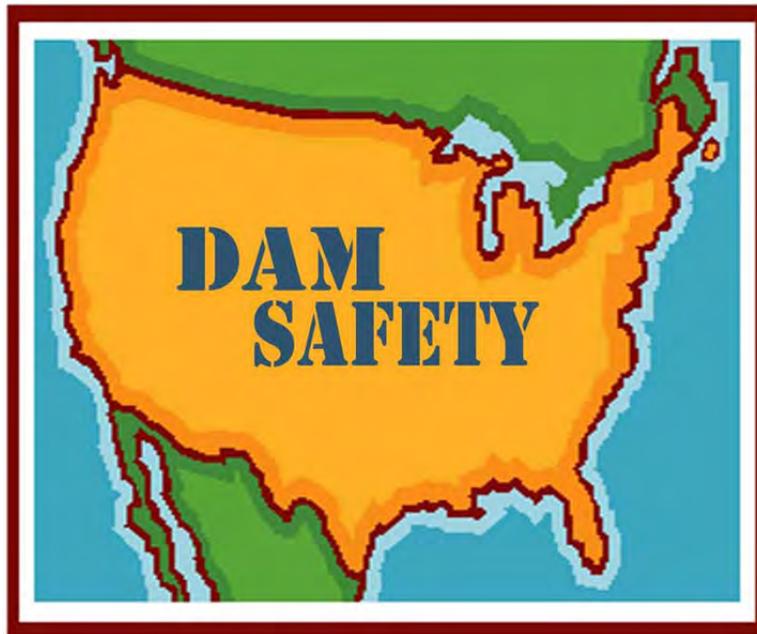


The National Dam Safety Program

Model State Dam Safety Program

FEMA 316/July 2007



Federal Emergency Management Agency
www.fema.gov

Association of State Dam Safety Officials
www.damsafety.org

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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.

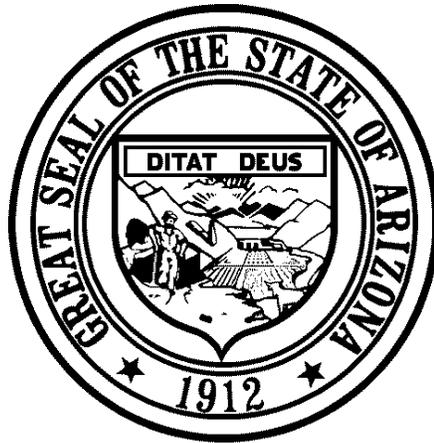
APPENDIX B

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>	<u>Surface Water Diversion Plan</u> - 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

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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

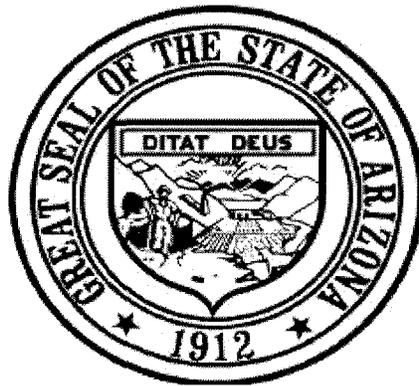
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disturbance, requires prior clearance regarding cultural resources
sensitivity and treatment from the State Historic Preservation Officer.
Contact the Arizona State Parks, (602) 542-4174.

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

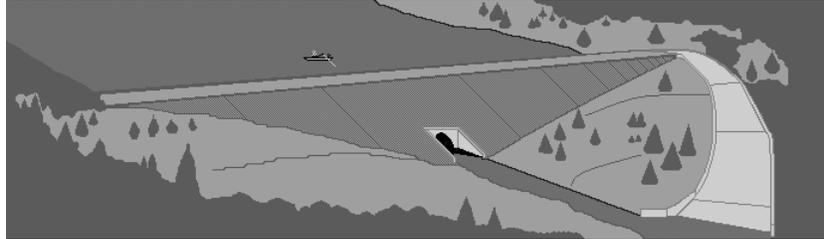
CASE 3: PENNSYLVANIA



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?

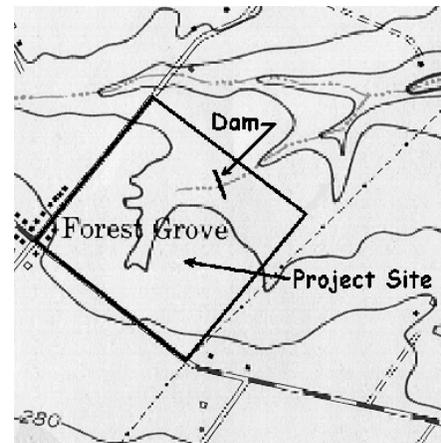
1. A dam permit is required if the proposed dam will be built across a stream and it meets one of the following criteria:
 - a. The contributory drainage area exceeds 100 acres. The drainage area is the land area that, during a storm event, contributes water runoff to the impounding area.
 - b. The maximum 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?

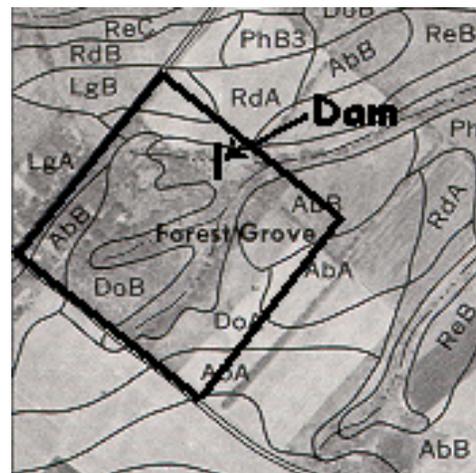
A determination of the need for a permit can be requested from the Department of Environmental Protection's (DEP's) Division of Dam Safety. The

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.

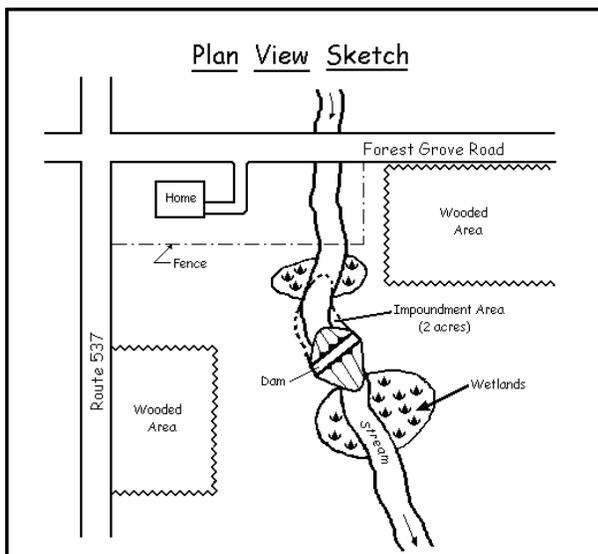


- *2. A copy of the Soil Survey Map for the project area.

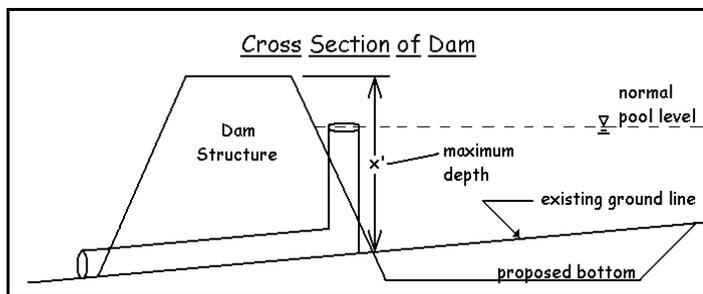


- * A copy of these maps may be obtained from your County Conservation District Office.

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

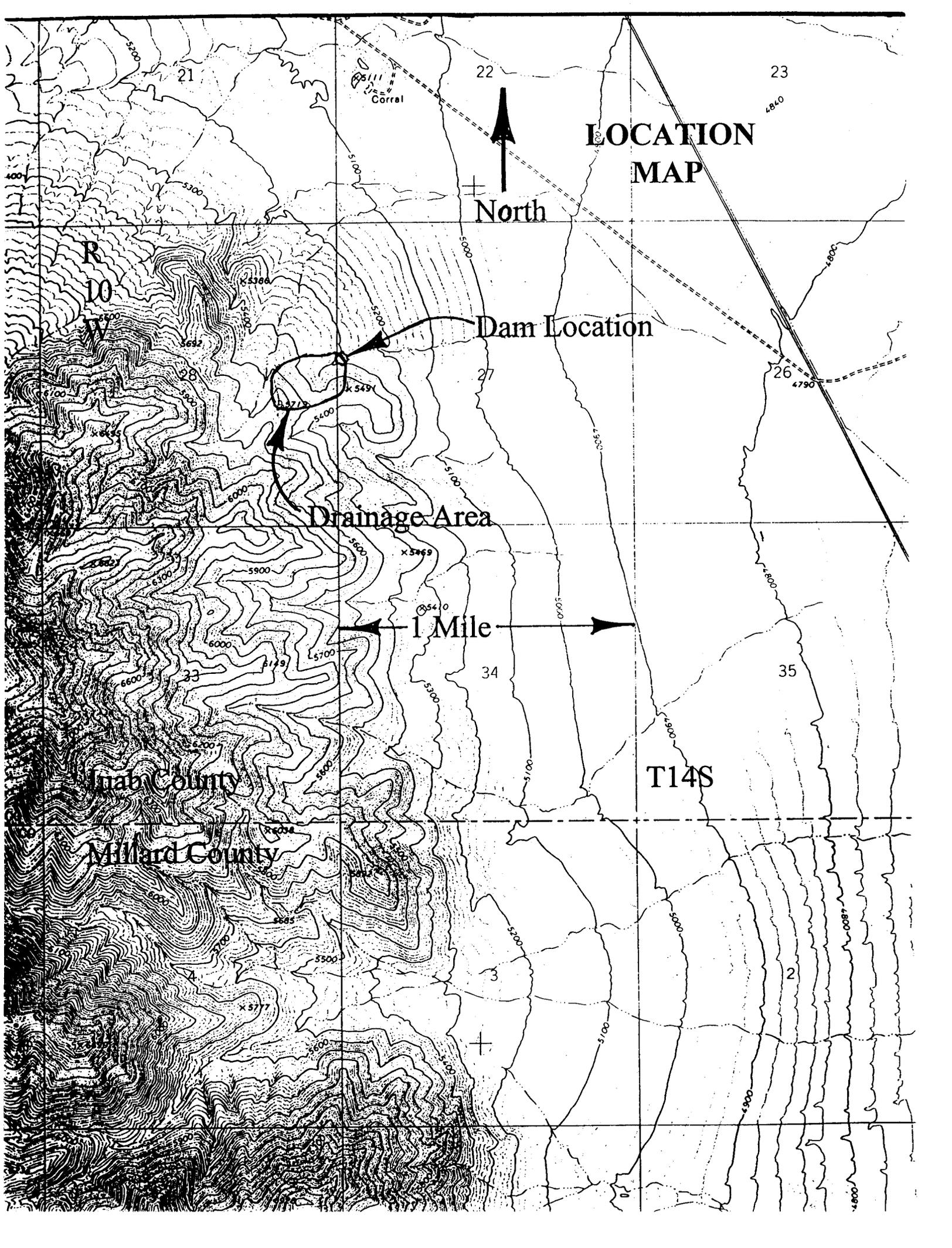
Definitions (Section 73-5a-106 of the Utah Code) Hazard classifications are as follows:

- (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



Dam Location

Drainage Area

1 Mile

Inab County

Millard County

T14S

21

22

23

27

26

23

34

35

3

2

Corral

400

5300

5300

5100

6000

4386

5632

5878

5491

5369

5540

5149

5700

5500

5500

5585

5500

5777

5600

5400

4840

4800

4790

4800

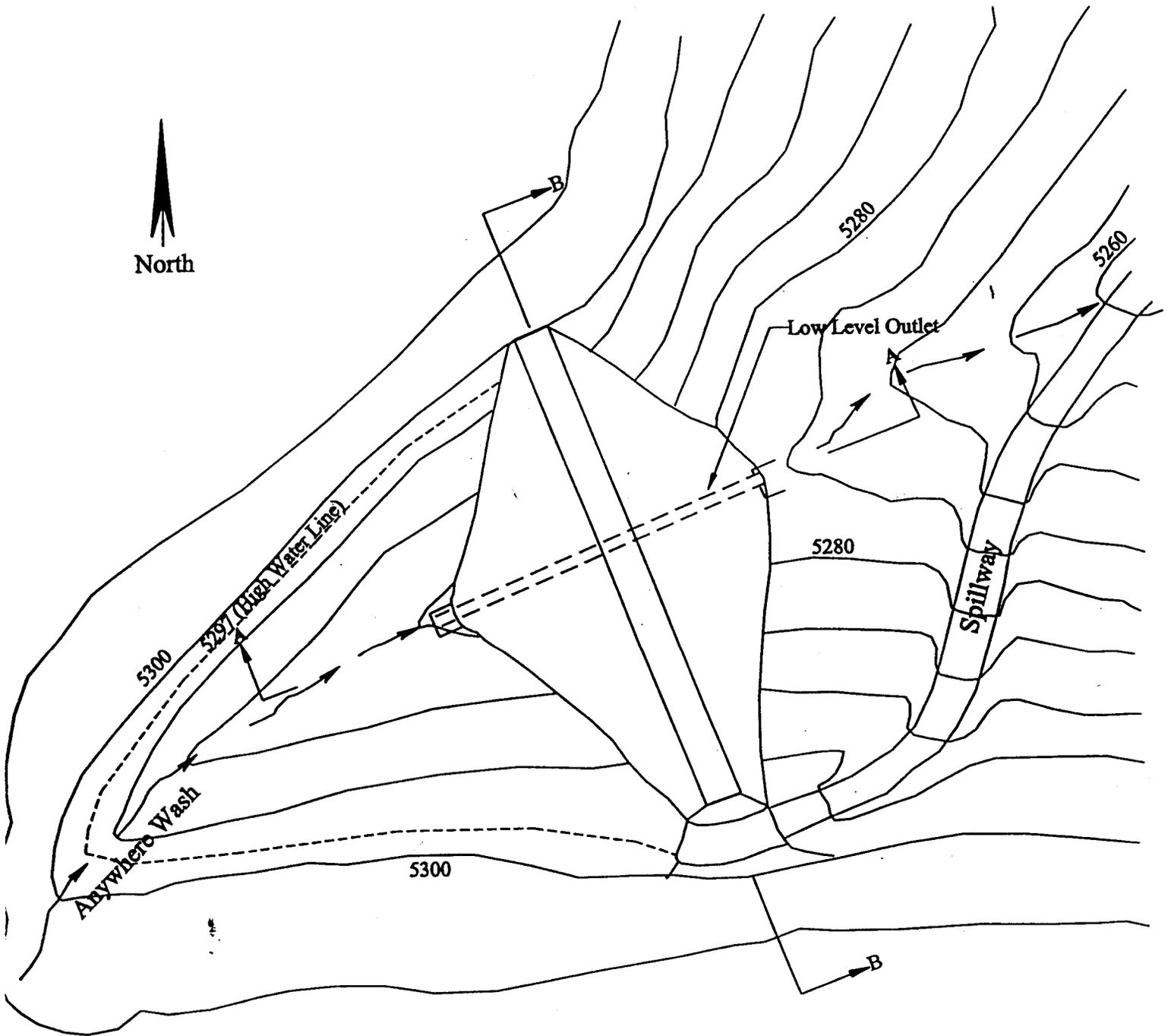
4500

5000

4900

4800

PLAN VIEW

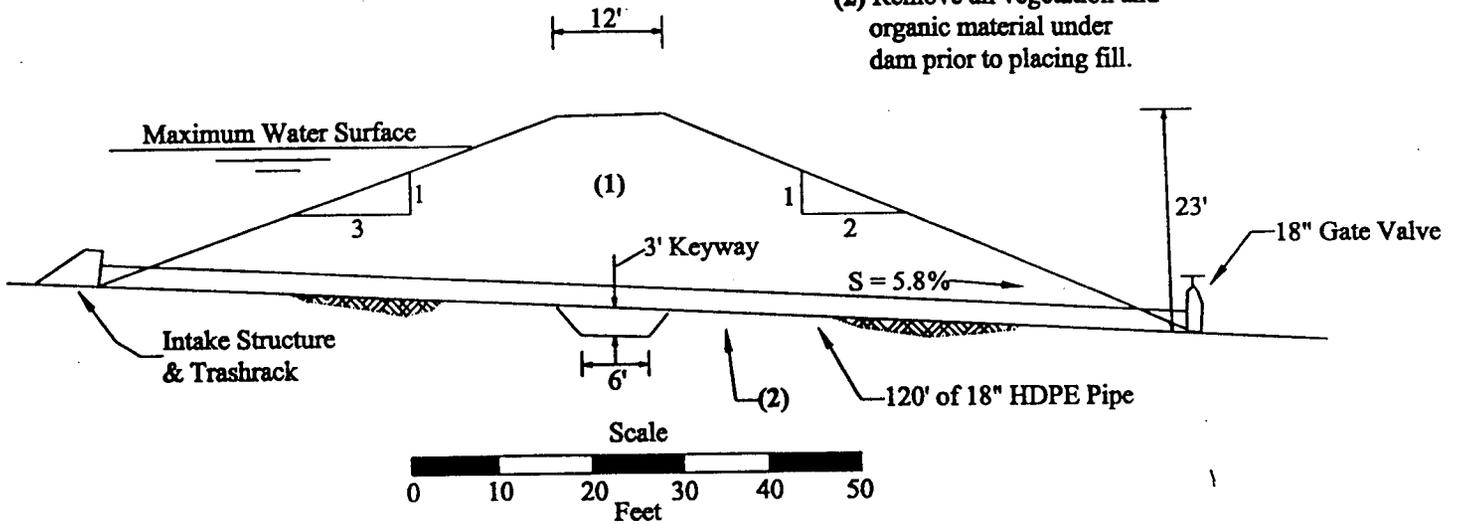


50 Feet

Section A - A (Cross-Section of Dam)

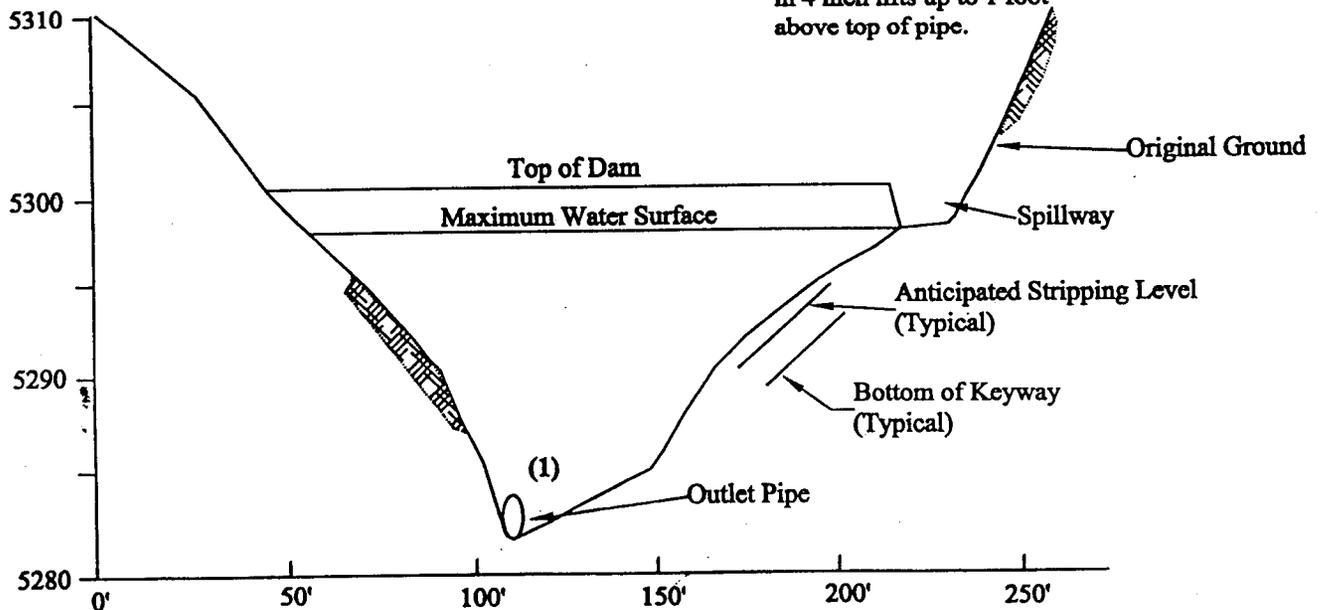
(1) Dam is to be built of moisture conditioned silty clays (CL) placed in 9" lift and compacted by 8 passes of a sheeps foot roller.

(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