

SUBCHAPTER C - APPLICATIONS

PART 522 - SNOW SURVEY AND WATER SUPPLY FORECASTING

SUBPART A - RESERVOIR OPERATIONS GUIDE FOR SNOWMELT

522.00 General.

(a) Selecting appropriate storage levels and average release rates for reservoirs in snowmelt runoff environments is a prerequisite to sound water management. A number of impoundments, operated for single or multiple purpose use in the United States, lack adequate management tools to guide this process each year. The Reservoir Storage Volume Planning (RSVP) process in Technical Release 75 (TR-75) has been developed to use seasonal volume forecasts to improve water management at these reservoirs.

(b) A number of reservoir operation guides (ROG), formerly called reservoir operations plans, have been or are being developed as a result of requests for assistance. These guides are developed as decision support tools to help reservoir operators manage their facilities by using streamflow forecasts. The guides provide a means to optimize water use while minimizing flood damages. This policy has been developed to assure that operation guides are technically sound and meet the operators' needs.

522.01 Authority and Request for Assistance.

A ROG can be prepared for any reservoir upon receipt of a written request from the reservoir operator or owner. Requests shall be reviewed by the Soil and Water Conservation District before forwarding to the State Conservationist for approval.

522.02 Responsibility.

(a) The owner or operator responsibilities are outlined in the National Operation Maintenance Manual (NO&MM), Operation and Maintenance Subpart B, 500.14 Responsibilities, (a) Sponsor/land user, part (3).

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(b) SCS responsibilities are outlined in NO&MM, Operation and Maintenance Subpart B, 500.14 Responsibilities, (b) parts (1) and (2), and include determination of feasibility and desirability of preparing a guide. This determination will be made jointly by the State Conservation Engineer and the Water Supply Specialist, or the Data Collection Office Supervisor. Their respective concurrence is required before proceeding with the development of the reservoir operation guide. The reservoir operation guide shall use the procedures in TR-75.

(c) Federal land or structure administering agency responsibilities: It is essential that full agreement be reached between the Federal agency (non-SCS), the sponsor/land user, and SCS regarding the establishment of a ROG on a Federally owned, operated or funded structure.

522.03 SCS Technical Review.

The State Conservation Engineer and the Engineering and Water Supply Forecasting Staffs, WNTC, will be actively involved in the development and review of the ROGs. A copy of the ROG should be sent to the state agency responsible for administering dam regulations during the SCS review process.

522.04 Reservoir Operation Guide Review.

There will be an annual review for the first 3 years of the ROG for a reservoir by the State Conservation Engineer to determine its effectiveness as a management tool for the reservoir. After the first 3 years, the frequency of review should be reevaluated.

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522.05 Reservoir Operation Guide Contents.

The following outline is to be used in preparing a reservoir operation guide. Topics shown in each section are to be included only if they apply to the management of the reservoir. This standard format is intended to ensure comprehensive coverage of pertinent hydrologic factors and provide a consistent organization for completed guides. The outline is designed so that for actual operation of a structure, an operator would normally only need to refer to sections (e) and (f). The Reservoir Storage Volume Planning (RSVP) computer programs are a part of the Centralized Forecasting System (CFS) at the WNTC. These programs are to be used to generate the volume-outflow curves contained in each guide.

- (a) Introduction
 - (1) Background for guide request
 - (i) Requesting sponsor
 - (ii) Cooperating agencies, if any
 - (iii) Guide is a decision support tool
 - (2) Reservoir operation guide objectives
 - (i) Water conservation
 - (ii) Flood management
 - (iii) Fisheries protection
 - (iv) Recreation
 - (v) Other

- (b) Reservoir Characteristics
 - (1) History of structure
 - (i) Engineering firm or agency
 - (ii) Construction date
 - (iii) Type of dam

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- (2) Primary and secondary purposes of reservoir
- (3) Structural dimensions of dam
- (4) Storage characteristics of reservoir
 - (i) Total storage capacity
 - (ii) Conservation storage
 - (iii) Recreation pool
 - (iv) Dead storage
 - (v) Flood storage
 - (vi) Surcharge capacity
 - (vii) Storage vs. elevation information
 - (viii) Surface area
- (5) Release capability
 - (i) Principal spillway
 - (ii) Auxiliary spillway
 - (iii) Pump
 - (iv) Gated outlet
 - (v) Other
- (6) Special operating characteristics
 - (i) Radial and other crest control gates
 - (ii) Use of flashboards
 - (iii) Restriction on storage (regulatory, court orders, etc.)
 - (iv) Seepage

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- (v) Dam deterioration
 - (vi) Other
- (7) Storage/release pattern for reservoir
- (i) Historical end-of-month storage analysis
 - (ii) Desirable storage pattern--low, average, and high years
- (c) Watershed Characteristics
- (1) Location and drainage area
- (2) Topography
- (i) Geology
 - (ii) Elevation range
 - (iii) Area vs. elevation relationship
- (3) Climatology (cite references)
- (i) Average annual precipitation
 - (ii) Seasonal distribution of precipitation
 - (iii) Snowpack accumulation and ablation pattern
 - (iv) Extremes and variability of precipitation
- (4) Streamflow (cite references)
- (i) Average annual flow
 - (ii) Runoff vs. elevation relationship
 - (iii) Extremes and variability
 - (iv) Seasonal distribution of streamflow
 - (v) Flow duration analysis

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(d) Hydrologic and Meteorologic Data

(1) Streamflow and reservoir records

- (i) Reference maps and tables in appendix
- (ii) Explain any synthetic inflow calculations
- (iii) Accuracy of records

(2) Precipitation and snowpack records

- (i) Reference maps and tables in appendix
- (ii) Climatological stations
- (iii) SCS SNOTEL sites and snow courses

(3) Other data

- (i) Diversions
- (ii) Temperature data
- (iii) Pumping data

(e) Reservoir Volume-Outflow Concept

(1) Theory of curves

- (i) Relationship between hydrograph shape and flow volume
- (ii) Evaporation-seepage losses are almost constant from year-to-year
- (iii) Concept of volume-outflow curves with forecasts to set outflow
- (iv) Use of forecasts at probability levels of 50, 10, 30, 70, and 90 percent chance of exceedance with volume-outflow curves
- (v) Figure showing model volume-outflow curves

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- (2) Use of volume-outflow curves in a typical year
 - (i) Reference figure of flow, storage, releases
 - (ii) Explain how forecasts are used to set outflows
 - (iii) Determining maximum storage level desirable from upper range of desirable outflow

- (3) Management considerations in various years
 - (i) Average
 - (ii) High years
 - (iii) Low years

- (4) Desirable outflow range defined
 - (i) Low flow consideration, e.g., fisheries
 - (ii) Water rights
 - (iii) Irrigation demands
 - (iv) Flood flow threshold-where flood damage occurs

- (f) Reservoir Operation
 - (1) Data needs
 - (i) Streamflow forecasts
 - (ii) Storage level in reservoir
 - (iii) Mid-month forecast updates

 - (2) Volume-outflow curves for primary forecast periods
 - (i) April-July
 - (ii) May-July
 - (iii) June-July

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- (3) Reservoir rule curves
 - (i) Use of rule curves with volume-outflow curves
 - (ii) Reservoir rule curves
- (4) Low runoff year example - (actual year, if possible)
- (5) Average runoff year example - (actual year, if possible)
- (6) High runoff year example - (actual year, if possible)
- (7) Timing of snowmelt runoff peak
 - (i) Relationship to snow pillow data
 - (ii) Variability from year to year
- (8) Streamflow recession analysis
 - (i) Snowmelt recession curve
 - (ii) Influence of precipitation events
- (9) Summary
 - (i) Guide is an operational tool for risk assessment and project regulation
 - (ii) Informed decisions based on probability of seasonal flows
 - (iii) Organizes planning process
 - (iv) Relevant information in one document
 - (v) Guide should be reviewed annually
 - (vi) SCS contacts for assistance and/or interpretations

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(g) Annual Review

- (1) Recommendations
- (2) Record of review

(h) APPENDICES

(1) Watershed characteristics

- (i) Location map, elevation map, data sites map, area vs. elevation curve
- (ii) Average annual precipitation map
- (iii) Seasonal precipitation map
- (iv) Average annual runoff map

(2) Reservoir records

- (i) Elevation vs. storage table
- (ii) Principal spillway or gated outlet rating table
- (iii) Auxiliary spillway rating table
- (iv) Pumping plant rating
- (v) Historical end-of-month reservoir records
- (vi) Average reservoir storage hydrograph

(3) Streamflow records

- (i) Historical monthly streamflow data
- (ii) Annual inflow hydrographs
- (iii) Mean annual inflow hydrograph
- (iv) Frequency analysis of seasonal volumes

(4) Precipitation records

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(5) Snowpack records

(i) Snow course and snow pillow monthly data

(ii) Snow pillow hydrographs

(i) Averages

(1) Monthly reservoir

(2) Monthly streamflow

(3) Monthly precipitation

(4) Monthly snow course

(j) Approval

(1) Example attached

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"We, the undersigned individuals, as authorized by the laws and regulations of the State of Anystate, have reviewed this Reservoir Operation Guide and find it acceptable for the operation of Anyplace Reservoir."

Operator

Soil and Water Conservation
District

Date

Date

State Conservationist

State Conservation Engineer

Date

Date