

**STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION**

_____)
In the Matter of:)
)
)
PROPOSED AMENDMENT)
TO 20.6.2 NMAC (Copper Rule))
_____)

No. WQCC 12-01(R)

EXHIBIT SCOTT – D-21

NEW MEXICO OFFICE OF THE STATE ENGINEER
Dam Safety Bureau
Operation and Maintenance Manual for Dams
October 23, 2008

An Operation and Maintenance (O&M) Program is critical for protecting the dam, downstream communities and personnel that work at the dam. The Goals of an O&M Program are to help dam owners to:

- ensure the safe operation of the dam,
- extend the life and achieve the intended purpose of the dam,
- protect the environment and owner's investment,
- protect the dam operator,
- promote cost-efficient operation, and
- meet legal and social obligations

An effective O&M Program involves 3 phases: planning, implementation and evaluation. The O&M Manual addresses the planning phase of an owner's Operation and Maintenance Program. It is recognized that an owner must implement the operation and maintenance activity and evaluate the effectiveness of the activity and revise as necessary. Therefore, it is recognized that an O&M Program must be reviewed periodically and updated as needed to meet the goals of an effective O&M Program. Updates must be submitted to the OSE Dam Safety Bureau for review and approval.

O&M Manual requirements for dams are cited in the Rules and Regulations Governing Dam Design, Construction and Dam Safety, which were filed with the New Mexico State Record Center as Title 19, Chapter 25, Part 12 of the New Mexico Administrative Code (19.25.12 NMAC). Section 17 of 19.25.12 NMAC states that owners of dams classified as high or significant hazard potential shall prepare, maintain and adhere to an operation and maintenance manual.

Listed below is an example outline of areas that should be addressed in the O&M Manual depending on the type of dam and purpose. The outline suggests frequencies for various activities. A range of values is provided in recognition that water storage dams have different O&M needs compared to normally dry flood control dams. In addition, appurtenances are operated under varying loading conditions and inspection frequency must be appropriate for the operating conditions.

Certifications for the dam owner and the engineer that prepares the O&M Manual and State Engineer acceptance are required at the beginning of the document. The O&M Manual should be submitted in a 3-ring Binder to facilitate updates. Dates in the header or footer of each page will keep track of changes in the O&M Manual along with a summary in the Appendix. Please refer to the OSE paper titled "Technical Reports for Dams" to ensure the O&M Manual is presented in a well organized document.

For additional information on developing and organizing an O&M Program please refer to Training Aids for Dam Safety (TADS) Module "How to organize an O&M Program".

- I. INTRODUCTION** - State or list pertinent facts about the dam and reservoir. Construction drawings must be included in the Appendix. Typical items to address are:
- a. Location
 - b. Access
 - c. Purpose
 - d. Description
 - e. Table of Properties
 - f. History of Construction
 - g. History of Repairs
 - h. History of Performance
- II. OPERATION** - This section should indicate who, how frequent, and what is involved in operating the dam. Maintaining records of operation activities is also required. Titles rather than individuals may be identified. Give a brief but complete description of all operation procedures. Specific procedures for operation of mechanical equipment such as valves could be included. Emergency operation procedures in this section must be consistent with the procedures in the Emergency Action Plan (EAP). Typical items to address are:
- a. Reservoir Operation Instructions
 - i. Storage Allocations
 - ii. Spillway Design Flood Water Level
 - iii. First Fill Criteria and Monitoring Requirements
 - iv. Maximum Drawdown Rate and corresponding Outlet Discharge for both emergency and non-emergency conditions. If outlet discharge will cause flooding downstream, then activation of the EAP is required.
 - b. Outlet Works Operations
 - i. Procedures for operation of mechanical equipment
 - ii. Procedures for seasonal start up
 - iii. Procedures for seasonal shut down
 - iv. Procedures for installation of bulkheads
 - v. Electrical systems labeled and procedures for operation
 - vi. Frequency of Operation including identifying the time of the year. Recommended frequencies are listed in Table 1.

TABLE 1 OPERATION FREQUENCY	
Item	Action Required
Lake Drain Gate or Valve	Fully cycle open at least once/year
All other Gates or Valves	Fully cycle at least 2 times/year

III. INSTRUMENTATION - This section identifies the type of instrumentation, general description, location, purpose, procedures for obtaining readings and identification of critical readings. Installation construction details should be included in the Appendix along with flow rating tables for weirs and flumes. Frequency of readings may be addressed in this section or in the Inspection Section. The form for recording readings should also be included in the Appendix. The individual responsible for evaluating the data must be identified in this section. Typical items to address and suggested frequency of monitoring are listed in Table 2.

TABLE 2 INSTRUMENTATION MONITORING FREQUENCY			
Instrumentation to Monitor & Evaluate	Frequency	Personnel	Form
Reservoir Level	Monthly	Damtender	Identify the Form
Toe Drains	Monthly	Damtender	Identify the Form and include Critical Flow Rate
Weirs / Flumes	Monthly	Damtender	Identify the Form and include Critical Flow Rates
Piezometers / Inclinometers	Monthly	Damtender	Identify the Form and include Critical Elevations
Settlement Monuments	3 - 5 Years	Engineer / Surveyor	Identify the Form

IV. INSPECTION - This section should indicate personnel responsible for inspection and how frequent and what is involved in an inspection. A form or forms must be included in the Appendix for each type of inspection. Each dam will have specific problem areas, which will possibly require more frequent monitoring. Recognition that the owner must maintain records on applicable forms of all inspections and monitoring is required. It is recommended that a table identifying each item with required inspection frequency be included in the O&M Manual. OSE Inspections may vary depending on budget availability and staffing levels. It is not appropriate to identify OSE staff as being responsible for performing inspections on behalf of the owners or to commit OSE staff to perform inspections on a given frequency. Suggested inspection frequencies are listed in Table 3. Operating conditions and the condition of the dam may require more frequent inspections.

V. MAINTENANCE - Indicate items that will require periodic maintenance. Each dam should have specific items that need to be addressed. Conditions specified on past inspection reports should be included. Specific procedures for addressing the maintenance should also be included in this section or the Appendix. Information on replacement parts for equipment should be included in the Appendix. Recommended maintenance frequencies are listed in Table 4.

TABLE 3 INSPECTION FREQUENCY				
Items to Inspect	Frequency Wet Dams	Frequency Dry Dams	Personnel	Form
Rainfall	As Needed	As Needed	Damtender	Identify the Form
Seepage / Wet Areas / Drains	Weekly	After X inches of rain	Damtender	Identify the Form
Toe Drains	Weekly		Damtender	Identify the Form
Reservoir Level	Weekly	After X inches of rain	Damtender	Identify the Form
Trash rack Debris	Weekly	After X inches of rain	Damtender	Identify the Form
Slides / Cracks	Weekly	Every 3 months	Damtender	Identify the Form
Rodent Activity	Weekly	Monthly	Damtender	Identify the Form
Vandalism	Weekly	Monthly	Damtender	Identify the Form
Piezometers	Monthly		Damtender	Identify the Form and include Critical Readings
Woody Vegetation	Every 6 Months	Yearly	Damtender	Identify the Form
Riprap Protection	Yearly		Damtender	Identify the Form
Slope Erosion	Yearly	Yearly	Damtender	Identify the Form
Vegetative Cover	Yearly	Yearly	Damtender	Identify the Form
Embankment Condition	Yearly	Yearly	Damtender	Identify the Form
Spillway Condition	Yearly	Yearly	Damtender	Identify the Form
Outlet Conduit	3 - 5 Years	5 - 10 Years	Engineer	Identify the Form
Settlement Monuments	3 - 5 Years	5 - 10 Years	Engineer / Surveyor	Identify the Form
Formal Engineering Inspection	5 Years	5 Years	Professional Engineer	Identify the Form

TABLE 4 MAINTENANCE FREQUENCY	
Item	Frequency
Exterminate or Remove Rodent	As Needed
Repair Rodent Burrows	As Needed
Remove Woody Vegetation including rootballs and repair embankment	As Needed
Re-establish Vegetative Cover	As Needed
Repair Erosion	As Needed
Clean Trashrack	As Needed
Repair Concrete	As Needed
Repair Gates, Valves or Other Mechanical Equip	As Needed
Instrumentation	As Needed
Mow the embankment	Twice a Year
Lubricate Gates and Valves	Yearly
Other Mechanical Equipment	Yearly
Replace / Replenish Riprap	Yearly

- VI. APPENDICES** - Supporting documentation and reference material must be included in the Appendices. Items to be included in the Appendices are provided below. Depending on the type of dam and purpose, additional information may be required.
- a. Pictures of the Dam
 - b. Construction Drawings (Reduced to 11" x 17")
 - c. Reservoir Stage/Storage/Area Table
 - d. Spillway and Outlet Rating Table
 - e. Instrumentation Construction Drawings
 - f. Weir and Flume Rating Tables
 - g. Monitoring Forms
 - h. Inspection Forms
 - i. Recommended Procedures for Maintenance. References for developing procedures are:
 - FEMA 473, Technical Manual for Dam Owners, Impacts of Animals on Earthen Dams, September 2005
 - FEMA 534, Technical Manual for Dam Owners, Impacts of Plants on Earthen Dams, September 2005
 - OSE, Guidelines for Woody Vegetation Removal on Dams, August 2002
 - USBR, Guide to Concrete Repair
 - j. Equipment Replacement Parts (Part No and Order Form of Phone number).
 - k. Summary of Updates or Revisions to the O&M Manual