

# Reclamation Manual

## Directives and Standards

<b>Subject:</b>	Review/Examination Program for High and Significant Hazard Potential Dams
<b>Purpose:</b>	To ensure the Bureau of Reclamation's Facility Review Program and related site inspections and examinations for high and significant hazard potential dams are effectively and consistently implemented throughout Reclamation. The primary benefits of this Directive and Standard (D&S) are dams are operated and maintained properly and effectively, will continue to provide authorized project benefits, and will not create unacceptable risks to public safety and welfare, property, and the environment.
<b>Authority:</b>	The Reclamation Act (Act of June 17, 1902, ch. 1093, 32 Stat. 388); and Departmental Manual (DM) Part 753 – <i>Dam Safety and Security Program</i>
<b>Approving Official:</b>	Director, Dam Safety and Infrastructure
<b>Contact:</b>	Dam Safety Office (86-67100); Asset Management Division (86-67200)

1. **Introduction.** The review/examination program outlined under this D&S represents those related activities historically conducted on high and significant hazard potential dams under the Review of Operation and Maintenance (RO&M) and the Safety Evaluation of Existing Dams (SEED) Programs. Because of the close coordination and program interface necessary in the implementation of the review/examination activities, a determination was made to combine the related activities under a single program.
2. **Applicability.** This D&S applies to all Reclamation staff with operational, jurisdictional, review, or oversight responsibilities for Reclamation-owned high and significant hazard potential dams identified in Section 12 of Public Law 95-578, 95th Cong. (92 Stat. 2471), the Reclamation Safety of Dams Act of 1978, as amended.
3. **Program Goals.** Reviews/examinations of high and significant hazard potential dams will be conducted to ensure:
  - A. no dams create a risk to public safety and welfare, property, the environment, or cultural resources;
  - B. all dams continue to provide authorized project benefits;
  - C. each dam is operated and maintained properly and effectively;
  - D. operating and emergency management procedures are adequate and current;
  - E. liability to the federal government is reduced;
  - F. the effectiveness of other program issues related to operation and maintenance (O&M) activities is monitored;

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- G. technical exchange of information is promoted;
- H. familiarity with the dam is maintained by, and training is provided to, operating staff; and
- I. compliance with contract (water repayment and water service contracts, O&M transfer agreements, etc.) provisions related to safe and reliable operation of the dam is verified.

#### 4. Program Implementation.

##### A. Responsibilities.

- (1) The Director of Dam Safety and Infrastructure establishes guidance for conducting formal facility reviews; coordinates training opportunities for offices and staff involved in the review of high and significant hazard potential dams; and ensures program records are in compliance with Reclamation Manual (RM) D&S, *Information Management* ([RCD 05-01](#)).
- (2) Regional directors are responsible for coordinating a program of review/examination activities and providing oversight of area office compliance with the requirements of this D&S.
- (3) Area managers are responsible for managing the review/examination program for high and significant hazard potential dams; collaborating with operating entities of transferred works on all aspects of review/examination activities; and updating the status of O&M recommendations, including schedules and cost estimates, at least annually (prior to October 1 for performance goal reporting) in the Dam Safety Information System (DSIS).

**B. Listing of Dams.** A comprehensive and current listing of high and significant hazard potential dams (dams owned by Reclamation or included in an authorized project) will be maintained by the Director of Dam Safety and Infrastructure.

- (1) **Hazard Reclassification.** Reviews of low hazard potential dams will include any downstream site conditions affecting the dam's hazard classification.<sup>1</sup> The Dam Safety Office and Asset Management Division will be notified of any significant downstream observations resulting in reassessment of the hazard classification. The related tabular inventory of high, significant, and low hazard potential dams will be updated and provided as a report in the DSIS.

**C. Funding.** Unless otherwise noted, costs associated with the reviews/examinations performed on high and significant hazard potential dams for dam safety purposes will

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<sup>1</sup> RO&M examinations of all low hazard potential dams are part of periodic reviews conducted in accordance with RM D&S, *Review of Operation and Maintenance (RO&M) Program Examination of Associated Facilities (Facilities Other Than High- and Significant-Hazard Dams)* ([FAC 01-04](#)).

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be non-reimbursable. The review of O&M practices and procedures are an integral part of evaluating the structural condition and performance of dams and providing safety for the downstream public; therefore, these costs will also be non-reimbursable.

5. **Review/Examination Procedures.** The review/examination program for all high and significant hazard potential dams will consist of annual site inspections (ASIs), periodic facility reviews (PFRs), comprehensive reviews (CRs), examinations of normally inaccessible features, and special examinations.

A. **ASI.**

- (1) **Scope/Content.** The ASI will consist of a general condition assessment of pertinent features using a checklist developed specifically for that dam. The ASI checklist is combined with, or augmented by, a narrative describing deficient conditions and recommended observations outlined in the ongoing visual inspection checklist (OVIC) of the previous CR report. Content will encompass the following issues, as applicable:
- (a) structural integrity and performance of the dam, foundation, abutments, and appurtenant structures;
  - (b) operational problems (e.g., utility crossings, right-of-way encroachment);
  - (c) special and inaccessible feature examination needs and frequency (e.g., underwater, dewatered, rope access);
  - (d) public safety concerns;
  - (e) follow-up of previous O&M and safety of dams (SOD) recommendations and the current status of completion; and
  - (f) review documentation of required exercising and testing (e.g., gates, valves, and auxiliary generators).<sup>2</sup>
- (2) **Site Inspection Preparation.** Preparing for the ASIs will consist of reviewing applicable material and completing a job hazard analysis (JHA). Preparation will include a review of:
- (a) the history of the facility (if not already familiar);
  - (b) recent (since last formal facility review) ASI checklists;

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<sup>2</sup> If exercising or testing occurred since the last examination or inspection.

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- (c) previous RO&M, SEED, CR, PFR, special examination, and inaccessible feature inspection reports and correspondence;<sup>3</sup>
  - (d) previous O&M and SOD recommendations and the current status of completion; and
  - (e) the JHA (paragraph 6).
- (3) **Frequency/Schedule.** The frequency will be annual. The schedule within the fiscal year for conducting these inspections is at the discretion of the area manager responsible for the facility. Consideration must be given to conducting these inspections at varying loading conditions (e.g., reservoir levels). Conditions identified in the Evaluation of Performance Monitoring and Instrumentation and Future Performance Monitoring section of the CR report will provide additional basis for the timing of the inspection. ASIs are only required to be performed during the years when PFRs or CRs are not performed.
- (4) **Personnel Involvement.** Conducting ASIs is the responsibility of, and is conducted by personnel from, the responsible area office. The personnel managing the ASI must be one office removed from the facility. Additionally, as part of the preparation or review of the Potential Failure Modes, Evaluation of Performance Monitoring and Instrumentation and Future Performance Monitoring sections of the CR report, particular expertise (e.g., a geotechnical engineer) to address particular concerns on these inspections will be identified and included in the group performing the inspection. It is also possible extra attention will need to be given to a concern by persons with expertise at times other than the ASI. The personnel shall consult with the Technical Response Team (TRT) as appropriate.
- (5) **Training/Experience.** Personnel involved in conducting the ASIs must understand the principles related to the design, construction, and O&M of dams and dam safety. Personnel leading ASIs must have, at a minimum:
- (a) reviewed the Training Aids for Dam Safety (TADS) modules related to the inspection of dam features;
  - (b) attended either a SEED Seminar, facility review workshop, or a dam operator training session within the previous 4 years;
  - (c) participated on a PFR and/or CR team for a high and significant hazard potential dam; and

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<sup>3</sup> Particularly the Potential Failure Mode and Risk Analysis and Evaluation of Performance Monitoring and Instrumentation sections of the CR report.

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- (d) other training as applicable.
- (6) **Documentation.**
- (a) The documentation for an ASI will consist of a completed checklist with accompanying photographs and descriptive narratives.
  - (b) Descriptions of areas of concern shall explain each issue and allow a determination of the need for a normal recommendation.
  - (c) The documentation will include the identification of any modifications or changes in the operating procedures that would require a revision to the standing operating procedures.
  - (d) The documentation will include a status update of outstanding O&M recommendations (e.g., all Category 1, 2, and 3 O&M recommendations that were new or had an “Incomplete” status in the previous ASI, PFR or CR report.)
  - (e) Review of all O&M recommendations which changed status to “completed” or “deleted” since the previous ASI, PFR or CR report. All “deleted” recommendations will remain outstanding until verified as part of the next PFR or CR.
  - (f) Photographs are required for identified areas of concern and of those areas identified within Evaluation of Performance Monitoring and Instrumentation and Future Performance Monitoring sections of the CR report.
  - (g) The documentation will identify any special or normally inaccessible feature examinations needed prior to next PFR or CR.
  - (h) A listing of new O&M recommendations made as a result of the review/examination.
- (7) **Report Transmittal.** The ASI documentation, including completed checklists, must be distributed electronically within 60 calendar days of the inspection, unless justifiable delays exist and are documented, to appropriate operating offices/entities, regional and area offices, Dam Safety and Infrastructure, and Dam Safety Office, for inclusion within the Department of the Interior’s official records repository.<sup>4</sup>

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<sup>4</sup> Follow the current processes for ASI transmittal guidance available on the [Dam Safety References](#) Intranet site.

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- (8) **Funding.** Expenses incurred by Reclamation in conducting or participating in these ASIs are non-reimbursable costs (e.g., non-reimbursable O&M) funded by the responsible regional or area office.
- B. **TRT Dam Performance Assessment.** The TRT is a facility-specific multidisciplinary team which conducts facility performance assessments.
- (1) **Scope/Content.** The TRT Performance Assessment session will include the following agenda items:
- (a) review and discussion of operations during the past several years;
  - (b) review of instrumentation and visual monitoring data;
  - (c) discussion of the Dam Safety Priority Rating (DSPR) and the factors which support the rating; and
  - (d) summary of assessment findings.
- (2) **Objectives.** The objectives of the TRT Performance Assessment are to:
- (a) complete a focused and thorough review of the performance of the dam based on the available data and information;
  - (b) analyze and discuss the visual inspections, instrumentation data, and other monitoring data on the project to identify successful performance or spot any unusual behavior or trends in the context of potential failure modes;
  - (c) provide an up-to-date review and analysis of the dam's performance based on the previous CR work, the previous PFR, and the current instrumentation data;
  - (d) ensure the TRT for each project is engaged and mobilized to enable effective, knowledgeable response to technical issues that may arise at the project;
  - (e) support and enhance the accomplishment of the next PFR by providing an intermediate, detailed review of the dam performance information and thereby identifying any issues or conditions to be considered and examined during the PFR; and
  - (f) fulfill the concept of the performance parameters principle of ongoing utilization of instrumentation and visual monitoring by providing:
    - (i) a periodic, focused, multidiscipline review and evaluation of specific monitoring and visual inspection information data keyed to identified potential failure modes; and

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- (ii) an examination of all instrumentation performance, to ensure other potential failure modes are not developing (previously considered or newly identified).
- (3) **Frequency/Schedule.** The TRT Performance Assessment sessions take place in preparation for an upcoming PFR and whenever an incident or unusual performance is observed or predicted. The TRT should be scheduled no later than 3 months prior to the planned PFR.
- (4) **Personnel Involvement.** The TRT consists of members of the Technical Service Center (TSC) project team and those Reclamation personnel in the regional, area, and field offices or others with close association with the evaluation of the dam's ongoing performance and operations, including the principal engineer, geotechnical engineers, structural engineers, and instrumentation personnel.
- (5) **Documentation.** Documentation of the TRT Performance Assessment session will consist of meeting notes reflecting the discussions and a listing of all resulting action items.

### C. PFR.

- (1) **Scope/Content.** The PFR is to be conducted as a combined examination, fulfilling the purposes of the RO&M Program and to address potential dam safety issues and concerns. Content will encompass the following issues, as applicable:
  - (a) structural integrity and performance of the dam, foundation, abutments, and appurtenant structures;
  - (b) performance monitoring and instrumentation;
  - (c) emergency action plans/emergency management plans;
  - (d) operating procedures/documentation;
  - (e) operator training (adequacy/needs);
  - (f) maintenance management/practices;
  - (g) operational problems (e.g., utility crossings, right-of-way encroachment);
  - (h) floodplain management issues (e.g., safe downstream channel capacity);
  - (i) special examination needs and frequency (e.g., underwater, dewatered, technical climbing);
  - (j) public safety concerns; and

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- (k) reviewing all outstanding Category 1, 2, and 3 O&M recommendations including those completed or deleted since last CR.
- (2) **Site Examination Preparation.** Preparation for the site examination will include:
- (a) attending the TRT meeting in accordance with paragraph 5.B;
  - (b) becoming familiar with the history of the facility (if not already familiar);
  - (c) reviewing recent (since last formal facility review) annual site inspection checklists completed for the facility;
  - (d) reviewing previous RO&M, SEED, PFR, CR, ASI checklist reports, special examination, and inaccessible features inspection reports and related correspondence;
  - (e) reading past O&M and SOD recommendations and knowing the current status of completion;
  - (f) reading applicable operating criteria and procedures (e.g., design summaries, designers' operating criteria, standing operating procedures, emergency action plan);
  - (g) identifying past and ongoing dam safety analysis and construction work; and
  - (h) developing a comprehensive JHA (paragraph 6).
- (3) **Frequency/Schedule.** PFRs will be performed every 8 years, alternating every 4 years with the CRs. The PFR team leader will coordinate with all involved offices to develop the schedule for PFRs. Site visits for SOD technical studies (e.g., issue evaluation (IE), corrective action studies (CAS), etc.) will be combined with PFRs whenever practical for efficiency purposes and on a case-by-case basis. In some cases, the periodic equipment testing frequency requirements may coincide with the PFR frequency. In performing reviews, the PFR team may have to rely on periodic testing by qualified staff performed outside of the PFR frequency.
- (4) **Personnel Involvement.** The team leader will be from the regional office; however, this can be reassigned to an area office upon mutual agreement between the two offices, provided the area office is, at a minimum, one office removed from the operating office/entity (to provide an independent review). For transferred works facilities managed by an operating entity the area office having jurisdiction is considered one office removed. The regional office can also request the TSC to provide a team leader/member(s) for this review. This will consist of an area office representative, a regional office representative, and those selected by the team leader for specified technical expertise. Additionally,



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pertinent operating personnel are required to be onsite as part of the review. The area manager will also invite at least one representative of users or customers who have the responsibility for all or part of the dam's O&M to participate, at their own expense, as a member of the team conducting the PFR. This representative will be involved in the review process from start to finish, including the development of specific O&M recommendations. However, the Reclamation examination team leader will determine the final O&M recommendations to be included in the PFR report. Participation in the onsite review activities by users and customers will be subject to applicable security and safety considerations. Users and customers will be informed the number of representatives may need to be limited and determined on a case-by-case basis by the area office representatives involved in the review.

- (5) **Training/Experience.** The team leader is required to have:
- (a) a thorough knowledge of principles related to O&M and safety of a dam;
  - (b) significant experience in the inspection of dams;
  - (c) attended either a SEED Seminar, facility review workshop, or a dam operator training session within the previous 4 years;
  - (d) reviewed TADS modules related to the inspection of applicable dam features;
  - (e) reviewed [RO&M Field Examination Guidelines](#); and
  - (f) be a licensed professional engineer or the corresponding review report will be peer reviewed and signed by a licensed professional engineer in accordance with the requirements in RM Policy, *Peer Review of Scientific Information and Assessments* ([CMP P14](#)).
- (6) **Documentation.** Documentation will consist of a detailed report addressing both the O&M and dam safety of the facility. At a minimum, the report will include:
- (a) the name of the author(s) and associated office(s);
  - (b) the date(s) of the examination;
  - (c) the names and offices of other participants in the review/examination;
  - (d) the operational conditions and weather data at the time of the review/examination (including any occurrence of precipitation prior to or during the facility review) which may have an impact on field observations;

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- (e) the status of all previous O&M and SOD recommendations (those made during last review/examination and any others remaining outstanding at that time, including those deleted or completed since the last examination);
  - (f) a listing of new O&M recommendations;
  - (g) a brief description of the dam examined;
  - (h) a narrative to describe conditions of the dam and all appurtenances;
  - (i) scope of the examination, as described in paragraph 5.C.(1);
  - (j) observed deficiencies and significant events (e.g., operational incidents, historic high reservoir levels and releases, etc.) supporting the recommendations;
  - (k) a statement describing the need for any special site examinations or special monitoring requirements;
  - (l) a description and results of equipment tests operated (exercised);
  - (m) tabular list of inaccessible features, justification for frequency of examinations, and recommended inspection team (e.g., rope access or underwater);
  - (n) representative photographs of all features of the facility and identified concerns, and drawings, maps, and/or sketches of the dam features or dam site which document pertinent conditions and deficiencies for future reference purposes;
  - (o) signatures of those (at a minimum, team leader and peer reviewer(s)) responsible for preparing/reviewing the report;
  - (p) statements addressing all action items as outlined in the TRT performance assessment session meeting notes; and
  - (q) a copy of the TRT performance assessment session meeting notes, including a tabularized status of each action item as the first appendix to the report (e.g., the table will include the action item number, description of the action item, status of the item as of the completion of the PFR report, and any additional recommended action (post-PFR)).
- (7) **Summary of Recommendations.** For informational purposes, a summary of outstanding and proposed O&M recommendations resulting from each PFR will be transmitted (either by formal memorandum or email) by the team leader within 2 weeks following the actual review/examination date. This summary will be transmitted to all team participants and pertinent Reclamation offices, including

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Dam Safety and Infrastructure. Distribution of the summary to the operating entity will be the responsibility of the area/field office.

- (8) **Report Transmittal.** A draft PFR report will be provided to the responsible TSC principal engineer, the regional and area offices, and Dam Safety and Infrastructure for their review and comment prior to finalizing. Dam Safety and Infrastructure will perform the review in parallel with the principal engineer and shall not extend the review period past the principle engineer's review time. This review and comment process will address any additional effort required by the principal engineer, as outlined in the tabular appendix of the PFR report. Final PFR reports will be transmitted as soon as practical following the review/examination, but within 120 calendar days of the actual review/examination date, unless justifiable delays exist and are documented. Reports must be distributed electronically to appropriate operating offices/entities, regional and area offices, the responsible principal engineer, the applicable state dam safety office, Asset Management Division, and Dam Safety Office, for inclusion within the Department's official records repository.<sup>5</sup> A current distribution list will be periodically updated by the Dam Safety Office and provided to all pertinent Reclamation offices, including Dam Safety and Infrastructure.
- (9) **Data Entry.** Area managers are responsible for scheduling, estimating costs, and updating the status of O&M recommendations annually (prior to October 1 for performance goal reporting) in the DSIS database. All O&M recommendations will be entered into the DSIS by the office producing the report within 30 days of report transmittal.
- (10) **Funding.**
- (a) All associated costs (including preparation, travel, per diem, field review, and report preparation) will be considered non-reimbursable and funded within each region.
  - (b) Funding will be provided within regional and area offices' budgets to cover participation in the PFR, as well as any other staff requested or approved by the team leader for technical expertise, irrespective of office location.
  - (c) Any review activities performed at the time of the PFR not considered to be related to the evaluation of the safety of the dam/downstream public will be funded under other review program funding or cost recoverable similar to other project O&M costs.

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<sup>5</sup> Follow the current processes for PFR transmittal guidance available on the [Dam Safety References](#) Intranet site.

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- (d) Expenses incurred by the operating entity participating in the PFR will be borne, as applicable, as an O&M cost to that facility.

### D. CR.

- (1) **Scope/Content.** This review will consist of:
  - (a) **State-of-the-Art Review and Potential Failure Modes.** This will include a review of the dam and its performance and previous studies/analysis and decisions relative to current state-of-the-art design, loading, structural response and downstream consequences, and construction practices. Included will be a review of the potential failure modes and a revision/development of performance monitoring requirements. Additional or newly identified failure modes, as appropriate, will be developed and evaluated.
  - (b) **Site Examination.** This site examination will have a similar scope to a PFR. When the PFR scope references frequencies based on the last CR, the frequency should, for this section, be based on the last PFR. Some additional focus items for the CR scope will be added as determined by the CR team and review process, including participation by a senior dam engineer. Additional emphasis will be placed on the operational adequacy and reliability of mechanical equipment and features.
- (2) **Site Examination Preparation.** Preparation for the site examination will include:
  - (a) becoming familiar with the history of the facility (if not already familiar);
  - (b) reviewing recent (since last formal facility review) annual site inspection checklists completed for the facility;
  - (c) reviewing previous RO&M, SEED, PFR, CR, ASI checklist reports, special examination, and inaccessible features inspection reports and related correspondence;
  - (d) reading past O&M and SOD recommendations and knowing the current status of completion;
  - (e) reading applicable operating criteria and procedures (e.g., design summaries, designers' operating criteria, standing operating procedures, emergency action plan);
  - (f) identifying past and ongoing dam safety analysis and construction work; and
  - (g) developing a comprehensive JHA (paragraph 6).

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- (3) **Frequency/Schedule.** These reviews will be performed every 8 years, alternating every 4 years with the PFRs. The Chief, Dam Safety Office is responsible for providing overall intra-agency coordination for the scheduling and accomplishment of CRs. The Dam Safety Office and the regional and area offices will coordinate the scheduling for performing these reviews. Site visits for ongoing SOD technical studies (IE, CAS, etc.) will be combined with these reviews, whenever practical, for efficiency purposes on a case-by-case basis. In some cases, the periodic equipment testing frequency requirements may coincide with the CR frequency. In performing reviews, the CR team may have to rely on periodic testing by qualified staff performed outside of the CR frequency.
- (4) **Personnel Involvement.**
- (a) **State-of-the-Art Review.** The CR will be a “team review” of the facility. The overall team leader for these activities will typically be a senior dam engineer from the TSC, as designated by the TSC and approved by the Dam Safety Office. Team participants will be selected by the TSC and regional and area offices. The team will be mostly comprised of members of an assigned TRT. The operating entity, as applicable, may choose to participate on this review team. CR teams will consist of the following members:
- (i) senior engineer;
  - (ii) principal engineer;
  - (iii) peer reviewer;
  - (iv) examination specialist;
  - (v) responsible civil/geotechnical engineer;
  - (vi) responsible geologist;
  - (vii) instrumentation specialist;
  - (viii) mechanical engineer;
  - (ix) hydrologic loadings specialist;
  - (x) seismic loadings specialist;
  - (xi) area office and/or facility representatives;
  - (xii) regional office representative; and
  - (xiii) Dam Safety Office representative.

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(b) **Site Examinations.** For the CR site examination, there will be co-team leaders and signatories to the final report, one from the regional office and one from the TSC. Participants, in addition to the co-team leaders and the designated senior dam engineer, will be limited to those required to review and evaluate the structure. Generally, this will consist of an area office representative, a regional office representative, and those requested by the state-of-the-art review team and the co-team leaders for specialized technical expertise. The co-team leaders, during the early stages of coordinating the site examination, will mutually decide on examination and reporting responsibilities. Unless otherwise justified, all CR site examinations will include the involvement of mechanical engineering expertise, either prior to or during the CR, to verify the condition and operational reliability of all pertinent, non-hydropower mechanical equipment associated with the dam. Personnel involved in the site examination will be those cross-trained in the O&M of various types of mechanical equipment to be encountered at the dam. If the timing is not conducive to participate at the time of the actual CR site examination (due to access or operational constraints), the mechanical inspection portion of the CR will take place at a mutually agreeable time determined by the responsible regional and area offices, sometime within the year preceding the CR. For efficiency, the mechanical inspection is to be combined with other onsite activities, where feasible, such as with the ASI or onsite dam operator's training. The area manager will also invite at least one representative of users/customers who have the responsibility for all or part of the facility's O&M costs to participate, at their own expense, as a member of the team conducting the examination. This representative(s) will be involved in the examination process from start-to-finish, including the development of specific O&M recommendations. However, the Reclamation co-examination team leaders, with input from other team members, will determine the final O&M recommendations included in the examination report. Participation in the examination activities by users/customers will be subject to applicable security and safety considerations. Users/customers will be informed the number of representatives may need to be limited and will be determined on a case-by-case basis by the area office representatives involved in the examination.

(5) **Training/Experience.**

(a) **State-of-the-Art Review Team.** The senior dam engineer and other team members are to possess current state-of-the-art practice and/or knowledge, have at least 10 years of experience, be currently licensed as a professional engineer, and have an extensive knowledge of dam incidents and dam safety concerns and deficiencies. (Note: Seismology and Geology do not have a licensing program.) If the senior dam engineer and members do not possess the above-described experience/qualifications, it is required for a corresponding peer reviewer to possess the experience/qualifications. In

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addition to these minimum requirements, the senior dam engineer will be approved by the Dam Safety Office.

- (b) **Site Examination Team Leader.** The same training/experience as required for a PFR team leader outlined in paragraph 5.C.(5).
- (6) **Documentation.** At a minimum, the CR report package must include:
  - (a) signatures of applicable team leaders, peer reviewers, participants responsible for preparing and/or reviewing the various sections and any appropriate management concurrence;
  - (b) decision document and technical report of findings (TROF);
  - (c) results of the background data/information review of the dam and its performance, and previous analysis and decisions relative to current state-of-the-art in design, loading, and construction practices;
  - (d) analysis/evaluation of instrumentation data compiled;
  - (e) potential failure mode and risk analysis;
  - (f) evaluation of visual and instrumented structural performance;
  - (g) conclusions regarding dam safety and continued safe operation;
  - (h) updated performance and/or operating parameters;
  - (i) the status of all previous O&M and SOD recommendations (those made during last review/examination and any others remaining outstanding at that time, including those deleted or completed since the last PFR or ASI);
  - (j) tabular list of inaccessible features, justification for frequency of examinations, and recommended inspection team (e.g., rope access or underwater);
  - (k) any recommended actions resulting from the review, including:
    - (i) SOD;
    - (ii) O&M;
    - (iii) future performance monitoring;
    - (iv) additional analytic studies (based on an assessment of risk);
    - (v) additional data gathering, including instrumentation or special monitoring needed (based on an assessment of risk);

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- (vi) need for and frequency of special site examinations; and
  - (vii) need for comprehensive assessment of risk;
  - (l) updated bibliography of reference documents;
  - (m) photographs, drawings, sketches;
  - (n) consequences; and
  - (o) documentation for the site examination for the CR must conform to the requirements as outlined in paragraph 5.C.(6).
- (7) **Summary of Recommendations.** For informational purposes, a summary of known and proposed O&M recommendations resulting from the CR site examination will be transmitted (either by formal memorandum or email) by the team leader within 2 weeks following the actual examination date. This summary will be transmitted to all team participants and pertinent Reclamation offices, including the Dam Safety Office and Asset Management Division. Distribution of the summary to the operating entity will be the responsibility of the area/field office.
- (8) **Report Transmittal.** A draft CR report will be provided to the responsible TSC principal engineer, the regional and area office, and Dam Safety and Infrastructure, for their review and comment prior to the Dam Safety Advisory Team (DSAT) meeting. The Dam Safety and Infrastructure reviewers will perform the review in parallel with the principal engineer and shall not extend the review period past the principle engineer's review time. This review and comment process will address any additional effort required by the principal engineer, as outlined in the tabular appendix of the CR report. Final CR reports will be completed as soon as practical following the site examination, but within 120 calendar days of the actual examination date, unless justifiable delays exist and are documented to the Dam Safety Office. Final reports will be transmitted electronically by the Dam Safety Office to appropriate operating offices/entities, Reclamation's regional and area offices, Asset Management Division, and TSC offices following completion of the Decision Document. The Dam Safety Office will upload the final version into the Department's official records repository.<sup>6</sup>
- (9) **Data Entry.** Regional offices will ensure O&M recommendations with associated cost estimates and schedules for completion resulting from these reviews and updating of the status, schedule, and cost estimates of existing O&M recommendations will be entered into the DSIS within 30 days of report transmittal.

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<sup>6</sup> Follow the current processes for CR transmittal guidance available on the [Dam Safety References](#) Intranet site.



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- (10) **Funding.** All associated costs (including state-of-the-art review, site examination preparation, travel, per diem, site examination, and report preparation) will be considered non-reimbursable and funded in accordance with the following:
- (a) funding for preparation and participation in the examination and associated report will be the responsibility of each regional or area office;
  - (b) the remainder of the costs associated with the CR (e.g., those costs incurred by TSC personnel) will be funded under the SEED program by the Dam Safety Office;
  - (c) any review activities performed at the time of the CR not considered to be related to the evaluation of the safety of the dam/downstream public will be funded under other review program funding or cost recoverable similar to other project O&M costs; and
  - (d) expenses incurred by the operating entity, as applicable, in participating in the CR will be borne as their cost.

### E. Examinations of Normally Inaccessible Features.

- (1) **Scope/Content.** Regular evaluation and visual examination/monitoring of such features is necessary to ensure safe and reliable dam operation. During the course of regularly scheduled PFRs and CRs, there is a need for the review teams to address those features normally inaccessible much of the time due to reservoir or tailwater conditions, operational commitments, and/or access constraints.
- (a) **Applicable Typical Features.** Typical inaccessible features include:
- (i) stilling basins (spillways/outlet works);
  - (ii) intake structures (spillways/outlet works);
  - (iii) gate structures (spillways/outlet works);
  - (iv) certain portions of bridges;
  - (v) tunnels/conduits/pipelines (spillways/outlet works);
  - (vi) drains and toe drains; and
  - (vii) abutments/faces of concrete dams.
- (2) **Frequency/Schedule.**
- (a) **Evaluation.** Similar to the way “readily accessible” features are evaluated while conducting PFRs and CRs of all high and significant hazard potential

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dams, all normally inaccessible features associated with the dam require at least minimal level of evaluation every 4 years to determine the appropriateness for any further in-depth field examination, design analysis, and/or nondestructive testing. This type of evaluation is necessary to assert past visual examination extent, or lack thereof, and visual examination frequency of these types of features is appropriate.

- (b) **Visual Examination.** Unless justification is provided to the facility review team, based on the factors, process, and referred requirements contained in paragraph 5.E.(3), the maximum time interval between visual examinations (considered “hands on” or equivalent) of all normally inaccessible features at high and significant hazard potential dams will be 8 years. Additionally, normally inundated outlet works features must be examined whenever facility operating conditions permit an examination with little additional provision or expense, such as when a low reservoir pool occurs or outlet works dewatered.

### (3) **Evaluation.**

- (a) **Factors.** The following factors must be considered in determining the extent and frequency for examining normally inaccessible features:
  - (i) results of previous “hands-on” or equivalent examination;
  - (ii) relative progression of changed conditions noted about the feature;
  - (iii) operational history and performance of the feature since its previous examination;
  - (iv) relative costs for providing access for examination of the feature, including costs associated with lost water and power revenues;
  - (v) age of the feature;
  - (vi) critical function of the feature; and
  - (vii) any site conditions which may compromise the safety of the feature.
- (b) **Process.** Based on the factors listed above, an evaluation must be made by the facility review (CR and PFR) team of the appropriate frequency and extent to which the feature will be examined. This will vary from examination to examination based on recent information. Facility review personnel making the evaluation will begin by evaluating whether 8 years, or more frequent, is appropriate for a “hands on” or equivalent visual examination. Appropriate recommendations resulting from the evaluation performed by facility review personnel will be presented in the TROF in a CR for consideration by the decision makers. If practical to do so, this

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examination will be scheduled during the year prior to the scheduled CR or at the time of the CR site examination itself. The final report will be transmitted as soon as practical following the site examination, but within 120 calendar days of the actual examination date.

- (c) **Related Discretionary Guidance.** Refer to the [RO&M Field Examination Guidelines](#)<sup>7</sup> for related discretionary guidance. As noted in the guidance, suspected conditions for outlet works features are outlined further in the Assistant Commissioner – Engineering and Research (ACER) Technical Memorandum No. 6, *Guidelines for Determining Whether Normally Inundated Outlet Works Features Should be Examined* (1985).
- (4) **Personnel Involvement.** Examinations of normally inaccessible features may require the use of individuals with specific technical expertise. Selection of technically qualified personnel to participate in the examination will be valuable in determining the appropriate examination frequency of that feature in the future.
- (5) **Training/Experience.** Many examinations of these types of features will require specialized personnel, trained in the safe access and operations related to the examination (e.g., underwater dive teams, rope access teams). Where safety is an obvious factor in conducting the examination, the personnel utilized must conform to established training/experience required by applicable Reclamation standards. Contracts to perform these examinations must also include language to this effect. The team leader is required to have:
  - (a) a knowledge of principles related to O&M and safety of a dam;
  - (b) experience in the inspection of dams; and
  - (c) reviewed [RO&M Field Examination Guidelines](#).
- (6) **Examination Alternatives.** In some instances, there may be alternatives for accomplishing the examination of inaccessible features. The determination of the appropriate examination method must be made by operation personnel based on both the associated costs and the quality/quantity of information to be obtained, given the site-specific conditions. Facility review personnel will provide guidance on a recommended examination method, as appropriate. For example, for features normally submerged by reservoir or tailwater conditions, options to consider are:
  - (a) unwatering/dewatering;

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<sup>7</sup> This document and other useful guidelines are available on the [Asset Management Division's One Stop Shop intranet site](#).

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- (b) Reclamation divers/contract divers; and
  - (c) remotely operated vehicles with cameras and/or special instruments.
- (7) **Documentation.**
- (a) Inaccessible features reviews/examinations will be documented in an inaccessible features report. At a minimum, the content of the report will include the following information:
    - (i) the name of author(s) and associated office(s);
    - (ii) the date(s) of the examination;
    - (iii) the names and offices of other participants in the examination;
    - (iv) the operational and weather data at the time of the examination (including precipitation during or prior to the examination) which may have an impact on field observations;
    - (v) a brief description/background of the particular concern and the need for the examination;
    - (vi) a narrative to describe conditions and deficiencies observed during the review/examination;
    - (vii) any resulting future actions based on the examination, including a statement regarding the scheduling of the next needed examination;
    - (viii) the status of any existing O&M recommendations related to the feature being examined;
    - (ix) representative photographs, drawings, of the concerned features which document pertinent conditions and deficiencies for future reference purposes; and
    - (x) signatures of the team leader and those participants responsible for preparing the report.
- (8) **Report Transmittal.** A draft inaccessible features report will be transmitted to the Dam Safety Office and Asset Management Division as soon as practical following the site examination, but within 120 calendar days of the actual examination date, unless justifiable delays exist and are documented.
- (9) **Data Entry.** O&M recommendations resulting from these reviews and updating of the status, schedule, and cost estimates of existing O&M recommendations will

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be entered into the DSIS by the office producing the report within 30 days of report transmittal.

- (10) **Funding.** Examinations of these types of features are considered similar in scope and content as the facility reviews performed of other readily accessible dam features. Therefore these examinations are non-reimbursable. The regional and area offices will be responsible for funding the needed examinations of these features, as determined by the facility reviews conducted at each dam. Costs incurred by the operating entity, as applicable, for participating in or preparing for (e.g., dewatering a stilling basin) such examinations will be borne as an O&M cost for that dam.

### F. Special Examinations.

- (1) **Scope/Content.** In general, the need for special examinations is satisfied by performing the required ASIs, PFRs and CRs. These examinations will be very site-specific and concentrate on features identified as being of concern and conducted on an as-needed basis for the following purposes:
  - (a) Evaluation of those concerns identified during the preparation of the CR report or during the site examinations of the facility (e.g., ongoing seepage or stability concerns). These special examinations will be performed and documented in conjunction with the ASI.
  - (b) Following natural phenomena events (unusual loading events such as earthquakes or major floods).
  - (c) Site visits resulting from dam safety analysis activities (e.g., IE, CAS).
  - (d) Site visits to investigate an instrumentation anomaly or a visually observed anomaly.
  - (e) Special unscheduled exposure of dam features advantageous to examine because of existing site/reservoir conditions or planned operations.
  - (f) Examinations for which personnel with specialized technical expertise are required.
  - (g) Special inspections/monitoring of a dam where exceeding maximum reservoir level is considered part of “first fill” procedures (historical high reservoir elevation). More rigorous inspections and monitoring, as typically outlined in the standing operating procedures and/or CR report, is required when new historic reservoir levels are attained. If “first fill” procedures are not available or were developed prior to 1980, a review is necessary by the Dam Safety Office and the TSC to determine whether new or revised procedures are appropriate.

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- (2) **Personnel Involvement.** The participation from offices and how the examination is to be accomplished in conjunction with other scheduled reviews, examinations, or inspections will be made collaboratively by the regional and area offices.
- (3) **Training/Experience.** Specialized training and experience is necessary for personnel participating in the examination.
- (4) **Documentation.**
  - (a) Special examinations/reviews will be documented in a special examination report. At a minimum, the content of the report will include the following information:
    - (i) the name of author(s) and associated office(s);
    - (ii) the date(s) of the examination;
    - (iii) the names and offices of other participants in the examination;
    - (iv) the operational and weather data at the time of the examination (including precipitation during or prior to the examination) which may have an impact on field observations;
    - (v) a brief description/background of the special examination and feature;
    - (vi) a narrative to describe conditions and deficiencies observed during the review/examination;
    - (vii) any resulting future actions based on the examination, including a statement regarding the scheduling of the next needed examination;
    - (viii) the status of any existing O&M recommendations related to the feature being examined;
    - (ix) representative photographs and drawings of the concerned features which document pertinent conditions and deficiencies for future reference purposes; and
    - (x) signatures of the team leader and those participants responsible for preparing the report.
  - (b) A checklist, which can be the same as the ASIs, will be completed for documenting any special examination conducted following a natural phenomenon event.

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- (c) Distribution of special examination/review reports or completed checklists will be made in the same manner outlined for the distribution of other facility review documentation within this D&S.
  - (d) A draft report will be transmitted as soon as practical following the site examination, but within 120 calendar days of the actual examination date, unless justifiable delays exist and are documented to the Dam Safety Office.
- (5) **Data Entry.** O&M recommendations resulting from these reviews and updating of the status, schedule, and cost estimates of existing O&M recommendations will be entered into the DSIS by the office producing the report within 30 days of report transmittal.
- (6) **Funding.** Special examinations and reviews are considered non-reimbursable.

### 6. Review/Examination JHA Development.

- A. To help ensure the safety of personnel conducting the site examination, the responsible area office will prepare a JHA.
- B. The JHA must address all potential safety hazards for activities anticipated and correspondingly provide acceptable methods, procedures, and/or equipment to safely accomplish the activities.
- C. Provide the JHA to each participant a minimum of 5 days prior to allow for review and to obtain necessary safety equipment.
- D. Each team member will review and sign the JHA at the dam site during the entrance briefing.

### 7. O&M Recommendation Categorizing and Tracking.

#### A. Categorizing.

##### (1) Category 1 O&M Recommendations.

- (a) Category 1 O&M recommendations will be made for the correction of severe deficiencies where immediate and responsive action is required to ensure structural safety and operational integrity of a facility.
- (b) Based on the severity of the deficiency and the condition of the structure or facility at the time of the examination, the examination team will mutually prescribe an appropriate timeframe for completing the O&M recommendation. Suggested remedial measures will be discussed at the time of the examination and included in the examination report. Within 30 days following preparation or receipt (depending on the office conducting the examination) of the examination report containing a Category 1 O&M

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recommendation, the responsible regional director will notify all concerned offices (e.g., Deputy Commissioner – Operations, Director, Dam Safety and Infrastructure, and the Asset Management Division) of the operating office's or entity's plans for accomplishing the work and a scheduled completion date.

(2) **Category 2 O&M Recommendations.**

- (a) Category 2 O&M recommendations will be made for a wide range of important matters where action is needed to prevent or reduce further damage or preclude possible operational failure of the facility.
  - (b) Such O&M recommendations are intended to be acted upon following receipt of the corresponding examination report by the operating office or entity. Those O&M recommendations which can be included, scheduled, and accomplished as part of the normal O&M program, will be undertaken as soon as weather or water conditions allow to permit quality remedial actions. Some O&M recommendations may require a longer time to accomplish because of budget funds, completing designs, or securing equipment, materials, or personnel. In such cases, the related planning and budgeting must be initiated in a timely manner.
  - (c) Any category 2 O&M recommendation remaining outstanding at the time of the following examination (ASIs, PFRs, and CRs) will be addressed during that examination and within the corresponding examination report.
  - (d) Category 2 O&M recommendations shall not be re-dated (the recommendation shall always maintain the original recommendation date, even if making editorial changes to the recommendation language).
  - (e) Category 2 O&M recommendations cannot be deleted without documentation and justification transmitted to Dam Safety and Infrastructure and will remain outstanding until verified during a PFR or CR.
- (3) **Category 3 O&M Recommendations.** Category 3 O&M recommendations will be made for sound and beneficial suggestions to improve or enhance the O&M of the project or facility. The status of each Category 3 O&M recommendation will be provided in the subsequent examination report.

**B. Tracking.**

- (1) **Category 1 O&M Recommendations.** Status reports will be provided by the responsible area manager, through the Regional Director and copying the Director, Dam Safety and Infrastructure and Asset Management Division, to the Deputy Commissioner – Operations every 6 months (October 1 and April 1) until the O&M recommendation is complete. All new Category 1 O&M



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recommendations resulting from each facility review will be entered into DSIS within 30 calendar days of report transmittal and will include both a scheduled completion date and a preliminary cost estimate.

- (2) **Category 2 O&M Recommendations.** Status reports will be provided by the responsible area manager to the corresponding regional director on an annual basis. All new Category 2 O&M recommendations resulting from each facility review will be entered into DSIS within 60 days of report transmittal and will include both a preliminary scheduled completion date and a preliminary cost estimate.
- (3) **Category 3 O&M Recommendations.** Status reports on an annual basis are not required for these O&M recommendations. All new Category 3 O&M recommendations resulting from each facility review will be entered into DSIS within 60 days of report transmittal.

C. **Annual Summary Report.** Dam Safety and Infrastructure will prepare an annual report summarizing the effectiveness in accomplishing Category 1 and 2 O&M recommendations related to these dams. This report will be based on the data and completion status of all current O&M recommendations entered into DSIS by the regional and area offices.

### 8. SOD Recommendations.

- A. **Purpose.** SOD recommendations will be used to document the need for data collection, analyses, and decision making associated with dam safety issues for identified and potential dam safety related deficiencies. These recommendations are not to be used in identifying O&M type activities ultimately funded with project O&M funds and accomplished as part of a facility's O&M program; these types of activities will be identified by the above-described O&M recommendations.
- B. **Tracking.** The completion status of SOD recommendations will be documented every 4 years in conjunction with each PFR and CR. The current status of each recommendation, scheduled completion date, and cost estimate will be provided within each corresponding examination/review report. The status on the SOD recommendations will be updated annually within DSIS by the Dam Safety Office, as status information on specific recommendations become available.

9. **Database.** The DSIS database will be used to maintain the information related to the required tracking/status reports on Category 1, 2, and 3 O&M and SOD recommendations.

- A. Each regional or area office will update the status of O&M recommendations previously entered into DSIS at the frequency indicated for each O&M recommendation category under paragraph 7.B. of this D&S.

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- B. Based on the status of recommendations provided within each SOD examination/review report, the Dam Safety Office will update the existing database of recommendations within the DSIS.
  - C. All current and historically completed O&M recommendations will be included within the DSIS database.
10. **Related Discretionary Guidance.** In addition to the training/experience requirements cited in this D&S, the following are referenced as related discretionary guidance to assist personnel in conducting the various reviews/examinations and inspections:
- A. [\*RO&M Field Examination Guidelines\*](#);
  - B. SEED Manual;
  - C. Facility Instructions Standards and Techniques (FIST) Manuals;
  - D. Guidelines for Safety Evaluation of Mechanical Equipment;
  - E. Comprehensive Review Guidelines;
  - F. TADS Program Modules;
  - G. Federal Guidelines for Dam Safety;
  - H. Association of State Dam Safety Officials – membership or affiliation; and
  - I. United States Committee on Large Dams (USCOLD) committee on Dam Safety – membership or affiliation.
11. **Definitions.**
- A. **High Hazard Potential Dam.** Failure or mis-operation will probably cause loss of human life.
  - B. **Low Hazard Potential Dam.** Failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.
  - C. **Significant Hazard Potential Dam.** Failure or mis-operation results in no probable loss of human life but can cause substantial economic loss, environmental damage, disruption of lifeline facilities, or other considerable impacts.
12. **Review Period.** The originating office will review this release every 4 years.

## RECLAMATION MANUAL TRANSMITTAL SHEET

Effective Date: \_\_\_\_\_

Release No. \_\_\_\_\_

Ensure all employees needing this information are provided a copy of this release.

### Reclamation Manual Release Number and Subject

### Summary of Changes

NOTE: This Reclamation Manual release applies to all Reclamation employees. When an exclusive bargaining unit exists, changes to this release may be subject to the provisions of collective bargaining agreements.

### Filing instructions

Remove Sheets

Insert Sheets

All Reclamation Manual releases are available at <http://www.usbr.gov/recman/>

Filed by: \_\_\_\_\_

Date: \_\_\_\_\_