

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**TABLE OF CONTENTS**

<b>Topics</b>	<b>Sections</b>
<a href="#"><u>OVERVIEW</u></a>	2.1 What is the purpose of this chapter? 2.2 What is the scope of this chapter? 2.3 What are the authorities for this chapter? 2.4 What terms do you need to know to understand this chapter? 2.5 How does the Service classify dams?
<a href="#"><u>DOCUMENTS WITHIN THE DAM SAFETY PROGRAM</u></a>	2.6 What is the Service’s Safety Evaluation of Existing Dams (SEED) Inspection Program? 2.7 What are the requirements for writing Standard Operating Procedures (SOP)? 2.8 What are the requirements for writing and implementing Emergency Action Plans?
<a href="#"><u>STANDARDS FOR NEW DAMS</u></a>	2.9 What is the approval process and procedure for building new dams? 2.10 How does the Service address newly acquired dams?
<a href="#"><u>STANDARDS FOR EXISTING DAMS</u></a>	2.11 What is the process for rehabilitating, modifying, or repairing an inventory dam? 2.12 How is funding requested for investigations, safety modifications, operations and monitoring, and rehabilitation of dams?
<a href="#"><u>COORDINATING WITH OTHER ENTITIES</u></a>	2.13 How does the Service coordinate with state dam safety programs? 2.14 How are dam safety responsibilities ensured for non-Federal dams on Service property? 2.15 What are the requirements for state dam projects to which the Service provides funding?
<a href="#"><u>TECHNICAL STANDARDS</u></a>	2.16 What are the technical standards for the Dam Safety Program?

**OVERVIEW**

**2.1 What is the purpose of this chapter?** This chapter describes the standards and requirements of the U.S. Fish and Wildlife Service’s (Service) Dam Safety Program.

**2.2 What is the scope of this chapter?** This chapter applies to all Service employees and contractors who are responsible for dams and their maintenance and inspection.

**2.3 What are the authorities for this chapter?** See 361 FW 1 for a list of the authorities for all the chapters in Part 361.

**2.4 What terms do you need to know to understand this chapter?**

**A. Comprehensive Review (CR).** A CR is an in-depth evaluation of a dam carried out by a multi-disciplinary team. It includes an onsite inspection; examination of design records; a review of performance, operation, and maintenance records; an analysis of potential failure modes; and an estimation of risk.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**B. Cross-Dike or Interior Dike.** A cross-dike or interior dike:

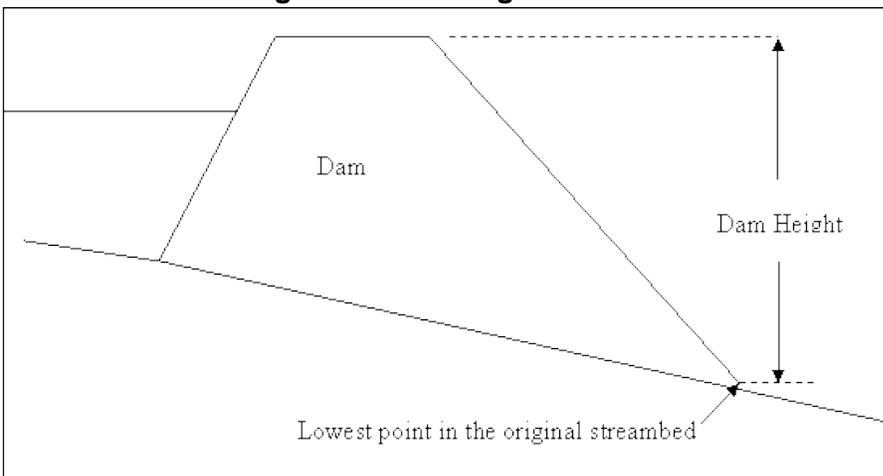
(1) Is an artificial embankment constructed to subdivide a reservoir or provide vehicular access across a reservoir, and

(2) Does not provide any additional water storage above the maximum storage of the dam that creates the reservoir.

**C. Dam.** A dam is an artificial barrier, including appurtenant works, constructed to impound water for permanent storage or flood control storage.

**D. Dam Height.** A dam's height is the vertical distance between the lowest point in the original streambed measured at the downstream toe of the dam and the maximum water storage elevation (see Figure 1).

**Figure 1: Dam Height**



**E. Dam Safety Priority Rating (DSPR).** A DSPR is a categorization scheme for a dam that helps us prioritize appropriate actions based on different levels of urgency due to risk.

**F. Hazard Classification.** Hazard classification is a rating based on the potential loss of life or property damage downstream of a dam if the dam were to fail or if dam operations were conducted incorrectly. We do not determine hazard classification based on the existing condition of a dam and its appurtenant structures.

**G. Hydraulic Height.** A dam's hydraulic height is the vertical distance between the maximum design water level and the lowest point in the original streambed measured at the downstream toe of the dam.

**H. Inflow Design Flood.** The inflow design flood is the rate of water coming into the reservoir over time that the dam must be able to safely pass through a combination of spillway and outlet works and attendant surcharge storage.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Engineering and Construction**

**Part 361 Dam Safety**

**Chapter 2 Dam Safety Program Description, Definitions, and Standards**

**361 FW 2**

**I. Inventory Dam.** We include a dam in the Service Inventory of Dams and the National Inventory of Dams if it meets the following criteria:

(1) It has a storage capacity at maximum water storage elevation in excess of 15 acre-feet, and:

(a) It is higher than 25 feet from the natural bed of the stream (or a watercourse) to the maximum water storage elevation measured at the downstream toe of the dam, or

(b) If it is not across a stream channel or watercourse, it is higher than 25 feet measured from the lowest elevation of the outside limit of the dam to the maximum water storage elevation;

(2) It exceeds an impounding capacity at maximum water storage elevation of 50 acre-feet **and** a height measured as [section 2.4I\(1\)](#) above describes in excess of 6 feet; or

(3) It has a high or significant hazard classification.

**J. Maximum Design Water Level.** The maximum design water level is the highest elevation of water determined as a result of safely passing the inflow design flood (see [section 2.16A](#)).

**K. Maximum Water Storage Elevation.** The maximum water storage elevation is the highest elevation of water that the dam can impound, including temporary storage of flood water.

**L. Non-inventory Dam.** Non-inventory dams are:

(1) Low hazard dams that do not meet the criteria in [section 2.4I](#), and

(2) Interior dikes or cross-dikes located within an impoundment.

**M. Probable Maximum Flood (PMF).** The PMF is the runoff flow of water that we expect from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a drainage area under study.

**N. Risk Analysis.** A risk analysis is a qualitative or quantitative procedure that identifies potential modes of failure and the conditions and events that must take place for failure to occur. A quantitative risk analysis yields a numerical estimate of the risk of adverse consequence, multiplying the probability of load times the probability of dam failure. As a result of the analysis, you can estimate the magnitude of adverse consequences if there was a dam failure.

**O. Risk Assessment.** A risk assessment is the process of considering the quantitative or qualitative estimate of risk, along with all related social, environmental, cost, temporal, and other factors to determine a recommended course of action to mitigate or accept the risk.

**P. Screening Level Risk Assessment (SLRA).** An SLRA is a simple approach to identifying and understanding the risks for a dam and providing the basis for prioritization. We typically perform this assessment as part of a dam safety inspection report.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Q. Structural Height.** The structural height of a dam is the vertical distance between the lowest point of the excavated foundation and the top of the dam.

**2.5 How does the Service classify dams?** We classify dams based on hazard potential and a dam's size.

**A. Hazard Classification.** The hazard classification for a dam gives us the minimum requirements for security, investigation, design, emergency preparedness, inspection, and construction.

**(1)** The Regional Dam Safety Officer (RDSO) or the Service's Dam Safety Officer (SDSO) provides a preliminary hazard classification recommendation.

**(2)** The Division of Engineering analyzes the hazard classification, when appropriate, in accordance with the latest version of the [Federal Emergency Management Agency \(FEMA\) 333](#), Department of the Interior policy ([753 DM 1 and 2](#)), and the Bureau of Reclamation (BOR) guidelines, (i.e., [Downstream Hazard Classification Guidelines, Assistant Commissioner Engineering and Research \(ACER\) Technical Memorandum \(TM\) #11](#)).

**(3)** A hazard classification panel assigns a formal hazard classification to Service dams by using the preliminary hazard classification recommendation, the Division of Engineering's hazard classification analysis, and other data.

**(a)** The panel consists of the SDSO's designee(s), the affected RDSO, and an RDSO from another Region. The panel provides a written determination to the SDSO.

**(i)** A majority vote of the panel is required to classify new dams, and

**(ii)** A unanimous vote of the panel is required to change the hazard classification of existing dams.

**(b)** The hazard classification panel determines the formal classification of a dam in accordance with the guidelines in [section 2.5A\(2\)](#).

**(4)** The SDSO reviews the hazard classification of low hazard inventory dams at least every 5 years.

**(5)** The RDSO or the SDSO may request the reclassification of a dam if he/she believes the current hazard classification is in error, the consequences of a failure have changed due to land use changes, or more accurate elevation data becomes available.

**B. Size Classification.** The RDSO or a member of the Service's dam safety inspection team determines the size classification of a dam. They use the dam height or the water storage capacity at maximum water storage elevation, whichever yields the larger size classification, to determine the size of a dam.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Engineering and Construction**

**Part 361 Dam Safety**

**Chapter 2 Dam Safety Program Description, Definitions, and Standards**

**361 FW 2**

(1) *Small dams* are structures that are less than 40 feet high or that impound less than 1,000 acre-feet of water.

(2) *Intermediate dams* are structures that are 40 to 100 feet high or that impound 1,000 to 50,000 acre-feet of water.

(3) *Large dams* are structures that are more than 100 feet high or that impound more than 50,000 acre-feet of water.

## **DOCUMENTS WITHIN THE DAM SAFETY PROGRAM**

### **2.6 What is the Service's Safety Evaluation of Existing Dams (SEED) Inspection Program?**

#### **A. The SEED Inspection Program.**

(1) *Purpose.* The purpose of the SEED Program is to ensure protection of life and property and the integrity of our inventory dams and appurtenant structures (also see [The Federal Guidelines for Dam Safety, FEMA 93, 2004](#)). Periodic inspections disclose conditions that might disrupt operation or threaten dam safety.

(2) *Correction of deficiencies.* We must correct any deficiencies noted as a result of inspections. The Division of Engineering will set priorities and recommend completion dates to correct deficiencies in accordance with the relative level of failure potential and downstream consequences. To determine priorities for maintenance, repair, or removal, the Division of Engineering looks at the adequacy of structures and facilities to continue serving the purpose for which they were constructed and identifies the extent of deterioration.

#### **B. Types of Inspections.** There are six types of inspections:

(1) *Informal inspections* are visual examinations carried out during day-to-day operations. They provide frequent surveillance of the general appearance and functioning of the dam and its appurtenances to identify, as soon as possible, any readily observable changes. For each high and significant hazard dam, Project Leaders and staff perform these inspections in accordance with the dam's Standing Operating Procedures (SOP) (see [section 2.7](#)).

(2) *Formal SEED inspections* assess the safety and integrity of all aspects of a dam. Formal inspections are comprehensive searches for evidence of deterioration of materials, developing weaknesses, and unsafe hydraulic or structural conditions. Engineers perform these inspections, which include:

- (a) Field examinations;
- (b) Photographic or video recording of all physical features;
- (c) Examination of the area downstream of the dam;

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

(d) Review and evaluation of all recorded performance data, including engineering loadings, analytical methods, and monitoring and instrumentation data;

(e) Review and confirmation of the design and analyses of the dam, including an assessment of the assumptions and methodology used in the analyses;

(f) Evaluation of the performance of the dam and a comparison of the long-term examination record with current conditions;

(g) Re-evaluation of the SLRA or the comprehensive review (formal risk analysis), or both;

(h) Review of the status of previous recommendations;

(i) Establishment of an overall condition rating; and

(j) Recommendations and cost estimates to maintain the dam and to correct deficiencies.

(3) *Intermediate SEED inspections* are visual site investigations conducted to identify deterioration of materials, developing weaknesses, and unsafe hydraulic or structural conditions. These inspections do not include a comprehensive evaluation of the engineering loadings and analytical methods to predict dam performance. Engineers perform intermediate SEED inspections, which include:

(a) Field examinations,

(b) Photographic or video recording of all physical features,

(c) Examination of any adjacent endangering conditions,

(d) Confirmation that the overall condition rating is accurate, and

(e) Recommendations and cost estimates to maintain the dam and to correct deficiencies.

(4) *Special inspections* are conducted by duty station staff or the RDSO, or both, and are made following (or during, if possible) unusual floods, significant earthquakes, misoperation, potential security incidents, or the appearance of unexpected dam performance. These inspections determine the extent of any damage and the need for emergency repair or other action.

(5) *Annual checklist inspections* are conducted by the RDSO and include:

(a) Review of monitoring and instrumentation,

(b) Review of the status of previous recommendations,

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

- (c) Visual inspection and photographs,
  - (d) Identification of any additional deficiencies,
  - (e) Recommendations to maintain the dam and correct deficiencies, and
  - (f) Confirmation that the overall condition rating is accurate.
- (6) *Low hazard dam checklist inspections* are conducted by engineers and include:
- (a) Review of the status of previous recommendations,
  - (b) Visual inspection and photographs,
  - (c) Identification of any additional deficiencies,
  - (d) Recommendations to maintain the dam and correct deficiencies, and
  - (e) Confirmation that the overall condition rating is accurate.

**C. Frequency of Inspections.**

- (1) Project Leaders and dam operators perform informal inspections routinely during day-to-day operations in accordance with SOPs.
- (2) The frequency of formal and intermediate inspections is based on the hazard classification of the dam and risk assessment.
- (a) High and significant hazard dams must undergo a formal inspection at least every 5 years. The SDSO determines the frequency of formal and intermediate inspections for these dams based on the most recent SLRA, comprehensive review, and current DSPR.
  - (b) Low hazard dams are also inspected every 5 years. The SDSO determines the type of inspection and may change the frequency based on size, risk, and condition of the dam.

- (3) The frequency of special inspections depends on the occurrence of an unusual event (e.g., seepage through the dam has become turbid). Those responsible for the dam must be alert to identify situations or events that may require special inspections.

**D. Reporting Dangerous or Unusual Conditions.**

- (1) The SEED Inspector must immediately report dangerous or unusual conditions to the Project Leader, RDSO, and SDSO.
- (2) In response to a dangerous or unusual condition, the Project Leader must immediately:

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Engineering and Construction**

**Part 361 Dam Safety**

**Chapter 2 Dam Safety Program Description, Definitions, and Standards**

**361 FW 2**

- (a) If the dam is a high or significant hazard dam, initiate appropriate response in accordance with the dam's Emergency Action Plan (see [section 2.8](#) and [361 FW 3](#))
- (b) If the dam is a low hazard dam, contact the RDSO for technical assistance.
- (c) Also contact the SDSO (if he/she hasn't been contacted already) and the Regional Safety Manager if an inspection indicates imminent danger or threat of serious injury or significant property damage.

**E. Inspection Reports.**

- (1) Use written checklists for informal inspection reports. They contain enough information to determine whether or not further action is necessary and may be obtained from the SDSO or the RDSO.
- (2) Formal and intermediate inspection reports are written reports prepared in a format consistent with established Service guidelines, which can be found within the [DAMS database](#).

**F. Inspectors.**

(1) *Inspectors for informal inspections:* These inspectors:

- (a) May be Project Leaders, dam operators, and other Service personnel who are in the vicinity of the dam in the course of their regular activities. The RDSO may request an individual to conduct informal inspections of a dam.
- (b) Should have a basic knowledge of dams so they can recognize unusual conditions, abrupt changes from previous conditions, and obvious new defects such as seepage, cracks, and displacements.

(2) *Inspectors for formal, intermediate, and special inspections:* Staff from the Division of Engineering, RDSOs, or consultants perform these SEED inspections.

- (a) For high and significant hazard dams, members of the inspection team must include a Registered Professional Engineer trained in the safety inspection of dams.
- (b) For low hazard dams, dam safety professionals must perform the inspections under the direct supervision of a Registered Professional Engineer trained in the safety inspection of dams.

(3) *Training:*

- (a) All Service personnel who perform inspections of high or significant hazard dams must complete 40 hours of approved dam safety or dam security training annually.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Engineering and Construction**

**Part 361 Dam Safety**

**Chapter 2 Dam Safety Program Description, Definitions, and Standards**

**361 FW 2**

(b) All managers at duty stations who have responsibility for high or significant hazard dams must complete 4 hours of approved online or on-site dam safety or security training annually.

**2.7 What are the requirements for writing SOPs?**

**A.** The SDSO must:

(1) Prepare SOPs for all high and significant hazard dams using the established Service format, and

(2) Update SOPs as necessary whenever there are major repairs or rehabilitation to high and significant hazard dams.

**B.** The RDSO must annually review and update, as appropriate, the SOPs for each high and significant hazard dam within the Region.

**2.8 What are the requirements for writing and implementing Emergency Action Plans?**

**A.** The SDSO must prepare Emergency Action Plans for all high and significant hazard dams (see [361 FW 3](#) for more information about Emergency Action Plans).

**B.** The RDSO:

(1) Must annually review the Emergency Action Plan for each high and significant hazard dam within the Region in accordance with procedures in the dam's plan.

(2) Is responsible for:

(a) Annual testing, verification, and certification of Emergency Action Plans by November 1<sup>st</sup>;

(b) Submitting a verification statement, in accordance with the SOPs, along with any revisions to the Emergency Action Plans, to the SDSO annually on or before December 30<sup>th</sup>; and

(c) Distributing revisions of Emergency Action Plans to the plan holders.

**C.** The SDSO is responsible for:

(1) Performing Emergency Action Plan exercises every 5 years, including periodic tests concurrent with formal SEED inspections and tabletop exercises concurrent with intermediate SEED inspections; and

(2) Updating Emergency Action Plans associated with major repair or rehabilitation to high and significant hazard dams.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

## **STANDARDS FOR NEW DAMS**

### **2.9 What is the approval process and procedure for building new dams?**

**A. Review and Approval.** Table 2-1 shows who must review and approve or decline to approve all plans, designs, drawings, and construction specifications for new Service dams by performing a Qualified Engineering Review and Approval.

**Table 2-1: Who Must Review and Approve Plans, Designs, Drawings, and Specifications for New Dams**

<b>Type of Dam</b>	<b>Approving Official(s)</b>
Non-inventory dams	The RDSO
Low hazard inventory dams	The RDSO and SDSO (The SDSO must upload design and construction documents to the DAMS database.)
High and significant hazard dams	The SDSO (The SDSO must also obtain an independent review by an outside organization, such as the Bureau of Reclamation, the Army Corps of Engineers, or a consultant.)

### **B. Project Planning, Design, and Construction.**

**(1)** For high and significant hazard dams, the SDSO or a designee serves as the project manager for planning (including environmental impacts), design, permitting, and construction.

**(2)** For all low hazard inventory and non-inventory dams, the Regional Engineer designates the RDSO or another qualified Engineering staff person to be the project manager for planning (including environmental impacts), design, permitting, and construction.

**(3)** The RDSO or a Service consultant recommends whether a new dam is an inventory or non-inventory dam. He/she sends this recommendation, along with the vital statistics of the dam, to the SDSO.

**(4)** The SDSO reviews the determination and supporting data and adds the dam to the Service inventory, if appropriate.

**2.10 How does the Service address newly acquired dams?** Before acquiring new lands, we must identify any dams being conveyed with the property. We must inspect and classify the dams and clearly identify any needed rehabilitation or repair costs before we acquire the land.

**A.** The RDSO must ensure that a SEED inspection is performed as part of the Engineering Assessment we conduct for all proposed land acquisitions (see [341 FW 2 and section 2.6](#)).

**(1)** The SEED inspection should describe:

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

- (a) The condition of the dam,
- (b) The cost of any work required to bring the dam up to Service safety standards, and
- (c) Future costs and liabilities associated with the dam.

(2) The RDSO must review the SEED report and approve it before it can be included with the Engineering Assessment. The Engineering Assessment must clearly state any significant deficiencies and costs associated with the dam(s) and must be included in the Decision Document the Region’s Engineering Division gives to the Regional Director for approval (see [341 FW 1](#)).

**B.** The acquisition contract or other legally enforceable agreement should include the cost associated with work required to bring the dam up to Service safety standards, including modifications, repairs, and development of Emergency Action Plans and SOPs. Land acquisition budget requests should include the costs for SEED inspections and SEED II studies (see [341 FW 3](#)). SEED II studies are detailed assessments of the design and condition of dams and normally include hydrologic and hydraulic, structural, and geotechnical analyses (stability, seepage, liquefaction, etc.).

**C.** The RDSO must ensure that SEED II studies are performed on all newly acquired dams.

**STANDARDS FOR EXISTING DAMS**

**2.11 What is the process for rehabilitating, modifying, or repairing an inventory dam?**

**A. Review and Approval.** Table 2-2 shows who must review and approve or decline to approve all plans, designs, drawings, and construction specifications for modifying existing Service dams by performing a Qualified Engineering Review and Approval.

**Table 2-2: Who Must Review and Approve Plans, Designs, Drawings, and Specifications for Existing Dams**

Type of Dam	Approving Official(s)
Non-inventory dams	The RDSO
Low hazard inventory dams less than 15 feet in height	The RDSO (The RDSO must upload design and construction documents to the DAMS database.)
Low hazard inventory dams 15 feet or more in height	The RDSO and SDSO. (The RDSO must upload design and construction documents to the DAMS database.)
High and significant hazard dams	The SDSO (The SDSO must also obtain an independent review by an outside organization, such as the Bureau of Reclamation, the Army Corps of Engineers, or a consultant.)

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**B. Project Planning, Design, and Construction.**

(1) For existing high and significant hazard dams, the SDSO or a designee serves as the project manager for planning (including environmental impacts), design, permitting, and construction.

(2) For existing low hazard inventory dams and non-inventory dams, the Regional Engineer designates the RDSO or another qualified Engineering staff person to be the project manager for planning (including environmental impacts), design, permitting, and construction.

**C. Major rehabilitation or modification may include:**

(1) Raising a dam crest,

(2) Enlarging or replacing spillways and outlets, and

(3) Constructing or modifying auxiliary or emergency spillways.

**D.** Major rehabilitation, modification, or emergency repair does not include annual operation and maintenance work such as repair to gates, repair of erosion on embankments, simple concrete repair, etc.

**2.12 How is funding requested for investigations, safety modifications, operations and monitoring, and rehabilitation of dams?** Table 2-3 shows who should request funding for modifying and operating dams.

**Table 2-3: Requesting Funding**

Type of Project	Responsible Official(s)	How Requested
<b>A.</b> Routine maintenance, operations, monitoring, and minor repairs of high and significant and low hazard dams	Project Leaders	Station Annual Operation and Maintenance Fund
<b>B.</b> Priority 1 and 2* recommendations, except recommendations for engineering studies or major repair or rehabilitation	Project Leaders and Regional Facilities Chief	Station Annual Operation and Maintenance Fund, Resource Management funds, or Construction funds
<b>C.</b> Engineering evaluations, planning, design, and construction of major rehabilitation or modification to low hazard dams and appurtenances and non-	Project Leader, in consultation with the Regional Facilities Chief, the RDSO, and the Regional Engineer	Resource Management or Construction funds through Deferred Maintenance (DM) or the Construction 5-year Plan

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

Type of Project	Responsible Official(s)	How Requested
inventory dams		
<b>D.</b> Engineering evaluations, planning, design, and construction of major rehabilitation or modification to high and significant hazard dams and appurtenances	SDSO, through the Chief, Division of Engineering in consultation with the Project Leader, the Regional Facilities Chief, and the Regional Engineer	Construction funds through the Construction 5-year Plan

\*P1 Recommendations indicate that the normal condition of the structure is impaired and the safety of the structure is in jeopardy.

P2 Recommendations are mainly maintenance deficiencies that do not threaten the safety of the dam; however, continued deterioration or unusual loadings may threaten the safety of the dam.

## COORDINATING WITH OTHER ENTITIES

**2.13 How does the Service coordinate with state dam safety programs?** We consult on the design and safety of dams with the dam safety program officials in the states in which we own or operate dams or propose their construction. We also invite state officials to participate in dam safety inspections and Emergency Action Plan exercises.

**2.14 How are dam safety responsibilities ensured for non-Federal dams on Service property?**

**A.** Service employees must not approve the construction of new non-Federal dams on Service property.

**B.** The non-Federal entity who owns an existing dam on Service property is responsible for ensuring the dam complies with state regulations and the [Federal Guidelines for Dam Safety](#) (FEMA 93 April, 2004). Although Service inspection teams do not inspect private dams on Service property, the SDSO maintains a list of the dams.

**C.** We must assign responsibilities for performing necessary dam safety functions to the non-Federal dam owner in a Memorandum of Agreement (MOA) with the dam owner.

**(1)** Responsibilities must include:

- (a)** Performing routine inspections and safety inspections by a qualified Professional Engineer,
- (b)** Operation and maintenance,
- (c)** Repairs and rehabilitation, including emergency repairs, and
- (d)** Emergency preparedness.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

**Engineering and Construction**

**Part 361 Dam Safety**

**Chapter 2 Dam Safety Program Description, Definitions, and Standards**

**361 FW 2**

**(2)** In addition, the MOA must require the non-Federal dam owner to contact the Project Leader if he/she identifies significant dam safety deficiencies or unusual circumstances.

**D.** The Project Leader must verify that the dam owner has a dedicated funding source to ensure that the necessary dam safety actions listed above will be conducted.

**E.** The Division of Engineering should enter into an MOA with the state dam safety official to have the state dam safety program perform inspections and regulatory oversight of the private dam.

**2.15 What are the requirements for state dam projects to which the Service provides funding?**

**A.** We may provide funds to supplement approved state dam safety projects on a cost-sharing basis through the Federal Assistance Program.

**B.** For all inventory dams for which we provide funds (see [section 2.4I](#)), we must obtain:

**(1)** Reasonable assurances that the dam owner has a dedicated funding source to safely operate and maintain the dam and that there is an Emergency Action Plan for any high and significant hazard dams; and

**(2)** Certification from the state dam safety official that any proposed project involving the construction, enlargement, or rehabilitation of a dam (including appurtenant works) satisfies the criteria for an inventory dam and meets Federal requirements. The certification must attest to the following:

**(a)** The hazard classification and size category of the dam are correct and its present condition and deficiencies have been accurately identified;

**(b)** The proposed project has been designed by a Professional Engineer who is qualified in dam design and construction to meet Federal standards for dam design, construction, and rehabilitation, including, but not limited to, the [Federal Guidelines for Dam Safety](#) (FEMA 93, 2004), and any other technical requirements identified in the Federal Assistance project agreement documents;

**(c)** The state dam safety program will perform inspections and regulatory oversight of the dam, including construction oversight;

**(d)** There is a dedicated funding source that will provide for future operation, inspection, maintenance, and repairs of the dam;

**(e)** If the dam is a high and significant hazard dam, there is an Emergency Action Plan in effect for the dam that meets the requirements of [Emergency Action Planning for Dam Owners](#) (FEMA 64, 2004); and

**(f)** Federal and state permits will be obtained prior to construction.

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

C. The requirements in [section 2.15B](#) do not apply to non-inventory Federal Assistance dams.

## **TECHNICAL STANDARDS**

**2.16 What are the technical standards for the Dam Safety Program?** The planning, design, construction, and rehabilitation of all inventory dams, non-Federal dams on Service land, and dams that receive Service funding must follow the technical standards below and in [361 FW 1](#) and [3](#).

### **A. Inflow Design Flood.**

(1) Service inventory dams must meet the inflow design flood standards in [Exhibit 1](#).

(2) If the Project Leader or Regional Engineer needs a waiver from the inflow design flood standards in [Exhibit 1](#):

(a) For high or significant hazard dams, he/she must obtain the waiver from the Chief, Division of Engineering and the SDSO.

(b) For low hazard inventory dams, he/she must obtain the waiver from the SDSO and the RDSO.

(3) Approval of inflow design floods other than those in [Exhibit 1](#) may be granted only after performing an incremental damage assessment or risk-based analysis to determine if a waiver is appropriate.

(a) Studies and mapping must clearly demonstrate that consequences of dam failure at flood flows larger than the selected inflow design flood will not increase projected loss of life and will have no significant incremental increase on property damage. All inflow design floods must follow [FEMA 97](#), Federal Guidelines for Selecting and Accommodating Inflow Design Floods for Dams or a more conservative approach. Analysis must include existing structures and inhabitants and projected (i.e., over the next 20 years) structures and inhabitants based on approved planning. The incremental increase in property damage versus the potential frequency of floods must be clearly identified in a management decision chart.

(b) The RDSO or the SDSO must provide the proposed inflow design flood using an incremental damage assessment or risk-based analysis to the affected state dam safety office for review and discussion.

(c) The minimum inflow design flood for high and significant hazard dams must at least meet the 500-year flood frequency.

**B. Freeboard Requirements.** Freeboard is the vertical distance from the water surface to the top of the dam. Freeboard should meet the requirements of [ACER TM No. 2](#), Freeboard Criteria

**FISH AND WILDLIFE SERVICE  
ENGINEERING AND CONSTRUCTION**

and Guidelines for Computing Freeboard Allowances for Storage Dams, Bureau of Reclamation (BOR), 1992 or the latest revision.

**C. Low-Level Outlets.** All inventory dams must have a low-level outlet that can evacuate the major portion of the reservoir storage volume by gravity flow.

(1) Only the SDSO may approve waivers to this requirement.

(2) Criteria for reservoir draining should recognize site-specific conditions, economic aspects, and project needs to provide an acceptable balance between costs and rates of draining and filling. Draining times established for a dam reflect downstream channel capacity, level of risk to the dam, and hazard potential to the downstream areas. Low-level outlet works, in conjunction with other release facilities, should meet the requirements in ACER TM No. 3, Criteria and Guidelines for Evacuating Storage Reservoirs and Sizing Low-level Outlet Works, BOR, 1990 or the latest revision.

(3) For small, low-hazard inventory dams, the low-level outlet works, in conjunction with other release facilities, should be located and sized to draw down the reservoir within 1 to 4 months, at a minimum, to the lower of the following levels:

(a) The reservoir level commensurate with a storage capacity that is 10 percent of that at the normal reservoir level, or

(b) The reservoir level with less than 50 percent of the hydraulic height.

**D. Risk Analyses.** The Division of Engineering may use risk assessments to assist in decision making, prioritizing repairs, determining inspection frequencies, and establishing acceptable risk values in accordance with BOR's Tolerable Risk Guidelines. The assessments estimate the annual probability of failure and annualized loss of life due to the failure or misoperation of the dam.

(1) The average annual loss of life probability should be less than or equal to 1 in 1,000.

(2) The annual failure probability of the structure should be less than or equal to 1 in 10,000.

/sgd/ James W. Kurth  
DEPUTY DIRECTOR

Date: August 31, 2018