

Reclamation Manual

Directives and Standards

Subject: Landslide Surveillance Program

Purpose: Establishes the requirements for landslide surveillance and reporting

Authority: Reclamation Project Act of 1902 and Supplementary Acts

Contact: Maintenance Services Office, D-5700

1. **Background.** The Landslide Surveillance Program was primarily established to monitor landslide areas associated with either the construction or operation of project facilities for which the Bureau of Reclamation is responsible, and which pose a significant threat to Reclamation personnel and public safety, or could result in substantial property damage.
2. **Scope.** These Directives and Standards (D&S) apply to known landslide areas, or those areas recognized as having potential for landslides at, or adjacent to, Reclamation facilities that could be affected by operations or could affect operations, access, structural stability of the facility, or safety of Reclamation personnel and the public.
3. **Purpose.** The purpose of the Landslide Surveillance Program is to decrease the potential for damage and loss of life as a result of landslides. Also of concern are operational impacts to associated facilities located in, or adjacent to, landslide areas.
4. **Definitions.**
 - A. **Associated Facilities.** Reclamation water-related facilities, other than high- and significant-hazard dams, as outlined in Reclamation Manual FAC 01-04 (<http://www.usbr.gov/recman/fac/fac01-04.pdf>).
 - B. **High- and Significant-Hazard Dams.** All dams presently classified as such under Reclamation's Safety Evaluation of Existing Dams (SEED) Program, where failure or misoperation of the dam would probably cause loss of human life or would cause appreciable economic, environmental, or lifeline losses (rural area with notable agriculture, industry, work sites, or outstanding natural resources). The D&S governing the examinations (facility reviews) of these dams are outlined in Reclamation Manual FAC 01-07 (<http://www.usbr.gov/recman/fac/fac01-07.pdf>).
 - C. **Landslide Hazard.** Potential for impacts associated with movement or failure of a soil or rock slope at, or adjacent to, Reclamation facilities that could affect operation, access, structural stability of the facility, or safety of Reclamation personnel or the public. Landslide hazards are categorized qualitatively by Reclamation personnel who possess a comprehensive understanding of landslide classification, movement processes, and likely failure velocity. The degree of hazard is classified as high, moderate, low, or nil. Potential and inactive landslide areas have the potential for

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movement or display evidence of historic movement. Categorization of hazards is influenced by the size (volume); proximity to structures including dams, associated facilities, and other property; and/or exposure to risk for Reclamation personnel and the public.

5. **Landslide Register Data and Format.** The Landslide Register is a comprehensive listing of landslide areas and summarization of descriptive data. Through an agreement with the Commissioner's Office of Program and Policy Services (OPPS), the Engineering Geology Group (D-8320), Technical Service Center (TSC), Denver maintains an up-to-date Landslide Register in database format. In addition to printouts of the comprehensive register, the database can be used to sort and compile data for special study and reporting purposes. Detailed instructions about preparing the Landslide Register can be found in the bound volume of each year's landslide data compiled by the TSC at the request of OPPS and sent to each region, or copies of the instructions can be obtained from the TSC, D-8320. The Landslide Register will include identified existing slide areas, or those areas recognized to have potential for future soil or rock slope movement. Landslides applicable for inclusion in the Landslide Register include those which have been, or could be, aggravated by the construction or operation of project facilities for which Reclamation has responsibility, and pose a potential hazard to Reclamation personnel, the public, project facilities, or private property.
6. **Landslides to be Reported.**
 - A. **Landslides Near Dams.** If the situation is urgent or critical, procedures will be followed in accordance with the affected facility's Emergency Action Plan (EAP) and with emergency notification procedures, as applicable. Appropriate regional or area office personnel will promptly report to the Geotechnical Services Division (D-8300) and the Dam Safety Office (D-1440), any unusual and new occurrence observed with respect to landslide areas that pose a risk to a high- and significant hazard dam.
 - B. **Landslides Near Associated Facilities.** For unusual and new landslide areas observed near or around associated facilities, appropriate personnel in the regional and area offices will notify D-8300.
 - C. **Landslides Near Power Facilities.** If unusual or new slide areas are observed adjacent to power facilities, if the situation is urgent or critical, procedures will be followed in accordance with the affected facility's emergency procedures. Appropriate regional and/or area office personnel will promptly notify the Hydroelectric Research and Technical Services Group (D-8450), D-8300, and the Power Resources Office (D-5400).
 - D. **Other Potentially Affected Areas.** Regional and/or area office personnel need to be cognizant of existing landslides or the potential for landslides on Federal land adjacent

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to recreation areas, utility crossings, easements, private property, etc. If unusual or new slide areas are observed adjacent to the areas described in this paragraph, appropriate regional and/or area office personnel will promptly notify D-8300 and the Land Resources Office (D-5300).

- E. **Slides During Construction Activities.** Slide conditions created during construction of a project are to be inspected by appropriate personnel prior to continuation of work. The slide may be omitted from the Landslide Register if the entire slide area is removed as a portion of the construction process. If the slides are not removed, and are inactive, they are to be treated as any other slide in regards to the Landslide Register.
- F. **Deletion of Slides from the Register.** If a landslide in the Landslide Register is determined by the region to no longer meet the objectives of this program, as stated in section 1. of this D&S, the region will notify D-8320 that the slide be removed from the Register. Once removed, the landslide will be moved to an archived status in the database to prevent loss of historical information related to the landslide.
7. **Landslide Instructions Regarding Surveillance and Restrictions.** Each region's operation and maintenance (O&M), geology, and/or geotechnical personnel will jointly review proposed instructions pertaining to landslide surveillance and operating restrictions prior to including them in the Standing Operating Procedures (SOPs). Associated facilities may need special instructions documented where no SOPs exist.
8. **Transmittal of Register Input Data.** Input data for the register will be requested each October by memorandum to all regional offices from D-5700 in OPPS. This memorandum will include a blank copy of the Landslide Register Data Sheet and a copy of the "Instructions on Preparation of Landslide Register Data."
9. **Updating and Distributing Register.** The register will be reviewed annually by the regions and revised by furnishing D-8320 with updated information on Landslide Register Data Sheets by December 1. The regions will include with the data sheets a brief explanation of changes as appropriate. D-8320 will process the revisions and send them to each region's O&M, Geology, and/or Geotechnical Offices with a copy to the Dam Safety Office, D-1440; Maintenance Services Office, D-5700; and Geotechnical Services Office, D-8300, by March 31, each year following the initial request and at other times when requested or warranted by additional data.
10. **Regional Files and Special Reports.** Each region will maintain a file on each landslide area listed in the Landslide Register and furnish landslide-specific technical evaluation reports to D-8300 in the TSC, on new or unusual landslide activities which are judged to pose a hazard to Reclamation project operations, facilities, personnel or the public.

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11. **Landslide Classification.** Landslides will be classified and appropriate information provided in accordance with “Instructions on Preparation of Landslide Register Data.”
12. **Landslide Examinations.**
 - A. **Examinations of Slides Near High- and Significant-Hazard Dams.**
 - (1) All landslides identified and listed in the Register, and those slides that are actively moving, will be examined by appropriate regional or area office personnel and revised data record input forms will be sent to the TSC, attention: D-8320. The landslides will be examined on an annual frequency unless otherwise specified through the Comprehensive Facility Review (CFR) process and/or the Schedule for Periodic Readings (Form L-23). Each region’s O&M and geology/geotechnical personnel will coordinate the budgeting for, and scheduling of, landslide examinations and reporting.
 - (2) The CFR process will be used to evaluate landslides that have the potential to cause dam failure or impact appurtenant facilities at the dam. As part of the CFR process, existing information in the Landslide Register is to be reviewed to ensure that landslides with dam safety significance are identified. It is incumbent upon the CFR team to coordinate and communicate with appropriate regional and area office personnel to determine landslides that potentially have dam safety implications. The CFR process will result in a formalized procedure for evaluating landslides that have the potential of causing failure of a high- or significant-hazard dam.
 - (3) Landslide examinations by TSC geologists will be performed when warranted in conjunction with the CFR process. A formal service agreement between the Dam Safety Office and TSC will be formulated as part of the CFR scope of work (or amended if CFR scope of work exists) prior to performing the examination.
 - B. **Examinations of Slides Near Associated Facilities (Facilities Other Than High- and Significant-Hazard Dams).** Each regional director/area manager, with input from geologic and geotechnical staff, will determine the hazard of this type of landslide, monitoring frequency, and if mitigation is necessary. However, no overall risk will be assigned to this type of landslide in the Landslide Register.
 - C. **Examinations of Potential or Inactive Landslides.** These types of slides may require less frequent examinations (not to exceed 3 years between examinations). However, more frequent examinations may be warranted following unusual events listed under section 12.E. of this D&S.

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- D. **Examination Scheduling.** As appropriate, examinations of landslides which would directly affect high- and significant-hazard dams (addressed under CFRs) will be coordinated among regional office geologic and geotechnical staff, area offices, and the Inspections and Emergency Management Group (D-8470) and D-8300 in the TSC. Regional geologists will be responsible for determining the appropriate expertise, qualifications, and experience necessary for staff to conduct these examinations. Landslide examinations related to facilities reviewed under regional Periodic Facility Reviews (PFRs) or reviews under the Associated Facilities Review of Operation and Maintenance (RO&M) Program will be coordinated among regional and area office personnel. This will ensure that TSC examiners have current information on such landslides from regional/area office geological or geotechnical personnel. A joint examination of a particular slide may be requested by O&M, Geology, Geotechnical, and/or Dam Safety Offices in Denver from time to time.
- E. **Special Examinations.** Special examinations may be required on landslides near Reclamation facilities which have been listed in the Landslide Register. Special examinations may need to be performed immediately following unusual events. Unusual events may include seismic events, significant and/or rapid reservoir drawdowns, heavy precipitation, or forest/wildfires. Special examinations will be performed by the TSC at the request of regional office geologic and geotechnical staff.
- F. **Funding.** No new funding source is being established for landslide examinations. Funding of landslide examinations will be through each region's current Examination of Existing Structures Program. Landslides are to be monitored periodically by operating personnel using project O&M funding. Evaluations of landslides required to address dam safety issues will be funded in accordance with the Decision Document.

13. Reports.

A. Written Reports of Special Examinations.

- (1) All special examination reports, with recommendations on public safety posting and operating requirements, observation procedures, and remedial/stabilization plans will be reviewed by the regional geological or geotechnical representative, and will be furnished to the appropriate offices in Denver (D-8300 and D-1440) and to O&M staff in the regional and area offices for review. The appropriate Region, O&M, Geology/Geotechnical, and/or Dam Safety Offices will be consulted in developing recommendations.
- (2) Examination teams conducting CFRs, PFRs, or RO&M examinations of a facility potentially affected by landslide areas will inquire, during their examinations, about whether the established landslide surveillance procedures and approved recommendations are being implemented. A discussion of the status will be

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included in the "Landslide" subparagraph of the Evaluation of Design, Analyses, and Construction section of the CFR report. Regional Geologists' reports and recommendations on remedial actions concerning landslide areas, which could affect the structure being examined, will be made available to the regional office and D-8300, and, if appropriate, D-1440 (for landslides posing a risk of dam failure), before the examination.

- B. Recommendations.** If it is determined during an examination of a dam or associated facility that a landslide or landslides associated with a facility has (have) not been formally examined, or a new landslide has been identified for inclusion in the Landslide Register but has not been entered, then a Category 2 O&M Recommendation will be made and included in the Evaluation of Design, Analyses, and Construction section of the CFR or PFR report, or in the RO&M examination report, as applicable. Appropriate regional/area office personnel are to be consulted for their input prior to the issuance of such recommendations.
- C. Numbering Recommendations.** The office making recommendations will number them in accordance with the numbering system established for O&M recommendations (year, category, alphabetical letter: 1998-2-A) and enter them into the "Recommendations" table in the Dam Safety Information System or will arrange for regional/area office O&M staff to enter them. The recommendation numbering is to be sequential and follow any existing recommendations already made for that calendar year.
- D. Photographs and Distribution of Examination Reports.** Current photographs of all landslides identified as high hazard in the Landslide Register will be attached to written examination reports which will then be sent to the TSC, attention: D-8470 (DSDaMS). Reports prepared on special examinations of new or unusual landslide activities which are judged to be a hazard to Reclamation project operations or facilities will also be sent to D-8470 (DSDaMS) and D-8300. D-8470 will scan all reports and photographs into the Dam Safety Document Management System. Where the technology is available, digital reports and supporting data may be provided in database format or a Geographic Information Systems format, if it is determined to be easier to index, search, and transmit, when necessary.
- 14. Related Directives and Standards and Other Documents.** For related and supporting Reclamation Manual D&S, see FAC-01-04, "Review of Operation and Maintenance (RO&M) Program Examination of Associated Facilities (Facilities Other Than High- and Significant-Hazard Dams)"; FAC 01-07, "Review/Examination Program for High- and Significant-Hazard Dams"; FAC 04-01, "Power Review of Operation and Maintenance (PRO&M) Program"; and Guidelines for Comprehensive Facility Reviews, Section XIV entitled "Guidelines Regarding Landslide Evaluation."