vegetation, animal burrows, slumps and slides, and reservoir levels should be covered in training courses;

E. Emergency inspection techniques;

The inspection team must be aware of procedures to be followed in an emergency. Specific agency arrangements for communication, reporting, travel, vehicles, emergency equipment, and coordination with other emergency agencies must be understood. Procedures for determining the freeboard, rate of reservoir rise or fall, amount of overtopping, seriousness of embankment seepage or piping, and criteria for recommending evacuations must be covered. Legal responsibilities of the agency and inspection team must be stressed;

F. Field safety;

The inspection team must be aware of all pertinent safety concerns and procedures including trenching and excavating, confined space, height and water hazard, and plant and animal hazards; and

G. Communications skills and public relations (see Chapter VIII).

II. Education and Training of Dam Owners

Dam owners and operators must be made aware of their state's dam safety laws and regulations, the associated responsibilities and liabilities, and the proper

operation, maintenance and inspection of their dams. Usually, the best education and training for the dam owner is provided through their contacts with the state's dam safety personnel. These individual contacts can be supplemented by publications such as operation and maintenance manuals which describe the owner's various responsibilities. Public awareness workshops and seminars conducted by the state dam safety staff are other effective means for communicating with dam owners.

Many states have already developed and published manuals describing operation, maintenance, inspection, and emergency preparedness and action procedures for use by dam owners and operators. These manuals are intended to be of assistance to the dam owner in becoming familiar with the general principles and features of their dams as well as developing adequate skills of observation and safety inspection. See Appendix G for a list of sample dam owner's manuals.

States should sponsor workshops, seminars, and training sessions which are designed to instruct owners about dams, necessary monitoring, operation, maintenance and inspection procedures, liability, emergency action plans, and financing for rehabilitation. These workshops can be conducted to raise the awareness level of dam owners for a relatively small investment of state resources. ASDSO and FEMA have provided assistance to states in conducting workshops and seminars to instruct dam owners about their liabilities and responsibilities. ASDSO, with support from FEMA, also offers workshops geared specifically to owner education.

CHAPTER VIII, DAM SAFETY PROGRAM, PUBLIC RELATIONS PLAN

I. Introduction

Every government agency needs public relations. The choice is only between good public relations and poor public relations (Starr 1968 and Marshall 1974). Dam safety programs are no exception to this rule.

What is meant by public relations?

By definition, public relations include all of the activities that build good relations with audiences. Public relations attempts to reinforce positive opinions, to increase understanding and support for programs and issues, and to involve the public in the development of policies, programs, and projects.

Administrators of state agencies, although they may recognize the desirability of good public relations, generally make no conscious effort to reach out to the public through a well-planned effort. This is especially true for dam safety programs that perceive themselves as generating media attention only in the case of dam incidents.

In fact, many dam safety activities, such as permit issuance, public hearings, and meetings with dam owners, community representatives and public officials, can be used as public outreach opportunities to promote two-way communications with the agency and the public.

A public relations program will not turn public opinion around overnight. To be effective, public relations must be an on-going and long range effort that involves program staff. In addition, a conscious effort must be made to integrate a public relations effort with year-round planning and operations as outlined in an organization's strategic plan.

The best approach to any public outreach effort is a planned one. A dam safety program benefits from positive and proactive public relations. A carefully developed public relations plan will result in a strategy for making others aware of what the organization is doing, why it is doing it, and why it contributes to the welfare of the community. The plan provides the road map to exchange information, ideas and concerns regarding program issues and activities. Once a plan is developed, materials needed to interest the audience and media should be assembled. A public information officer should be fully involved in the development of materials and implementation of the campaign. All staff of the program should also be trained in the area of public relations.

II. Dam Safety Public Relations Plan

A public relations plan should include the following elements:

A. Objectives;

Setting objectives provides direction to a public relations plan. Long-term objectives for state dam safety programs could include:

1. Promotion of program awareness among the general public, elected officials, and other state and federal organizations;
2. Promotion of program awareness among the regulated community through utilization of ASDSO's "Dam Owner Education Program Workshop"
3. Involvement of the public in the permitting process if public input is a component of the permit decision for a dam; and
4. Development of a public relations contingency/emergency plan in case of dam incident.

Short-term objectives could include:

5. Advertisement of workshops, seminars or hearings to potential attendees; and
6. Release of professional and timely information to the media during and after dam incidents.

B. Target audiences;

Defining the audiences will be a great help in planning activities and evaluating which activities best match both the selected audiences and objectives. Examples of potential target audiences for dam safety communication efforts include:

1. the general public;
2. the media;
3. persons and communities below dams;
4. dam owners;
5. state and local elected officials;

6. government officials;
7. consulting engineers;
8. emergency services officials;
9. federal agencies;

Students and prospective employees

10. other state organizations; and
11. and individuals or groups whose support is necessary for the program's success.

C. Strategies;

Strategies include developing activities and materials to meet the communication objectives for selected audiences.

These activities may include workshops, seminars, conventions, publicity campaigns, and awards programs. Materials that can further the objectives of the program include brochures, fact sheets, displays, slides, media kits, newsletters, questionnaires and news releases. General topic brochures and fact sheets that are related to the safety of dams are available from the Federal Emergency Management Agency and from the Association of State Dam Safety Officials.

D. Timetable;

A timetable lists deadlines that the organization can realistically meet to carry out assignments.

E. Budget;

Budgeting comes down to making choices about where and how the program will spend available money. If a program operates under a tight budget, careful prioritization of public relations objectives will maximize results.

A good way to summarize objectives, audiences and strategies is through the use of a table.

Table I - Sample Dam Safety Public Relations Plan

<u>Objectives</u>	<u>Audiences</u>	<u>Strategies</u>	<u>Timetable</u>	<u>Cost</u>
Raise program Awareness	Elected officials	Hold informational meeting, exhibit dam safety display at legislature Copy elected official regarding specific issues with dams in their district	During legislative session	Budget to develop display and informational materials
Raise program awareness	Media, general public	1) Issue news releases, 2) exhibit display at public events, 3) develop media contacts	1) As needed 2) Conventions, fairs, youth events 3) Ongoing	Funding of public info office, entrance fees, budget for printing, graphic services
Obtain public input to the permit process if public comment affects permit issuance decisions,	Affected public, regulated community, engineering firms	Publish public notices, issue news release, hold public hearings/ meetings	Within specified number of days or as law requires	Budget for newspaper advertisement, public service announcements, meeting rooms.
Provide information about program activities and promote two-way communications	Regulated community, public, elected officials, emergency personnel	Develop Questionnaires & newsletters, hold public meetings about program activities, hold an open house	Short-term: print newsletter; Long-term: solicit feedback, conduct public meetings	Budget for graphic artist, printing, newsletter cost, room and meeting expenses

Be prepared for a dam incident	Media, public, elected officials	The agency's public affairs office should assemble a press kit, develop public relations emergency response action plan that can be coordinated with the public information officer at the site	Short-term: prepare press kit; Long-term: Prepare type and amount of emergency information in advance	Budget to assemble press kit; public announcements
Raise program awareness	Dam owners	Conduct an ASDSO "Dam Owner Education Program Workshop"	As needed	Budget for meeting expenses

III. Developing Informational Materials

Below are a number of recommended materials a dam safety program may develop for a public outreach program.

IV. Brochure

A brochure that outlines a program's purpose, activities, and services is a must for every dam safety organization (See appendix J).

Brochures may be included in press kits; inserted in responses to Freedom of Information Act (FOIA) requests or general correspondence; provided as handouts at hearings or public meetings; placed on display racks at agency offices or public libraries; and passed out at conventions, state fairs and other public events.

Tip: The writing should be brief, descriptive, clear, and free of technical jargon or bureaucratic terminology. Use simple and attractive graphics. The simpler the brochure, the more it will be read.

If more than one brochure is produced, make sure to use similar paper sizes, matching or complementary colors, type faces, and layouts.

V. Webpage

A well designed webpage that is kept current is perhaps one of the most effective methods of presenting useful information on the dam safety program and raising public awareness and status of the program. Most states have a webpage as part of the larger department website. As with printed brochures, the information presented must be accurate, descriptive and clearly written. Many states include information on the program mission and purpose as well as:

- copies of legislation and regulations
- history of the program
- program organization chart
- technical guidelines
- references
- permit application forms
- general emergency action plan information
- dam safety awareness information
- photographs
- grants and loan program information
- current news
- a link to the U.S. Army, Corps of Engineers dam inventory
- frequently asked questions

VI. Fact Sheets

Fact sheets are a way to provide in-depth information on specific issues and to present topics that are subject to frequent questions. Possible topics include dam ownership information, explanation of specific permit issues, classifications

of dams, size of dams, clarification of technical topics, aspects of emergency planning, and the roles of external agencies during emergencies.

VII. Newsletter

A newsletter can improve public understanding and participation in the dam safety program. The publication will serve as a means of direct communication to inform and update audiences regarding organizational developments, regulations, concerns, and goals.

A newsletter can reach dam owners, engineering consultants, emergency services personnel, legislators, media contacts, agency administrators, agency field staff, and other interested persons.

A typical newsletter issue may contain: guidance about procedural matters, applications received, permits issued, construction projects completed, new employee profiles, interesting statistics, question and answer section, recent emergency situation, reprints or synopsis of major changes in regulations, calendar of events, and an ASDSO news corner.

Tip: Develop an attractive design and layout; maintain graphic continuity and provide a few regular features such as a question and answer section. Be aware of the informational needs of the audiences. Publish regularly and maintain an informative style.

VIII. News Release

A basic element of any public information plan is the news release. Program activities that include dedication of new dams, repair of popular dams, new or revised regulations, public comment periods, or awards are newsworthy.

In drafting a news release, stick to the facts, use complete names, write with an emphasis on community benefits and be timely. Be aware of the newspaper's deadlines and write the news release as far in advance of publication day as possible.

A public information officer should work closely with the program in developing and distributing news releases

IX. Display

A display can be an effective and flexible tool to draw attention to a dam safety program. Displays can be set up at trade shows, legislative halls, libraries, and

other public events. Display materials may be found in existing files and materials. For example, if the display is to be set up at a construction-related exhibition, before and after pictures of dam safety construction projects may be found in existing files.

Tip: Decide on the best representative pictures, enlarge to display size and arrange the pictures on the display backdrop. The display arrangement should be uncluttered, easy to see at a distance, and provide simple picture captions.

Consult with a graphic artist or public information specialist to plan the “look” of the display. Once a visitor approaches the display, there should be handouts available including brochures, fact sheets, summaries of the displayed projects (with additional pictures), current and previous issues of the dam safety newsletter, and copies of the press kit for appropriate target individuals. Staff the display booth with people knowledgeable about the dam safety program. Keep approaches to the display open so that free circulation of visitors is possible.

X. Press Kit

Dam Safety administrators should always have materials available that will provide background information to reporters, to an interviewer on a radio talk show, or television story. A press kit can also be used to introduce the program to the legislature and local elected officials.

Materials include: Brochures and fact sheets, an agency’s organizational chart, copies of recent newsletters, photographs of program activities, editorials or any articles that demonstrate the benefits that the program brings to the community. When assembled in a folder, these materials will comprise a Press Kit.

XI. Planning for Incidents

Every Dam Safety program is subject to the possibility of a dam incident. If an incident occurs, an emergency/crisis communication plan can pay dividends by managing critical information quickly and efficiently. An emergency/crisis plan should include:

- A. The general policy should be to disseminate, in coordination with the public information officer at the site, objective and accurate information regarding the incident, and to provide agency officials, press and radio representatives with timely answers to questions;
- B. The plan should consider the probable communications situation and radio or cellular telephone security and procedures. Communications with key personnel on a 24-hour basis may be necessary;

- C. To function effectively, only designated agency officials should take questions and provide answers. The officials must state only established facts without any guessing or speculation;
- D. Press Kits should be available to provide information regarding the dam safety program's operations;
- E. In addition to providing incident information about the immediate situation, the agency should have a qualified person available to persons inquiring about policy or current issues involving the program; and
- F. Shortly after a major emergency incident is resolved, a press conference should be called to summarize the incident and agency actions taken to protect life and property.

If the Dam Safety program plans for incidents during routine times, the transition to an emergency/crisis plan will be much smoother. The result should be an accurate and timely information flow from the agency to the media.

See ASDSO web site for links to example: State web pages; Fact Sheets, Newsletters

XII. References

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GLOSSARY OF TERMS

“Abandonment” means to render a dam non-impounding by dewatering and filling the reservoir created by that dam with solid materials and by diverting the natural drainway around the site.

“Adverse Consequences” means negative impacts that may occur upstream, downstream, or at locations remote from the dam. The primary concerns are loss of human life, economic loss (including property damage), lifeline disruption, and environmental impact.

“Agency” means that agency, department, office, or other unit of state government designated by state law to be responsible for implementation or direction of this Act. (This section to be replaced in enactment of the law by a reference to the state unit created or selected to implement and direct the Act which may be regular state employees or specialists and consultants, including consulting engineering firms or organizations, for any or all of the provisions of this Act. While a single agency with the responsibilities and authorities noted in this model is believed to provide the most direct and consistent oversight for dams, it is recognized that there may be a need to include these dam safety components within the existing governmental organization of several agencies established in individual states.)

“Alterations” or “repairs” means only such alterations or repairs to existing dam and appurtenant structures as may directly affect the safety of the dam or reservoir, as determined by the agency.

“Application Approval” means authorization in writing issued by the agency to an owner who has applied to the agency for permission to construct, reconstruct, enlarge, repair, alter, remove, maintain, operate or abandon a dam and which specifies the conditions or limitations under which work is to be performed by the owner or under which approval is granted.

“Appurtenant works” include, but are not limited to, such structures as spillways, either in the dam or separate there from; the reservoir and its rim; low level outlet works; and water conduits such as tunnels, pipelines or penstocks, either through the dam or its abutments.

“ASDSO” means the Association of State Dam Safety Officials.

“BOR” means the Bureau of Reclamation.

“Breach” means partial removal of a dam, creating a channel through the dam to the original stream bottom elevation.

“Certificate of Approval to Impound” means authorization in writing issued by the agency to an owner who has completed construction, reconstruction, enlargement, repair, or alteration of a dam and which specifies the conditions or limitations under which the dam and reservoir are to be maintained and operated.

“COE” means the U.S. Army Corps of Engineers.

“Dam” means any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or liquid borne materials and which (a) is 25 feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation; or (b) has an impounding capacity at maximum water storage elevation of 50 acre-feet or more.

(a) This definition does not apply to any such barrier which is not in excess of 6 feet in height regardless of storage capacity or which has a storage capacity at maximum water storage elevation not greater than 15 acre feet regardless of height, unless such a barrier, due to its location or other physical characteristics, is classified as a high hazard potential dam.

(b) No obstruction in a canal used to raise or lower water shall be considered a dam.

(c) A fill or structure for highway or railroad used or for any other purpose, which may impound water, may be subject to review by the agency and shall be considered a dam if the criteria in this definition are found applicable.

“Emergency” includes, but is not limited to, breaches and all conditions leading to or causing a breach, overtopping, or any other condition in a dam and its appurtenant structures that may be construed as unsafe or threatening to life or property.

“Engineer” means a qualified professional engineer. The term “qualified professional engineer” as used in this law is intended to mean an individual who has a background in civil engineering and;

(a) Is a licensed engineer;

(b) Is competent in areas related to dam investigation, design, construction, and operation for the type of dam being investigated, designed, constructed or operated;

(c) Has at least ten (10) years of relevant experience in areas such as investigation, design, construction, reconstruction, enlargement, repair, alteration, maintenance, operation, breach, removal or abandonment of dams;

(d) Understands adverse dam incidents, failures and the potential causes and consequences of failures.

“Enlargement” means any change in or addition to an existing dam or reservoir, which raises or may raise the water storage elevation of the water impounded by the dam.

“FEMA” means the Federal Emergency Management Agency.

“FERC” means the Federal Energy Regulatory Commission.

“FOIA” means the Freedom of Information Act.

“Hazard Potential” means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the dam or mis-operation of the dam or appurtenances. The hazard potential classification of a dam does not reflect in any way on the current condition of the dam and its appurtenant structures (e.g., safety, structural integrity, flood routing capacity).

“High Hazard Potential Dam” means a dam assigned the high hazard potential classification where failure or misoperation will probably cause loss of human life.

“Incremental” means under the same conditions (e.g., flood, earthquake, or other event), the difference in impacts that would occur due to failure or misoperation of the dam over those that would have occurred without failure or misoperation of the dam and appurtenances.

“Inspection” means a comprehensive review of the design and performance of a dam and appurtenant structures; site evaluation of dam, appurtenant structures and reservoir area; approval of an emergency action plan, if required; all in accordance with the Training Aids for Dam Safety modules on Safety Inspection of Dams, or equivalent, conducted by or under the supervision of an engineer as defined in the ASDSO Model State Dam Safety Program.

“Inspector” means a person under the direct supervision of an engineer.

“Low Hazard Potential Dam” means a dam assigned the low hazard potential classification where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

“Maximum Storage Capacity” means the reservoir volume measured at the maximum elevation of water surface which can be obtained by the dam or reservoir.

“MSHA” means the Mine Safety and Health Administration.

“NID” means the National Inventory of Dams.

“NPDP” means the National Performance of Dams Program.

“NRCS” means the Natural Resources Conservation Service.

“Owner” includes any of the following who own, control, operate, maintain, manage, or propose to construct, reconstruct, enlarge, repair, alter, remove or abandon a dam or reservoir:

- (a) The state and its departments, institutions, agencies, and political subdivisions.
- (b) Every municipal or quasi-municipal corporation.
- (c) Every public utility.
- (d) Every district.
- (e) Every person.
- (f) The duly authorized agents, lessees, or trustees of any of the foregoing.
- (g) Receivers or trustees appointed by any court for any of the foregoing.

“Owner” does not include any agency of the United States government, including those who operate and maintain dams owned by the United States. Dams designed and constructed by the United States that will be operated by an owner other than the United States shall be within the jurisdiction of the state from their inception, including application approval of design and inspection of construction.

“Person” means any person, firm, association, organization, partnership, business trust, corporation, or company.

“Probable” means likely to occur; reasonably expected; realistic.

“Reconstruction” means removal and replacement of an existing dam.

“Removal” means complete elimination of the dam embankment or structure to restore the approximate original topographic contours of the valley.

“Reservoir” means any basin which contains or will contain impounded water, wastewater, or liquid-borne materials by virtue of its having been impounded by a dam.

“Significant Hazard Potential Dam” means a dam assigned the significant hazard potential classification where failure or misoperation results in no probable loss of human life but can cause major economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

“USGS” means the United States Geological Survey.

“Water Storage Elevation” means the maximum elevation of water surface which can be obtained by the dam or reservoir.

APPENDIX A

MODEL STATE LAW

MODEL LAW FOR STATE SUPERVISION OF SAFETY OF DAMS AND RESERVOIRS

It is the intent of the legislature by this Act to provide for the regulation of dams and reservoirs exclusively by the state for the protection of public safety.

Chapter 1000. Definitions: The definitions in this chapter govern the construction of this Act.

1001. "Abandonment" means to render a dam non-impounding by dewatering and filling the reservoir created by that dam with solid materials and by diverting the natural drainway around the site.

1002. "Adverse Consequences" means negative impacts that may occur upstream, downstream, or at locations remote from the dam. The primary concerns are loss of human life, economic loss (including property damage), disruption of public utilities, and environmental impact.

1003. "Agency" means that agency, department, office, or other unit of state government designated by state law to be responsible for implementation and administration of this Act. (This section to be replaced in enactment of the law by a reference to the state unit created or selected to implement and administer the Act. The state unit created or selected to implement and administer the Act may consist of regular state employees or specialists and consultants, including consulting engineering firms or organizations.)

1004. "Alterations" or "repairs" means only alterations or repairs to existing dam and appurtenant structures that affect the safety of the dam or reservoir, as determined by the agency.

1005. "Application Approval" means authorization in writing issued by the agency to an owner who has applied to the agency for permission to construct, reconstruct, enlarge, repair, alter, remove, maintain, operate or abandon a dam and which specifies the conditions or limitations under which work is to be performed by the owner or under which approval is granted.

1006. "Appurtenant works" include, but are not limited to, such structures as spillways, either in the dam or separate therefrom; the reservoir and its rim; low level outlet works; and water conduits such as tunnels, pipelines or penstocks, either through the dam or its abutments.

1007. "Breach" means partial removal of a dam, creating a channel through the dam to the original stream bottom elevation.

1008. "Certificate of Approval to Impound" means authorization in writing issued by the agency to an owner who has completed construction,

reconstruction, enlargement, repair, or alteration of a dam and which specifies the conditions or limitations under which the dam and reservoir are to be maintained and operated.

1009. "Dam" means any artificial barrier, including appurtenant works, with the ability to impound water, wastewater, or liquid borne materials and which (a) is 25 feet or more in height from the natural bed of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation; or (b) has an impounding capacity at maximum water storage elevation of 50 acre-feet or more,

A. This definition does not apply to any such barrier which is not in excess of 6 feet in height regardless of storage capacity or which has a storage capacity at maximum water storage elevation not greater than 15 acre feet regardless of height, unless such a barrier, due to its location or other physical characteristics, is classified as a high hazard potential dam;

B. No obstruction in a canal used to raise or lower water shall be considered a dam; and

C. A fill or structure for highway or railroad use or for any other purpose, which impounds water, shall be subject to review by the agency. Such fill or structure shall be considered a dam if the criteria of Section 1009 are applicable.

1010. "Dam Rehabilitation Loan Program" means a low interest revolving dam rehabilitation loan program, created through this Statute.

1011. "Days" used in establishing deadlines, means all calendar days, including Sundays and holidays.

1012. "Emergency" includes, but is not limited to, breaches and all conditions leading to or causing a breach, overtopping, or any other condition in a dam and its appurtenant structures that may be construed as unsafe or threatening to life or property.

1013. "Emergency Action Plan" means a plan that identifies the area that would likely be inundated by the failure of a dam and the actions that should be taken in the event of a failure or threatening condition at the dam. The plan is usually implemented in conjunction with the local and regional emergency government personnel.

1014. "Engineer" means a qualified professional engineer. The term "qualified professional engineer" as used in this law is intended to mean an individual who has a background in civil engineering and;

A. Is a licensed professional engineer;

B. Is competent in areas related to dam investigation, design, construction, and operation for the type of dam being investigated, designed, constructed or operated;

C. Has at least ten (10) years of relevant experience in areas such as investigation, design, construction, reconstruction, enlargement, repair, alteration, maintenance, operation, breach, removal or abandonment of dams; and

D. Understands adverse dam incidents, failures and the potential causes and consequences of failures.

E. Continues with necessary training to keep abreast of the state of the practice in dam safety engineering.

1015. "Enlargement" means any change in or addition to an existing dam or reservoir that raises or may raise the water storage elevation of the water impounded by the dam.

1016. "Hazard Potential" means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the dam or mis-operation of the dam or appurtenances. The hazard potential classification of a dam does not reflect in any way on the current condition of the dam and its appurtenant structures (e.g., safety, structural integrity, flood routing capacity).

1017. "High Hazard Potential Dam" means a dam assigned the high hazard potential classification where the dam's failure or mis-operation will probably cause loss of human life

1018. "Incremental" means under the same conditions (e.g., flood, earthquake, or other event), the difference in impacts that would occur due to failure or mis-operation of the dam over those that would have occurred without failure or mis-operation of the dam and appurtenances.

1019. "Low Hazard Potential Dam" means a dam assigned the low hazard potential classification where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Economic losses are principally limited to the owner's property.

1020. "Owner" includes any of the following who own, control, operate, maintain, manage, or propose to construct, reconstruct, enlarge, repair, alter, remove or abandon a dam or reservoir:

- A. The state and its departments, institutions, agencies, and political subdivisions;
- B. Every municipal or quasi-municipal corporation;
- C. Every public utility;
- D. Every district;
- E. Every person;
- F. The duly authorized agents, lessees, or trustees of any of the foregoing; and
- G. Receivers or trustees appointed by any court for any of the foregoing.

1021. "Person" means any person, bankruptcy trustee, firm, association, organization, partnership, business trust, corporation, LLC, LLP, or company.

1022. "Probable" means more likely than not to occur; reasonably expected; realistic.

1023. "Reconstruction" means removal and replacement of an existing dam, or a portion thereof.

1024. "Removal" means complete elimination of the dam embankment or structure to restore the approximate original topographic contours of the valley.

1025. "Reservoir" means any area which contains or will contain impounded water, wastewater, or liquid-borne materials by virtue of its having been impounded by a dam.

1026. "Significant Hazard Potential Dam" means a dam assigned the significant hazard potential classification where failure or mis-operation results in no probable loss of human life but can cause major economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

1027. "State Dam Safety Office" means that agency, department, division, office, or other unit of State government, created, empowered, or designated by statute to be responsible for implementation, direction, or administration of The Model Law for State supervision of safety of dams and reservoirs.

1028. "Water Storage Elevation" means the maximum elevation of water surface which can be obtained by the dam or reservoir.

Chapter 2000. General Provisions

2010. It is the intent of the legislature by this Act to provide for the regulation of all dams and reservoirs exclusively by the state for the protection of public safety.

2020. No political subdivision of this State may enact a rule, ordinance, or other such law which conflicts with the regulatory authority established by this Act. Additionally, no political subdivision of this State may enact a rule, ordinance, or other such law which results in a dam or reservoir being regulated less stringently than it would otherwise be regulated under this Act. Notwithstanding the preceding, this Act shall not prevent a city or county from adopting ordinances regulating, supervising, or providing for the regulation or supervision of dams and reservoirs that (a) are not within this Act's state's jurisdiction; and (b) are not subject to regulation by another public agency or body, or apply only to appurtenances such as roads and fences not germane to the safety of the structure.

2030. All plans and specifications for initial construction, reconstruction, enlargement, alteration, repair, operation, breach, abandonment, or removal of dams and supervision of construction shall be in the charge of an engineer, assisted by qualified engineering geologists and other specialists as necessary.

2040. No action shall be brought against the state, the agency or its agents or employees for the recovery of damages caused by the partial or total failure of any dam or reservoir as a result of the agency's inspection or regulation of such dam or reservoir:

2050. Nothing in this Act shall be construed to relieve an owner or operator of a dam or reservoir of the legal duties, obligations, or liabilities incident to the ownership or operation of the dam or reservoir.

2060. The findings and orders of the agency, an agency's approval of an application, and the certificate of approval to impound of any dam or reservoir issued by the state are final, conclusive and binding upon all owners, state agencies, and other government agencies, regulatory or otherwise, as to the safety of design, construction, reconstruction, enlargement, repair, alteration, breach, removal, abandonment, maintenance, and operation of any dam or

reservoir. The agency's approval of an application or a certificate of approval to impound will not be considered final if it can be demonstrated to the agency that the agency's approval of the relevant application or certificate of approval was based on one or more misrepresentations.

2070. Nothing in this Act shall be construed to deprive any owner of such administrative or judicial recourse to the courts as he may be entitled to under the laws of this state.

2080. Records of official actions of the agency pertaining to the supervision of dams and reservoirs are public documents.

2090. Current owners shall notify the agency of any proposed change in ownership of any dam subject to this Act prior to the transfer of ownership.

Chapter 3000. Administrative Provisions

3010. The agency shall be administered and directed by an engineer, licensed by this state, and clearly qualified by training and experienced in the design, construction, reconstruction, enlargement, repair, alteration, breach, removal, maintenance, operation and abandonment of dams and reservoirs, and it shall employ such clerical, engineering, and other assistants as are necessary for carrying on the work of dam and reservoir supervision in accordance with this Act.

3020. The agency may require additional independent specialists or consulting boards for technical considerations pertaining to an application, approval for plans and specifications or certificate of approval to impound water. Appointment of these specialists/consulting boards must be approved by the agency. The expenses of these specialists/consulting boards shall be paid for entirely by the owner.

Chapter 4000. Powers of the Agency

Article 4100. Powers in General

4110. The agency, under the police power of the state, shall review and approve the design, construction, reconstruction, enlargement, alteration, repair, maintenance, operation, breach, abandonment and removal of dams and reservoirs for the protection of life and property as provided in this Act.

4120. All dams and reservoirs in the state shall be under the jurisdiction of the agency.

4130. It is unlawful to construct, reconstruct, enlarge, repair, alter, remove, maintain, operate or abandon any dam or reservoir coming within the

purview of this Act except upon application approval of the agency, provided that this section shall not be deemed to apply to routine maintenance and operation not affecting the safety of the structure, provided that action taken under Chapter 8000, Article 2 – Emergency Actions will not require an application.

4140. In order to protect life and property, owners of high and significant hazard potential dams shall develop, and periodically test and update, an emergency action plan that shall be implemented in the event of an emergency involving that owner's dam(s). This plan shall include, but not be limited to, the following elements

- A. Emergency notification plan with flowchart;
- B. Statement of purpose;
- C. Project description;
- D. Emergency detection, evaluation, and classification;
- E. General responsibilities;
- F. Preparedness;
- G. Inundation maps or other acceptable description of the inundated area; and
- H. Appendices.

4150. For the purposes of evaluating the adequacy of a dam owner's emergency action plan, the agency shall review and approve each emergency action plan submitted under the provisions of this Act.

4160. In making any investigation or inspection necessary to enforce or implement this Act, the agency or its representatives may enter upon such private property of the dam owner as may be necessary.

4170. When the agency determines that a dam and reservoir constitutes a risk to life or property, the agency shall order the owner to take such action as necessary to remove the resultant risk to life and property.

Article 4200. Investigations and Studies

4210. The agency shall investigate and gather or cause the owner to gather such data including advances made in safety practices elsewhere, as may be needed for a proper review and study of the various features of the design,

construction, reconstruction, repair, enlargement, alteration, breach, removal, maintenance, operation, or abandonment of dams, reservoirs, and appurtenances.

4220. The agency shall make or cause the owner to make such watershed investigations and studies as shall be necessary to keep abreast of development affecting run-off and peak storm discharges from the dam

4230. The agency shall make or cause the owner to make seismic investigations and studies as shall be necessary to keep abreast of developments affecting seismic stability of dams.

Article 4300. Administrative and Legal Actions

4310. The agency may take any administrative or legal action necessary for the enforcement of this Act.

4320. An action or proceeding under this article may be initiated whenever any owner or any person acting as an agent of any owner is:

A. Failing to comply with the requirements imposed by this Act or by any application approval, certificate of approval to impound, order, rule, regulation, or requirement of the agency under the authority of this Act; or

B. Committing or allowing the commission of violations of this Act or any application approval, certificate of approval to impound, order, rule, regulation, or requirement of the agency under this Act.

4330. Any action or proceeding under this article shall be initiated either administratively or by appropriate legal filing in a court of appropriate jurisdiction in which:

A. The dam, area of hazard potential, or some part thereof exists;

B. The owner or person complained of has its principal place of business;

C. The person complained of resides; or

D. The state capitol resides.

Article 4400. Regulations and Standards

4410. The agency shall have the power and duty to adopt such regulations and standards for the design, construction, reconstruction, enlargement, alteration, operation, monitoring, maintenance, modification, repair,

breach, abandonment and removal of dams and reservoirs to carry out the purposes of this Act. The regulations shall include, but are not limited to, rules establishing:

A. Standards and criteria for the siting and design of dams considering both existing and projected conditions which may affect the safety of a project during its construction and operational life;

B. Requirements for operation of dams including operational plans to be prepared and implemented by owners;

C. Requirements for monitoring, inspection and reporting of conditions affecting the safety of dams;

D. Requirements for emergency action plans to be prepared and implemented by owners, in cooperation with civil authorities;

E. Reasonable fees for the processing of applications and periodic inspections, for the purpose of reimbursing the state for the costs of administration of this Act; and

F. Requirements that the owner of an approved dam be financially responsible.

4420. In promulgating regulations pursuant to this Act applicable to dams regulated by this Act which may present a risk to life or property, the agency shall consider:

A. the inclusion of the best available preventative measures necessary to assure protection of life, health, property and the environment with an adequate factor of safety;

B. water management and the impacts of development in watersheds and;

C. the state of scientific and technological knowledge at the time the regulations are adopted.

Chapter 5000. Applications

Article 5100. New Dams or Enlargements of Dams

5110. Construction of any new dam or the enlargement of any dam shall not be commenced until the owner has applied for and obtained from the agency written application approval of plans and specifications.

5120. A separate application for each dam shall be filed with the agency upon forms provided by the agency. Plans and specifications signed and sealed by the design engineer must accompany the application.

5130. The application shall provide the following information:

- A. The name and address of the owner;
- B. The location, type, size, purpose, and height of the proposed dam and reservoir and appurtenant works;
- C. The storage capacity and reservoir surface areas for normal pool and maximum water storage elevation;
- D. Plans for proposed permanent instrument installations in the dam;
- E. As accurately as may be readily obtained, the area of the drainage basin, rainfall and streamflow records, flood-flow records and estimates;
- F. Maps and design drawings showing plans, elevations, and sections of all principal structures and appurtenant works with other features of the project in sufficient detail, including design analyses, to determine safety, adequacy and suitability of design; and
- G. Proof of financial responsibility
- H. Such other pertinent information as the agency requires.

5140. The agency shall, when in its judgment it is necessary, also require the following:

- A. Data concerning subsoil and rock foundation conditions and the materials involved in the construction, or enlargement of the dam or reservoir;
- B. Investigations of, and reports on, subsurface conditions, exploratory pits, trenches and adits, drilling, coring, geophysical tests to measure in place and in the laboratory the properties and behavior of foundation materials at the dam and reservoir site;
- C. Investigations and reports on the geology of the dam or reservoir site, possible geologic hazards, seismic activity, faults, weak seams and joints, availability and quality of construction materials, and other pertinent features;

D. Separate emergency action plans (EAP) for construction and post construction periods; and

E. Such other appropriate information as may be necessary.

Article 5200. Reconstruction, Repairs, Alterations, Abandonment, Breach or Removals

5210. Before commencing the reconstruction, repair, or alteration of a dam, or the abandonment, breach or removal of a dam so that it no longer constitutes a dam as defined in this Act, the owner shall file an application and secure the written approval of that application by the agency. Repairs shall not be deemed to apply to routine maintenance and operation not affecting the safety of the dam.

A. The application shall give such pertinent information or data concerning the dam, as may be required by the agency;

B. The application shall give the name and address of the applicant, and shall adequately detail, with appropriate references to the existing dam, the proposed reconstruction, repair, alteration, abandonment, breach, or removal of the dam. The application shall be accompanied by plans and specifications signed and sealed by the design engineer. The agency may waive any of the requirements of the application process outlined in this section if: (1) the requirements are unnecessary for the application approval, or (2) an emergency is declared by the agency.

C. In case of an emergency where the agency declares that repairs or breaching of the dam is necessary to safeguard life and property, repairs or breaching shall be started immediately by the owner or by the agency at the owner's expense. The agency shall be notified at once of emergency repairs or breaching when instituted by the owner; and

D. The proposed repairs, breaching and work shall conform to such orders as the agency issues.

Article 5300. Application Approval

5310. Upon receipt of an application the agency shall approve or disapprove the application within the time provided in Section 5330.

5320. If an application is incomplete or defective, the agency shall return the application to the applicant to correct the defects. If the applicant wishes to pursue the agency's approval of the application, the applicant must correct the defects in the application and must resubmit the application to the agency within 30 days, or such additional time as the agency may grant the applicant, after the

agency returns the application to the applicant. If the application is not returned to the agency within the appropriate time period, the agency shall reject the application.

5330. No applications shall be approved in fewer than 10 days after the receipt of the fee required by Article 6100, but all applications shall be approved or disapproved as soon as practicable thereafter. At the discretion of the agency, public hearings may be held on each application.

5340. Application approval shall be granted with terms, conditions, and limitations necessary to safeguard life and property.

5350. Actual construction, reconstruction, enlargement, repair, alteration, breach, removal, or abandonment shall be commenced within the time frame set by the agency; otherwise, the application approval becomes void.

5360. The agency may, upon written application and for good cause shown, extend an owner's time for commencing construction, reconstruction, repair, alteration, breach, removal, or abandonment of a dam or reservoir.

5370. Written notice shall be provided to the agency at least 10 days before construction, reconstruction, repair, alteration, breach, removal, or abandonment is to begin and such other notices shall be given to the agency as it may require.

Chapter 6000. Fees

Article 6100. The application for construction, reconstruction, enlargement, repair, alteration, breach, removal, or abandonment of a dam shall set forth the estimated cost of the project and shall be accompanied by a filing fee as established in the regulations.

6110. Only one filing fee shall be collected for an enlargement of a dam by flashboards, sandbags, earthen levees, gates, or other works, devices, or obstructions which will from time to time, be removed and replaced or opened and shut and thereby operated so as to vary the surface elevation of the reservoir.

6120. For the purposes of this Act, the estimated cost of the dam construction, reconstruction, enlargement, repair, alteration, breach, removal, or abandonment involved shall include the following:

A. The cost of all labor and materials for the dam, appurtenant works and reservoir;

B. The cost of preliminary investigations and surveys;

C. The cost of the construction plant properly chargeable to the cost of the dam and reservoir; and

D. Any and all other items entering directly into the cost of the dam and reservoir.

6130. Excluded from the cost listed in Section 6120 shall be:

A. The costs of right-of-way, detached powerhouses, electrical generating machinery, and roads and railroads affording access to the dam and reservoir; and

B. Any and all other items not entering directly into the cost of the dam and reservoir.

6140. Dams and reservoirs that are 90 percent or more constructed, reconstructed, enlarged, repaired, altered, removed or abandoned on the effective date of this Act as determined by the agency and that are subject to the provisions of this Act shall not be required to pay a fee but shall submit an application for approval and issuance of an application approval. Application approvals of dams and reservoirs that are made subject to this Act that are found by the agency to have been less than 90 percent constructed, reconstructed, enlarged, repaired, altered, removed or abandoned on the effective date of this Act shall be accompanied by fees reduced by the percentage of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment found by the agency to have been completed on that date.

6150. An application approval shall not be considered by the agency until the filing fee is received. All or part of the filing fee may be returned to the applicant only if he withdraws or cancels the application any time prior to the start of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment. The amount of the refund will be determined by the agency with due regard to funds actually expended by the agency in review of the application.

6160. Within 30 days after giving the notice of completion required in Section 7110 and Section 7310, the owner shall file a sworn affidavit with the agency stating the actual cost of the dam and reservoir or enlargement thereof. to determine whether a further fee is due. In the event the owner of a new or enlarged dam, because of loss of records, recent change of ownership, or other causes beyond his control, is unable to report the actual cost of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment, he shall file an affidavit, stating the reasons why. The agency shall then make its own appraisal of the cost of construction, reconstruction, enlargement, repair,

alteration, breach, removal or abandonment, and determine what further fee, if any, is required.

6170. All filing fees and other charges collected under the provisions of this Act shall be paid into a special fund in the state treasury, to be available to the agency for expenditure for the purposes authorized by this Act.

6180. The fees provided for in this article shall be required of all owners as defined in Chapter 1000 of this Act.

Article 6200. Annual Registration Fees and Inspection Fees

6210. Owners of existing dams holding certificates of approval to impound shall be assessed an annual registration fee as established in the regulations. Existing certificates of approval to impound will be extended for one year upon receipt of the annual registration fee. Any certificate of approval to impound is void without notification to the person holding the certificate of approval to impound when the annual registration fee is more than forty-five (45) days past due. Resubmission of an application is required where a certificate of approval to impound has become void due to failure to pay the appropriate annual registration fee within 45 days of the date due; and

6220. Dam owners shall pay a fee following state inspections conducted in accordance with Section 8130 of this Act.

Chapter 7000. Inspections and Certificates of Approval to Impound

Article 7100. New, Reconstructed or Enlarged Dams and Reservoirs

7110. The design engineer shall be represented during construction as specified in Section 7610. Immediately upon completion of a new or reconstructed dam and reservoir, or enlargement of a dam and reservoir, the owner shall give a notice of completion to the agency. The owner shall file with the agency a statement signed by the design engineer certifying that the project was constructed, reconstructed or enlarged in conformance with approved plans and specifications, accompanied by supplementary drawings or descriptive matter signed and sealed by the design engineer showing or describing the dam and reservoir as actually constructed, reconstructed, or enlarged. Such supplementary materials shall include, but not be limited to, the following:

A. A record of all geological boreholes and grout holes and grouting;

B. A record of permanent location points, benchmarks and instruments embedded in the structure;

C. A record of tests of concrete or other material used in the construction, reconstruction, or enlargement of the dam and reservoir; and

D. A record of initial seepage flows and embedded instrument readings.

Article 7200. Certificates of Approval to Impound

7210. Each dam owner must hold a valid certificate of approval to impound in order to legally impound water under the laws of this State.

7220. A certificate of approval to impound shall be issued by the agency upon a finding by the agency that the dam and reservoir are safe to impound water within the limitations prescribed in the application approval. No water shall be impounded by a dam or reservoir prior to issuance of a valid certificate to impound.

7230. Each certificate of approval to impound issued by the agency under this Act shall contain such terms and conditions as the agency may prescribe.

7240. The agency shall revoke, suspend, or amend any certificate of approval to impound whenever it determines that the dam or reservoir constitutes a danger to life and property. Upon the agency's revocation of a certificate to impound, the owner of the dam must take action within time limits specified by the agency to alleviate the hazard associated with the dam.

7250. Before any certificate of approval to impound is revoked by the agency, the agency shall hold a public hearing. Written notice of the time and place of the hearing shall be mailed, at least 10 days prior to the date set for the hearing, to the holder of the certificate to impound. Any interested person(s) may appear at the hearing and present their views and objections to the proposed action. Any petition to a court of appropriate jurisdiction to inquire into the validity of action of the agency revoking a certificate of approval to impound shall be commenced within 30 days after the date the agency issues its decision to revoke the owner's certificate to impound. An appeal of the agency's decision shall not be constitute an automatic stay of the agency's action.

Article 7300. Repaired or Altered Dams and Reservoirs

7310. Immediately upon completion of the repair or alteration of any dam or reservoir, the owner shall give written notice of completion to the agency. The design engineer shall file with the agency a written statement certifying that the repairs or alterations were completed in accordance with the approved plans and specifications. The statement shall be accompanied by supplementary drawings

and descriptive matter signed and sealed by the design engineer describing the dam and reservoir as repaired or altered together with such maps, data, records, and information pertaining to the dam and reservoir as repaired or altered.

7320. A certificate of approval to impound shall be issued upon a finding by the agency that the dam and reservoir are safe to impound water within the limitations and conditions prescribed in the application approval. Pending issuance of a new or revised certificate of approval to impound, the owner of the dam or reservoir shall not cause the dam or reservoir to impound water beyond the limitations or conditions prescribed in the existing application approval.

Article 7400. Removal, Breach, or Abandonment of Dams and Reservoirs

7410. Upon completion of the removal, breach, or abandonment of a dam, the design engineer shall file with the agency a written statement certifying that the breach, removal or abandonment was completed in accordance with the approved plans and specifications.

7420. Before final approval of the removal of a dam or reservoir is issued, the agency shall inspect the site of the work and determine that all work was accomplished in substantial conformance with the approved application.

7430. Following the removal of a dam or reservoir, the agency may report this event in a timely manner to the National Inventory of Dams (NID)

Article 7500. Complaints of Unsafe Conditions

7510. Upon receipt of a written complaint alleging that the person or property of the complainant is endangered by the construction, reconstruction, enlargement, repairs, alterations, maintenance, or operation of any dam and reservoir, the agency shall cause an inspection and investigation to be made unless the data, records, and inspection reports on file are found adequate to make a determination whether the complaint is valid. The complainant shall be provided with a copy of the official report of the inspection and investigation.

7520. If the agency finds that an unsafe condition exists, the agency shall notify the owner to take such action as is necessary to render or cause the condition to be corrected, including breaching or removal of any dam found beyond repair. If the owner is unavailable or unresponsive, the agency may commence action under Chapter 8000, Article 8200 – Emergency Actions.

Article 7600. Inspection During Progress of Work

7610. During the construction, reconstruction, enlargement, repair, alteration, breach, abandonment or removal of any dam or reservoir, the agency shall make periodic inspections for the purpose of ascertaining compliance with

the approved plans and specifications. The agency shall require the owner to provide adequate supervision by an engineer during construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment and to provide sufficient information to enable the agency to determine that conformity with the approved plans and specifications is being attained. The design engineer shall be continuously represented on-site during construction.

7620. If, after any inspection or investigation, during the construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment, or at any time prior to issuance of a certificate of approval to impound, it is found by the agency that modifications or changes are necessary to ensure the safety of the dam, the agency shall order the owner to revise his plans and specifications.

7630. If at anytime during construction, reconstruction, enlargement, repair, alterations, breach, removal, or abandonment of any dam and reservoir, the agency finds that the work is not being done in accordance with the provisions of the approved plans and specifications, the agency shall deliver a written notice of noncompliance to the owner. The notice shall be delivered by registered mail or by personal service to the owner.

A. The notice of non-compliance shall state the particulars in which the approved plans and specifications are not being or have not been complied with and shall order the immediate compliance with the approved plans and specifications; and

B. The agency may order that no further work be done until such compliance has been effected and approved by the agency.

7640. A failure to comply with the application approval may cause revocation of application approval by the agency. If compliance with the notice is not forthcoming in sixty days, the agency shall order the incomplete structure removed sufficiently to eliminate any safety hazard to life or property.

Chapter 8000. Maintenance, Operation, Emergency Actions and Funding

Article 8100. Maintenance and Operation

8110. The agency shall regulate the maintenance and operation of dams and reservoirs as necessary to safeguard life and property from a dam failure.

8120. The agency shall require owners to keep available and in good order, records of original and any modification construction. The owner shall report at least annually with respect to maintenance, operation and engineering, including horizontal and vertical controls, seepage measurements, piezometric

data and geologic investigations. The agency shall require engineering and geologic investigations to safeguard life and property. The agency may accept reports of equivalent inspections prepared by governmental agencies. In addition, the owner of a dam and reservoir shall immediately advise the agency of any flood or unusual circumstances which may affect the safety of the dam and reservoir.

8130. The agency shall make inspections of dams and reservoirs at any time for the purpose of determining their safety. If serious safety concerns are found by the agency during the inspections, the agency shall require the owner to conduct tests and investigations sufficient for the agency to determine the condition of the dam. After review of the tests or investigations, the agency may require modification, removal or breach of the dam or alteration of operating procedures to restore or improve the safety of the dam, and may require installation of instrumentation to monitor the performance of the dam.

Article 8200. Emergency Actions

8210. Owners of dams and reservoirs have the primary responsibility for determining when an emergency involving a dam or reservoir exists. When the owner of a dam or reservoir determines an emergency exists, the owner shall immediately implement the emergency action plan required by Section 4140, notify any persons who may be endangered if the dam should fail, notify emergency management organizations, and take additional actions necessary to safeguard life, health and property.

8220. If necessary actions are not being taken by the owner in the judgment of the agency, the agency has the authority and shall take any action necessary to protect life and property if, in the agency's judgment, either:

A. The condition of any dam or reservoir is so dangerous to the safety of life or property as not to permit time for the issuance and enforcement of an order relative to maintenance or operation, or

B. Passing or imminent floods or any other condition threatens the safety of any dam or reservoir.

8230. In applying the remedial means provided for in this article, the agency may in an emergency with its own forces, or by other means at its disposal, do any or all of the following:

A. Take full charge and control of any dam or reservoir;

B. Lower the water level by releasing water from the reservoir;

C. Completely drain the reservoir;

D. Perform any necessary remedial or protective work at the site;

or

E. Take such other steps as may be essential to safeguard life and property.

8240. The agency shall continue in full charge and control of such dam and reservoir and its appurtenances until they are rendered safe or the emergency occasioning the action has ceased and the owner is able to take back such operations. The agency's take-over of the dam, the reservoir, or their appurtenances shall not relieve the owner of a dam or reservoir of legal liability to the agency or third parties for those items which are causing an emergency situation. The agency's assumption of control over the dam shall not constitute a takings and the agency shall not be liable to the dam owner or others for diminution in value that may be caused by the agency's work.

Article 8300. Funding

8310. The cost and expense of the remedial means provided in this article, including cost of any work done to render a dam and reservoir or its appurtenances safe, shall be collected by presentation of bills to owners in the same manner as other debts to the state are recoverable. If such bills are not promptly paid by the owners, the cost shall be recovered by the state from the owner by action brought by the agency in a court of appropriate jurisdiction.

8320. Emergency Dam Repair Fund

A. The emergency dam repair fund shall be funded through monies appropriated by the legislature and monies collected by the agency in full or partial satisfaction of liens created by Subsection 8320 B (iii). Monies in the fund shall be used to employ remedial measures necessary to protect life and property in accordance with provisions of Section 8230 and Section 8240. The agency shall administer the fund. On notice from the agency, the state treasurer shall invest and divest monies in the fund and monies earned from investment shall be credited to the fund. Monies in the emergency dam repair fund are exempt from lapsing.

B. The agency may spend monies from the emergency dam repair fund established by Section 8320 with the following provisions:

i. If monies in the emergency dam repair fund are insufficient to pay for such remedial measures, the agency may transfer monies

from the non-emergency dam repair fund established by Section 8330 to meet necessary costs of employing remedial measures;

ii. The agency shall remain in full charge and control of the dam, reservoir and appurtenances until they have been rendered safe or the emergency has terminated;

(iii). The costs and expenses of the control, regulation and abatement provided by this section, including costs of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment work done to render the dam, reservoir, or appurtenances safe, shall constitute a statutory lien against all property of the owner. The lien shall be considered prior and superior to all other mortgages, liens or encumbrances of record even if those other mortgages, liens, or encumbrances were filed before the lien becomes due.

iv. The lien referred to in Subsection 8320 B (iii) may be perfected and foreclosed in advance of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment or after completion of the construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment. If perfected in advance, the lien shall be perfected by the filing of an affidavit of the agency setting forth the estimate of the costs of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment within the county in which the dam is located in the same manner as prescribed for mechanic's liens. When the affidavit is filed, the amount set forth in the affidavit shall be a lien in such amount against all property of the owner. If the actual cost of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment exceeds the estimated cost, the agency may amend the affidavit setting forth the additional estimated cost. If the estimated cost exceeds the actual costs of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment at completion, the agency shall file an amended affidavit at completion. If a lien is perfected in advance and the construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment is not commenced within two years from the date of perfection, the lien shall be void. The agency shall file a satisfaction of lien upon payment of the costs of construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment by the owner;

v. Monies collected in full or partial satisfaction of a lien created pursuant to Section 8320 B (iii) of this section shall be deposited in the emergency dam repair fund established by Section 8320.

8330. Non-Emergency Funding

A. The Agency shall create a Dam Rehabilitation Loan Program; or may partner with other public or private agencies or organizations to create a

Dam Rehabilitation Loan Program. The program shall initially be funded with \$XX Million through monies appropriated by the legislature and:

i. The State Legislature may authorize required funding to expand the financial size of the Dam Rehabilitation Loan Program.

ii. The Dam Rehabilitation Loan Program is a revolving fund to be used exclusively for the purposes of this law. The Program shall be initially funded through monies appropriated by the legislature

iii. The Program shall be subsequently funded through additional monies appropriated by the legislature or agency inspection fees collected, filing fees collected pursuant to Article 6100 and Article 6200, payments of principal and interest collected by the agency pursuant to Section 8330, civil penalties collected pursuant to Section 9050, monies paid to the fund pursuant to directive of the legislature and all interest earned on the investment of monies in the fund by the state treasurer.

iv. The Dam Rehabilitation Loan Program may obtain funds through partnerships with any private or public, bonding or loaning, agency or organization.

v. State funding to the Dam Rehabilitation Loan Program cannot be reduced because of federal funds provided for a rehabilitation loan program.

vii. Monies in the Dam Rehabilitation Loan fund do not revert to the State general fund. Monies in the fund are exempt from lapsing.

B. The following Dam Rehabilitation Loan Program provisions apply:

i. Monies in the fund shall be used for loans as provided in Section 8330 A. The agency may transfer monies in the fund to the emergency dam repair fund established by Section 8320 to pay necessary costs of remedial measures as authorized in Section 8230 and Section 8240; and

ii. The agency may grant loans from the non-emergency dam repair fund to dam owners to defray the costs of repairing dams which the agency determines to be dangerous to the safety of life and property but which are not in an emergency condition. Loans shall be granted on such terms and conditions as may be imposed by the agency. The following provisions apply:

(a) The Agency shall adopt administrative rules that are required to administer this statute.

(b) The Agency may take any administrative or legal action necessary for the administration of this statute.

iii. If the balance of the non-emergency dam repair fund exceeds one million dollars, no single loan shall be made for more than twenty percent of the monies available in the fund. No loan shall be made to any dam owner that, at the time of the loan application, has more than twenty percent of the outstanding loans of the fund;

iv. The loans granted by the agency shall be for a term of not more than twenty years; and the loans shall bear interest at rates set by the agency in the regulations;

v. Each loan shall be evidenced by a contract between the dam owner and the agency, acting on behalf of this state. The contract shall provide for the loan by this state of a stated amount to defray some or all of the costs of repairing the dam. The contract shall provide for equal annual payments of principal and interest for the term of the loan. Eligible cost provisions include:

(a) Any costs directly related to rehabilitating safety deficiencies of a dam shall be eligible to be funded through the Dam Rehabilitation Loan Program.

(b) Fees for analysis, feasibility work, alternative evaluation, and engineering design, are only eligible retroactively after construction has been initiated, or at the point that analysis has shown a dam to be in compliance.

(c) Up to 100% of rehabilitation costs for a dam may be loaned.

(d) Dam owners may use multiple programs or sources to fund the rehabilitation costs for a dam, up to 100% of rehabilitation costs.

(e) Rehabilitation cost for any dam is eligible, except for dams owned by the federal government.

(f) Any costs directly related to compliance with other laws and regulations, above the State's minimum dam safety requirements are eligible as part of an overall rehabilitation project.

(g) Any costs for State agency required fish passage is eligible if it is part of an overall rehabilitation project; but such

costs are not eligible if they are not part of an overall rehabilitation project.

vi. The agency may take whatever security interest it deems necessary in the dam owner's property in exchange for the loan. If the agency chooses to take a security interest in the dam owner's property, the agency shall perfect that security interest by filing appropriate documentation with the proper authorities.

vii. The attorney general or the agency's legal counsel may, with the consent of the agency, commence whatever actions are necessary to enforce the contract and achieve repayment of loans provided by the agency pursuant to this section.

C. Owners' responsibilities include:

i. Once a loan has been granted under this statute, the owner of a dam must have an operation and maintenance plan with written, regularly scheduled reports, so as to maintain and keep the structure and its appurtenant works in the state of repair and operating condition required by the exercise of prudence; due regard for life or property; the application of sound and accepted engineering principles; the provisions of rules, guidelines, or policies.

ii. As part of any rehabilitation project utilizing funds from this program the owner must have an emergency action plan developed (if one doesn't currently exist).

iii. Cooperate with the Agency's agents, engineers, and other employees in the conduct of the statute.

iv. Facilitate access to the structure or appurtenance.

v. Furnish upon request the plans, specifications, operating and maintenance data, or other information that is pertinent to the structure, appurtenance, and loan.

D. General Loan Guidelines

i. Owners of dams without taxing authority should be allowed to participate in the Dam Rehabilitation Loan Program.

ii. Complete rehabilitations are to be encouraged, but phased projects can be funded.

iii. Removal of dams as a rehabilitation alternative should be allowed.

iv. As part of the application process, owners should demonstrate the ability to appropriately operate and maintain the dam after rehabilitation is complete.

v. Owners are allowed to partner with an individual, local agency, or organization, for purposes of the loan, and for purposes of operation and maintenance.

vi. Rehabilitation projects that are in compliance with State statute and rules, and are permitted, accepted, and approved by the State Dam Safety Office are eligible to be funded through the Dam Rehabilitation Loan Program.

vii. If a dam is exempt from State regulation, to obtain funding through the Dam Rehabilitation Loan Program, the project must adhere to State standards that relate to design, construction and provisions of this act.

viii. Costs for lake enhancement projects such as, lake dredging, sediment removal projects, or boat ramps, which do not enhance the safety of the dam, are not eligible to be funded through the Dam Rehabilitation Loan Program.

ix. The Agency and its agents, engineers, and other employees may, for the purposes of this Model State Law, enter upon any land or water in the State without a search warrant or liability for trespass.

x. The State Legislature authorizes staff positions, required funding, and organizational structure, to administer the Dam Rehabilitation Loan Program.

xi. This statute does not create a liability for damages against the Agency, its officers, agents, and employees caused by or arising out of any of the following:

(a) The construction, maintenance, operation, or failure of a dam, or appurtenant works.

(b) The issuance and enforcement of an order or a rule issued by the Agency to carry out the Agency's duties.

xii. The State does not assume ownership obligations, responsibilities, or liabilities if an owner defaults on a loan.

Chapter 9000. Offenses and Penalties

9010 Penalties

A. Whenever the Agency finds that any owner or any person has violated any provision of the Act or any rule, regulation or order issued pursuant thereto, the Agency may:

- i. Issue an order requiring any such person to comply in accordance with subsection B. of this section; or
- ii. Bring a civil action in accordance with subsection C. of this section; or
- iii. Levy a civil administrative penalty in accordance with subsection D. of this section; or
- iv. Bring an action for a civil penalty in accordance with subsection E. of this section; or
- v. Petition the Attorney General to bring a criminal action in accordance with subsection F. of this section.

Recourse to any of the remedies available under this section shall not preclude recourse to any of the other remedies prescribed in this section or by any other applicable law.

B. Whenever, on the basis of available information, the Agency finds a person in violation of any provision of this Act or any rule, regulation or order issued pursuant thereto, the Agency may issue an administrative order:

- i. Specifying the provision or provisions of the law, rule, regulation, or order, of which the person is in violation;
- ii. Citing the action which constituted the violation;
- iii. Requiring compliance with the provision or provisions violated;

- iv. Requiring the restoration of the area which is the site of the violation; and
- v. Providing notice to the person of the right to a hearing on the matters contained in the order.

C. The Agency is authorized to institute a civil action in Superior Court for appropriate relief from any violation of this Act, or any rule, regulation or order issued pursuant thereto. Such relief may include, singly or in combination:

i. A temporary or permanent injunction, including an order or judgment as will effectually secure the persons interested from danger of loss from the breaking of a dam. The court may proceed in the action in a summary manner or otherwise;

ii. Assessment of the violator for the costs of any investigation, inspection, or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection

iii. Assessment of the violator for any costs incurred by the State in removing, correcting, or terminating the adverse effects resulting from any violation for which legal action under this subsection may have been brought;

iv. Assessment against the violator for compensatory damages for any loss or destruction of wildlife, fish or aquatic life, and for any other actual damages caused by a violation;

v. A requirement that the violator restore the site of the violation to the maximum extent practicable and feasible.

D. The Agency is authorized to assess a civil administrative penalty of up to \$25,000 for each violation of any provision of this Act, or any rule, regulation or order issued pursuant thereto, and each day during which each violation continues shall constitute an additional, separate, and distinct offense. Any amount assessed under this subsection shall fall within a range established by regulation by the Agency for violations of similar type, seriousness, and duration. In adopting rules and regulations establishing the amount of any penalty to be assessed, the Agency may take into account the economic benefits from the violation gained by the violator. No assessment shall be levied pursuant to this section until after the party has been notified by certified mail or personal service. The notice shall:

i. Identify the section of the law, rule, regulation or order violated;

ii. Recite the facts alleged to constitute a violation;

iii. State the amount of the civil penalties to be imposed; and

iv. Affirm the rights of the alleged violator to a hearing. The ordered party shall have 20 days from receipt of the notice within which to deliver to the Agency a written request for a hearing. After the hearing and upon finding that a violation has occurred, the Agency may issue a final order specifying the amount of the fine imposed. If no hearing is requested, the notice shall become final

after the expiration of the 20-day period. Payment of the assessment is due when a final order is issued or the notice becomes a final order. The authority to levy an administrative penalty is in addition to all other enforcement provisions in this act and in any other applicable law, rule, or regulation, and the payment of any assessment shall not be deemed to affect the availability of any other enforcement provisions in connection with the violation for which the assessment is levied. Any civil administrative penalty assessed under this section may be compromised by the Agency upon the posting of a performance bond by the violator, or upon such terms and conditions as the Agency may establish by regulation.

E. A person who violates any provision of this Act or any rule, regulation or order issued pursuant thereto, an administrative order issued pursuant to subsection b. of this section, or a court order issued pursuant to subsection c. of this section, or who fails to pay a civil administrative penalty in full pursuant to subsection d. of this section, shall be subject, upon order of a court, to a civil penalty not to exceed \$10,000 per day of such violation, and each day during which the violation continues shall constitute an additional, separate, and distinct offense. In addition to any penalties, costs or interest charges, the court may assess against the violator the amount of actual economic benefit accruing to the violator from the violation.

F. A person who purposely, knowingly or recklessly violates any provision of this Act, or any rule, regulation or order issued pursuant thereto, shall be guilty, upon conviction, of a crime of the fourth degree and shall be subject to a fine of not less than \$2,500 nor more than \$25,000 per day of violation. A second or subsequent offense under this subsection shall subject the violator to a fine to the contrary, of not less than \$5,000 nor more than \$50,000 per day of violation. A person who knowingly makes a false statement, representation, or certification in any application, record, or other document filed or required to be maintained under the provisions of this Act shall be guilty, upon conviction, of a crime of the fourth degree and shall be subject to a fine of not more than \$10,000

G. In addition to the penalties prescribed in this section, a notice of violation of any provision of this Act, or any rule, regulation or order issued pursuant thereto, shall be recorded on the deed of the property wherein the violation occurred, on order of the Agency, by the clerk or register of deeds and mortgages of the county wherein the affected property is located and with the clerk of the Superior Court and shall remain attached thereto until such time as the violation has been remedied and the Agency orders the notice of violation removed.

H. The Agency may require an owner or person having control of a reservoir or dam to provide any information the Agency requires to determine compliance with any provision of this Act, or any rule, regulation or order issued pursuant thereto.

I. Any person who knowingly, recklessly, or negligently makes a false statement, representation or certification in any application, record, or other document filed or required to be maintained under the provisions of this Act shall be in violation of the act and shall be subject to the penalties assessed pursuant to subsections D. and E. of this section.

J. All penalties collected pursuant to this section or sums collected pursuant to Act shall be deposited in the " Non-emergency/Emergency Dam Repair Fund," established pursuant to this Act.

K. The Agency shall have the authority to enter any property, facility, premises, or site for the purpose of conducting inspections to determine the condition of any dam, or to conduct inspections of ordered repairs or to otherwise determine compliance with the provisions of this Act.

9020 Cease and Desist Order; Temporary Cease and Desist Order; Hearing; Injunctive Relief

A. Except as provided by Subsection B of this section, if the agency has reason to believe that an owner or person is violating or has violated a provision of this Act, application approval, certificate of approval to impound, rule, regulation, order or requirement of the agency issued or adopted pursuant to this Act, the agency shall give the owner or person written notice by certified mail that the owner or person may appear and show cause at a hearing before the agency not less than thirty days from the date of mailing of the notice why the owner or person should not be ordered to cease and desist from the violation. The notice shall inform the owner or person of how to request the hearing and the consequences of failure to request a hearing.

B. If the agency finds that an owner or person is constructing, reconstructing, enlarging, repairing, altering, operating, removing, or abandoning a dam without having first obtained the required application approval of the agency, the agency shall issue a temporary order for the owner or person to cease and desist the construction, reconstruction, enlargement, repair, alteration, operation, breach, removal or abandonment pending final action by the agency pursuant to Subsection C. of this section. The temporary order shall include written notice by certified mail to the owner or person of a hearing before the agency to show cause why the temporary order should be vacated.

C. After a hearing pursuant to Subsection A or Subsection B of this section, or after the expiration of the time to request a hearing, the agency shall issue a decision and final order. The decision and final order may take such form as the agency determines to be reasonable and appropriate and may include a determination of violation, a cease and desist order, the recommendation of a civil penalty and an order directing that positive steps be taken to abate or ameliorate any harm or damage arising from the violation. The owner or person affected may appeal the hearing decision to a court of appropriate jurisdiction in which the violation is alleged to have occurred.

D. If the owner or person continues the violation after the agency has issued a final decision and order pursuant to Subsection C. of this section or a temporary order pursuant to Subsection B of this section, the agency may apply for a temporary restraining order or preliminary or permanent injunction from a court of appropriate jurisdiction according to the state rules of civil procedure. A decision to seek injunctive relief does not preclude other forms of relief or enforcement against the violator.

Chapter 10000. Dams and Reservoirs Existing Prior to the Effective Date of this Act

Article 10100. Dams and Reservoirs Completed Prior to Effective Date of this Act

10110. Every owner of a dam that falls within the definition of a dam in this Act and completed prior to the effective date of this Act shall file with the agency a separate application and any other supporting information as required by the agency for each of these dams. Each application shall also be accompanied by applicable application fees referenced by Article 6100.

10120. The agency shall give notice to file an application to impound to owners of such dams or reservoirs who have failed to file such applications as required by this article.

10130. The notice provided for in this article shall be delivered by certified mail to the owner at his last address of record in the office of the county tax assessor in which the dam is located. Such mailing shall constitute service.

10140. The agency shall make inspections of such dams and reservoirs.

10150. The agency shall require owners of such dams and reservoirs to perform at their expense such work or tests as may reasonably be required to disclose information sufficient to enable the agency to determine whether to issue certificates of approval to impound, or to issue orders directing further work at the owner's expense necessary to safeguard life and property. For this purpose, the agency may require an owner to lower the water level of, or to drain, the reservoir.

10160. If, upon inspection or upon completion to the satisfaction of the agency of all work that may be ordered, the agency finds that the dam and reservoir are safe to impound water, a certificate of approval to impound shall be issued. The agency may find that the dam or reservoir will not safely impound water and may refuse to issue a certificate of approval to impound. Upon finding the dam and reservoir are unsafe to impound water, the agency shall issue a written notice to the owner, whereupon the owner shall cause the dam and reservoir to no longer impound water after receipt of the notice.

Article 10200. Dams and Reservoirs Under Construction, Reconstruction, Enlargement, Repair, Alteration, Breach, Removal or Abandonment Before Effective Date of this Act

10210. Any dam or reservoir that falls within the definition of a dam and reservoir in this Act and which the agency finds was under construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment and based on its findings not 90 percent constructed, reconstructed, enlarged, repaired, altered, removed or abandoned on the effective date of this Act shall, except as provided in Section 10220, be subject to the same provisions in this Act as a dam or reservoir commenced after that date. Every owner of such a dam and reservoir shall file an application with the agency for the agency's written application approval of the plans and specifications.

10220. Construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment work on such a dam and reservoir may proceed, provided an application for approval of the plans and specifications is filed, until an application approval is received by the owner approving the dam and reservoir or an order is received by the owner specifying how the construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment must be performed to render the dam or reservoir safe. After receipt of an application approval or order specifying how construction, reconstruction, enlargement, repair, alteration, breach, removal or abandonment of the dam or reservoir must be performed, work thereafter must be in accordance with the application approval or order.

A. All laws and parts of law in conflict with this Act are hereby repealed.

B. A declaration that certain parts of this Act are unconstitutional shall not affect the constitutionality of other parts of this Act.

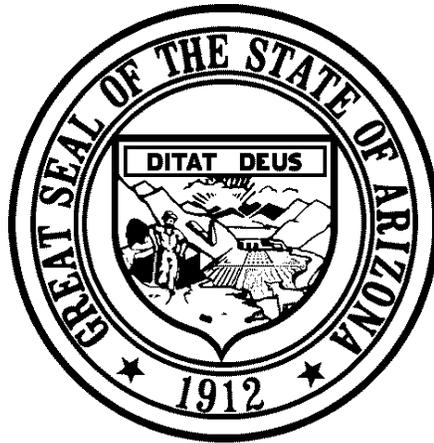
APPENDIX B

EXAMPLE PERMIT REQUIREMENTS

CASE 1: ARIZONA

ARIZONA DEPARTMENT OF WATER RESOURCES

OFFICE OF DAM SAFETY AND FLOOD MITIGATION



INSTRUCTIONS FOR FILING AN APPLICATION

INTRODUCTION

This guide for filing an application has been prepared to facilitate the applicant's understanding of the application process. Any omissions or errors do not relieve the applicant from complying with applicable sections of Arizona Revised Statutes (A.R.S.) Title 45-Waters, Chapter 6 and Arizona Administrative Code (A.A.C.) Title 12-Natural Resources, Chapter 15-Department of Water Resources. The applicant must review and comply with these documents.

Arizona Revised Statutes Title 45, Chapter 6, Article 1 A.R.S. §§ 45-1203, A.R.S. 45-1206 and A.R.S. 45-1207 require written approval of an application prior to construction of a new dam, or the enlargement, repair, alteration or removal of an existing dam. The application process must comply with A.A.C. R12-15-1207, which also defines specific situations that do not require an application.

In accordance with A.A.C. R12-15-1207, an applicant must contact the Arizona Department of Water Resources' (Department) Dam Safety Program at (602) 417-2445 to schedule pre-application conferences. These conferences are to discuss the requirements of the Director for specific applications and to answer any questions. In accordance with A.R.S. § 45-1214 and A.A.C. R12-15-1207, Dam Safety staff will visit the dam site with the applicant during the pre-application period. Depending on the hazard classification and type of proposed construction, an application must comply with the following:

- To construct, reconstruct, repair, enlarge or alter a high or significant hazard potential dam, an application must comply with the A.A.C. R12-15-1208.
- To breach or remove a high or significant hazard potential dam, an application must comply with A.A.C. R12-15-1209.
- To construct, reconstruct, repair, enlarge, alter, breach or remove a low hazard potential dam, an application must comply with A.A.C. R12-15-1210.
- To construct, reconstruct, repair, enlarge, alter, breach or remove a very low hazard potential dam, an application must comply with A.A.C. R12-15-1211.

All application packages must be prepared in duplicate and received by the Department's Office of Water Engineering by appointment. The Office of Water Engineering is located at 500 North Third Street, Phoenix, Arizona 85004-3903; telephone number (602) 417-2445.

In addition to the duplicate application form provided by the Director, two complete sets of construction documents including engineering drawings, specifications, engineering reports, calculations and other supporting information must be submitted to the Department by appointment with the proper filing fee. The required documents are described in detail in the Department's guide titled "Checklist of Items Required for a Complete Application," which must also be completed and included with the application. These documents must be prepared by a professional engineer registered in Arizona to a level of detail appropriate for construction. The design engineer must be experienced in the design and construction of dams. The engineer's professional seal and signature must appear on all submitted drawings, specifications, engineering reports and calculations.

As prescribed in A.R.S. § 45-1204 and A.A.C. R12-15-151, no application shall be given consideration unless accompanied by a filing fee based on the estimated cost of the project (see the following section on Fee Requirements), as well as all required supporting documentation. The Director may waive or increase any requirements for information to accompany an application. During the appointment where the Department receives the application, a brief review of the application will be conducted to determine if the application contains each of the items required in the "Checklist of Items Required for a Complete Application" pursuant to A.A.C. R12-15-1208, R12-15-1209, R12-15-1210 or R12-15-1211, as applicable.

Following receipt of an application and fee, the Department will conduct an administrative review of the application and supporting documentation defined in the “Checklist of Items Required for a Complete Application” and notify the applicant in writing whether the application is administratively complete. If the application is not administratively complete, the notification will include a list of additional information that is required to complete the application. The Department will also notify other agencies that we have received an application.

In accordance with A.A.C. R12-15-401 and A.A.C. R12-15-1207, the administrative completeness review time frame is 120 days from the day the Department receives the application. The time frame is suspended once a notification requesting additional information is mailed until the date the applicant responds with the additional information. Additional information requested must be supplied within 60 days of the date of the notice, or within another time frame agreed upon by the Department. Failure to complete the application within the specified time frame may deem the application withdrawn and the Department would close the file.

After the application has been determined to be administratively complete (i.e., contains all the required supporting documentation completed to a level of detail appropriate for construction), the Department will begin a substantive review. The substantive review time frame is 60 days from the day the Department determines that the application is administratively complete. The Department will notify the applicant in writing of any defects and conduct one or more conferences, if necessary, to delineate revisions to the documents that will meet the Department’s substantive review requirements. The time frame is suspended once a notification requesting additional information is mailed and until the date the applicant responds with the additional information.

Once the Department has completed its substantive review, the applicant will be notified in writing that the application is either approved or denied. If the application is denied, the Department will provide written justification for the denial and a written explanation of the applicant’s right to appeal.

After the Department has completed its substantive review and approved the application, revised sets of construction documents (engineering drawings, specifications, construction quality assurance plan and construction schedule) incorporating any required changes must be submitted in triplicate to the Department to receive the Department’s approval stamp. One set of the construction documents, containing the Department’s approval stamp, will be returned to the applicant and must be retained on site during construction, one set will be retained for permanent State record and another will be retained for use by the Department during construction. In addition to the construction documents, a revised engineering design report may also be required. An operation and maintenance plan and an emergency action plan must also be submitted unless they are planned to be submitted during construction pursuant to A.A.C. R12-15-1208(B) or as otherwise approved by the Director.

FEE REQUIREMENTS

Payment of the filing fee is required pursuant to A.R.S. § 45-1204 and A.A.C. R12-15-151 for all applications. The Department may not consider or permit construction until the filing fee has been paid. The fee is based upon the total project costs associated with construction of the dam and appurtenant works integral to the design and safe operation of the dam. Preliminary investigations and surveys, engineering designs, the Department’s application requirements, administration and supervision of construction and any other engineering costs related to construction shall also be included.

Based upon these total costs and pursuant to A.A.C. R12-15-151(B)(11), the fee will be computed to the nearest dollar according to the following schedule:

- For the first \$100,000 of the estimated cost, two (2.0 %) percent.
- For the next \$400,000, one and one-half (1.5 %) percent.
- For the next \$500,000, one (1.0 %) percent.
- For all costs in excess of \$1,000,000, one-half of one (0.5 %) percent.

Example estimated fee calculation (fee must accompany the application):

<i>ESTIMATED COST</i>	\$6,420,000.00
2% x \$100,000.....	2,000.00
1.5% x \$400,000.....	6,000.00
1% x \$500,000.....	5,000.00
0.5% x \$5,420,000.....	27,100.00
	+
<i>ESTIMATED FEE</i>	\$ 40,100.00

Upon completion of the project, pursuant to A.R.S. § 45-1209(C) the actual total cost shall be tabulated using the sample Affidavit of Total Cost shown in the Department’s document titled “Requirements During and Following Construction of High and Significant Hazard Dams.” The application fee must be recomputed using the Example Final Fee Calculation also shown in the Department’s document titled “Requirements During and Following Construction of High and Significant Hazard Dams.” If the recomputed fee exceeds the fee paid with the application by \$50.00 or more, then the owner shall pay the difference between the fee already paid and the recomputed fee. If the recomputed fee is less than the original fee by an amount of \$50.00 or more, then the owner shall be entitled to a refund by the amount of the difference between the fee already paid and the recomputed fee.

LIST OF REFERENCES

Included below is a brief list of references, which have proved useful in solving basic dam design problems. The list is not all-inclusive. Many of these references include comprehensive bibliographies, which may provide additional assistance in locating more detailed or more recent reference materials. When complex dam design problems are encountered, it is advisable to retain a qualified specialist engineer.

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ARIZONA DEPARTMENT OF WATER RESOURCES
OFFICE OF DAM SAFETY AND FLOOD MITIGATION



Application No. _____ Filed _____
(Applicant shall not fill in above blanks)

**APPLICATION for APPROVAL of the PLANS and SPECIFICATIONS
for the CONSTRUCTION, ENLARGEMENT, REPAIR, ALTERATION
or REMOVAL of a DAM and RESERVOIR (A.R.S. 45-1203 & 1206)**

JANET NAPOLITANO
Governor

HERB GUENTHER
Director

This application is for the _____ of the _____ Dam.
(Construction, Enlargement, Repair, etc.) (Name of Dam)

LOCATION OF DAM

This dam is in _____ County, in the _____ 1/4, Sec. _____, Twp. _____, Rge. _____, G&SR B&M, at
North Latitude _____ E, _____', _____" and West Longitude _____ E, _____', _____", on USGS Quad _____, and is
located on _____, tributary to _____.
(Wash, Creek, River or Watershed) (Wash, Creek or River)

OWNER

Name: _____ Telephone: _____

Mailing Address: _____

If this application is for construction of a new dam complete all items (1 through 21) except item 12. For enlargement, repair, alteration or removal complete items 12 through 21 and those other items where a change is being made.

DESCRIPTION OF DAM AND RESERVOIR

1. Type of dam _____ Purpose of dam _____
(Earth, Rock, Concrete Gravity, etc.)
2. Dam crest elevation _____ feet. Spillway crest elev. _____ feet. Outlet invert elev. _____ feet.
3. Dam height is _____ feet (Measured from the lowest elevation of the outside limit of the dam at its intersection with the natural ground surface to the crest of the spillway – A.A.C. R12-15-1202(17)).
4. Dam crest length _____ feet. Dam crest width _____ feet. Dam Crest Camber (if any) _____ feet.
5. Dam slope: Upstream _____ : 1 (horizontal:vertical); Downstream _____ : 1 (horizontal:vertical).
6. Emergency Spillway (type, dimensions, control(s), design capacity, flow depth, etc.):
7. Outlet Works (type, internal diameter, dimensions, control(s), capacity, trashrack, energy dissipator):
8. Reservoir at spillway crest elevation: Storage capacity _____ acre-feet; Surface area _____ acres.
Reservoir at dam crest elevation: Storage capacity _____ acre-feet; Surface area _____ acres.

HYDROLOGIC DATA

9. Drainage area _____ square miles. Names of upstream dams _____
10. Downstream Hazard: _____
(Nearest downstream town, population, distance, other inhabitants or development, and Downstream Hazard Potential Classification per A.A.C. R12-15-1206)

11. Inflow design flood: _____ Duration _____ hours. Precipitation _____ inches.
(100-year, 0.25 PMF, 0.5 PMF, 0.75PMF, PMF)
Peak inflow rate _____ cfs. Water surface elevation is _____ feet at the time of the maximum emergency spillway discharge of _____ cfs during routing of the Inflow Design Flood.

GENERAL INFORMATION

- 12. Description of Work (enlargement, repair, alteration, etc.):
- 13. Type of stored water: _____. Use of stored water: _____.
(surface, groundwater, effluent, etc.)
Existing water rights claims/filings associated with water to be stored:
Has primary storage permit application been made? ____ Yes ____ No
- 14. Other federal, state or local permits (to be) applied for; Give details, include date(s):
- 15. Describe provisions to divert flood flows during construction; include frequency (years) and flow rate (cfs):
- 16. Construction is expected to begin _____. Estimated completion _____.
(Month and Year) (Month and Year)
- 17. Estimated cost of dam, reservoir and appurtenances (ARS 45-1204.A): _____
- 18. Fees accompanying this application (fees based on cost; R12-15-151): _____
- 19. Investigations, design, drawings and specifications prepared by (identify firm and Engineer of Record; attach resume highlighting dam design experience):
- 20. Construction Quality Assurance & Quality Control to be performed by (identify firm, Site Engineer, and Engineer of Record; attach resume(s) highlighting dam construction experience):
- 21. Emergency Action Plan prepared by: _____

Application submitted by (Name): _____ Telephone: _____ Date: _____
Signature: _____ Legal Capacity If Other Than Owner: _____
Mailing Address: _____

APPROVAL OF APPLICATION No. _____

This is to certify that Application No. _____, including the drawings and specifications for _____ Dam and Reservoir has been examined and the same is hereby approved, subject to the following terms and limitations:

- 1. Construction work shall be started within one (1) year from date of application approval.
- 2. No foundations or abutments shall be covered by the material of the dam until the Department has been given an opportunity to inspect and approve the same.

Dated this _____ day of _____, 20____.

J. Darrell Jordan, Manager
Office of Dam Safety and Flood Mitigation

**ARIZONA DEPARTMENT OF WATER RESOURCES
OFFICE OF DAM SAFETY AND FLOOD MITIGATION**



JANET NAPOLITANO
Governor

HERB GUENTHER
Director

CHECKLIST OF ITEMS REQUIRED FOR A COMPLETE APPLICATION

Name of Dam: _____ Owner of Dam: _____

Application No. _____ Date Filed: _____
 [Application No. and Date Filed to be filled in by Arizona Department of Water Resources]

Instructions

This checklist is primarily applicable to significant and high hazard potential dams in accordance with Arizona Administrative Code (A.A.C.) R12-15-1208(A)(2), 1215 and 1216. All items and/or the designated level of design detail may not be required for all applications, including those for low and very low hazard potential dams in accordance with A.A.C. R12-15-1207(D), 1209, 1210, 1211, 1215 and 1216.

This guide, which identifies items required for a complete application, has been prepared to facilitate the applicant's understanding of the process. Any omissions or errors do not relieve the applicant from complying with applicable sections of Arizona Revised Statutes (A.R.S.) Title 45-Waters, Chapter 6 and A.A.C. Title 12-Natural Resources, Chapter 15-Department of Water Resources. The Director may require additional information, beyond the items delineated in this checklist, in accordance with A.R.S. §§ 45-1203(E) and 1206(A).

Complete the following checklist by indicating to the left that the item has been included and to the right its location(s) within the application documents. If a checklist item does not apply, indicate **N/A** and provide a supporting discussion. The checklist will be provided electronically via e-mail upon the applicant's request.

Example

<u>Y</u>	Surface Water Diversion Plan - Details of the plan for control or diversion of surface water during construction, if required.	<u>See Page 7 and Appendix C of the design report & Section 1036 of the specifications</u>
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I. GENERAL ITEMS

<hr/>	Application Form – Complete and submitted in duplicate. [Ref. A.R.S. §§ 45-1203(B), 1206(A); A.A.C. R12-15-1208(A)(1), 1209(E), 1210(A)(1), 1210(B)(1), 1211(A)(1)]	<hr/> <hr/> <hr/>
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<hr/>	Fee –The fee must be based upon the total estimated project cost associated with construction of the dam and appurtenant works. Preliminary investigations and surveys, engineering design, supervision of construction and any other engineering costs shall be included in the project construction costs (refer to “Instructions for Filing an Application”). [Ref. A.R.S. § 45-1204; A.A.C. R12-15-151(B)(11), 1208(A)(3), 1210(A)(2), 1210(B)(2), 1211(A)(4)]	<hr/> <hr/> <hr/> <hr/>
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_____ Two Sets (minimum) of Construction Drawings
[Ref. A.R.S. §§ 45-1203(A), 1206(A); A.A.C. R12-15-1208(A)(5),
1209(E)(1), 1210(A)(6), 1211(A)(6), 1215(1)]

_____ Two Sets (minimum) of Construction Specifications
[Ref. A.R.S. §§ 45-1203(A), 1206(A); A.A.C. R12-15-1208(A)(6),
1210(A)(7), 1215(2)]

_____ Two Design Reports (minimum)
[Ref. A.A.C. R12-15-1208(A)(7), 1210(A)(8), 1215(3)]

_____ Two Sets (minimum) of Construction Quality Assurance (CQA) Plan
[Ref. A.A.C. R12-15-1208(A)(8), 1210(A)(9), 1212(C), 1215(2)(e)]

_____ Two Sets (minimum) of Evidence of Financial Capability – Consists of
a long-term budget plan and evidence of financing, prepared using
customary accounting principles, that demonstrate that the applicant
has the financial capability to construct, operate and maintain the dam
in a safe manner. [Ref. A.A.C. R12-15-1208(A)(10)]

_____ Two Sets (minimum) of the Construction Schedule
[Ref. A.R.S. §§ 45-1203(E), 1206(A)]

_____ Two Sets (minimum) of the Emergency Action Plan, Operation and
Maintenance Plan, and Instrumentation Plan – These documents, if not
ready for submittal with the application filing, may be submitted
during construction. [Ref. A.R.S. § 45-1203(E); A.A.C. R12-15-
1208(B), 1217, 1221]

_____ Drawings, Specifications, CQA Plan and Design Report Sealed by P.E.
The drawings, specifications, CQA Plan and design reports (each of
which are described in detail below) must be prepared by a professional
engineer registered in Arizona to a level of detail appropriate for
construction. The design engineer must be experienced in the design
and construction of dams. The engineer's seal and signature must
appear on all drawings, specifications and engineering reports, and
conform to the requirements of the Arizona State Board of Technical
Registration. A preliminary review set of drawings submitted with the
application may also be stamped "preliminary" and/or "not for
construction" in accordance with the rules of the Arizona State Board
of Technical Registration. [Ref. R4-304; A.A.C. R12-15-1215(1)(a),
1215(2)(a), 1215(3)(a)]

II. CONSTRUCTION DRAWINGS

Drawings should be prepared on conventional drafting material such that clear, legible prints can be obtained. Drawings must clearly present all details and dimensions required to construct the dam in accordance with the engineers design. Submittal of blue line prints, black line prints or mylar for final approval will be satisfactory. The following drawings should be included. List additional drawings in this section if applicable to the design. [Ref. A.A.C. R12-15-1208(A)(5), 1209(E)(1), 1209(F)(1), 1210(A)(6), 1211(A)(4), 1215(1)]

_____ Dam Safety Section Approval Block – In preparing the drawings, each sheet should contain the normal title block in the lower right hand corner as well as a space 1" high x 4" wide in proximity to the lower right hand corner for the Department's approval stamp.

_____ Topographic Map - A topographic map(s) of the dam, spillway, outlet works and reservoir on a scale large enough to accurately locate the dam and appurtenances, indicate cut and fill lines, and show property lines and ownership status of the land. Elevations must be to a national datum base, such as mean sea level, rather than an assumed elevation. Contour intervals must be compatible with the height and size of the dam and its appurtenances as required to provide adequate design and construction details. Horizontal control must be in accordance with the State coordinate system and/or per latitude and longitude. [Ref. A.A.C. R12-15-1215(1)(b)]

_____ Reservoir Area and Capacity Curves – The area-capacity curves shall reflect area in acres and capacity in acre-feet in relation to depth of water and elevation in the reservoir. The spillway invert and top of dam elevations must be shown. The reservoir volume/space functional allocations must also be shown. Alternate scales may be included as required for the owner's use. [(Ref. A.A.C. R12-15-1215(1)(c)]

_____ Spillway and Outlet Works Rating Curves and Tables - The spillway rating curve must be at a scale or scales which allow determination of discharge rate (cfs) at both low and high flows as measured by depth of water passing over the control section. [Ref. A.A.C. R12-15-1215(1)(d)]

_____ Location Map - A location map showing the dam footprint and all exploration drill holes, test pits, trenches, adits, borrow areas and bench marks with elevations, reference points and permanent ties. This map shall use the same vertical and horizontal control as the "topographic map." [Ref. A.A.C. R12-15-1215(1)(e)]

_____ Geologic Information – Geologic information including geologic map(s), profile along the centerline and other pertinent cross sections of the dam site, spillway(s) and appurtenant structures, aggregate and material sources, and reservoir area at scale(s) compatible with the site and geologic complexity, showing logs of exploration drill holes, test pits, trenches and adits. [Ref. A.A.C. R12-15-1215(1)(f)]

_____ Dam Plan – Plan(s) of the dam to adequately delineate design and construction details. [Ref. A.A.C. R12-15-1215(1)(g)]

_____ Foundation Profile - A foundation profile along the dam centerline at a

ADWR, Dam Safety Section
Checklist for Application No. _____

true scale (vertical=horizontal) showing the existing ground and proposed finished grade (cut and fill) elevations, including anticipated geologic formations. Include any proposed grout and drain holes. [Ref. A.A.C. R12-15-1215(1)(h)]

_____ Dam Profiles and Sections - A profile and a sufficient number of cross-sections of the dam to delineate design and construction details. Camber, crest details, interior filters and drains, and other zone details must be shown and dimensioned. The profile of the dam may be drawn to different horizontal and vertical scales if required for detail. A maximum section of the dam shall be included; it must be drawn to a true scale (vertical = horizontal). The outlet conduit may be shown on the maximum section if this is typical of the proposed construction. [Ref. A.A.C. R12-15-1215(1)(i)]

_____ Foundation Plan – Foundation plan(s) showing excavation grades and cut slopes with any proposed foundation preparation, grout and drain holes, and foundation dewatering requirements. [Ref. A.A.C. R12-15-1215(1)(j)]

_____ Outlet Works – A plan, profile and details of the outlet works, including the intake structure, the gate system, conduit, trashrack, filter diaphragm, concrete encasement and the downstream outlet structure. Include all connection and structural design details. [Ref. A.A.C. R12-15-1215(1)(k)]

_____ Spillway - A plan, profile, control section and cross sections of the spillway. Include details of any foundation preparation, grouting or concrete work that is planned. A complex control structure, a concrete chute or an energy-dissipating device for a terminal structure will require both hydraulic and structural design details. [Ref. A.A.C. R12-15-1215(1)(l)]

_____ Drainage Area – Hydrologic data, drainage area and flood routing criteria. [Ref. A.A.C. R12-15-1215(1)(m)]

III. CONSTRUCTION SPECIFICATIONS

The specifications must include a detailed description of the work to be performed and a statement of the requirements for the various types of material and installation techniques that will enter into the permanent construction. Of particular importance are those sections describing foundation preparation, placement of materials and material testing. Specifications must be complete and not cross-referenced to specifications in other documents. As a minimum, the following specifications should be included, when applicable, to the design. List additional specifications applicable to the design in this checklist. [Ref. A.A.C. R12-15-1208(A)(6), 1210(A)(7), 1211(A)(3), 1215(2)]

_____ Earthwork Specification – Include all earth and rock material descriptions, placement criteria and construction requirements for all elements of the dam and related structures. [Ref. A.A.C. R12-15-1215(2)(f)(i)] _____

_____ Concrete, Grout and Shotcrete Specifications – Include all concrete, grout and shotcrete material descriptions, placement and consolidation criteria, temperature controls and construction requirements for all elements of the dam and related structures. [Ref. A.A.C. R12-15-1215(2)(f)(ii)] _____

_____ Foundation Specification – Include acceptable material criteria and testing, cleaning and treatment. If foundation or curtain grouting is required, include the type of grout, grouting method, special equipment, recording during grouting and foundation monitoring to avoid disturbance from grouting. [Ref. A.A.C. R12-15-1215(2)(f)(iii)] _____

_____ Materials Testing – Include in each specification all materials testing to be performed by the contractor for pre-qualification of materials for use and acceptance of materials as constructed in place in accordance with specifications. Include all required special performance testing such as water pressure tests in conduits. [Ref. A.A.C. R12-15-1215(2)(f)(iv)] _____

_____ Control of Stream During Construction - A plan for control or diversion of surface water during construction. The frequency of storm runoff to be controlled during construction may be determined by the design engineer commensurate with the risk of economic loss during construction. [Ref. A.A.C. R12-15-1215(2)(f)(v)] _____

_____ Blasting – Criteria for blast monitoring and acceptable blast vibration levels (particle velocities), monitoring equipment and monitoring locations must be included for the dam and other vibration sensitive structures and equipment. [Ref. A.A.C. R12-15-1215(2)(f)(vi)] _____

_____ Instrumentation – Include material descriptions, placement criteria and construction requirements. Instrumentation should be required to be installed by experienced specialty subcontractors. [Ref. A.A.C. R12-15-1215(2)(f)(vii)] _____

_____ Additional Specification: _____

IV. DESIGN REPORT

A design report is required for all dams and appurtenant structures. The report should include a discussion and definition of the engineering consideration and conclusions incorporated in the design. The report must also include copies of pertinent calculations as appendices. As a minimum, the following sections should be included in the design report when applicable to the design. List additional sections applicable to the design report in this checklist. [Ref. A.A.C. R12-15-1208(A)(7), 1210(A)(8), 1215(3)]

_____ Classification – The classification under AAC R12-15-1206 of the proposed dam, or for the proposed enlargement of an existing dam and reservoir. [Ref. A.A.C. R12-15-1215(3)(b)]

_____ Hydrology – Hydrologic considerations, including calculations and a summary table of data used in determining the required emergency spillway capacity and freeboard, and design of any diversion or detention structures. Input and output listings (both hard copy and on diskette) of any computer programs used must be included. Include calculations for wave runoff and wave setup in the reservoir as well as estimated sedimentation rates. [Ref. A.A.C. R12-15-1215(3)(c)]

_____ Hydraulics - Hydraulic characteristics, engineering data and calculations used in determining the capacities of the outlet works and emergency spillway. Input and output listings (both hard copy and on diskette) of any computer programs used must be included. Technical references must support any complex hydraulic designs. [Ref. A.A.C. R12-15-1215(3)(d)]

_____ Geotechnical Investigation – Geotechnical investigation and testing of the dam site and reservoir basin. Results and analysis of subsurface investigations including logs of test borings and geologic cross sections. [Ref. A.A.C. R12-15-1215(3)(e)]

_____ Blasting Plan – Guidelines and criteria for blasting to be used by the contractor in preparing the blasting plan. [Ref. A.A.C. R12-15-1215(3)(f)]

_____ Surface Water Diversion Plan - Details of the plan for control or diversion of surface water during construction. Include a discussion for the basis for selection of the frequency of storm runoff to be controlled during construction. [Ref. A.A.C. R12-15-1215(3)(g)]

_____ Dewatering Plan – Details of the dewatering plan for subsurface water during construction. [Ref. A.A.C. R12-15-1215(3)(h)]

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_____ Materials Information – Testing results of earth and rock materials, including the location of test pits and the logs of these pits. Strength test results must be plotted and the strengths selected for use in stability analyses shown. [Ref. A.A.C. R12-15-1215(3)(i)]

_____ Grout Design – Discussion and design of the foundation grouting, grout curtain and grout cap based on foundation stability and seepage considerations. [Ref. A.A.C. R12-15-1215(3)(j)]

_____ Reinforced Concrete Design – Calculations and basic assumptions on loads and limiting stresses for reinforced concrete design. Input and output listings (both hard copy and on diskette) of any computer programs used should be included. [Ref. A.A.C. R12-15-1215(3)(k)]

_____ Stability Analysis – A discussion and stability analysis of the dam including appropriate seismic loading, safety factors and embankment zone strength characteristics. Analyses must include both short-term and long-term loading on upstream and downstream slopes. Input and output listings (both hard copy and on diskette) of any computer programs used should be included. Plots of critical failure surfaces as well as the zones and phreatic surface used in the analyses must be shown on the critical cross section of the embankment. [Ref. A.A.C. R12-15-1215(3)(l)]

_____ Seismicity – The seismicity of the project area and activity of faults in the vicinity must be discussed. Both deterministic and statistical methods must be utilized and the appropriate seismic coefficient identified for use in analyses. [Ref. A.A.C. R12-15-1215(3)(m)]

_____ Cutoff Trench Design - Discussion and design of the cutoff trench based on seepage and/or other considerations. [Ref. A.A.C. R12-15-1215(3)(n)]

_____ Seepage – Permeability characteristics of foundation and dam embankment materials, including calculations for seepage quantities through the dam, the foundation and anticipated in the internal drain system. Input and output listings (both hard copy and on diskette) of any computer programs used should be included. Copies of flow nets, if utilized, must be included. [Ref. A.A.C. R12-15-1215(3)(o)]

_____ Internal Drainage – Discussion and design of internal drainage based on seepage quantity calculations. Include instrumentation necessary to monitor the drainage system and filter design calculations for protection against piping of foundation and embankment materials. [Ref. A.A.C. R12-15-1215(3)(p)]

_____ Erosion Protection – Erosion protection against waves and rainfall runoff must be provided for both the upstream and downstream slopes, as appropriate. [Ref. A.A.C. R12-15-1215(3)(q)]

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_____ Dam Foundation Treatment and Abutment Contact Design, and Spillway Foundation Design - Discussion and design of foundation treatment to adequately compensate for geological weakness in the dam foundation and abutment areas, and in the spillway foundation area. [Ref. A.A.C. R12-15-1215(3)(r)]

_____ Post-construction Vertical and Horizontal Movement Systems
[Ref. A.A.C. R12-15-1215(3)(s)]

_____ Foundation Conditions – Discussion of foundation conditions including the potential for subsidence, fissures, dispersive soils, collapsible soils and sinkholes. [Ref. A.A.C. R12-15-1215(3)(t)]

_____ Additional Report Section:

_____ Additional Report Section:

V. CONSTRUCTION QUALITY ASSURANCE PLAN

A Construction Quality Assurance (CQA) Plan is required for all dams and appurtenant structures. A statement of the designer's requirement with regard to construction testing frequencies, foundation preparation guidelines, etc., must be included in the CQA Plan to facilitate the construction in conformance with the plans and specifications. As a minimum, the CQA Plan should include the following sections:
[Ref. A.A.C. R12-15-1208(A)(8), 1209(E)(3), 1210(A)(9), 1212, 1213]

_____ Delineation of Responsibilities and Authority – The responsibilities and lines of authority of the organizations involved in the construction of the dam must be described. The role of pre-construction, progress and problem or work deficiency meetings should be discussed. [Ref. A.A.C. R12-15-1212(A)]

_____ Third Party Testing – The CQA Plan should detail the responsibilities of third party (independent of the contractor) field and laboratory testing by a registered engineer for all elements of the dam and related structures. [Ref. A.A.C. R12-15-1212(B)]

_____ Statement of Qualifications – The CQA Plan should identify the training and experience of the CQA personnel, field supervisors and engineer of record. This information should document their ability to fulfill their assigned roles. [Ref. A.A.C. R12-15-1212(C)]

_____ Inspection and Testing Activities - The CQA Plan should specify the inspection, testing and sampling activities to be implemented for all

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elements of dam construction. The CQA Plan should identify key inspection items that require the Department's approval. [Ref. A.A.C. R12-15-1212(A), 1212(D), 1212(G)]

Acceptance and Rejection Criteria - The acceptance or rejection criteria for inspection and testing activities should be clearly stated. The CQA Plan should describe procedures for documenting corrective measures and design changes that require prior approval by the Department. [Ref. A.A.C. R12-15-1212(E), 1212(F)]

Documentation Requirements - The CQA Plan should include requirements for the submittals of as-built drawings and a completion report, which are required prior to the issuance of a license. [Ref. A.A.C. R12-15-1213]

VI. CONSTRUCTION SCHEDULE

Construction Schedule - A statement of the anticipated sequence and duration of construction operations must be filed in duplicate with the application. [Ref. A.R.S. § 45-1203(E)]

VII. OPERATION AND MAINTENANCE PLAN

An Operation and Maintenance (O&M) Plan must be prepared for all dams and their appurtenant structures. The O&M Plan must specify the frequency of inspections and maintenance of the dam and appurtenant structures. The frequency for exercising any mechanical or electrical equipment or systems must also be specified. Equipment must be exercised and inspected at least once each year. The frequency of inspections for submerged facilities such as intake structures or outlet pipes must also be specified. More frequent inspections and operation may be required depending on the size of the dam or reservoir, hazard classification or condition of the dam. The O&M Plan must specifically address the following: [Ref. A.R.S. § 45-1212; A.A.C. R12-15-1205(D), 1208(B)]

Dam Structure (Earth & Rockfill) – Settlement, slides, depressions, misalignment, cracking (transverse and longitudinal), burrowing animals, erosion, seepage and adequacy of slope protection.

Dam Structure (Concrete & Masonry) – Cracking, spalling, scaling, joint displacement or offsets, foundation and abutment contacts displacement or offset, seepage and adverse vegetation.

Metal Surfaces – Corrosion, deficient protective coatings, misaligned or split seams. Includes gates, stairs and ladders, handrails, pipe, drainage culverts, instrumentation pipes or hardware, drainage culverts, bridges, etc.

Spillways – Spillway control structures (gates, concrete sills, flash boards, etc.), approach channels, main channels, stilling basins and energy dissipaters.

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_____ Outlet Works – Includes buildings or structures that enclose the outlet works and submerged facilities such as intake structures.

_____ Downstream Channel Areas – Sloughing, eroding or backcutting, obstructions, adequacy of erosion protection and tailwater, and flow conditions.

_____ Reservoir Rim Area – Areas susceptible to slides or major rock falls that could result in overtopping of the dam or significant releases.

_____ Site Security – Fencing, surveillance cameras, security patrols, etc.

_____ Instrumentation – Description of the instrumentation system(s) that is part of the performance monitoring system for the dam and all appurtenant structures. The O&M Plan must clearly separate instruments and reading frequencies for the following conditions: (a) during construction, (b) immediately following completion of construction, (c) until initial reservoir fill is completed, and (d) long term monitoring. Vertical and horizontal movement monitoring of the dam must be performed, as a minimum. The design, construction and geological conditions of the dam may require other instrumentation, such as monitoring wells, piezometers, inclinometers, pressure cells, extensometers, crack monitors, seepage or drainage monitors, and strong motion (seismograph).

_____ Log Book - A logbook must be maintained for the life of the dam. The logbook must be part of the dam's permanent records and must be used to document each inspection, maintenance work performed and record of equipment operation (exercising). Each entry in the logbook must include the date, a description of the inspection and operation or maintenance work done, and shall be signed by the responsible person. Dates when instrumentation readings are taken and person taking readings must be recorded in the logbook.

_____ Annual Report – The owner or operator providing an annual report to ADWR, Office of Water Engineering, must list all inspections made, maintenance work performed, instrumentation data collected and dates of same. The report must include an interpretation of the instrumentation data by a person qualified to evaluate the data of the dam's performance. The report must include the significance of the instrumentation data and a discussion of planned maintenance or repairs at the dam.

_____ Photographic Record - The owner or operator maintaining complete photographic record of sufficient detail that would typically show the

extent of cracks in concrete, erosion of embankments or condition of metal parts. Photos must be taken on a five-year interval (minimum) and must be maintained for the life of the dam. A complete set of the photos (minimum 3 1/2 x 5 inches in size) must be provided to ADWR when taken and included as part of the annual report for that year.

VIII. EMERGENCY ACTION PLAN

Dams classified as having high or significant downstream hazard potential must file an Emergency Action Plan (EAP) including a dam breach inundation map. The EAP must be filed in duplicate and, at a minimum, include the following elements: [Ref. A.A.C. R12-15-1221]

_____ Notification Flow Chart – The EAP should include a chart showing the hierarchy for notification in an emergency situation, including priority of notifications. Notifications should include local emergency response agencies, affected downstream populations, county emergency management agencies and affected flood control districts. [Ref. A.A.C. R12-15-1221(A)(1)]

_____ Statement of Purpose – The EAP must describe the project and scope of the EAP. [Ref. A.A.C. R12-15-1221(A)(2)]

_____ Emergency Detection, Evaluation and Action - The EAP must delineate the type of potential unsafe conditions, evaluation procedures and triggering events that require the initiation of partial or full emergency notification procedures based on the urgency of the situation. [Ref. A.A.C. R12-15-1221(A)(3)]

_____ Responsibilities – The EAP should delineate areas of responsibility, particularly the owners, to ensure effective and timely action. The individuals responsible for notifications and declaring an emergency must be clearly identified. [Ref. A.A.C. R12-15-1221(A)(4)]

_____ Notification Procedures – The EAP should be specific for each emergency situation that is anticipated. [Ref. A.A.C. R12-15-1221(A)(5)]

_____ Preparedness - The EAP should identify emergency supplies and resources, equipment access to the site and alternative means of communication. The EAP should also identify specific preparedness activities required such as annual full or partial mock exercises and updates of the EAP. [Ref. A.A.C. R12-15-1221(A)(6)]

_____ Inundation Map – An inundation map should show the area that would be subject to flooding due to spillway flows and dam failure. [Ref. A.A.C. R12-15-1221(A)(7)]

IX. OTHER PERMITS

It is not unusual that additional permits from this and/or other government agencies may also be required before construction may commence. Several other permits are described below. It is the responsibility of the owner to obtain all permits required for construction.

_____ State Trust Land - If the dam is to be constructed on, any materials for the dam to be borrowed from or the reservoir will inundate State Trust Land; contact the State Land Department at (602) 542-4621 for details of their requirements. _____

_____ Federal Land - If the dam is to be constructed on, any materials for the dam are to be borrowed from or the reservoir will inundate federal land, contact the appropriate federal agency for details of their requirements. _____

_____ Water Rights - If surface waters are to be impounded, contact the Arizona Department of Water Resources, Office of Water Engineering, at (602) 417-2445 for details. _____

_____ Corps 404 Permit – Any significant work in or affecting a stream may require a A404 Permit. Contact the U.S. Army Corps of Engineers for details. _____

_____ Corps 401 Certification - A 401 Certification from the Arizona Department of Environmental Quality is required before a 404 Permit can be obtained to ensure that federal activities do not violate state water quality standards. _____

_____ Geotechnical Exploration Holes, Monitoring and Piezometers Wells - Certain types of drilled holes require permits and/or must be abandoned in accordance with prescribed procedures. For details, contact the Arizona Department of Water Resources, Groundwater Management Support Section, (602) 417-2470. _____

_____ Dewatering Wells – If dewatering of the dam foundation is required, contact the Arizona Department of Water Resources, Groundwater Management Support Section, (602) 417-2470. _____

_____ Floodplain Management - Any activity in a floodplain requires a floodplain use permit from the local flood control district. Any structure, which will divert, retard or obstruct the flow of water, will require an in-depth review by a flood control district before issuance of the permit. Removal of a dam will also require an in-depth review. Contact the local flood control district. _____

_____ Archaeological Clearance - Any activity, which involves ground _____

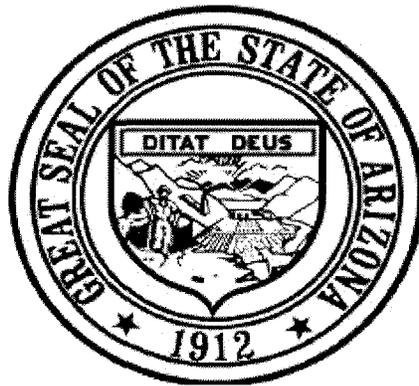
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disturbance, requires prior clearance regarding cultural resources
sensitivity and treatment from the State Historic Preservation Officer.
Contact the Arizona State Parks, (602) 542-4174.

ARIZONA DEPARTMENT OF WATER RESOURCES

OFFICE OF DAM SAFETY AND FLOOD MITIGATION

Dam Safety Section



REQUIREMENTS

DURING AND FOLLOWING CONSTRUCTION

OF

HIGH AND SIGNIFICANT HAZARD DAMS

INTRODUCTION

This guide, regarding the requirements during and following construction, has been prepared to facilitate the applicant's understanding and compliance with Arizona law. Any omissions or errors do not relieve the applicant from complying with applicable sections of Arizona Revised Statutes (A.R.S.) Title 45-Waters, Chapter 6 and Arizona Administrative Code (A.A.C.) Title 12—Natural Resources, Chapter 15—Department of Water Resources (Department).

A.R.S. § 45-1202 places all dams, unless specifically exempt, under supervision by the Arizona Department of Water Resources (Department). In accordance with A.R.S §§ 45-1203, 1206 and 1207, and A.A.C. R12-15-1207(A), written approval of an owner's application is required prior to construction of a new dam or enlargement, repair, alteration or removal of an existing dam. Application requirements differ according to the hazard potential of the dam. A.A.C. R12-15-1212 in conjunction with A.A.C. R12-15-1208 specifies requirements that must be followed during construction of a new high or significant hazard dam, or the reconstruction, repair, enlargement or alteration of an existing high or significant hazard dam. A.A.C. R12-15-1213 specifies the requirements following completion of construction of a new high or significant hazard dam, or the reconstruction, repair, enlargement, alteration or removal of an existing high or significant hazard dam.

A.A.C. R12-15-1212 in conjunction with A.A.C. R12-15-1210 through 1211 specify the construction and post-construction requirements for low or very low hazard dams. This guide only addresses the requirements for high and significant hazard dams.

REQUIREMENTS DURING DAM CONSTRUCTION

In accordance with A.R.S. § 45-1207 and A.A.C. R12-15-1207(F), an approval to construct a new dam or repair, enlarge, alter, breach or remove an existing dam is valid for one year. If construction does not begin within one year, the approval is void. Upon written request and good cause shown by the owner, the Department may extend the time for commencing construction. The Department must review the application again in light of changes that may have occurred since the approval was originally given and grant another approval. An applicant may not start construction before the Director reviews the application for changes and grants another approval.

Pre-Construction Conference

In accordance with A.R.S. § 45-1207, the applicant must provide the Director notice of the construction start by registered mail at least 10 days before the start. Before commencement of construction activities, the owner must invite to a pre-construction conference all involved regulatory agencies, the prime contractor and all subcontractors in accordance with A.A.C. R12-15-1212. At this meeting, the Department will identify, to the extent possible, the key construction stages at which an inspection will be made. At least 48 hours before each key construction stage identified for inspection, the owner, or the owner's engineer, must provide notice to the Department. From the Department's perspective, the conference provides a final forum for communication of regulatory requirements so that the contractor can plan construction activities accordingly.

Construction Control

The owner and the owner's engineer must supervise, or direct, the supervision of construction of a new dam or reconstruction, repair, enlargement, alteration, breach or removal of an existing dam complying with the construction quality assurance plan in accordance with A.A.C. R12-15-1212. Failure to perform the work in accordance with the application approved by the Department renders the approval revocable in accordance with A.A.C. R12-15-1212. The owner's engineer must exercise professional judgment independent of the contractor, and be a registered professional engineer licensed in Arizona with proficiency in engineering and knowledge of dam technology.

The Department will periodically inspect construction to confirm that it is proceeding according to the approved design and to confirm that the owner's engineer is exercising proper construction control. The owner's engineer must submit summary reports of construction activities and test results according to a schedule approved by the Department. The owner, or the owner's engineer, must remedy any unsatisfactory condition with the contractor.

The Department must have access to the dam site in accordance with A.A.C. R12-15-1214, for purposes of inspecting all phases of construction including, but not limited to, the foundation, embankment, concrete placement, inspection and test records, and mechanical installations.

The owner must immediately report to the Department any condition encountered during construction that requires a deviation from the approved plans and specifications. The owner must promptly submit a written request for approval of any necessary change and sufficient information to justify the proposed change. The owner may not commence construction without the written approval of the Director unless the change is a minor change. A minor change is a change that complies with rules and provides equal or better safety performance.

REQUIREMENTS FOLLOWING COMPLETION OF DAM CONSTRUCTION

In accordance with A.R.S. § 45-1209 and A.A.C. R12-15-1212, upon completion of construction, the owner must notify the Department in writing to that effect. The Department will make a final inspection as soon as practicable. The owner must correct any deficiencies noted during the final inspection as soon as possible. The Department may conduct a follow-up inspection and confirm that the deficiencies have been corrected. Use of the reservoir requires written permission from the Department.

Within 90 days of completion of construction of high and significant hazard dams, A.R.S. § 45-1209 and A.A.C. R12-15-1213 require that the owner file the following:

- An affidavit showing the actual cost of construction. Attach a detailed accounting of the costs of construction, including all engineering costs (see paragraph below on Fee Requirements). A sample affidavit is included in this section.
- An additional fee or refund request, as appropriate, based on the actual cost of construction (see the section below on Fee Requirements).
- One (1) set of full sized as-constructed drawings, in the form of paper prints, sealed by the engineer who supervised and approved the construction. As-constructed plans must show confirmation survey points and elevations, for the dam and appurtenant structures, made during and after completion of construction. If changes were made to the approved drawings during construction, supplemental drawings showing the dam and appurtenances as actually constructed must be included.
- Construction records, including grouting, materials testing, and locations and baseline readings for permanent benchmarks and other instrumentation, initial surveys and readings.
- Photographs of construction from exposure of the foundation to completion of construction.
- A brief completion report summarizing the salient features of the project, including a description of the causes for any changes or deviations from the approved drawings and specifications which were made during the construction phase.
- A schedule for filling the reservoir specifying fill rates, water level elevations to be held for observation and a schedule for inspecting and monitoring the dam. The owner must monitor the dam monthly during the first filling.
- An operating manual for the dam and its appurtenant structures. The operating manual must include a process for safety inspections prescribed in A.A.C. R12-15-1219. The operating manual must also include schedules for surveillance activities and baseline information for any installed instrumentation as follows:

- a. The frequency of monitoring.
- b. The data recording format.
- c. A graphical presentation of data.
- d. The person who will perform the work.
- e. Evaluation of collected data.

In accordance with A.R.S. § 45-1209 and A.A.C. R12-15-1214, upon review and approval of these items and finding that construction has been conducted in accordance with the approved plans and specifications and finding that the dam is safe, a License of Approval will be issued by the Director unless a license currently in effect requires no changes. Use of the reservoir requires written permission from the Director.

Fee Requirements

Upon completion of the project, the total actual costs related to construction shall be tabulated and an affidavit of Total Cost shall be filed with the Department, in accordance with A.R.S. § 45-1209(C), A.A.C. R12-15-1213 and A.A.C. R12-15-151(B)(1 I). The filing fee shall be recomputed for the total cost in accordance with the Example Final Fee Calculation as shown below and payment shall be made for the difference between the fee already paid and the recomputed fee. In accordance with A.R.S. § 45-1209(C), no License of Final Approval shall be issued until a completed affidavit and the final filing fee is received and approved by the Department.

The fee is based upon the total project costs associated with construction of the dam and appurtenant works integral to the design and safe operation of the dam. Preliminary investigations and surveys, engineering designs, the Department’s application requirements, administration and supervision of construction, and any other engineering costs related to construction shall also be included.

If the recomputed fee for actual total costs exceeds the estimated fee paid with the application filing by \$50.00 or more, then the owner must pay the difference between the fee already paid and the recomputed fee. If the recomputed fee is less than the original fee by an amount of \$50.00 or more, then the owner is entitled to a refund by the amount of the difference between the fee already paid and the recomputed fee.

A refund may be obtained by written request including supporting documentation. The Department will review the final cost statement and initiate the refund process if a refund is indicated.

Example Final Fee Calculation

Based upon the actual total costs the fee will be computed according to the following schedule:

- For the first \$100,000 of the cost, two (2 %) percent.
- For the next \$400,000, one and one-half (1.5 %) percent.
- For the next \$500,000, one (1 %) percent.
- For all costs in excess of \$1,000,000, one-half of one (0.5 %) percent.

ESTIMATED FEE CALCULATION FOR SUBMITTAL WITH THE APPLICATION:

<i>ESTIMATED COST</i>	<i>\$6,420,000.00</i>
<i>2% x \$100,000</i>	<i>2,000.00</i>
<i>1.5% x \$400,000</i>	<i>6,000.00</i>
<i>1% x \$500,000</i>	<i>5,000.00</i>
<i>0.5% x \$5,420,000</i>	<i>27,100.00</i>
 <i>ESTIMATED FEE</i>	 <i>\$40,100.00</i>

**RECOMPUTED FEE CALCULATION FOR A CTUAL PROJECT COST INA CCORDANCE WITH THE
AFFIDAVIT OF TOTAL COST:**

<i>ACTUAL COST</i>	\$6,482,500.00
<i>2% x \$100,000</i>	2,000.00
<i>1.5% x \$400,000</i>	6,000.00
<i>1% x \$500,000</i>	5,000.00
<i>0.5% x \$5,482,500</i>	27,412.50
 <i>RECOMPUTED ACTUAL FEE</i>	 \$40,412.00
 <i>ORIGINAL ESTIMATED FEE</i>	 -40,100.00
 <i>ADDITIONAL FEE</i>	 \$312.50

In the example, the owner would be required to pay an additional fee of \$312.50. If the actual cost were \$6,320,000.00, then the recomputed fee would be \$39,600.00. The difference of \$500.00 would be an over payment and the owner would be entitled to a refund of \$500.00.

Place On Applicant's Letterhead

Arizona Department of Water Resources
Office of Water Engineering
Dam Safety Section
500 North Third Street
Phoenix, Arizona 85004-3903

Director:

I, _____ am the _____
(Name) (Owner or Authorized Agent of Owner)
of the _____
(Name of Dam and Reservoir)

The final actual total cost of the construction (or enlargement, repair, alteration or removal, as appropriate) of the dam and appurtenant works to completion thereof is as follows:

• 1.	ENGINEERING	
1.1	Preliminary investigations, surveys and design	\$ _____
1.2	Final investigations, surveys, design and ADWR application requirements	\$ _____
1.3	Contract administration, construction supervision	\$ _____
1.4	Construction quality control testing	\$ _____
	TOTAL ENGINEERING	\$ _____
• 2.	CONSTRUCTION CONTRACT PAYMENTS	
**	2.1 Final payment for contract bid quantity list	\$ _____
**	2.2 Final Payment for change orders to bid quantity list	\$ _____
	TOTAL CONSTRUCTION CONTRACTS	\$ _____
	TOTAL CONSTRUCTION COST (Engineering + Construction Contracts)	\$ _____

I hereby declare under penalty of perjury that, to the best of my knowledge and belief, the above statement is true and correct.

Executed on _____ at _____, Arizona.

(Owner's Signature)

(Notary) (Date)

- The cost breakdown must include all applicable costs as indicated. For projects with two or more features, an allocation of total project cost items to each appropriate feature may be made. Allocations of project cost items may be combined when properly identified to fit the individual circumstances.
- ** Attach forms showing contract bid quantities with prices and final pay quantities, including Change Order items.

APPENDIX B

EXAMPLE PERMIT REQUIREMENTS

CASE 2: NEW JERSEY

DAM SAFETY STANDARDS
N.J.A.C. 7:20
EFFECTIVE DATE: SEPTEMBER 8, 2005,
AMENDMENT OCTOBER 3, 2005,
EXPIRATION DATE: SEPTEMBER 8, 2010

**SUBCHAPTER 1. APPLICATION PROCEDURE; DESIGN CRITERIA
FOR DAM CONSTRUCTION; DAM INSPECTION
PROCEDURE**

N.J.A.C. 7:20-1.1 Scope and applicability

The rules in this subchapter were adopted pursuant to the authority of N.J.S.A. 58:4-1 et seq., as amended by the Safe Dam Act of 1981, and N.J.S.A. 13:1D-1 et seq.

1. These rules set forth procedures for application to construct, repair or modify a dam, as defined in N.J.A.C. 7:20-1.2 and set standards for design and maintenance of dams. These rules also establish a dam inspection procedure.
2. Any dam which raises the waters of a stream five feet or less above its usual, mean, low water height falls under the jurisdiction of the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq.
3. The requirements in this subchapter shall not affect or relate to a dam or reservoir in the pinelands area, as designated by subsection a. of section 10 of P.L. 1979, c.111 (C. 13:18A-11), which will raise the waters of any river or stream less than eight feet above the surface of the ground where the drainage area above the same is less than one square mile in extent and where the water surface created by the dam or reservoir is less than 100 acres in extent except that the commissioner may investigate and take appropriate action regarding any dam or reservoir about which he has a security or safety concern. With respect to dams and reservoirs located on lands utilized for agricultural or horticultural purposes within the pinelands area, the commissioner's actions shall be undertaken after consultation with the Secretary of Agriculture. See N.J.S.A. 58:4-1, P.L. 1985, c.33, S1 and 2.

N.J.A.C. 7:20-1.2 Definitions

The following words and terms, as used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

"Applicant" means any person making application for a dam permit.

"Auxiliary spillway" means the second used spillway during flood flows which is not the emergency spillway.

"Dam" means any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of dam.

"Department" means the New Jersey Department of Environmental Protection.

"Design freeboard" means the minimum freeboard which would exist during passage of the design flood.

"Division" means the Division of Engineering and Construction in the Department of Environmental Protection.

"Emergency spillway" means the spillway capable of passing the spillway design storm with the principal and/or auxiliary spillway blocked.

"Environmental impact statement" means a report which describes the real and potential impacts which will or may result from the construction and operation of a proposed dam project, the adverse environmental impacts which cannot be avoided, the steps to be taken to minimize adverse impacts and the alternatives to the project with reasons for the acceptability or unacceptability; and

1. The report shall address real or potential impacts upon ecology, natural resources, historical and archeological resource, recreational resources, aesthetic resources, endangered and non-game species, fisheries and any other identifiable impacts;
2. The report shall include a listing of qualifications of those preparing the report and a reference list of pertinent published information relating to the project, the project site and the surrounding region.

"Formal inspection" means the inspection by a New Jersey licensed professional engineer to reevaluate the safety and integrity of the dam and appurtenant structures to determine if the structure meets current design criteria, including a field inspection and a review of the records on project design, construction and performance.

"Freeboard" means the vertical dimension between the crest of the embankment of a dam (without camber) and the reservoir water surface at the spillway design flood stage.

"Height-of-dam" means the vertical dimension from the lowest point in the stream bed or ground surface at the downstream toe of the dam to the elevation of the top of dam (without camber).

"Independent Review Board" means one or more independent professional engineers who are qualified in the design, construction and rehabilitation of dams to perform a review of

the project design and construction.

"Informal inspection" means the visual inspection of the dam by the dam owner or operator to detect apparent signs of deterioration or other deficiencies of the dam structure or function.

"Levee" or "dike" means any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream or river.

"One-hundred-year storm" means the storm which is estimated to have a one percent chance, or one chance in 100, of being equaled or exceeded in one year.

"Outlet" means an opening through which water can be freely discharged from a reservoir for a particular purpose.

"Owner and/or operator" means any person who owns, controls, operates, maintains, manages or proposes to construct a dam.

"Permit" or "dam permit" means all approvals required under N.J.S.A. 58:4-1 et seq. for the construction and operation of a dam.

"Person" means any individual, proprietorship, partnership, association, corporation, municipality, county or public agency.

"Principal spillway" means the primary or first used spillway during normal inflow and flood flows.

"Probable maximum precipitation" or "(PMP)" means the theoretically greatest depth of precipitation for a given duration that is physically possible, over a given size storm area, at a particular geographic location, at a certain time of year.

"Regular inspection" means the visual inspection of a dam by a New Jersey licensed professional engineer to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior.

"Reservoir" means any impoundment or any potential impoundment that will be created by a dam, dike or levee.

"Spillway" means a structure other than low flow outlets, over or through which flood flows are discharged.

"Spillway design storm" means the storm upon which the hydraulic capacity of the spillway structure is designed.

"Toe-of-dam" means the junction of the downstream face of a dam with the ground surface or the invert of the outlet pipe whichever is the lowest point.

N.J.A.C. 7:20-1.3 Permit-by-rule

- (a) All dams must be designed, constructed, operated maintained or removed in compliance with the rules in this subchapter except as set forth below:
1. Owners and operators of Class IV dams (see N.J.A.C. 7:20-1.8, Dam classification) are not required to file documents with nor obtain a permit from the Department, but must meet the following requirements, in addition to those set forth elsewhere in this subchapter:
 - i. Design must be based upon a spillway design storm that results in rainfall of 50 percent greater than a 24- hour, 100-year, Type III storm (Later technology adopted by the United States Department of Agriculture, Natural Resources Conservation Service may be substituted for the use of the Type III storm.); and
 - ii. All necessary local approvals must be obtained;
 - iii. A New Jersey licensed professional engineer must design the Class IV Dam to meet all technical requirements of this subchapter; and
 - iv. If the Class IV dam is designed or constructed for stormwater management purposes, the dam shall comply with the Stormwater Management Rules at N.J.A.C. 7:8.
 2. Owners and operators of Class III agricultural impoundments, meaning any impoundment used for fish and wildlife, fire control or livestock or crop production and maintenance, where the drainage area is less than one-half square mile in extent, must meet only the following requirements.
 - i. All necessary local approvals must be obtained;
 - ii. Design and construction must be supervised by the United States Department of Agriculture, Natural Resources Conservation Service.
- (b) The Department may, in its discretion, require the owner or operator of any dam subject to (a) above to obtain a permit and/or to submit any information relating to dam design, construction, operation or maintenance.
- (c) The Department may, in its discretion, require the owner or operator of any dam to make modification of the design, construction or operation of the dam in order to comply with the intent of this chapter and the Safe Dam Act, N.J.S.A. 58:4-1 et

seq.

N.J.A.C. 7:20-1.4 General requirements and prohibitions

- (a) No person may construct or operate a new dam or modify or repair an existing dam without first having obtained a permit from the Department, unless subject to the permit-by-rule provision in N.J.A.C. 7:20-1.3. Where emergency circumstances justify, repairs of a dam may be undertaken prior to obtaining a permit, in accordance with (i) below.
- (b) No dam may be approved by the Department where, in the opinion of the Department, there is an unacceptable potential for harm to human health or to human safety.
- (c) Backwater created by a dam during a 100-year storm shall be the minimum which is contained within the applicant's property unless written consent is obtained from all potentially affected property owners. Effects on both surface and ground water shall be considered, during normal pool conditions.
- (d) No person may construct a dam in any waterway of this state which is a runway for migratory fish, without installing a fish ladder or other approved structure to permit the fish to pass the dam in either direction (see N.J.S.A. 23:5-29.1).
 - 1. This provision is applicable to dams of any size.
 - 2. The Department will determine whether a stream is currently a runway for migratory fish, during the review of the dam permit application. Applicants should consult the Division of Fish and Wildlife in this matter prior to finalizing the application.
- (e) Unless otherwise approved by the Department, dam construction shall commence within one year from the date of the permit and be completed within two years from the said date or the permit will become null and void. For good cause shown, the Department may extend the two year construction deadline for a total of no more than five years, one year at a time. Applicants must make written request for an extension, prior to the expiration date of the permit or prior extension.
- (f) No action shall be brought against the State or the Department or its agents or employees for the recovery of damages caused by the partial or total failure of any dam or reservoir or through the operation of any dam or reservoir upon the ground that the Department is liable by virtue of any of the following:
 - 1. The approval of the dam or reservoir, or approval of flood handling plans during construction.

2. The issuance or enforcement of orders relative to maintenance or operation of the dam or reservoir.
 3. Control, regulation and inspection of the dam or reservoir.
 4. Measures taken to protect against failure during an emergency.
- (g) The Department may deny any application for a dam permit, based upon its conclusion that the construction or operation of dam will cause an unacceptable threat to or impact on natural or cultural resources or the environment.
- (h) The Department shall be notified immediately by the owner or operator upon the detection of any condition which may jeopardize the safety of the structure.
- (i) Situations which threaten the public health, safety, and welfare and require emergency dam repair will be considered by the Department under the following procedure:
1. The owner or operator shall inform the Department by telephone as to the extent of work to be performed, the reason for the emergency and the location of the project.
 2. The owner or operator shall perform the emergency work upon verbal approval of the Department, which approval shall be verified by the Department in writing within three working days. The Department shall offer guidance and instructions in performing the work.
 3. After the work has been completed in accordance with the Department's instructions, the owner or operator shall submit a dam Permit Application and "as built" drawings to the Department for review. A letter shall be issued by Department in lieu of a dam permit.
- (j) The Department shall be notified in writing on or before the transfer of dam ownership.
- (k) Unless otherwise approved by the Department in writing, no person shall dredge within 200 feet of a dam.
- (l) Utilities crossing within dam embankments are prohibited unless demonstrated to the satisfaction of the Department that such utilities will not jeopardize the safety of the dam.
- (m) No person shall remove or breach an existing dam without first having obtained a permit from the Department unless subject to the permit-by-rule provisions in N.J.A.C. 7:20-1.3.

- (n) Unless otherwise approved by the Department, no trees shall be permitted to grow on the dam embankment.

N.J.A.C. 7:20-1.5 General application procedures

- (a) The procedures for applying for a dam construction, modification or repair permit and for submitting the supporting engineering documents include the preapplication stage and the application stage, as described below. For Class III dams (see N.J.A.C. 7:20-1.8) all required information may be submitted at one time, with such detail as is appropriate to the safe design of the type of structure proposed.
- (b) The applicant for a dam permit must use a New Jersey licensed professional engineer to prepare the plans and specifications and to supervise the inspection of the construction.
- (c) The Department may require any owner or operator of an existing dam to obtain a permit for repair or modification of the dam and appurtenances where:
 - 1. Repair or modification is necessary to insure protection of human health or safety; or
 - 2. Modification is required to comply with the provisions of this chapter, unless the following circumstances exist:
 - i. Compliance is impracticable; and,
 - ii. Noncompliance poses no unacceptable threat to human health or safety.
- (d) Appeal procedures; permit denials
 - 1. An applicant for a dam permit may request in writing an administrative hearing from the Department within 15 days of receipt of the decision by the Department to deny the application.
 - 2. The request for a hearing shall specify in detail the basis for the request, including all issues of fact or law. The Department may attempt to settle the dispute by conducting such proceedings, meetings and conferences as

deemed appropriate. Should the efforts to settle the dispute fail and if the Department determines that the matter is a contested case, the Department shall forward the request for a hearing to the Office of Administrative Law, pursuant to the provisions of the Administrative Procedure Act (N.J.S.A. 52:14B-1 et seq.)

- (e) Applicants for a dam permit for a Class III dam, as defined pursuant to N.J.A.C. 7:20-1.8, may submit a preliminary application, which should include that information needed to establish a Class III hazard classification. Thereafter, in its discretion, the Department may waive certain documentation and inspection requirements set forth in these rules.

N.J.A.C. 7:20-1.6 Preapplication Stage

- (a) The applicant must submit a written Preliminary Report which must include the following:
 - 1. A general description of the dam and all appurtenances thereto, and the proposed dam classification, pursuant to N.J.A.C. 7:20-1.8. The description shall include the following:
 - i. A statement of the purpose for which the dam and appurtenances are to be used; and
 - ii. A description of the potential effects of project construction and operation upon the environment.
 - 2. Maps of the area within one-half mile of the dam and impoundment boundary, showing the following:
 - i. The location of the proposed dam and all appurtenances, thereto;
 - ii. The location of all structures;
 - iii. The county and township;
 - iv. The boundary of the reservoir;
 - v. The location of all streets and roads;
 - vi. The location of all major utilities, i.e. pipe lines and transmission, telegraph, and telephone lines; all minor utilities shall be identified in the immediate vicinity of the dam and impoundment area.

- vii. The topography and scale; and
 - viii. All other structures or facilities affected by the proposed dam, including the area downstream from the dam (State, county, and U.S.G.S. maps and aerial photographs may be used for this purpose).
3. A written report of the surficial conditions (i.e. geology, topography, and culture), based upon a field reconnaissance by the applicant's engineer;
 4. Typical cross-sections of the dam, and any dike(s) and levee(s), showing proposed elevations, pool levels and top and bottom widths;
 5. Preliminary design data, tentative conclusions and references. The design data shall address hydrologic features such as drainage area and rainfall data, the basis for proposed dam location, the basis for the type of structure and spillway proposed, the soils and geologic engineering criteria and the basis for design and construction;
 6. The hydrologic design procedure and the storm durations which are used in the design;
 7. All documentation and information related to determining hazard classification; and
 8. Other information required by the Department.
- (b) Upon review of the pre-application, the Department will notify the applicant of what design criteria will apply.
- (c) Applicants for a permit to repair an existing dam are not required to submit a preliminary report unless the Department determines it to be necessary.

N.J.A.C. 7:20-1.7 Application Stage

- (a) The application shall be on forms specified and supplied by the Department and must be accompanied by two copies of the final design report, construction specifications and all plans, drawings, and designs. Upon the written request of the applicant, the Department may waive certain requirements for documentation in the application stage set forth at (b) to (g) below for a permit to modify or repair an existing dam.
- (b) The application shall include a Final Design Report, which must contain the following:
1. A report of the field and laboratory investigation(s) of the foundation soils

and/or bedrock, a location map to identify borings and the materials that will comprise the dam and any dikes or levees. Stability and settlement analyses and seepage and underseepage studies are required, unless the applicant can demonstrate to the satisfaction of the Department that these analyses are not necessary.

2. The bases, references, calculations and conclusions relative to hydrologic studies and design of spillway.
 3. Structural and hydraulic design studies and calculations. Structural, hydraulic and hydrologic design procedures should be used, as established by one of the following: the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the U.S. Natural Resources Conservation Service and other procedures universally accepted as sound engineering practice.
- (c) The application must include all drawings necessary to fully describe the proposal. Drawings must be prepared in accordance with the following:
1. All drawings must be prepared by a New Jersey licensed professional engineer or land surveyor, as appropriate. Each drawing shall have a title block which meets the requirements of the State Board of Professional Engineers and Land Surveyors.
 2. Drawings must clearly show the datum to which elevations shown are referred. The National Geodetic Vertical Datum of 1929 (N.G.V.D.), formerly known as the U.S. Coast & Geodetic Survey datum, should be used wherever possible. If the N.G.V.D. datum is not used, an appropriate conversion equation must be indicated on the drawings.
 3. The applicant must submit drawings showing the following information:
 - i. A general plan of the dam, drawn to an appropriate scale, which must show accurately the position of all essential details, such as the spillway and its point of discharge into the stream, pipes through the dam, inlets, outlets, screen chambers, gate or valve houses, head-races, the canal mill or power plant, tailraces and downstream bridges which might cause backwater on the dam;
 - ii. A longitudinal section of the dam and cross-section of the valley at the site of the dam, showing the elevation of the crest of the dam, the elevation of the normal and design storm flow line of the lake or reservoir, the original surface of the ground, the nature and depth of the underlying strata, the probable depth of the excavation for the

foundation of the dam and for the cutoff, foundation treatment, elevation of the restored surface of the ground, the location and elevation of all pipes or conduits passing through the dam, the core wall, if any, and the spillway structure;

iii. Typical cross sections, including a maximum section of the dam and of a spillway section which shall meet the following requirements;

- (1) Cross sections must show the original surface of the ground, subsurface conditions as disclosed by test pits or borings, the probable depth of excavations for the foundation and for cutoff, the elevations of the top of the dam, the crest of the spillway and the normal flow line or water surface in the reservoir;
- (2) For earth dams, the depth of stripping must be shown, as well as the position, material and dimensions of the cutoff or core wall, the width of the crest, the slopes and the nature and dimensions of the slope protection, the position and dimensions of the outlet pipes or conduits and the cutoff to prevent seepage along such structures, the disposition of different classes of embankment material if of varying composition, toe drains and clay blankets;
- (3) For concrete or other composite dams, the cross sections shall show all dimensions and shall indicate the position and kinds of material to be included in the structure.

iv. If not clearly indicated on one or more of the drawings listed above, the following details shall be shown on additional detail sheets:

- (1) Detail of spillway or overflow, showing the length and depth of opening, together with the width and shape of the crest, grade and shape of the approach and discharge channels, if any, methods of protecting the toe of the dam or end of the discharge channel from erosion and the dimensions of all walls, floors and paving;
- (2) Details of the intake and outlet works, showing the location and dimensions of all valves or sluice gates, intakes, screen chambers, racks, outlet towers and gate houses and appurtenances;
- (3) For reinforced concrete dams, detailed drawings must also be

submitted, showing the size, spacing and arrangement of all reinforcing steel and expansion joints; and

- (4) Special drawings shall be submitted showing any special construction features not otherwise shown, such as piling, fishways, aprons, materials used in the core wall, movable dams, tainter gates and mechanical devices, drains and instrumentation.

(d) The application must include specifications, containing the following:

1. General provisions, specifying the rights, duties and responsibilities of the owner, applicant, applicant's engineer and the builder;
2. The estimated project schedule and sequence of work; and
3. Technical provisions, describing carefully and in detail the approved work methods and procedures, standards for equipment and testing, materials to be used and the results to be obtained.

(e) The applicant shall complete all investigations, including the following, prior to submission of the final design report which shall meet the following requirements:

1. The scope and the degree of precision of investigations required for a specific project shall be based on the complexities of the site, the importance of the proposed structure and the hazard created by the proposed structure.
2. The foundation investigation shall consist of borings, test pits, seismic investigations or other subsurface explorations and must be performed so as to accurately define the soil and rock stratigraphy and the ground water conditions to the satisfaction of the Department.
3. Laboratory testing of undisturbed and remolded soil specimens and rock samples may be required by the Department.
4. The applicant must determine the nature and extent of materials which are proposed for use in the structure, (e.g., borrow material, concrete aggregate, riprap stone, filter materials) and their structural properties when incorporated into the proposed structure.
5. Stability analysis and calculations for the proposed structure to ensure safety against failure due to overturning, sliding or overstressing must be

submitted and approved by the Department.

6. Topographic surveys must be performed with sufficient accuracy to locate the proposed construction and to define the volume of the storage in the reservoir and the flowage limits. The upstream and downstream area must be investigated in order to delineate the area of potential damage in case of failure or flooding. Locations of baselines, centerlines and other horizontal and vertical control points must be shown on the topographic map of the site.
 7. The drainage area must be accurately determined. Both present and projected future land use must be considered in determining the runoff characteristics of the drainage area. The most severe of these two conditions must be used in the design. The hydrologic assumptions and design calculations used in spillway designs shall be specified and shall include:
 - i. Drainage area size;
 - ii. Rainfall and runoff data;
 - iii. Reservoir inflow hydrographs;
 - iv. Reservoir area-capacity-elevation data;
 - v. Spillway elevation-discharge data; and
 - vi. Reservoir flood routings, except as otherwise provided in this subchapter.
- (f) All applicants must submit an Operation and Maintenance Manual in accordance with N.J.A.C. 7:20-1.1 and applicants for Class I and II dams (see N.J.A.C. 7:20-1.8) shall prepare and submit an Emergency Action Plan which shall at least include a Dam Breach Analysis, Inundation Maps and Emergency Notification and Evacuation Plans.
- (g) The Department may require the submission of an Environmental Impact Statement, as defined in N.J.A.C. 7:20- 1.2, by any applicant for a dam permit.
- (h) The application to remove or breach a dam shall include the following:
1. Design report, and plans and computations to effect the breach including size of breach, shape of breach, disposal of spoil material;
 2. Plans and computations for stabilization of the lake bed including the channel upstream of the breach, and for the control of sediment within the lake and downstream of the breach during and after the breach has been

effected;

3. Computations for design of the method and timing for dewatering the lake;
 4. Computations detailing the effects of the breach on the downstream channel and demonstrating that the project will not adversely affect flooding conditions downstream during the 10, 50 and 100 year storms;
 5. Specifications containing the technical provision which describe in detail the proposed work methods and equipment and, in addition, a work schedule for the entire project;
 6. A plan of the existing dam and lake along with surrounding property lines;
 7. Evidence that all adjoining property owners of the impoundment and the municipality where the reservoir or dam is located have received notification that an application has been submitted to the Department to remove or breach a dam and proof of publication of notice of the proposed removal application in at least one newspaper of general circulation in the municipality where the reservoir or dam is located;
 8. A description of the potential effects of the dam removal or breach upon the environment; and
 9. A description of the potential effects of the dam removal or breach upon life and property downstream of the dam.
- (i) When a petition has been filed in accordance with the Safe Dam Act, N.J.S.A. 58:4-9, protesting against the removal of any reservoir, water or dam or against the decommissioning of any reservoir or dam, the Commissioner shall, pursuant to the requirements of N.J.S.A. 58:4-10, hold a public hearing, upon 30 days notice to all parties interested, and following prior notice published 30 days before the hearing in at least one newspaper of general circulation in the municipality in which the reservoir or dam is located.

N.J.A.C. 7:20-1.8 Dam Classification

- (a) The Department will use the following guidelines to classify dams according to hazard. Probable future development of the area downstream from the dam which might be affected by its failure will be considered in determining the hazard classification. The Department may, in its discretion, change the hazard class of any proposed or existing dam.
1. Class I - High Hazard Potential: This classification includes those dams, the

failure of which may cause the probable loss of life or extensive property damage.

- i. The existence of normally occupied homes in the area that are susceptible to significant damage in the event of a dam failure will be assumed to mean "probable loss of life".
 - ii. Extensive property damage means the destructive loss of industrial or commercial facilities, essential public utilities, main highways, railroads or bridges. A dam may be classified as having a high hazard potential based solely on high projected economic loss.
 - iii. Recreational facilities below a dam, such as a campground or recreation area, may be sufficient reason to classify a dam as having a high hazard potential.
2. **Class II - Significant Hazard Potential:** This classification includes those dams, the failure of which may cause significant damage to property and project operation, but loss of human life is not envisioned. This classification applies to predominantly rural, agricultural areas, where dam failure may damage isolated homes, major highways or railroads or cause interruption of service of relatively important public utilities.
 3. **Class III - Low Hazard Potential:** This classification includes those dams, the failure of which would cause loss of the dam itself but little or no additional damage to other property. This classification applies to rural or agricultural areas where failure may damage farm buildings other than residences, agricultural lands or non-major roads.
 4. **Class IV - Small Dams:** This classification includes any project which impounds less than 15 acre-feet of water to the top of dam, has less than 15 feet height-of-dam and which has a drainage area above the dam of 150 acres or less in extent. No dam may be included in Class IV if it meets the criteria for Class I or II. Any applicant may request consideration as a Class III dam upon submission of a positive report and demonstration proving low hazard.

N.J.A.C. 7:20-1.9 Design criteria

- (a) The minimum design storm used to calculate required spillway capacity must be determined according to the following table:

<u>Hazard</u>	<u>Spillway Design Storm (SDS)</u>
Class I	PMP
Class II	One-half PMP

the pipe conduit is 30 inches.

- ii. For Class III dams, the minimum allowable inside diameter of the pipe conduit is 18 inches.
 - iii. For Class IV dams, the minimum allowable inside diameter of the pipe conduit is 12 inches.
2. All pipe conduits shall convey water at the maximum design velocity without damage to the interior surface;
 3. The pipe conduit must be designed so that negative pressures will not occur at any point along the primary (principal) spillway system;
 4. Anti-seep collars or other methods approved by the Department must be installed to control seepage along the conduit;
 5. Adequate allowances shall be incorporated in the design to compensate for differential settlement and possible elongation of the pipe conduit;
 6. An anti-vortex device must be included in the design, unless the applicant can demonstrate that one is not necessary.
 7. A trash rack, approved by the Department, shall be installed at the intake to prevent clogging of the pipe conduit; and
 8. An emergency spillway shall be provided; and
 9. Cathodic protection is required for all metal pipes .
- (h) Should a vegetated or unlined auxiliary spillway, approved by the Department, be installed, it must be able to pass the design storm without jeopardizing the safety of the structure and that has a predicted average frequency of use less than:
1. Once in 100 years for Class I dams:
 2. Once in 50 years for Class II dams; or
 3. Once in 25 years for Class III and IV dams.
- (i) Drawdown requirements are as follows:

1. Except for excavated impoundments, all dams shall include a device to permit draining the reservoir, as approved in writing by the Department. Computations for the minimum time required to drain the reservoir shall be required for new and existing dams.
 2. Unless the applicant demonstrates to the satisfaction of the Department that there is a need to locate a valve downstream from the dam and that the areas downstream of the dam will remain protected, all valves or sluice gates in pipe conduit drains must be installed upstream of the dam.
 3. All pipe conduits used as drawdown drains for all dam classifications shall meet requirements of (g) above, except that the minimum allowable inside dimension may be less than 30 inches.
 4. Dams which impound water on a permanent basis shall include a means to allow the reduction of the reservoir water surface elevation five feet in 10 days at a rate not to exceed one foot per day. This requirement shall not apply to dams whose intended purpose requires and whose design allows faster drawdown times. For existing dams which satisfactorily meet Department safety and operating criteria, the applicant may, with prior approval of the Department, present alternative reservoir drawdown plans.
- (j) Design references used shall be cited in the information submitted to the Department.
- (k) Monitoring devices to permit inspection and assessment of the dam's condition may be required by the Department for use in the inspections during and after completion of construction.
- (l) The applicant shall demonstrate to the Department that the riparian rights of downstream property owners will be protected during construction, during the period when the reservoir is being filled and during the life of the dam and reservoir.
- (m) Unless the applicant can demonstrate that an alternative slope is acceptable, upstream slopes of an earth dam may be no steeper than three horizontal to one vertical ratio, and downstream slopes may be no steeper than two horizontal to one vertical ratio. Measures are required for protection of upstream slopes against wave action or rapid draw-down and for protection of the downstream slope against scour or erosion due to high tailwater.
- (n) Freeboard requirements are as follows:
1. Sufficient freeboard shall be provided to prevent overtopping of the dam or any dike or levee due to passage of the design flood or due to frost damage, ice damage or wave action.

2. For all dams the minimum elevation of the top of the dam must be that necessary to pass the design storm with at least one foot of freeboard to the top of dam.
 3. Where special conditions of severe frost damage, ice damage or wave action may occur, higher elevations than required in (n)2 above may be required and should be considered by the applicant.
- (o) The Department may require the design and installation of any additional or modified measures by any applicant for a dam permit where appropriate to insure the protection of human health or safety.

N.J.A.C. 7:20-1.10 Construction

- (a) Requirements relating to supervision of dam construction are as follows:
1. All applicants shall submit a written description and schedule of the proposed construction, including:
 - i. The estimated time to complete the construction activities, see N.J.A.C. 7:20-1.4(e);
 - ii. Where applicable, a description of the means by which stream flow will be diverted around or through the dam site, or otherwise kept from interfering with the work;
 - iii. The number of inspectors designated for inspection for construction quality control; and
 - iv. Steps to be taken to minimize erosion and sediment production during construction.
 2. The extent and method of inspection for construction quality control must be described and approved by the Department, including an inspection schedule.
 3. The diversion facility, as outlined in 1.i above, must remain open and no water may be permanently stored in the reservoir until the permittee demonstrates to the Department that storage of water will neither interfere with construction activities nor create a hazard to life, health or property.
 4. The professional engineer responsible for inspecting the construction must submit progress reports to the Department at least once each month, during the construction period.

5. The permittee shall promptly advise the Department of all proposed changes in the approved design, plans or specifications. There may be no change in the approved design, plans or specifications without prior approval of the Department. All approved changes must be recorded on the complete set of as-built plans, required in (a) 6, below. The Department may require the submission of revised designs at any time. Written prior approval from the Department is required for major modifications, which shall include significant changes in scale, use, design, impact, etc. of the project, as initially approved. The Department may require written, prior approval of any proposed modification.
 6. A complete set of as-built designs, plans and specifications must be submitted to the Department upon completion of the project.
 7. The professional engineer who has inspected the construction shall submit written certification that the structure has been built in conformance with the designs, plans and specifications, and with any changes approved by the Department.
- (b) The Department may, in its discretion, require the owner to obtain the services of an Independent Review Board to oversee the design and construction of any proposed or existing dam.
- c) Construction inspection program requirements are as follows:
1. The Department may inspect the dam during construction to insure that it is being built in compliance with the designs, plans and specifications submitted to the Department. Departmental inspections in no way relieve either the permittee or the professional engineer in charge from the responsibility of providing adequate inspection of the work.
 2. If, at any time during the progress of the work, the Department finds that the work is not being performed in accordance with the approved designs, plans and specifications and any approved changes, the Department will serve a written notice to that effect on the permittee or his representative. Such notice will state the particulars with which the work has not complied. Additionally, the Department may order the immediate compliance with such designs, plans, specifications, and changes and suspension of all other work until compliance has been effected. If the owner or his representative fails to comply with this order, the permit under which construction is authorized may be revoked or suspended by the Department.
 3. Upon receipt of the as-built plans required in subsection (a) 6 above and the engineer's certification required in subsection (a) 7 above the Department will inspect the completed construction within 45 days. If the Department finds that construction was completed in accordance with the approved

designs, plans, specifications and approved changes, the construction will be approved in writing within 30 days. The approval date shall be the date such approval is sent by the Department.

4. In the 12th month following approval of construction by the Department pursuant to (c) 3 above, the Department will make a final inspection of the construction. If the Department makes a final inspection of the construction, a final approval may be given by the Department, if the final inspection shows that the terms of the permit, designs, plans, specifications and approved changes thereof have been met.

N.J.A.C. 7:20-1.11 Dam operating requirements and inspections: new and existing dams

- (a) The owners and operators of all dams shall develop and use an Operation and Maintenance Manual which provides guidance and instruction to project personnel for the proper operation and maintenance of the reservoir and dam, and meets the following requirements:
 1. The manual shall be composed of two parts:
 - i. Part One shall include an introduction, project description, project authorizations, project history and list of project contracts.
 - ii. Part Two shall contain the operation and maintenance instructions for major project facilities and equipment and a schedule for maintenance.
- (b) The owners or operators of all dams which raise the waters of any stream more than 70 feet above its usual mean low-water height or which impound more than 10,000 acre-feet of water shall have a regular inspection performed annually and formal inspections performed every three years by a New Jersey licensed professional engineer. These inspections must be attended by a professional engineer assigned from the Department. In the year of the formal inspection, regular or informal inspections need not be performed.
- (c) Owners or operators of Class I dams not meeting the size characteristics described in (b) above shall have a regular inspection performed once every two years and a formal inspection performed every six years.
- (d) Owners or operators of Class II dams shall have a regular inspection performed once every two years and a formal inspection performed every 10 years.
- (e) Owners or operators of Class III and IV dams shall have a regular inspection

performed every four years. The Department may at its discretion require the owner or operators to perform a formal inspection of a Class III or IV dam.

- (f) All dam inspections shall be performed from March through December.
- (g) All inspections shall be performed in compliance with the following requirements:
 1. A written guide provided by the Department for the preparation of a Report on Condition of the dam shall be used for all inspections.
 2. Formal and regular dam inspections shall be performed by a licensed New Jersey professional engineer. Except for Class IV dams, the required report shall be submitted to the Department by the engineer within 30 days of completion of the inspection. The report shall indicate the results of the inspection, documenting the conclusions and recommendations. Reports for Class IV dams shall be submitted to the county and/or municipal engineer having jurisdiction over the dam structure.
 3. Informal inspections may be performed by the dam owner or operator and the Report on Condition shall be part of the owner's or operator's permanent file and, unless requested by the Department, Reports shall not be submitted to the Department.
 4. The Department may extend the time for submission of the required material for up to 30 days, if the owner or operator justifies the need for such extension.
 5. Failure by the permittee to inspect within the required time periods or failure to submit the Report on Condition may result in an order to drain the impoundment under the provisions of the Safe Dam Act (N.J.S.A. 58:4-1 et seq.), and/or any other remedy allowed by law.
- (h) For good cause, the Department may require the owner or operator of any dam to perform an inspection of any type at any time.
- (i) The owner or operator of all Class I and II dams shall prepare and use an Emergency Action Plan, as described in N.J.A.C. 7:20-1.7(f).

State of New Jersey

Department of Environmental Protection

Dam Safety Permit Application

Submit to:
Dam Safety Section
P.O. Box 419
501 E. State Street
Trenton, NJ 08625
Tel: (609) 984-0859 Fax: (609) 984-1908

Read requirements and follow instructions carefully. Please print or type.

1a. Applicant/Owner _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

1b. Applicant/Owner _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

1c. Co-permittee _____ Telephone _____
Legal Address _____
City or Town _____ State _____ Zip Code _____

2. Owner's Engineer
Name _____ N.J. License No. _____
Name of Firm _____
Address _____
City or Town _____ State _____ Zip Code _____
Telephone _____

3. Project Description _____

4. Estimated construction cost of project _____

5. Will the work require the lake to be lowered? _____

Date received:	Assigned to:
----------------	--------------

6. Project Location _____
 Name of Dam _____
 Across (name of Stream) _____
 At a Point _____
 (A distance from mouth of stream or County or municipal boundary)
 Municipality _____ County _____
 Latitude _____ Longitude _____
 Quad sheet Location _____ Nearest downstream Municipality _____
 Lot _____ Block _____

7. GENERAL INFORMATION:

NJ File No. _____
 Federal ID No. _____
 Application No. _____
 Hazard Classification _____ Purpose of Dam _____
 Dam Height (ft) _____ Normal Surface (ac) _____
 Dam Length (ft) _____ Normal Capacity (af) _____
 Dam Type _____ Maximum Capacity (af) _____
 Upstream slope _____ Downstream slope _____
 Spillway type _____ Design Flood Flow (cfs) _____
 Other Spillway _____ Freeboard (SDF) (ft) _____
 Drainage (sqr mls) _____ Spillway Capacity (cfs) _____

8. The Dam Safety Standards (N.J.A.C. 7:20-1 et. seq.) must be used in preparation of the following attachments which must be submitted in addition to this form:

- A. Two sets of construction specifications.
- B. Site location map (U.S.G.S. sheet)
- C. Five sets of all construction plans and details.
- D. Two sets of the final design report including all supporting calculations.
- E. Operation and Maintenance Manual (O&M).
- F. Emergency Action Plan (EAP). Required for Class I and II only.

9. Have any other applications for this site/project been submitted, or have any state permits been issued for this project? (If yes, indicate status and project number below.)

	<u>Permit Type</u>	<u>Application Status</u> (i.e. pending/approved)	<u>Project No.</u>
9.1	Stream Encroachment Permit.....	_____	_____
9.2	Waterfront Development Permit.....	_____	_____
9.3	Statewide General FWW Permit.....	_____	_____
9.4	Freshwater Wetlands Individual Permit..	_____	_____
9.5	Pinelands Certificate of Filing.....	_____	_____
9.6	D & R Canal Commission Certificate.....	_____	_____
9.7	Temporary Water Lowering.....	_____	_____
9.8	Permanent Water Lowering.....	_____	_____
9.9	Water Diversion.....	_____	_____
9.10	Local Permits (Specify).....	_____	_____
9.11	Federal Permits (Specify).....	_____	_____

ENDORSEMENTS

A. **APPLICANT SIGNATURE**

I certify under penalty of law that the information provided in this document is true and accurate. I am aware that there are significant civil and criminal penalties for submitting false or inaccurate information.

Type name

Type name

Signature of Applicant/Owner

Signature of Applicant/Owner

Date

Date

B. PROPERTY OWNER-S CERTIFICATION

I hereby certify that the undersigned is the owner of the property upon which the proposed work is to be done. This endorsement is certification that the owner grants permission for the conduct of the proposed activity. In addition, I hereby give unconditional written consent to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection or survey of the project site.

In addition, the undersigned property owner hereby certifies:

- 1. Whether any work is to be done within an easement - Yes____ No____
- 2. Whether any part of the entire project (e.g., pipeline, roadway, cable, transmission line, structure, etc.) will be located within property belonging to the State of New Jersey Yes____ No____

Type or print name and address of owner, if different from item 1 on page 1

Date

Signature of Property Owner

C. STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR-S OR ENGINEER-S REPORT.

I hereby certify that the plans, specifications and engineer-s report, if any, applicable to this project comply with the current rules and regulations of the New Jersey Department of Environmental Protection and that I am familiar with the laws and regulations governing the practice of engineering and land surveying in New Jersey and the definition of Aresponsible charge@therein and my responsibility under this definition.

Signature

Print Name and Date

Position, name of firm

Professional Engineer-s
Embossed Seal

APPENDIX B

EXAMPLE PERMIT REQUIREMENTS

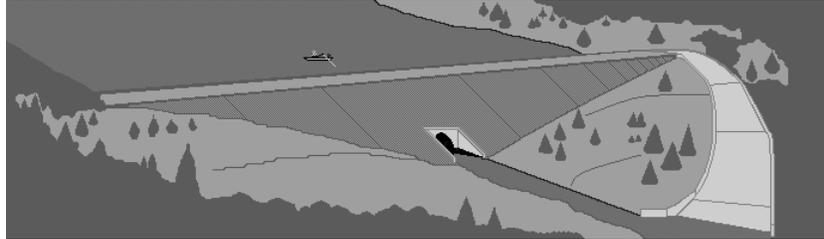
CASE 3: PENNSYLVANIA



Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

DAM PERMITS IN PENNSYLVANIA



What is a dam?

A dam is any artificial barrier, such as an earthen embankment or concrete structure, built for the purpose of impounding or storing water or another fluid or semi-fluid.

When does a dam need a permit?

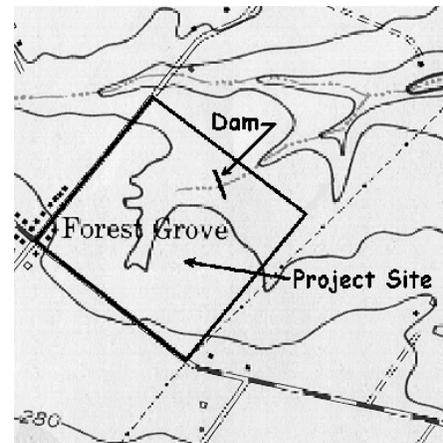
1. A dam permit is required if the proposed dam will be built across a stream and it meets one of the following criteria:
 - a. The contributory drainage area exceeds 100 acres. The drainage area is the land area that, during a storm event, contributes water runoff to the impounding area.
 - b. The maximum depth of water, measured from the upstream toe of the dam to the top of the dam at maximum storage elevation, is greater than 15 feet.
 - c. The impounding capacity (storage volume) at maximum storage elevation is greater than 50 acre-feet.
2. A dam permit is required if the proposed dam is not located across a stream and criteria 1.b AND 1.c listed above are met.
3. A dam permit is required if the dam will store a fluid or semi-fluid, other than water, that may result in pollution or danger to persons or property if it escapes.

Who makes the determination of the need for a permit for proposed dams?

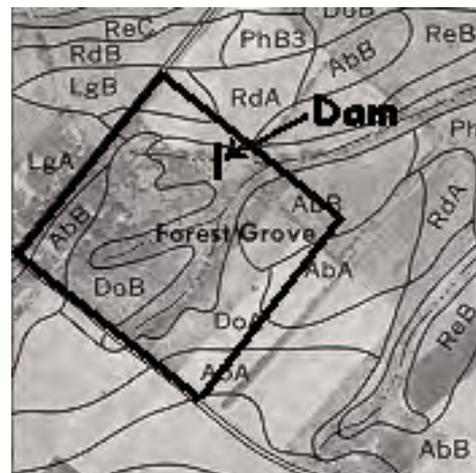
A determination of the need for a permit can be requested from the Department of Environmental Protection's (DEP's) Division of Dam Safety. The

following information is necessary for a jurisdictional determination:

- *1. The location of the proposed project site, indicated on a copy of a United States Geological Survey Topographic Map.

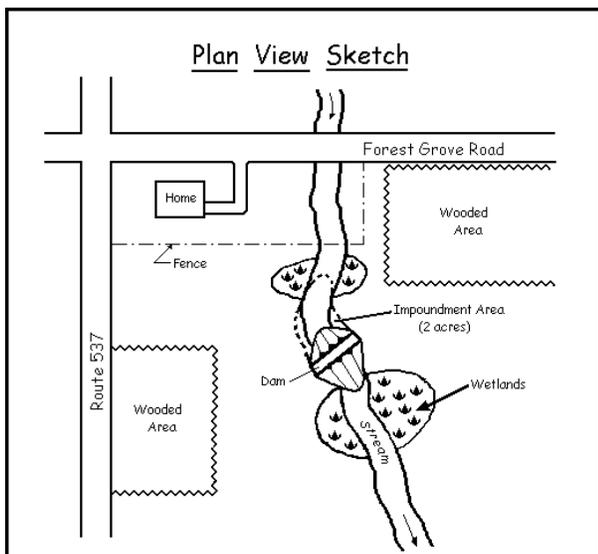


- *2. A copy of the Soil Survey Map for the project area.

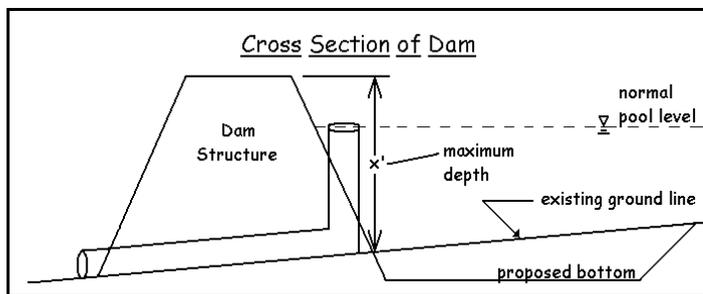


- * A copy of these maps may be obtained from your County Conservation District Office.

3. A plan view sketch, indicating the proposed surface area of the impoundment and its proximity to streams, wetlands and other structures at the site.



4. A cross-section of the dam (or embankment) indicating the maximum depth.



5. Color photographs of the site.

To request a determination of the need for a permit, send the information described in this fact sheet to:

Department of Environmental Protection
 Bureau of Waterways Engineering
 Division of Dam Safety
 P. O. Box 8554
 Harrisburg, PA 17105-8554
 (717) 787-8568

What if wetlands or a stream exist at the site?

1. If the proposed dam does not require a dam permit, but is located in, along or projecting into a wetlands or across a stream, DEP approval of an Environmental Assessment is required. (An Environmental Assessment is an evaluation of the potential impacts that a project may have on aquatic resources.) The department will provide an Environmental Assessment form with the notification of the determination of the need for a permit or other approvals.
2. In addition, if the proposed dam does not require a dam permit, but is located in an exceptional value watershed, DEP approval of an Environmental Assessment is required.
3. Any excavation of wetlands, stream or floodway within the impoundment area would require an encroachment permit from DEP. The department, upon receipt of the information discussed above, will make this determination.

For more information, visit DEP's website at www.state.pa.us, Keyword: "DEP Dam Safety."

APPENDIX B

EXAMPLE PERMIT REQUIREMENTS

CASE 4: UTAH

DAM SAFETY INFORMATION PACKET

**PROCEDURES FOR THE APPROVAL OF DAM
CONSTRUCTION PLANS**

**EXPLANATION OF UTAH STATE ENGINEER'S
APPROVAL PROCESS
TO
CONSTRUCT, ENLARGE, OR REPAIR A DAM**

**EXAMPLE DRAWINGS FOR DAMS NOT REQUIRING THE
SUBMISSION OF FORMAL PLANS**

Location Map

Plan View

Cross-Section and Profile

PROCEDURES FOR THE APPROVAL OF DAM CONSTRUCTION PLANS

73-5a-201. Approval of state engineer necessary to construct, alter, or abandon dams.

No person may construct, enlarge, repair, alter, remove, or abandon any dam or reservoir without obtaining written approval from the state engineer. Routine maintenance of the structure does not require approval from the state engineer.

73-5a-202. Submission of plans.

- (1) Before a dam is constructed, enlarged, repaired, altered, removed, or abandoned, plans for the work shall be submitted to the state engineer for his approval, unless the dam:
 - (a) impounds less than 20 acre-feet of water; and
 - (b) does not constitute a threat to human life if it fails.
- (2)
 - (a) The plans shall be submitted 90 days before:
 - (i) awarding the construction contract; or
 - (ii) the commencement of construction, if the owner constructs the dam.
 - (b) The state engineer may shorten the 90-day review period if the owner and the design engineer submit satisfactory preliminary plans and design reports for review.
- (3) The state engineer may waive the requirement of plans if it can be demonstrated that failure of the proposed dam:
 - (a) does not constitute a threat to human life; and
 - (b) may result in only minor property damage that would be limited to property held by the owner of the structure.

73-5a-203. Review of plans.

- (1) The state engineer shall establish a formal written procedure for the review of plans submitted pursuant to Section 73-5a-202. Plans shall be reviewed according to:
 - (a) design criteria which the state engineer shall specify in rules; and
 - (b) data or criteria generally accepted by the general dam design community.
- (2) Upon review of the plans, the state engineer will:
 - (a) approve them with appropriate conditions;
 - (b) reject them; or
 - (c) return them for correction.
- (3) The state engineer shall document each review indicating:
 - (a) how the plans were reviewed; and
 - (b) his evaluation of the plans.

73-5a-204. Application for approval.

- (1) If the submission of plans are not required by Subsection 73-5a-202(1) or are waived pursuant to Subsection 73-5a-202(3), approval to construct, enlarge, repair, alter, remove, or abandon the dam must be obtained by submitting an application to the state engineer.
- (2) The application shall contain:
 - (a) the location of the dam;
 - (b) physical dimensions of the dam;
 - (c) water rights attached to the dam; and
 - (d) any other information or drawings as required by the state engineer to evaluate the application.
- (3) Upon review, the application will be approved, rejected, or approved with conditions.

73-5a-205. Approvals void after one year if construction delayed -- Exceptions.

- (1) Any approval granted under Section 73-5a-203 is void one year after the date of approval if construction has not started.
- (2) The state engineer may extend the approval in one year increments:
 - (a) upon a showing of reasonable cause for delay; and
 - (b) provided state-of-the-art design criteria has not changed in the intervening period.

**EXPLANATION OF
UTAH STATE ENGINEER'S APPROVAL PROCESS
TO CONSTRUCT, ENLARGE, OR REPAIR A DAM**

DEFINITIONS

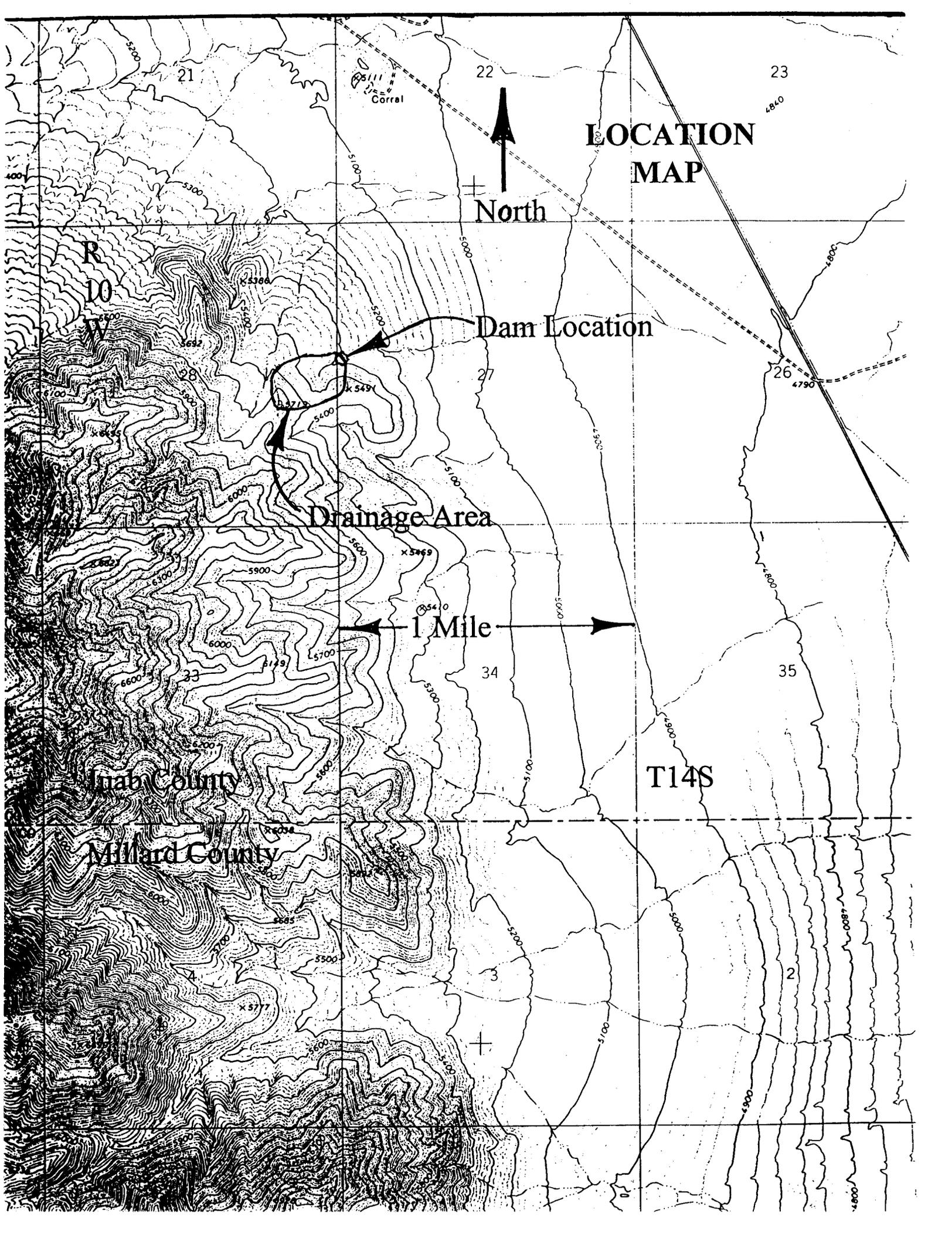
Definitions (Section 73-5a-106 of the Utah Code) Hazard classifications are as follows:

- (A) **High Hazard** - those dams which, if they fail, have a high probability of causing loss of human life or extensive economic loss, including damage to critical public utilities;
- (B) **Moderate Hazard** - those dams which, if they fail, have a low probability of causing loss of human life, but would cause appreciable property damage, including damage to public utilities; and
- (C) **Low Hazard** - those dams which, if they fail, would cause minimal threat to human life, and economic losses would be minor or limited to damage sustained by the owner of the structure.

Note: The State Engineer has the final authority in assigning Hazard Ratings. If a person proposing to construct a dam has any doubt as to the appropriate Hazard Rating they can submit the location of the project, the height of the dam, and the storage capacity to the State Engineer who will make a determination and inform the applicant of his findings.

CATEGORIES

Hazard Rating	Storage	Approval Process	Statutes	Explanation
High	Any Amount	Submit Formal Plans	73-5a-202 (1) 73-5a-203	Formal Plans required because failure constitutes a threat to Human Life and/or could cause extensive economic loss.
Moderate	Over 20 Ac-ft	Submit Formal Plans	73-5a-202 (1) 73-5a-202	Formal Plans required since the reservoir impounds over 20 ac-ft and failure could cause appreciable property damage
Moderate	Under 20 Ac.-ft.	Application Procedure	73-5a-202 (1) 73-5a-204	Application Procedure since the reservoir impounds less than 20 ac-ft And failure of the dam does not constitute a threat to Human Life.
Low	Over 20 Ac.-ft.	Submit Formal Plans	73-5a-202 (1) 73-5a-203	Formal Plans required since the reservoir impounds over 20 ac-ft and failure would damage property not held by the owner.
Low	Over 20 Ac.-ft.	Application Procedure	73-5a-202 (3) 73-5a-204	Application Procedure since failure of the dam would be limited to property held by the owner (requires waiver from State Engineer).
Low	Under 20 Ac.-ft.	Application Procedure	73-5a-202 (1) 73-5a-204	Application Procedure since the reservoir impounds less than 20 ac-ft and failure of the dam does not constitute a threat Human Life.



LOCATION MAP



North

Dam Location

Drainage Area

1 Mile

Inab County

Millard County

T14S

21

22

23

27

26

23

34

35

3

2

Corral

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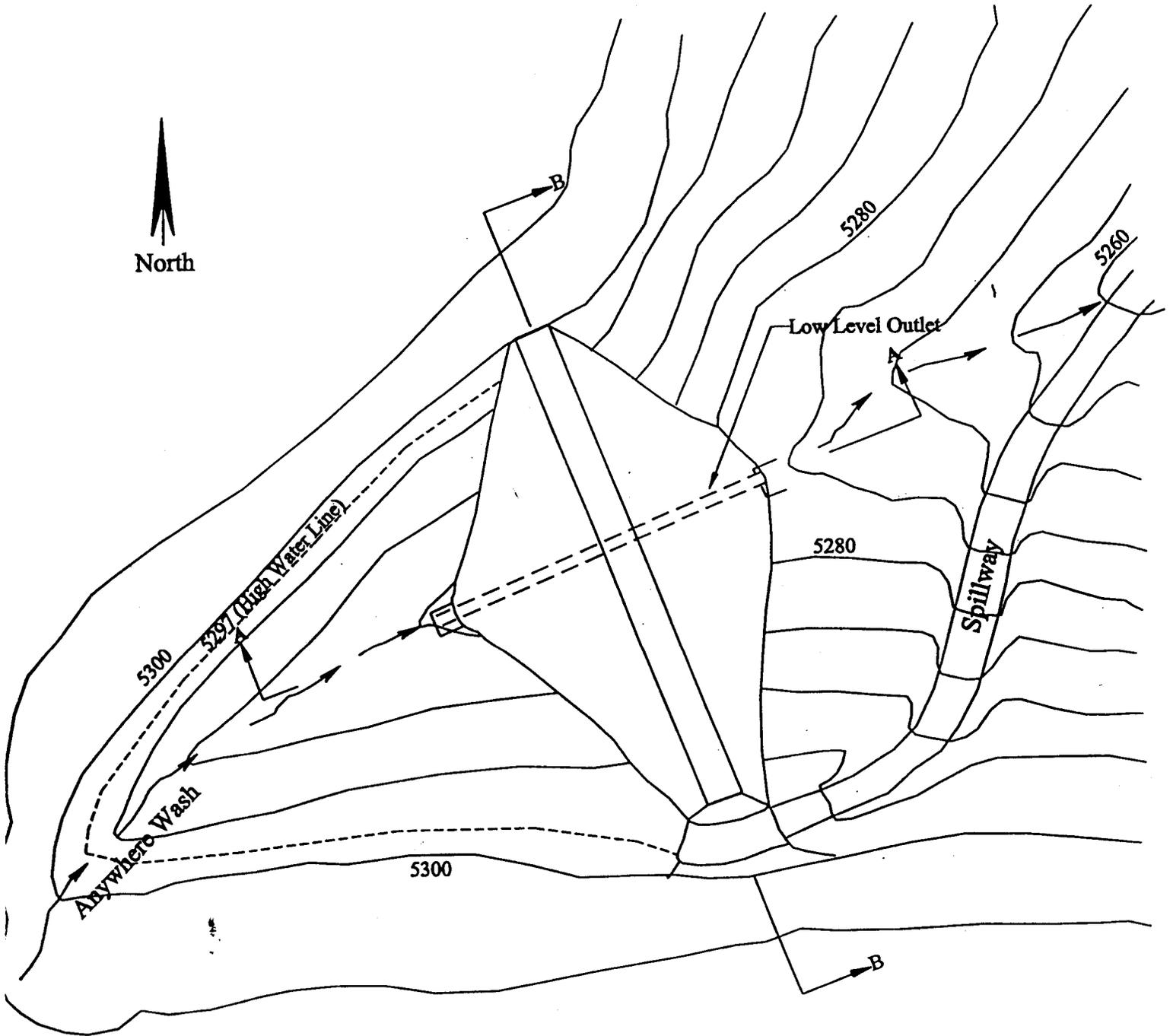
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PLAN VIEW

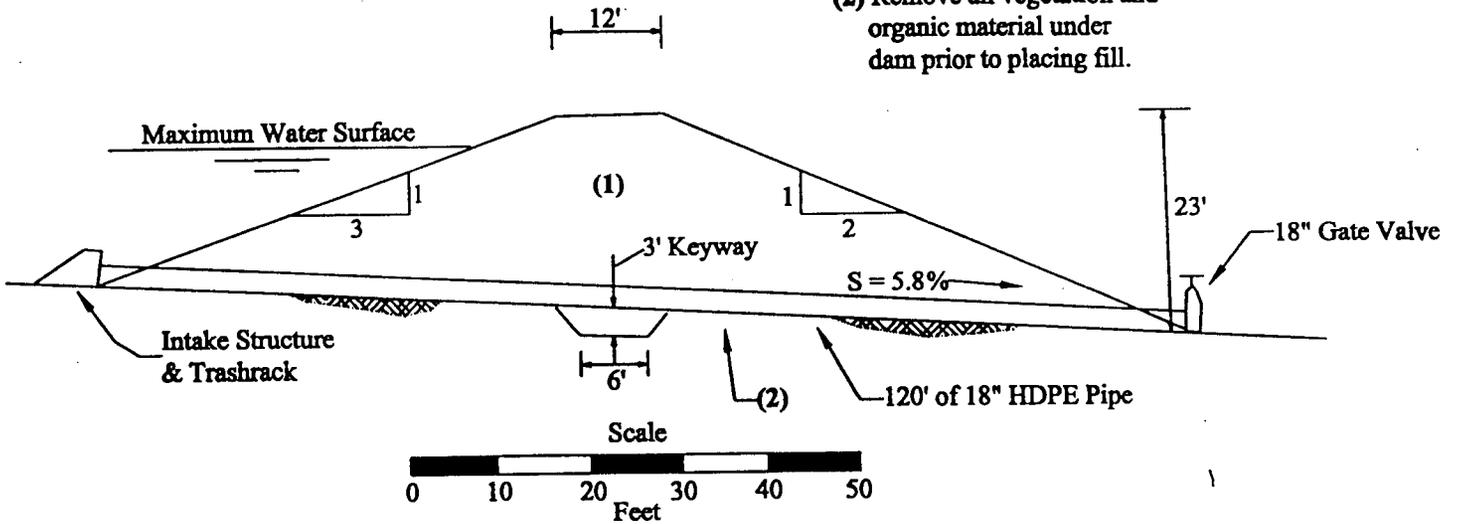


50 Feet

Section A - A (Cross-Section of Dam)

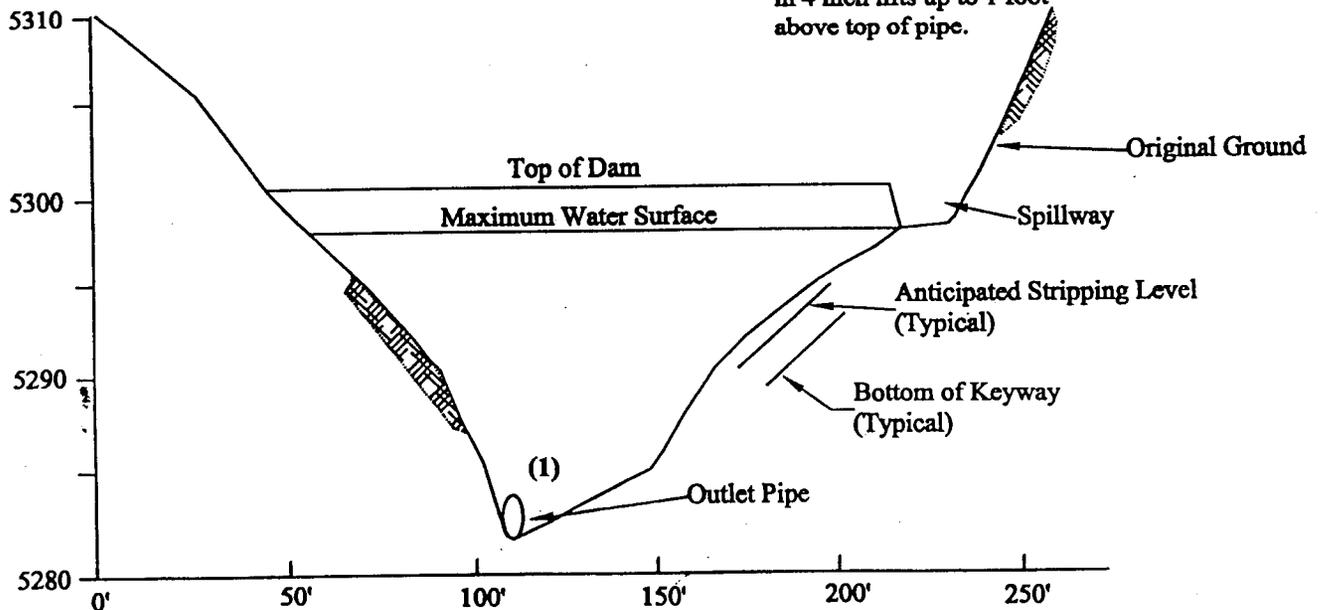
(1) Dam is to be built of moisture conditioned silty clays (CL) placed in 9" lift and compacted by 8 passes of a sheeps foot roller.

(2) Remove all vegetation and organic material under dam prior to placing fill.



Section B-B (Profile of Dam)

(1) Material around outlet pipe should be hand compacted in 4 inch lifts up to 1 foot above top of pipe.



Scale is as shown,
vertical scale exaggerated

APPENDIX C

INSPECTION CHECKLIST

CASE 1: ARIZONA

**ARIZONA DEPARTMENT OF WATER RESOURCES
OFFICE OF WATER ENGINEERING – DAM SAFETY SECTION
DAM SAFETY INSPECTION REPORT**

Each item of the checklist should be completed. Repair is required when obvious problems are observed. Monitoring is recommended if there is a potential for a problem to occur in the future. Investigation is necessary if the reason for the observed problem is not obvious.

SID: (xx.xx)	DAM NAME:	TYPE:	PURPOSE:	N O T A P P L I C A B L E	N O	Y E S	M O N I T O R	R E P A I R	I N V E S T I G A T E
CONTACT(S):			REPORT DATE:						
INSPECTED BY:			INSPECTION DATE:						
REVIEWED BY:			DATE:						
DESIGN DAM CREST ELEVATION:		DESIGN SPILLWAY CREST ELEVATION:							
DESIGN TOTAL FREEBOARD (FT):		MEASURED TOTAL FREEBOARD (FT):							
STATUTORY DAM HEIGHT (FT):		MAXIMUM EMBANKMENT HEIGHT (FT):							
DAM CREST LENGTH (FT):	UPSTREAM SLOPE:	DOWNSTREAM SLOPE:							
DAM CREST WIDTH (FT):	GPS	Lat.: xx°xx'xx.x"	WATER RIGHTS:						
		Long.: xx°xx'xx.x"							
RSRVR. AREA (AC):	RSRVR. STORAGE (AC-FT):	MAX. STORAGE (AC-FT):							
INFLOW DESIGN FLOOD / SAFE FLOOD-PASSING CAPACITY:									
RESERVOIR LEVEL DURING INSPECTION:			PHOTOS:						

COMPLIANCE CHECKLIST

1. CONDITION SUMMARY / LICENSE / EAP / NEXT INSPECTION						
a. Recorded downstream hazard: _____ Should hazard be revised?						
b. If High Hazard, estimate downstream persons-at-risk (PAR): _____ Is there a significant increase since the last inspection?						
c. Recorded size: _____ Should size be revised?						
d. Any safety deficiencies? Describe:						
e. Any Statute or Rule violations? Describe and list required action:						
f. Safe storage level on License: _____ Should level be revised?						
g. Any License violations? Describe and list required action:						
h. Date of current License: _____ Should new License be issued?						
i. Date of last Emergency Action Plan revision: _____ Should EAP be revised?						
j. Normal inspection frequency: _____ Should inspection frequency be revised?						
k. Recommended date for next inspection:						

MONITORING CHECKLIST

2. INSTRUMENTATION AND MONITORING						
a. Describe:						
b. Any repair or replacement required? Describe:						
c. Date of last monitoring report: _____ Should new readings be taken and new report provided?						

DAM EMBANKMENT CHECKLIST

3. DAM CREST						
---------------------	--	--	--	--	--	--

a. Settlements, slides, depressions?						
b. Misalignment?						
c. Longitudinal/Transverse cracking?						
d. Animal burrows?						
e. Adverse Vegetation?						
f. Erosion?						

4. UPSTREAM SLOPE

a. Erosion?						
b. Inadequate ground cover?						
c. Adverse vegetation?						
d. Longitudinal/Transverse cracking?						
e. Inadequate riprap?						
f. Stone deterioration?						
g. Settlements, slides, depressions, bulges?						
h. Animal burrows?						

5. DOWNSTREAM SLOPE

a. Erosion?						
b. Inadequate ground cover?						
c. Adverse vegetation?						
d. Longitudinal/Transverse cracking?						
e. Inadequate riprap?						
f. Stone deterioration?						
g. Settlements, slides, depressions, bulges?						
h. Soft spots or boggy areas?						
i. Movement at or beyond toe?						
j. Animal burrows?						

6. ABUTMENT CONTACTS

a. Erosion?						
b. Differential movement?						
c. Cracks?						
d. Settlements, slides, depressions, bulges?						
e. Seepage? Est. Left ___ gpm; Est. Right ___ gpm						
f. Animal burrows?						

7. SEEPAGE/PIPING CONTROL DESIGN FEATURE(S)

a. Describe:						
b. Internal drains flowing? Est. Left ___ gpm; Est. Right ___ gpm						
c. Seepage at or beyond toe? Estimated ___ gpm						
e. If so, does seepage contain fines?						
d. Evidence of sand boils at or beyond toe?						

OUTLET WORKS CHECKLIST

8. APPROACH CHANNEL								
a. Describe:								
b. Eroding or backcutting?								
c. Sloughing?								
d. Restricted by vegetation?								
e. Obstructed with debris?								
f. Silted in?								
9. INLET STRUCTURE								
a. Describe:								
b. Seepage into structure?								
c. Debris or obstructions?								
d. <i>If concrete</i> , do surfaces show:								
1. Spalling or Scaling?								
2. Cracking?								
3. Erosion?								
4. Exposed reinforcement?								
e. <i>If metal</i> , do surfaces show:								
1. Corrosion?								
2. Protective coating deficient?								
3. Misalignment or split seams?								
f. Do the joints show:								
1. Displacement or offset?								
2. Loss of joint material?								
3. Leakage?								
g. Are the trash racks:								
1. Broken or bent?.								
2. Corroded or rusted?								
3. Obstructed?								
h. Operator, gates and valves:								
1. Describe:								
2. Date(s) last operated:								
3. Broken or bent?								
4. Corroded or rusted?								
5. Leaking?								
6. Not seated properly?								
7. Not operational?								
8. Not periodically maintained?								
10. CONDUIT								
a. Describe:								
b. Seepage into conduit?								

c. Debris present?							
d. <i>If concrete</i> , do surfaces show:							
1. Spalling or scaling?							
2. Cracking?							
3. Erosion?							
4. Exposed reinforcement?							
e. <i>If metal</i> , do surfaces show:							
1. Corrosion?							
2. Protective coating deficient?							
3. Misalignment or split seams?							
f. Do the joints show:							
1. Displacement or offset?							
2. Loss of joint material?							
3. Leakage?							

11. STILLING BASIN / ENERGY DISSIPATOR

a. Describe:							
b. Do surfaces show:							
1. Spalling or Scaling?							
2. Cracking?							
3. Erosion?							
4. Exposed reinforcement?							
c. Do joints show:							
1. Displacement or offset?							
2. Loss of joint material?							
3. Leakage?							
d. Do energy dissipaters show:							
1. Signs of deterioration?							
2. Covered with debris?							
3. Signs of inadequacy?							

12. OUTLET CHANNEL

a. Describe:							
b. Eroding or backcutting?							
c. Sloughing?							
d. Obstructions or restrictions?							
e. Poorly riprapped?							
f. Tailwater elevation and flow condition:							

EMERGENCY SPILLWAY CHECKLIST

13. ENTRANCE CHANNEL

a. Describe							
b. Eroding or backcutting?							

c. Sloughing?						
d. Restricted by vegetation?						
e. Obstructed with debris?						
f. Silted in?						

14. CONTROL SECTION

a. Describe:						
b. <i>If concrete</i> , do surfaces show:						
1. Spalling or Scaling?						
2. Cracking?						
3. Erosion?						
4. Exposed reinforcement?						
c. <i>If concrete</i> , do joints show:						
1. Displacement or offset?						
2. Loss of joint material?						
3. Leakage?						
f. If spillway is <i>unlined</i> :						
1. Are slopes eroding?						
2. Are slopes sloughing?						
3. Is crest eroding?						
g. Is the control structure (i.e. weir, sill, etc.) in poor condition?						

15. DISCHARGE CHANNEL

a. Describe:						
b. Obstructions or restrictions?						
c. <i>If concrete</i> , do surfaces show:						
1. Spalling or Scaling?						
2. Cracking?						
3. Erosion?						
4. Exposed reinforcement?						
d. <i>If concrete</i> , do joints show:						
1. Displacement or offset?						
2. Loss of joint material?						
3. Leakage?						
e. If spillway is <i>unlined</i> :						
1. Are slopes eroding?						
2. Are slopes sloughing?						
3. Poorly protected w/ vegetation/riprap?						

16. STILLING BASIN / ENERGY DISSIPATOR

a. Describe:						
b. Do surfaces show:						
1. Spalling or Scaling?						
2. Cracking?						

3. Erosion?								
4. Exposed reinforcement?								
c. Do joints show:								
1. Displacement or offset?								
2. Loss of joint material?								
3. Leakage?								
d. Do energy dissipaters show:								
1. Signs of deterioration?								
2. Covered with debris?								
3. Signs of inadequacy?								
17. OUTLET CHANNEL								
a. Eroding or backcutting?								
b. Sloughing?								
c. Obstructions or restrictions?								

RESERVOIR CHECKLIST

18. RESERVOIR								
a. High water marks?								
b. Erosion/Slides into pool area?								
c. Sediment accumulation?								
d. Floating debris present?								
e. Depressions, sinkholes or vortices?								
f. Low ridges/saddles allowing overflow?								
g. Structures below dam crest elevation?								

ADDITIONAL COMMENTS AND RECOMMENDATIONS:

APPENDIX C

INSPECTION CHECKLIST

CASE 2: NEW JERSEY

Guidelines for Inspection of Existing Dams

New Jersey
Department of Environmental Protection
Dam Safety
Trenton, NJ 08625

March, 2004

Guide for the Inspection and Preparation of a Report on the Condition of a Dam

New Jersey Dam Safety Inspection Program

State law relating to the construction, repair, modification, and inspection of existing and proposed dams has been in existence since 1912. The law was amended in 1981 and cited as the Safe Dam Act, N.J.S.A. 58:4-1 et seq. The Dam Safety Standards N.J.A.C. 7:20-1 et seq. were promulgated in May 1985 **and last readopted in May 2000.**

The New Jersey Dam Safety Program is implemented by the Department of Environmental Protection, Division of Engineering and Construction, Dam Safety Section. The objective of the program is to protect lives and property from the consequences of a dam failure or the improper release of impounded water. A primary means of achieving this goal is through the maintenance and periodic inspection of in-service dams.

The New Jersey Dam Safety inspection program is intended to identify conditions that may adversely affect the safety and functionality of a dam and its appurtenant structures; to note the extent of deterioration as a basis for long term planning, periodic maintenance or immediate repair; to evaluate conformity with current design and construction practices; and to determine the appropriateness of the existing hazard classification. The professional engineer performing the inspection should, where appropriate, recommend subsequent investigations required to resolve uncertain conditions and corrective measures to enable the dam to continue to perform its intended functions. ***For Class I and Class II dams, all addresses, e-mail, and phone numbers contained within the Emergency Action Plan must be verified and current. Inspection reports will be deemed incomplete without this information.***

Inspection Guidelines

The New Jersey Dam Safety inspection guidelines are designed to assist the dam owner to better understand the requirements, responsibilities, and duties inherent with dam ownership and to assist the professional engineer by providing a consistent approach to dam inspection and in-service evaluation.

Several different types of dam inspections can be performed. Dams and appurtenances should be inspected regularly to identify conditions that may adversely affect the safety of a dam and its ability to perform intended functions. An inspection may include the periodic evaluation of the as-built dam to insure conformity with current design and construction practices.

Dam Classifications

The State of New Jersey recognizes four (4) classes of dams. Class I dams are those structures which, should they fail, would likely cause loss of life. Class II dams are structures which, should they fail, would likely cause substantial downstream property damage but are not considered to be a threat to life. Class III dams are structures which would cause little or no downstream damage should they fail. Class IV dams are structures which are less than 15 feet in height, impound less than 15 acre feet of water to the top of dam, and drain less than 150 acres. No dam may be included in the Class IV category if failure of the dam could cause downstream property damage or loss of life.

When Should Dams be Inspected

Class I and Class II dam owners are required to have a regular inspection performed every two years and a formal inspection performed every six or ten years respectively. Class III and Class IV dam owners are required to have a regular inspection performed every four years but are not normally required to perform periodic formal inspections. On those years a formal inspection is performed, a regular inspection will not be required. All dams over 70 feet in height or which can potentially store more than 10,000 acre feet of water, regardless of hazard classification, are required to be inspected every year with a formal inspection conducted every third year. All dam inspections shall be performed from March through December.

Types of Inspections

Formal Inspection - The inspection and performance evaluation of Class I and Class II dams under the supervision of a qualified, New Jersey licensed professional engineer to review and determine the safety and integrity of the dam and appurtenant structures. Formal inspections require a detailed field examination and should include a thorough review of the records on project design, construction, and performance. Where appropriate, a reanalysis employing advanced methods and modern design criteria and practices should be conducted in order to determine if the structure meets current design criteria. In addition, formal inspections require that the long-term behavioral patterns revealed by instrumentation and spillway discharges be closely examined. Detailed underwater inspections should be included as needed. A Department approved Emergency Action Plan and Operation and Maintenance Manual should be confirmed and their adequacy determined. ***All addresses, e-mail, and phone numbers contained within the Emergency Action Plan must be verified and current. Inspection reports will be deemed incomplete without this information*** Technical experts and specialists may be required to evaluate individual features and conditions; however, a qualified New Jersey licensed professional engineer must make the final coordinated evaluation. A review of prior regular and formal inspection reports should be undertaken to evaluate trends in performance.

Regular Inspection - The visual inspection of a dam by a qualified, New Jersey licensed professional engineer to detect any signs of deterioration in material, developing weaknesses or unsafe hydraulic or structural behavior. For Class I and Class II dams, a Department approved Emergency Action Plan should be confirmed and its adequacy determined. ***All addresses, e-mail, and phone numbers contained within the Emergency Action Plan must be verified and current. Inspection reports will be deemed incomplete without this information*** For all dams a Department approved Operation and Maintenance Manual should be confirmed and its adequacy determined. All instrumentation data should be reviewed and evaluated.

Informal Inspection - The visual inspection of the dam by the dam owner or operator to detect apparent signs of deterioration or other deficiencies of the dam structure or function. Informal inspections require that personnel conducting the inspection be knowledgeable about the dam and its appurtenances.

Emergency Inspection - An emergency inspection is an unscheduled inspection of a dam and its appurtenances necessitated by a potentially adverse natural event such as a large flood, earthquake, landslide or when a condition develops that appears to immediately threaten the safety of the dam. An emergency inspection is applicable to any hazard classification and requires immediate attention. Any required emergency repairs resulting from the emergency inspection should be conducted in compliance with N.J.A.C. 7:20 - 1.4 (i).

Inspection Reports and Qualifications of Inspection Personnel

Formal and regular dam inspections must be performed by a qualified, professional engineer. The term “qualified engineer,” as used in these standard guidelines is intended to mean an individual who:

1. Is a licensed New Jersey professional engineer.
2. Is competent in items related to dam investigation, design, construction, and operation for the type of dam being inspected.
3. Has at least 10 years of relevant experience in dam investigation, design, construction, operation, and evaluation.
4. Understands the effects of adverse dam incidents and failures and the potential cause of failures.

The text of the report on the condition of a dam should be concise and provide all relevant dam and dam related facts, findings, conclusions, analysis, recommendations, and data. ***For Class I and Class II dams, all addresses, e-mail, and phone numbers contained within the Emergency Action Plan must be verified and current. Inspection reports will be deemed incomplete without this information.*** In addition, each report should contain clear, color photographs with each photograph indicating the date it was taken, the State dam reference number, and the photograph location. The visual inspection checklist, provided by the Department, should be completed and accompany all inspection reports. At the discretion of the Department, a completed visual inspection checklist, together with relevant color photographs and a completed NJ Dam Safety Compliance Schedule Form, will be considered the minimum information required for an acceptable inspection report.

Inspection reports for Class I, Class II and Class III dams should be submitted to the Department within 30 days of the completion of the inspection. Reports for Class IV dams are to be submitted to the county and/or municipality that has jurisdiction over the dam structure.

Informal inspections may be performed by the dam owner or operator and the resulting inspection report shall be part of the owner’s or operator’s permanent file. Unless specifically requested, informal inspection reports are not to be submitted to the Department. The Department may require the owner or operator of any dam to perform an inspection of any type at any time.

VISUAL INSPECTION CHECKLIST

This general checklist should be used as an aid when examining all dams. This checklist may not, however, include all features or conditions found at a specific dam that are relevant to the safety of that dam. All features integral to the safety of the dam being examined should be inspected and their condition reported.

NJ INSPECTION YEAR:

TYPE OF INSPECTION: (formal, regular, informal):

DAM NAME:

DAM FILE NO.:

LOCATION:

OWNER:

OPERATOR:

DATE OF INSPECTION:

RESERVOIR INFORMATION

Normal Reservoir Elevation (ft):

Reservoir Elevation at time of inspection (ft):

WEATHER CONDITIONS (including recent rainfall):

INSPECTION PERSONNEL

New Jersey Licensed Professional Engineer(s):

<u>Name</u>	<u>Affiliation</u>	<u>Area of Expertise</u>
-------------	--------------------	--------------------------

Non-Licensed technical expert(s) and advisor(s):

<u>Name</u>	<u>Affiliation</u>	<u>Area of Expertise</u>
-------------	--------------------	--------------------------

State Representative(s):

<u>Name</u>	<u>Affiliation</u>
-------------	--------------------

Dam Owner Representative(s):

<u>Name</u>	<u>Affiliation</u>
-------------	--------------------

Others:

<u>Name</u>	<u>Affiliation</u>
-------------	--------------------

GENERAL INFORMATION

Name of Dam:

Fed. I.D. No.

N.J. Dam No.:

River Basin:

Town:

County:

Block:

Lot:

Nearest Downstream City-Town:

Stream Name:

Tributary of:

Latitude (N):

Longitude (W):

Type of Dam:

Purpose of Dam:

Hazard Category:

Drainage Area (sqr mls):

Height (ft):

Length (ft):

Normal Surface (ac):

Normal Capacity (af):

Maximum Capacity (af):

Spillway Capacity (cfs):

HISTORY

Date Constructed:

Dates(s) Reconstructed:

Designer:

Constructed By:

Owner & Address:

Owner/Operator present during inspection (yes or no):

PREVIOUS INSPECTIONS (date of)

Last Inspection:

Last Regular Inspection:

Phase I Inspection:

Last Formal Inspection:

EMERGENCY ACTION PLAN (Required for all Class I and Class II dams)

Date of Approved Plan:

Date of Plan Revision:

Is the notification flowchart complete and current? *(If the notification flow chart is not complete and current, all modifications, corrections, and additions must be made and replacement pages submitted with this report)*

Is inundation mapping or a description included?

Are emergency materials and equipment identified?

When was the plan last tested?

DOWNSTREAM HAZARD CLASSIFICATIONS

Present Hazard Classification:

Changes in Downstream Land Use and Habitation:

Is present classification appropriate?

OPERATION AND MAINTENANCE

Date of Operation and Maintenance Plan:

Are instructions adequate?

Do operating personnel follow instructions?

What are operating personnel capabilities?

EXAMINATION OF EMBANKMENT DAMS AND DIKES

DESCRIPTION OF STRUCTURE

Embankment Material:

Cutoff Type:

Impervious Core:

Internal Drainage System:

Movement (Horizontal and Vertical Alignment):

Junctions with Abutments or Embankments:

Miscellaneous:

CREST

Vertical Alignment:

Horizontal Alignment:

Surface Cracks:

Settlement:

Unusual Conditions:

UPSTREAM SLOPE

Slope (Estimate) (H:V):

Trees, Undesirable Growth or Debris, Animal Burrows:

Sloughing, Subsidence or Depressions:

Slope Protection:

Surface Cracks or Movement at Toe:

Unusual Conditions:

DOWNSTREAM SLOPE

Slope (Estimate) (H:V):

Trees, Undesirable Growth or Debris, Animal Burrows:

Sloughing, Subsidence or Depressions:

Surface Cracks or Movement at Toe:

Seepage:

External Drainage System (Ditches, Trenches, Blanket):

Condition Around Outlet Structure:

Unusual Conditions:

ABUTMENTS AND TOE AREA

Erosion at Contract:

Seepage or Wet Area Along Contract:

Signs of Movement:

Depressions, Sinkholes:

Unusual Conditions:

SEEPAGE AND TOE DRAIN / RELIEF WELL FLOW SUMMATION

Location

Estimated Flow

Color (Turbidity)

(Attach additional sheets for facilities with more than one embankment dam or dike)

EXAMINATION OF CONCRETE AND MASONRY DAMS

DESCRIPTION OF STRUCTURE

Type of Dam (Gravity, Arch, etc.):

Internal Drainage System:

Movement (Horizontal and Vertical Alignment):

Miscellaneous:

UPSTREAM FACE

Condition of Concrete or Masonry:

Cracking:

<u>Location</u>	<u>Orientation</u>	<u>Length</u>	<u>Width</u>	<u>Type</u>
-----------------	--------------------	---------------	--------------	-------------

DOWNSTREAM FACE

Condition of Concrete or Masonry:

Cracking:

<u>Location</u>	<u>Orientation</u>	<u>Length</u>	<u>Width</u>	<u>Type</u>
-----------------	--------------------	---------------	--------------	-------------

Leakage Through Dam (Location and Estimated Flow):

CREST

Condition of Concrete or Masonry:

Cracking

<u>Location</u>	<u>Orientation</u>	<u>Length</u>	<u>Width</u>	<u>Type</u>
-----------------	--------------------	---------------	--------------	-------------

Signs of Movement:

Differential Movement (Joint or Crack Separation or Offset):

GALLERIES

Cracking

<u>Location</u>	<u>Orientation</u>	<u>Length</u>	<u>Width</u>	<u>Type</u>
-----------------	--------------------	---------------	--------------	-------------

Differential Movement (Joint or Crack Separation):

Leakage into Galleries (Location and Estimated Flow):

Condition of Gallery Drains:

FOUNDATION

Condition of Rock or Concrete Lining:

Cracking:

Signs of Movement:

Seepage (Location and Estimated Flow):

ABUTMENTS AND TOE AREA

Seepage or Wet Areas:

Signs of Movement:

Cracking:

Erosion:

Unusual Conditions:

(Attach additional sheets for facilities with more than one concrete or masonry dam or dike)

EXAMINATION OF SPILLWAYS AND OUTLET WORKS

TYPE(S) AND DESCRIPTION OF SPILLWAY(S)

Primary:

Secondary (auxiliary):

Emergency:

Other:

FOR EACH SPILLWAY THE FOLLOWING ASPECTS MUST BE EXAMINED WHERE APPROPRIATE

ENTRANCE CHANNEL

Description:

Vegetation (Trees, Bushes):

Debris:

Channel Side-Slope Stability:

Slope Protection/Erosion:

Unusual Conditions:

SPILLWAY CREST

Description:

Condition of Material:

Signs of Movement:

Joints:

Unusual Conditions:

DROP BOX

Description:

Condition of Material:

Signs of Movement:

Joints:

Floor:

Unusual Conditions:

SPILLWAY WING WALLS

Description:

Condition of Material:

Signs of Movement:

Joints:

Drains:

Unusual Conditions:

DOWNSTREAM APRON

Description:

Condition of Material:

Signs of Movement:

Unusual Conditions:

CULVERTS

Description:

Condition of Material:

Joints:

Signs of Movement:

Seepage:

Location

Estimated Flow

Turbidity

Unusual Conditions:

TRASH RACKS

Description:

Condition of Material:

Unusual Conditions:

CHUTES

Description:

Condition of Material:

Signs of Movement:

Unusual Conditions:

STILLING BASIN

Description:

Condition of Material:

Signs of Movement:

Erosion:

Unusual Conditions:

EXIT CHANNEL

Vegetation (Trees, Bushes):

Debris:

Channel Side-Slope Stability:

Erosion:

Unusual Conditions:

LOW LEVEL OUTLET

Description:

Condition:

Trash Rack:

Leakage:

Location

Estimated Flow

Unusual Conditions:

Was the low level outlet operated during the inspection?

Were there difficulties operating the low level outlet?

When was the low level outlet last operated and did this conform with the Operation and Maintenance procedures?

Miscellaneous:

STILLING BASIN FOR LOW LEVEL OUTLET

Description:

Condition of Material:

Signs of Movement:

Erosion:

Unusual Conditions:

EXIT CHANNEL FOR LOW LEVEL OUTLET

Description (Trees, Bushes):

Debris:

Channel Side-Slope Stability:

Slope Protection Erosion:

Unusual Conditions:

EXAMINATION OF OTHER FEATURES

INSTRUMENTATION (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.) location, condition:

(A separate report including instrument readings, condition of instruments, observations, and conclusions based upon the collected data should be attached.)

RESERVOIR

Slopes:

Sedimentation:

Unusual Conditions Which Affect Dam:

Unusual Conditions:

APPURTENANT STRUCTURES (Power House, Gatehouse, Penstocks, Water Supply, Other)

Description and Condition of each:

CONCLUSION

I certify that the above dam was personally inspected by me and was found to be in:

<input type="checkbox"/> Safe <input type="checkbox"/> Unsafe condition (check one).
--

The following studies should be undertaken:	<input type="checkbox"/> Hydrologic and Hydraulic analysis
	<input type="checkbox"/> Stability analysis
	<input type="checkbox"/> Failure/Inundation analysis
	<input type="checkbox"/> Other _____
	<input type="checkbox"/> None

I recommend the following repairs be made immediately:

The following long term improvements should also be undertaken:

Have the recommendations above included those from the Phase I Inspection Report or previous Regular or Formal Inspection Reports? If not, indicate why.

Does the Emergency Action Plan require revisions?

Do the Operation and Maintenance Procedures require revisions?

Has the NJ Dam Safety Compliance Schedule Form (attached) been completed? (This form must be completed or the Inspection Report will be deemed incomplete.)

Name of Professional Engineering Company/Consultant Representing the Owner:

Company/Consultant Address:

Company/Consultant Telephone Number:

New Jersey Licensed Professional Engineer representing the dam owner in responsible charge of the inspection:

Sign _____

Date

New Jersey Professional Engineer License Number _____

SEAL

New Jersey Dam Safety Compliance Schedule Form

Dam Name: <hr/> File No:	Owner: _____ Address: _____ Address: _____ Address: _____ Phone: _____ Email: _____	Owners Engineering Firm: Name: _____ Address: _____ Address: _____ Address: _____ Phone: _____
---	--	---

The purpose of this form is to allow the dam owner, through consultation with their engineer, to establish a time line for addressing the deficiencies identified in the inspection report for the dam and bringing the dam into compliance with the New Jersey Dam Safety Standards, N.J.A.C. 7:20-1.1 et seq.

Proposed time frame for submission of required information and implementation of recommended repairs:
(Engineer should check required sections and propose appropriate time frames. However, the Dam Safety Section reserves the right to require additional dates and/or information as needed.)

Performance of maintenance and repairs not requiring approval from the Dam Safety Section (Such work includes grass mowing, brush removal, debris removal, filling of animal burrows, minor concrete repairs, minor gate repairs, filling of areas of minor surface erosion, etc. The Dam Safety Section must be notified upon completion of these activities.)

Work to be completed no later than: _____

Engineering Report / Studies (This work includes any required hydrologic and hydraulic analysis, structural analysis, alternative analysis, geotechnical investigations or dam breach analysis that may be recommended by your engineer and/or required by the Dam Safety Section.)

Studies to be submitted for review no later than: _____

Permit Application: (A permit application must be submitted for any construction activity at the dam. The permit application must address all deficiencies as identified in the inspection report and the subsequent engineering report / studies.)

Permit application to be submitted no later than _____ months after the date of the Dam Safety Section's approval of any required studies. (Please provide date if no studies are required.)

Construction to start no later than _____ months after the date of issuance of the permit by the Dam Safety Section.

Operation and Maintenance Plan (O&M): (An O&M is required for all dams. O&M's should be submitted with the permit application or sooner if possible. Existing O&M's may need to be updated if a dam is being rehabilitated. Please indicate if an O&M has already been submitted and approved.)

O&M to be submitted no later than: _____

Emergency Action Plan (EAP): (EAPs are required for all high and significant hazard dams and should be submitted as soon as possible. Existing EAPs should be reviewed on a yearly basis and revised as necessary. Please indicate if an EAP has already been submitted and approved.)

EAP to be submitted no later than: _____

The dates provided above will be reviewed by the Dam Safety Section to determine if the schedule is acceptable to achieve compliance with the Dam Safety Standards. Requests for extensions to the accepted time frames outlined above must be submitted to this office in writing along with appropriate justification and will be considered on its merits on a case by case basis.

Signed: Dam Owner **Date** **Signed: Owner's Engineer** **Date**

Additional information including Dam Safety Section forms, standards and inspection guidelines as well and EAP guidelines and a sample O&M is available at <http://www.state.nj.us/dep/damsafety> or contact this office via e-mail at Damsafety@dep.state.nj.us or telephone at (609)984-0859. Please submit the completed form to: NJDEP, Dam Safety Section, P.O. Box 419, Trenton, NJ 08625

APPENDIX C

INSPECTION CHECKLIST

CASE 3: COLORADO

ENGINEERS INSPECTION REPORT

OFFICE OF THE STATE ENGINEER-DIVISION OF WATER RESOURCES - DAM SAFETY BRANCH
1313 Sherman Street, Room 818, Denver, CO 80203, (303) 866-3581

DAM NAME _____ W. DIV. _____ W. DIST. _____ DATE OF INSPECTION ____/____/____

DAM ID _____ FILE NO. C- _____ FOREST I.D. _____ DATE OF LAST INSPECTION ____/____/____

OWNER NAME _____ OWNER PHONE _____

ADDRESS _____ ZIP CODE _____

CONTACT NAME _____ CONTACT PHONE _____

CLASS _____ CAPACITY _____ AF SURFACE AREA _____ AC. HEIGHT _____ FT. CREST LENGTH _____ FT CREST WIDTH _____ FT.

CURRENT RESTRICTION (NO) (YES) LEVEL _____ EPP ON FILE (NO) (YES) SPWY WIDTH _____ FT. FBD. _____ FT. Z _____

INSPECTION PARTY REPRESENTING _____

DIRECTIONS: MARK AN X FOR CONDITIONS FOUND AND UNDERLINE WORDS THAT APPLY. GIVE LOCATION AND EXTENT WITH NUMBER REFERENCE I.E. (25) ALL ALONG SLOPE, OR SHOW IT ON SKETCH.

FIELD CONDITIONS OBSERVED

WATER LEVEL - BELOW DAM CREST _____ FT., BELOW SPILLWAY _____ FT., GAGE ROD _____

GROUND MOISTURE CONDITION: DRY _____ WET _____ SNOWCOVER _____ OTHER _____

UPSTREAM SLOPE

PROBLEMS NOTED: (0) NONE (1) RIPRAP - MISSING, SPARSE, DISPLACED, WEATHERED (2) WAVE EROSION-WITH SCARPS

(3) CRACKS-WITH DISPLACEMENT (4) SINKHOLE (5) APPEARS TOO STEEP (6) DEPRESSIONS OR BULGES (7) SLIDES

(8) CONCRETE FACING-HOLES, CRACKS, DISPLACED, UNDERMINED (9) OTHER _____

Comments: _____

CREST

PROBLEMS NOTED: (10) NONE (11) RUTS OR PUDDLES (12) EROSION (13) CRACKS - WITH DISPLACEMENT (14) SINKHOLES

(15) NOT WIDE ENOUGH (16) LOW AREA (17) MISALIGNMENT (18) INADEQUATE SURFACE DRAINAGE

(19) OTHER _____

Comments: _____

DOWNSTREAM SLOPE

PROBLEMS NOTED: (20) NONE (21) LIVESTOCK DAMAGE (22) EROSION OR GULLIES (23) CRACKS - WITH DISPLACEMENT (24) SINKHOLE

(25) APPEARS TOO STEEP (26) DEPRESSION OR BULGES (27) SLIDE (28) SOFT AREAS (29) OTHER _____

Comments: _____

SEEPAGE

PROBLEMS NOTED: (30) NONE (31) SATURATED EMBANKMENT AREA (32) SEEPAGE EXITS ON EMBANKMENT

(33) SEEPAGE EXITS AT POINT SOURCE (34) SEEPAGE AREA AT TOE (35) FLOW ADJACENT TO OUTLET (36) SEEPAGE INCREASED/MUDDY

DRAIN OUTFALLS SEEN ___No ___Yes (37) FLOW INCREASED/MUDDY (38) DRAIN DRY/OBSTRUCTED

(39) OTHER _____ Show location of drains on sketch and indicate amount and quality of discharge

Comments: _____

OUTLET

PROBLEMS NOTED: (40) NONE (41) NO OUTLET FOUND (42) POOR OPERATING ACCESS (43) INOPERABLE

(44) UPSTREAM OR DOWNSTREAM STRUCTURE DETERIORATED (45) OUTLET NOT OPERATED DURING INSPECTION

INTERIOR INSPECTED (120) NO (121) YES (46) CONDUIT DETERIORATED OR COLLAPSED (47) JOINTS DISPLACED (48) VALVE LEAKAGE

(49) OTHER _____

Comments: _____

SPILLWAY

PROBLEMS NOTED: (50) NONE (51) NO EMERGENCY SPILLWAY FOUND (52) EROSION-WITH BACKCUTTING (53) CRACK - WITH DISPLACEMENT

(54) APPEARS TO BE STRUCTURALLY INADEQUATE (55) APPEARS TOO SMALL (56) INADEQUATE FREEBOARD (57) FLOW OBSTRUCTED

(58) CONCRETE DETERIORATED/UNDERMINED (59) OTHER _____

Comments: _____

Conditions Observed		
GOOD	ACCEPTABLE	POOR

See Guidelines on Back of this Sheet

GUIDELINES FOR DETERMINING CONDITIONS

CONDITIONS OBSERVED - APPLIES TO UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, OUTLET, SPILLWAY

GOOD	ACCEPTABLE	POOR
In general, this part of the structure has a near new appearance, and conditions observed in this area do not appear to threaten the safety of the dam.	Although general cross-section is maintained, surfaces may be irregular, eroded, rutted, spalled, or otherwise not in new condition. Conditions in this area do not currently appear to threaten the safety of the dam.	Conditions observed in this area appear to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO SEEPAGE

GOOD	ACCEPTABLE	POOR
No evidence of uncontrolled seepage. No unexplained increase in flows from designed drains. All seepage is clear. Seepage conditions do not appear to threaten the safety of the dam.	Some seepage exists at areas other than the drain outfalls, or other designed drains. No unexplained increase in seepage. All seepage is clear. Seepage conditions observed do not currently appear to threaten the safety of the dam.	Seepage conditions observed appear to threaten the safety of the dam. Examples: 1) Designed drain or seepage flows have increased without increase in reservoir level. 2) Drain or seepage flows contain sediment, i.e., muddy water or particles in jar samples. 3) Widespread seepage, concentrated seepage or ponding appears to threaten the safety of the dam.

CONDITIONS OBSERVED - APPLIES TO MONITORING

GOOD	ACCEPTABLE	POOR
Monitoring includes movement surveys and leakage measurements for all dams, and piezometer readings for Class I dams. Instrumentation is in reliable, working condition. A plan for monitoring the instrumentation and analyzing results by the owner's engineer is in effect. Periodic inspections by owner's engineer.	Monitoring includes movement surveys and leakage measurements for Class I & II dams; leakage measurements for Class III dams. Instrumentation is in serviceable condition. A plan for monitoring instrumentation is in effect by owner . Periodic inspections by owner or representative. OR, NO MONITORING REQUIRED.	All instrumentation and monitoring described under "ACCEPTABLE" here for each class of dam, are not provided, or required periodic readings are not being made, or unexplained changes in readings are not reacted to by the owner.

CONDITIONS OBSERVED - APPLIES TO MAINTENANCE AND REPAIR

GOOD	ACCEPTABLE	POOR
Dam appears to receive effective on-going maintenance and repair, and only a few minor items may need to be addressed.	Dam appears to receive maintenance, but some maintenance items need to be addressed. No major repairs are required.	Dam does not appear to receive adequate maintenance. One or more items needing maintenance or repair has begun to threaten the safety of the dam.

OVERALL CONDITIONS

SATISFACTORY	CONDITIONALLY SATISFACTORY	UNSATISFACTORY
The safety inspection indicates no conditions that appear to threaten the safety of the dam, and the dam is expected to perform satisfactorily under all design loading conditions. Most of the required monitoring is being performed.	The safety inspection indicates symptoms of <i>possible</i> structural distress (seepage, evidence of minor displacements, etc.), which, if conditions worsen, <i>could</i> lead to the failure of the dam. Essential monitoring, inspection, and maintenance must be performed as a requirement for continued full or reduced storage in the reservoir.	The safety inspection indicates <i>definite</i> signs of structural distress (excessive seepage, cracks, slides, sinkholes, severe deterioration, etc.), which <i>could</i> lead to the failure of the dam if the reservoir is used to full capacity. The dam is judged unsafe for full storage of water.

SAFE STORAGE LEVEL

FULL STORAGE	CONDITIONAL FULL STORAGE	RESTRICTION
Dam may be used to full capacity with no conditions attached.	Dam may be used to full storage if certain monitoring, maintenance, or operational conditions are met.	Dam may not be used to full capacity, but must be operated at some reduced level in the interest of public safety.

CLASSIFICATION OF DAMS

CLASS I	CLASS II	CLASS III
Class I - Loss of human life is expected in the event of failure of the dam, while the reservoir is at the high water line.	Class II - Significant damage to improved property is expected in the event of failure of the dam while the reservoir is at the high water line, but no loss of human life is expected.	Class III - Loss of human life is not expected, and damage to improved property is expected to be small, in the event of failure of the dam while the reservoir is at high water line.

MONITORING	EXISTING INSTRUMENTATION FOUND <input type="checkbox"/> (110) NONE <input type="checkbox"/> (111) GAGE ROD <input type="checkbox"/> (112) PIEZOMETERS <input type="checkbox"/> (113) SEEPAGE WEIRS/FLUMES <input type="checkbox"/> (114) SURVEY MONUMENTS <input type="checkbox"/> (115) OTHER _____	GOOD ACCEPTABLE POOR	MONITORING
	MONITORING OF INSTRUMENTATION: <input type="checkbox"/> (116) NO <input type="checkbox"/> (117) YES PERIODIC INSPECTIONS BY: <input type="checkbox"/> (118) OWNER <input type="checkbox"/> (119) ENGINEER Comments: _____		

MAINTENANCE AND REPAIR	PROBLEMS NOTED: <input type="checkbox"/> (60) NONE <input type="checkbox"/> (61) ACCESS ROAD NEEDS MAINTENANCE <input type="checkbox"/> (62) CATTLE DAMAGE <input type="checkbox"/> (63) BRUSH ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (64) TREES ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (65) RODENT ACTIVITY ON UPSTREAM SLOPE, CREST, DOWNSTREAM SLOPE, TOE <input type="checkbox"/> (66) DETERIORATED CONCRETE-FACING, OUTLET, SPILLWAY <input type="checkbox"/> (67) GATE AND OPERATING MECHANISM NEED MAINTENANCE <input type="checkbox"/> (68) OTHER _____	GOOD ACCEPTABLE POOR	MAINTENANCE AND REPAIRS
	Comments: _____		

OVERALL CONDITIONS	REMARKS: _____ _____ _____	OVERALL CONDITIONS
	Based on this Safety Inspection and recent file review, the overall condition is determined to be: <input type="checkbox"/> 71 SATISFACTORY <input type="checkbox"/> 72 CONDITIONALLY SATISFACTORY <input type="checkbox"/> 73 UNSATISFACTORY	

The State Engineer, by providing this dam safety inspection report, does not assume responsibility for any unsafe condition of the subject dam. The sole responsibility for the safety of this dam rests with the reservoir owner or operator, who should take every step necessary to prevent damages caused by leakage or overflow of waters from the reservoir or floods resulting from a failure of the dam.

ITEMS REQUIRING ACTION BY OWNER TO IMPROVE THE SAFETY OF THE DAM

MAINTENANCE - MINOR REPAIR - MONITORING

(80) PROVIDE ADDITIONAL RIPRAP: _____

(81) LUBRICATE AND OPERATE OUTLET GATES THROUGH FULL CYCLE: _____

(82) CLEAR TREES AND/OR BRUSH FROM: _____

(83) INITIATE RODENT CONTROL PROGRAM AND PROPERLY BACKFILL EXISTING HOLES: _____

(84) GRADE CREST TO A UNIFORM ELEVATION WITH DRAINAGE TO THE UPSTREAM SLOPE: _____

(85) PROVIDE SURFACE DRAINAGE FOR: _____

(86) MONITOR: _____

(87) DEVELOP AND SUBMIT AN EMERGENCY PREPAREDNESS PLAN. _____

(88) OTHER: _____

(89) OTHER: _____

ENGINEERING - EMPLOY AN ENGINEER EXPERIENCED IN DESIGN AND CONSTRUCTION OF DAMS TO: (Plans & Specification must be approved by State Engineer prior to construction.)

(90) PREPARE PLANS AND SPECIFICATIONS FOR THE REHABILITATION OF THE DAM: _____

(91) PREPARE AS-BUILT DRAWINGS OF: _____

(92) PERFORM A GEOTECHNICAL INVESTIGATION TO EVALUATE THE STABILITY OF THE DAM: _____

(93) PERFORM A HYDROLOGIC STUDY TO DETERMINE REQUIRED SPILLWAY SIZE: _____

(94) PREPARE PLANS AND SPECIFICATIONS FOR AN ADEQUATE SPILLWAY: _____

(95) SET UP A MONITORING SYSTEM INCLUDING WORK SHEETS, REDUCED DATA AND GRAPHED RESULTS: _____

(96) PERFORM AN INTERNAL INSPECTION OF THE OUTLET: _____

(97) OTHER: _____

(98) OTHER: _____

(99) OTHER: _____

SAFE STORAGE LEVEL RECOMMENDED AS A RESULT OF THIS INSPECTION

<input type="checkbox"/> (101) FULL STORAGE <input type="checkbox"/> (102) CONDITIONAL FULL STORAGE <input type="checkbox"/> (103) RECOMMENDED RESTRICTION	RESTRICTED LEVEL OFFICIAL ORDER TO FOLLOW	_____ FT. BELOW DAMS CREST _____ FT. BELOW SPILLWAY CREST _____ FT. GAGE HEIGHT _____ NO STORAGE-MAINTAIN OUTLET FULLY OPEN
--	--	--

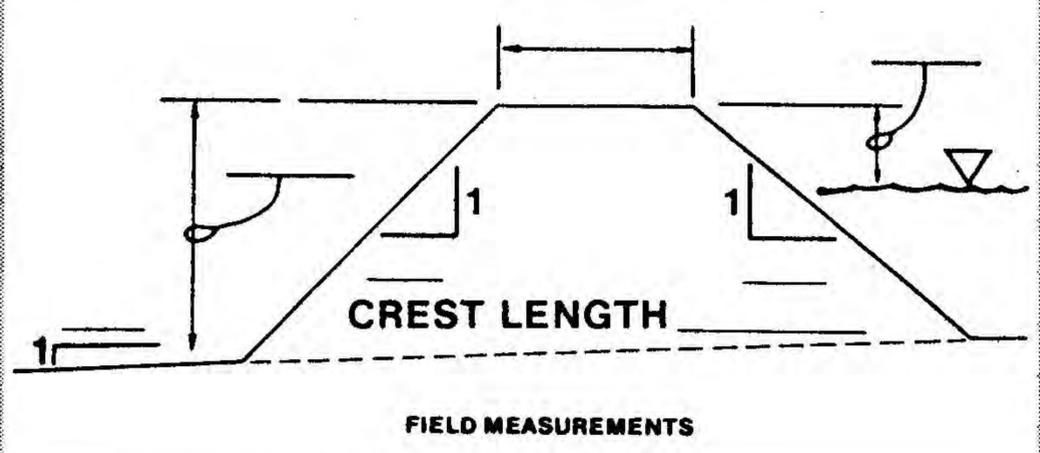
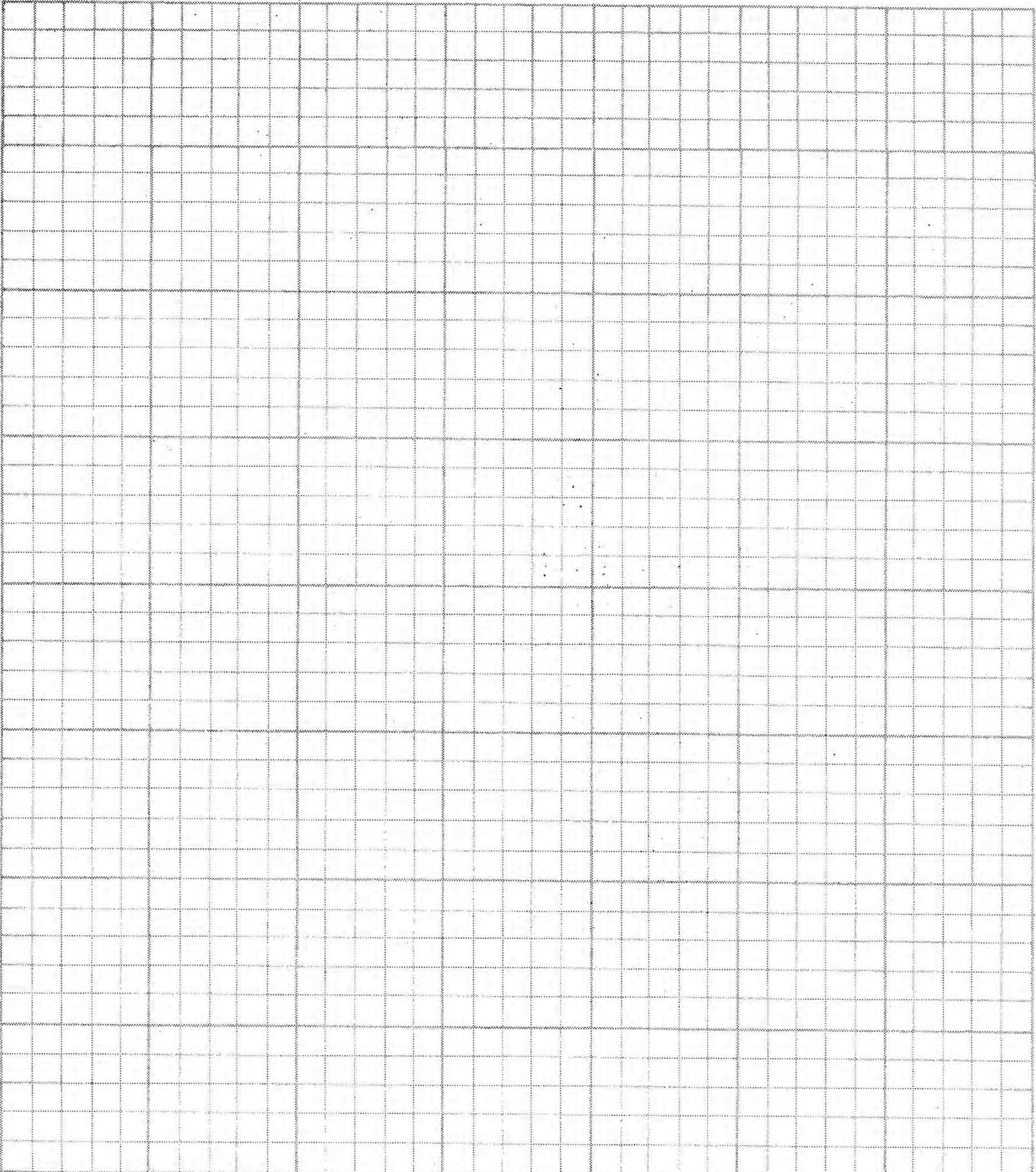
REASON FOR RESTRICTION: _____

ACTIONS REQUIRED FOR CONDITIONAL FULL STORAGE OR CONTINUED STORAGE AT THE RESTRICTED LEVEL _____

DAM NAME _____

DAM ID _____

DATE / /



APPENDIX C

INSPECTION CHECKLIST

CASE 4: PENNSYLVANIA



Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

DAM INSPECTIONS BY OWNERS

Although all Hazard Potential Category 1 or 2 (i.e., "High Hazard") dams must be inspected annually by a registered professional engineer, dam owners in Pennsylvania are required to inspect their dam(s) at least once every three months. A manual entitled *The Inspection, Maintenance and Operation of Dams in Pennsylvania* is available upon request from the Division of Dam Safety.

The Inspection

It is helpful to prepare an inspection route in advance to assure that every part of the dam will be observed. The following is a recommended sequence to assist you in your inspection:

CREST - Walk across the crest from abutment to abutment.

UPSTREAM/DOWNSTREAM SLOPE - Walk across the slope in an up and down or zigzag pattern from abutment to abutment.

EMBANKMENT-ABUTMENT CONTACTS - Walk the entire length of the embankment-abutment contacts (groin).

OUTLET CONDUIT - Observe all accessible features of the outlet conduit.

SPILLWAY - Walk along the entire length of the spillway in a back and forth manner.

ABUTMENTS - Traverse abutments in a practical manner so as to gain a general feel for the conditions which exist along the valley sidewalls.

DOWNSTREAM CHANNEL - Travel the route of the stream below the dam to maintain familiarity with locations of residences and property which can be affected by dam failure.

DOWNSTREAM TOE - Walk the entire length of the downstream toe.

RESERVOIR SLOPES - Scout the reservoir perimeter in an effort to develop an overall familiarity with its conditions.

What To Look For

The following is a partial list of some of the conditions a dam owner may discover. This list does not cover all of the problems which may be encountered.

SETTLEMENT

STRUCTURAL CRACKING

EROSION

SINKHOLES

ANIMAL BURROWS

DEPRESSIONS

SEEPS

EXCESSIVE VEGETATION

BOILS

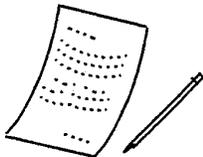
TURBID DISCHARGE

FOUNDATION MOVEMENT

VANDALISM

Keeping Records

It is important for the dam owner/operator to keep records throughout the existence of the dam. Accurate records can better illustrate the dynamic nature of the structure.



DEP requires the dam owner to establish a permanent file to retain inspection records including records of actions taken to correct conditions found in such inspections. The following items will aid the dam owner/operator in keeping good records.

Inspection Checklist - A convenient way of compiling inspection observations is by recording them directly onto an inspection checklist. The checklist should be attached to a clipboard and carried by the dam inspector as he/she traverses the entire structure. Copies of the checklist can be obtained by contacting DEP.

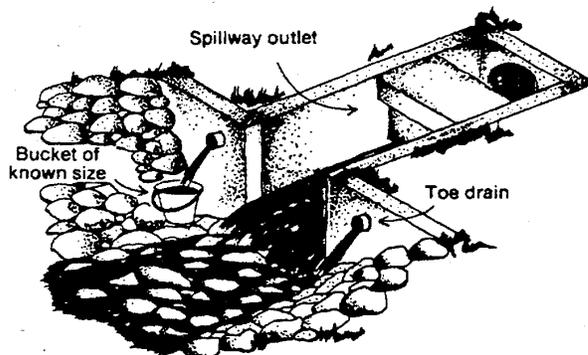
A good practice to follow along with filling out the inspection checklist is to draw a field sketch of observed conditions. The field sketch is intended to supplement the information recorded on the inspection checklist, however, it should never be used as a substitute for clear and concise inspection checklists.

Photographs - Inspection photographs can be vitally important. Over time, photographs serve to provide a pictorial history of the evolving characteristics of a dam. The dam owner/operator often finds them to be great money savers because they can illustrate that some observed conditions (seepage, foundation movement, etc.) have existed for many years and may have reached a state of equilibrium. With this knowledge, quick and economical remedial actions can be developed and implemented. Photographs should be dated on the back and provided with brief descriptions of the locations shown in the pictures.



Monitoring Data - As previously indicated, it may become necessary to make measurements of various

items during the course of a dam inspection. This may include measurements of seepage rates, spillway discharge rates, settlement, and for some dam owners, readings from instruments such as piezometers. It is important that this data also be compiled in a systematic manner and placed in a permanent file.



Accompany Your Engineer During Annual Inspections

Many engineers encourage dam owners or operators to accompany them, or even assist them, on annual dam inspections. Also, many owners accompany department engineers during our periodic inspections. Owners can learn many things from experienced inspectors such as:

- What to look for;
- How to photograph certain features of a dam;
- What records to keep; and
- How to read different types of instrumentation.

For more information contact:

Department of Environmental Protection
Bureau of Waterways Engineering
Division of Dam Safety
P.O. Box 8554
Harrisburg, PA 17105-8554
(717) 787-8568

For more information, visit DEP's Web site at www.depweb.state.pa.us, Keyword: "Dam Safety."

APPENDIX D

PENALTIES FOR VIOLATIONS

CASE 1: PENNSYLVANIA

APPENDIX D
PENALTIES FOR VIOLATIONS
CASE 1 : PENNSYLVANIA

Section 19. Civil Remedies.

(a) Any activity or condition declared by this act to be unlawful conduct shall be restrained or prevented in the manner provided by law or equity for abatement of public nuisances, and the expense thereof shall be recoverable from the violator in such manner as may now or hereafter be provided by law.

(b) In addition, suits to restrain or prevent any unlawful conduct as defined in this act or to compel action to discontinue any unlawful conduct may be instituted in equity or at law in the name of the Commonwealth upon relation of the Attorney General, or upon relation of any district attorney of any county or upon relation of the solicitor of any municipality affected after 30 days notice has first been served upon the Attorney General of the intention of the district attorney or solicitor to proceed. Such proceedings may be prosecuted in the Commonwealth Court, or in the court of common pleas of the county where the activity has taken place, the dam, water obstruction or encroachment is maintained or the public is affected, and to that end jurisdiction is hereby conferred in law and equity upon such courts: Provided, That except in cases of emergency where, in the opinion of the court, the exigencies of the cases require immediate abatement of said unlawful conduct, the court may, in its decree, fix a reasonable time during which the person responsible for the unlawful conduct may make provision of the same. The expense of such proceedings shall be recoverable from the violator in such manner as may now or hereafter be provided by law.

Section 20. Enforcement Orders.

(a) The Department may issue such orders as are necessary to aid in the enforcement of the provisions of this act. Such orders shall include, but shall not be limited to, orders modifying, suspending or revoking permits and orders requiring persons to cease any activity which is in violation of the provisions of this act. Such an order may be issued if the Department finds that a person is in violation of any provision of this act, or any rule or regulation issued hereunder. The Department may, in its order, require compliance with such terms and conditions as are necessary to effect the purposes of this act.

(b) An order issued under this section shall take effect upon notice, unless the order specifies otherwise.

(c) Any person violating or failing to comply with any order of the Department from which no appeal has been taken or which has been sustained on appeal, or which has been appealed but where no supersedeas has been

granted for the period in which the order has been violated shall be deemed to be in contempt of such order. Upon petition and certification of such order by the Department or the hearing board, the Commonwealth Court or the court of common place of the county where the unlawful conduct occurred or is occurring, shall, if it finds, after hearing or otherwise, that the respondent is not in compliance with the order, adjudge the respondent in contempt of the order and shall assess civil penalties of an amount not less than \$100 nor greater than \$10,000 per violation plus \$500 or each continuing day of violation. Where the respondent has not as of the date of hearing before the court complied with the order of the Department or board, the court shall specifically order the respondent to immediately and fully comply with such order, and may issue any further order as, may be appropriate.

(d) The right of the Department to issue an order under this section is in addition to any penalty which may be imposed or any action taken pursuant to this act. The failure to comply with any such order is hereby declared to be unlawful conduct and a nuisance.

Section 21. Civil Penalties.

(a) In addition to proceeding under any other remedy available at law or equity for :

(1) a violation of a provision of this act or any rule or regulation issued hereunder;

(2) a violation of any order of the Department ; or

(3) engaging in any unlawful conduct of the provisions of this act the hearing board, in an action instituted before it by the Department, may assess a civil penalty upon any person for such violation or unlawful conduct. Such a penalty may be assessed whether or not the violation was willful. The civil penalty so assessed shall not exceed \$10,000, plus \$500 for each day of continued violation. In determining the amount of the civil penalty, the board shall consider the willfulness of the violation, damage or injury to the stream regimen and downstream areas of the Commonwealth, cost of restoration, the cost to the Commonwealth of enforcing the provisions of the act against such person, and other relevant factors. The assessment of the civil penalty shall be made after hearing, unless hearing is specifically waived by the respondent.

(b) Civil penalties shall be payable to the Commonwealth and shall be collectible in any manner provided by law for the collection of debts. If any person liable to pay any such penalty neglects or refuses to pay the same after demand, the amount, together with interest and any costs that may accrue, shall be a lien in favor of the Commonwealth upon the property, both real and personal, of such

person but only after the amount of the lien has been entered and docketed of record by prothonotary of the county where the property is situated. The board may, at any time, transmit to the protonotaries of the respective counties certified copies of all such liens, and it shall be the duty of each prothonotary to enter and docket the same of record in his office, and to index the same as judgments are indexed, without requiring the payment of costs as a condition precedent to the entry thereof.

(c) Any officer of any corporation, association, municipality or county, who knowingly, willfully, recklessly or with gross negligence engages in or authorizes unlawful conduct as defined in this act shall be subject to the imposition upon civil penalties in accordance with subsection (a). Any civil penalty imposed upon such officer shall be in addition to and separate from any civil penalty imposed upon the corporation, association, municipality or county. Nothing in this subsection shall be construed to affect the liability or duty of any officer of a corporation, association, municipality or county for the purposes of criminal penalties imposed under this act, or for the purposes of any other rights or remedies now or hereafter existing or herein provided.

Section 22. Criminal Penalties.

(a) Any person who engages in unlawful conduct as defined in this act is guilty of a summary offense and, upon conviction, shall be sentenced to pay a fine of not less than \$100 nor more than \$1,000 for each separate offense, and, in default of the payment of such fine, to imprisonment for a period of not more than 60 days.

(b) Any person who, within two years after a conviction in a summary proceeding as provided in subsection (a) engages in unlawful conduct as defined in this act is guilty of a misdemeanor of the third degree and, upon conviction, shall be sentenced to pay a fine of not less than \$500 nor more than \$5,000 for each separate offense or to imprisonment for a period of not more than one year, or both.

(c) Each day of continued violation of any provision of this act or any rule or regulation or order of the Department issued pursuant to this act shall constitute a separate offense under subsections (a) and (b). Some states may find it advisable to add a provision for injunctive relief (i.e., a court order to repair or breach a dam).

Section 23. Summary proceedings.

All summary proceedings under the provisions of this act may be brought before any magistrate, alderman, or justice of the peace of the county where the unlawful conduct has occurred or the dam, water obstruction or encroachment is maintained, or the public affected, and to that end jurisdiction is hereby conferred

upon said magistrates, aldermen or justices of the peace, subject to appeal by either party in the manner provided by law. In the case of any appeal from any such conviction in the manner provided by law for appeals from summary conviction, it shall be the duty of the district attorney of the county to represent the interests of the Commonwealth.

Section 24. Administrative and judicial review.

(a) Any person who shall be aggrieved by any action of the Department under this act shall have the right within 30 days of receipt of notice of such action to appeal to the Environmental Hearing Board. Any appeal of a general permit issued pursuant to section 7 shall be filed within 30 days of the date of publication of the general permit in the Pennsylvania Bulletin. Hearings under this subsection any subsequent appeal shall be in accordance with section 1921 (a) of the act of April 9, 1929 (P .L . 177, No . 175), known as " The Administrative Code of 1929", and the " Administrative Agency Law".

(b) An appeal to the hearing board of any action of the Department shall not act as a supersedeas. A supersedeas may be granted by the hearing board upon a showing by the petitioner:

(1) the irreparable harm to the petitioner or other interested parties will result if the supersedeas is denied;

(2) that there is a likelihood of the petitioner's success on the merits; and

(3) that the grant of a supersedeas will not result in irreparable harm to the Commonwealth. The board may grant such a supersedeas subject to such security as it may deem proper.

Section 25. Preservation of existing rights and remedies.

The collection of any penalty under the provisions of this act shall not be construed as estopping the Commonwealth, or any district attorney or solicitor of a municipality, from proceeding in courts of law or equity to abate conduct forbidden under this act, or abate nuisances under existing law. It is hereby declared to be the purpose of this act to provide additional and cumulative remedies to abate unsafe dams, water obstructions or encroachments in this Commonwealth, and nothing in this act shall in any way abridge or alter rights of action or remedies now or hereafter existing in equity, or under the common law or statutory law, criminal or civil, nor shall any provision in this act, or the granting of any permit under this act, or any act done by virtue of this act, be construed as estopping the Commonwealth, persons or municipalities, in the exercise of their rights under the common law or decisional law or in equity, from proceeding in

courts of law or equity to suppress nuisances, or to abate any unsafe dam now or hereafter existing, or enforce common law or statutory rights.

The division of penalties into several categories reflects the fact that in most cases penalties that follow violations will be different according to not only severity but also nature. That is, it should be possible to distinguish between civil violations and criminal violations of the law.

APPENDIX D

PENALTIES FOR VIOLATIONS

CASE 2: CALIFORNIA

Appendix D - Penalties for Violations
CASE 2: CALIFORNIA
Offenses and Punishment
(California 1995)

6425. Every person who violates any of the provisions of this part or of any approval, order, rule, regulation, or requirement of the department is guilty of a misdemeanor and punishable by a fine of not more than two thousand dollars (\$2, 000) or by imprisonment in the county jail not exceeding six months, or both. In the event of a continuing violation, each day that the violation continues constitutes a separate and distinct offense.

6426 . Any person who willfully obstructs, hinders, or prevents the department or its agents or employees from performing the duties imposed by this part or who willfully resists the exercise of the control and supervision conferred by this part upon the department or its agents or employees is guilty of a misdemeanor and punishable as provided in this article.

6427 . Any owner or any person acting as a director, officer, agent, or employee of an owner, or any contractor or agent or employee of a contractor who engages in the construction, enlargement, repair, alteration, maintenance, or removal of any dam or reservoir, who knowingly does work or permits work to be executed on the dam or reservoir without an approval or in violation of or contrary to any approval as provided for in this part or any inspector, agent, or employee of the department who has knowledge of such work being done and who fails to immediately notify the department thereof is guilty of a misdemeanor and punishable as provided in this article.

6428 . Any owner who fails to pay any annual fee or any part of any annual fee required to be paid pursuant to Section 6307 within the time required shall pay a penalty of 10 percent of the annual fee or part of the annual fee, plus interest at the rate of one-half of 1 percent per month, or fraction thereof, from the date on which the annual fee or the part of the annual fee became due and payable to the state until the date of payment.

APPENDIX D

PENALTIES FOR VIOLATIONS

CASE 3: NORTH CAROLINA

Appendix D - Penalties for Violations
CASE 3: NORTH CAROLINA

(North Carolina 1994)

143-215 .36. Enforcement procedures.

(a) Criminal Penalties.

Any person who shall be adjudged to have violated this Article shall be guilty of a Class 3 misdemeanor and shall only be liable to a penalty of not less than one hundred dollars (\$100 .00) nor more than one thousand dollars (\$1,000) for each violation. In addition, if any person is adjudged to have committed such violation willfully, the court may determine that each day during which such violation continued constitutes a separate violation subject to the foregoing penalty.

(b) Civil Penalties.

(1) The Secretary may assess a civil penalty of not less than one hundred dollars (\$100 .00) nor more than five hundred dollars (\$500 .00) against any person who violates any provisions of this Part, a rule implementing this Part, or an order issued under this Part.

(2) If any action or failure to act for which a penalty may be assessed under this Part is willful, the Secretary may assess a penalty not to exceed five hundred dollars (\$500 .00) per day for each day of violation.

(3) In determining the amount of the penalty, the Secretary shall consider the factors set out in G .S . 143B-282 .1(b). The procedures set out in G .S . 143B-282 .1 shall apply to civil penalty assessments that are presented to the Commission for final agency decision.

(4) The Secretary shall notify any person assessed a civil penalty of the assessment and the specific reasons therefor by registered or certified mail, or by any means authorized by G .S . 1A-1, Rule 4. Contested case petitions shall be filed in accordance with G .S .150B-23 within 30 days of receipt of the notice of assessment.

(5) Requests for remission of civil penalties shall be filed with the Secretary. Remission requests shall not be considered unless made within 30 days of receipt of the notice of assessment. Remission requests must be accompanied by a waiver of the right to a contested case hearing pursuant to Chapter 150B and a stipulation of the facts on which the

assessment was based. Consistent with the limitations in G .S . 143B-282 .1(c) and G .S. 143-282 .1(d), remission requests may be resolved by the Secretary and the violator. If the Secretary and the violator are unable to resolve the request, the Secretary shall deliver remission requests and his recommended action to the Committee on Civil Penalty Remissions of the Environmental Management Commission appointed pursuant to G .S . 143B-282 .1(c).

(6) If any civil penalty has not been paid within 30 days after notice of assessment has been served on the violator, the Secretary shall request the Attorney General to institute a civil action in the Superior Court of any county in which the violator resides or has his or its principal place of business to recover the amount of the assessment, unless the violator contests the assessment as provided in subdivision (4) of this subsection. If any civil penalty has not been paid within 30 days after the final agency decision or court order has been served on the violator, the Secretary shall request the Attorney General to institute a civil action in the Superior Court of any county in which the violator resides or has his or its principal place of business to recover the amount of the assessment. A civil action shall be filed within three years of the date the final agency decision was served on the violator.

(7) The Secretary may delegate his powers and duties under this section to the Director of the Division of Land Resources of the Department.

(c) Injunctive Relief. - Upon violation of any of the provisions of this Part, a rule implementing this Part, or an order issued under this Part, the Secretary may, either before or after the institution of proceedings for the collection of the penalty imposed by this Part for such violations, request the Attorney General to institute a civil action in the superior court of the county or counties where the violation occurred in the name of the State upon the relation of the Department for injunctive relief to restrain the violation or require corrective action, and for such other or further relief in the premises as said court shall deem proper. Neither the institution of the action nor any of the proceedings thereon shall relieve any party to such proceedings from the penalty prescribed by this Part for any violation of the same. (1967, c . 1068, s . 14 ; 1973, c . 1262, s . 23 ; 1975, c . 842, s . 3 ; 1977, c . 771, s . 4 ; 1987, c . 827, ss . 154, 180 ; 1989 (Reg . Sess., 1990), c . 1036, s . 5 ; 1991, c . 342, ss . 10, 11 ; 1993, c . 394, s . 9 ; c . 539, s . 1021 ; 1994, Ex . Sess ., c . 24, s . 14(c) .)

APPENDIX E

EMERGENCY ACTION PLANS

EAP Reviewer's Checklist

Page 1 of 2

1. General Document Items

	Is the name of the dam clearly labeled in large letters on the binder?
	Is the document a controlled document, including the names, titles, and addresses of all plan holders?
	Are the roles and responsibilities of key emergency personnel clearly documented, preferably at the beginning of the document?
	Is there an up-to-date revision sheet provided near the beginning of the document?
	Are revision numbers and revision dates provided as footers on each page of the document?

2. Detection Items

	Are detection and/or early warning systems at the dam clearly described, including dam operators' observations, instrumentation systems, and observations by the general public?
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3. Decision Making Items

	Are the emergency event levels clearly described?
	Are there clear guidelines and decision criteria to help the dam owner determine the appropriate emergency event level for potential unusual and emergency conditions that could occur at the dam?

4. Notification and Communication Items

	Are primary and back-up communication systems among the dam owner, local emergency responders, and other key stakeholders described in the document?
	Are the notification flow charts complete and logical?
	Are phone numbers, after-hours phone numbers, and back-up personnel listed on the notification flow charts?
	Do the notification flow charts include contacts to provide timely engineering support?
	Do the notification flow charts include contacts for timely notification of local emergency management organizations for the more serious emergency event levels?
	Do the notification flow charts minimize the number of calls that the dam operators are required to make, so that they can focus on implementing preventative actions?

5. Pre-planned Action Items

	Are there descriptions of recommended pre-planned actions for potential unusual and emergency conditions at the dam?
	Is a list of locally available engineering, labor, materials, and equipment resources that can be referenced in an emergency?
	Has the contact information for the locally available resources been recently updated or verified?

EAP Reviewer's Checklist

6. Termination and Follow-up Items

	Does the document describe who has the authority to terminate emergency operations?
	Are the procedures for terminating emergency operations clearly described in the document?
	Does the document have guidance on follow-up responsibilities after the emergency is terminated?

7. Inundation Mapping

	Does the inundation map include a north arrow and a bar scale?
	Are the inundation areas clearly delineated and labeled. This is especially important if there are "sunny day" failure and PMF plus breach inundation limits shown on the inundation maps?
	Does the inundation map include a qualification stating that the inundation limits for an actual dam failure may vary in some ways from what is shown on the inundation map?
	Are local roads, drainages, and other landmarks clearly labeled on the basemap?
	Is the downstream limit of the inundation mapping logical (e.g. at a major reservoir, river, or other water course)?
	Were channel cross sections taken at critical downstream locations, such as at major road crossings, schools, major population centers, etc.?
	Is the following flood inundation information provided at important downstream cross sections: <ul style="list-style-type: none"> • Peak flood stage • Floodwave arrival time • Maximum water surface elevation • Peak discharge

8. Other Items

	Are there clear procedures for testing and updating the document provided in the document?
	Is the frequency of testing and updating the document clearly described?
	Is the person or position responsible for updating the document indicated in the document along with updated contact information for that person?
	Are the process for training personnel in how to use the document and the frequency and responsibility for this training clearly described in the document?
	Are key hydrologic/hydraulic data, such as spillway and outlet discharge curves and reservoir area capacity curves, provided in the document?
	Does the document include a general location map that shows where the dam is located relative to other key local roads, drainages, and population centers?

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
Midwest							
IA	Iowa	Yes	75	-	176	-	Guidelines not specific to dams
IL	Illinois	Yes	185	143	287	109	None Found
IN	Indiana	Yes	242	16	225	-	Guidelines
MI	Michigan	Yes	80	79	137	133	DEQ has a set of guidelines and suggests use of FEMA format.
MN	Minnesota	Yes	23	23	155	3	None Found
MO	Missouri	Yes	239	-	210	-	None Found
NE	Nebraska	Yes	101	97	245	6	Guidelines
OH	Ohio	Yes	401	137	556	106	Recommendation
WI	Wisconsin	Yes	62	35	12	11	Sample
		Regional Totals	1408	530	2003	368	
Northeast							

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
CT	Connecticut	Yes	227	160	198	159	Should follow guidelines established by the commissioner
DE	Delaware	No	11	3	-	-	None Found
MA	Massachusetts	Yes	334	95	743	54	Emergency action plans must follow one of the examples furnished by the Department
MD	Maryland	No	66	58	84	38	Guidelines
ME	Maine	Yes	26	25	66	39	Emergency plans must follow a model plan supplied by the department
NH	New Hampshire	Yes	89	87	193	140	Guidelines
NJ	New Jersey	Yes	203	193	364	232	Yes
NY	New York	Yes	384	202	757	53	Guidelines/ FEMA-64

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
PA	Pennsylvania	Yes	787	377	262	45	Guidelines
RI	Rhode Island	Yes	16	unknown	41	unknown	-
VT	Vermont	No	52	-	134	-	Blanket Procedure
		Regional Totals	2195	1200	2842	760	
		Southeast					
AL	Alabama	Yes	172	0	421	0	None Found
AR	Arkansas	Yes	103	92	94	0	Guidelines
FL	Florida	?	99	99	259	220	None Found
GA	Georgia	?	372	15	-	-	None Found
KY	Kentucky	No	157	3	192	2	FEMA 64, Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners
LA	Louisiana	?	11	2	46	1	None Found
MS	Mississippi	Yes	273	14	72	0	FEMA 64, Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners
NC	North Carolina	Yes	1006	202	657	26	None Found

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
SC	South Carolina	Yes	148	137	458	410	None Found
TN	Tennessee	Yes	148	148	200	2	Guidelines
VA	Virginia	Yes	124	124	166	163	Form
WV	West Virginia	Yes	245	148	65	3	Example
		Regional Totals	2858	984	2630	827	
		West					
AK	Alaska	Yes	15	8	29	4	State and Federal Guidelines
AZ	Arizona	Yes	88	66	51	38	Guidelines
CA	California	Yes	395	176	530	87	None Found
CO	Colorado	Yes	264	262	292	287	Rule 16, Model
HI	Hawaii	Yes	76	45	21	10	None Found
ID	Idaho	Yes	105	101	150	38	None Found

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
KS	Kansas	Yes	193	135	257	14	None Found
MT	Montana	Yes	97	95	126	0	Administrative Rules dictate what should be contained in EAP. Refer to: http://www.dnrc.mt.gov/wrd/water_op/dam_safety/damsafetyrules.a sp#36.14.406
ND	North Dakota	Yes	28	12	92	1	Some Suggestions
NM	New Mexico	Yes	172	12	91	1	Format similar to the NRCS model
NV	Nevada	Yes	135	91	103	6	FEMA 64, Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners
OK	Oklahoma	Yes	165	124	78	4	None Found

Summary of EAP State Guidelines

From ASDSO tech seminar: <i>EAP for Dam Safety</i> (2006) Presented by J.France, S.Jamieson, & G.Batchelder Adams		Does the state have the authority to require EAPs?	State Regulated High Hazard Dams		State Regulated Significant Hazard Dams		Format
			No.	EAPs	No.	EAPs	
OR	Oregon	No	122	59	181	10	-
SD	South Dakota	Yes	47	31	144	6	None Found
TX	Texas	Yes	835	96	809	12	None Found
UT	Utah	Yes	185	103	200	-	Suggestions
WA	Washington	Yes	144	113	189	58	Form
WY	Wyoming	?	83	33	110	4	-

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
The Department has the authority to “implement a program for the protection of life and property from floods and to promote the orderly development and wise use of the flood plains of the state”. There are no direct references to emergency action plans in Iowa’s laws or regulations.	
The Department of Natural Resources is authorized by law to...establish standards, and issue permits for the safe construction, reconstruction, repair, operation , and maintenance of dams.	YES
Indiana has only situational authority to require EAPs. There is no state statute giving them authority to require EAPs.	YES
Owners of high and significant hazard potential dams are required to have an emergency action plan submitted to the department and to the local emergency services coordinator. (Sec. 31523)	YES
The rules require owners of Class I dams to file EAPs. The rules list items that need to be included in an EAP. Only 18 EAPs found in the states files. Some contacts have been made to urge EAP updates.	YES
Emergency action plans are required by regulation (10 CSR 22-3.030(1)(B) and 3.040(1)(A)15).	YES
Emergency procedures are clearly stated in the Guide for Preparing Emergency Preparedness Plans for Dams and Reservoirs. Emergency Preparedness Plans are required for all high hazard dams and some significant hazard dams. EPPs are required per the Rules Chapter 12-005. New Safety of Dams and Reservoirs Act went into effect on September 4, 2005. Section 46-1647 requires "the owner of every high hazard potential dam shall develop and periodically test and update an emergency action plan to be implemented in the event of an emergency involving such dam. In order to protect life and property, the department may require the owners of any significant hazard potential dam to develop and periodically test and update an emergency action plan to be implemented in the event of an emergency involving such dams." Codification of new law available from the Nebraska DNR.	YES
In accordance with Ohio Administrative Code Rules 1501:21-15-07, an emergency action plan is required for all class I, II and III structures.	YES
Wisconsin regulations require the following for the approval of permits:...documentation and approval of safety requirements, including an emergency action plan (Chapter NR 333.07)	YES

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
	YES
There is currently rules and regulations being developed that will require EAPs for certain classifications of dams, and that will provide guidelines and requirements for EAPs. These rules are scheduled to be promulgated in 2007.	
The Department of Conservation and Recreation is authorized to supervise the construction, alteration, repair, removal, enlargement, and emergency action plans of jurisdictional dams in Massachusetts. All proposed dams which would be classified as Significant Hazard Class are also required to have an EAP.	YES
The laws and regulations do not explicitly state that the owner of an existing dam must have an "Emergency Action Plan" Permits for new dams or repairs to existing ones require EAP for high and significant hazard dams.	YES
Maine State Law MRSA 37B Chapter 24 states §1127. Emergency action plans Within 6 months after the determination of classification, the owner of a dam under the commissioner's jurisdiction that is classified as high or significant hazard potential shall prepare an emergency action plan, which must be updated every 2 years. Such emergency action plans must be reviewed for adequacy by the department. All emergency action plans must be available and on file at the appropriate local and county government offices and at the department.	YES
Only 146 of the 193 Significant Hazard dams require an EAP. All high hazard dams and most significant hazard dams are required to have an Emergency Action Plan. Some dams which are classified as Significant Hazard solely because they impound public water supplies or contain waste (such as commercial waste or sewage) are exempted from the EAP requirement. EAPs must be prepared in accordance with the provisions of Part Env-Wr 500 of the regulations, Guidelines for the Development of an Emergency Action Plan.	YES
Powers and duties of the Department of Environmental Protection are also detailed in N.J.A.C. 7:20-1, which includes regulations relating to the permit process, emergency procedures , permit denials...	YES
EAP may be required during permit process for High Hazard dams. Environmental Conservation Law 15-0507 allows promulgation of regs requiring emergency action plans. Regs are being written.	YES

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
The owner of any dam or reservoir that may cause loss of life or serious damage to property should a failure of the dam occur shall develop an emergency action plan to be followed in the event of a dam hazard emergency.	YES
Dam safety laws are contained in the General Laws of Rhode Island Sections 46-18 and 46-19, dated 1956, as amended. Regulations have not been promulgated since the laws do not give the Department such authority. A Bill was passed in July 2006 that requires an EAP to be developed for each high & significant hazard dam by July 1, 2008, by the municipality in which the dam is located.	YES
Procedures for emergency action are described in 10 V.S.A. Section 1095.	YES
00-00-11. Emergency Action Plan. The Owner of a High or Moderate Hazard Potential Dam shall develop an Emergency Action Plan.	
Requirements and Guideline	YES
EAP usually required during permit process	
...include the power to "establish by rule or regulation such policies, requirements or standards governing the construction, operation and maintenance of dams or artificial barriers". Emergency Action Plans are not required under Georgia law or regulations.	
The Secretary of the Natural Resources and Environmental Protection Cabinet is empowered by KRS 151 to exercise the following powers:...to establish standards for the safe construction, enlargement, repair, alteration, maintenance, or operation of a dam. Emergency Action Plans are not required by Kentucky statute or regulation.	YES
	YES
The Commission may direct the owner of a high hazard dam to develop an Emergency Action Plan (Regulations Section 7-C 15).	
The North Carolina Department of Environment and Natural Resources is responsible for the safety of dams and for the adoption of all rules and regulations designed to protect life and property. Emergency Action Plans are required as a condition of impoundment for all new high hazard dams .	YES

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
The laws and regulation require Emergency Action Plans for high hazard and significant hazard dams, based on a 1992 change to the law.	
The regulations require that new dams with a high-hazard potential rating submit emergency action plans to the commissioner. The regulations list what should be included in the EAP (1200-5-7-.07).	YES
The Virginia Soil and Water Conservation Board (Board) promulgates the Virginia Impounding Structures Regulations in accordance with Virginia Code, Dam Safety Act, Article 2, Chapter 6, Title 10.1. The Board has the authority to ensure the proper and safe design, construction, maintenance and operation of impounding structures. An Emergency Action Plan and other forms are required, for the Board to issue a dam owner an Operation and Maintenance Certificate to operate the dam.	YES
Emergency action plans are required for all Class I and II dams. (11 AAC 93.167 and 11 AAC 93.171). Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners (FEMA,1998c)	
The director is directed by law to supervise the operation and maintenance of all jurisdictional dams to safeguard life and property . Department provides a template in MS Word.	YES
The Department of Water Resources, Division of Safety of Dams (department),..., shall supervise the construction, ..., operation , and removal of dams and reservoirs for the protection of life and property as provided in these provisions (4.1.6075).	
Owners of Class I and II dams are required to prepare, maintain and exercise Emergency Preparedness Plans in accordance with the requirements described in Rule 16.	
Authority currently requires EAP's for all High hazard. Future work to revise rules to include EAP's for all dams. In 2006 the program requested EAP's for all dams (due Sept 30, 2006), EAP training scheduled for Oct-Dec 2006.	YES
The law gives authority to the Idaho Water Resources Board to adopt rules and regulations. (I.C. 42-1714)	YES

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
The Chief Engineer of the Division of Water Resources, Kansas Department of Agriculture is empowered by law to provide for the exclusive regulation of the construction, operation, repair or removal of all dams to the extent required to carry out the protection of public safety. Regulations (KAR 5-40-2k) require each application for a permit to construct a high hazard dam to include an emergency action plan . Number of dams/EAP data from 2004 NID submittal.	YES
The law grants the Department the power to adopt rules to classify high-hazard dams and reservoirs; to approve and issue permits; to govern inspections; establish safety standards for the design, construction, operation, and maintenance of high-hazard dams and reservoirs; to establish emergency procedures and to establish fees commensurate with costs to cover inspections under the law (85-15-110). The administrative rules require that a high hazard dam owner have an EAP and that it be updated annually.	YES
The North Dakota State Engineer, pursuant to Chapter 61-04 and Sections 61-16.1-38 and 61-16.1-53 of the NDCC and North Dakota State Water Commission, pursuant to Section 61-02-14 of the NDCC, have the power and general jurisdiction to regulate, control and supervise the construction and operation of all dams within the State of North Dakota, both public and private, which they deem necessary. It is strongly recommended that an Emergency Action Plan be developed for all dams. The level of detail should be commensurate with the hazard category of the dam. <i>An operation plan is required for all dams that store greater than 1000 acre-feet. (NDCC 61-03-21). The operation plan must contain emergency procedures and warning plans (NDAC 89-08-04-01). Authority to require an EAP should consider NDCC 61-03-21 and NDAC 89-08-04-01.</i>	YES
State Engineer Rules and Regulations require EAPs for existing high and significant hazard potential dams with a time frame for compliance (Subsection F of 19.25.12.21 NMAC)	YES
Nevada Administrative Code 535.320 (regulation) currently requires an emergency action plan for all high hazard dams, and will be required for significant hazard dams on or before March 31, 2007.	YES
Rule 785:25-7-7 requires owners of existing or proposed dams classified as high hazard to provide an adequate warning system and evacuation plan to protect downstream lives and property. The plan is to be approved by and filed with the local Civil Defense authorities.	

Summary of EAP State Guidelines

Notes	Reviewed/Updated by State Dam Safety Officials Prior to EAP Training Course
The laws and regulations do not specifically require an owner to have an Emergency Action Plan . The Director can condition a Permit for new construction to include an Emergency Action Plan; however, no such opportunity is available for existing structures whose hazard rating may have increased in the time since its initial construction/permitting. The Dam Safety program must issue an Order and present the case before a hearings officer before being given legal authority to enforce said Order.	YES
Emergency Preparedness Plans (Rules 74:02:08:09 & :10) are required to be prepared and submitted by the owners of all existing category 1 dams, and as part of the plans and specifications for proposed category 1 dams. For the 16 High Hazard dams with no EAPs, the dam owner is the only downstream hazard.	YES
As required by emergency management planning, the executive director may request, and/or the commission may order a dam owner to provide sufficient data to plan for potential effects of failure or malfunction of a dam and/or associated appurtenant facilities (299.17).	YES
Various sections of the Code specify that the state engineer may make rules governing such aspects of the dam safety program as: exemptions, the use of independent consultants on design, construction and operation considerations, review and approval of plans, inspection and reporting procedures, revocation of approval, standard operating and emergency action plans .	
The Department of Ecology has supervision and control over all dams and stream obstructions, and authorizes the making of regulations necessary for the protection of life and property . Emergency action plans are required for all high and significant hazard dams.	YES
Emergency Action Plans are not included as part of the dam safety program in Wyoming.	

Emergency Action Plan (EAP)

Rock Creek Watershed, Dam No. 23

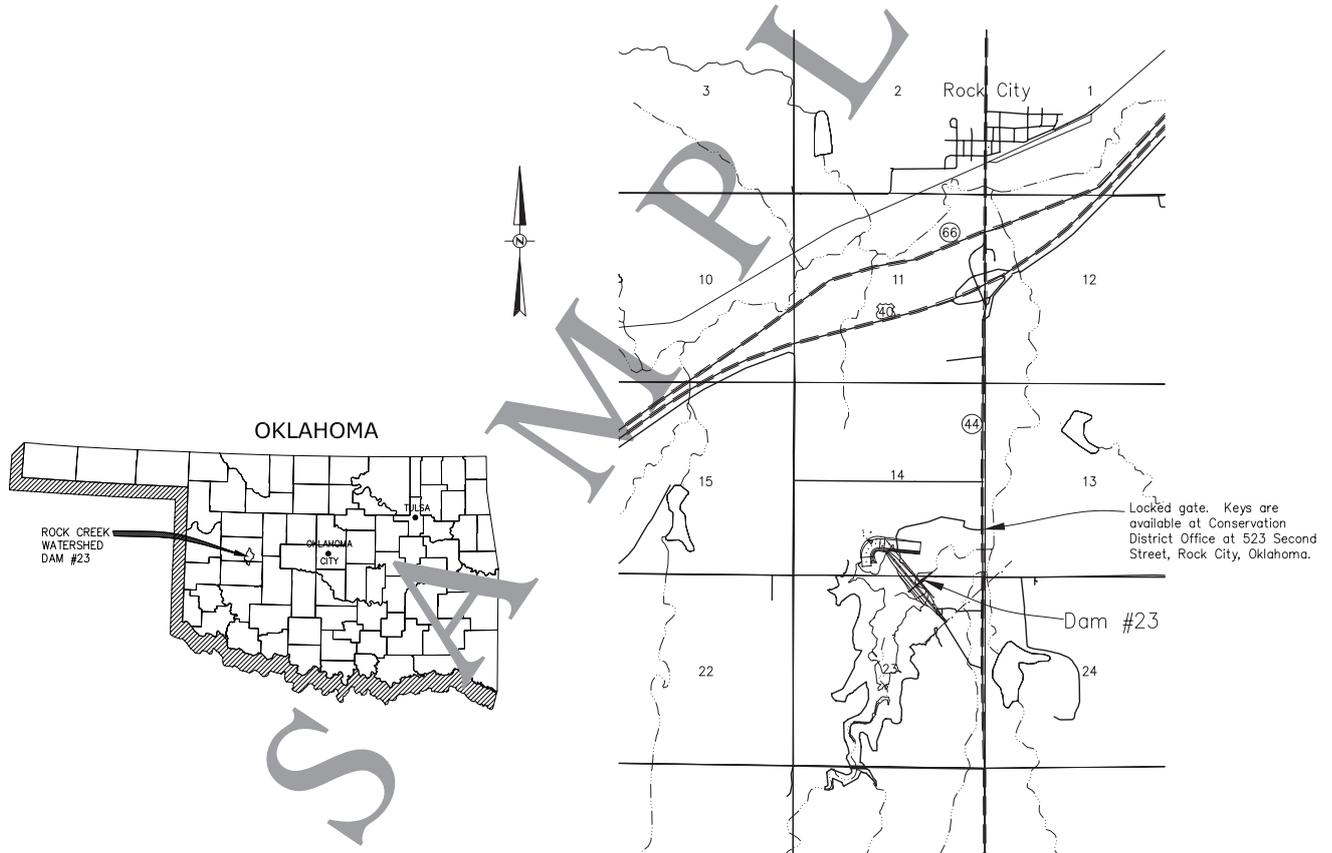
(Rock City Lake)

National Inventory of Dams (NID) No. OK11111

Coal County, Oklahoma

Coal County Conservation District

With assistance from the
U.S. Department of Agriculture
Natural Resources Conservation Service



Reviewed and Updated:

Chair, Coal County Conservation District

Sheriff, Coal County, OK

Date

Date

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Basic EAP Data

Purpose:

The purpose of this EAP is to reduce the risk of human life loss and injury and to minimize property damage during an unusual or emergency event at Rock Creek Watershed, Dam No. 23.

Potential Impacted Area:

See *Evacuation Map* tab (Appendix B–4) and *People at Risk* tab (Appendix B–5) for the locations and contact information of the following residents and businesses that may be flooded if the dam should fail and the estimated time for the flood wave to travel from the dam to these locations:

- 6 houses:
 - 4 on the south side of the Elmwood Heights subdivision in southeast Rock City
 - 2 outside city limits:
 - 1 on south side of Rock Creek, south of Rock City
 - 1 on east side of Highway 44 approximately 1 mile south of Rock City
- 3 businesses on east side of Highway 44 south of Rock City:
 - Lori’s Music Shop, Larry’s Hardware, and Bill’s Coffee Shop
- 3 highways:
 - Interstate 40 and OK Highways 44 and 66

Dam Description:

Height: 40 ft	Drainage Area: 7.7 mi
Built: 1960	Hazard Classification: High
Legal Description: Sects. 14 and 23, T13N, R21W	Dam Operator: Coal Co. Cons. District
Latitude: 35.42875 Longitude: -99.19802	Major Property Owner: Bryan Babcock
National Inventory of Dams No.: OK11111	Dam Designer: NRCS

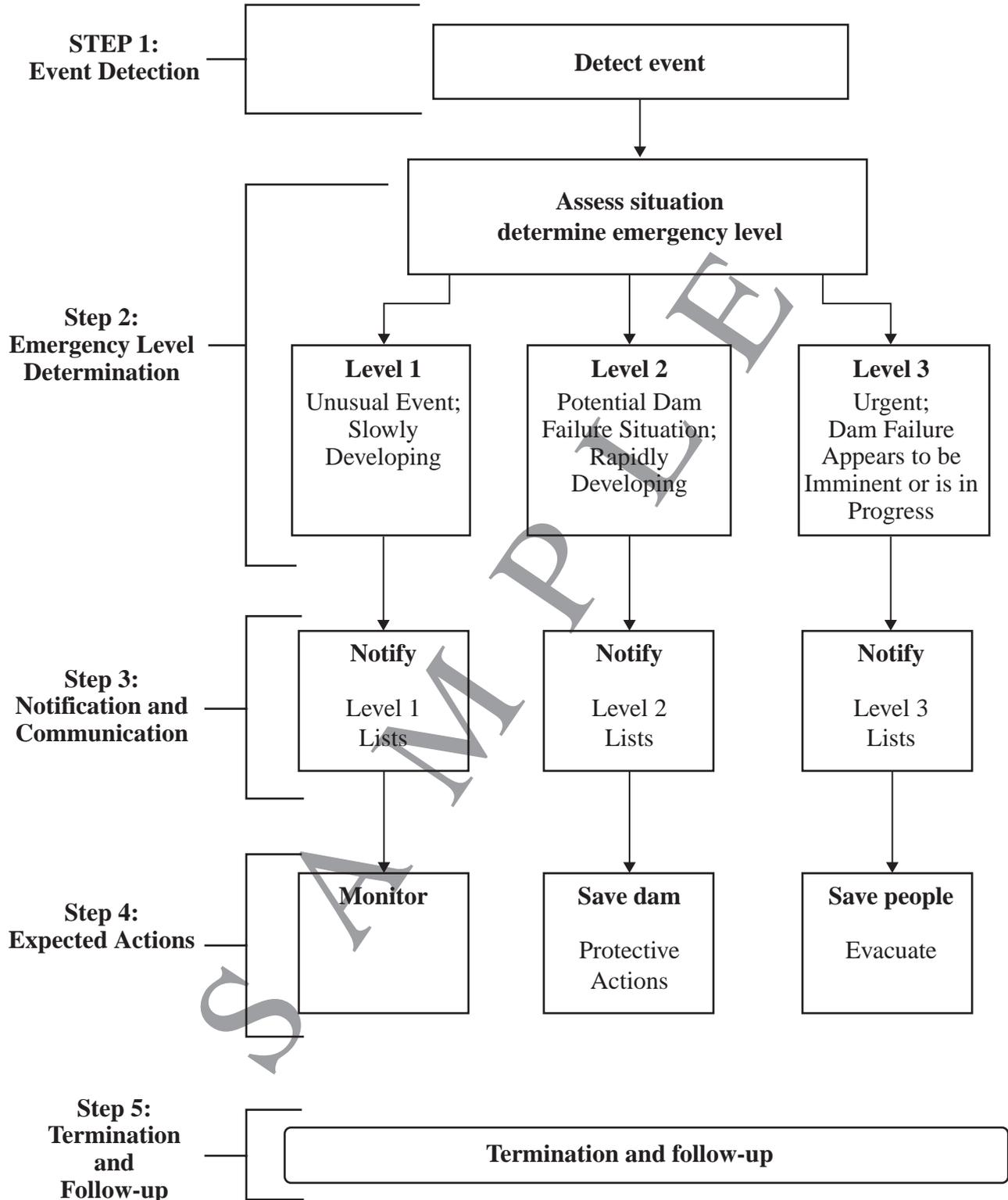
See detailed design data in appendix B tab.

Directions to dam: (See *Location and Vicinity Map*; Appendix B–2.)

Rock Creek, Dam No. 23 can be accessed by traveling south 1.2 miles on OK Highway 44 from the Interstate 40 interchange south of Rock City; turn right (west) on a gated dirt road that goes directly to the left abutment of the dam. Keys for the lock on the gate are available from the Conservation District Manager at 523 Second Street, Rock City, OK. Note that a portion of this road is within the dam breach inundation area and the valley below the dam may be flooded.

An alternate route to the dam is available approximately 0.5 miles south of Rock Creek on Highway 44; turn right on an ungated dirt road that goes to the right abutment of the dam. Note that Highway 44 may be inundated or the bridge may be damaged so access to this alternate route may have to be accessed from Highway 44 south of the dam.

Emergency Action Plan Overview



Roles and Responsibilities

Dam Operator's Representative (Conservation District Manager)

- As soon as an emergency event is observed or reported, immediately determine the emergency level (see *Emergency Level Determination* tab).
 - Level 1: unusual event, slowly developing
 - Level 2: potential dam failure situation, rapidly developing
 - Level 3: dam failure is imminent or in progress
- Immediately notify the personnel in the order shown on the notification flow chart for the appropriate level (see *Notification Flow Charts* tab).
- Provide updates of the situation to the Police/Sheriff dispatcher to assist them in making timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated annually and copies of the revised EAP are distributed to all who received copies of the original EAP.

Incident Commander (County sheriff)

- Serves as the primary contact person responsible for coordination of all emergency actions
- When a Level 2 situation occurs: Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
- When a Level 3 situation occurs:
 - Initiate warnings and order evacuation of people at risk downstream of the dam.
 - Notify local emergency management services to carry out the evacuation of people and close roads within the evacuation area (see *Evacuation Map* tab).
- Decide when to terminate the emergency.
- Participate in annual review and update of the EAP.

Emergency Management Services (Rock City)

- Maintain communication with media.
- When a Level 2 situation occurs:
 - Prepare emergency management personnel for possible evacuations that may be needed if a Level 3 situation occurs.
 - Alert public as appropriate
- When a Level 3 situation occurs:
 - Alert the general public of the emergency.
 - Immediately close roads and evacuate people located within the evacuation area (see *Evacuation Map* tab).
- Participate in annual review and update of the EAP.

Dam Operator's Technical Representatives (NRCS)

- Advise dam operator on emergency level determination if time permits.
- Advise dam operator on remedial actions to take if Level 2 event occurs.

State Dam Safety Agency (Oklahoma Water Resources Board)

- Advise dam operator on emergency level determination if time permits.
- Advise dam operator on remedial actions to take if Level 2 event occurs and if time permits.

The Five-step EAP Process

Step 1 *Event Detection*

This step describes the detection of an unusual or emergency event and provides information to assist the dam operator in determining the appropriate emergency level for the event.

Unusual or emergency events may be detected by:

- Observations at or near the dam by government personnel (local, state, or Federal), landowners, visitors to the dam, or the public
- Evaluation of instrumentation data
- Earthquakes felt or reported in the vicinity of the dam
- Forewarning of conditions, which may cause an unusual event or emergency event at the dam (for example, a severe weather or flash flood forecast)

See *Guidance for Determining the Emergency Level* table for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

SAMPLE

Step 2 *Emergency Level Determination*

After an unusual or emergency event is detected or reported, the Conservation District Manager or his alternate is responsible for classifying the event into one of the following three emergency levels:

Emergency level 1—Nonemergency, unusual event, slowly developing:

This situation is not normal but has not yet threatened the operation or structural integrity of the dam, but possibly could if it continues to develop. NRCS technical representatives or State Dam Safety officials should be contacted to investigate the situation and recommend actions to be taken. The condition of the dam should be closely monitored, especially during storm events, to detect any development of a potential or imminent dam failure situation. The Sheriff should be informed if it is determined that the conditions may possibly develop into a worse condition that may require emergency actions.

Emergency level 2—Potential dam failure situation, rapidly developing:

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The sheriff should be notified of this emergency situation and placed on alert. The dam operator should closely monitor the condition of the dam and periodically report the status of the situation to the Sheriff. If the dam condition worsens and failure becomes imminent, the sheriff must be notified immediately of the change in the emergency level to evacuate the people at risk downstream.

If time permits, NRCS and state dam safety officials should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The dam operator should initiate remedial repairs (note local resources that may be available—see Appendix B-1). Time available to employ remedial actions may be hours or days.

This emergency level is also applicable when flow through the earth spillway has or is expected to result in flooding of downstream areas and people near the channel could be endangered. Emergency services should be on alert to initiate evacuations or road closures if the flooding increases.

Emergency Level 3—Urgent—Dam failure appears to be imminent or is in progress:

This is an extremely urgent situation when a dam failure is occurring or obviously is about to occur and cannot be prevented. Flash flooding will occur downstream of the dam. This situation is also applicable when flow through the earth spillway is causing downstream flooding of people and roads. The Sheriff should be contacted immediately so emergency services can begin evacuations of all at-risk people and close roads as needed (see *Evacuation Map* tab).

See following pages for guidance in determining the proper emergency level for various situations.

Guidance for Determining the Emergency Level

Event	Situation	Emergency level*
Earth spillway flow	Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion	1
	Spillway flowing with active gully erosion	2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise	2
	Spillway flowing with an advancing headcut that is threatening the control section	3
	Spillway flow that is flooding people downstream	3
Embankment overtopping	Reservoir level is 1 foot below the top of the dam	2
	Water from the reservoir is flowing over the top of the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2
	Seepage with discharge greater than 10 gallons per minute	3
Sinkholes	Observation of new sinkhole in reservoir area or on embankment	2
	Rapidly enlarging sinkhole	3
Embankment cracking	New cracks in the embankment greater than 1/4-inch wide without seepage	1
	Cracks in the embankment with seepage	2
Embankment movement	Visual movement/slippage of the embankment slope	1
	Sudden or rapidly proceeding slides of the embankment slopes	3
Instruments	Instrumentation readings beyond predetermined values	1
Earthquake	Measurable earthquake felt or reported on or within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2
	Earthquake resulting in uncontrolled release of water from the dam	3
Security threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Sabotage/ vandalism	Damage to dam or appurtenances with no impacts to the functioning of the dam	1
	Modification to the dam or appurtenances that could adversely impact the functioning of the dam	1
	Damage to dam or appurtenances that has resulted in seepage flow	2
	Damage to dam or appurtenances that has resulted in uncontrolled water release	3

* Emergency level 1: Nonemergency, unusual event, slowly developing

* Emergency level 2: Potential dam failure situation, rapidly developing

* Emergency level 3: Urgent; dam failure appears to be imminent or is in progress

Examples of Emergency Situations

The following are typical examples of conditions that may occur at a dam that usually constitute an emergency situation. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original designed conditions can cause significant flow through the auxiliary spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency level condition. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the dam operator is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam.

Pre-existing conditions on this dam: There has been a small seepage area near the downstream toe on the north side of the release channel. This was first noticed in the 1990s, but has not changed since that time.

Earth Spillway Flows

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Significant erosion or head cutting of the spillway is occurring but the rate does not appear to threaten an imminent breach of the spillway crest that would result in an uncontrolled release of the reservoir.
2. Flow through the earth auxiliary spillway is or is expected to cause flooding that could threaten people, homes, and/or roads downstream from the dam.

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

1. Significant erosion or head cutting of the spillway is occurring at a rapid rate and a breach of the control section appears to be imminent.
2. Flow through the earth auxiliary spillway is causing flooding that is threatening people, homes, and/or roads downstream from the dam.

Embankment Overtopping

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. The reservoir level is within 1 foot from the top of the dam.

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

1. The reservoir level has exceeded the top of the dam and flow is occurring over the embankment.

Seepage and Sinkholes

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Cloudy seepage or soil deposits are observed at seepage exit points or from internal drain outlet pipes.
2. New or increased areas of wet or muddy soils are present on the downstream slope, abutment, and/or foundation of the dam, and there is an easily detectable and unusual increase in volume of downstream seepage.
3. Significant new or enlarging sinkhole(s) near the dam or settlement of the dam is observed.
4. Reservoir level is falling without apparent cause.
5. The following known dam defects are or will soon be inundated by a rise in the reservoir:
 - Sinkhole(s) located on the upstream slope, crest, abutment, and/or foundation of the dam; or
 - Transverse cracks extending through the dam, abutments, or foundation.

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

1. Rapidly increasing cloudy seepage or soil deposits at seepage exit points to the extent that failure appears imminent or is in progress.
2. Rapid increase in volume of downstream seepage to the extent that failure appears imminent or is in progress.
3. Water flowing out of holes in the downstream slope, abutment, and/or foundation of the dam to the extent that failure appears imminent or is in progress.
4. Whirlpools or other evidence exists indicating that the reservoir is draining rapidly through the dam or foundation.
5. Rapidly enlarging sinkhole(s) are forming on the dam or abutments to the extent that failure appears imminent or is in progress.
6. Rapidly increasing flow through crack(s) eroding materials to the extent that failure appears imminent or is in progress.

Embankment Movement and Cracking

Emergency Level 2—Potential dam failure situation; rapidly developing:

1. Settlement of the crest, slopes, abutments and/or foundation of the dam that may eventually result in breaching of the dam.
2. Significant increase in length, width, or offset of cracks in the crest, slopes, abutments, and/or foundation of the dam that may eventually result in breaching of the dam.

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

1. Sudden or rapidly proceeding slides, settlement, or cracking of the embankment crest, slopes, abutments, and/or foundation, and breaching of the dam appears imminent or is in progress.

Step 3 Notification and Communication

Notification:

After the emergency level has been determined, the people on the following notification flowcharts for the appropriate emergency level shall be notified immediately.

Communication:

Emergency Level 1—Nonemergency, unusual event; slowly developing:

The Conservation District Manager and NRCS District Conservationist should contact the NRCS State Conservation Engineer and Oklahoma Water Resources Board. Describe the situation and request technical assistance on next steps that should be taken.

Emergency Level 2—Potential dam failure situation; rapidly developing:

The following message may be used to help describe the emergency situation to the Sheriff or Rock City emergency management personnel:

“This is _____ (Identify yourself; name, position, etc.) _____.”

We have an emergency condition at Rock Creek watershed dam no. 23 that is located 2 miles south of Rock City.

We have activated the emergency action plan for this dam and are currently under Emergency Level 2.

We are implementing predetermined actions to respond to a rapidly developing situation that could result in dam failure.

Please prepare to evacuate the area along low-lying portions of rock creek.

Reference the evacuation map in your copy of the emergency action plan.

We will advise you as soon as the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____ . If you cannot reach me, please call the following alternative number _____ .”

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

The Sheriff should be contacted immediately, and the potential area flooded, if the dam should fail, must be evacuated (see *Evacuation Map* tab). The following actions should be taken:

1. Call the Sheriff’s dispatch center. Be sure to say, “This is an emergency.” They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to the Sheriff or Rock City emergency management personnel:

“This is an emergency. This is _____ (Identify yourself; name, position) _____.

Rock Creek watershed dam no. 23 located 2 miles south of Rock City is failing. The downstream area must be evacuated immediately. Repeat, Rock Creek Dam No. 23 is failing; evacuate the area along low-lying portions of Rock Creek.

We have activated the emergency action plan for this dam and are currently under Emergency Level 3. Reference the evacuation map in your copy of the Emergency Action Plan.

I can be contacted at the following number _____ . If you cannot reach me, please call the following alternative number _____ .”

2. Do whatever is necessary to bring people in immediate danger to safety if directed by the Sheriff (anyone on the dam, downstream from the dam, boating on the reservoir, or evacuees).
3. Keep in frequent contact with the Sheriff and emergency services to keep them up-to-date on the condition of the dam. They will tell you how you can help handle the emergency.
4. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to re-establish communications. If these means fail, handle the immediate problems as well as you can, and periodically try to reestablish contact with the Sheriff and emergency services.

The following pre-scripted message may be used as a guide for the Sheriff or Rock City emergency services personnel to communicate the status of the emergency with the public:

Attention: This is an emergency message from the Sheriff. Listen carefully. Your life may depend on immediate action.

Rock Creek Dam no. 23 located 2 miles south of Rock City is failing. Repeat. Rock Creek Dam No. 23 located 2 miles south of Rock City is failing.

If you are in or near this area, proceed immediately to high ground away from the valley. Do not travel on Highway 44 south of Rock City or return to your home to recover your possessions. You cannot outrun or drive away from the flood wave. Proceed immediately to high ground away from the valley.

Repeat message.

Emergency Level 1 Notifications

**Nonemergency
unusual event, slowly developing**

Dam Operator’s Rep.
Coal County Conservation District Manager John Jordan 407-555-XXXX (Office) 407-555-XXXX (Home) 407-555-XXXX (Cell)

(1)

(2)

Dam Operator’s Technical Reps.
NRCS District Conservationist Shelly Winters 407-555-XXXX (Office) 407-555-XXXX (Home) 407-555-XXXX (Cell)

State Dam Safety Official
Oklahoma Water Resources Board Joe Griswold 618-555-XXXX (Office) 618-555-XXXX (Home) 618-555-XXXX (Cell)

NRCS State Engineer Robert Redford 917-555-XXXX (Office) 917-555-XXXX (Home) 917-555-XXXX (Cell)
--

<p>Note: 1,2, etc. denotes call sequence</p> <p>Legend: Calls by operator ——— Second level calls -----</p>
--

<p>See “Contacts” tab for contact information for back-ups to the persons shown above and other emergency personnel</p>

Emergency Level 2 Notifications

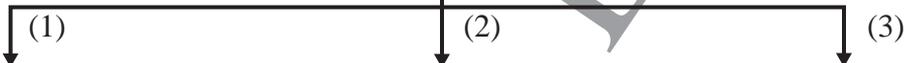
Emergency event, potential dam failure situation; rapidly developing

Dam Operator’s Rep.

Coal County Conservation District Manager

John Jordan

407-555-XXXX (Office)
407-555-XXXX (Home)
407-555-XXXX (Cell)



Dam Operator’s Technical Reps.

NRCS District Conservationist

Shelly Winters

407-555-XXXX (Office)
407-555-XXXX (Home)
407-555-XXXX2 (Cell)

NRCS State Engineer

Robert Redford

917-555-XXXX (Office)
917-555-XXXX (Home)
917-555-XXXX (Cell)

Incident Commander

Sheriff

Henry Martin

407-555-XXXX (Office)
407-555-XXXX (Home)

Rock City Emergency Management Dispatcher

OK Highway Patrol Dispatcher

Rock City Police Dispatcher

State Dam Safety Official

Oklahoma Water Resources Board

Joe Griswold

618-555-XXXX (Office)
618-555-XXXX (Home)
618-555-XXXX (Cell)

Coal County Amateur Radio Association:

John Turney

KE5GBD
407-555-XXXX

National Weather Service

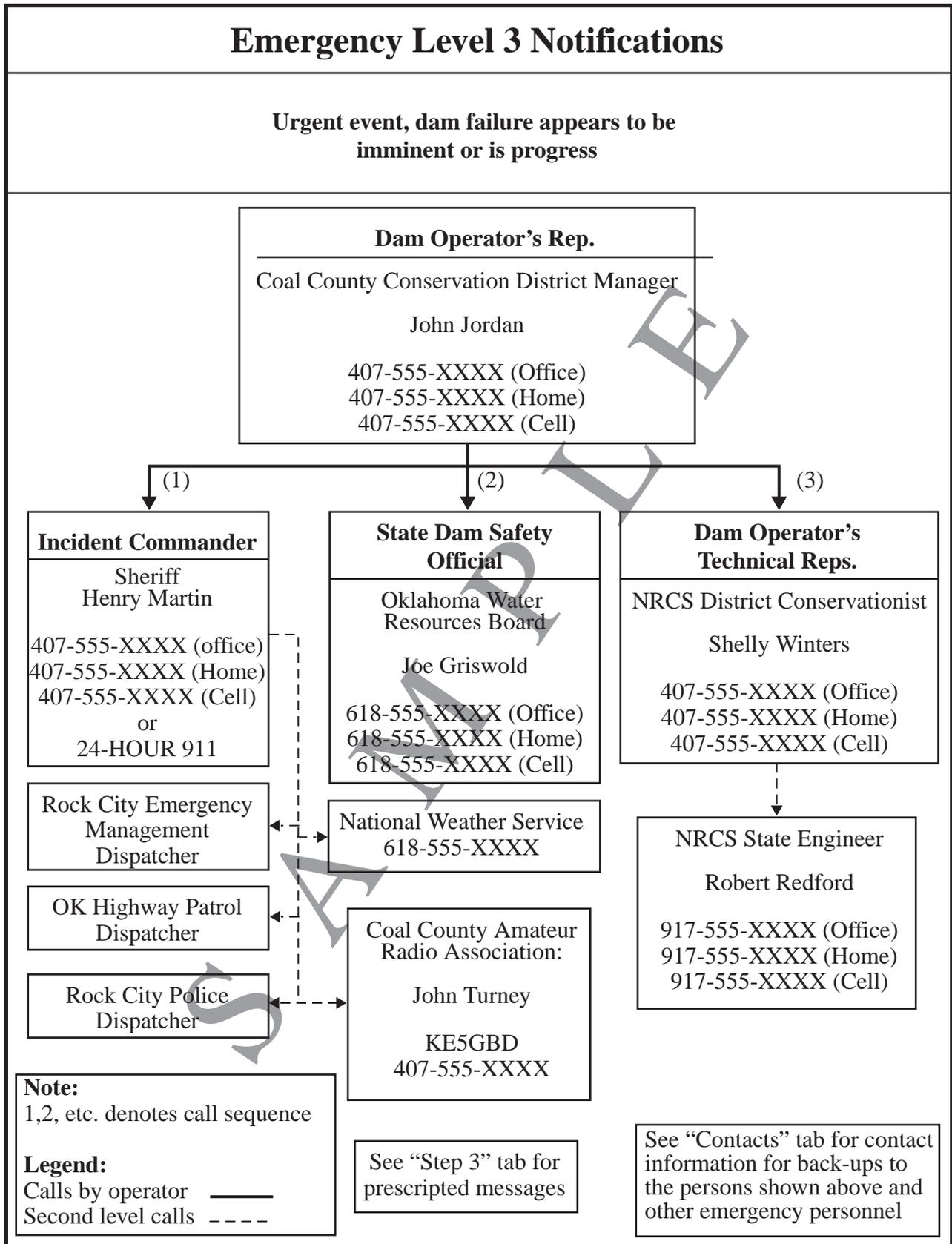
618-555-XXXX

Note:
1,2, etc. denotes call sequence

Legend:
Calls by operator ———
Second level calls - - - -

See “Step 3” tab for prescribed messages

See “Contacts” tab for contact information for back-ups to the persons shown above and other emergency personnel



Emergency Services Contacts

Agency / Organization	Principal contact	Address	Office telephone number	Alternate telephone numbers
Coal County Board of Supervisors	Gloria Brown Chair	336 Highway 66 Rock City, OK	407-555-XXXX	
Coal County Road Department	Max Gray Supervisor	973 Ninth Street Rock City, OK	407-555-XXXX	
Coal County Conservation District	John Jordon * District Manager	523 Second Street Rock City, OK	407-555-XXXX	407-555-XXXX (H) 405-555-XXXX (C)
Coal County Conservation District	Mary James * District Secretary	523 Second Street Rock City, OK	407-555-XXXX	407-555-XXXX (H) 405-555-XXXX (C)
Coal County Conservation District	Mike Blain * Board Chair	523 Second Street Rock City, OK	407-555-XXXX	407-555-XXXX (H) 405-555-XXXX (C)
Coal County Sheriff	Henry Martin	336 Highway 66 Rock City, OK	407-555-XXXX	407-555-XXXX (H) 407-555-XXXX (C)
Dry Gulch Television Station KJMT	Chris Klinger Manager	5632 Main Street Dry Gulch, OK	407-555-XXXX	
Landowner of Dam No. 23	Bryon Babcock	R.R. #2 Rock City, OK		407-555-XXXX (H) 407-555-XXXX (C)
National Weather Service	Danny Lee Climatologist	66374 Elm Street Norman, OK	618-555-XXXX	
Natural Resources Conservation Service	Shelly Winters District Conservationist	523 Second Street Rock City, OK	407-555-XXXX	407-555-XXXX (H) 405-555-XXXX (C)
Natural Resources Conservation Service	John Blake * Technician	523 Second Street Rock City, OK	407-555-XXXX	407-555-XXXX (H)
Natural Resources Conservation Service	Robert Redford State Engineer	3458 Farm Road Strong City, OK	917-555-XXXX	917-555-XXXX (H) 917-555-XXXX (C)
Oklahoma Department of Transportation	Bill Dobson District Engineer	539 Center Street Dry Gulch, OK	407-555-XXXX	
Oklahoma Highway Patrol	Richard Barnell	299 First Ave. Dry Gulch, OK	407-555-XXXX	
Oklahoma Water Resources Board	Joe Griswold Dam Safety Officer	1522 Maple Ave. Strong City, OK	618-555-XXXX	618-555-XXXX (H) 618-555-XXXX (C)
Rock City Emergency Management Coordinator	Jeff Powers	121 Main Street Rock City, OK	407-555-XXXX	
Rock City Fire Department	Harry James	336 Maple Street Rock City, OK	407-555-XXXX	
Rock City Police	Red Jones	336 Maple Street Rock City, OK	407-555-XXXX	
Rock City Radio Station 1040 AM	Scott Fagen Manager	667 Eighth Street Rock City, OK	407-555-XXXX	

* Back-up to primary contact

Step 4 Expected Actions

If the police or sheriff receives a 911 call regarding observations of an unusual or emergency event at the dam, they should immediately contact the Conservation District office. After the conservation district manager determines the emergency level, the following actions should be taken. If time permits, NRCS and the Oklahoma Water Resources Board should be contacted for technical consultation.

Emergency Level 1—Nonemergency, unusual event; slowly developing:

- A. The Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS or the Oklahoma Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**
- B. Record all contacts that were made on the *Contact Checklist* (Appendix A–1) Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video if possible.
- C. The Conservation District Manager should contact NRCS and request technical staff to investigate the situation and recommend corrective actions.

Emergency Level 2—Potential dam failure situation; rapidly developing:

- A. The Conservation District Manager should contact the NRCS and the Oklahoma Water Resources Board to report the situation and, if time permits, request technical staff to investigate the situation and recommend corrective actions.
- B. The Conservation District Manager should contact the Sheriff to inform him/her that the EAP has been activated and if current conditions get worse, an emergency situation may require evacuation. Preparations should be made for possible road closures and evacuations.
- C. Provide updates to the Sheriff and emergency services personnel to assist them in making timely decisions concerning the need for warnings, road closures, and evacuations.
- D. If time permits, the Conservation District Manager should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, and downstream slope. Also check the reservoir area, abutments, and downstream channel for signs of changing conditions. **If piping, increased seepage, erosion, cracking, or settlement are observed, immediately report the observed conditions to the NRCS and the Oklahoma Water Resources Board; refer to the emergency level table for guidance in determining the appropriate event level for the new condition and recommended actions.**
- E. Record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.
- F. If time permits, the following emergency remedial actions should be taken as appropriate.

Emergency Level 2—Potential dam failure situation; rapidly developing—continued:***Emergency remedial actions***

If time permits, the following emergency remedial actions should be considered for Emergency Level 2 conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Close monitoring of the dam must be maintained to confirm the success of any remedial action taken at the dam. Time permitting, any remedial action should be developed through consultation with NRCS and the Oklahoma Water Resources Board. See *Resources Available* (Appendix B–1) for sources of equipment and materials to assist with remedial actions.

Embankment overtopping

1. If the water level in the reservoir is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheets, or other materials to provide erosion-resistant protection.

Seepage and sinkholes

1. Open principal spillway gate to lower the reservoir level as rapidly as possible to a level that stops or decreases the seepage to a nonerosive velocity. If the gate is damaged or blocked, pumping or siphoning may be required.
Continue lowering the water level until the seepage stops.
2. If the entrance to the seepage origination point is observed in the reservoir (possible whirlpool) and is accessible, attempt to reduce the flow by plugging the entrance with readily available materials, such as hay bales, bentonite, soil or rock fill, or plastic sheeting.
3. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
4. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss from the collapse of an underground void.

Embankment movement

1. Open outlet(s) and lower the reservoir to a safe level at a rate commensurate with the urgency and severity of the condition of the slide or slump. If the gate is damaged or blocked, pumping or siphoning may be required.
2. Repair settlement of the crest by placing sandbags or earth and rock fill materials in the damaged area to restore freeboard.
3. Stabilize slides by placing a soil or rock fill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform field survey to determine if there has been any settlement and movement of the dam embankment, spillway and low level outlet works.
3. Drain reservoir if required.

Emergency Level 3—Urgent; dam failure appears to be imminent or is in progress:

- A. The Conservation District Manager shall immediately contact the Sheriff and others shown on the notification flow chart.
- B. The sheriff shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam (see *Evacuation Map* tab).
- C. Emergency Management services personnel shall alert the general public and immediately evacuate at-risk people and close roads as necessary.
- D. The Conservation District Manager shall maintain continuous communication and provide the sheriff with updates of the situation to assist him in making timely decisions concerning warnings and evacuations.
- E. The Conservation District Manager should record all contacts that were made on the *Contact Checklist* (Appendix A–1). Record all information, observations, and actions taken on the *Event Log Form* (Appendix A–2). Note the time of changing conditions. Document the situation with photographs and video, if possible.
- F. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

SAMPLE

Step 5 Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination responsibilities

The Sheriff is responsible for terminating EAP operations and relaying this decision to the Conservation District Manager. It is then the responsibility of each person to notify the same group of contacts that he or she notified during the original event notification process to inform those people that the event has been terminated.

Prior to termination of an Emergency Level 3 event that has not caused actual dam failure, the NRCS technical representative or the State Dam Safety Officer will inspect the dam or require the inspection of the dam to determine whether any damage has occurred that could potentially result in loss of life, injury, or property damage. If it is determined that conditions do not pose a threat to people or property, the Sheriff will be advised to terminate EAP operations as described above.

The Conservation District Manager shall assure that the *Dam Safety Emergency Situation Report* (Appendix A-3) is completed to document the emergency event and all actions that were taken. The Conservation District shall distribute copies of the completed report to the Oklahoma Water Resources Board and the NRCS State Conservation Engineer.

SAMPLE

Maintenance—EAP Review and Revision

EAP annual review

The Conservation District Manager will review and, if needed, update the EAP at least once each year. The EAP annual review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be revised if any of the contacts have changed.
- Contacting the local law enforcement agency to verify the phone numbers and persons in the specified positions. In addition, the Conservation District Manager will ask if the person contacted knows where the EAP is kept and if responsibilities as described in the EAP are understood.
- Calling the locally available resources to verify that the phone numbers, addresses, and services are current.

Revisions

The Conservation District is responsible for updating the EAP documents. The EAP document held by the Conservation District is the master document. When revisions occur, the Conservation District will provide the revised pages and a revised revision summary page to all the EAP document holders. The document holders are responsible for revising outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the revisions.

EAP periodic test

The Conservation District will host and facilitate a periodic test of the EAP at least once every 5 years.

The periodic test will consist of a meeting, including a tabletop exercise, conducted at the Coal County Conservation District office. Attendance should include the Conservation District Manager, key conservation district staff members, NRCS staff, at least one representative of the local law enforcement agency, and others with key responsibilities listed in the EAP. At the discretion of the Conservation District, other organizations that may be involved with an unusual or emergency event at the dam are encouraged to participate. Before the tabletop exercise begins, meeting participants will visit the dam during the periodic test to familiarize themselves with the dam site.

The tabletop exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address and resolve the scenario. The narrator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise. The Conservation District Manager should complete an event log as they would during an actual event.

After the tabletop exercise, the five sections of the EAP will be reviewed and discussed. Mutual aid agreements and other emergency procedures can be discussed. The Conservation District will prepare a written summary of the periodic test and revise the EAP as necessary.

Record of Holders of Control Copies of this EAP

Copy Number	Organization	Person receiving copy
1	Coal County Conservation District 523 Second Street Rock City, OK 50010	John Jordan
2	Coal County Conservation District 523 Second Street Rock City, OK 50010	Mike Blain
3	NRCS Field Office 523 Second Street Rock City, OK 50010	Shelly Winters
4	NRCS State Office 3458 Farm Road Strong City, OK 51020	Robert Redford
5	Coal County Sheriff’s Department 336 Highway 66 Rock City, OK 50010	Henry Martin
6	Rock City Emergency Management 121 Main Street Rock City, OK 50010	Jeff Powers
7	Rock City Police Department 336 Maple Street Rock City, OK 50010	Red Jones
8	Oklahoma Water Resources Board 1522 Maple Street Strong City, OK 51020	Joe Griswold

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1. _____
Signature *Organization* *Date*

Printed name and title: Mike Blain, Chair, Coal County Conservation District

2. _____
Signature *Organization* *Date*

Printed name and title: Henry Martin, Sheriff, Coal County

3. _____
Signature *Organization* *Date*

Printed name and title: Jeff Powers, Emergency Management Coordinator, Rock City

4. _____
Signature *Organization* *Date*

Printed name and title: Red Jones, Chief of Police, Rock City

5. _____
Signature *Organization* *Date*

Printed name and title: Shelley Winters, District Conservationist, NRCS, Rock City

6. _____
Signature *Organization* *Date*

Printed name and title: _____

7. _____
Signature *Organization* *Date*

Printed name and title: _____

Appendixes—Forms, Glossary, Maps, and Supporting Data

Appendix A

- A-1 Contact Checklist
- A-2 Unusual or Emergency Event Log Form
- A-3 Dam Emergency Situation Report Form
- A-4 Glossary of Terms

Appendix B

- B-1 Resources Available
- B-2 Location and Vicinity Maps
- B-3 Watershed Project Map
- B-4 Evacuation Map
- B-5 Residents/Businesses/Highways at Risk
- B-6 Plan View of Dam
- B-7 Profile of Principal Spillway
- B-8 Reservoir Elevation-Area-Volume and Spillway Capacity Data
- B-9 National Inventory of Dams (NID) Data

SAMPLE

Appendix A–1

Contact Checklist

Rock Creek Watershed, Dam Number 23

Coal County, Oklahoma

Date _____

The following contacts should be made immediately after the emergency level is determined (see pages 7–10 for guidance to determine the appropriate emergency level for a specific situation). The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the Notification Flowcharts for critical contact information and page 16 for contact information for other possible emergency services.

Emergency Level 1 (see page 13)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ Oklahoma Water Resources Board	_____	_____	_____

Emergency Level 2 (see page 14)	Person Contacted	Time Contacted	Contacted by
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____
___ Oklahoma Water Resources Board	_____	_____	_____
___ Sheriff	_____	_____	_____

Emergency Level 3 (see page 15)	Person Contacted	Time Contacted	Contacted by
___ Sheriff	_____	_____	_____
___ Oklahoma Water Resources Board	_____	_____	_____
___ NRCS District Conservationist	_____	_____	_____
___ NRCS State Conservation Engineer	_____	_____	_____

Appendix A-3

Dam Emergency Situation Report

(to be completed following the termination of the emergency)

Dam name: Rock Creek Watershed, Dam No. 23

National Inventory of Dams (NID) No.: OK11111

Dam location: 2 miles South of Rock City
(City)

Coal County
(County)

Rock Creek
(Stream/River)

Date: _____

Time: _____

Weather conditions: _____

General description of emergency situation: _____

Area(s) of dam affected: _____

Extent of dam damage: _____

Possible cause(s): _____

Effect on dam's operation: _____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

Other data and comments: _____

Observer's name and telephone number: _____

Report prepared by: _____ Date: _____

Appendix A–4: Glossary of Terms

Abutment	That part of the valley side against which the dam is constructed. The left and right abutments of dams are defined with the observer looking downstream from the dam.
Acre-foot	A unit of volumetric measure that would cover one acre to a depth of one foot. One acre-foot is equal to 43,560 cubic feet or 325,850 gallons.
Berm	A nearly horizontal step (bench) in the upstream or downstream sloping face of the dam.
Boil	A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
Breach	An opening through the dam that allows draining of the reservoir. A controlled breach is an intentionally constructed opening. An uncontrolled breach is an unintended failure of the dam.
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Control section	A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.
Cross section	A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also a slice through a spillway showing elevation vertically and left and right sides of the spillway looking downstream.
Dam	An artificial barrier generally constructed across a watercourse for the purpose of impounding or diverting water.
Dam failure	The uncontrolled release of a dam's impounded water.
Dam Operator	The person(s) or unit(s) of government that has responsibility for the operation and maintenance of dam.
Drain, toe or foundation, or blanket	A water collection system of sand and gravel and typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.
Drainage area (watershed)	The geographic area on which rainfall flows into the dam.
Drawdown	The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.

Emergency	A condition that develops unexpectedly, endangers the structural integrity of the dam and/or downstream human life and property, and requires immediate action.
Emergency Action Plan (EAP)	A formal document identifying potential emergency conditions that may occur at the dam and specifying preplanned actions to minimize potential failure of the dam or minimize failure consequences including loss of life, property damage, and environmental impacts.
Evacuation map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Filter	Those layers of sand and gravel in a drain that allow seepage through an embankment to discharge into the drain without eroding the embankment soil.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice, or regulating	An operable, watertight valve to manage the discharge of water from the dam.
Groin	That area along the intersection of the face of a dam and the abutment.
Hazard classification	A system that categorizes dams (high, significant, or low) according to the degree of their potential to create adverse incremental consequences such as loss of life, property damage, or environmental impacts of a failure or misoperation of a dam.
Height, dam	The vertical distance between the lowest point along the top of the dam and the lowest point at the downstream toe which usually occurs in the bed of the outlet channel.
Hydrograph, inflow or outflow, or breach	A graphical representation of either the flow rate or flow depth at a specific point above or below the dam over time for a specific flood occurrence.
Incident Commander	The highest predetermined official available at the scene of an emergency situation.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation area or map	The geographic area downstream of the dam that would be flooded by a breach of the dam or other large discharge.
Notification	To immediately inform appropriate individuals, organizations, or agencies about a potentially emergency situation so they can initiate appropriate actions.

Outlet works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive destruction of an embankment or embankment foundation by internal erosion of the soil by seepage flows.
Probable Maximum Precipitation (PMP) or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over a specific drainage area at a particular geographical location.
Reservoir	The body of water impounded or potentially impounded by the dam.
Riprap	A layer of large rock, precast blocks, bags of cement, or other suitable material, generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway crest	The lowest level at which reservoir water can flow into the spillway.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of dam	The junction of the upstream or downstream face of an embankment with the ground surface.
Top of dam (crest of dam)	The elevation of the uppermost surface of an embankment which can safely impound water behind the dam.

Appendix B–1: Resources Available

Locally available equipment, labor, and materials:

The County Commissioners have the following resources that can be utilized in the event of an emergency:

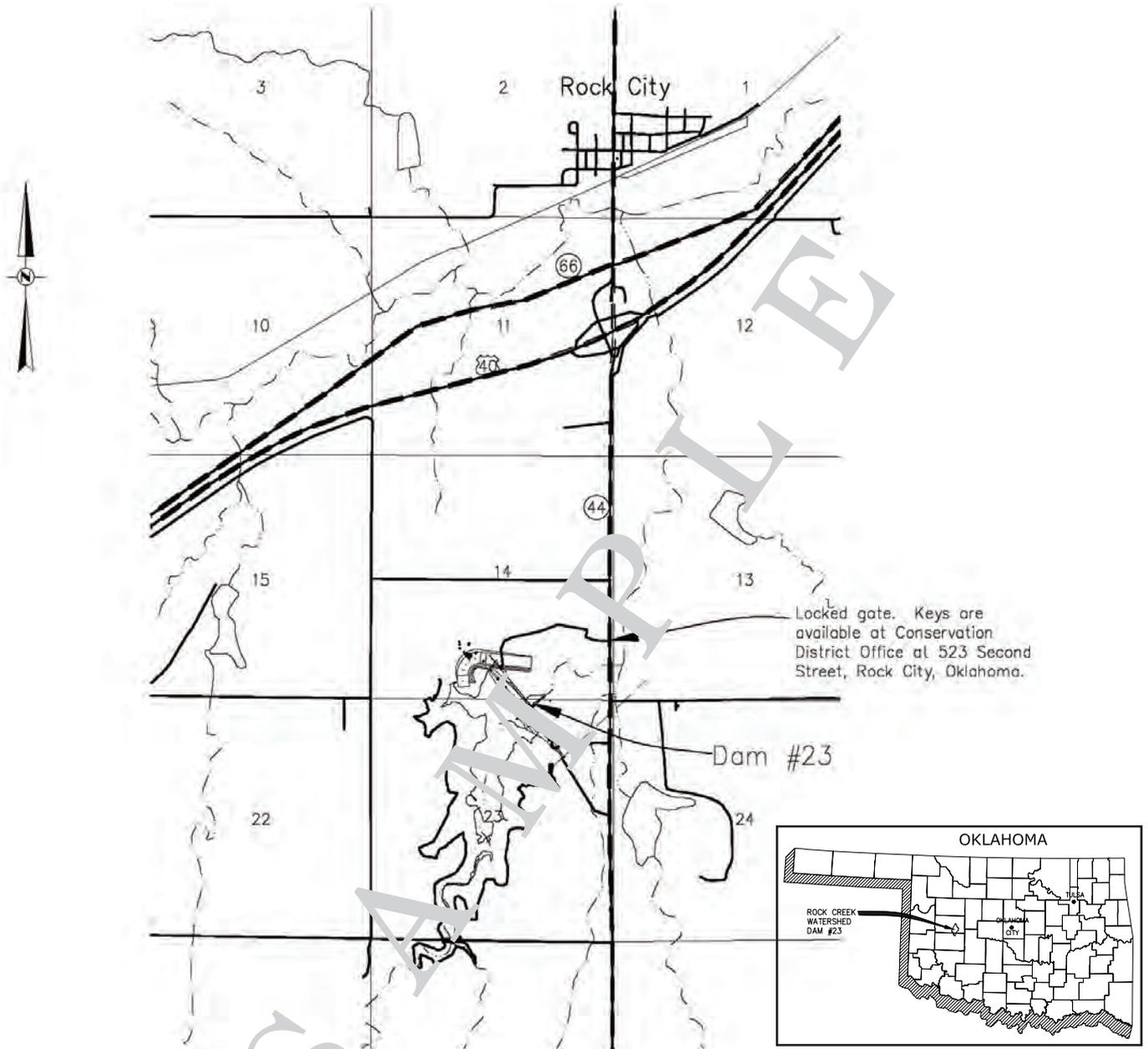
- two front-end loaders
- two backhoes
- one track hoe
- two graders
- two dump trucks
- a sand borrow pit
- a clay borrow pit

Contact the Coal County Road Department—see *Emergency Services Contacts*, page 16.

Other locally available resources include:

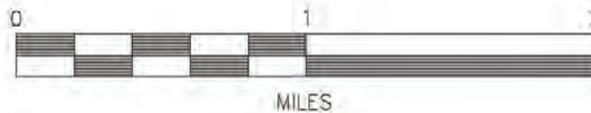
Heavy equipment service and rental	Sand and gravel supply	Ready-mix concrete supply
Bob’s Dozer Service	Kern’s Sand and Gravel	Burnett Concrete Co.
134 Elm Street Rock City, OK	R.R. 2 Rock City, OK	231 Sixth Street Dry Gulch, OK
407-555-XXXX	407-555-XXXX	407-555-XXXX
Tiller Construction Co.	Renfro Sand Products	
405 Second Street Dry Gulch, OK	334 Aston Ave. Spring Lake, OK	
407-555-XXXX	407-555-XXXX	
Pumps	Diving contractor	Sand bags
A to Z Rental	Steve White	A to Z Rental
569 Seventh Street Rock City, OK	2201 56th Street Johnstown, OK	5643 Water Street Johnstown, OK
407-555-XXXX	917-555-XXXX	917-555-XXXX

Appendix B–2: Location and Vicinity Maps

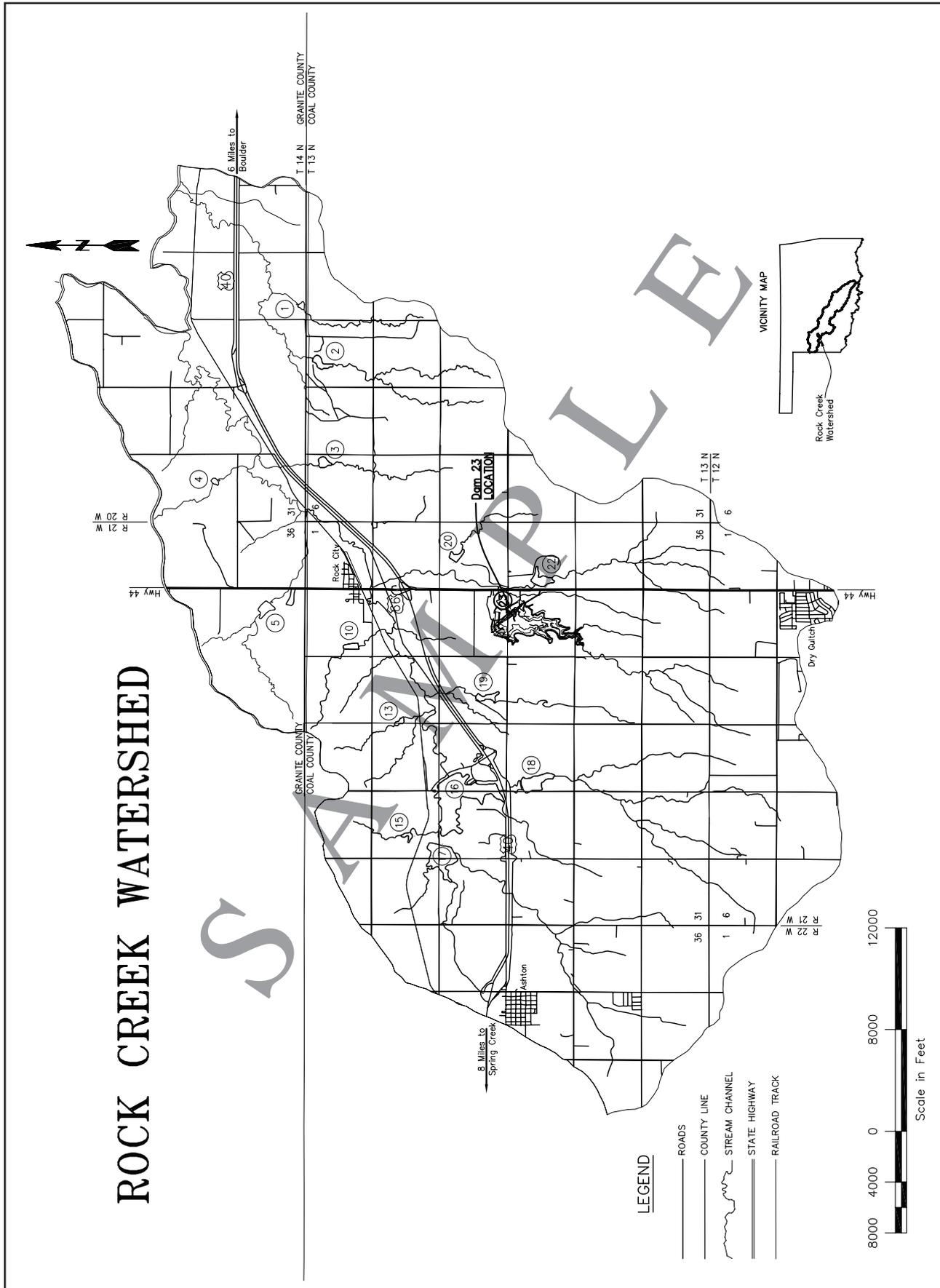


VICINITY MAP

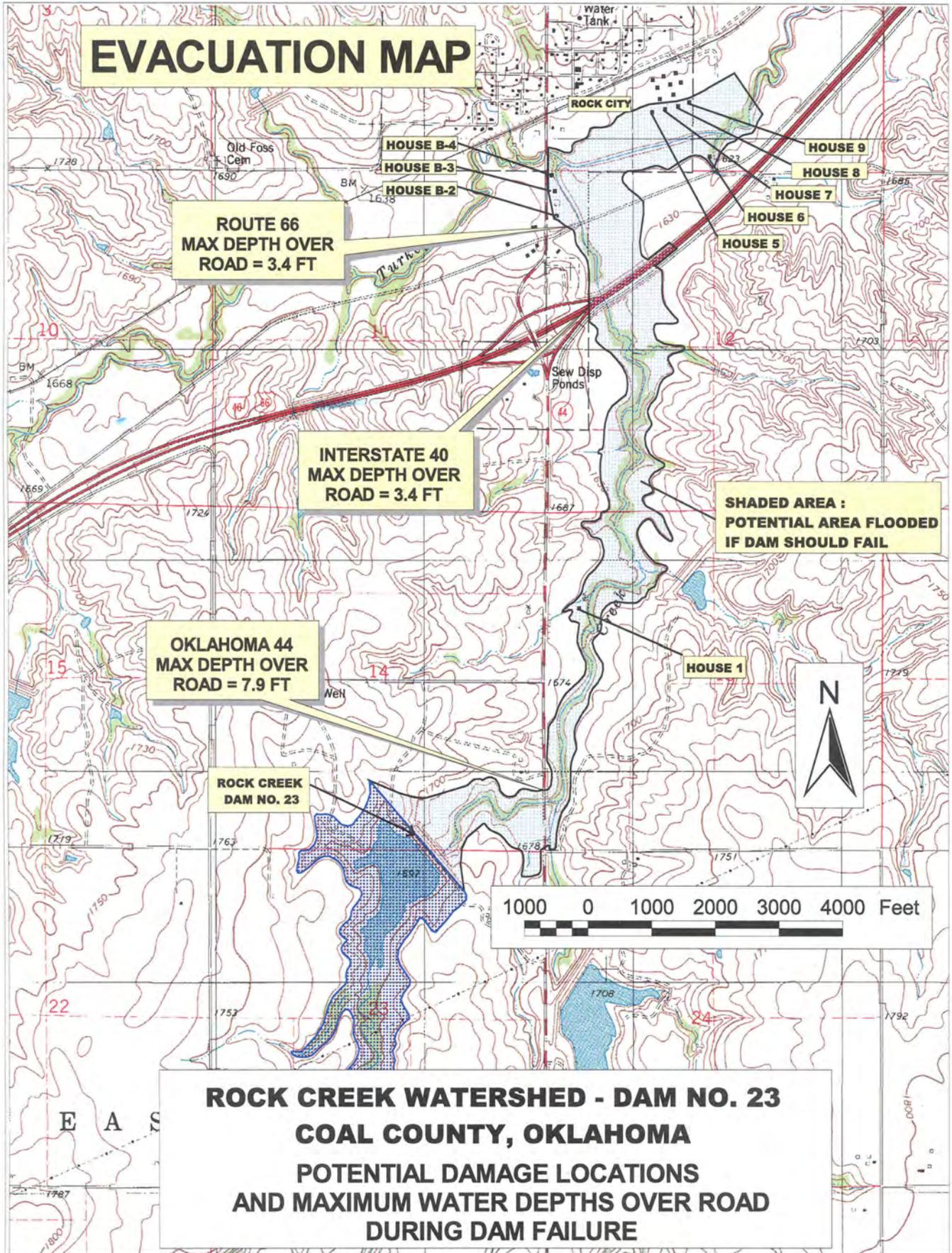
Dam #23 is located approximately 2 miles South and 1/2 mile West of Rock City, Coal County, Oklahoma, in Sections 14 & 23, Township 13 North, Range 21 West.



Appendix B-3: Watershed Project Map



Appendix B-4: Evacuation Map



Appendix B–5: Residents/Businesses/Highways at Risk

A major flood caused by a sudden breach of the dam is estimated to inundate six homes, three businesses, and three highways. These homes and businesses (marked on the evacuation map) are located east of OK Highway 44 and south of Chestnut Street in Rock City.

House/ business no.*	Resident/business	Address	Phone no.	Distance Dstrm. from dam (ft)	Travel time ** (hr)	Max water depth above first floor (ft)
1	Fred and Ethel James	10300 132nd St.	555-XXXX	5,000	0.3	5.4
B-2	Larry's Hardware	3214 Chestnut	555-XXXX	11,400	0.9	0.8
B-3	Lori's Music Shop	2288 Farm Road	555-XXXX	11,600	0.9	2.6
B-4	Bill's Coffee Shop	1455 Sugar St.	555-XXXX	11,800	1.0	4.8
5	Terry and Ann Smith	4812 Chestnut	555-XXXX	13,600	1.1	3.0
6	Amos Hill	5500 Apple Road	555-XXXX	14,000	1.1	3.2
7	Allen and Ruth Jones	4814 Chestnut	555-XXXX	13,800	1.1	1.2
8	Mike and Carol Green	4902 Chestnut	555-XXXX	14,000	1.1	2.4
9	Stephanie Evans	4910 Chestnut	555-XXXX	14,200	1.1	0.5
	OK Highway 44			2,000	0.2	7.9
	Interstate 40			10,000	0.8	3.4
	OK Route 66			11,200	0.9	3.4

* See appendix B–4.

** Estimated time for breach wave (peak) to travel from dam to downstream locations

Basis for computation of evacuation area and flooding depths

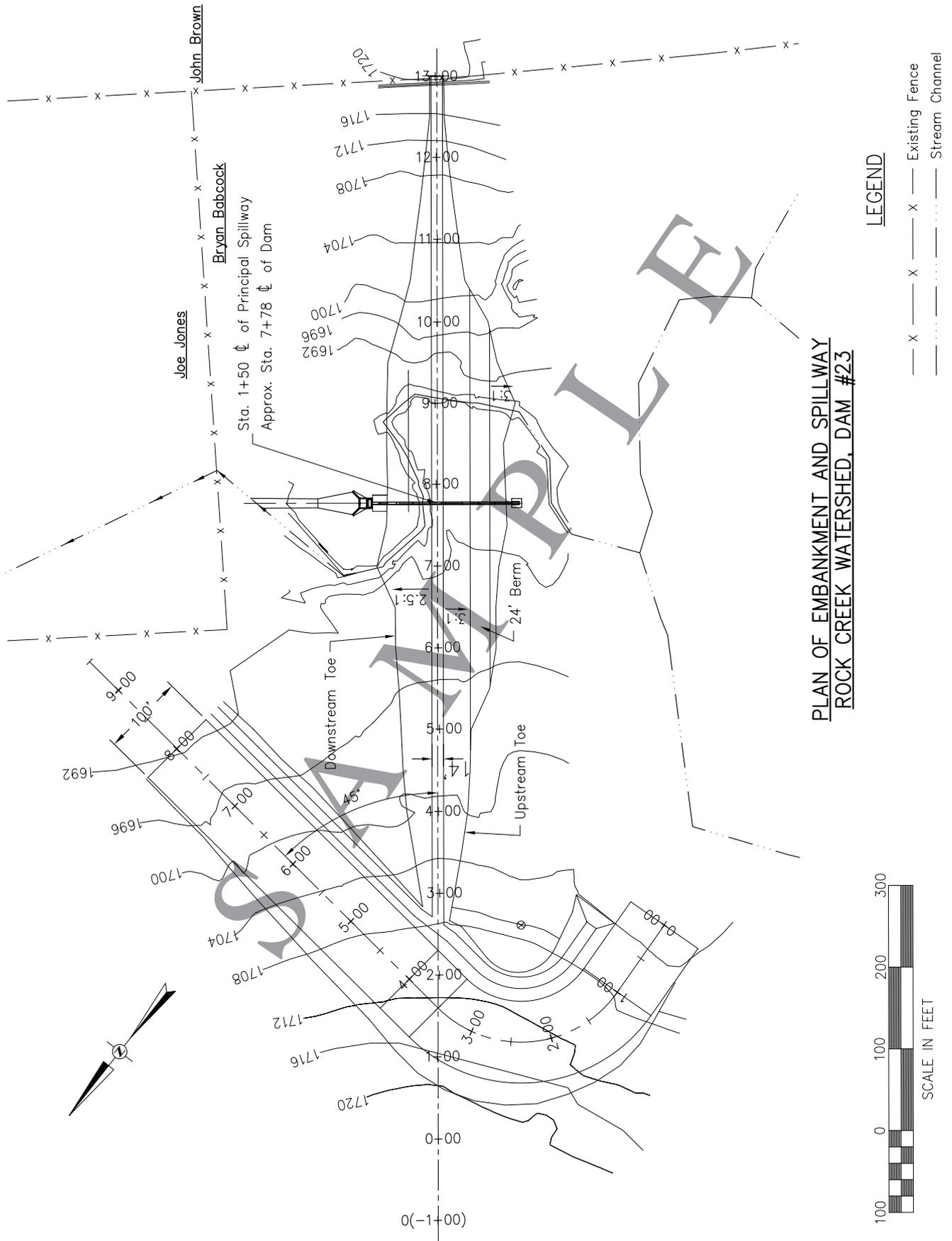
Breach inundation study completed by NRCS–August 2004

Hydraulic model used: NRCS TR–20 (routing); TR–60 (peak discharge); TR–66 (hydrograph)

Model assumptions:

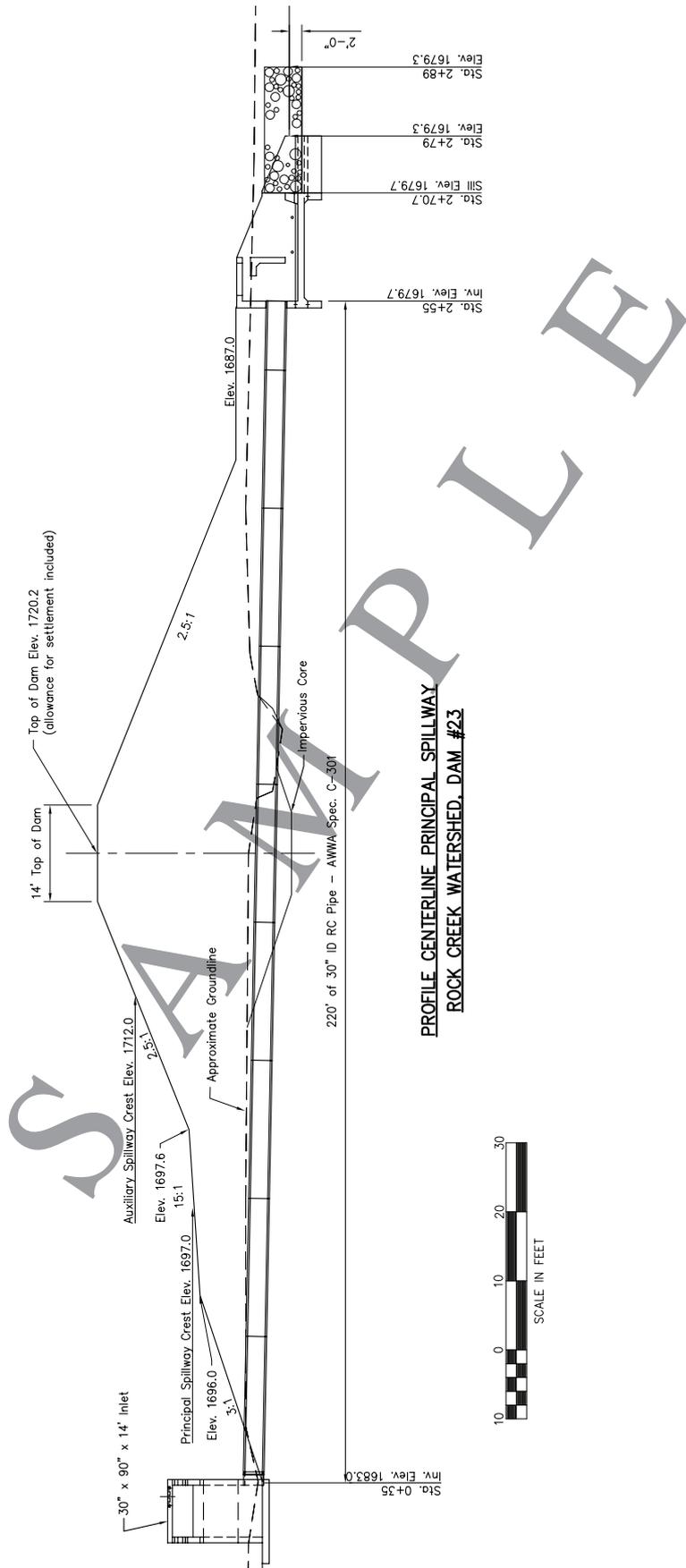
- “Sunny Day” Breach (no inflow into the reservoir)
- Water surface in reservoir prior to breach = 1,770.2 (top of dam)
- Total volume of breach hydrograph = 2,340 ac-ft
- Height of water at time of breach = 36 ft
- Peak breach discharge = 49,700 cfs
- Downstream area defined by field surveys consisting of 10 cross sections and 3 bridge openings

Appendix B-6: Plan View of Dam



PLAN OF EMBANKMENT AND SPILLWAY
ROCK CREEK WATERSHED, DAM #23

Appendix B-7: Profile of Principal Spillway



Appendix B–8: Reservoir Elevation-area-volume and Spillway Capacity Data

ROCK CREEK WATERSHED DAM No. 23

Elevation	Reservoir Surface Acres	Reservoir Storage Ac. Ft.	Spillway Discharge cfs
1682.0	0.0	0.0	0
1684.0	0.3	0.3	0
1686.0	2.0	2.5	0
1688.0	3.7	8.2	0
1690.0	8.6	20.5	0
1692.0	15.9	45.0	0
1694.0	18.7	79.6	0
1696.0	23.5	121.8	0
Principal Spillway Crest			
1697.0	26.2	146.7	0
1698.0	31.1	175.4	45
1700.0	40.8	247.3	76
1702.0	49.3	337.4	82
1704.0	62.0	448.7	87
1706.0	71.4	582.1	92
1708.0	86.7	740.2	97
1710.0	98.6	925.5	102
Auxilliary Spillway Crest			
1712.0	115.0	1139.1	108
1714.0	129.9	1384.0	516
1716.0	145.3	1659.2	2090
1718.0	160.7	1965.2	4437
1720.0	178.8	2304.7	7763
Top of Dam			
1720.2	180.6	2340.6	7937

Appendix B–9: National Inventory of Dams (NID) Data

Dam name: **Rock Creek 23**

State: **OK**

Federal ID: **OKFP1896**

NID ID: **OK11111**

Longitude: **-99.19802**

Latitude: **35.42875**

Geodetic loc.: **S23 T13N R21W**

County: **Coal**

Stream: **Rock Creek**

Nearest town: **Rock City**

Distance to nearest town: **2 mi**

Operator: **Coal County Cons. Distr.**

Year completed: **1960**

Dam length: **1,030 ft**

Dam height: **40.7 ft**

Max. discharge: **2,090 cfs**

Max. storage: **2,340 ac-ft**

Normal storage: **147 ac-ft**

Surface area: **26 ac**

Drainage area: **7.7 mi²**

Hazard potential: **High**

EAP?: **Yes**

Inspection frequency: **5 yr**

State regulated?: **Yes**

State reg. agency: **Oklahoma Water Resources Board**

Spillway width: **100 ft**

Dam volume: **62,367 yd³**

Federal funding: **USDA NRCS**

Federal design: **USDA NRCS**

Federal constructed: **USDA NRCS**

Program auth.: **Flood prevention**

Watershed No.: **3015**

Watershed name: **Rock Creek**

Service life: **50 yr**

O&M insp. resp.: **Coal Co. Cons. Distr.**

O&M insp. current?: **Yes**

Population at risk: **45**

Design hazard potential: **High**

Hazard potential class. year: **2006**

EAP year: **2006**

Sediment storage: **152 ac-ft**

Flood storage: **773 ac-ft**

Surcharge storage: **1,415 ac-ft**

Other storage: **0 ac-ft**

Principal spillway type: **Concrete pipe**

Primary aux. spillway type: **Vegetated earth**

Conduit height: **2.5 ft**

EAP and Dam Safety References

1. Arizona Department of Water Resources, Emergency Action Plan Requirements.
2. Colorado Dam Safety Manual.
3. Colorado Model for Preparing a Dam Safety Emergency Preparedness Plan.
4. Connecticut Department of Environmental Protection, Guidelines for Dam Emergency Operation Plan
5. Federal Guidelines for the Evaluation of Hydropower Projects.
6. FEMA 64 - Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners.
7. FEMA 145 – Dam Safety an Owner’s Guidance Manual.
8. Indiana Department of Natural Resources, Dam Safety Inspection Manual.
9. Interagency Committee on Dam Safety EAP Guidelines for Dam Owners.
10. Iowa Model Plan: An Emergency Preparedness Plan for Water Utilities
11. Maryland Model EAP for High Hazard Dams.
12. Maryland Model EAP for Significant Hazard Dams.
13. Nebraska Guide for Preparing Emergency Preparedness Plans for Dams and Reservoirs.
14. New Hampshire Department of Environmental Services, Dam Bureau, Guidelines for Development of Emergency Action Plans (Template).
15. New Jersey Department of Environmental Protection Guidelines for Developing an Emergency Action Plan.
16. New York Department of Environmental Conservation Policies and Procedures Manual.
17. Guidelines for Cooperation with the Alaska Dam Safety Program.
18. Pennsylvania Department of Environmental Protection, Guidelines for Developing an Emergency Action Plan.
19. Utah Dam Safety Guide to Emergency Action Plan Development and Implementation.
20. Virginia Department of Conservation and Recreation, Emergency Action Plan for Class I, Class II and Class III Impounding Structures.
21. Washington Department of Ecology, Simplified Emergency Action Plan Form.
22. West Virginia Department of Environmental Protection, Example Monitoring and Emergency Action Plan.
23. Wisconsin Sample Emergency Action Plan Format.

APPENDIX F

ORGANIZATIONAL CHARTS

Appendix F shows examples of different options for dam safety organizations. These examples show sections organized by function or expertise.

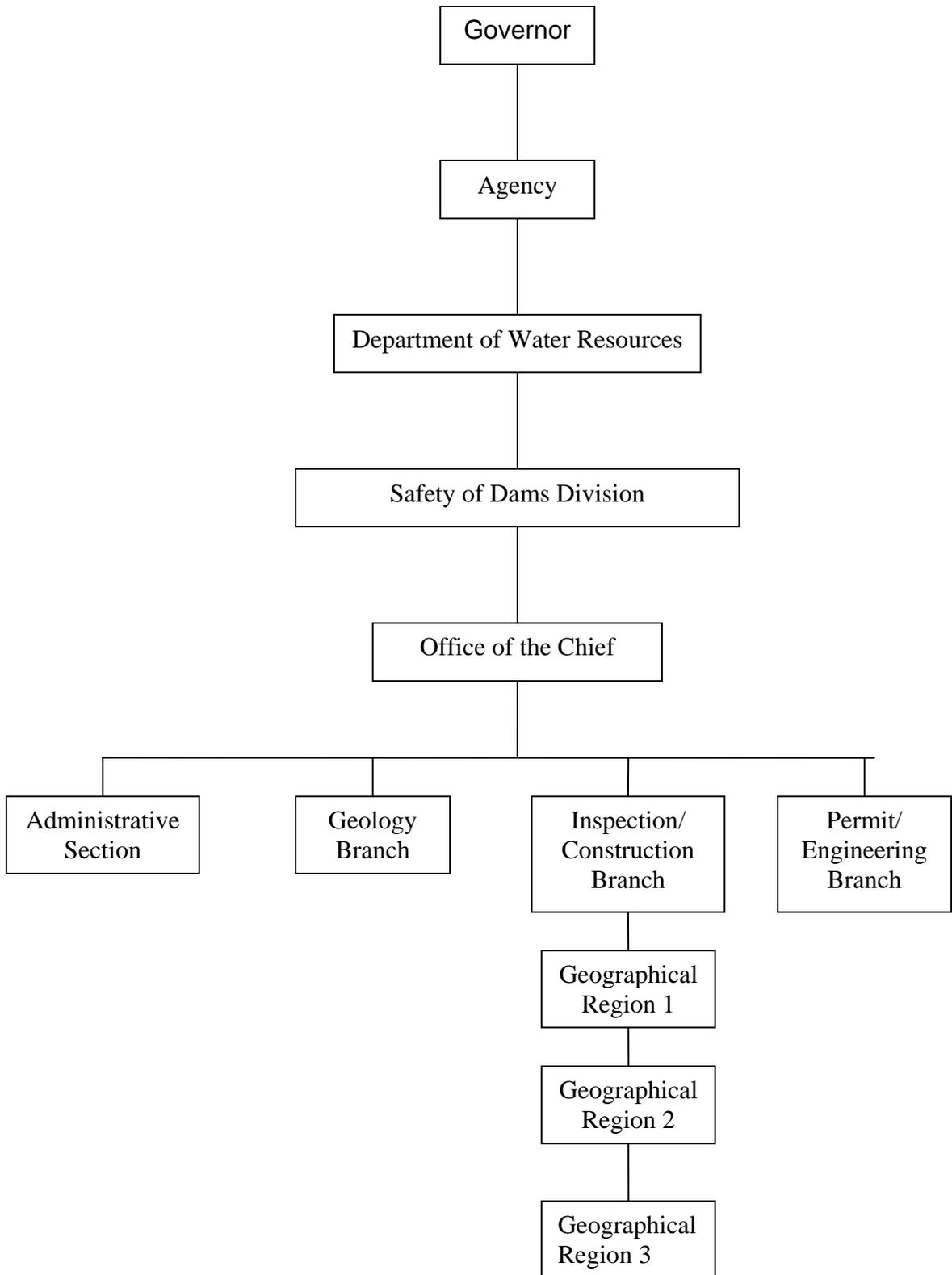
The first example is of a state, such as California, with a large organization utilizing functions. The organization is headed by a Chief then four branches with unique functions for each. The administrative section handles all clerical, personnel and business type functions for the organization. The Geology Branch supports both engineering branches. The Inspection/Construction Branch is responsible for all maintenance and construction inspections. The Permit/Engineering Branch conducts permit reviews for new construction, and alteration and repair reviews of existing dams. This Branch also conducts any in depth evaluations. While it may be desirable to have the same engineer in charge of construction who supervised the design review, efficiency can be increased by separating staff by function and expertise.

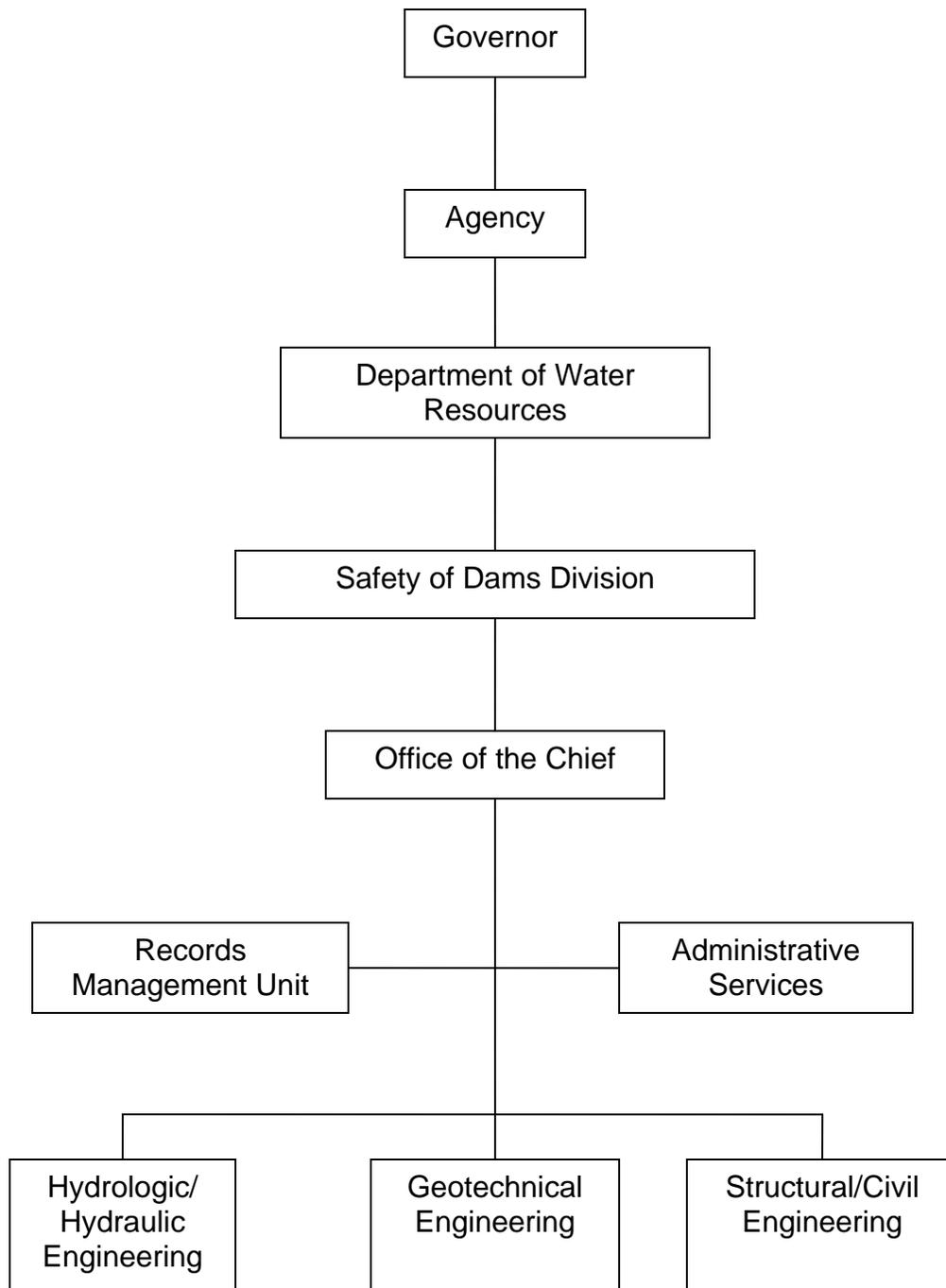
This organization structure could be used for states with large or small programs or engineers could be assigned to specific projects and work across the functions.

The second example chart is set up by field of expertise and would generally be applied to smaller programs where coverage of all aspects of dam safety is desirable. A team approach is used for design review with construction of safety inspections being handled by one or more field inspectors or all staff would participate in field work.

Modifications of either of the above examples may be required depending on the personnel and expertise available. For example, a state could have a permits unit with engineers who are assigned projects and have responsibility of design review and construction inspections. Similarly, the safety inspection unit would handle the periodic inspection, modification design reviews and construction inspections for all dams assigned to them. Then engineers could be rotated between units for further cross-training.

State programs which require the owner to hire a qualified civil engineer to perform inspections and attend a percentage of inspection for quality control would result in a smaller organization and would probably require engineers to perform a variety of tasks.





APPENDIX G

TRAINING COURSES AND MATERIALS

A. FEDERAL DAM SAFETY TRAINING MATERIALS

1. TRAINING AIDS FOR DAM SAFETY (TADS)

Inspections of Embankment Dams
Inspections of Mechanical Equipment
Inspections of Concrete Dams
Inspections of Spillways & Outlet Works
Inspections of Foundation & Abutment Works
Identification of Visual Deficiencies
Material Deficiencies
Organization of a Dam Safety Program
Organization of an Operation & Maintenance Program
Emergency Action Planning
Evaluation of Hydrologic Adequacy
Evaluation of Hydraulic Adequacy
Embankment Seismic & Static Stability
Concrete Seismic & Static Stability
Evaluation of Seepage Adequacy
Instrumentation

B. DAM OWNER OPERATION AND MAINTENANCE MANUALS

1. Georgia
2. Ohio
3. Wisconsin
4. New Hampshire
5. Texas
6. Wyoming
7. Virginia
8. Dam Safety; An Owners Guidance Manual (FEMA #145)

C. ASDSO TRAINING COURSES

1. Emergency Action Plans
2. Soil Mechanics for Dam Safety
3. Slope Stability Analysis of Embankment Dams
4. Seepage for Earth Dams
5. Hydraulic Analysis of Spillways
6. Dam Failure Analysis

7. Construction Inspection for Dams and Ancillary Structures
8. Safety Evaluation of Existing Dams
9. Plant & Animal Impacts of Embankment Dams
10. Plans & Specifications Review
11. Earthquake Engineering for Dam Safety
12. Tailings Dams

D. REFERENCE MATERIALS (FROM ASDSO SUGGESTED REFERENCE MATERIALS – TIER 1, DATED DECEMBER 2000, TEIR 2 IS ALSO AVAILABLE ON THE ASDSO WEBSITE)

1. General Handbooks, Reference Manuals, Textbooks

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

Federal Emergency Management Agency. *Glossary of Terms for Dam Safety*, FEMA 148, Washington, D. C., February 1988, 18 pp.

Golzé, Alfred R.[Ed.]. *Handbook of Dam Engineering*, New York: Van Nostrand Reinhold, 1977, 793 pp.

Sherard, James L.; Woodward, Richard J.; Gizienski, Stanley F. and Clevenger , William A. *Earth and Earth-Rock Dams: Engineering Problems of Design and Construction*. New York: John Wiley and Sons, Inc., 1963, 738 pp.

U.S. Bureau of Reclamation. *Design of Small Dams, 3rd Edition*, 1987, 860 pp.

U.S. Bureau of Reclamation. *Glossary of Terms*. Available on-line <http://www.usbr.gov/cdams/glossary.html>

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

2. Dam Performance, Incidents, and Historic Failures (Includes Case Histories, Analyses/Statistical Evaluations, Lessons Learned, Legal Cases, Hearings, Books)

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

Guggenheim Productions. *The Johnstown Flood*, Washington, D.C.: Public Broadcasting System, 1991, RT: 26 min.

Jansen, Robert B. *Dams and Public Safety*, Denver: U.S. Bureau of Reclamation 1983, 332 pp.

Simons, Li & Associates. *Minimizing Embankment Damage During Overtopping Flow*, Federal Highway Administration, Report 88-181 and video, November 1988.

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Committee on Large Dams. Committee on Failures and Accidents to Large Dams. *Lessons from Dam Incidents*, New York: American Society of Civil Engineers, 1975, 387 pp.

Web site: National Performance of Dams <http://npdp.stanford.edu>

3. Inspections, Operating Procedures and Maintenance

American Concrete Institute Committee 201. *Guide for Making a Condition Survey of Concrete in Service*, American Concrete Institute, 1984, 14 pp.

Association of State Dam Safety Officials. *Woody Vegetation/Animal Impacts on Dams Workshop Manual* (not yet published).

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

STS Consultants, Ltd. *Dam Safety Guidebook*, Lansing, Michigan, 1985, ~180pp.

Tschantz, Bruce, et al. *Bibliography on the Effects of Woody Vegetation on Dams*, ASDSO Steering Committee on Plant and Animal Penetration of Earthen Dams, University of Tennessee, September 1999, 18 pp.

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

U. S. Department of Agriculture, Soil Conservation Service. *Operations and Maintenance Alternatives for Removing Trees from Dams*, Technical Note 705, Fort Worth, Texas: South Technical Service Center, April 1981, 8 pp.

4. Hazard Classification, Inundation Studies, and Emergency Preparedness

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

Federal Emergency Management Agency. *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, FEMA 64, 1998, 36 pp.

Federal Emergency Management Agency. *Federal Guidelines for Dam Safety: Hazard Potential Classification Systems for Dams*, FEMA 333, 1998, 90 pp.

Fread, Danny L. *DAMBRK – Revision 4*, National Weather Service, 1998 (manual only), or Fread, Danny L. and Lewis, J.M. *FLDWAV*, National Weather Service, 1996 (manual only).

Graham, Wayne. *A Procedure for Estimating Loss of Life Due to Dam Failure*, 1997 ASDSO Annual Conference, pp. 629-640.

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

5. Monitoring, Instrumentation, and Surveillance

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

Federal Energy Regulatory Commission, *Engineering Guidelines for the Evaluation of Hydropower Projects*.

U.S. Bureau of Reclamation, *Embankment Dams Instrumentation Manual*, 1995, 268 pp.

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

6. Dam Design and Analysis

(a) General

Golzé, Alfred R.[Ed.]. *Handbook of Dam Engineering*, New York: Van Nostrand Reinhold, 1977, 793 pp.

Koerner, R. *Designing with Geosynthetics*, Prentice-Hall, Englewood Cliffs, N. J., 1998, 777 pp.

Lowe, John III. *Rapid Drawdown Stability/Filters and Sinkholes*, 1997, Interagency Committee on Dam Safety (ICODS) video series.

McCook, Danny. *Chimney Filters - Design and Construction Considerations*, 1997 ASDSO Annual Conference Proceedings, pp. 29-38.

McCook, Danny and Talbot, James. *NRCS Filter Design Criteria: A Step by Step Approach*, Proceedings, ASDSO Annual Conference, Atlanta, Ga., September 1995, pp. 49-58.

Portland Cement Association. [*Collection of Roller-Compacted Concrete Manuals*]

U.S. Bureau of Reclamation. *Design of Small Dams, 3rd Edition*, 1987, 860 pp.

U.S. Department of Agriculture. Natural Resources Conservation Service/Soil Conservation Service, National Engineering Handbook #4 (Some sections available on-line – see table.)

(b) Earthen Dams and Tailings Dams

Casagrande, Arthur; Hirschfeld, Ronald C. and Bertram, George E. *Embankment Dam Engineering: Casagrande Volume*. New York: John Wiley, 1973, 465 pp.

Cedergren, Harry R. *Seepage, Drainage and Flownets, 3rd Ed.*. New York: John Wiley & Sons, 1997.

McCook, Danny and Talbot, James. *NRCS Filter Design Criteria: A Step by Step Approach*, Proceedings, ASDSO Annual Conference, Atlanta, Ga., September 1995, pp. 49-58.

Sherard, James L.; Woodward, Richard J.; Gizienski, Stanley F. and Clevenger, William A. *Earth and Earth-Rock Dams: Engineering Problems of Design and Construction*. New York: John Wiley and Sons, Inc., 1963, 738 pp.

STABL IV, REAM or SWASE slope stability analysis program manuals.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

U.S. Department of Agriculture. Natural Resources Conservation Service/Soil Conservation Service, National Engineering Handbook #4 (Some sections available on-line – see table.)

U. S. Department of the Interior, Mining Enforcement and Safety Administration (MESA), Prepared by D'Appolonia Consulting Engineers, Inc. *Engineering and Design Manual, Coal Refuse Disposal Facilities*, U. S. GPO: 1975, O-579-601, 9 chapters.

(c) Concrete Gravity Dams

U.S. Army Corps of Engineers. *Gravity Dam Design*, EM 1110-2-2200.

U.S. Bureau of Reclamation. *Design of Gravity Dams*, 1995, 556 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

(d) Arch and Buttress Dams

U.S. Army Corps of Engineers. *Arch Dam Design*, EM 1110-2-2201, 1994, 238 pp.

U.S. Bureau of Reclamation. *Design of Arch Dams*, 1995, 915 pp.

7. Construction Inspection and Materials Testing

American Society for Testing and Materials. *ASTM Book of Standards: Cement; Lime; Gypsum, Vol. 4.01*. West Conshohocken, PA. 2001, 638 pp.

American Society for Testing and Materials. *ASTM Book of Standards: Chemical-Resistant Nonmetallic Materials; Vitrified Clay Pipe, Concrete Pipe, Fiber-Reinforced Cement Products; Mortars and Grouts; Masonry, Vol 4.05*. 2001, 1244 pp.

American Society for Testing and Materials. *ASTM Book of Standards: Concrete and Aggregates, Vol 4.02*. 2001, 780 pp.

American Society for Testing and Materials. *ASTM Book of Standards: Plastic Pipe and Building Products, Vol. 8.04*. 2001, 1488 pp.

American Society for Testing and Materials. *ASTM Book of Standards: Road and Paving Materials; Vehicle-Pavement Systems, Vol 4.03*. 2001, 1126 pp.

American Society for Testing and Materials. *ASTM Book of Standards: Soil and Rock (I): D 420 to D 5779, Vol 4.08*. 2001, 1658pp.

American Society for Testing and Materials. *ASTM Book of Standards: Soil and Rock (II): D5780 - latest; Geosynthetics, Vol 4.09*. 2001, 1382 pp.

Sherard, James L.; Woodward, Richard J.; Gizienski, Stanley F. and Clevenger, William A. *Earth and Earth-Rock Dams: Engineering Problems of Design and Construction*. New York: John Wiley and Sons, Inc., 1963, 738 pp.

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U.S. Bureau of Reclamation. *Design of Small Dams, 3rd Edition*, 1987, 860 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

8. Spillway Capacity Evaluation, Modification, and Hydraulics

Brater, E.F., and King, H.W. *Handbook of Hydraulics for the Solution of Hydraulic Engineering Problems*, New York: McGraw-Hill, Seventh Edition, 1996, 640 pp.

Chow, Ven Te. *Open Channel Hydraulics*, McGraw-Hill, 1959, 680 pp.

Davis, Calvin V. and Sorenson, Kenneth E. *Handbook of Applied Hydraulics*, New York: McGraw-Hill, 1969 (1 v., various pagings).

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Elevatorski, Edward A. *Hydraulic Energy Dissipators*, New York: McGraw Hill, 1959, 214 pp.

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U.S. Army Corps of Engineers. Hydrologic Engineering Center. *HEC-2 Water Surface Profiles*, Version 4.6k or *HEC-RAS Program and Manual*: Davis, CA., 1990 (revised September 1991).

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U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

U.S. Department of Agriculture. Natural Resources Conservation Service/Soil Conservation Service, *National Engineering Handbook #4* (Some sections available on-line – see table.)

9. Site Exploration, Foundations, Geology, Geotechnical

Casagrande, Arthur; Hirschfeld, Ronald C. and Bertram, George E. *Embankment Dam Engineering: Casagrande Volume*. New York: John Wiley, 1973, 465 pp.

Cedergren, Harry R. *Seepage, Drainage and Flownets*, 3rd Ed.. New York: John Wiley & Sons, 1997.

Deere, D.U. *Dam Foundations*, 1996, Interagency Committee on Dam Safety (ICODS) video series.

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Mitchell, James K. *Ground Improvements for Dam Safety*, 1999, Interagency Committee on Dam Safety (ICODS) video series.

Terzaghi, Karl, Peck, Ralph, Mesri, Gholamreza. *Soil Mechanics and Engineering Practice*, 1996.

Tschebotarioff, Gregory P. *Foundations, Retaining and Earth Structures: The Art of Design and Construction and Its Scientific Basis in Soil Mechanics*, 1973.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

10. Seismic Evaluation and Design Earthquake Selection

Cedergren, Harry R. *Seepage, Drainage and Flownets*, 3rd Ed.. New York: John Wiley & Sons, 1997.

Hynes-Griffin, Mary and Franklin, Arley. *Rationalizing the Seismic Coefficient Method*, USACE Misc. Paper GL-84 13, 1984.

Idriss, I.M. *Behavior of Embankment Dams During Earthquakes* (To be released as part of Interagency Committee on Dam Safety (ICODS) video series).

Makdisi, F. I. and Seed, H. I. *A Simplified Procedure for Estimating Earthquake Induced Deformations in Dams and Embankments*, EERC 77/19 August 1977.

National Research Council. *Liquefaction of Soils During Earthquakes*, Washington, D.C.: National Academy Press, 1985, 240 pp.

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Seed, H. Bolton; Makdisi, Faiz I. and De Alba, Pedro. *Performance of Embankment Dams during Earthquakes*, 1977, Report No. UCB/EERC-77/20, Earthquake Engineering Research Center College of Engineering University of California – Berkeley.

11. Hydrology, Design Flood and PMF

Brater, E.F., and King, H.W. *Handbook of Hydraulics for the Solution of Hydraulic Engineering Problems*, New York: McGraw-Hill, Seventh Edition, 1996, 640 pp.

Chow, Ven Te. *Handbook of Applied Hydrology*, New York: McGraw-Hill, 1964.

Davis, Calvin V. and Sorenson, Kenneth E. *Handbook of Applied Hydraulics*, New York: McGraw-Hill, 1969 (1 v., various pagings).

Federal Emergency Management Agency. *Selecting and Accommodating Inflow Design Floods for Dams*, FEMA 94, 1998.

Federal Energy Regulatory Commission. *Engineering Guidelines for the Evaluation of Hydropower Projects*.

U.S. Army Corps of Engineers. Hydrologic Engineering Center. *HEC-1 Flood Hydrograph Package, Version 4.0* or HEC-HMS (program and manual), Davis, CA, 1990.

U. S. Army Corps of Engineers, Hydrologic Engineering Center. *HMR-52, Probable Maximum Storm (Eastern United States), Users Manual and Software*, March 1984, 89 pp. (all HMR manuals appropriate to region).

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

U.S. Department of Agriculture. Natural Resources Conservation Service/Soil Conservation Service, National Engineering Handbook #4 (Some sections available on-line – see table).

U. S. Department of Commerce, NOAA and U. S. Department of Army, Corps of Engineers. *Hydrometeorological Report No. 51 (HMR-51), Probable Maximum Precipitation Estimates, United States East of the 105th Meridian*, Washington, D. C., June 1978, 87 pp. (HMR reports appropriate to region).

12. Overtopping Evaluation and Protection

Brater, E.F., and King, H.W. *Handbook of Hydraulics for the Solution of Hydraulic Engineering Problems*, New York: McGraw-Hill, Seventh Edition, 1996, 640 pp.

Davis, Calvin V. and Sorenson, Kenneth E. *Handbook of Applied Hydraulics*, New York: McGraw-Hill, 1969 (1 v., various pagings).

Simons, Li & Associates. *Minimizing Embankment Damage During Overtopping Flow*, Federal Highway Administration, Report 88-181 and video, November 1988.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

13. Seepage and Piping

Cedergren, Harry R. *Seepage, Drainage and Flownets, 3rd Ed.*. New York: John Wiley & Sons, 1997.

Koerner, R. *Designing with Geosynthetics*, Prentice-Hall, Englewood Cliffs, N. J., 1998, 777 pp.

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McCook, Danny and Talbot, James. *NRCS Filter Design Criteria: A Step by Step Approach*, Proceedings, ASDSO Annual Conference, Atlanta, Ga., September 1995, pp. 49-58.

Peck, Ralph. *Seepage and Piping*, 1995, Interagency Committee on Dam Safety (ICODS) video series.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

U.S. Department of Agriculture. Natural Resources Conservation Service/Soil Conservation Service, National Engineering Handbook #4 (Some sections available on-line – see table).

Von Thun, Lawrence. *Understanding Piping and Seepage Failure – the No. 1 Dam Safety Problem in the West*, ASDSO West Regional Conference, 1996, pp. 3-21.

14. Laws, Regulations, and Guidelines

Association of State Dam Safety Officials. *Summary of State Laws & Regulations on Dam Safety*, July 2000, 163 pp.

Federal Emergency Management Agency. *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, FEMA 64, 1998, 36 pp.

Federal Emergency Management Agency. *Federal Guidelines for Dam Safety: Hazard Potential Classification Systems for Dams*, FEMA 333, 1998, 90 pp.

Federal Energy Regulatory Commission, *Engineering Guidelines for the Evaluation of Hydropower Projects*.

National Research Council. *Safety of Dams Flood and Earthquake Criteria*, Washington, D.C.: National Academy Press, 1985, 292 pp. (Available online, <http://www.nap.edu>).

Web site: Washington State Guidelines (good model)
http://www.wa.gov/ecology/wr/dams/guidelines_part_1.pdf

15. Dam Safety Programs/Management

Association of State Dam Safety Officials. *Summary of State Laws & Regulations on Dam Safety*, July 2000, 163 pp.

Association of State Dam Safety Officials and the Federal Emergency Management Agency. *Model State Dam Safety Program*, FEMA 316, March 1998, 211 pp.

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

U.S. Bureau of Reclamation. *Safety Evaluation of Existing Dams (SEED Manual)*, 1992. 178 pp.

U.S. Bureau of Reclamation. *Training Aids for Dam Safety*, Denver, 1988.

Web site: Washington State Guidelines:

http://www.wa.gov/ecology/wr/dams/guidelines_part_1.pdf

16. Risk Assessment

American Society of Civil Engineers. [*Risk Guidelines*]- not yet published.

Federal Emergency Management Agency. *Dam Safety: An Owner's Guidance Manual*, FEMA 145, July 1987, 117 pp.

Graham, Wayne. *A Procedure for Estimating Loss of Life Due to Dam Failure*, 1997 ASDSO Annual Conference, pp. 629-640.

National Research Council. *Safety of Dams Flood and Earthquake Criteria*, Washington, D.C.: National Academy Press, 1985, 292 pp. (Available online, <http://www.nap.edu>).

U.S. Bureau of Reclamation. *Guidelines to Decision Analysis*, ACER Technical Memorandum No. 7, Denver, 1986, 223 pp.

U.S. Committee on Large Dams. *Eighteenth Annual USCOLD Lecture: Managing the Risks of Dam Project Development, Safety and Operation*, 1998.

Von Thun, Lawrence; Bowles, David and McCann, Martin. *Workshop on Risk Assessment*, ASDSO Technical Seminar, Oct. 1999, 325 pp.

See ASDSO Website for links to contacts and training material.

APPENDIX H

SAMPLE DATABASE FIELDS

DESCRIPTIONS & DEFINITIONS of Fieldnames

From National Inventory of Dams Field Definitions

Record

Assigned by TEC.

Dam Name

Official name of the dam. No abbreviations used unless a part of the official name. For dams that do not have an official name, the popular name is used.

Other Dam Names

Reservoir name or names in common use other than the official name of the dam. Names are separated with semi-colons. Leave blank if not applicable.

Dam Former Name

Any previous reservoir or dam name(s), if changed. Names are separated with semi-colons.

State or Federal Agency ID

Official State or Agency identification number for the dam.

NID ID

The official NID identification number for the dam, known formerly as the National ID. This is a required field, and must have an entry for each dam included in the NID. This field is used as the unique identifier for each dam record. The first two characters of the identity are the state two-letter abbreviation, based on the location of the dam. The last five characters of the identity are a unique number (AB#####).

The NID ID is the Corps Identification Number assigned to each dam in the 1995-96 NID update, under the National Dam Inspection Program (P.L. 92-367). Once assigned, this number should be not changed. However, the following guidelines are provided for assignment of ID numbers for new dams. Each new dam will be assigned an NID ID number by the state or federal coordinator. *NID ID numbers will not be reused.* If a dam is retired or is otherwise not longer in existence, that ID number is retired. The state coordinator is responsible for assigning ID numbers for all dams, regardless of ownership. The numbers may not necessarily be continuous, because of a previously established scheme which assigned certain number ranges to federal agencies. Continued use of this numbering scheme for new dams is at the discretion of the state coordinator. Please contact ASDSO or USACE Dam Safety Team for further information

on the process of assigning NID ID numbers or if an alternative number sequence is necessary to meet the needs of the state.

Longitude

Longitude at dam centerline as a single value in decimal degrees.

Latitude

Latitude at dam centerline as a single value in decimal degrees.

Section, Township, Range Location

Dam location in terms of Section, Township, and Range. Meridian location is included if it is needed to locate the dam. (Optional field)

County

Name of the county in which the dam is located.

River or Stream

Official name of the river or stream on which the dam is built. If the stream is unnamed, it is identified as a tributary ("TR") to the named river. If the dam is located offstream, the name of the river or stream is entered plus "-OS" or "OFFSTREAM".

Nearest City/Town

Name of the nearest city, town, or village that is most likely to be affected by floods resulting from the failure of the dam.

Distance to Nearest City/Town

Distance from the dam to the nearest affected City/Town/Village, to the nearest mile (and tenth if appropriate).

Owner Name

Name of the owner of the dam.

Owner Type

Code indicating owner type:

F for Federal;

S for State;

L for Local Government;

U for Public Utility;

P for Private.

Dam Designer-----New field

Name of the principal firm(s) or agency accomplishing design of dam and major

appurtenant operating features, and major modifications. The original designer is listed first then modification designers (if applicable). The names are separated with semi-colons.

Private Dam On Federal Property

Code indicating whether the dam is a private dam located on federal property:

Y for Yes;

N for No.

Dam Type

Code indicating the type of dam (in order of importance): RE for Earth;

ER for Rockfill;

PG for Gravity;

CB for Buttress;

VA for Arch;

MV for Multi-Arch;

CN for Concrete;

MS for Masonry;

ST for Stone;

TC for Timber Crib;

OT for Other.

Codes are concatenated if the dam is a combination of several types. For example, the entry *CNCB* would indicate a concrete buttress dam type.

Core-----New field

Code indicating the position, type of watertight member and certainty.

Position:

F for upstream facing;

H for homogeneous dam;

I for core;

X for unlisted/unknown;

Type: A for bituminous concrete;

C for concrete;

E for earth;

M for metal;

P for plastic;

X for unlisted/unknown;

Certainty:

K for known;

Z for estimated;

Foundation-----New field

Code for the material upon which dam is founded, and certainty.

Foundation:

R for rock;
RS for rock and soil;
S for soil;
U for unlisted/unknown.

Certainty:
K for known;
Z for estimated.

Purposes

Codes indicating the purposes for which the reservoir is used:

I for Irrigation;
H for Hydroelectric;
C for Flood Control and Storm Water Management;
N for Navigation;
S for Water Supply;
R for Recreation;
P for Fire Protection, Stock, Or Small Farm Pond;
F for Fish and Wildlife Pond;
D for Debris Control;
T for Tailings;
O for Other.

The order indicates the relative decreasing importance of the purpose. Codes are concatenated if the dam has multiple purposes. For example, *SCR* would indicate the primary purposes, *Water Supply* and *Flood Control and Storm Water Management*, followed by *Recreation*.

Year Completed

Year when the original main dam structure was completed, optionally followed by code ("E") to indicate an estimated date. If unknown, and reasonable estimate is unavailable, "0000" will be used.

Year Modified-----New field

Year (four digit) when major modifications or rehabilitation of dam or major control structures were completed. Major modifications are defined as a structural, foundation, or mechanical construction activity which significantly restores the project to original condition; changes the project's operation; capacity or structural characteristics (e.g. spillway or seismic modification); or increases the longevity, stability, or safety of the dam and appurtenant structures. Entries should be followed by *one of more of the following codes* indicating type of modification:

S for structural;
F for foundation;
M for mechanical;
E for seismic;
H for hydraulic;
O for other.

Up to ten modifications can be entered, separated by semicolons.

Dam Length

Length of the dam, in feet, which is defined as the length along the top of the dam. This length also includes the spillway, powerplant, navigation lock, fish pass, etc., where these form part of the length of the dam. If detached from the dam, these structures should not be included.

**** Because the "height of dam" definition used by each of the participating State and Federal agencies varies, three different height fields are provided in the NID database. Each agency is requested to enter values for the height field item(s) that most closely correspond to the height of the dam definition(s) used by the agency. Height field items #24-26 that do not correspond to agency data maybe left blank****

Dam Height

Height of the dam, in feet to the nearest foot, which is defined as the vertical distance between the lowest point on the crest of the dam and the lowest point in the original streambed.

Structural Height

Structural height of the dam, in feet to the nearest foot, which is defined as the vertical distance from the lowest point of the excavated foundation to the top of the dam.

Hydraulic Height

Hydraulic height of the dam, in feet to the nearest foot, which is defined as the vertical difference between the maximum design water level and the lowest point in the original streambed.

NID Height

A calculated field based on the maximum value of field items #25 Dam Height, #26 Structural Height, and #27 Hydraulic Height, providing a single height value to facilitate database queries.

Maximum Discharge

Number of cubic feet per second (cu ft/sec) which the spillway is capable of discharging when the reservoir is at its maximum designed water surface elevation.

Maximum Storage

Maximum storage, in acre-feet, which is defined as the total storage space in a reservoir below the maximum attainable water surface elevation, including any surcharge storage.

Normal Storage

Normal storage, in acre-feet, which is defined as the total storage space in a reservoir below the normal retention level, including dead and inactive storage and excluding any flood control or surcharge storage.

NID Storage

A calculated field based on the maximum value of field items #30 Maximum Storage and #31 Normal storage, providing a single storage value to facilitate database queries.

Surface Area

Surface area, in acres, of the impoundment at its normal retention level.

Drainage Area

Drainage area of the dam, in square miles, which is defined as the area that drains to a particular point (in this case, the dam) on a river or stream.

Downstream Hazard Potential

Code indicating the potential hazard to the downstream area resulting from failure or misoperation of the dam or facilities:

- L for Low;
- S for Significant;
- H for High.

Definitions, as accepted by the Interagency Committee on Dam Safety, are as follows:

1. LOW HAZARD POTENTIAL

Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

2. SIGNIFICANT HAZARD POTENTIAL

Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

3. HIGH HAZARD POTENTIAL

Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Hazard Potential Classification	Loss of Human Life	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner

Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

Emergency Action Plan

Code, indicating whether the dam has an Emergency Action Plan (EAP) developed by the dam owner. An EAP is defined as a plan of action to be taken to reduce the potential for property damage and loss of life in an area affected by a dam failure or large flood.

Y for Yes;

N for No;

NR for Not Required by submitting agency.

Inspection Date

Date of the most recent inspection of the dam prior to the transmittal of the data by the submitting agency. Date fields require day, month and year information, and various alphanumeric or numeric combinations are used.

Inspection Frequency---New Field

Scheduled frequency interval for periodic inspections, in years. NOTE: Replacement for "Phase I Inspection" field.

State Regulated Dam---New Field

Code indicating whether the dam is "State Regulated" under the National Dam Safety Program Act:

Y for Yes;

N for No.

A "State Regulated Dam" is defined as a dam meeting the NID criteria for which the State executes one or more of the following general responsibilities: (a) Inspection; (b) Enforcement; or (c) Permitting.

State Regulatory Agency

Name of the primary state agency with regulatory or approval authority over the dam.

******NOTE: Following four fields are optional submissions for states******

Spillway Types

Code that describes the type of spillway:

C for Controlled;

U for Uncontrolled;

N for None.

Spillway Width

Width of the spillway, to the nearest foot, available for discharge when the reservoir is at its maximum designed water surface elevation.

Outlet Gates---New Field

Code(s) that describe the type of spillway and controlled outlet gates, if any:

X for None;

U for Uncontrolled;

T for Tainter (radial);

L for Vertical Lift;

R for Roller;

B for Bascule;

D for Drum;

N for Needle;

F for Flap;

S for Slide (sluice gate);

V for Valve;

O for Other controlled.

Enter up to five types in decreasing size order, separated by semicolons, followed by number of gates.

Volume of Dam

Total number of cubic yards occupied by the materials used in the dam structure. Portions of powerhouse, locks, and spillways are included only if they are an integral part of the dam and required for structural stability.

***** NOTE: The remaining fields are federal submissions only *****

Number of Locks

Number of existing navigation locks for the project.

Length of Locks

Length of the primary navigation lock to the nearest foot.

Lock Width

Width of the primary navigation lock to the nearest foot.

***** NOTE: See Table below for required codes for the following fields *****

Federal Agency Involvement in Funding

Code identifying which federal agency was involved in funding of the dam. Codes are concatenated if several agencies were involved.

Federal Agency Involvement in Design

Code identifying which federal agency was involved in the design of the dam. Codes are concatenated if several agencies were involved.

Federal Agency Involvement in Construction

Code identifying which federal agency was involved in the construction of the dam. Codes are concatenated if several agencies were involved.

Federal Agency Involvement in Regulatory

Code identifying which federal agency is involved in the regulation of the dam. Codes are concatenated if several agencies are involved.

Federal Agency Involvement in Inspection

Code identifying which federal agency is involved in the inspection of the dam. Codes are concatenated if several agencies are involved.

Federal Agency Involvement in Operation

Code identifying which federal agency is involved in the operation of the dam. Codes are concatenated if several agencies are involved.

Federal Agency Owner

Code identifying which federal agency partly or wholly owns the dam. Codes are concatenated if several owners are involved.

Federal Agency Involvement in Other

Code identifying which federal agency is involved in other aspects of the dam. Codes are concatenated if several owners are involved.

Source Agency

Code identifying the federal or state source agency that has provided the field data on the dam. The code used for a state source agency is the two letter abbreviation for the state; the code used for a federal source agency is the Federal Agency Code defined in the table below.

State

The two letter abbreviation for the state in which the dam is located. A calculated field based on the field item #6 NIDID.

Congressional Person

The congressional person representing the district where the dam is located. A calculated field based on the latitude/longitude coordinate of the dam.

Political Party

The political party of the congressional person. A calculated field based on the congressional person and district fields.

Congressional District

The congressional district where the dam is located. A calculated field based on the latitude/longitude coordinate of the dam.

FEDERAL AGENCY CODE TABLE	
Federal Agency Name	Federal Agency Code
<i>Department of Agriculture:</i>	
Natural Resources Conservation Serv <i>Formerly Soil Conservation Serv (SCS)</i>	USDA NRCS
Forest Service	USDA FS
Rural Housing Service <i>Formerly Farmers Home Loan</i>	USDA RHS
<i>Department of Defense:</i>	
US Army Corps of Engineers	CE
US Army	DOD USA
US Navy	DOD USN
US Air Force	DOD USAF
<i>Department of Interior:</i>	
Bureau of Reclamation	DOI BR
Bureau of Indian Affairs	DOI BIA
Bureau of Land Management	DOI BLM
Fish and Wildlife Service	DOI FWS
Geological Survey	DOI GS
National Park Service	DOI NPS

<i>Department of Labor:</i>	
Mine Safety and Health Administration	DOL MSHA
<i>Department of State:</i>	
International Boundary and Water Commission	IBWC
<i>Department of Energy:</i>	
Federal Energy Regulatory Commission	DOE FERC
Nuclear Regulatory Commission	US NRC
Tennessee Valley Authority	TVA

Examples of Other Fieldnames not included in National Inventory of Dams

Owners Address

Owner's Agent or Responsible Person

Primarily used for mailing purposes. The name of the person responsible for correspondence inspection contacts, etc.

Emergency Phone Number

The phone number to be called in case of an emergency.

Dam Crest Elevation

Approximate USGS datum (to the nearest 0.1 foot). Top of parapet wall when applicable.

Parapet

Parapet code number as defined below:

1. Dam has a parapet wall and the wall is adequate to impound water and/or for flood routing.
2. Dam has a parapet wall, however, it is not adequate for flood routing.
3. Dam does not have a parapet wall.

Note: If parapet code is 1, the dam crest elevation is taken to be the top of the parapet wall.

Crest Width

Normal to the dam axis at the narrowest point (in feet). Parapet widths are never used.

Spillway Crest

Elevation of the lowest point of the spillway in the control section excluding any flashboard, gate, etc. (to the nearest 0.1 foot).

Spillway Type

1. Earth or soil
2. Concrete
3. Rock channels
4. Masonry or placed stone
5. Corrugated metal pipe
6. Reinforced concrete pipe
7. Steel pipe
8. Tile

Total Freeboard

Vertical distance from dam crest to spillway crest (to the nearest 0.1 foot).

Operating Freeboard

Vertical distance from the dam crest to the certified water storage elevation; i.e. top of flashboards, restricted elevation, etc. (to the nearest 0.1 foot).

Certified Storage Level

Maximum certified water surface elevation.

Gating Code

Gating code for spillway. Gates are any movable structure used to control the reservoir level including but not limited to radial gates, sluice gates and flashboards.

1. Ungated, Unrestricted
2. Gated, Unrestricted.
3. Seasonally Restricted Gates. Storage is permitted above the spillway crest during a specified season.
4. Restricted Gates. Gates must be opened or removed only prior to impending flood flows.
5. Restricted. Storage is restricted to a specified elevation which is different from the top of gates or spillway crest. Normally the restriction is a specified elevation below the spillway crest.
6. Seasonally Restricted. Storage is reduced seasonally to a specified level which is different from the spillway crest. The operating freeboard entered is that to the restricted level.

Note: Dams that are certified 1 foot or less below the spillway crest to control wave splash should have operating freeboard which includes the 1 foot, but the 1 foot should not be considered in determining gating code.

Maximum Surcharge Storage

Storage between spillway crest and dam crest (or between top of gates or flashboards if applicable).

Basin Impairment

Impairment exists only if either of the following conditions exist:

- a. Water is diverted out of drainage basin.
- b. Upstream control impairs runoff.

Impaired Yes (1) or No (2)

Basin Location

- a. Latitude Mean latitude of the drainage basin (to the nearest minute).
- b. Longitude Mean longitude of the drainage basin (to the nearest minute).

Mean Annual Precipitation

Mean annual precipitation on the drainage basin (to the nearest 0.1 inch).

National Forest

If a dam is located within a National Forest.

Application Status

The most current status of an application.

Type of Flood Estimate

Probability of flood estimate or probable maximum flood.

Date of Flood Estimate

Date the flood estimate was completed.

Storm Precipitation

Total design storm precipitation (to the nearest 0.1 inch).

Precipitation Duration

Duration of design storm precipitation (in hours).

Time of Concentration

Time of concentration used in hydrology study (to the nearest hundredth of an hour).

Storm Runoff

Total design storm runoff volume from the drainage basin (to the nearest acre-foot).

Peak Flood Inflow

Peak design storm inflow to the reservoir (to the nearest cfs).

Peak Flood Inflow

Peak design storm inflow to the reservoir (in cubic feet per square mile).

Routed

Was the storm routed?

Yes (1)

No (2)

Peak Flood Discharge

Peak design storm outflow from the reservoir (to the nearest cfs).

Residual Freeboard

Residual freeboard measured from the maximum reservoir flood stage to the dam crest (to the nearest 0.1 foot).

Maximum Flood Stage

Maximum reservoir flood stage elevation (to the nearest 0.1 foot).

Outlet Description

The description could include diameter or size of the outlet as well as type of outlet (CMP, clay tile, etc.).

Outlet Capacity

The full head flow capacity of the outlet works at the normal reservoir water surface elevation, in cfs.

Outlet Inspection

Date of last internal outlet inspection.

Inspection Date

Date when last safety inspection was conducted.

Instrumentation

Only used when instruments including piezometers, crest monuments, seepage weirs, slope indicators, accelerograms present.

1. Piezometers
2. Crest monuments
3. Seepage wiers
4. Slope indicators
5. Accelerograms
6. Other

APPENDIX I

BUDGET PREPARATION

STAFFING LEVEL REQUIREMENTS: EXAMPLE STATE DAM SAFETY PROGRAM

Chapter VI discusses program staffing and funding. This appendix is intended as a supplement to Chapter VI.

For any state dam safety program to be effective and accountable, personnel levels must be sufficient to satisfy the statutory mandates. Each state must assess its particular needs based on its legislative, organizational, geographic, topographic and political constraints, some of which are described above under Chapter VI, section I. Due to the wide range of these constraints from state to state, it is difficult to provide precise guidelines for the number of inspections one engineer should be expected to perform in a year. This is equally true of each of the other functions of a state dam safety program. With these limitations in mind, an attempt has been made to provide guidelines that should provide assistance in the preparation of a budget for a state dam safety program.

INSPECTION OF EXISTING DAMS:

If inspection frequency is not set by law, annual inspections of high hazard potential dams, biennial inspections of significant hazard potential dams and inspections every five years for low hazard potential dams are recommended. Each dam should be inspected at least once every five years. Some states require the owner to hire a qualified engineer to conduct the inspections. When this is the case, a staff of one engineer per 250 - 400 inspections would be required to review the inspection reports and to attend 20 percent of the inspections for quality control purposes. Most state programs conduct safety inspections utilizing state employed engineers. For budget preparation, the recommended time for a detailed visual inspection of one existing high hazard potential dam including file review, preparation, travel time, on-site inspection time, engineering analysis and report writing is four (4) person-days. For significant and low hazard potential dams the recommended time to budget for inspections are three (3) and two (2) days respectively. It is desirable to include more than one person on the inspection team. There are many reasons for including more than one person on the inspection including training, personal safety, and special needs at the dam. Special needs include surveying and the complexities of the particular dam being inspected that may require staff members with different areas of expertise.

APPLICATION APPROVAL:

Chapter II describes the tasks included in the processing of an application. Statutory and internal policy controls may define the time allocated to review and approve or deny an application. The complexity of the application under review, the completeness of the data provided, the experience of the staff assigned to the review, etc., are factors in determining the length of a particular review. The

length of the permitting process can vary greatly; however, a recommended engineering review time for a complete application is 20 person days, with an additional 5 days for clerical/administrative tasks. The engineering review should include a site inspection as part of the application review. Reviews should also include the major aspects of the engineering design for the dam being proposed. Among these aspects are hydrologic, hydraulic, geotechnical, seismic, and stability considerations. Review and approval of the Emergency Action Plan (EAP), if required, is also part of the application approval.

CONSTRUCTION ASSURANCE:

Although it is the owner's responsibility (through the owner's engineer) in most states to assure that any construction is completed according to the approved application and that all unforeseen conditions are properly handled, review of construction activity by the state is recommended. Inspection and approval of all foundation preparation is essential and is a part of most programs. Inspection of the outlet, the main structure, and the spillway should also be conducted. In addition, many projects include prefinal and final inspections. A recommended inspection length is two (2) person days including preparation, travel and report preparation. The recommended time could double in those states where travel distances are significant. The recommended number of construction assurance inspections per new dam is fifteen (15). Ten (10) construction assurance inspections are recommended for repair of existing dams. The above inspection frequencies include review of quality assurance records of the owner's engineer. Changes to the approved application during construction require additional review. The time required for such additional review is not included in this section but is included in the application approval section above.

FOLLOW-UP ON DEFICIENCIES:

Inspections of operational dams frequently reveal deficiencies that require correction. The inspection report shall identify deficiencies and include an appropriate schedule to complete corrective actions. A program to follow up and assure that these actions are taken should be part of all state programs. The amount of time required to conduct a follow-up inspection can vary, however, for operating dams it can take an average of three (3) persons-days per deficiency. For budget preparation purposes, it should be anticipated that deficiencies will occur at 20 percent of the dams inspected.

Contacts with owners of unsafe dams to bring about the remediation of unsafe conditions is also an essential part of follow-up activities. The actual amount of time required can vary. It is recommended that 15 person-days per unsafe dam be used in budget preparation. The 15 person-days recommended does not include application review time for repair, reconstruction, breach or removal of the dam. In most cases a state will have to prioritize follow-up activity since the time required can easily exceed the available staff.

ENFORCEMENT:

In the event that progress toward correction of deficiencies is not satisfactory, enforcement actions must be pursued. Enforcement can be very time consuming. For budget estimates a recommended time for each enforcement action is 50 person-days for the dam safety engineering staff. The estimated time includes the time of the legal staff as well as that of the engineering staff for preparation, etc. The above estimates assume that actions taken by the technical staff have been properly documented to support the enforcement actions.

TRAINING:

Education and training of staff is an important part of an effective program. It is recommended that a minimum of 5 percent of staff time be devoted to specific training provided by short courses, etc. as described in Chapter VII.

ADMINISTRATION/OVERHEAD:

Depending on the agency within which the dam safety program is placed and the overall state government organizational structure, the administration of the dam safety program can require significant amounts of time. The administrator may be responsible for overseeing other programs as well. The recommended administrative staffing time is 30 percent of the technical staff time described above. The above estimates include supervision and support of the program.

Example Program Staffing Level Requirements

Example program: 200 Dams:

70 High hazard potential,
60 Significant hazard potential,
70 Low hazard potential

with inspection frequency as follows:

High hazard potential, annual;
Significant hazard potential, every two years; and
Low hazard potential, every five years

<u>TASK</u>	<u>No. of Tasks (Dams)</u>	<u>Person-Days Per Task</u>	<u>Total Person Days</u>
Average annual inspections ²			
High hazard potential	70/yr	4	280
Significant hazard	60/2 = 30/yr	3	90
Low hazard potential	70/5 = 14/yr	2	28
Special Conditions, Requests	30	2	60
Training new staff	1	15	<u>15</u>

Sub-Total: Annual Inspection Days = 473 days

	<u>Person Tasks per Task</u>	<u>Person-Day per Task</u>	<u>Total Person-Days</u>
Application approval:			
New Dams	10	20	200
Repair Existing Dams	10	10	100
Emergency Action Plans (EAP)	25	5	125

Sub-Total: Application Approval Days = 425

	<u>Person Tasks Per year</u>	<u>Person-Day per Task</u>	<u>Total Person-Days</u>
Construction Assurance:			
New Dams	10	30^3	300
Repair Existing Dams	10	20^4	<u>200</u>
Sub-Total: Construction Assurance Days = 500			

Follow-up on deficiencies:

114 dams/yr. X 20% =	23	3	69
Unsafe dams	2	15	30
Enforcement:	4	50	200

Summary of Tasks:

Inspections:	473 days
Applications:	425 days
Construction:	500 days
Follow-ups:	69 days
Unsafe Dams:	30 days
Enforcement:	<u>200 days</u>
TOTAL:	1,697 days

Professional Development/
Continuing Education:

$$1697 \times 5\% = 85 \text{ days}$$

Total Engineering/
Technical Staff:

$$1697 + 85 = 1782 \text{ days} / (225 \text{ days/FTE/yr.}) = 7.9 \text{ FTE}$$

Administrative/
Clerical:

$$1782 \times 30\% = 535 \text{ days} / (225 \text{ days/FTE/yr.}) = 2.4 \text{ FTE}$$

TOTAL STAFFING REQUIRED:
(For Inventory of 200 dams)

10.3 FTE

³2 person-days per inspection X 15 inspections per year = 30

⁴2 person-days per inspection X 10 inspections per year = 20

Note:

- 1) In geographically large states without regional dam safety offices, a "distance multiplier" of 1.5 may be used to estimate the number of person-days required for field inspections.
- 2) "Construction Assurance" would include site inspections during:
 - A. Foundation Preparation
 - B. Embankment Construction
 - C. Low Level Outlet Structure Construction/Placement
 - D. Spillway Construction
 - E. Final Review
- 3) In states with seismic risk, a "seismic multiplier" of 1.5 may be used to estimate the number of person-days required for application approval.
- 4) Initial inspection of an existing dam and production of a Phase I inspection report will likely take up to between 10 to 15 man-days.
- 5) Other administrative activities must be considered

Chapter VI lists other costs which must be considered in the budgeting process.

APPENDIX J

PUBLIC OUTREACH TOOL SAMPLES

CASE 1: OHIO

CASE 2: PENNSYLVANIA

CASE 3: CALIFORNIA



Ohio Department of Natural Resources Division of Water Fact Sheet

Fact Sheet 94-27

Dam Safety: Rodent Control

Rodents such as the groundhog (woodchuck), muskrat, and beaver are attracted to dams and reservoirs, and can be quite dangerous to the structural integrity and proper performance of the embankment and spillway. Groundhog and muskrat burrows weaken the embankment and can serve as pathways for seepage. Beavers may plug the spillway and raise the pool level. Rodent control is essential in preserving a well-maintained dam.

Groundhog

The groundhog is the largest member of the squirrel family. Its coarse fur is a grizzled grayish brown with a reddish cast. Typical foods include grasses, clover, alfalfa, soybeans, peas, lettuce, and apples. Breeding takes place during early spring (beginning at the age of one year) with an average of four or five young per litter, one litter per year. The average life expectancy is two or three years with a maximum of six years.

Occupied groundhog burrows are easily recognized in the spring due to the groundhog's habit of keeping them "cleaned out." Fresh dirt is generally found at the mouth of active burrows. Half-round mounds, paths leading from the den to nearby fields, and clawed or girdled trees and shrubs also help identify inhabited burrows and dens.

When burrowing into an embankment, groundhogs stay above the phreatic surface (upper surface of seepage or saturation) to stay dry. The burrow is rarely a single tunnel. It is usually forked, with more than one entrance and with several side passages or rooms from 1 to 12 feet long.

Groundhog Control

Control methods should be implemented during early spring when active burrows are easy to find, young groundhogs have not scattered, and there is less likelihood of damage to other wildlife. In later summer, fall, and winter, game animals will scurry into groundhog burrows for brief protection and may even take up permanent abode during the period of groundhog hibernation.

Groundhogs can be controlled by using fumigants or by shooting. Fumigation is the most practical method of controlling groundhogs. Around buildings or other high fire hazard areas, shooting may be preferable. Groundhogs will be discouraged from inhabiting the embankment if the vegetal cover is kept mowed.

Gas cartridges may be purchased at garden supply and hardware stores. Information about the use and availability of gas cartridges may be obtained from county extension offices, or the U.S. Department of Agriculture at the following address:

The USDA
Animal and Plant Health Inspection Service
Wildlife Services
200 North High Street, Room 622
Columbus, Ohio 43215
(614) 469-5681

Muskrat

The muskrat is a stocky rodent with a broad head, short legs, small eyes, and rich dark brown fur. Muskrats are chiefly nocturnal. Their principal food includes stems, roots, bulbs, and foliage of aquatic plants. They also feed on snails, mussels, crustaceans, insects, and fish. Usually three to five litters, averaging six to eight young per litter, are produced each year. Adult muskrats average one foot in length and three pounds in weight. The life expectancy is less than two years, with a maximum of four years. Muskrats can be found wherever there are marshes, swamps, ponds, lakes and streams having calm or very slowly moving water with vegetation in the water and along the banks.

Muskrats make their homes by burrowing into the banks of lakes and streams or by building "houses" of bushes and other plants. Their burrows begin from 6 to 18 inches below the water surface and penetrate the embankment on an upward slant. At distances up to 15 feet from the entrance, a dry chamber is hollowed out above the water level. Once a muskrat den is occupied, a rise in the water level will cause the muskrat to dig farther and higher to excavate a new dry chamber. Damage (and the potential for problems) is compounded where groundhogs or other burrowing animals construct their dens in the embankment opposite muskrat dens.

Continued on back!

Muskrat Control

Barriers to prevent burrowing offer the most practical protection to earthen structures. A properly constructed riprap and filter layer will discourage burrowing. The filter and riprap should extend at least 3 feet below the water line. As the muskrat attempts to construct a burrow, the sand and gravel of the filter layer caves in and thus discourages den building. Heavy wire fencing laid flat against the slope and extending above and below the water line can also be effective. Eliminating or reducing aquatic vegetation along the shoreline will discourage muskrat habitation. Where muskrats have inhabited the area, trapping is usually the most practical method of removing them from a pond.

Eliminating a Burrow

The recommended method of backfilling a burrow in an embankment is mud-packing. This simple, inexpensive method can be accomplished by placing one or two lengths of metal stove or vent pipe in a vertical position over the entrance of the den. Making sure that the pipe connection to the den does not leak, the mud-pack mixture is then poured into the pipe until the burrow and pipe are filled with the earth-water mixture. The pipe is removed and dry earth is tamped into the entrance. The mud-pack is made by adding water to a 90 percent earth and 10 percent cement mixture until a slurry or thin cement consistency is attained. All entrances should be plugged with well-compacted earth and vegetation re-established. Dens should be eliminated without delay because damage from just one hole can lead to failure of a dam or levee.

Beaver

Beaver will try to plug spillways with their cuttings. Routinely removing the cuttings is one way to alleviate the problem. Trapping beaver may be done by the owner during the appropriate season; however, the nearest ODNR, Division of Wildlife, District Office or state game protector should be contacted first.

Hunting and Trapping Regulations

Because hunting and trapping rules change from year to year, ODNR, Division of Wildlife authorities at one of the following offices should be consulted before taking any action.



Wildlife District One
1500 Dublin Road
Columbus 43215
Phone: (614) 644-3925
FAX (614) 644-3931

Wildlife District Two
952 Lima Avenue, Box A
Findlay 45840
Phone: (419) 424-5000
FAX (419) 422-4875

Wildlife District Three
912 Portage Lakes Drive
Akron 44319
Phone: (330) 644-2293
FAX (330) 644-8403

Wildlife District Four
360 E. State Street
Athens 45701
Phone: (740) 594-2211
FAX (740) 592-1626

Wildlife District Five
1076 Old Springfield Pike
Xenia 45385
Phone: (937) 372-9261
FAX (937) 376-3011

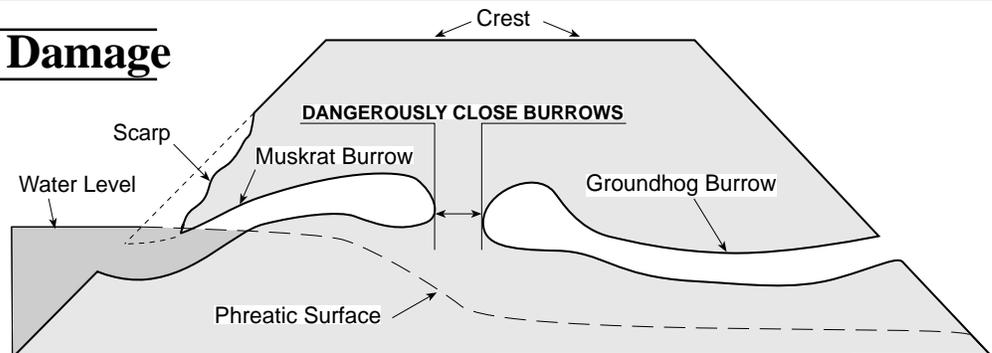
In Sandusky
305 East Shoreline Drive
Sandusky 44870
Phone: (419) 625-8062
FAX (419) 625-6272

In Fairport Harbor
Phone: (440) 352-6100
FAX (440) 350-0250

Any other questions, comments concerns, or fact sheet requests, should be directed to the Division of Water at the following address:

Ohio Department of Natural Resources
Division of Water
Dam Safety Engineering Program
2045 Morse Road
Columbus, Ohio 43229-6693
Voice: (614) 265-6731 Fax: (614) 447-9503
Website: <http://www.dnr.state.oh.us/water>

Rodent Burrow Damage





Division of Water Dam Safety

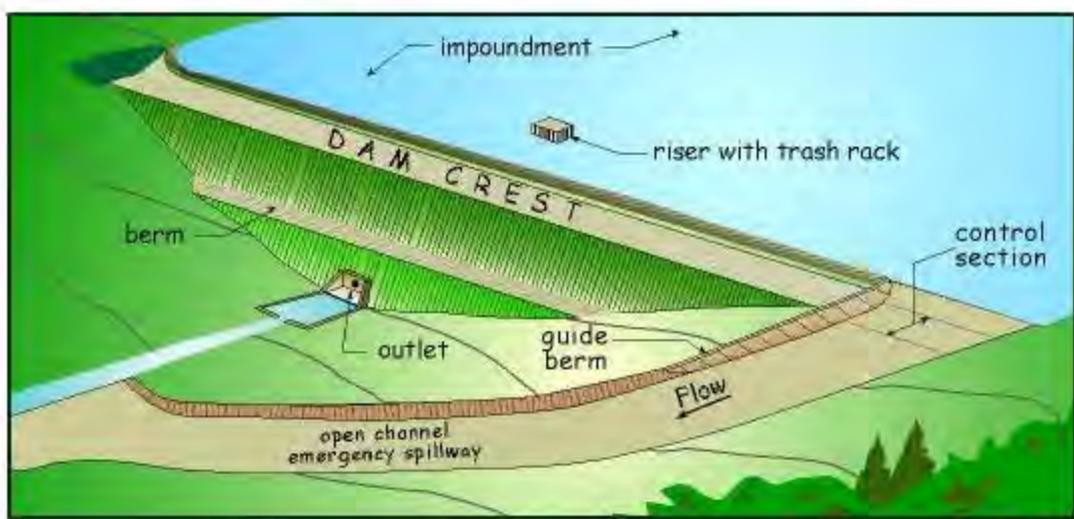
- Home
- About Water
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- GIS Data
- Well Log Search
- Well Log Filing
- Index
- Contact Us
- Canals
- Dams
- Education
- Floodplains
- Ground Water
- Water Inventory
- Water Planning
- Withdrawal Registration

Dam Safety

- About Dam Safety Program
- Contacts & Phone Numbers
- Publications of this Program
- Dam Definitions, Classifications and Statistics
- Levee Definitions, Classifications and Statistics
- Lowhead Dams Inventory and Removal
- Owners Responsibility, Dam Failures
- Importance of Regular Inspections
- Dam Owners Annual Fee
- Engineering Consultant List
- Loan Programs for Repair or improvements
- Construction Permits for Dams
- Construction Permits for Levees
- Permit Forms and Instructions
- Inspection Forms and References
- Repair of Dams & Levees

Dam Safety Engineering Main Page

24-Hour Emergency Number (614) 799-9538



Downstream view of an earth and rock open channel spillway.
From Dam Safety Fact Sheet number 49.

New Program Items



Four NEW Lowhead Dam Removal Case Studies Added

The four structures removed are: Munroe Falls Dam (Cuyahoga River), Lovers Lane Dam (Mahoning River), North River Rd. Dam (Mahoning River), and River Street Dam (Olentangy River).

[Go to Case Studies Page](#)



Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

BUREAU OF WATERWAYS ENGINEERING

VEGETATION AND EROSION CONTROL ON DAMS

Problems with Trees and Brush Near Dams

Trees and brush on a dam's earthen embankment, as well as 10 to 20 feet along the downstream edge of the embankment, can hide developing structural problems and also create potential new problems. Sudden uprooting of trees by strong winds can result in the displacement of a relatively large amount of embankment material. This in turn can lower the crest of the dam, reduce the effective width of the dam and enhance seepage. Falling trees also can cause structural damage to concrete, steel, stone or timber structures.

The root systems of trees can be a potential hazard by allowing seepage pathways to develop through a dam. Trees eventually die and their roots decay and rot. A network of channels is formed by decaying roots that increases seepage within the dam's embankment or foundation. This seepage can develop into serious piping (internal erosion) that removes the soil particles from the embankment of the foundation, which can ultimately lead to the failure of the dam.

Brush and woody vegetation can hinder the visual inspection of dam surfaces. Sinkholes, animal burrows, seeps and other irregularities can be obscured by trees and brush. Woody vegetation can cause excessive shade that can hinder the growth of a sturdy, dense grass coverage. These affected areas are more prone to surface erosion.

Erosion Control

Grass cover is a very effective and inexpensive way to prevent the erosion of embankment surfaces. The stems and root systems of grasses tend to trap fine particles of soil, thus inhibiting the migration of these particles. A good grass cover provides an excellent means against erosion due to runoff caused by rains, and can protect the embankment during limited overtopping.

Maintenance

Grass cover should be routinely cut to provide a surface that can be easily inspected. **Trees and brush should never be allowed to grow on or very near a dam!** Many older dams have very large trees growing on or near them. Removal of trees, roots and brush should be done under the direction of a qualified professional engineer knowledgeable in dam safety and maintenance.



For more information contact:

Department of Environmental Protection
Bureau of Waterways Engineering
Division of Dam Safety
P.O. Box 8554
Harrisburg, PA 17105-8554
(717) 787-8568

For more information, visit DEP's website at www.state.pa.us, Keyword: "DEP Dam Safety."

DEP Regional Offices

Southeast Region

2 East Main Street
Norristown, PA 19401
484-250-5900

Counties: Bucks, Chester, Delaware, Montgomery and Philadelphia

Southwest Region

400 Waterfront Drive
Pittsburgh, PA 15222-4745
412-442-4217

Counties: Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington and Westmoreland

Southcentral Region

909 Elmerton Avenue
Harrisburg, PA 17110
717-705-4708

Counties: Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry and York

Northcentral Region

208 W. Third Street, Suite 101
Williamsport, PA 17701
570-327-3675

Counties: Bradford, Cameron, Clearfield, Centre, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga and Union

Northeast Region

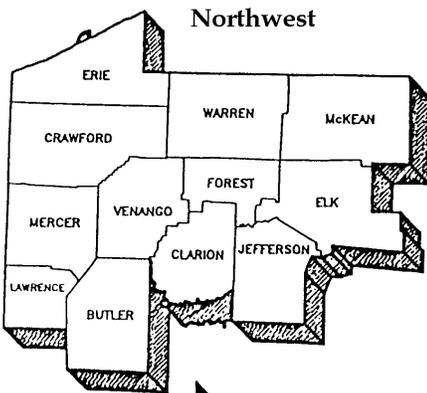
2 Public Square
Wilkes-Barre, PA 18711-0790
570-826-2511

Counties: Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne & Wyoming

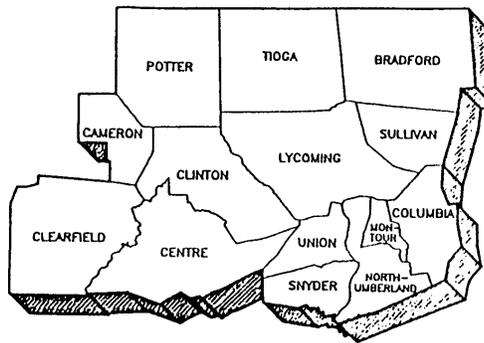
Northwest Region

230 Chestnut Street
Meadville, PA 16335-3481
814-332-6899

Counties: Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango and Warren



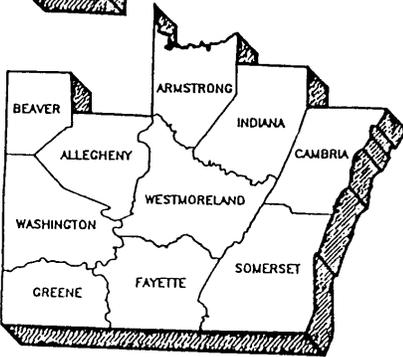
Northwest



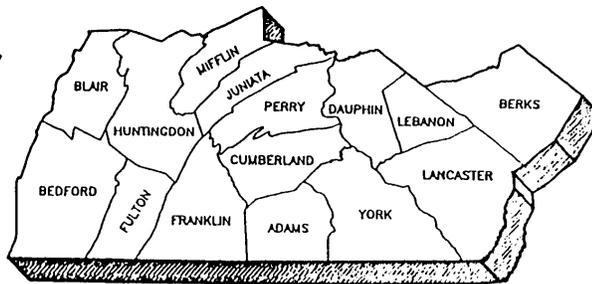
Northcentral



Northeast



Southwest



Southcentral



Southeast

THE CALIFORNIA CHALLENGE

On average, two dozen dams in the United States fail each year. Since 1970, significant dam failures have resulted in hundreds of lives lost and billions of dollars in property damage.

California has 1,250 state-regulated dams. Many of those dams are on the nation's highest hazard list because they pose a significant public safety threat due to their large size and proximity to major population centers. Other potential risk factors include:

- Many dams are located close to or on faults capable of generating major earthquakes.
- California has some of the most complex geology in the world, which affects the design and performance of dams.
- California's dams are aging. Most are over 50 years old.

Something Had To Be Done

In 1928, the 205-foot-high St. Francis Dam in Southern California failed. More than 12 billion gallons of water rushed down the San Francisquito Canyon, demolishing 1,200 homes, washing out 10 bridges, and killing approximately 450 people. The dam had been designed and constructed just two years earlier – without any regulatory oversight.

This sudden and tragic dam failure, one of the worst disasters in California's history, resulted in the creation of California's Dam Safety Program in 1929. Although dam owners are responsible for the safety of their own dams, the Department of Water Resources' Division of Safety of Dams (DSOD) is required by state law to regulate non-federal publicly and privately owned dams to prevent dam failure.



Division of Safety of Dams

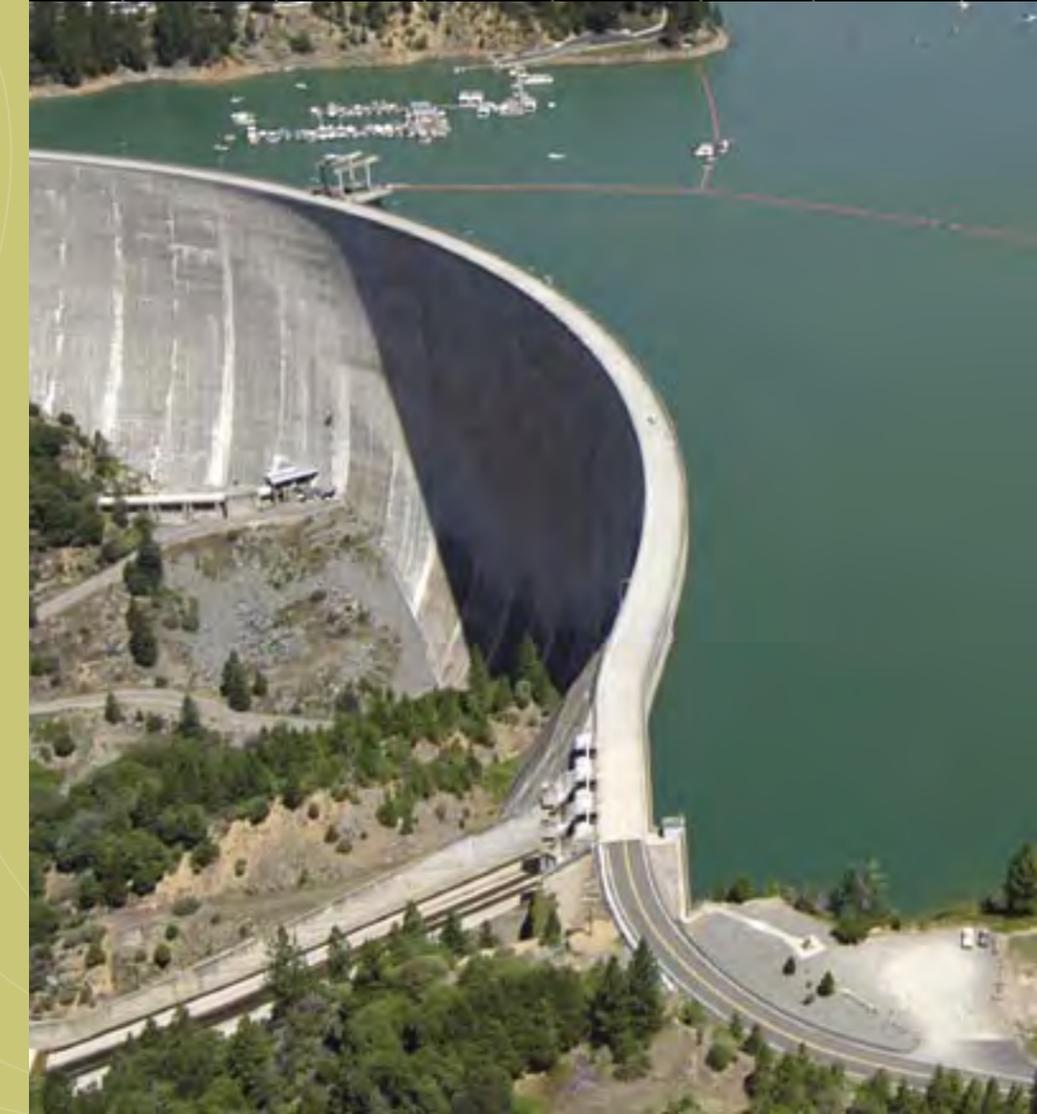
2200 X Street, Suite 200

Sacramento, CA 95818

916 227.4644

<http://damsafety.water.ca.gov/>

CALIFORNIA'S
DAM SAFETY PROGRAM:
Safeguarding People & Property



MAJOR BENEFITS, CONSIDERABLE RISKS

Because of California's seasonal and climatic conditions, water storage is critical. Dams help reserve the water necessary for agriculture, hydroelectric power, recreational, environmental protection, and a stable drinking water supply. They are also critical tools in flood control. Along with their many benefits, dams present formidable consequences if not properly designed, built, and maintained.

All dam owners in California must be prepared for the inevitability of earthquakes and flooding. However, even without large-scale natural disasters, there are numerous causes of failure that can occur under less extreme conditions, including:

- Poor design
- Unsound construction
- Inadequate maintenance
- Age-related problems



St. Francis Dam during failure, near Los Angeles, CA (1928)



Baldwin Hills Dam after failure, Los Angeles, CA (1963)



Teton Dam during failure, Madison County, Southeast Idaho (1976)

DIVISION OF SAFETY OF DAMS – MORE THAN JUST INSPECTIONS

DSOD is composed of highly specialized engineers and geologists that work closely with dam owners and their consulting engineers to ensure the safety of dams in California. Division engineers independently review and evaluate designs of new dams which must meet state safety requirements. Enlargements and repairs of existing dams are also thoroughly analyzed.

Division engineers and geologists perform frequent inspections of dams under construction to verify compliance with approved plans and specifications. The 1,250 state-regulated dams are inspected at least once a year by DSOD engineers familiar with the history, performance, instrumentation, background, and unique details of each dam.

Although California dams are designed and maintained to the highest standards in the country, our state's seismic activity and extreme rainfall in some areas require today's DSOD staff to be experts in how earthquakes and floods affect such structures. Complex analyses are completed by engineers and geologists to predict dam performance during extreme conditions. Division engineers quickly respond to emergency situations, to assess performance and ensure downstream safety following natural disaster type loading.



Near failure of the Lower San Fernando Dam, San Fernando Valley, CA (1971)

CLOSE CALL

During a 1971 earthquake, the near failure of the San Fernando Dam increased the focus on seismic safety of dams. Over 80,000 people lived downstream of the dam at the time of the earthquake. A DSOD water level restriction imposed before the earthquake, in combination with quick action taken by DSOD and the owner, helped to avert a major catastrophe.

THE SYSTEM WORKS BEST WHEN WE WORK TOGETHER

DSOD is constantly developing and applying new technologies in dam design, seismic fortification, testing, and maintenance. We work in close cooperation with other state and national organizations concerned with dam safety and public protection to ensure the most efficient use of our resources and to keep abreast of state-of-the-art in dam engineering. When dam owners work in concert with DSOD, they benefit from the collective experience of all of these organizations.

Cooperation, communication, knowledge, action, and a constant watchfulness will keep California's dams, and its people, enjoying the best protection possible.



DSOD engineers perform field inspections to assess the dam's structural condition and how well it is maintained.



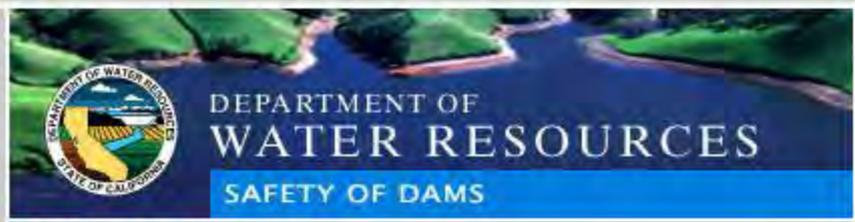
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- [DSOD Home](#)
- [About DSOD](#)
- [Organizational Chart](#)
- [Statutes and Regulations](#)
- [Application Forms](#)
- [Fees](#)
- [Listing of Dams](#)
- [Jurisdictional Size Chart](#)
- [FAQs](#)
- [Employment Opportunities with DSOD](#)
- [Contact Us](#)

Division of Safety of Dams
Department of Water Resources

Mailing Address:
 P. O. Box 942836,
 Sacramento, CA
 94236-0001

Telephone #:
 (916) 227-4644

E-Mail: General Information:
damsafety@water.ca.gov



DSOD - Our Mission

To protect people against loss of life and property from dam failure. The California Water Code entrusts this regulatory power to the Department of Water Resources which delegates the program to the Division of Safety of Dams.

Information regarding the supervision of dams is provided here to better serve the public, dam owners and applicants – links to this information are located on the left side of this web page. Information regarding the technical aspects of dams is provided on the right side of this page.

DWR My CA

- Related Links**
- [Technical References](#)
 - [Featured Links](#)



APPENDIX K

SAMPLE FEE STRUCTURES

CASE 1: WEST VIRGINIA

CASE 1: West Virginia Example:

Annual Registration Fees - Owners of existing dams holding certificates of approval shall be assessed an annual registration fee. In accordance with provisions of the Dam Control and Safety Act, West Virginia Code • 22-14-7, existing certificates of approval will be extended for one year upon receipt of the annual registration fee, an inspection report, a monitoring and emergency action plan, and a maintenance plan; Provided that where an approved, up-to-date: inspection report; monitoring and emergency action plan; and maintenance plan are on file in the Dam Safety Section, and where no outstanding violation(s) exist, then the certificate of approval will be extended without resubmission of the foregoing documents upon receipt of the annual registration fee. The following annual registration fees apply:

Low hazard potential dams shall be assessed fifty dollars.

Significant hazard potential dams shall be assessed seventy-five dollars.

High hazard potential dams shall be assessed one hundred dollars.

Any certificate of approval issued pursuant to W. Va. Code • 22-14-17 and this rule is void without notification to the person holding the certificate of approval when the annual registration fee is more than one hundred eighty (180) days past due. Resubmission of an application in accordance with section 5 of this rule is required where a certificate has become void due to failure to pay the appropriate annual registration fee within 180 days of the date due.