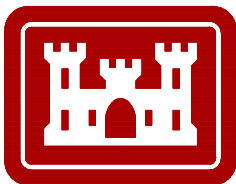


VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO

WATER CONTROL MANUAL

UPPER COLORADO RIVER BASIN



**US ARMY CORPS
OF ENGINEERS**
Sacramento District

**DECEMBER 1973
REVISED JUNE 2002**

[R]

NUMERICAL INDEX OF EFFECTIVE PAGES

List of Current Changes

Original 0 December 1973

Revision 1 June 2002

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WATER CONTROL MANUAL

VALLECITO DAM AND RESERVOIR

Los Piños River
Colorado

Upper Colorado River Basin
Colorado

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

December 1973
Revised June 2002

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NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published looseleaf form in a hard copy binder, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be added to make the manual current. Changes to individual pages must indicate the date of revision, which is also the division's approval date. Pages or sections that are changed after the revision is approved and distributed will indicate the new change month/year.

All elevations in this manual are based on the National Geodetic Vertical Datum of 1929 (NGVD29). As directed by EM 1110-1-1004, the datum has been changed to the North American Vertical Datum of 1988 (NAVD88). However, the elevations in this manual do not reflect the NAVD88.

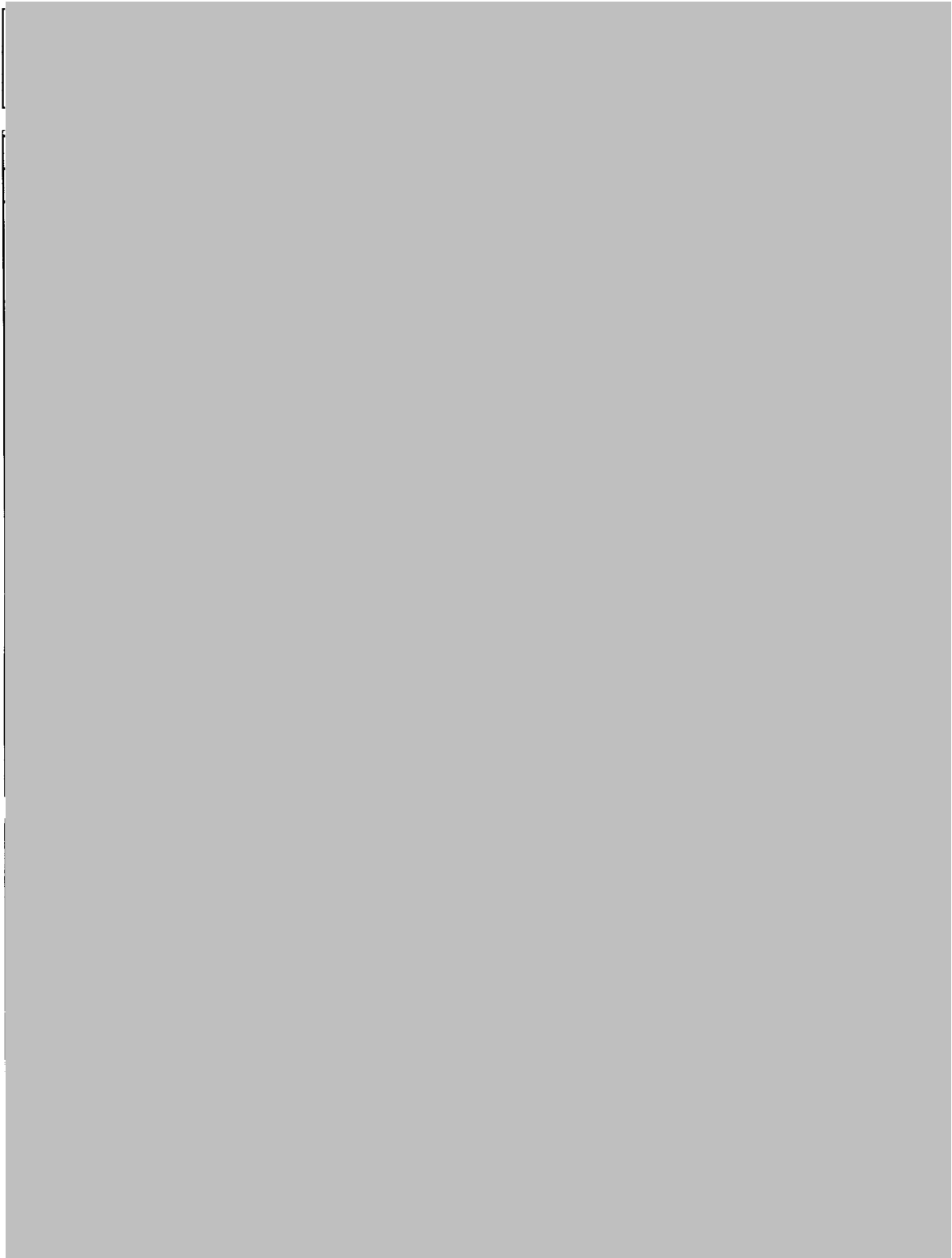
Soft metrics according to ER 1110-1-4 will be used throughout the manual for information purposes only. They are not to be used as exact measurements.

WATER CONTROL PERSONNEL

In the event that unusual conditions arise during non-duty hours, communication can be achieved by contacting the personnel listed on pages vii-ix.

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VALLECITO RESERVOIR
LOS PIÑOS RIVER, COLORADO

U.S. Army Corps of Engineers
Sacramento District
June 2002

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Exhibit D	Environmental Inventory Paper for Vallecito Dam and Reservoir
Exhibit E	Guidance on the Preparation of Deviations from Approved Water Control Plans

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Abbreviations and Acronyms

ac	acre	EOC	Emergency Operations Center
ac-ft	acre-feet (the volume of an acre one foot deep)	ERB	Environmental Review Board
API	Antecedent Precipitation Index	ESA	Endangered Species Act
C	Celsius	ESRD	Emergency Spillway Release Diagram
CDEC	California Data Exchange Center	ER	Engineering Regulation, U.S. Army Corps of Engineers
CESPD	U.S. Army Corps of Engineers, South Pacific Division	ETL	Engineering Technical Letter, U.S. Army Corps of Engineers
CESPK	U.S. Army Corps of Engineers, Sacramento District	F	Fahrenheit
CESPA	U.S. Army Corps of Engineers, South Pacific Division, Albuquerque District	FEMA	Federal Emergency Management Agency
CFR	Code of Federal Regulations	FERC	Federal Energy Regulation Commission
cfs	cubic feet per second	ft	feet
cm	centimeter	GOES	Geostationary Operational Environmental Satellite
Corps	Corps of Engineers	ha	hectare
cu-yd	cubic yard	hm	hectometer
dam³	cubic dekameter	hm²	square hectometer
DCP	Data Collection Platforms	hm³	cubic hectometer
DETS	Directorate of Engineering and Technical Services	in	inch
dm	decimeter	km	kilometer
DWR	California Department of Water Resources	km²	square kilometer
EA	Environmental Assessment	kv	kilovolt
EIP	Environmental Inventory Paper	kVA	kilovolt-Ampere
EIS	Environmental Impact Statement	kW	kilowatt
elev	elevation	kWh	kilowatt hour
EM	Engineering Manual, U.S. Army Corps of Engineers	m	meter
		m²	square meter
		m³	cubic meter
		m³/s	cubic meters per second
		mgd	million gallons per day
		mi	mile
		mi²	square mile

MOA	Memorandum of Agreement	SDF	Spillway Design Flood
MOU	Memorandum of Understanding	SOP	Standard Operation Procedure (or standard format)
MW	Megawatt	SPF	Standard Project Flood
NAP	Normal Annual Precipitation	SRI	Sacramento River Index
NAVD	North American Vertical Datum	TDS	Total Dissolved Solids
NEPA	National Environmental Policy Act	USACE	United States Army Corps of Engineers
NEXRAD	The Next Generation Weather Radar System	USBR	United States Bureau of Reclamation
NGVD	North American Geodetic Vertical Datum	USGS	United States Geological Survey
NOAA	National Oceanographic Atmospheric Administration	WCD	Water Control Diagram
NRCS	Natural Resources Conservation Service	WCM	Water Control Manual
NWS	National Weather Service (an organization of NOAA)	WCDS	Water Control Data System
PAO	Public Affairs Officer	WCP	Water Control Plan
PC	Personal Computer	yr	year
pf	power factor	<u>Abbreviations Special to this Manual</u>	
PL	Public Law	BIA	Bureau of Indian Affairs
PMF	Probable Maximum Flood	CBRFC	Colorado Basin River Forecast Center
PMP	Probable Maximum Precipitation	CDOW	Colorado Division of Wildlife
PMS	Probable Maximum Storm	CDWR	Colorado Division of Water Resources
PPM	parts per million	CRFS	Colorado River Forecast Service
PRV	Pressure Regulator Valve	EFV	Emergency Flow Valve
QPF	Quantitative Precipitation Forecast	MCL	Maximum Contaminant Level
RDF	Reservoir Design Flood	PDI	Palmer Drought Index
RFC	Joint Federal-California State River Forecast Center	PRID	Pine River Irrigation District
RKM	River Kilometer	USDA	U.S. Department of Agriculture
RM	River Mile (Pacific Southwest Interagency Committee)	USFS	United States Forest Service
RPM	Revolutions Per Minute	WCAO-SD	Western Colorado Area Office - Southern Division
SDAT	California State Drought Action Team		

CONVERSION CONSTANTS		
TO CONVERT ENGLISH UNITS	MULTIPLY BY	TO OBTAIN METRIC
LENGTH AND HEIGHT		
in	2.54	cm
ft	0.3048	m
mi	1.609	km
AREA		
ft ²	0.0929	m ²
ac	4047	m ²
ac	0.4047	ha
mi ²	2.59	km ²
VOLUME		
ft ³	0.02832	m ³
mgd	0.04381	m ³ /day
ac-ft	0.001233	hm ³
ac-ft	1233	m ³
MISCELLANEOUS		
Slope in ft/mi	0.1894	m/km
ac-ft/mi ²	476.1	m ³ /km ²
Fahrenheit	(F-32)*5/9	Celsius

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**VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER
COLORADO**

PERTINENT DATA
(IP Units)

GENERAL

Location	
Los Piños River	32.6 mi
County	La Plata
State	Colorado
Drainage areas	
Los Piños River near Bayfield	270 sq miles
Basin normal annual precipitation	25 in
Flows at Damsite (Los Piños River near Bayfield)	
Average annual (60 years)	266,301 ac-ft
Mean annual inflow	2,363 cfs
Minimum daily inflow	0 cfs
Maximum Flows of Record	
1911 (estimated)	22,000 cfs
19 June 1949 (Maximum instantaneous)	5,387 cfs
Maximum annual runoff	431,080 ac-ft
Reservoir Design Flood	
Length of Design Flood	15 days
Inflow Peak	39,000 cfs
Inflow Volume of Design Flood	202,000 ac-ft

Area	
Dead storage	378 ac
Minimum pool	695 ac
Gross pool	2,720 ac
Spillway design flood pool	2,728 ac
Storage Capacity (Includes 4,247 ac-ft dead storage)	
Dead storage	4,247 ac-ft
Minimum pool	13,338 ac-ft
Gross pool	129,678 ac-ft
Spillway design flood pool	139,178 ac-ft

OUTLET WORKS

Total Discharge Capacity (elev 7,665.0 ft) 2,910 cfs

SPILLWAY

Capacity (elev 7,664.0 ft) 27,100 cfs
Capacity (elev 7,668.5 ft) 30,000 cfs

RESERVOIR

Elevation	
Streambed	7,547.0 ft
Dead storage	7,582.5 ft
Minimum pool	7,600.0 ft
Gross pool	7,665.0 ft
Spillway design flood pool	7,668.5 ft

RUNOFF



1-inch basin runoff = 14,400 acre-feet at dam

Manual Revised June 2002

**VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER
COLORADO**

**PERTINENT DATA
(SI Units)**

GENERAL

Location	
Los Piños River	52.5 RKM
	
County	La Plata
State	Colorado
Drainage areas	
Los Piños River near Bayfield	699.3 sq km
Basin normal annual precipitation	63.5 cm
Flows at Damsite (Los Piños River near Bayfield)	
Average annual (60 years)	328.3 hm ³
Mean annual inflow	66.9 m ³ /s
Minimum daily inflow	0 m ³ /s
Maximum Flows of Record	
1911 (estimated)	623.0 m ³ /s
19 June 1949 (Maximum instantaneous)	152.5 m ³ /s
Maximum annual runoff	531.5 hm ³
Reservoir Design Flood	
Length of Design Flood	15 days
Inflow Peak	1,104.4 m ³ /s
Inflow Volume of Design Flood	249.2 hm ³



RESERVOIR

Elevation	
Streambed	2,300.3 m
Dead storage	2,311.1 m
Minimum pool	2,316.5 m
Gross pool	2,336.3 m
Spillway design flood pool	2,337.4 m

Area	
Dead storage	141.6 ha
Minimum pool	281 ha
Gross pool	1,100.7 ha
Spillway design flood pool	1,104 ha
Storage Capacity (Includes 5.2 hm³ dead storage)	
Dead storage	5.2 hm ³
Minimum pool	11.2 hm ³
Gross pool	160.0 hm ³
Spillway Design Flood pool	171.7 hm ³

OUTLET WORKS



Total Discharge Capacity (elev 2,336.3 m) 82.4 m³/s

SPILLWAY



Capacity (elev 2,336.0 m)	767.4 m ³ /s
Capacity (elev 2,337.4 m)	849.5 m ³ /s



RUNOFF

2.5 cm basin runoff = 17.76 hm³ at dam

Manual Revised June 2002

I - INTRODUCTION

1-01. Authorization. This Water Control Manual is for Vallecito Dam and Reservoir, located on the Los Piños River in southwestern Colorado. It is prepared in accordance with instructions contained in the Code of Federal Regulations 33, Part 222.5 and Part 208.11, as well as in:

EM 1110-1-1004	Geodetic and Control Surveying	01 June 2002
EM 1110-2-3600	Management of Water Control Systems	30 November 1987
ER 1110-1-4	Metric Measurements in USACE Publication Media	31 March 1994
ER 1110-2-240	Water Control Management	8 October 1982
ER 1110-2-241	Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects	24 May 1990
ER 1110-2-8156	Preparation of Water Control Manuals	31 August 1995
CESPD-R-1110-2-8	Guidance on the Preparation of Deviations from Approved Water Control Plans	12 September 2002

All instructions pertain to the requirements for reports on reservoir regulation for projects subject to the provisions of Section 7 of the 22 December 1944 Flood Control Act (58 Stat 890). The pertinent portion of that act reads as follows:

"Hereafter it shall be the duty of the Secretary of War to prescribe regulations for use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with . . ."

1-02. Purpose and Scope. This manual contains descriptive information and a detailed plan for water control and management at Vallecito Dam and Reservoir on the Los Piños River in Colorado. It also assigns responsibilities for water control operation of the project.

1-03. Related Manuals and Reports. Manuals were published by the U.S. Army Corps of Engineers (USACE), and reports were published by the U.S. Bureau of Reclamation (USBR), except as noted. They are as follows:

Upper Colorado River Flood Control Projects - Water Control Manuals

Blue Mesa Dam and Reservoir	February 1988
Lemon Dam and Reservoir	July 1974

Revised June 2002

McPhee Dam and Reservoir ¹	June 1991
Paonia Dam and Reservoir	February 1971
Red Fleet Dam and Reservoir	January 1997
Ridgway Dam and Reservoir	November 1996
Starvation Dam and Reservoir	September 1988

<u>Reports</u>	<u>Date</u>
[REDACTED]	[REDACTED]
MOA USBR and the Bureau of Indian Affairs Regarding the Development, Administration, Operation and Maintenance of Certain Vallecito Reservoir Lands for Water-Based Recreation Purposes	11 June 1984

(Some materials and plates used in this manual were furnished by the USBR.)

1-04. Project Owner. Vallecito Dam and Reservoir is owned by the U.S. Government and represented by the USBR.

1-05. Operating Agency. The USBR's Facilities Resource Group, Southern Division, Western Colorado Area Office, in Durango, Colorado, is responsible for flood control and oversees the safe and proper operation and maintenance of Vallecito Dam and Reservoir. The Pine River Irrigation District (PRID) is under contract with the USBR to operate Vallecito Dam and Reservoir.

Operational responsibilities, along with business and home phone numbers of the individuals responsible for project operation, are located in the front of this manual and in Exhibit A.

1-06. Regulating Agencies

a. Vallecito Reservoir's Water Control Plan for flood control was developed by the Sacramento District, USACE, and agreed upon by the USBR. The Sacramento District, USACE, is responsible for providing an approved Water Control Plan for flood control. The USBR is responsible for the administration of flood control operations. Any deviation from the flood control regulations presented in this Water Control Manual, except for Emergency Deviations as explained in Chapter VII and Exhibit A, must be authorized by the USACE.

b. Monthly water supply forecasts are furnished by the Colorado Basin River Forecast Center (CBRFC) and prepared by the National Weather Service (NWS). During the snowmelt runoff season, the Water Control Plan will govern the operational releases if flood releases are required.

¹ Flood control has been removed as a project purpose.

c. Irrigation and other water supply releases will be made by the PRID in accordance with operating criteria and procedures established by the USBR.

d. The Colorado Division of Wildlife stocks the reservoir for fishing and enforces all wildlife, game, and fishing laws and regulations within the reservoir management area.

e. The U.S. Forest Service, San Juan National Forest, is responsible for regulating and administrating the recreational programs and facilities.



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II - DESCRIPTION OF PROJECT

2-01. Location. The project area of Vallecito Dam and Reservoir is located in La Plata County, Colorado, on the Los Piños River at river mile 32.6 (52.5 RKM), upstream from its confluence with the Navajo Reservoir. It is about 15 miles (24.1 km) north of the town of Bayfield. The location of Vallecito Dam and Reservoir is shown on the General Map, Plate 2-1. The geographic coordinates of the structure are:



The Vallecito Dam and Reservoir Area Map is shown on Plate 2-2.

2-02. Purpose. Vallecito Dam and Reservoir was authorized for the purpose of flood control, non-Corps hydropower, and irrigation. Since 1971, the Vallecito Dam and Reservoir has been operated and maintained by the Pine River Irrigation District (PRID), under supervision and assistance of the USBR. The reservoir provides flood protection for areas along the Los Piños River, and irrigation water to approximately 18,500 acres (7,487 ha) of the Southern Ute Indian Reservation and approximately 45,000 acres (18,211 ha) of privately owned land. Recreation facilities are provided on the east side and north of the reservoir by the U.S. Forest Service and on the west side by private concerns.

a. Vallecito Dam and Reservoir was authorized by acts of Congress dated 25 June 1910, Public Law 61-288 (36 Stat. 836), and 5 December 1924, Public Law 68-292 (43 Stat. 702).

b. The Pine River Project was approved for construction by the President on 17 June 1937, under the provisions of Section 4 of 36 Stat. 836 and Subsection B, Section 4 of 43 Stat. 702; however, there is no authorization assigned by Congress in law specific to the Pine River Project.

c. The following Congressional acts apply to Vallecito Dam and Reservoir:

- (1) PL 78-534 Flood Control Act of 1944 (recreation, surplus water)
- (2) PL 85-624 Fish and Wildlife Coordination Act of 1958
- (3) PL 85-500 Water Supply Act of 1958
- (4) PL 88-29 (77 Stat. 49) Coordination of Recreation Programs Act of 1963
- (5) PL 89-72 (79 Stat. 213) Federal Recreation Programs Act of 1965

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- (6) PL 89-665 National Historic Preservation Act of 1966 (historic and archaeological data preservation)
- (7) PL 91-190 National Environmental Policy Act of 1969 (environmental protection)
- (8) PL 92-500 Federal Water Pollution Control Act Amendments of 1972 (water quality)
- (9) PL 93-205 Endangered Species Act of 1973 (endangered or threatened fish/wildlife)
- (10) PL 102-240 Clean Air Act of 1990
- (11) Title 28 of PL 102-575 Reclamation Recreation Management Act of 1992

d. Incidental benefits of the project are that the reservoir improves conditions of the fishery and increases the recreational use of the adjacent San Juan National Forest. [REDACTED]

2-03. Physical Components. [REDACTED]

All elevations in this manual are based on the National Geodetic Vertical Datum of 1929 (NGVD29). As directed by EM 1110-1-1004, the datum has been changed to the North American Vertical Datum of 1988 (NAVD88). The elevations in this manual do not reflect the NAVD88.

a. Dam. [REDACTED]

b. Outlet Works. [REDACTED]

[Redacted]

c. Spillway.

[Redacted]

[Redacted]

2-04. Related Control Facilities. There are no related control facilities affecting water control as part of the Los Piños River Project.

2-05. Real Estate Acquisition. Project lands comprise a total of 3,650 acres (1,477 ha) acquired in fee simple ownership, of which 930 acres (376 ha) are above the high water line. Within the project boundaries of the 930 acres (376 ha), the U.S. Forest Service (USFS) owns 93 acres (38 ha), which it administers as campgrounds. A Memorandum of Agreement (MOA) between

the Bureau of Reclamation and the Bureau of Indian Affairs dated 11 June 1984 explains the development, administration, operation, and maintenance of certain Vallecito Reservoir lands for water-based recreation purposes. Further information on this MOA can be found in the referenced documents listed in Section 1-03, Related Manuals and Reports. A map of both project boundaries and reservoir boundaries, representing gross pool, is shown on Plate 2-6, Real Estate and Recreation Facilities.

2-06. Public Facilities. The USFS operates four campgrounds and one day-use picnic area along the east side of the reservoir. Three privately owned and operated marinas and two picnic areas allow additional day-use on the project's grounds. A restaurant and other businesses abut the project boundary on the west side of the reservoir at the site of two marinas. Public recreation activities include boating, fishing, hiking, camping, picnicking, and nature study. The public facilities are located along the shoreline of the reservoir, as shown on Plate 2-6. These include four USGS campgrounds, totaling 105 camping units with parking spaces; 32 spaces for boat trailers; 22 picnic units with tables and grills; short scenic trails; 22 comfort stations; 4 boat ramps; and 226 additional parking spaces.

III - HISTORY OF PROJECT

3-01. Authorization. Vallecito Dam and Reservoir was authorized by acts of Congress dated 25 June 1910, Public Law 61-288 (36 Stat. 836), and 5 December 1924, Public Law 68-292 (43 Stat. 702). The Pine River Project, which included as the primary construction feature Vallecito Dam and Reservoir, was approved for construction by the President on 17 June 1937, under the provisions of Section 4 of 36 Stat. 836 and Subsection B, Section 4 of 43 Stat. 702. Authorized project purposes include flood control, non-Corps hydropower, and irrigation.


3-02. Planning and Design. The planning of Vallecito Dam and Reservoir was accomplished by the USBR, Upper Colorado Region, and reviewed by authorities at higher levels, including the Engineering and Research Center in Denver, Colorado, and the Commissioner's Office in Washington, D.C. The design, related drawings, and specifications for Vallecito Dam and Reservoir and the appurtenant structures, were prepared by the USBR's Design Office in Salt Lake City, Utah. Further information on the history of planning and design can be found in the referenced documents listed in Section 1-03, Related Manuals and Reports.

3-03. Construction. Under contracts supervised by the USBR, construction of Vallecito Dam commenced on 14 May 1938. The project was completed in March 1941, and the reservoir began filling later that year. Construction of the hydropower plant was completed in 1989.


3-04. Related Projects. The Pine River Project also includes five diversion dams, 196 miles (315.4 km) of canals, 148 miles (238.1 km) of laterals, and 19 miles (30.6 km) of drains. The project provides supplemental irrigation service to 45,000 acres (18,211 ha) of private lands along the Los Piños River and 18,500 acres (7,487 ha) of Southern Ute Indian Reservation lands. Vallecito Dam is operated by the Pine River Irrigation District (PRID) under criteria developed by the USBR.

3-05. Modification to Regulations. There are no modifications to regulations.

3-06. Principal Regulation Problems. [REDACTED]



The Inflow Design Flood, or Probable Maximum Flood, was revised by the USBR on 8 February 1985. The revised PMF overtops the embankment by a maximum of 1.4 feet (42.6 cm) and for a duration of 7.5 hours. Refer to Section 8-02b for more detailed information.



There are no identifiable environmental concerns for the project. Further detailed information on any environmental subjects can be found in the referenced documents listed in Section 1-03, Related Manuals and Reports.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The project area for Vallecito Dam and Reservoir, shown on Plate 2-1, is located on the Los Piños River about 18 miles (29 km) northeast of Durango, Colorado. The drainage area is comprised of approximately 270 square miles (699.3 km²) of mostly rugged mountains along the southern edge of the San Juan Mountains. The Needle Mountains, which rise to more than 14,000 feet (4,267 m) in elevation, are located approximately 12 miles (19.3 km) north of the reservoir and form part of the northwest watershed boundary. The basin elevation averages 10,800 feet (3,291.8 m) and ranges from 7,665 feet (2,336.3 m) at the dam to 14,084 feet (4,292.8 m) at Windom Mountain. Slopes in excess of 10 percent predominate in the basin, and stream gradients of 100 to 300 feet per mile (18.9 to 56.8 m/km) are common. Locations with slopes less than 10 percent are concentrated in a few areas, including below the dam, the wetlands at the north edge of the reservoir, and the eastern shoreline of the reservoir.

Lower mountains rise abruptly from the Vallecito valley floor, which is a broad, flat valley approximately one mile (1.6 km) wide with an elevation of approximately 7,600 feet (2,316.4 m) above sea level. Perennial drainages flowing into the reservoir include the Los Piños River, Freeman Creek, Grimes Creek, D Creek, Vallecito Creek, Berri Creek, North Canyon, and Graham Creek.

The drainage area above Vallecito Dam is shaped by two canyons, one formed by the Vallecito Creek drainage, a north-south trending canyon approximately 1.3 miles (2.1 km) wide by 19 miles (30.6 km) long, the other by the Los Piños River drainage, a north-northeast trending canyon approximately 0.4 miles (0.6 km) wide and 22 miles (35.4 km) long. Vallecito Creek flows in a southerly direction and the Los Piños River flows in a south-southwesterly direction. Vegetative cover in the basin consists of the alpine plant community located above the timberline (elevations above 11,500 feet (3,505 m)) where vegetation is delicate and meager and barren areas of shale, rock slides, snow fields, and glaciers exist. The vegetative cover also includes the forest areas, situated between elevations 7,000 and 11,500 feet (2,133.6 m and 3,505 m), which are composed of huge stands of spruce, fir, and aspen at the upper elevations, ponderosa pine mixed with aspen and Douglas fir at the intermediate elevations, and mountain brush and rangeland shrubs at the lower elevations. While the mixed coniferous forest predominates, the basin also includes small, scattered grassland areas, emergent wetlands at the north end of the reservoir, riparian areas, and disturbed areas with a limited diversity of weedy species. Table 4-1 shows the type and extent of the vegetation cover as taken from maps prepared by the U.S. Geological Survey.

TABLE 4-1 DISTRIBUTION OF VEGETATION		
DESCRIPTION	RANGE OF ELEVATION (ft)	PERCENT OF BASIN AREA
Alpine Tundra	> 10,700	42
Sub-Alpine Conifer Forest and Grasslands (Mixed Conifer: spruce-fir)	$\geq 7,500 \leq 10,700$	58
Source: 'Desert Plants: Biotic Communities of the American Southwest - United States and Mexico,' Volume 4, University of Arizona, 1982.		

4-02. Topography. The drainage basin of Vallecito Dam and Reservoir consists of deep canyons greatly enlarged by glacial action. The ancestral Los Piños River flowed through a deep V-shaped valley about 200 feet (61 m) lower than the present valley floor. Through uplift and glaciation, the valley was broadened and transformed into its present U-shape. Glaciers, advancing down the Los Piños River and Vallecito Creek drainages, converged in the valley, carrying and depositing vast quantities of debris in the form of clay, sand, gravel, and boulders. Retreating glaciers left behind a terminal moraine about 200 feet (61 m) thick in the vicinity of the dam, and a lateral moraine along the east side of the valley between the Los Piños River and the dam. Meltwater streams from the glaciers' retreat led to significant Quaternary alluvial gravel deposits throughout the reservoir area that are still evident today. A topographic map of the Los Piños River Basin is presented on Plate 4-1. A stream profile of the Los Piños River is shown on Plate 4-2, and an Area-Elevation Curve of the basin (above Vallecito Dam) is presented on Plate 4-3.

4-03. Geology and Soils. The Los Piños River and Vallecito Creek drainages originate in the southern San Juan Mountains, which lie in the southwestern portion of the Southern Rocky Mountains Province. The San Juans form a broad swell, the San Juan uplift, which is probably a beveled Laramide uplift largely overlain by volcanic plateau deposits. The basement rocks are high-grade Precambrian metamorphics and granites. Most of the area has Precambrian nuclei that have been progressively up-warped in broad anticlines throughout Paleozoic and Mesozoic times. In south-central Colorado there was an extensive development of Tertiary-Quaternary volcanics, forming the San Juan volcanic field. The Quaternary saw the development of many cirque glaciers and even large valley glaciers in the high mountains. Very widespread periglacial features developed in the San Juans, such as the vast talus streams and "rock glaciers."

In the San Juan Mountains there are numerous deposits of silver, lead, zinc, as well as copper and gold. In a diagonal NE-SW transverse zone from the San Juan Mountains to the northern part of the Front Range, the Colorado "Mineral Belt," a 43.5-mile (70-kilometer) wide shear zone, there are numerous gold and silver-lead deposits.

The mountainous portions of the drainage area contain numerous igneous rock outcrops and deep well-drained soils formed in material weathered from quartz, latite, andesite, and other volcanic rock. At lower elevations near the dam and reservoir, the exposed rocks are younger and include limestone and shale, overlain by red arkosic sandstone and conglomerate with beds of red mudstone and siltstone.

The mesas and canyons have moderately deep to deep well-drained soils formed in residuum and alluvium derived from interbedded shale and sandstone. The majority of land area around and above the reservoir is classified as having severe soil limitations, based on the presence of slopes in excess of 10 percent, a steepness that presents limitations to many land uses. The soils at elevations below the dam and reservoir are principally of two types: recent alluvial soils of mixed origin and residual soils composed of residuals of shale and sandstone. Soils from the higher bench lands are a light reddish brown to reddish brown in color. Surface textures of these soils vary from fine sandy loams to friable clay loams, with the lighter textures more typical. Below 12 inches (30.5 cm), the subsoils are generally heavier, ranging from light silt loams to friable clays. Layers of cobbles frequently underlie these soils at depths below 4 feet (1.2 m). The organic content is low, due to a semiarid climate and subsequent limited cover of vegetation. There are no harmful accumulations of soluble or alkaline salts in these soils.

Alluvial soils are located on the benches, terraces, fans, and other alluvial formations adjacent to the Los Piños River and its tributaries. The color of these soils varies considerably, but grayish browns to light reddish browns predominate. Textures vary from sandy loams to clay loams, but with lighter textures being most common. The largest accumulations of the heavier textures appear in alluvial fan formations. The soils are generally friable and permeable to root and water penetration. Localized, low-lying areas having a high water table are subject to accumulation of seepage water from adjacent higher areas and contain concentrated salts which severely limit plant growth.

Further detailed information on geology can be found in the referenced documents listed in Section 1-03, Related Manuals and Reports.

4-04. Sediment. Sediment deposition in Vallecito Reservoir was estimated using runoff models prepared by the USBR's Denver Technical Service Center Sedimentation Section. Their studies revealed that the watershed above Vallecito Reservoir produces approximately 0.20 acre-feet (246.7 m³) of sediment per square mile (2.59 km²) of contributing drainage area. The 100-year sediment yields to Vallecito Reservoir of the upstream basin are estimated to be 5,400 acre-feet (6.7 hm³). The 100-year decrease in capacity of the reservoir is estimated to be 4.2 percent.

No surveys have been completed and no sediment ranges have been established since the completion of the dam to verify the average sediment yield.

4-05. Climate

a. General. The climate in the mountainous Vallecito drainage basin above Vallecito Dam and Reservoir is temperate and semi-arid, characterized by short warm summers and long snowy winters. In the watershed below the dam and reservoir, summers are hotter and drier, and winters are moderate, with occasional cold waves of short duration. The San Juan Mountains have a reputation for heavy winter snowfall, while summer months are characterized by warm days and cool nights. Precipitation is most frequent during the winter and early spring months.

b. Temperature. At high elevations the summers are moderate, while the winters can be severe. Lower elevations on the valley floor are usually parallel in temperature changes, but 10 to 15°F (5.5 to 8.3°C) warmer. The Monthly and Annual Mean, Average Maximum, and Average Minimum Temperatures for three stations in the local area, including data from Vallecito Dam, are presented in Table 4-2.

TABLE 4-2 MONTHLY AND ANNUAL MEAN, AVERAGE MAXIMUM, AND AVERAGE MINIMUM TEMPERATURES (°F)									
Month	Vallecito Dam (7,650 ft)			Durango, CO (6,550 ft)			Ignacio, CO (6,420 ft)		
	Monthly Averages			Monthly Averages			Monthly Averages		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
January	21.7	37.1	6.2	25.3	39.5	11	22.8	38.5	7.1
February	25.0	40.8	9.2	31.5	46.1	16.8	29.3	45.1	13.5
March	31.9	46.7	17.1	38.2	53.2	23.1	37.0	52.9	21.1
April	40.4	55.9	24.9	45.8	62.2	29.3	44.3	61.6	26.9
May	48.7	64.8	32.5	53.5	71.1	35.8	52.9	71.5	34.2
June	57.6	75.4	39.8	62.7	82.3	43.1	62.2	82.8	41.5
July	63.7	80.3	47.0	68.5	86.8	50.2	68.2	87.3	49
August	62.0	78.0	46.0	66.6	84.1	49	66.1	84.4	47.7
September	55.5	72.0	39.0	58.9	76.5	41.2	58.2	76.5	39.9
October	45.7	61.6	29.8	48.6	65.9	31.3	47.6	65	30.2
November	33.7	47.5	19.8	35.5	50	20.9	34.5	49.2	19.7
December	25.3	39.2	11.4	27.3	41.3	13.3	25.5	40.7	10.3
Average-Annual	42.6	58.3	26.9	47.0	63.4	30.5	45.8	63.1	28.5
Record	1948-2001			1971-2000			1971-2000		
Source: Western Regional Climate Center (www.wrcc.dri.edu)									

c. Precipitation. Snowfall accounts for almost half of the average annual precipitation within the drainage area above Vallecito Dam. Flood-producing rains have been observed in the summer and early fall. Average annual precipitation in the area can range from about 18.5 inches (47 cm) at Fort Lewis, CO, up to 40 inches (101.6 cm) near the highest peaks. The average annual precipitation at the Vallecito Dam is 27.76 inches (70.5 cm). Lemon Dam, approximately 4.5 miles west of Vallecito Dam, has an average annual precipitation of 30.03 inches (76.3 cm). Mean Monthly Precipitation at these locations is shown in Table 4-3. Total Mean Monthly, Maximum, Minimum, and Annual Average Precipitation is presented in Table 4-4. Locations of climatological stations are shown on Plate 4-4.

TABLE 4-3 MEAN MONTHLY PRECIPITATION						
Month	Vallecito Dam ¹ (7,650 ft)		Lemon Dam ¹ (8,083 ft)		Fort Lewis Colorado ² (7,598 ft)	
	inches	%	inches	%	inches	%
January	2.50	9.01	2.61	8.69	1.50	8.13
February	2.39	8.61	2.47	8.22	1.50	8.13
March	2.55	9.19	2.69	8.95	1.56	8.46
April	1.78	6.41	2.08	6.92	1.23	6.67
May	1.60	5.76	1.74	5.79	1.11	6.02
June	1.13	4.07	1.11	3.70	0.83	4.50
July	2.71	9.77	2.9	9.65	1.94	10.51
August	3.63	13.08	4.06	13.52	2.24	12.14
September	2.71	9.77	2.98	9.92	1.88	10.19
October	2.53	9.12	2.8	9.32	1.94	10.51
November	2.43	8.76	2.7	8.99	1.20	6.50
December	1.79	6.45	1.9	6.33	1.52	8.24
Average Annual	27.75	100.00	30.04	100.00	18.45	100.00
Maximum Annual	42.12		39.52		35.98	
Minimum Annual	12.51		14.58		9.35	
Record	1974-2001		1974-2001		1931-2001	
1. Source: USBR, Durango, CO office 2. Source: NCDC (http://lwf.ncdc.noaa.gov/oa/ncdc.html)						

TABLE 4-4
TOTAL MONTHLY AND ANNUAL AVERAGE,
MAXIMUM, AND MINIMUM PRECIPITATION (in)

Month	Vallecito Dam ¹ (7,650 ft)			Lemon Dam ¹ (8,083 ft)			Fort Lewis Colorado ² (7598 ft)		
	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min
January	2.50	8.18	0.20	2.61	8.11	0.12	1.50	6.36	0.00
February	2.39	5.82	0.13	2.47	6.14	0.37	1.50	4.32	0.00
March	2.55	5.06	0.07	2.69	5.45	0.20	1.56	4.29	0.00
April	1.78	4.87	0.11	2.08	6.01	0.09	1.23	5.28	0.00
May	1.60	3.43	0.09	1.74	4.15	0.03	1.11	3.49	0.00
June	1.13	5.75	0.00	1.11	4.01	0.00	0.83	2.94	0.00
July	2.71	5.86	0.23	2.90	6.73	0.43	1.94	5.23	0.44
August	3.63	9.21	0.95	4.06	8.70	0.82	2.24	7.20	0.21
September	2.71	5.55	0.11	2.98	6.63	0.10	1.88	6.32	0.18
October	2.53	6.64	0.00	2.80	7.52	0.02	1.94	9.04	0.00
November	2.43	6.47	0.00	2.70	6.25	0.08	1.20	4.25	0.00
December	1.79	6.30	0.00	1.90	7.28	0.01	1.52	5.03	0.00
Annual	27.76	42.12	12.51	30.03	39.52	14.58	18.45	35.98	9.35
Record	1974-2001			1974-2001			1931-2001		
1. Source: USBR, Durango, CO office									
2. Source: NCDC (http://lwf.ncdc.noaa.gov/oa/ncdc.html)									

d. Snow. Snowmelt is the main source of inflow into Vallecito Reservoir. Snowfall above Vallecito Dam normally accumulates through April, then increasing temperatures mark the beginning of the snowmelt season. Table 4-5 presents data for representative snowpack telemetry (SNOTEL) sites used by the NWS for forecasting snowmelt runoff for Vallecito Dam and Reservoir. Snow surveys are done each year by the National Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA). The locations of the SNOTEL and snow course sites are shown on Plate 4-4.

TABLE 4-5
MONTHLY AVERAGE AND MAXIMUM SNOWFALL
(Snow Water Equivalent - Inches)

SNOTEL STATION	AVERAGE					MAX. (Date)	MIN. (Date)
	1-Jan	1-Feb	1-Mar	1-Apr	1-May		
Vallecito (10,880 feet)	6.7	9.8	15.3	19.2	13.9	34.4 (20 Apr 93)	0.0 (Many)
Red Mountain Pass (11,200 feet)	9.8	14.5	19.3	25.4	26.7	36.8 (14 May 95)	0.0 (Many)
Upper Rio Grande (9,400 feet)	2.3	3.8	5.2	5.7	1.9	13.5 (17 Apr 93)	0.0 (Many)
Cascade (8,880 feet)	5.7	8.8	12.1	12.1	4.1	25.3 (01 Mar 93)	0.0 (Many)

Source: Natural Resources Conservation Service (http://www.wcc.nrcs.usda.gov/factpub/ads/ads_co.html)

e. Wind and Evaporation. Peak wind velocities generally occur in the spring, with prevailing winds blowing from a westerly direction. Average pan evaporation recorded at the dam are presented in Table 4-6. The nearest recording wind gages are located northwest of Vallecito Dam at Grand Junction, Colorado, and to the southeast at Alamosa, Colorado. The mean and peak wind data for these stations are presented in Table 4-7.

TABLE 4-6
AVERAGE MONTHLY
PAN EVAPORATION AT VALLECITO DAM, COLORADO

Evaporation (inches)							
APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
3.81	5.26	6.2	6.07	5.28	4.36	3.04	1.6

Source: Western Regional Climate Center 1948-2000 (<http://www.wrcc.dri.edu/htmlfiles/westevap.final.html>)

TABLE 4-7
MEAN AND PEAK MONTHLY WIND VELOCITIES

MONTH	MEAN (mph)		PEAK GUST (mph)	
	Alamosa	Grand Junction	Alamosa	Grand Junction
January	5.4	6.3	58	41
February	6.6	7.2	51	59
March	8.2	8.5	54	53
April	9.7	9.0	67	78
May	9.8	9.5	63	62
June	9.2	10.1	59	66
July	7.2	9.8	58	64
August	6.0	9.5	48	74
September	6.4	8.9	54	64
October	6.3	7.9	62	54
November	5.5	6.6	49	49
December	4.8	6.1	54	45
Annual	7.1	8.3	67	78

Source: Western Regional Climate Center 1992-2000 (<http://www.wrcc.dri.edu/htmlfiles/westwind.final.html>)

4-06. Storms and Floods. Floods in the Vallecito Basin are caused by snowmelt and thunderstorms, with snowmelt floods usually the most damaging. These floods can have sustained high flows of two to four months with peaks generally occurring in the late spring. Thunderstorms can be intense, but usually isolated with short durations.

During the winter months, most of the snowfall comes from Pacific storms that move from west to east across the state. The precipitation during this season is the most consistent, and the major source of streamflow for the Los Piños River.

Thunderstorms have a different source than the winter storms; the moisture, usually following a high-pressure system, is carried from the Gulf of Mexico by unstable air masses over the watershed. When this unstable air is forced to rise suddenly over the steep San Juan Mountains, it cools and a short period of intense precipitation occurs in a localized area. Most thunderstorms have a duration of an hour or less and often cover an area not more than 5 square miles (12.95 km²). Prior to the construction of Vallecito Dam, flood damages along the Los Piños River, other than bank erosion, included damage to canal headings, farm buildings, fences, irrigation ditches, county roads and bridges, and silt damage to fields and crops.

The three largest snowmelt floods of record on the Los Piños River near Bayfield are provided in

Table 4-8.

TABLE 4-8 SNOWMELT FLOODS OF RECORD LOS PIÑOS RIVER, COLORADO		
WATER YEAR	MAXIMUM DAILY FLOW (cfs)	120-DAY VOLUME (acre-feet)
1979	3,710	374,876
1941	3,858	363,927
1957	4,443	333,699
Source: USBR		

The maximum reservoir stage occurred in July 1957, when heavy rains in the mountains caused the reservoir to be filled to capacity. The three flood gates were opened simultaneously, releasing a surge of water at approximately 13,000 cfs (368 m³/s). The river stage at Bayfield, 11 miles (17.7 km) downstream of the dam, reached the top of the U.S. Highway 160 bridge. The high water caused basement flooding and agricultural losses.

In October of 1911 a flood caused the Los Piños River to inundate land along the river at Bayfield for nearly a week. One house was washed away, as the water reached a depth of 3.5 to 4.0 feet (1.1 to 1.2 m) at the fairgrounds. Residents of Bayfield reported that a 1927 flood reached a stage equal to the 1911 flood.

Some maximum peak flows that have occurred in and around the project area are shown in Table 4-9.

TABLE 4-9 RECORDED MAXIMUM PEAK FLOWS				
Station	Drainage Area (mi ²)	Period of Record	Maximum Flood of Record (date)	Peak Flow (cfs)
Vallecito Creek near Bayfield, CO	72.1	1963 to Present	6 Sep 1970	7,050
Los Piños River near Bayfield, CO	270.0	October 1927 to September 1986	27 Jul 1957	13,800
Vallecito Dam near Bayfield, CO	270.0	April 1941 to Present	11 Jun 1949	5,386
Pine River below Vallecito Dam	284.0	October 1986 to Present ¹	24 Jun 1995	2,560
Los Piños River at La Boca, CO	510.0	April 1951 to Present	27 Jul 1957	6,400
Source: USGS (http://co.waterdata.usgs.gov); Colorado Division of Water (http://water.state.co.us/)				
¹ No official record available, gage is for administrative use only				

4-07. Runoff Characteristics. The Vallecito drainage basin is steeply sloped and has only a small number of high elevation lakes to moderate the rainfall runoff. The lower elevations are densely forested and would counteract the runoff characteristics of the barren upper basin. Spring snowmelt generates the largest inflow volume beginning in late March or early April in the lower elevations of the watershed. The runoff increases in May as considerable melting occurs in the higher mountains, normally reaching a peak late in May or early June. Heavy rainstorms, which may occur anytime from mid-June through December, may also cause peak inflows. Reconstitutions of historical floods in the area yield retention rates of 0.10 inches-per-hour to 0.15 inches-per-hour (0.25 cm/hr to 0.4 cm/hr) to replicate the peaks and volumes. Lag times from these reconstitutions yield values of 22.5 and 26.0 hours for Vallecito Creek and the Los Piños subareas, respectively. January through mid-March have little runoff, due to the cold weather keeping most of the precipitation in the form of snow. Average monthly inflow and outflow of the reservoir is shown in Table 4-10.

Streamflow records for the gaging stations indicated on Plate 4-1, Topography and Stream Gaging Stations, are published by the USGS and are available on either hard copy, computer automated formats (i.e., the Internet), or CD ROM. The Colorado Division of Water Resources (CDWR) also maintains records on its gage below the dam, which are available by request from the department.

The official operation record of Vallecito Reservoir is maintained by the USBR. Operation of Vallecito Dam began in 1941 and a graphical representation of historical operation is shown on Plate 4-5. Historical Monthly Inflows to Vallecito Reservoir is shown in Table 4-11, page T4-1.

A record of flood control requirements, storage, and flows pertinent to flood control operation will be contained in monthly reports as stated in Exhibit A.

TABLE 4-10 AVERAGE MONTHLY FLOWS (acre-feet) VALLECITO DAM AND RESERVOIR, COLORADO				
MONTH	INFLOW (ac-ft)	PERCENT OF ANNUAL	OUTFLOW (ac-ft)	PERCENT OF ANNUAL
January	4,737	1.78	3,762	1.40
February	4,208	1.58	3,392	1.27
March	6,567	2.47	5,635	2.10
April	20,827	7.82	12,635	4.71
May	67,912	25.50	41,772	15.59
June	76,158	28.60	60,656	22.63
July	30,297	11.38	46,449	17.33
August	17,505	6.57	35,971	13.42
September	14,051	5.28	28,428	10.61
October	11,402	4.28	17,942	6.70
November	7,262	2.73	6,532	2.44
December	5,375	2.02	4,820	1.80
Annual	266,301	100.00	267,994	100.00
Source: USBR, Durango, CO (1941-2001)				

The watershed response since the Missionary Ridge fire is expected to increase the peak flows of the streams leading to the Vallecito Dam and Reservoir. Elevated erosion, runoff, and stream flows are expected to occur for several years after the fire until the vegetation has recovered. Recovery of grasses, forbs, and shrubs is expected to occur in most areas within 3 to 5 years. Some areas burned at high severity may not fully recover for ten or more years. Once vegetation has recovered, the watershed is expected to return to pre-fire conditions. Based on the results of the discharge analysis, there is a high potential for flooding. Table 4-13 shows the changes in the watershed characteristics due to the fire, and also shows the increase in flood flows into the reservoir.

**TABLE 4-13
PRE-FIRE AND POST-FIRE CONDITIONS AT VALLECITO DAM
FOR LOS PIÑOS RIVER, COLORADO**

WATERSHED CHARACTERISTIC	PRE-FIRE CONDITIONS	POST-FIRE CONDITIONS
Area (acres)	46,010	46,010
Average Slope (%)	35	35
Time of Concentration (hrs)	5.8	5.1
Average Curve Number	55	60
Average Runoff Coefficient	.10	.23
1 yr 30 min Discharge (cfs)	11,852	14,563
2 yr 30 min Discharge (cfs)	17,565	21,314
5 yr 30 min Discharge (cfs)	26,057	31,019
10 yr 3 0min Discharge (cfs)	40,523	46,970
25 yr 3 0min Discharge (cfs)	45,719	52,587
50 yr 30 min Discharge (cfs)	51,061	58,323
100 yr 3 min Discharge (cfs)	62,105	70,084
1 yr 1 hr Discharge (cfs)	8,316	10,281
2 yr 1 hr Discharge (cfs)	11,309	13,910
5 yr 1 hr Discharge (cfs)	15,600	19,015
10 yr 1 hr Discharge (cfs)	19,593	23,664
25 yr 1 hr Discharge (cfs)	23,840	28,517
50 yr 1 hr Discharge (cfs)	28,334	35,570
100 yr 1 hr Discharge (cfs)	33,057	38,807
Source: San Juan National Forest BAER Report July 2002		

4-08. Water Quality. The chemical, physical, and biological properties of surface water, at any given point, are the product of a multitude of factors including geography, geology, climatic conditions, discharge, floral and faunal communities, ground water supply, and of major significance - the effect of man, his activities, and his domestic animals. Both the chemical and biological quality of the Los Piños River are excellent in the upper reaches, but gradually degrade in a downstream direction. This is typical for most streams and consistent with the general rule that the amount of solids, along with bacterial and algal growth increases from natural and man-made sources as water proceeds downstream.

An extensive water quality database exists for a U.S. Geological Survey (USGS) site located on Vallecito Creek about 3.5 miles (5.6 km) upstream of the confluence with Vallecito Reservoir. Water chemistry samples have been collected four times per year from 1963 to the present. Results of samples collected in water years 1991 and 1992 indicate good water quality conditions for the incoming water supply (USGS 1992 and 1993) and are presented in Table 4-12, located on page T4-4 in the Tables Section. Since releases from the reservoir into the Los Piños River

are eventually used as drinking water for the towns of Bayfield and Ignacio, Maximum Contaminant Levels (MCLs) recommended by the U.S. Environmental Protection Agency (USEPA 1993) were compared to the sampling results from Vallecito Creek (see Table 4-12 on page T4-3). For those parameters with an MCL value, concentrations in Vallecito Creek were well below the recommended standards, except for coliform bacteria. The goal for coliform bacteria is 0, but a count of 38 was reported for streptococci bacteria in August of 1991. Other counts exceeded 1, but the counting conditions were not ideal, indicating that sample holding times or some other condition were not optimum.

The USBR conducted a surface and ground water quality study during 1992 and 1993 within and adjacent to Vallecito Reservoir to determine the extent of fecal coliform and nutrient contamination of the reservoir, and to determine baseline water quality data for the area. This program was conducted under a technical assistance agreement with the Colorado Department of Health. Fecal coliform and trace metal samples were taken from domestic wells and monitoring wells at various locations along the shoreline, from reservoir surface water tributaries, and from reservoir open water locations. For purposes of this study, a standard of 240 fecal coliform colonies per 100 ml was considered to be a threshold value for contamination of untreated surface waters.

The USBR study indicated that the reservoir currently does not have a large-scale problem with fecal coliform contamination. However, several specific surface water locations were identified where fecal coliform contamination was evident: Root Creek, Five Branches Marina area, vicinity of Graham Creek Campground, and Gut Canyon. The majority of these locations are in the southern portion of the reservoir area. No fecal contamination problems were identified for domestic wells sampled. The USBR monitoring wells and reservoir surface water samples generally showed no detectable contamination. A preliminary conclusion of the study was that the high transmissivity of the groundwater system serves to rapidly dilute fecal contamination from human sources. Metals concentrations were within drinking water standards for all sampling locations.

A concern with elevated mercury levels in fish tissue has been identified by the Colorado Division of Wildlife (CDOW). One northern pike in the 36- to 42-inch (91.4- to 106.7-cm) size class that was collected from the reservoir in 1991 showed a concentration of 0.598 mg/liter. This value, which represented a fillet sample, exceeded the Colorado Department of Health hazard level of 0.5 mg/liter.

Based on a field reconnaissance conducted 27-28 October 1993, and discussions with USBR and PRID personnel, the following water quality issues were identified for Vallecito Reservoir:

- a. Algal blooms are evident in the reservoir during the summer and fall; periodic dense algal growth occurs in the outlet works.
- b. Livestock-grazing in areas adjacent to Vallecito Creek at the north end of the reservoir

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contributes to erosion and possible nutrient and coliform concerns.

- d. Possible leakage from domestic septic systems from adjacent cabins near the reservoir.

4-09. Channel and Floodway Characteristics. Below Vallecito Dam, the Los Piños River flows south through La Plata County for 32.6 river miles (52.5 river kilometers) until it enters Navajo Reservoir. As it leaves the sub-alpine forest at the damsite, the channel is shallow and rocky and about 15 to 20 feet (4.57 to 6.1 m) wide; the width of the valley ranges from .5 to .75 miles (0.8 to 1.2 km). The stream channel is braided, irregular, and meandering, with numerous sandbars and deposits of gravel and cobbles. The channel is lined with sagebrush and willows for most of its length.

The current non-damaging safe channel capacity is estimated at 2,000 cfs (56.6 m³/s). Releases from Vallecito Dam have been above 2,000 cfs for fifteen days over the period of 1991 through 1998. Below the town of Bayfield, the valley broadens to about 0.8 miles (1.3 km) wide as it flows through the Southern Ute Indian Reservation until it narrows to about 0.2 miles (0.3 km) wide as it enters the Los Piños arm of Navajo Reservoir. The stream gradient has an average slope of about 45 feet per mile (8.5 m/km) between Vallecito Dam and Navajo Reservoir. Tributaries below Vallecito Dam include Red Creek, Texas Creek, Bear Creek, Beaver Creek, Dry Creek, Rock Creek, Ute Creek, and Spring Creek.

When flows go overbank, agricultural land becomes eroded. There have been no channel encroachments, so no channel improvements have been necessary. Also, there are no damage centers for this project. For information on the discharge rating curve below Vallecito Dam and Reservoir, refer to Exhibit A, Plate A-6. The average travel time from Vallecito Dam to the mouth of the canyon of the Los Piños arm of Navajo Reservoir is 6 hours. The control point is located immediately below Vallecito Dam. A summary of the flood wave generated by the USBR 1985 Inundation Study is shown in Table 4-14.

TABLE 4-14
ESTIMATED FLOOD WAVE FROM START OF VALLECITO
DAM FAILURE TO INITIAL FLOOD RISE, LOS PIÑOS RIVER, COLORADO

LOCATION	MILES FROM DAM (mi)	TRAVEL TIME ¹ (hr)	PEAK FLOW (cfs)	DEPTH OF FLOW ² (ft)	MAX WATER SURFACE ELEVATION (ft)	VELOCITY (mph)
Vallecito Dam	0	0	690,000	17	7572	25
Dry Creek	2.1	0.25	635,000	33	7433	17
Texas Creek	5.0	0.25-0.5	580,000	27	7267	14
Bear Creek	8.3	0.5-1.0	518,000	27	7107	16
1 mi N of Bayfield, CO	11.5	1.0-2.0	464,000	13	6933	12
1 mi S of Bayfield, CO	13.6	1.0-2.0	431,000	14	6835	11
Ignacio, CO	22.1	2.0-3.0	322,000	20	6456	9
La Boca, CO	29.8	2.5-4.5	247,000	10	6168	9

Source: USBR, Inundation Study, February 8, 1985.

¹Time for leading flood wave to reach given location.

²Depth from bottom of river channel.

4-10. Upstream Structures. There are no structures located upstream of Vallecito Dam that have any significant effect on the flood-control operation of the Pine River Project, or whose failure could possibly cause damage.



4-12. Economic Data. In general, economic growth within the Four Corners Region (the five counties in the extreme southwest of Colorado and San Juan County, New Mexico) is expected to exceed the rate of growth for the State of Colorado. For instance, the Colorado Division of Local Government projects a 40 percent increase in labor force statewide between 2000-2020; in the Four Corners region during the same 20-year period, a 51 percent increase is predicted. Services, retail and government sectors employ most of the labor force in the Four Corners Region. This is most likely due to the strength of the tourism industry and the proximity of numerous public lands and their managing agencies.

a. Population. The city of Durango is the administrative, industrial, and commercial center for La Plata County and the surrounding area. Population estimates from the 2000 Census within Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties in Colorado, and San Juan County, New Mexico, appear in Table 4-15; population change appears in Table 4-16. San Juan County, New Mexico, is included because it is the most populated county in the Four Corners Region, and accounts for a substantial number of visitors to the recreation areas at Vallecito Reservoir.

TABLE 4-15 POPULATION					
LOCALITY	POPULATION BY YEAR				
	1980	1990	2000	2010*	2020*
Archuleta County, CO	3,664	5,345	9,898	14,621	19,324
Dolores County, CO	1,658	1,504	1,844	2,112	2,421
La Plata County, CO	27,424	32,284	43,941	55,909	64,132
Montezuma County, CO	16,510	18,672	23,830	29,302	34,920
San Juan County, CO	833	745	558	686	796
TOTAL	50,089	58,550	80,071	102,630	121,593
Colorado	2,889,964	3,294,394	4,301,261	5,162,179	6,042,949
USA (Millions)	226.5	248.7	281.4	299.9	327.5
San Juan County, NM	81,433	91,605	113,801	125,614	145,072
*Population projection Source: U.S. Department of Commerce, Bureau of Census, (www.census.gov/) Population projections provided by Colorado Department of Local Affairs (http://www.dola.state.co.us/), and the University of New Mexico (http://www.unm.edu/)					

TABLE 4-16
CHANGE IN POPULATION (since 1980)

LOCALITY	PERCENT CHANGE BY YEAR			
	1990	2000	2010*	2020*
Archuleta County, CO	+46%	+85%	+48%	+32%
Dolores County, CO	-9%	+23%	+15%	+15%
La Plata County, CO	+17%	+36%	+27%	+15%
Montezuma County, CO	+13%	+28%	+23%	+19%
San Juan County, CO	-11%	-25%	+23%	+16%
TOTAL	+17%	+37%	+28%	+18%
Colorado	+14%	+31%	+20%	+17%
USA (Millions)	+10%	+13%	+7%	+9%
San Juan County, NM	+12%	+24%	+10%	+15%

*Population projection
Source: U.S. Department of Commerce, Bureau of Census, (www.census.gov/)
Population projections provided by Colorado Department of Local Affairs
(<http://www.dola.state.co.us/>), and the University of New Mexico (<http://www.unm.edu/>).

b. Agriculture. Agricultural pursuits in the valley include irrigated pasture for livestock, alfalfa, wheat, barley, and dry edible beans. Untilled portions of the basin support livestock (primarily cattle). Table 4-17 indicates the value of agricultural activities in the region.

TABLE 4-17
1997 CENSUS OF AGRICULTURE
LA PLATA COUNTY, COLORADO

ITEM	QUANTITY			
	1997	1992	1987	1982
Total Cropland (acres)	91,129	108,216	109,135	96,677
Irrigated Land (acres)	71,855	85,394	61,461	58,443
Market Value of Crops Sold ¹ (\$1,000)	4,948	3,364	2,826	2,264
Market Value of Livestock, Poultry, and Products Sold (\$1,000)	10,889	10,884	13,214	9,690

¹including nursery and greenhouse crops
Source: Agricultural Census for La Plata County, Colorado
<http://govinfo.library.orst.edu/php/agri/search.php>

c. Industry. The services and retail industries are the largest employers in the area, as many visitors come to enjoy the San Juan Mountains and National Forest recreation areas. The other major economic activities support the tourist and recreation trade. Table 4-18 contains 2000 Census “Employment and Total Payroll Figures” for La Plata County, Colorado.

TABLE 4-18
EMPLOYMENT AND TOTAL PAYROLL BY
TRADE CATEGORY LA PLATA COUNTY, COLORADO

TRADE CATEGORY	TOTAL EMPLOYEES	TOTAL PAYROLL (\$1,000)
Services	6,283	127,600
Retail	4,667	63,713
Construction	1,523	36,223
Manufacturing	1,189	21,338
Finance, Insurance and Real Estate	958	25,079
Wholesale	740	20,187
Transportation and Public Utilities	583	16,052
Agricultural Services	202	3,766
Mining	186	6,815

Sources: 1997 County Business Patterns (<http://www.census.gov>); Colorado Employment and Wages Annual Avg 2000 Report, <http://www.coworkforce.com/lmi/es202/2000Annual.pdf>

d. Flood Damages. Since the construction of Vallecito Dam and Reservoir, there have been no flood damages to report. Prior to the construction of Vallecito Dam, flood damages along the Los Piños River, other than bank erosion, included damage to canal headings, farm buildings, fences, irrigation ditches, county roads and bridges, and silt damage to fields and crops. From operation studies conducted by the USBR, it was found that damages from snowmelt floods have been reduced by the operation of Vallecito Dam. Annual reports on flood damages prevented are written by the USBR at the end of each calendar year and copies are sent to the USACE. The estimated damages prevented for several flood years are listed in Table 4-19.

TABLE 4-19 DAMAGES PREVENTED BY VALLECITO DAM AND RESERVOIR	
FLOOD EVENT	DOLLAR VALUE OF DAMAGES PREVENTED IN YEAR OF OCCURRENCE (\$1,000)
1997	320
1970	120
1973	75
1975	40
Source: USBR, Durango,CO	

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V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations. Hydrologic and meteorologic data are recorded and published for several sites throughout the Los Piños River and adjacent basins, as shown on Plates 4-1 and 4-4.

a. Facilities.

[REDACTED]

[REDACTED]

[REDACTED]

b. Reporting. Hydrometeorological information at Vallecito Dam and Reservoir, and elsewhere in the Los Piños River Basin, is monitored through the automated data collection system to HYDROMET. Hydromet software was developed by the Sutron Corporation to facilitate the collection of data from the DCP, and is processed into a database management system. This data is transmitted from the DCP's and relayed via the GOES Central spacecraft to the USBR downlink. This raw data is transmitted every half hour from the downlink to the Salt Lake City H2O VAX computer. These raw messages are processed by the Sutron software, while data for the SNOTEL sites are transmitted via meteor burst radio. Table 5-1 presents the real-time hydrometeorologic data collection sites. [REDACTED]

[REDACTED] Reservoir elevations, releases, and computed inflows are all made available on a daily basis to the U.S. Army Corps of Engineers, Sacramento District. For flood emergencies, the Pine River Irrigation District (PRID) will contact the USBR. The USBR will contact the Sheriff's Office. Refer to Exhibit A, for more detailed information on specific reporting requirements.

**TABLE 5-1
VALLECITO DAM AND RESERVOIR REAL-TIME
HYDROMETEOROLOGIC DATA COLLECTION SITES**

Station Name	Mnemonic	Collected Parameters	Via	Agency
Durango	[REDACTED]	Precipitation Temperature	P	NRCS
Cascade	[REDACTED]	Snow Pillow Precipitation Temperature	P	NRCS
Hermit	[REDACTED]	Precipitation Temperature	P	NRCS
Red Mountain Pass	[REDACTED]	Snow Pillow Precipitation Temperature	P	NRCS
Silverton	[REDACTED]	Precipitation Temperature	P	NRCS
Stump Lakes	[REDACTED]	Snow Pillow Precipitation Temperature	P,R	NRCS
Upper Rio Grande	[REDACTED]	Snow Course Snow Pillow Precipitation Temperature	P	NRCS
Vallecito	[REDACTED]	Snow Pillow Precipitation Temperature	P,R	NRCS
Vallecito Dam and Reservoir	[REDACTED]	Evaporation Precipitation Temperature	P	PRID

KEY:

Via: P=Phone R=Radio

Agency: Indicates the agency responsible for the gage

NRCS: National Resources Conservation Service

USBR: U.S. Bureau of Reclamation

PRID: Pine River Irrigation District

5-02. Water Quality Stations

a. Facilities. The USGS stream gage on Vallecito Creek is also a water quality station. (See paragraph 4-08). There is a daily record for water temperatures for the period November 1962 to September 1982. For chemical analyses the record extends from October 1963 through the current year. Various parameters for chemical analyses are field-sampled and laboratory-analyzed on a six-month basis during the water year; however, the facility is not automated for water quality sampling.

b. Reporting. All water quality reports are generated by the USGS in their annual published report: "Water Resources Data for Colorado."

c. Maintenance. The operating water quality station is maintained by the USGS.

5-03. Sediment Stations

a. Facilities. There are no sediment stations on the Los Piños River, Vallecito Creek, or anywhere within the project area.

b. Reporting. No periodic reports on sedimentation are currently being generated.

c. Maintenance. Since there are no sediment stations, no maintenance is required.

5-04. Recording Hydrologic Data. Since filling began in 1941, a daily record of Vallecito Reservoir water surface elevation, storage, outflow, and computed inflow has been maintained by the USBR's Facilities Resource Group, Southern Division, Western Colorado Area Office (WCAO-SD), located in Durango, Colorado. The records are stored in the USBR's computer database. Stream flow records are stored in the USGS National Water Data System database.

5-05. Communication Network. Communication between the U.S. Army Corps of Engineers, Sacramento District, and the WCAO-SD, is through the telephone, facsimile, and e-mail. Communication between the WCAO-SD and the project operator is normally by telephone, facsimile, cell phone, and e-mail. Refer to the front of this manual for a list of personnel involved with the operation of Vallecito Dam.

5-06. Communication with Project

a. Regulating Office with Project Office. The WCAO-SD located in Durango, Colorado, has the primary responsibility and supervision of the hydrometeorological forecasts and flood control for Vallecito Dam and Reservoir. The USBR's Upper Colorado Regional Office in Salt Lake City, Utah, coordinating with the NWS and the NRCS, has responsibility for making

Vallecito Reservoir inflow forecasts. These forecasts are prepared and distributed to the WCAO-SD by the seventh day of each month from January through June.

The normal communication chain is from the USBR's Upper Colorado Regional Office to the WCAO-SD in Durango, which, in turn, will contact the PRID dam superintendent. The PRID is responsible for gate adjustments, if changes are required. For flood emergencies, the PRID will contact the USBR. Then the USBR will contact the La Plata County Sheriff's Office. Refer to Chapter IX and Exhibit A for more detailed information on communication requirements between the USBR and the U.S. Army Corps of Engineers (USACE).

b. Between Project Office and Others. For flood warnings, telephone, facsimile, e-mail, and cell phone are the normal means of communication between the WCAO-SD in Durango and other agencies. The USBR provides all material updates to the USACE. All agencies involved are listed in the Standard Operating Procedures for Vallecito Dam and Reservoir (SOP), which is referenced in Section 1-03 of this manual, Related Manuals and Reports.

5-07. Project Reporting Instructions. The USBR is the primary source of information concerning the operation of Vallecito Dam. The USBR will, on a daily basis, record reservoir water surface elevation, reservoir storage, outlet discharge, computed inflow, temperature, and precipitation. Reporting instructions are presented in Exhibit A.

5-08. Warnings. Normal activation of the Emergency Broadcast System for flood watches or warnings is provided by the National Weather Service, Colorado Basin River Forecast Center, in Salt Lake City, Utah. The WCAO-SD in Durango will notify local governmental agencies, law enforcement agencies, and the news media when there are significant changes in discharges that could affect downstream interests. Reporting instructions are presented in Exhibit A.

VI - HYDROLOGIC FORECASTS

6-01. General. Hydrologic forecasts are made in conjunction with the operation of Vallecito Dam for essentially two purposes: management of water during snowmelt season and for water supply operations planning. The ultimate aim of the forecasting system for Vallecito Reservoir is to forecast the approximate rates of inflow to the reservoir, and to estimate the total inflow volume expected, in order that outflow rates may be controlled, insofar as possible, without causing damages downstream. In order to ensure that the flood control operation of Vallecito Dam will be as effective and reasonable as possible, it is essential that all who bear responsibility for the operation of the project remain aware, at all times, of possible flood hazards, weather conditions, inflow to the reservoirs, and flow in the river.

a. Role of the U.S. Army Corps of Engineers. The U.S. Army Corps of Engineers, Sacramento District, is responsible for monitoring the operation of Vallecito Dam and Reservoir to ensure it complies with the authorized Water Control Plan. The Corps monitors the reservoir storage, outflow, calculated inflow, temperature, precipitation, and forecasted hydro-meteorological conditions. This monitoring is most critical during the snowmelt season. Weather, quantitative precipitation, and snowmelt forecasts developed by the NWS assist with project monitoring.

b. Role of Other Agencies. Forecasts are prepared by the NWS Colorado Basin River Forecast Center (CBRFC) in Salt Lake City, Utah. The NWS is the lead agency for the forecasting service. Forecasts represent a coordinated effort between the NWS, NRCS, USBR, USGS, and local water district managers. The USGS and the USBR provide flow and storage data, which are incorporated into the forecasts. The USBR develops water supply drawdown estimates for each year. The NRCS provides snow depth, extent of areal coverage, and snow-water content data from its extensive snow measurement network. Hydrologists in the NRCS and the NWS coordinate preparation of the forecasts. Refer to Section 9-02 for more information.

6-02. Flood Condition Forecasts. The forecasts are developed by the CBRFC for both long-term, snowmelt-based floods and short-term runoff from rainfall.

a. Requirements

(1) Snowmelt Floods. Snowmelt floods are characterized by large flow volumes, several months in duration, and low to moderate peak inflows. The magnitude of snowmelt floods may be forecast well in advance of the actual events, due to the relatively long time required for the snow to melt and produce runoff, the relative ease and reliability in measuring basic data, and the reliability of the methodology used. The time required for the USBR to compute an inflow hydrograph is approximately 1 to 2 hours. The inflow is a monthly time

increment, based on forecasted snowmelt. The inflow volume can be redistributed into smaller time increments using historical runoff patterns.

Snowmelt forecasts are estimates of the total runoff volume from the date of the forecast through the end of July. Forecasted inflows by the CBRFC are issued regularly (at least once a month between January and May) for Vallecito Reservoir. Preliminary forecasts are available to the USBR and the USACE by telephone the first of each month. The official forecast is not distributed until about the 7th of the month because of the time required to check the forecast. The current official forecast of snowmelt runoff for inflow to Vallecito Reservoir is made available on the NWS' DATACOL computer system and through the Internet. Supplementary forecasts are available by telephone request, whenever conditions change significantly due to the passage of large storms.

(2) Rain Floods. Rain floods arise from rainstorms and thunderstorms, which are two distinct types of events. General rainstorms produce widespread flooding of one to several days duration. These volumes are relatively low when compared with snowmelt flood volumes, but peak flows are often much higher. Local floods from thunderstorms are characterized by extremely high peaks, short durations, and small volumes, and generally dissipate within a relatively short distance from their origin. Of the two main rain flood events, general rain floods are both more predictable and more likely to cause widespread damage. Thunderstorms, on the other hand, occur erratically whenever atmospheric conditions are “ripe.” This makes local thunderstorm floods very difficult to predict.

The limited capacity of the downstream channel makes the pre-release of forecasted inflow from outlet works and the rain floods occurring above the dam impractical. The rapid response of downstream tributaries and the relatively long travel time of releases from Vallecito Dam causes the reduction of outflow due to observed or forecasted rain floods below the dam to be problematic. Consequently, most flood control benefits for rain floods result from storage in the reservoir. The Spillway Gates Operation Curve, Plate A-9, is based on the observed water surface elevation and not on forecasted inflows. Operation of the spillway gates must be in accordance with the diagram to avoid the risk of overtopping and possible failure of the embankment.

b. Methods

(1) Snowmelt Flood. Snowmelt flood forecasts are based on a statistical correlation of historical runoff volumes to related hydrologic variables. The forecasted runoff (dependent variable) is the remaining natural inflow between the forecast date and 31 July. It is the 30-year average of observed inflow to Vallecito Dam. No adjustment of natural inflow to Vallecito Reservoir is made, because of the limited nature of upstream consumptive uses.

The independent variables are current snow depth in water equivalent and antecedent precipitation from October to the forecast date. Snow depth is obtained from SNOTEL sites and antecedent precipitation is obtained from gages, as shown on Plate 4-4 and Table 5-1.

One key assumption of the forecast is that weather during the forecast period will be the same as the 30-year average of historical weather, as described in paragraph 6-02c.

(2) General Rain Floods. General rain flood forecasts are based on anticipated and measured precipitation, and established relationships between runoff and precipitation. This data is supplemented by information from stream gaging stations shown on Plate 4-4. The specific stations used at any time are subject to change as new ones are added and old ones re-evaluated or replaced. Forecasts are issued by telephone and are also made available on the DATACOL computer networks of the NWS and the Internet.

c. Uncertainty. Forecasts of any kind are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertain knowledge of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The CBRFC snowmelt forecast, therefore, must be interpreted not as a single value, but as a range of values with specific probabilities of occurrence. The middle range is expressed by the 50 percent exceedence probability forecast, for which there is a 50 percent chance that the actual flow will be above, and a 50 percent chance that the actual flow will be below this value. To describe the expected range around this 50 percent value, four other forecasts are provided: two smaller values (90 percent and 70 percent exceedence probability) and two larger values (30 percent, and 10 percent exceedence probability). For example, there is a 90 percent chance that the actual flow will be more than the 90 percent exceedence probability forecast. The others can be interpreted similarly. The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of future weather conditions becomes known; this is reflected by a narrowing of the range around the 50 percent exceedence probability forecast. The Water Control Diagram for Vallecito Reservoir is based upon the 50 percent exceedence probability forecast.

6-03. Conservation Purpose Forecasts

a. Requirements. The CBRFC in Salt Lake City makes snowmelt runoff forecasts for Vallecito Dam, as described in paragraph 6-02. Forecasts of conservation releases from Vallecito Reservoir are scheduled to meet the downstream requirements for irrigation. The scheduling of releases from Vallecito Reservoir is the responsibility of the PRID. There are no other requirements for conservation purpose forecasts.

b. Methods. The methods used by the CBRFC to determine snowmelt runoff forecasts are described in paragraph 6-02b. User demands are developed by the PRID based on their

needs. Changes in weather conditions may cause irrigation needs to vary significantly.

6-04. Long-Range Forecasts

a. Requirements. During the snowmelt season, the release schedule for Vallecito Dam and Reservoir is based on snowmelt runoff forecasts, as described in paragraph 6-02.

b. Methods. The methods used by the CBRFC to determine snowmelt runoff forecasts are described in paragraph 6-02b.

6-05. Drought Forecast

a. Requirements. There are no requirements for drought forecasts for Vallecito Reservoir; however, as a result of the streamflow forecasts, severe shortages to meet normal project deliveries will be indicated.

b. Methods. The U.S. Department of Agriculture determines the moisture of the soil, based on a testing method called the Palmer Drought Index (PDI). This test is done in conjunction with the NRCS and their projected runoff forecast, and the NWS and their long-range forecasts.

c. Reference Documents. No reference documents have been produced on drought forecasts.

VII - WATER CONTROL PLAN

7-01. General Objectives. Vallecito Dam and Reservoir was authorized for flood control, non-Corps hydropower, and irrigation. Seasonal distribution of storage reservation is provided for flood control purposes.

7-02. Constraints. Releases from Vallecito Dam, insofar as possible, will be restricted so that the flows into the Los Piños River below the dam near Bayfield, Colorado, do not exceed the current estimated non-damaging safe channel capacity of 2,000 cfs (56.6 m³/s). The restriction on the rate of release is limited to increases or decreases of no more than 500 cfs (14.1 m³/s) in any two-hour period. A minimum release of 25 cfs (0.7 m³/s) for fish flows is provided, but not required. Operation of the right outlet works gate requires a minimum flow of 50 cfs (1.4 m³/s) to avoid cavitation.

7-03. Overall Plan for Water Control. Vallecito Dam and Reservoir is operated to meet the following objectives:

- a. To protect the area within the Los Piños River floodplain against probable snowmelt and thunderstorm floods.
- b. To control flows into the Los Piños River, downstream from Vallecito Dam, to existing channel capacities.
- c. To provide the maximum amount of water conservation storage without impairing reservoir flood control functions.

In achieving these objectives, forecasting of snowmelt runoff is important. When the snowpack is at or above normal, a close daily watch of the flows is necessary.

7-04. Standing Instructions to Project Operators. During normal flood periods, the reservoir will be regulated in accordance with the normal regulations for flood control operation, as explained in Section 7-05 and Exhibit A of this manual. Exhibit A is designed for separation from this manual as the water control regulation guide. To facilitate independent use of Exhibit A, plates required for the operation of Vallecito Dam and Reservoir are included therein. The USBR will provide instructions to the PRID for discharge of floodwater in the flood control reservation, in accordance with the Water Control Diagram. If assistance is needed to help determine the flood control reservation and releases, then the USBR should contact the District Engineer, U.S. Army Corps of Engineers, Sacramento District or designee, Chief, Water Management Section. If communications are disrupted, the reservoir will be regulated in accordance with the emergency

regulations for flood control operation, as stated in Section 7-05 and Exhibit A.

7-05. Flood Control

a. Normal Regulation for Flood Control. Flood control regulation begins when storage in Vallecito Reservoir exceeds the flood control reservation required at any time, according to the Water Control Diagram, Plate A-8, located in Exhibit A. The Water Control Diagram and this manual are the authorized project documents regarding flood control regulation. The diagram is the result of analyses of flood frequency, seasonal flood potential, and downstream channel capacities consistent with project objectives. The diagram states the following:

(1) The required flood control reservation varies up to a maximum of 115,400 acre-feet (142 hm³) from 1 March to 31 July. This reservation varies according to snowmelt parameters based on the remaining forecasted snowmelt runoff issued by the NWS through 31 July. A 50 percent exceedence forecast is used for computing the top of conservation storage for the Water Control Diagram; however, the maximum (90 percent exceedence) and minimum (10 percent exceedence) forecasts are also considered. Consultation with the CBRFC on forecasts is also done. The parameter is computed daily by subtracting previous day runoff from the remaining forecasted runoff through 31 July. The variable storage provides for the required flood control reservation, while allowing the space below the flood control pool to be filled for conservation purposes. For more detailed information on forecasting, refer to Chapter VI.

(2) As the pool rises and the spillway flow begins, flow through the outlet works should be decreased so that total flow does not exceed the downstream channel capacity. If the reservoir storage is encroached within the flood control reservation, then flood control releases are made in accordance with the release schedule stated on the Water Control Diagram. Water stored in the flood control reservation will be released as rapidly as downstream conditions permit. For detailed information on responsibilities for flood control, refer to Chapter IX.

b. Emergency Regulation. If communications with the project are disrupted, the following procedures will be followed for project operation:

(1) Continue releases in accordance with the last instructions from the USBR's Facilities Resource Group, Southern Division, Western Colorado Area Office (WCAO-SD), located in Durango, Colorado, and make every attempt to re-establish communication.

(2) If communication cannot be re-established, make releases in accordance with the Water Control Diagram, Exhibit A, Plate A-8.

c. Constraints. Releases from Vallecito Dam, insofar as possible, will be restricted below the dam near Bayfield, Colorado, to the current estimated non-damaging safe channel capacity of 2,000 cfs (56.6 m³/s) (refer to Section 7-02). During surcharge operation, the PRID will notify the USBR immediately, and the USBR will contact the Sheriff's Office.

7-06. Recreation. Recreation at Vallecito Reservoir does not require specific control of releases or storage levels. The recreation facilities are discussed in Section 2-06, Public Facilities.

7-07. Water Quality. Although water quality control may not be an authorized project purpose, compliance with Public Law 92-500 requires that all federal facilities be managed, operated, and maintained to protect and enhance the quality of water and land resources through conformance with applicable federal, state, interstate, and local substantive standards. The State of Colorado Health Department, Water Control Department, monitors the quality of water in the Los Piños River below Vallecito Dam (see Table 4-12). The USBR has an Emergency Action Plan in the event a toxic spill should occur. Further detailed information on flood emergency action plans can be found in the USBR's SOP, which is referenced in Section 1-03, Related Manuals and Reports. There are no temperature-controlled releases available at the dam.

7-08. Fish and Wildlife. The State of Colorado, Division of Wildlife, stocks the reservoir with fish and manages game in the reservoir area. There are no reservoir storage allocations for fish and wildlife considerations; however, the U.S. Fish and Wildlife Service recommendation is 25 cfs (0.7 m³/s) release, if available from measured inflow into Vallecito Reservoir. The USBR and the PRID reserve the right to vary the water level in Vallecito Reservoir, in accordance with all necessary project operations. The inactive and dead storage below water surface elevation 7582.5 feet (2,311 m) impounds a 4,247 acre-feet (5.2 hm³) pool covering an area of 378 acres (153 ha) and provides an adequate fish pool.

7-09. Water Supply. Water supplies presently being used in the Los Piños River Basin consist of the regulated flows of the Los Piños River and its tributaries. Streamflow in the Los Piños River Basin varies both seasonally and annually in response to the quantity and distribution of precipitation and variations in temperature. Most surface water originates from winter snowpacks in the adjacent mountains, with spring snowmelt providing most of the annual runoff.

Unregulated streams usually discharge 60 to 80 percent of the annual flow during the April through June runoff period. Peak runoff flows are commonly in the order of 10 times the base late summer and winter flows. Firm water supplies on the unregulated streams are therefore limited to the magnitude of the base flows. These base flows have been appropriated and fully used since early settlement of the valley.

The annual runoff into the Los Piños River at the dam site, prior to construction of the dam,

averaged 250,000 acre-feet/year (308.25 hm³) over the water years 1928 through 1940. Post-construction, annual runoff averaged 265,200 acre-feet/year (327.0 hm³) during the water years 1941 through 1986 (the USGS gage was discontinued in 1986). There are water supply contracts between the United States, the PRID, and private individuals. These contracts are listed in Chapter 1 of the Standing Operating Procedures for Vallecito Dam and Reservoir, 1994 revised edition. Only during high volume runoff years are the surplus spring and winter flows on the Los Piños River discharged into Navajo Reservoir. During the non-irrigation season of 1 November through 30 April, and assuming normal operations, minimum releases shall be equal to inflow to the reservoir.



7-11. Navigation. Navigable waters include all “waters of the United States,” which are in turn defined by regulation to include all waters which might be susceptible to use in interstate commerce and all other waters, such as lakes and wetlands, which could affect interstate commerce, including those from which fish could be taken and sold in interstate commerce. Navigation is not a project purpose.

7-12. Drought Contingency Plans. During droughts, flood control is not expected to be a principal factor in the operation of Vallecito Dam. The Water Control Diagram is sufficient. It incorporates a drought contingency within the parameter. For example, during a drought, the resulting low inflow forecast will raise the top of conservation storage allowing the USBR to fill the reservoir, if possible. Conservation storage in Vallecito Reservoir is managed by the PRID in accordance with water service contracts. These contracts do not have precedence clauses. The PRID is expected to conserve water to the best of their abilities.

7-13. Flood Emergency Action Plans. The USBR has written the Standard Operating Procedures (SOP) for Vallecito Dam, revised 25 March 1994, which covers actions to be taken in various emergency situations (i.e., oil pollution, landslides, and project security).



7-14. Other. There are no other project purposes.

7-15. Deviation from Normal Regulation. Deviations from approved Water Control Plans occur

because every possible circumstance cannot be accounted for in a Water Control Plan. Because of the often competing goals and complex interactions of interested groups/agencies, even seemingly inconsequential deviations from an approved plan can lead to unforeseen environmental and legal complications. Deviations from approved Water Control Plans are intended, therefore, to address unforeseen and unique circumstances. They are not intended as a means for identifying or initiating new opportunities to re-operate or reallocate storage in response to new and changing public needs. Section A-04 in Exhibit A and Exhibit E of this manual provide general information for preparing all deviations.

7-16. Rate of Release Change. Releases shall not be changed more than 500 cfs (14.1 m³/s) in any 2-hour period. For normal operation, the drawdown rate should be limited to one foot (30.5 cm) per day to provide time for evaluation of the performance of the embankment, foundation, and natural slopes within the reservoir area. For emergency conditions, prior approval of drawdown greater than one foot (30.5 cm) per day must be obtained from the USBR, Denver office.

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VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Vallecito Dam and Reservoir regulates flood flows in the Los Piños River by controlling releases, insofar as possible, to obtain the maximum practical reduction in flood damages. The flood control storage in Vallecito Reservoir is adequate to control and divert the floods of record to existing non-damaging safe channel capacities below the dam. Seasonal storage is provided for irrigation, recreation, and fisheries to balance the benefits for farmers and the public.

8-02. Flood Control. The principal objective of the flood control plan is to prevent inundation of areas in the lower Los Piños River Basin.

a. Spillway Design Flood. The USBR's Spillway Design Flood (SDF) for Vallecito Reservoir consisted of runoff from a spring rainstorm occurring during a period of major snowmelt runoff. The design flood has a peak inflow of 39,000 cfs (1,104.4 m³/s) and a 15-day volume of 202,000 acre-feet (249 hm³).

The flood routing begins with the reservoir at a gross pool water surface elevation of 7,665.0 feet (2,336.3 m). This water surface is maintained until the inflow is equal to the maximum capacity of the outlet works of 2,900 cfs (82.1 m³/s). The spillway gates are then opened until a maximum opening of 11.2 feet (3.41 m) is achieved. The peak release of 30,000 cfs (849.6 m³/s) is reached about 6 hours after the peak inflow occurs. At this time, the inflow has dropped below 30,000 cfs (849.6 m³/s) and 9,500 acre-feet (11.7 hm³) has been stored as surcharge.

b. Probable Maximum Flood (PMF). The Probable Maximum Flood (PMF) study was prepared to update the Vallecito Spillway Design Flood study and was approved in February 1985. The study identified three PMF scenarios shown in Table 8-1. The PMF's are shown on Plate 8-1.

The most critical PMF is the fall general storm. Routing of this flood, assuming the dam did not fail, is shown in Table 8-2. The reservoir elevation was assumed to be 7,665.0 feet (2,336.3 m) when the storm begins. The high-pressure gate outlet works and spillway were used to help pass the flood. Using these assumptions, the PMF would overtop the dam by 1.4 feet (42.6 cm). Assuming the dam would fail in this scenario, inundation maps were prepared and are included in the Emergency Action Plan of the SOP.

TABLE 8-1 PROBABLE MAXIMUM FLOOD			
TYPE	PEAK INFLOW (cfs)	VOLUME (acre-feet)	VOLUME PERIOD (days)
Rain-on-Snowmelt	76,000	305,000	15
Local Thunderstorm	71,600	38,400	2
Fall General Storm	94,722	186,000	5

Source: USBR, WCAO-SD

TABLE 8-2 FALL GENERAL STORM PROBABLE MAXIMUM FLOOD ROUTING					
% PMF	Total Max Discharge (cfs)	Spillway Discharge (cfs)	Outlet Works Discharge (cfs)	Overtopping Depth (ft)	Overtopping Duration (hrs)
100	79,200	>40,000	2,950-3,050	1.4	7.5
90	59,900	>40,000	2,950-3,050	0.2	2.6
70	49,700	46,700	3,000	0	NA
50	40,400	37,400	3,000	0	NA

The rain-on-snowmelt and the local thunderstorm PMF's also produce spillway discharges that overtop the left spillway chute wall, upstream of the outlet works junction. Routing of the rain-on-snowmelt PMF produces freeboard of 5.4 feet (1.7 m); the local thunderstorm PMF produces 2.5 feet (0.8 m) of freeboard. Refer to Section 1-03, Related Manuals and Reports, for further information.

c. Other Floods. A 100-year, synthetic fall-type rainflood with a 22,000 cfs (623 m³/s) peak, when routed through the reservoir, indicated that 21,850 acre-feet (26.9 hm³) of vacant

storage space is required to reduce the flood flows to 2,000 cfs (56.6 m³/s) in the river below the dam. Although the Water Control Diagram does not provide for exclusive flood control storage, the normal operation of the reservoir is such that there is vacant space in excess of 22,000 acre-feet (27.1 hm³) of storage more than 90 percent of the time, and sufficient incidental space to permit some decrease in rain flood flows more than 99 percent of the time.

The hypothetical routing of the 100-year snowmelt flood is shown on Plate 8-2. The 120-day volume for 100-year snowmelt flood is 500,752 acre-feet (617.4 hm³), according to the unregulated frequency curves on Plate 8-3.

8-03. Recreation. The USFS administers 82 acres (33.2 ha) of public recreation areas adjacent to the dam and reservoir. These include four campgrounds and one day-use picnic area along the east side of the reservoir. Three privately owned marinas and two picnic areas provide informal and dispersed day-use areas on the project grounds. Restaurants, private campgrounds, residential areas, marinas, resorts and hotels about the project boundary along the northeast, north, and west sides of the reservoir. The recreational development areas are reached via CR 501, which is a paved, two-lane rural road from where it crosses the USBR boundary at the southwest end of the reservoir to Middle Mountain Campground on the east side. From this point it is unpaved along the southeast side of the reservoir and over the dam, where it is designated Forest Road 603 until it rejoins CR 501A. Public recreation activities include boating, fishing, hiking, camping, picnicking, and nature study. Current annual visitation is estimated at 86,000 people, with more than half of the use occurring between Memorial Day and Labor Day.

8-04. Water Quality. The USGS monitors water quality on Vallecito Creek about 3.5 miles (5.6 km) upstream of the confluence with Vallecito Reservoir. Results of samples collected in water years 1991 and 1992 indicate good water quality conditions for the incoming water supply to the reservoir. Since releases from the reservoir into the Los Piños are eventually used as drinking water for the towns of Bayfield and Ignacio, the 1991-1992 sampling results from Vallecito Creek were compared to the U.S. Environmental Protection Agency's (EPA) recommended Maximum Contaminant Levels (MCL's). The Vallecito Creek concentrations for parameters with MCL's were well below the recommended standards, except for coliform bacteria.

The USBR conducted a surface and groundwater quality study during 1992-1993 within and adjacent to Vallecito Reservoir. The USBR study indicated that the reservoir currently does not have a large-scale problem with fecal coliform contamination, although several specific surface water locations were identified where fecal coliform contamination was evident. The majority of these were located in the southern portion of the reservoir.

Siltation in the Los Piños River below Vallecito Dam is reduced as suspended sediment is impounded in the reservoir. Water impounded in the reservoir experiences an increase in the nutrient levels as the water level rises. Thus, water released into Los Piños River could have

somewhat higher concentrations of nutrients, which could result in changes in the aquatic ecosystem.

8-05. Fish and Wildlife. There is no reservoir storage allocation for fish and wildlife considerations in Vallecito Reservoir. The USBR and the PRID reserve the right to vary the water level in the reservoir in accordance with all necessary project operations. The inactive and dead storage pool below elevation 7,582.5 feet (2,311.1 m), however, impounds 4,247 acre-feet (5.2 hm³) of water with an area of 378 acres (153 ha), which provides an adequate pool for fish. Year-round minimum releases of 25 cfs (0.7 m³/s) are made for fishery purposes, but are not required.

Recreational fishing patterns in the reservoir include both shoreline and boat fishing. The majority of the fishing is in boats: 32,530 hours from boats versus 15,200 hours from the shoreline, in 1992.

While upland game birds have benefited from the irrigation of additional lands, reservoir inundation and project roads eliminated about 3,500 acres (1,416 ha) of upland game habitat, with recreational development eliminating another 2,500 acres (1,011 ha) of wildlife habitat. The development of the reservoir and adjacent recreational areas increased access to deer and elk habitat and thereby increased hunting pressure. The actual effect on person-days of deer/elk hunting due to the loss of habitat has not been measured, because hunting pressure in this area and statewide has increased since reservoir development.

8-06. Water Supply. An average of 253,500 acre-feet (312.6 hm³) of water is released each year from Vallecito Reservoir. Approximately 166,200 acre-feet (204.9 hm³) are diverted for the purposes of irrigating about 18,500 acres (7,487 ha) of land administered by the Bureau of Indian Affairs (BIA) and about 45,000 acres (18,211 ha) of privately-owned land. During wet years, unused Los Piños River water ends up flowing into Navajo Reservoir.



8-08. Navigation. Navigable waters include all “waters of the United States,” which are in turn defined by regulation to include all waters which might be susceptible to use in interstate commerce and all other waters, such as lakes and wetlands, which could affect interstate commerce, including those from which fish could be taken and sold in interstate commerce. Navigation is not a project purpose.

8-09. Drought Contingency Plans. There are no formal drought contingency plans for Vallecito Dam and Reservoir. The Water Control Diagram has a drought contingency incorporated within the parameter. Therefore, when there is a drought, the top of conservation storage is very high

and the USBR can fill the reservoir, accordingly.

8-10. Flood Emergency Action Plans. The USBR has written the Standard Operating Procedures (SOP) for Vallecito Dam, which cover actions to be taken in various emergency situations (i.e., oil pollution, landslides, and project security). The plan was prepared to minimize impacts during a flood emergency. Further detailed information on flood emergency action plans can be found in the USBR's SOP, which is referenced in Section 1-03, Related Manuals and Reports.

8-11. Frequencies

a. Unregulated Flow Frequencies. Unregulated flows and statistical parameters for snowmelt floods for the Los Piños River were transposed to the dam site, and tabulated in Table 8-3 on page T8-1. The intervening area of snowmelt below the dam is insignificant in developing the frequency curves. Unregulated snowmelt flow frequency curves (1-day, 15-day, 30-day, 60-day, 90-day, and 120-day) are shown on Plate 8-3. The curves were based upon criteria contained in Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," published by the U.S. Water Resources Council. A conditional probability adjustment was applied to the data, and the final statistics were adjusted to allow for orderly transition between curves of different durations.

b. Regulated Flow Frequencies. For the Los Piños River, maximum one-day curves for regulated and unregulated conditions are shown on Plate 8-4. The regulated curve was entirely developed through hypothetical routings because of the limited historical data available.

c. Pool Elevation Duration and Frequency. The Pool Elevation-Frequency Curve is shown on Plate 8-5. The historical data for 1941-2001 using the Weibull plotting position are presented. Hypothetical 100-year through 1,000-year exceedence intervals are also shown. The Pool Elevation-Duration Curve, Plate 8-6, was developed and provided by the USBR.

d. Seasonal Variation of Storage. The Seasonal Variation of Storage Frequency, Plate 8-7, was developed and provided by the USBR. The level of storage is highest in the spring at the beginning of the recreation season (May-September), as a result of storing runoff for water supply. Subsequent releases made through the summer for water supply draw the reservoir down by the fall.

8-12. Other Studies. There are currently no studies of the Los Piños River Basin, or related projects, nor are any planned for the immediate future.

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IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization

a. The U.S. Army Corps of Engineers. The District Engineer, U.S. Army Corps of Engineers, Sacramento District, is responsible for:

(1) Monitoring storage, inflow, and outflow for Vallecito Reservoir on a day-to-day basis to ensure that the operation is in accordance to the Water Control Plan. The Corps also coordinates with the USBR and the NWS, so that agreement on the forecasted inflow volumes is reached. The 50 percent frequency forecast is the basis used in the Water Control Diagram. For further information, refer to Exhibit A.

(2) Advising operating agencies and the Division Engineer of any departure from this Water Control Plan.

(3) Reviewing and reporting to the Division Engineer any emergency, or planned deviations from the prescribed Water Control Plan. Refer to Exhibit E for more detailed information on deviations.

(4) Preparing short period, daily, and monthly operation and other special reports relative to the operation of the project required by the Office, Chief of Engineers.

(5) Preparing revisions to the Water Control Manual and the Water Control Plan found herein.

b. Other Federal Agencies

(1) The USBR is responsible for:

(a) Overseeing and directing PRID in the operation of Vallecito Dam and Reservoir in accordance with the official regulations.

(b) Following deviation procedures process explicitly for any proposed or emergency deviations from the Water Control Plan. See Exhibit E for types of deviations and process.

(c) Reporting to the District Engineer or designee, U.S. Army Corps of Engineers, Sacramento District, any unusual condition in the reservoir, or along downstream channels, that might interfere with the approved flood control operation of the reservoir.

(d) Taking reasonable steps to inform the public of significant changes in flood control releases.

(e) Providing to the Water Management Section, U.S. Army Corps of Engineers, Sacramento District, data as outlined in Exhibit A, Section A-02, and other data and at other times that may be required.

(f) Keeping informed of the rules and regulations contained in the Water Control Manual, and bringing to the attention of the District Engineer, U.S. Army Corps of Engineers, Sacramento District or designee, any features of the manual that may require clarification or revision.

(2) Congress has given the NWS national responsibility for issuing flood warnings to the public. The Colorado Basin River Forecast Center (CBRFC) of the NWS at Salt Lake City, Utah, is responsible for forecasting streamflows, runoff, and precipitation throughout the Los Piños River watershed, as explained in Section 6-01. The NWS responsibilities also include the operation and maintenance of their computerized hydrologic and climatic information network (DATACOL), which is accessible by user agencies.

(3) The USGS is responsible for the maintenance and operation of all its streamflow gages throughout the project area. The Colorado Division of Water Resources (CDWR) is responsible for the maintenance and operation of all its streamflow gages throughout the project area.

(4) Monthly water supply forecasts are furnished by the CBRFC and carried out by the NWS. During the snowmelt runoff season, the Water Control Plan will govern operational releases if flood releases are necessary.

(5) The NRCS is responsible for providing accurate snow survey information.

(6) The USFS has responsibility for managing five campgrounds at Vallecito Reservoir and for collecting use fees at the campgrounds.

c. State and County Agencies. The Colorado State Engineer is responsible for the administration of water rights, while Colorado's Division of Wildlife (CDOW) has the responsibility of allocating water for fish and wildlife needs.

d. Private Organizations. The Pine River Irrigation District (PRID) is responsible for physical operation and maintenance of the dam and reservoir, and the power plant. The PRID is responsible for advising the USBR of any proposed deviations from the Water Control Plan. See Section 7-15 for types of deviations. The PRID also has responsibility for managing water-based recreational uses of the reservoir as well as the small number of day use facilities that have been developed at other areas around the reservoir.

9-02. Interagency Coordination. To ensure that the operation of Vallecito Dam will be as effective as possible, it is essential that the operating agencies be advised of possible flood hazards, weather conditions, inflow to the reservoir, and flows at key locations in the Los Piños Basin. This requires close liaison, on a daily or hourly basis, between the USACE, USBR, USGS, NRCS, USFS, NWS, PRID, and other downstream interests.

a. Local Press and Corps Bulletins. The USBR's Western Colorado Area Office - Southern Division (WCAO-SD) in Durango coordinates with the local press regarding floods and other aspects of the project operation. The USACE will provide any information to the USBR to help support flood operations according to the Water Control Plan.

b. National Weather Service. The NWS cooperates with several agencies by providing monthly forecasted inflows for the Vallecito Drainage Basin, as well as daily weather forecasts.

c. U.S. Geological Survey. The USGS cooperates with several agencies in the Vallecito Basin by operating and maintaining the stream gaging stations. The USGS maintains and services many of the stations under contract. Data from many of the gages are published by the USGS in the Water Supply Papers.

d. Colorado Division of Water Resources. The CDWR, Durango office, maintains some stream gaging stations in the San Juan-Dolores Basin. Data from these gages are published internally by the CDWR.



f. Other Federal, State, or Local Agencies. The USBR and the PRID will coordinate to accomplish their goals by providing water to their customers, as well as following the water control regulating guidelines.

9-03. Interagency Agreements

a. A Field Working Agreement between the USBR and the USACE for Flood Control Operation of Upper Colorado Basin Dams and Reservoirs in Colorado, New Mexico, Utah, and Wyoming, was finalized on 23 March 1978 by the Regional Director, Upper Colorado Region, of the USBR and the South Pacific Division Engineer of the USACE. The agreement was initiated to ensure that a clear understanding exists of flood control regulations and information exchange required for project operation. A copy of the agreement is contained in this Water Control Manual as Exhibit C.

b. An operating and maintenance agreement between the USBR and PRID was finalized

on 1 July 1971. Refer to Sections 9-01b and c for agreement responsibilities.

9-04. Commissions, River Authorities, Compacts, and Committees. There are no other commissions, authorities, or compacts associated with this project.



9-06. Reports. The Project Operator will provide reports by voice, telephone, or electronic media as early as practicable each and every day, and at other times as directed by the Water Management Section. Data is to be reported to the Water Management Section, Sacramento District, U.S. Army Corps of Engineers, as specified in Exhibit A, Section A-02.

Any Corps-requested information, such as monthly charts, short-term hydrologic reports, emergency regulation reports, graphical and tabular summaries, flood situation reports, and any other information requested by the USACE, will be provided in a timely manner. In addition, immediately after the end of each month, the Project Operator will provide to the Water Management Section, Sacramento District, U.S. Army Corps of Engineers, a summary of daily inflow, outflow, elevation, storage, precipitation, temperature, and daily requirements of flood control reservation at Vallecito Dam.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

U.S. Army Corps of Engineers
Sacramento District
June 2002

TABLES

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TABLE 4-11
HISTORICAL MONTHLY INFLOWS TO VALLECITO RESERVOIR
(acre-feet)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	APRIL- JULY TOTAL	TOTAL
1942				7,661	5,707	6,103	26,921	72,143	93,210	30,687	10,443	7,606	222,961	274,955
1943	5,676	5,180	3,618	4,157	3,824	5,995	37,070	54,025	41,316	16,254	25,400	10,062	148,665	217,418
1944	7,045	6,995	5,275	3,462	3,106	3,850	14,070	97,682	127,161	47,064	9,789	5,372	285,977	330,787
1945	8,408	7,106	3,717	3,281	3,343	4,002	12,467	73,561	64,759	24,739	12,521	5,143	175,526	220,581
1946	8,528	4,702	3,535	3,197	2,745	4,639	21,887	34,545	55,618	13,754	12,197	7,690	125,804	181,183
1947	11,344	7,704	5,863	4,755	4,224	5,391	13,743	71,074	64,422	26,975	29,636	19,545	176,214	279,508
1948	23,319	9,778	6,646	5,747	5,269	5,502	28,347	113,760	116,102	38,509	15,500	6,643	296,718	351,273
1949	7,027	4,623	4,244	5,253	3,869	4,247	26,873	80,760	142,767	56,300	12,117	6,042	306,700	356,339
1950	7,011	6,235	4,865	4,570	4,749	6,317	30,121	46,899	35,733	12,981	5,271	6,195	125,734	166,862
1951	6,765	3,764	3,497	3,243	3,179	3,813	8,041	40,781	41,917	11,634	13,795	6,584	102,373	146,157
1952	4,720	3,747	4,703	4,721	3,911	4,273	28,140	104,508	136,390	39,411	16,967	10,314	308,449	362,293
1953	5,625	4,067	3,966	3,787	3,301	4,780	16,517	38,338	48,262	12,563	8,586	3,455	115,680	155,588
1954	5,149	6,505	4,345	3,478	3,016	4,356	24,033	59,120	33,646	24,487	13,870	14,387	141,286	207,712
1955	17,698	5,496	4,125	3,994	3,401	4,353	12,858	49,432	56,640	15,416	22,417	7,581	134,346	187,604
1956	4,094	3,459	3,959	4,204	3,767	8,008	17,733	63,435	42,576	9,498	5,399	3,357	133,242	167,263
1957	3,530	2,940	2,816	3,327	3,176	4,624	19,357	40,444	155,518	101,556	44,876	16,556	316,875	424,966
1958	12,728	14,082	8,722	5,933	5,075	6,299	22,971	122,015	89,667	15,595	8,149	11,757	250,248	303,523
1959	6,932	5,098	4,032	3,457	3,381	3,616	8,667	36,930	38,091	7,619	11,110	5,578	91,307	148,358
1960	13,652	10,692	5,565	4,928	4,044	7,739	36,209	61,706	73,906	18,802	6,686	5,373	190,623	235,511
1961	7,005	5,311	3,802	3,450	2,925	5,054	18,020	79,721	46,977	11,273	15,244	17,195	155,991	228,985
1962	14,601	8,787	5,738	4,844	5,339	5,650	36,076	71,198	67,048	25,238	7,567	6,040	199,560	249,658
1963	9,497	6,760	4,401	3,947	3,588	7,164	21,241	59,267	20,356	9,302	11,876	12,958	110,166	163,691
1964	6,457	4,346	3,189	2,620	2,405	2,962	6,589	55,527	32,769	15,220	16,603	10,777	110,105	159,550
1965	6,246	3,897	3,935	4,353	4,009	4,525	27,460	69,975	122,304	73,438	21,615	21,278	293,177	380,841
1966	16,368	8,324	7,192	5,774	4,434	7,111	24,460	81,458	51,879	19,511	12,963	8,904	177,308	233,697
1967	6,632	4,445	6,126	4,155	3,306	6,164	11,726	51,460	37,470	17,765	21,626	12,194	118,421	178,733
1968	5,924	3,332	3,611	3,730	3,510	5,568	10,924	55,327	104,516	30,583	29,834	6,853	201,350	264,503
1969	5,952	4,102	3,604	4,162	3,798	4,270	24,574	85,304	66,277	41,959	18,185	23,591	218,114	312,454
1970	22,087	11,875	6,372	4,437	3,775	5,019	7,638	72,151	47,948	19,685	14,427	61,662	147,422	262,283
1971	12,998	6,997	5,546	5,014	4,689	7,823	20,717	36,008	51,967	20,197	11,981	8,457	128,889	198,187
1972	13,286	10,253	7,795	5,582	4,354	12,688	25,772	53,046	37,332	11,041	7,226	10,699	127,191	230,623
1973	38,290	14,901	9,692	7,303	5,562	7,515	13,873	101,362	136,146	60,603	19,749	13,810	311,984	380,460
1974	6,409	4,253	3,875	4,327	3,080	6,100	11,822	49,502	24,097	15,610	11,892	6,021	101,031	151,967
1975	7,156	7,837	4,523	4,202	3,765	5,646	12,388	67,313	143,113	80,748	17,799	11,123	303,562	360,255

TABLE 4-11
HISTORICAL MONTHLY INFLOWS TO VALLECITO RESERVOIR
(acre-feet)

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	APRIL- JULY TOTAL	TOTAL
1976	5,806	3,999	4,353	3,835	4,769	7,361	17,912	69,519	63,980	18,158	14,259	14,444	169,569	231,640
1977	10,404	4,255	2,744	2,819	2,357	2,825	8,576	17,040	15,934	10,398	11,261	10,000	51,948	96,324
1978	7,098	4,475	3,541	3,692	3,391	6,187	20,586	53,205	80,510	19,353	7,237	5,145	173,654	216,753
1979	4,943	6,764	5,740	5,796	4,605	6,747	26,733	108,407	159,771	69,710	25,462	8,492	364,621	431,080
1980	6,567	4,219	4,571	5,562	5,573	5,887	20,480	72,807	155,227	37,807	16,761	23,994	286,321	363,217
1981	8,322	5,904	4,893	3,896	3,289	4,251	18,355	41,667	45,307	28,990	16,706	15,310	134,319	218,674
1982	23,885	10,584	6,434	5,886	4,956	7,442	18,803	62,197	85,139	33,686	27,603	32,472	199,825	314,604
1983	17,720	10,235	8,465	5,843	5,048	7,829	11,524	59,790	109,539	44,890	22,149	11,985	225,743	311,173
1984	17,963	7,279	7,334	5,995	5,183	7,277	17,776	100,375	69,388	33,784	23,797	18,911	221,323	325,498
1985	22,721	11,682	8,609	6,835	5,372	8,503	40,700	96,517	128,129	43,741	17,480	25,178	309,087	413,490
1986	21,017	11,999	8,019	6,791	6,389	13,130	29,186	87,145	111,782	55,697	22,097	24,204	283,810	415,735
1987	29,055	20,035	10,224	7,116	6,017	8,751	33,755	84,243	134,959	45,779	22,591	11,491	298,736	379,772
1988	8,359	10,876	5,835	5,085	4,222	6,849	18,878	49,977	54,788	19,213	30,804	23,169	142,856	236,553
1989	11,646	6,126	5,796	5,218	5,206	13,843	41,388	57,679	34,576	14,924	12,331	6,312	148,567	206,608
1990	9,023	3,809	2,299	2,624	2,443	4,099	15,260	51,963	75,078	26,994	16,502	18,896	169,295	254,342
1991	21,033	12,356	7,094	5,543	3,869	5,842	22,353	65,198	50,734	14,986	9,266	31,615	153,271	230,910
1992	7,513	7,442	6,549	5,395	5,005	7,265	28,700	72,654	52,749	24,751	16,851	10,521	178,854	240,456
1993	5,393	5,610	5,562	5,829	7,082	7,718	22,839	100,396	100,258	31,226	21,694	17,024	254,719	333,238
1994	8,898	5,534	4,740	4,258	3,734	7,257	19,180	68,973	69,975	11,364	8,313	15,410	169,492	242,824
1995	15,237	11,935	7,188	4,652	6,219	15,482	18,705	49,025	140,380	80,623	26,663	13,354	288,733	371,086
1996	7,684	4,546	3,753	3,510	3,659	5,132	15,030	56,154	22,723	11,531	6,512	10,164	105,438	158,063
1997	9,952	6,848	6,848	6,900	5,526	14,075	23,443	91,984	116,626	49,187	38,803	37,836	281,240	424,657
1998	23,393	9,901	6,983	5,938	4,629	8,623	14,871	64,748	53,320	29,959	15,855	14,722	162,898	249,752
1999	15,237	13,736	8,114	5,815	4,561	7,343	16,376	70,018	91,197	50,456	62,971	33,477	228,047	362,113
2000	11,021	5,304	3,574	3,546	3,394	6,147	23,321	65,357	27,880	9,954	8,471	9,079	126,512	180,641
2001	10,291	7,774	5,427	4,779	4,385	7,015	25,566	107,907	71,602	24,651	24,518	9,034	229,726	295,076
Average	11,402	7,262	5,375	4,737	4,208	6,567	20,827	67,912	76,158	30,297	17,505	14,051	195,193	266,301

Source: USBR, Durango, CO office

TABLE 4-12
WATER QUALITY DATA, VALLECITO CREEK, COLORADO
(mg/L, except where noted)

Parameter	Oct 1991 - Sep 1992		Oct 1990 - Sep 1991		MCL ²
	Range ¹	Mean ¹	Range ¹	Mean ¹	
Specific Conductance (μ ohms/cm)	52 - 112	84	66 - 89	76	---
pH	7.5 - 7.9	7.7	7.5 - 8.3	7.9	6.5 - 8.5 ³
Temperature ($^{\circ}$ C)	0 $^{\circ}$ - 20 $^{\circ}$	---	0 $^{\circ}$ - 20 $^{\circ}$	---	---
Turbidity (NTU)	0.4 - 1.1	0.8	0.7 - 1.0	0.8	---
Dissolved Oxygen	8.4 - 11.3	9.8	8.8 - 11.0	10.1	---
Fecal Coliform (colonies/100 ml)	<1 - 1 ⁵	<1 ⁵	<1 - 5 ⁵	<1 ⁵	0 ⁶
Streptococci Coliform (colonies/100 ml)	<1 - 3 ⁴	<1 ⁵	<1 - 38	>1	0 ⁶
Hardness (Total, as CaCO ₃)	20 - 39	32	28 - 43	34	---
Calcium (Dissolved)	6 - 12	9.6	8.5 - 13	10.4	---
Magnesium (Dissolved)	1.2 - 2.3	1.9	1.6 - 2.5	2	---
Sodium (Dissolved)	0.6 - 1.7	1.1	0.7 - 1.3	1	---
Potassium (Dissolved)	0.5 - 0.7	0.5	0.5 - 0.8	0.6	---
Bicarbonate (Dissolved, as HCO ₃)	20 - 39	32	21 - 34	29	---
Alkalinity (Total Dissolved, mg/L as CaCO ₃)	16 - 32	26	19 - 28	24	---
Sulfate (Dissolved)	4.8 - 8.3	6.6	7.2 - 10	8.4	250 ³
Chloride (Dissolved)	<0.1 - 3.2	0.9	0.1 - 1.3	0.5	250 ³
Fluoride (Dissolved)	0.2 - 0.3	0.2	0.2 - 0.4	0.3	2
Silica (Dissolved, mg/L)	2.8 - 4.3	3.5	3.2 - 4.4	3.8	---
Solids (Dissolved)	25 - 56	40	24 - 65	44	---
Solids (Total Dissolved)	27 - 51	39	35 - 50	42	500 ³
Nitrate Nitrogen (Total)	<0.01	<0.01	0.08	0.08	---
Nitrite Nitrogen (Dissolved)	<0.01	<0.01	<0.01 - 0.02	<0.01	1
Nitrogen (Total)	0.06 - 0.15	0.1	0.07 - 0.21	0.13	10
Nitrogen (Dissolved)	0.07 - 0.15	0.1	0.08 - 0.17	0.12	---
Ammonia Nitrogen (Total)	<0.01 - 0.02	0.01	<0.01 - 0.05	0.03	---
Ammonia Nitrogen (Dissolved)	0.01 - 0.02	0.02	<0.01 - 0.03	0.02	---
Ammonia Nitrogen (Organic)	<0.2	<0.2	0.27	0.27	---
Phosphorus (Total)	<0.01 - 0.02	<0.01	<0.01 - 0.02	0.01	---
Phosphorus (Dissolved)	<0.01 - 0.02	<0.01	<0.01 - 0.02	<0.01	---
Orthophosphorous (Dissolved)	<0.01	<0.01	<0.01	<0.01	---

TABLE 4-12
WATER QUALITY DATA, VALLECITO CREEK, COLORADO
(mg/L, except where noted)

Parameter	Oct 1991 - Sep 1992		Oct 1990 - Sep 1991		MCL ²
	Range ¹	Mean ¹	Range ¹	Mean ¹	
Aluminum (Dissolved)	0.03 - 0.07	0.045	0.03 - 0.05	0.03	0.05 - 0.2 ³
Barium (Dissolved)	0.007 - 0.014	0.01	0.010 - 0.013	0.012	2
Cobalt (Dissolved)	<0.003	<0.003	<0.003	<0.003	---
Iron (Dissolved)	0.007 - 0.018	0.012	0.009 - 0.030	0.014	---
Lithium (Dissolved)	<0.004	<0.004	<0.004	<0.004	---
Manganese (Dissolved)	0.001 - 0.013	0.005	<0.001 - 0.020	0.007	0.05 ³
Molybdenum (Dissolved)	<0.01	<0.01	<0.01	<0.01	---
Nickel (Dissolved)	≤0.001	<0.001	0.001 - 0.003	0.002	0.1
Selenium (Dissolved)	<0.001	<0.001	<0.001	<0.001	0.05
Silver (Dissolved)	<0.001	<0.001	<0.001	<0.001	0.1 ³
Strontium (Dissolved)	0.019 - 0.034	0.027	0.025 - 0.037	0.028	---
Vanadium (Dissolved)	<0.006	<0.006	<0.006	<0.006	---

¹Results of four sampling dates for all parameters except temperature, which was monitored on a daily basis, and solids with two sample dates.

²Recommended Maximum Contaminant Level for drinking water (USEPA 1993).

³Secondary contaminant level.

⁴All temperature data were not available to calculate the mean.

⁵Results based on non-ideal counting conditions.

⁶Maximum Contaminant Level Goal.

SOURCES: USGS 1992, 1993

TABLE 8-3
ANNUAL MAXIMUM SNOWMELT FLOWS,
LOS PIÑOS RIVER, COLORADO, UNREGULATED CONDITIONS
(flow in cfs)

Water Year	1-DAY		15-DAY		30-DAY		60-DAY		90-DAY		120-DAY	
	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW
1941	23-JUN	3858	17-JUN	3033	07-JUN	2455	10-MAY	2285	03-MAY	1905	03-MAY	1529
1942	17-MAY	2633	25-MAY	2102	22-MAY	1934	07-MAY	1414	13-APR	1128	05-APR	942
1943	01-MAY	1785	23-APR	1280	16-APR	947	20-APR	867	05-APR	747	16-APR	626
1944	23-MAY	2952	20-MAY	2484	19-MAY	2302	11-MAY	1991	02-MAY	1518	07-APR	1201
1945	16-JUN	2100	17-MAY	1321	23-MAY	1280	02-MAY	1180	21-APR	937	21-APR	772
1946	08-JUN	1689	04-JUN	1373	04-JUN	962	25-APR	806	18-APR	651	18-APR	540
1947	09-JUN	1834	28-MAY	1342	28-MAY	1213	03-MAY	1142	21-APR	933	01-MAY	805
1948	21-MAY	3639	31-MAY	2821	31-MAY	2716	06-MAY	1931	18-APR	1547	15-APR	1263
1949	19-JUN	5387	11-JUN	3179	11-JUN	2469	15-MAY	1931	24-APR	1611	14-APR	1310
1950	24-MAY	1185	21-MAY	1004	21-MAY	878	21-APR	788	7-APR	649	02-APR	540
1951	29-MAY	2013	26-MAY	1174	25-MAY	974	06-MAY	714	21-APR	543	06-MAY	459
1952	10-JUN	3606	03-JUN	3072	27-MAY	2447	03-MAY	2012	17-APR	1615	06-MAY	1310
1953	29-MAY	1903	24-MAY	1286	22-MAY	1136	25-APR	770	22-APR	604	11-APR	502
1954	22-MAY	1562	13-MAY	1173	07-MAY	1046	22-APR	818	13-APR	687	07-APR	606
1955	09-JUN	1940	06-JUN	1245	22-MAY	1115	05-MAY	901	16-APR	710	29-APR	611
1956	21-MAY	1518	20-MAY	1286	16-MAY	1168	26-APR	912	07-APR	705	24-MAR	579
1957	06-JUN	4005	20-JUN	2816	03-JUN	2688	01-JUN	2086	20-MAY	1653	06-MAY	1402
1958	24-MAY	3625	24-MAY	2849	12-MAY	2444	26-APR	1778	17-APR	1357	06-APR	1063
1959	17-MAY	1160	29-MAY	890	14-MAY	813	29-APR	640	07-APR	484	24-APR	401
1960	04-JUN	2125	28-MAY	1515	24-MAY	1403	08-MAY	1158	07-APR	981	24-MAR	813
1961	28-MAY	1956	19-MAY	1804	12-MAY	1435	29-APR	1096	12-APR	831	22-APR	672
1962	12-MAY	2138	03-MAY	1525	18-APR	1266	18-APR	1168	15-APR	1041	08-APR	849
1963	09-MAY	1547	07-MAY	1221	04-MAY	1009	12-APR	714	28-MAR	582	22-MAR	483
1964	24-MAY	1851	15-MAY	1536	15-MAY	1135	09-MAY	759	11-MAY	602	26-APR	513
1965	16-JUN	2830	14-JUN	2331	06-JUN	2109	18-MAY	1790	22-APR	1505	24-MAR	1281
1966	31-MAY	2303	19-MAY	1487	05-MAY	1409	29-APR	1131	08-APR	897	09-APR	753
1967	23-MAY	1392	16-MAY	1116	10-MAY	977	08-MAY	760	27-APR	603	26-APR	546
1968	03-JUN	2751	27-MAY	2140	27-MAY	1977	12-MAY	1378	19-MAY	1108	30-APR	933
1969	22-MAY	2332	19-MAY	1922	17-MAY	1593	01-MAY	1274	24-APR	1107	11-APR	938
1970	18-MAY	2103	14-MAY	1759	12-MAY	1357	05-MAY	1274	28-APR	798	19-MAY	718
1971	29-MAY	1251	07-JUN	997	27-MAY	938	12-MAY	1031	11-APR	633	28-MAR	556
1972	09-JUN	1168	26-MAY	998	15-MAY	933	22-APR	755	09-APR	668	11-MAR	559
1973	12-JUN	3463	08-JUN	2547	08-JUN	2373	11-MAY	825	28-APR	1681	26-APR	1346
1974	17-MAY	1213	07-MAY	959	04-MAY	846	25-APR	2146	24-APR	519	18-APR	451
1975	16-JUN	3513	04-JUN	2886	04-JUN	2478	14-MAY	646	04-MAY	1635	23-APR	1318
1976	05-JUN	2086	28-MAY	1709	16-MAY	1527	02-MAY	2081	10-APR	879	08-APR	723
1977	02-JUN	499	30-MAY	418	19-MAY	321	18-APR	301	10-APR	246	24-APR	234
1978	11-JUN	2053	02-JUN	1764	23-MAY	1506	11-MAY	1148	21-APR	900	29-MAR	741

TABLE 8-3
ANNUAL MAXIMUM SNOWMELT FLOWS,
LOS PIÑOS RIVER, COLORADO, UNREGULATED CONDITIONS
(flow in cfs)

Water Year	1-DAY		15-DAY		30-DAY		60-DAY		90-DAY		120-DAY	
	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW
1979	14-JUN	3710	26-MAY	3068	21-MAY	2919	16-MAY	2412	23-APR	1912	20-APR	1575
1980	11-JUN	3945	05-JUN	3137	30-MAY	2688	08-MAY	1958	21-APR	1533	13-APR	1223
1981	09-JUN	1532	07-JUN	1214	27-MAY	927	12-MAY	786	11-APR	686	28-MAR	596
1982	30-MAY	1787	27-MAY	1641	16-MAY	1530	23-APR	1251	10-APR	1021	12-MAR	879
1983	31-MAY	2654	26-MAY	2148	27-MAY	2020	15-MAY	1530	10-MAY	1215	22-APR	1008
1984	25-MAY	3102	17-MAY	2406	11-MAY	1941	09-MAY	1467	05-MAY	1147	06-MAY	958
1985	09-JUN	3736	06-JUN	2719	26-MAY	2393	03-MAY	1884	12-APR	1547	08-APR	1315
1986	06-JUN	2808	04-JUN	2174	23-MAY	2011	02-MAY	1659	29-APR	1429	01-APR	1191
1987	15-JUN	3042	05-JUN	2685	02-JUN	2280	06-MAY	1838	19-APR	1548	13-APR	1277
1988	06-JUN	1503	29-MAY	1156	14-MAY	1106	09-MAY	898	12-APR	728	05-MAY	649
1989	04-MAY	1454	19-MAY	1101	08-MAY	986	09-APR	869	28-MAR	737	05-APR	620
1990	13-JUN	1980	17-MAY	1189	17-MAY	1063	13-MAY	886	17-APR	733	24-APR	608
1991	21-MAY	1673	17-MAY	1308	08-MAY	1157	03-MAY	970	06-APR	783	31-MAR	644
1992	20-MAY	1568	15-MAY	1294	29-APR	1196	26-APR	1071	11-APR	883	07-APR	751
1993	25-MAY	3064	20-MAY	2431	20-MAY	2046	11-MAY	1700	21-APR	1335	04-APR	1068
1994	03-JUN	2086	22-MAY	1666	13-MAY	1519	04-MAY	1165	13-APR	899	16-MAR	712
1995	17-JUN	3635	12-JUN	2874	11-JUN	2467	20-MAY	1913	04-MAY	1503	29-APR	1238
1996	11-MAY	1415	5-MAY	1223	26-APR	971	24-APR	674	15-APR	536	07-APR	443
1997	03-JUN	3061	30-MAY	2265	14-MAY	2058	06-MAY	1765	10-MAY	1255	21-APR	1255
1998	29-MAY	1838	20-MAY	1498	11-MAY	1207	01-MAY	973	24-APR	815	22-APR	684
1999	22-MAY	2286	20-MAY	1783	19-MAY	1698	13-MAY	1414	14-MAY	1243	11-MAY	1171
2000	25-MAY	1646	22-MAY	1148	03-MAY	1103	20-APR	844	06-APR	655	31-MAR	530
2001	19-MAY	2386	14-MAY	2159	12-MAY	2022	27-APR	1521	19-APR	1189	19-APR	993
Computed Statistics												
Mean	3.3449		3.2340		3.1757		3.0800		2.9851		2.9085	
Std Dev	0.1627		0.1629		0.1651		0.1667		0.1662		0.1626	
Log Skew	0.2002		0.1570		0.1564		0.1166		0.0872		0.0550	
Adopted Log Statistics												
Mean	3.3449		3.2340		3.1757		3.0800		2.9851		2.9085	
Std Dev	0.1640		0.1640		0.1640		0.1640		0.1640		0.1640	
Log Skew	-0.2000		-0.2000		-0.2000		-0.2000		-0.2000		-0.2000	

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

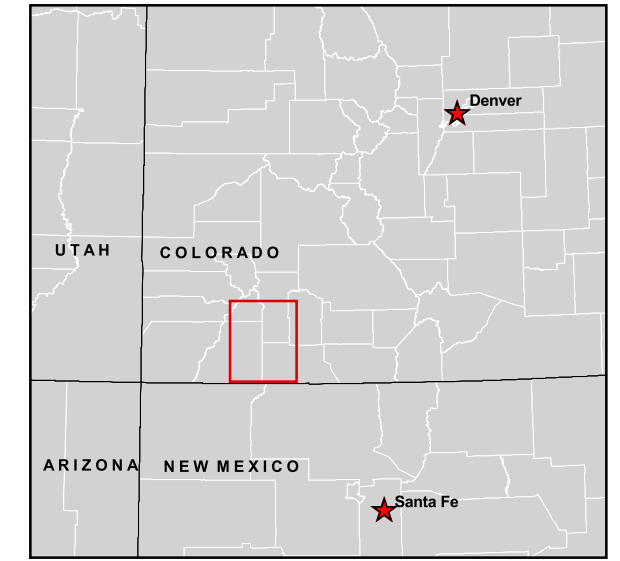
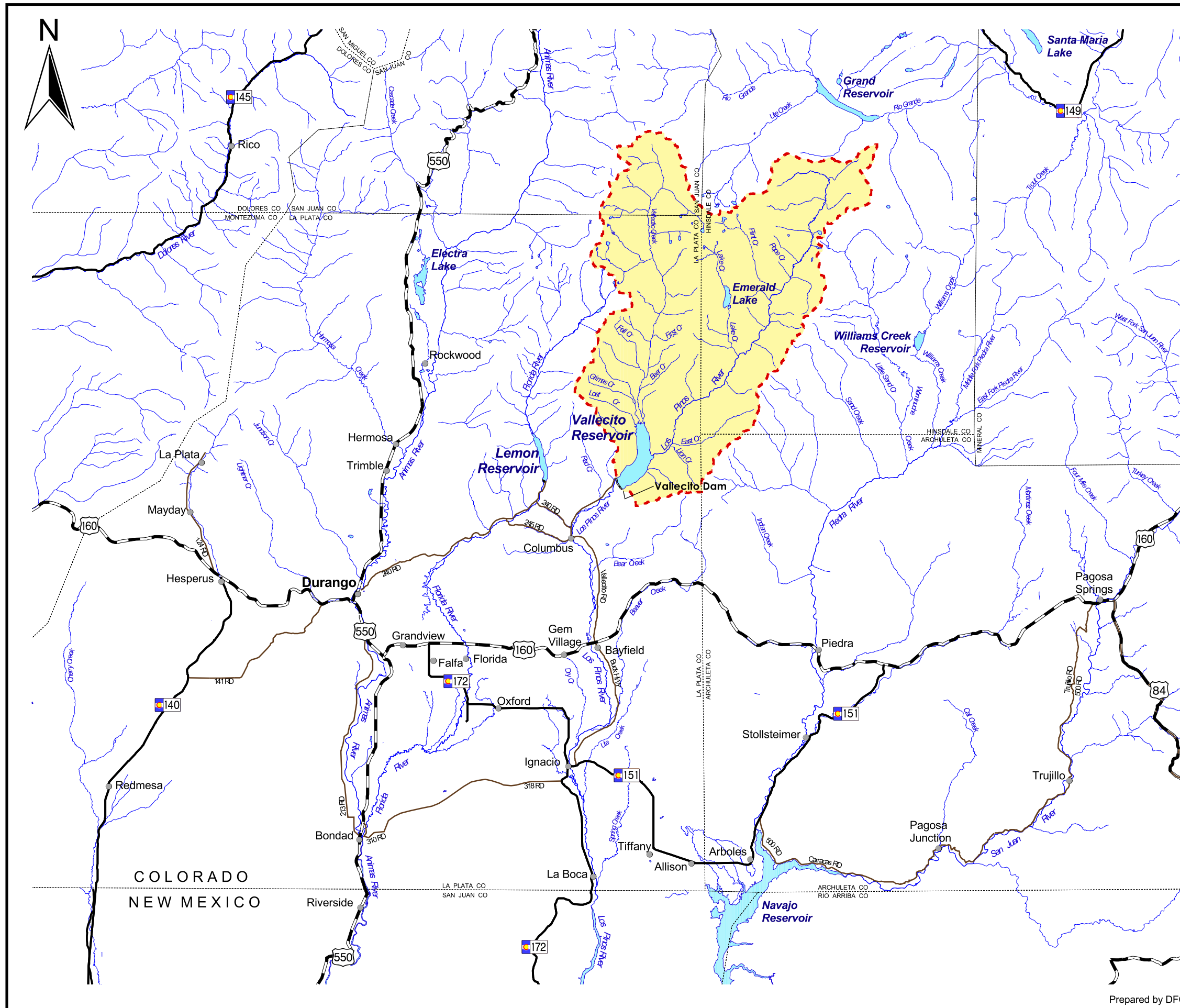
U.S. Army Corps of Engineers
Sacramento District
June 2002

LIST OF PLATES

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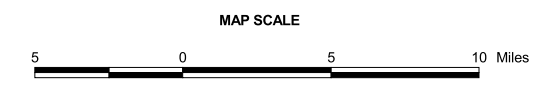
<u>Plate No</u>	<u>Title</u>
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2-2	Area Map
2-3	General Plan, Profile, and Sections
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MAP LEGEND

- Watershed Boundary
- Drainage Area
- Lake/Reservoir
- Stream
- City
- County Boundary
- U.S. Highway
- State Highway
- County Road

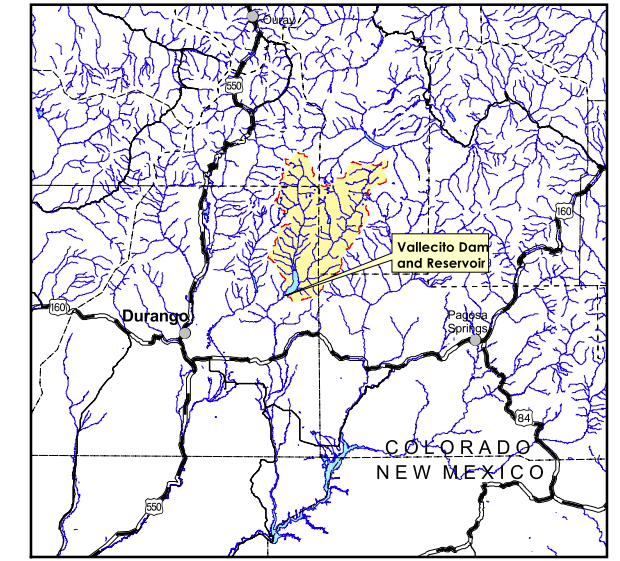
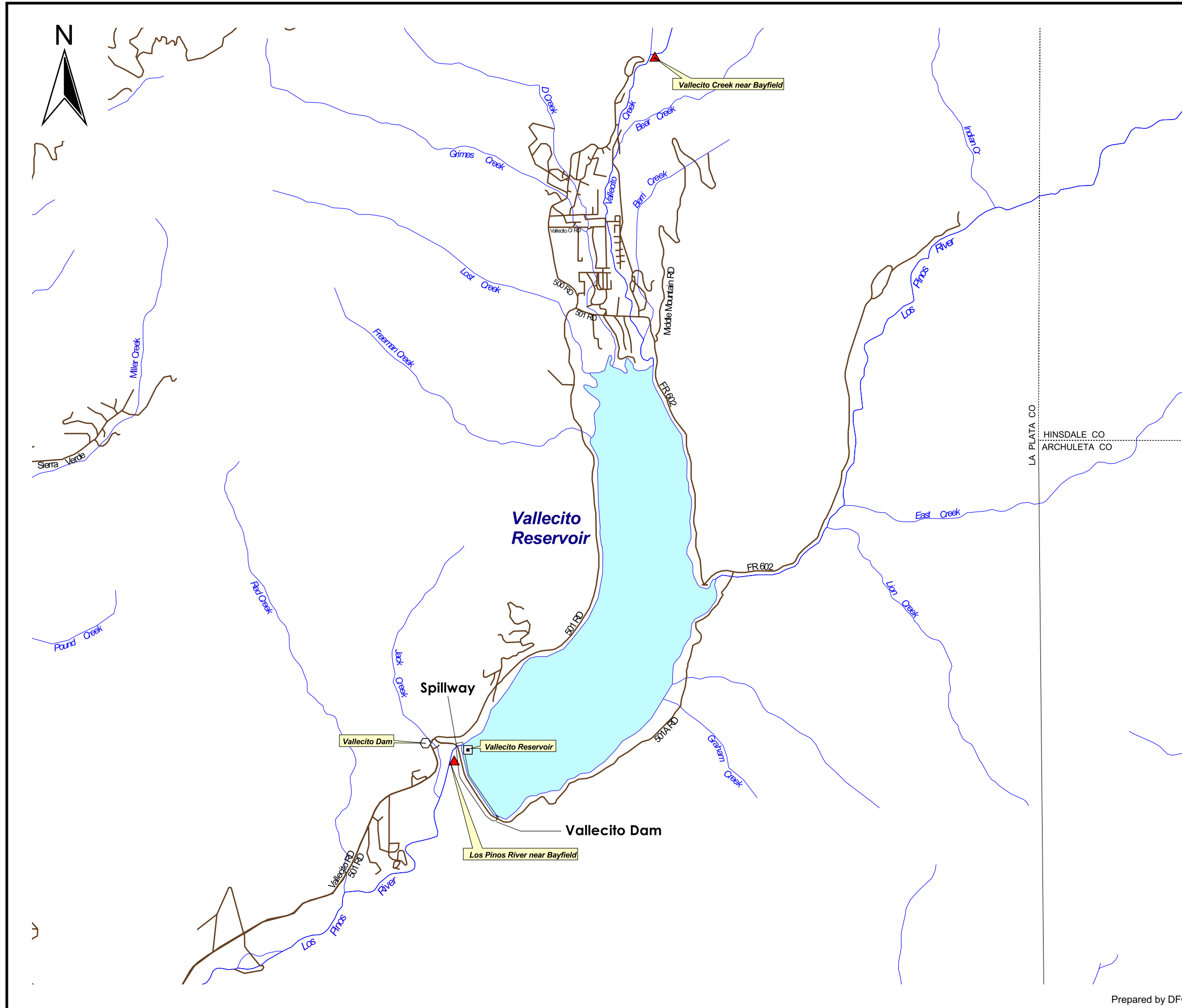


**VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO**

GENERAL MAP

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by DFCE

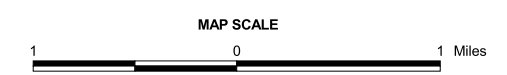


MAP LEGEND

- Reservoir
- Stream/River
- County Boundary
- County Road

Climatological Station Type:
 Recording Non-recording
◆ Precipitation/Temperature/Evaporation

Gaging Station Types:
▲ Stage Recorder
 Pool Elevation Recorder
■ Used in combination with symbol, ▲ to indicate telemetered gage



**VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO**

AREA MAP

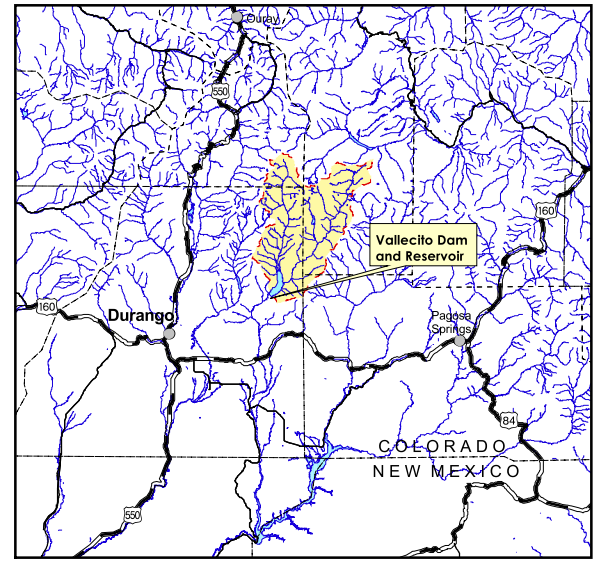
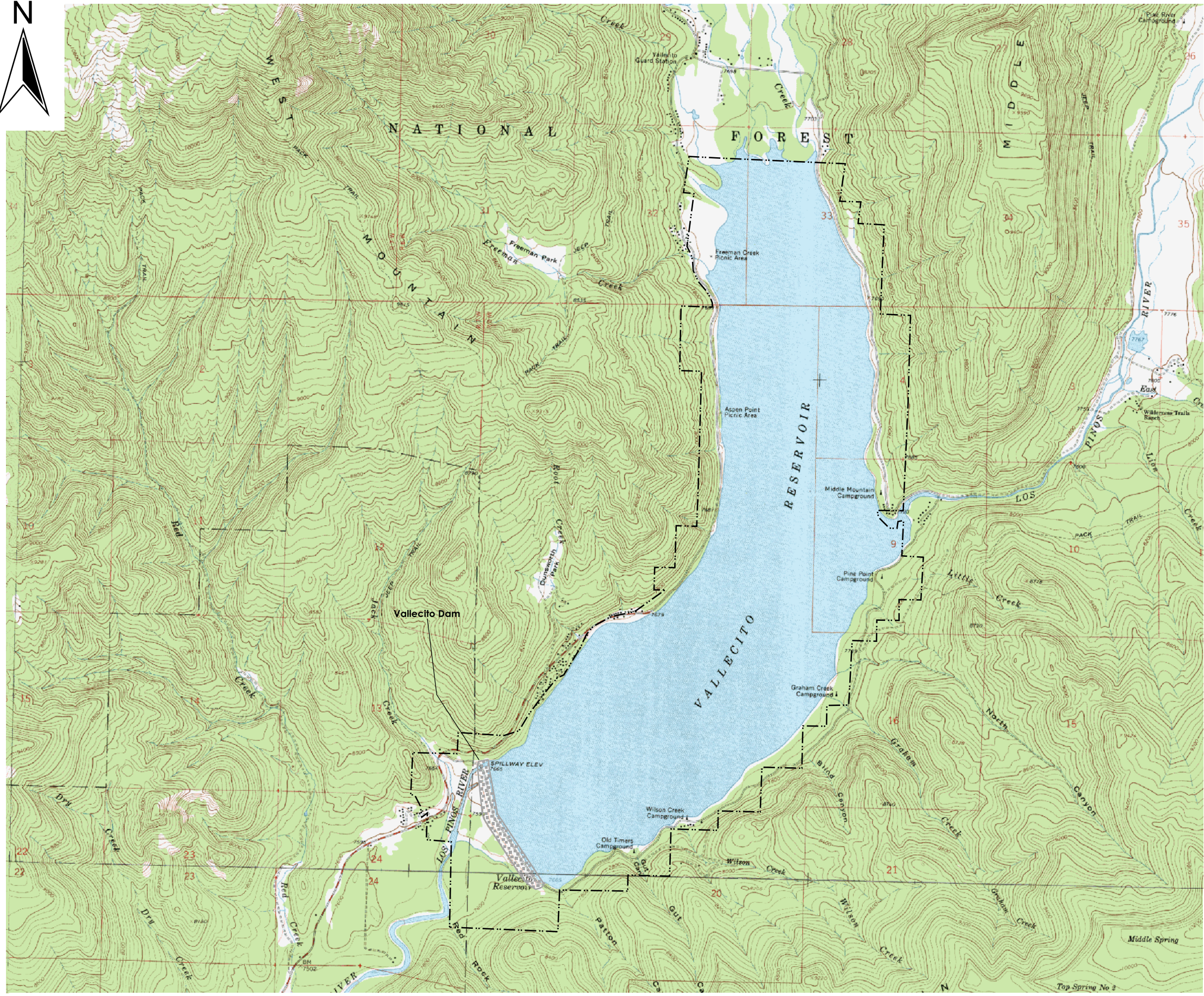
**U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT**

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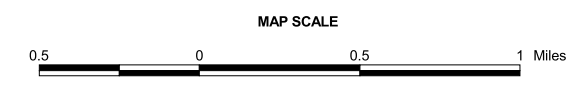




Map Legend

 Project Boundary

Notes:
Background map images are USGS Quadrangle maps:
VALLECITO, original 1964 - photinspected 1971
LUDWIG MOUNTAIN, original 1964



**VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO**

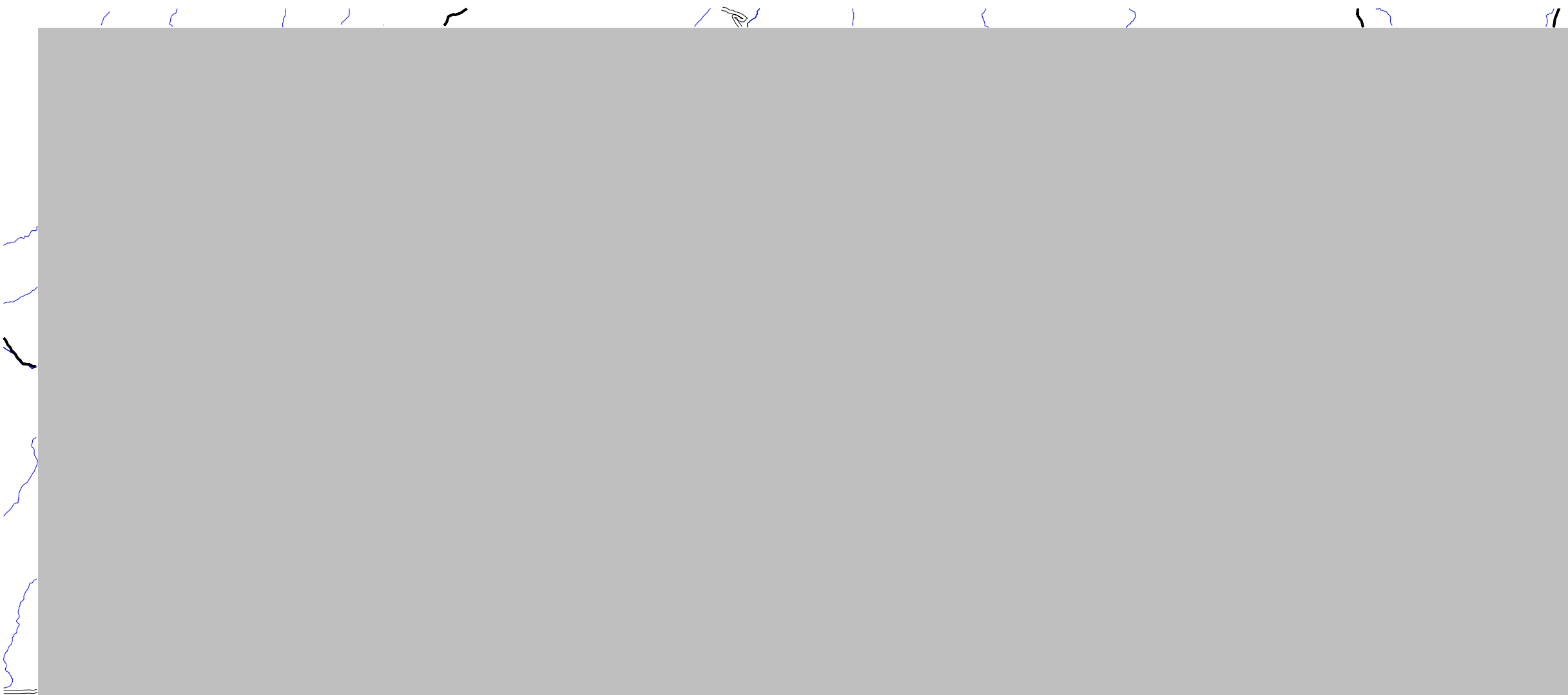
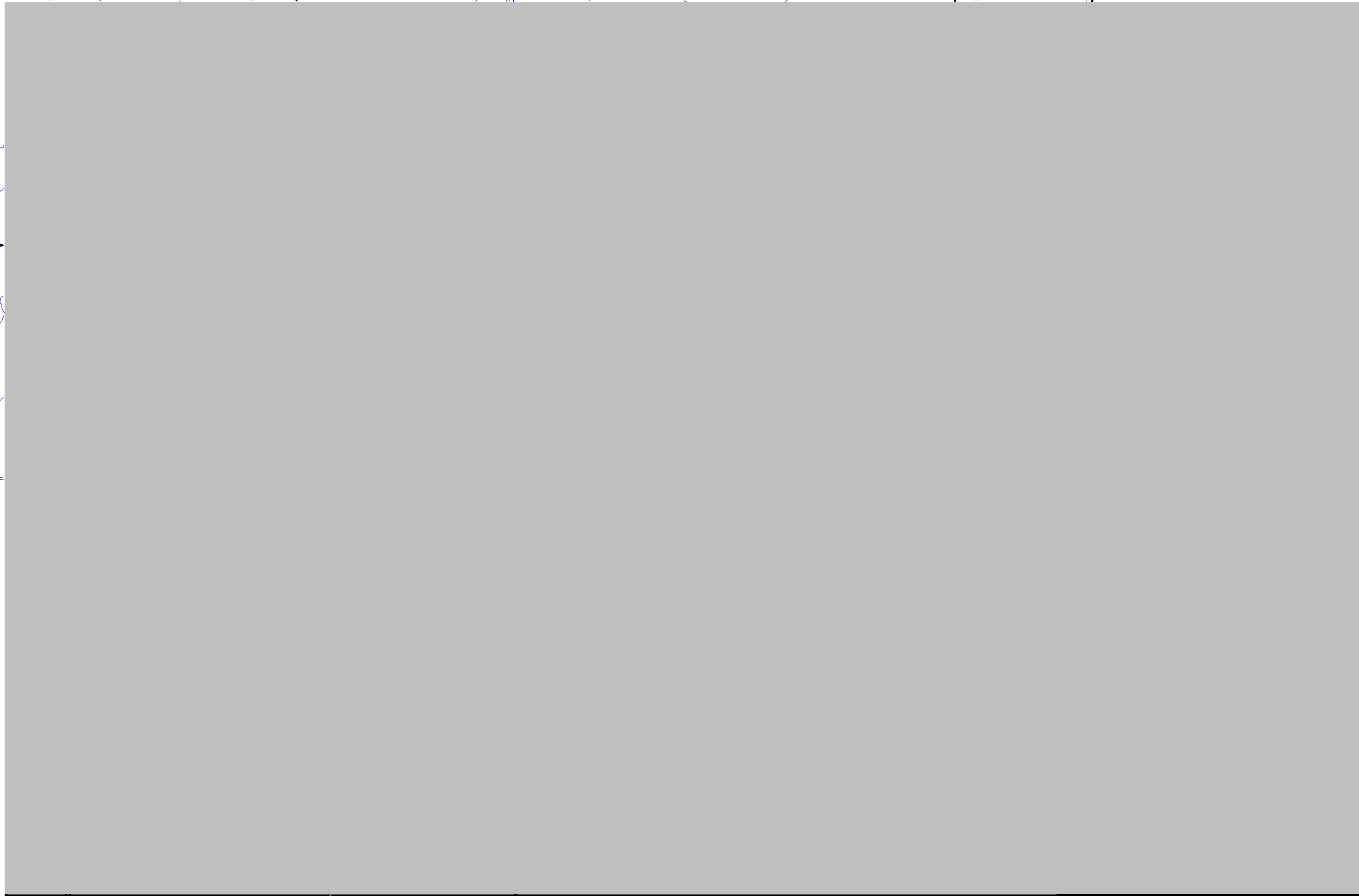
REAL ESTATE MAP

**U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT**

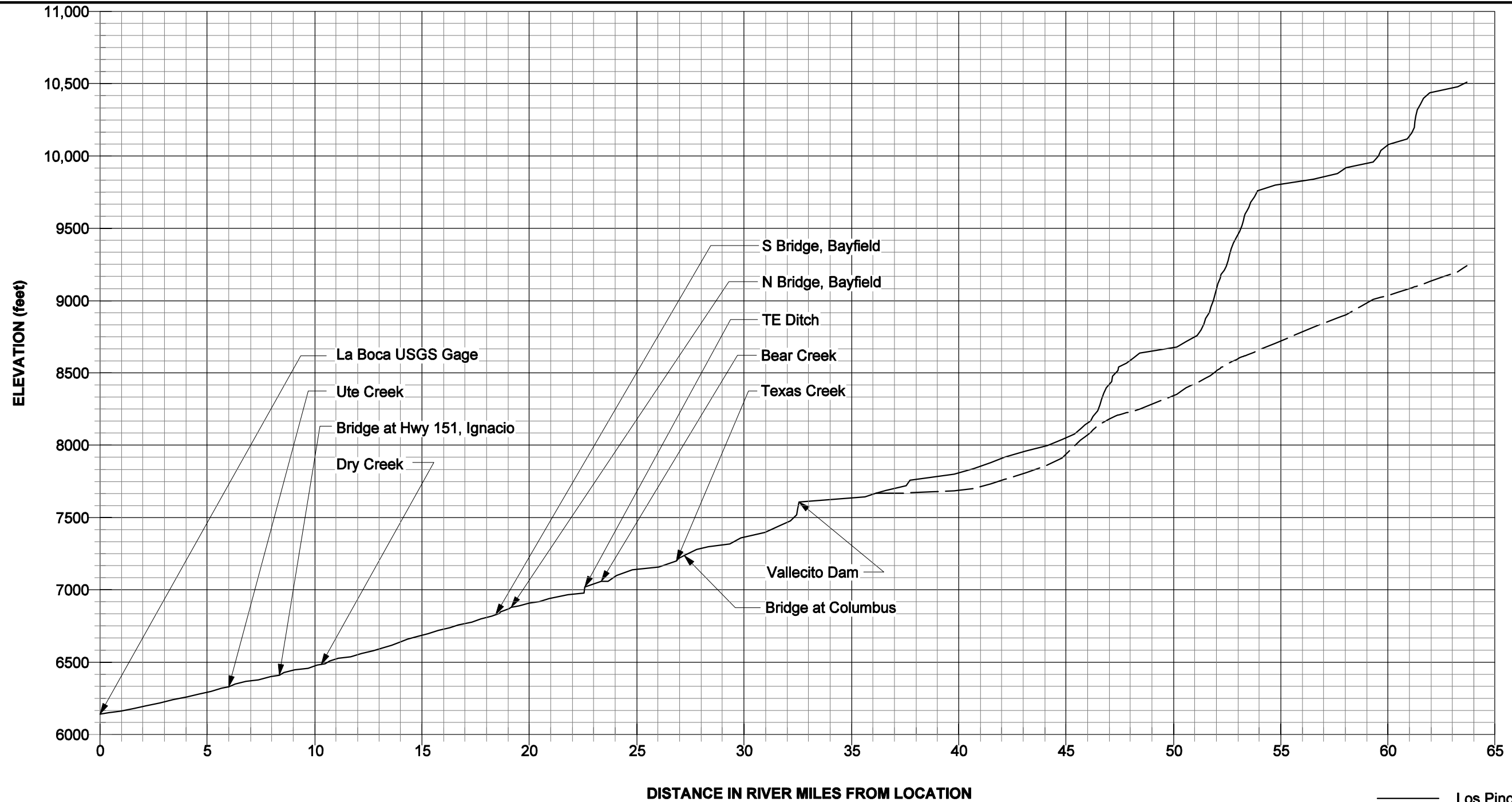
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Revised June 2002

PLATE 2-6







——— Los Pinos River
 - - - Vallecito Creek

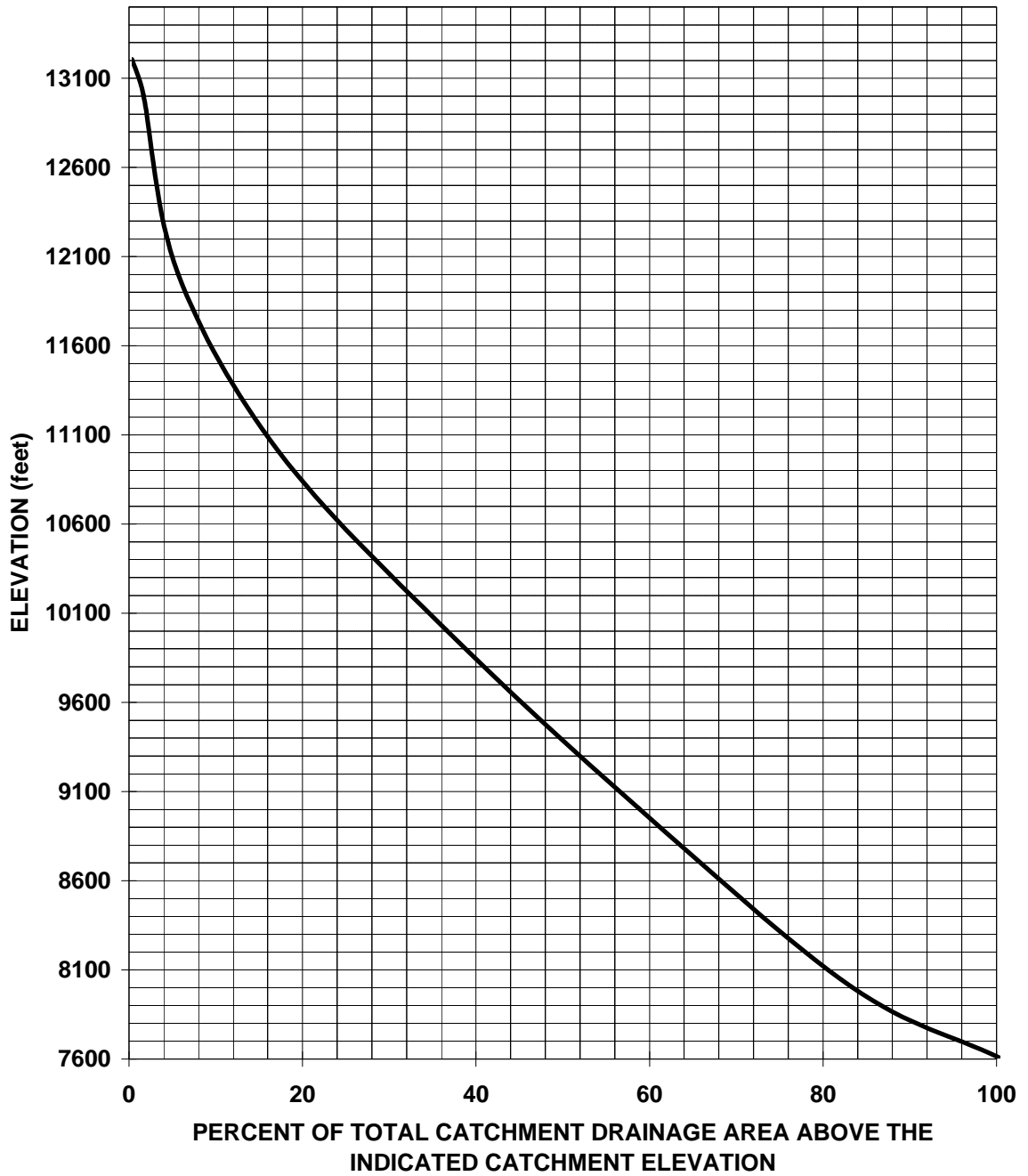
Note:
 1. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR
 LOS PIÑOS RIVER, COLORADO

STREAM PROFILES

U.S. ARMY CORPS OF ENGINEERS
 SACRAMENTO DISTRICT

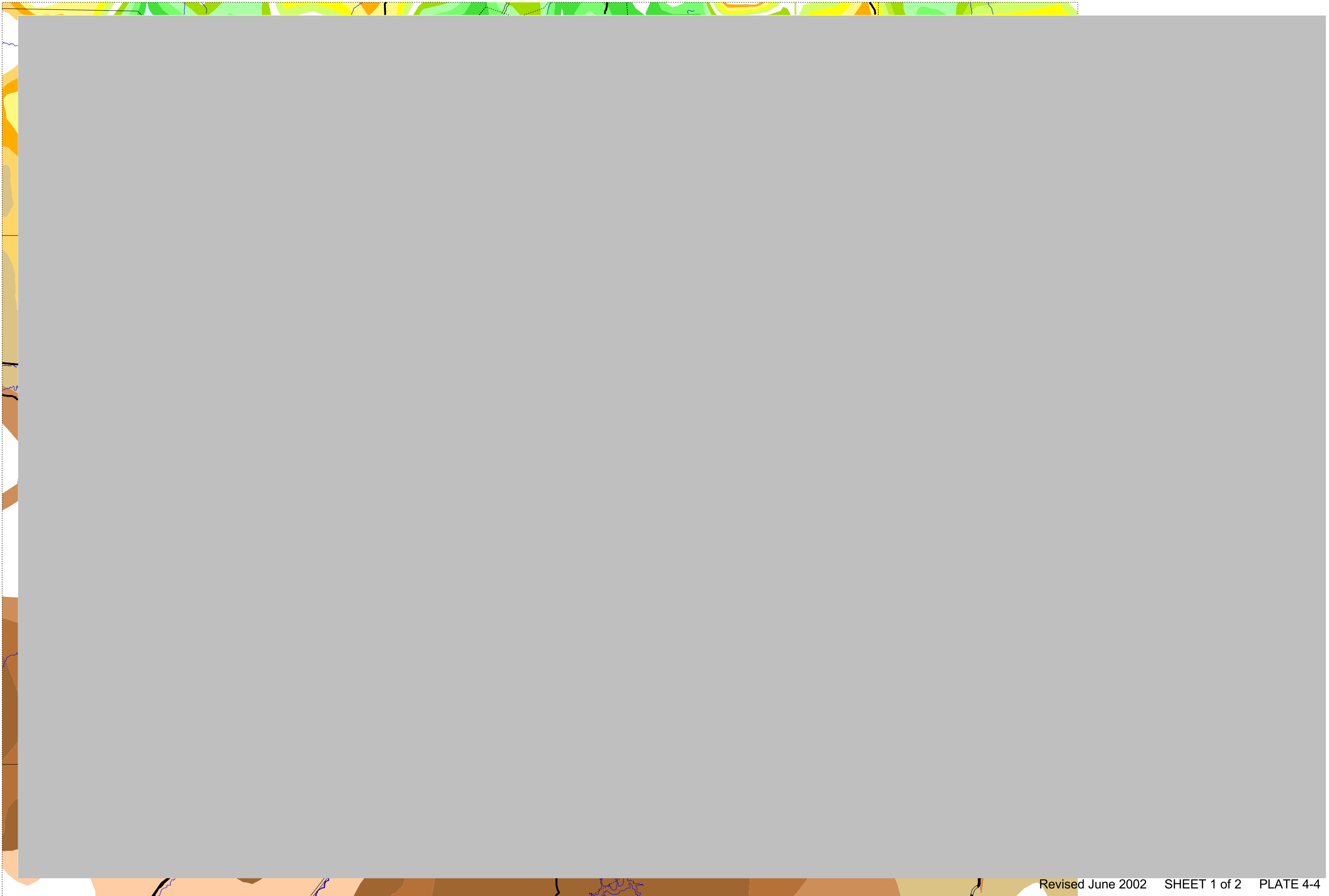
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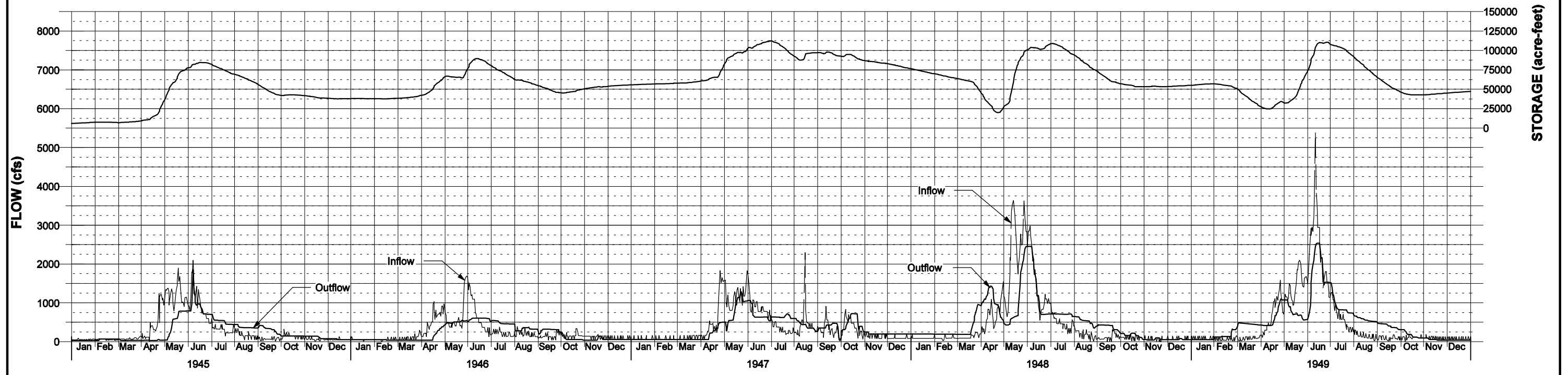
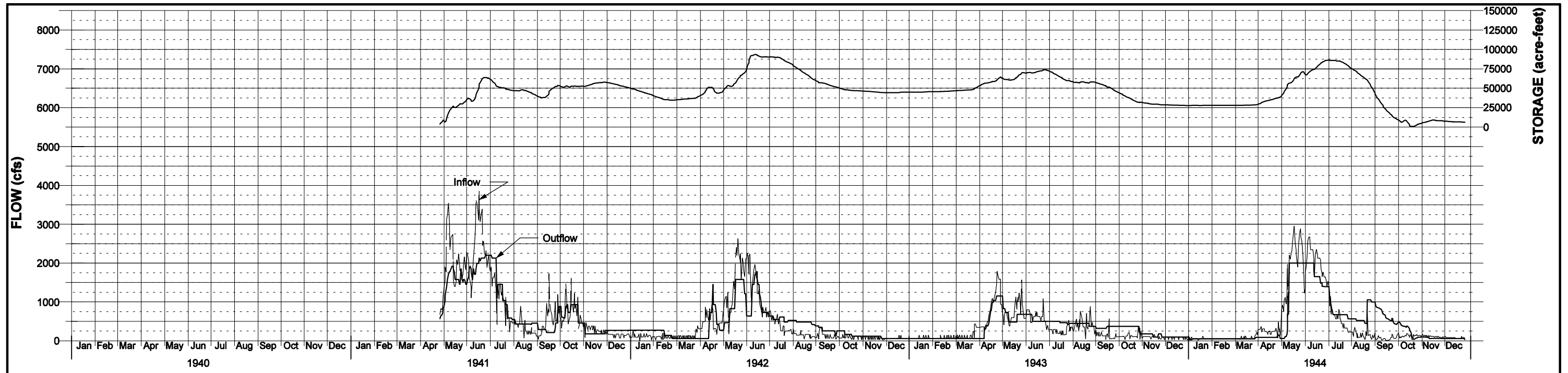
- NOTES: 1. Drainage Area: 270 square miles
 2. Minimum Pool Elevation: 7,600 feet
 3. Dam Crest Elevation: 7,673 feet

VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO
AREA-ELEVATION CURVE
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by DFCE







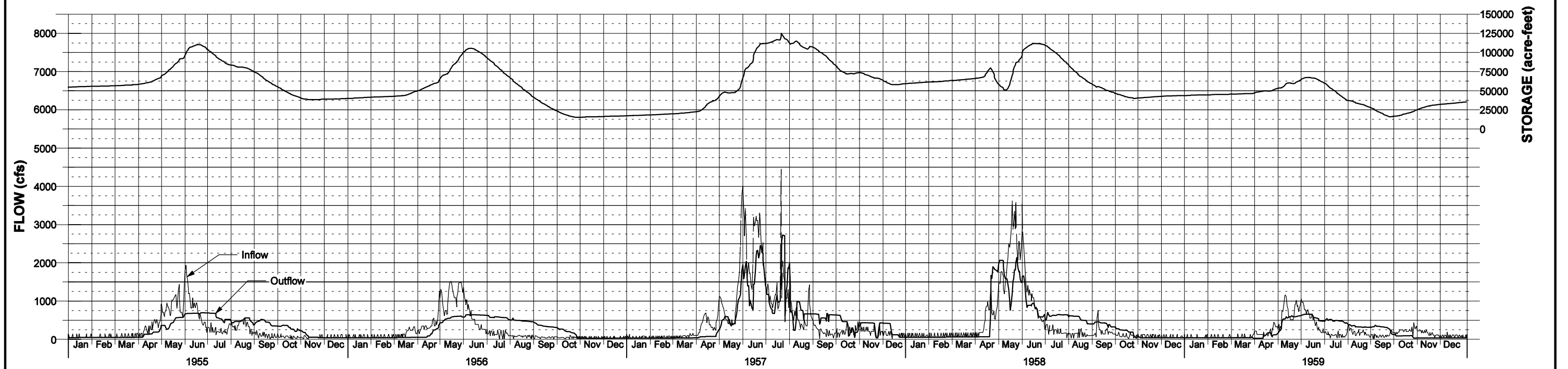
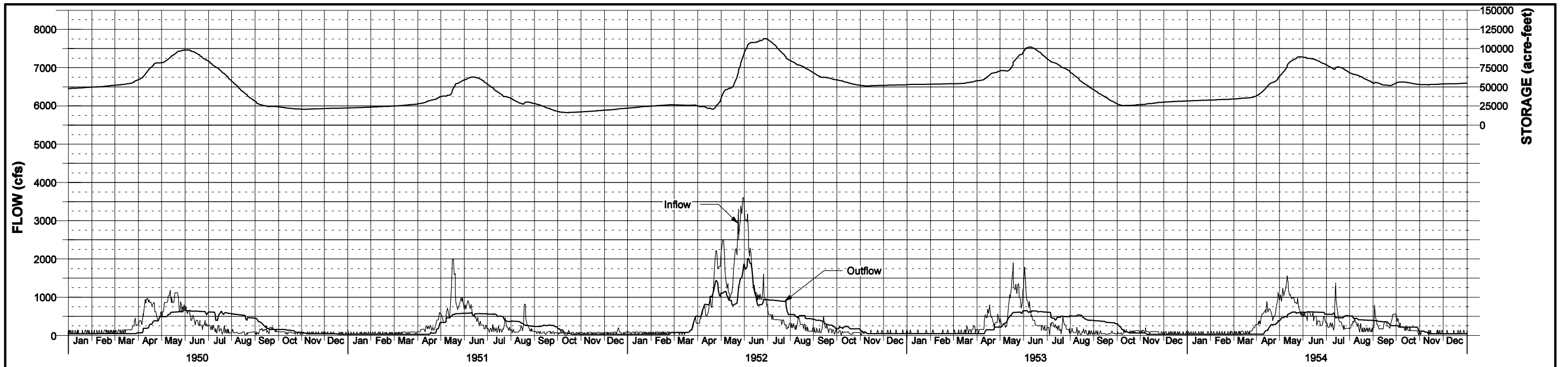
Note:
1. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

HISTORICAL OPERATION

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESPA

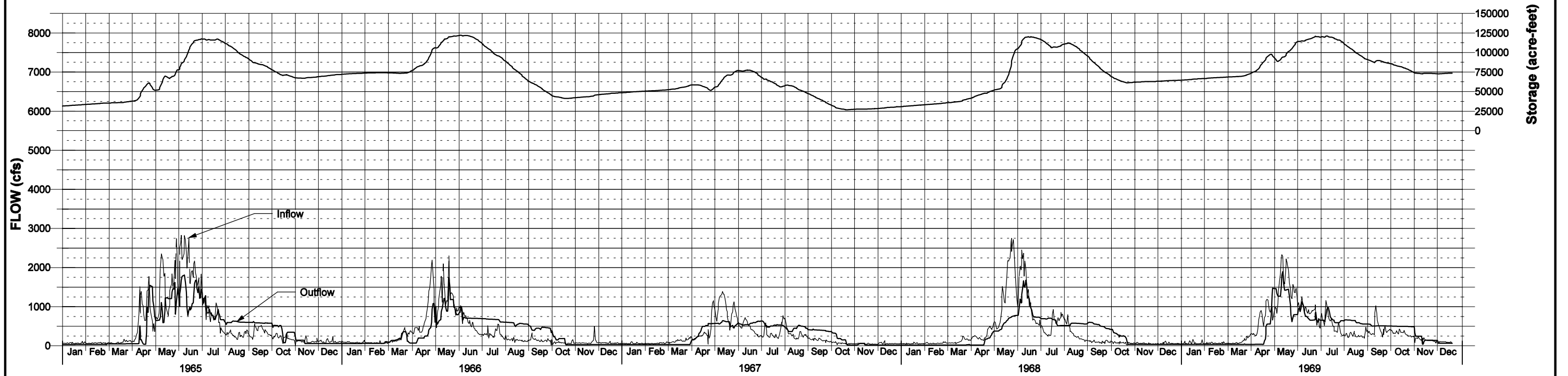
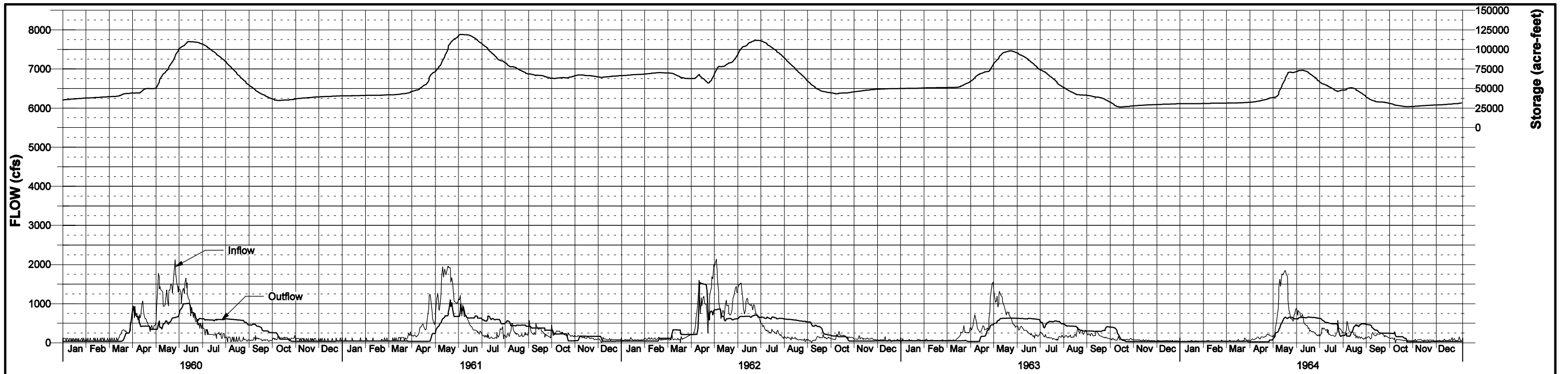


VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

HISTORICAL OPERATION

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESPA



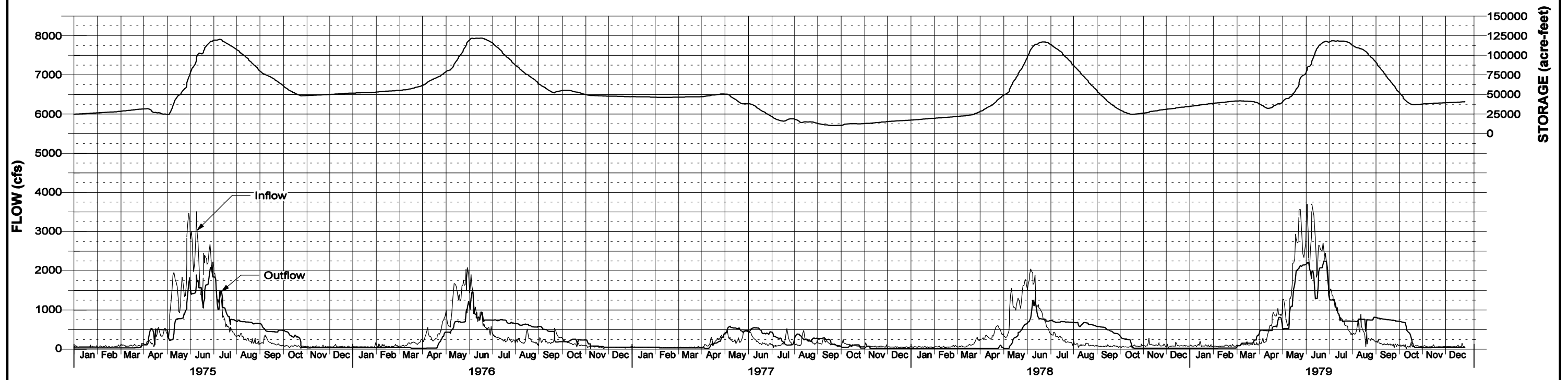
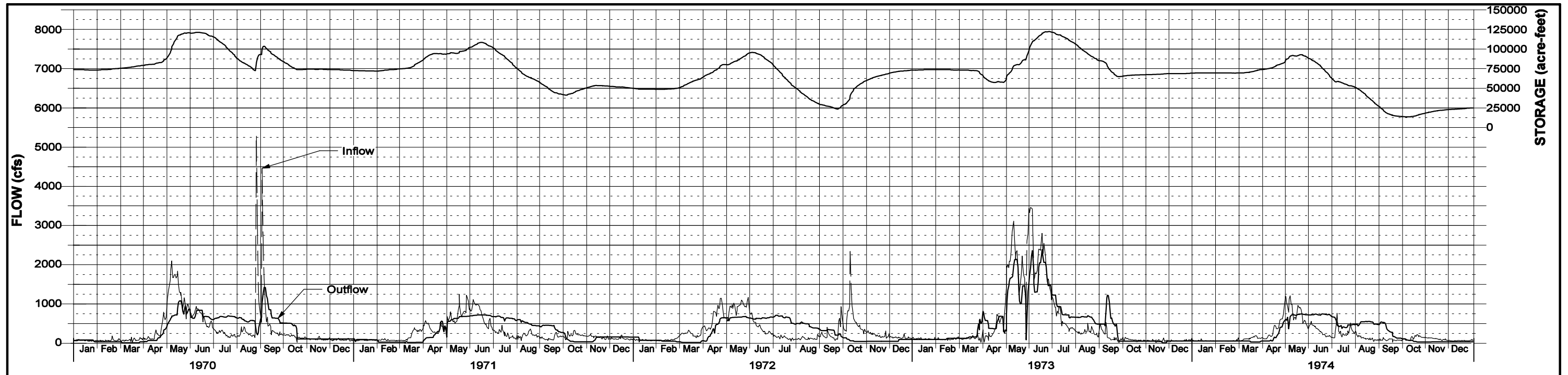
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1. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

HISTORICAL OPERATION

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESPA



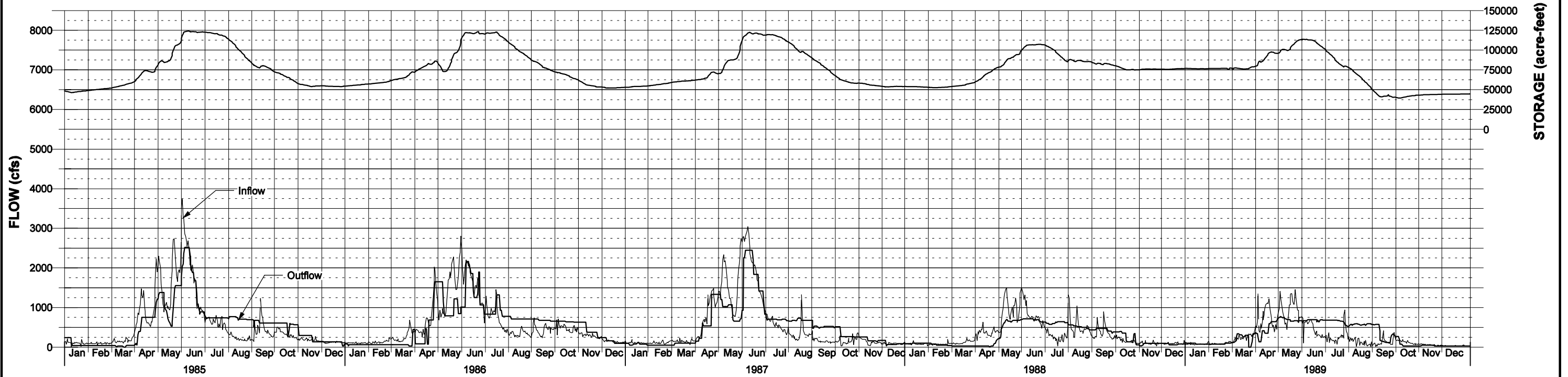
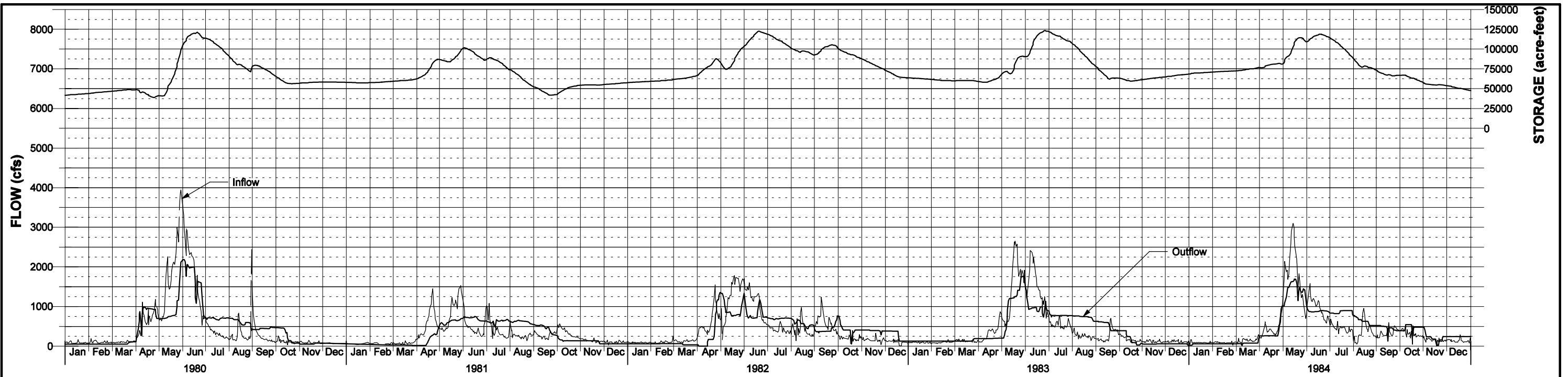
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VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

HISTORICAL OPERATION

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

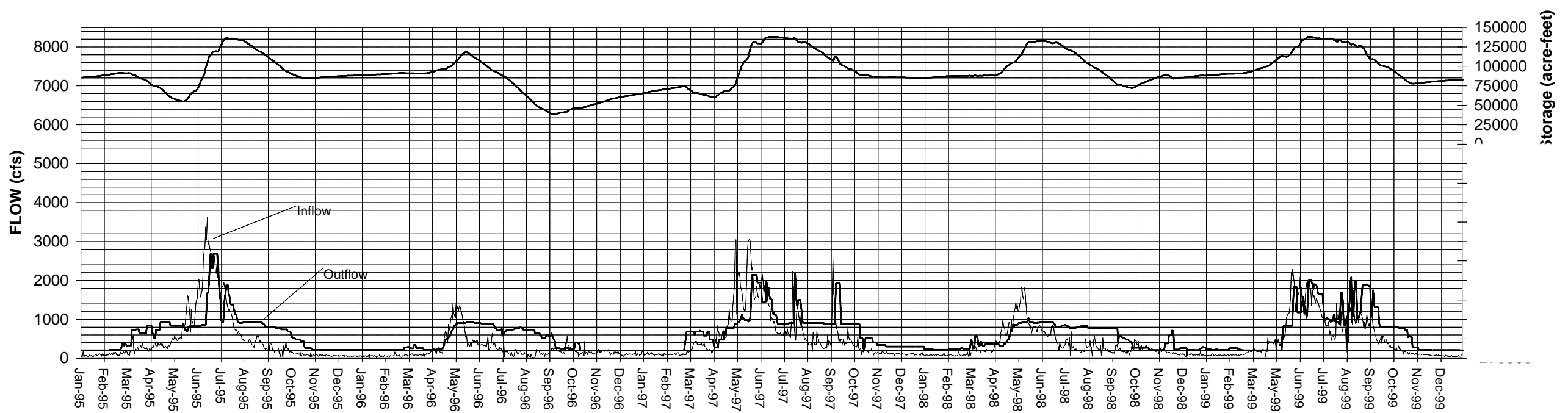
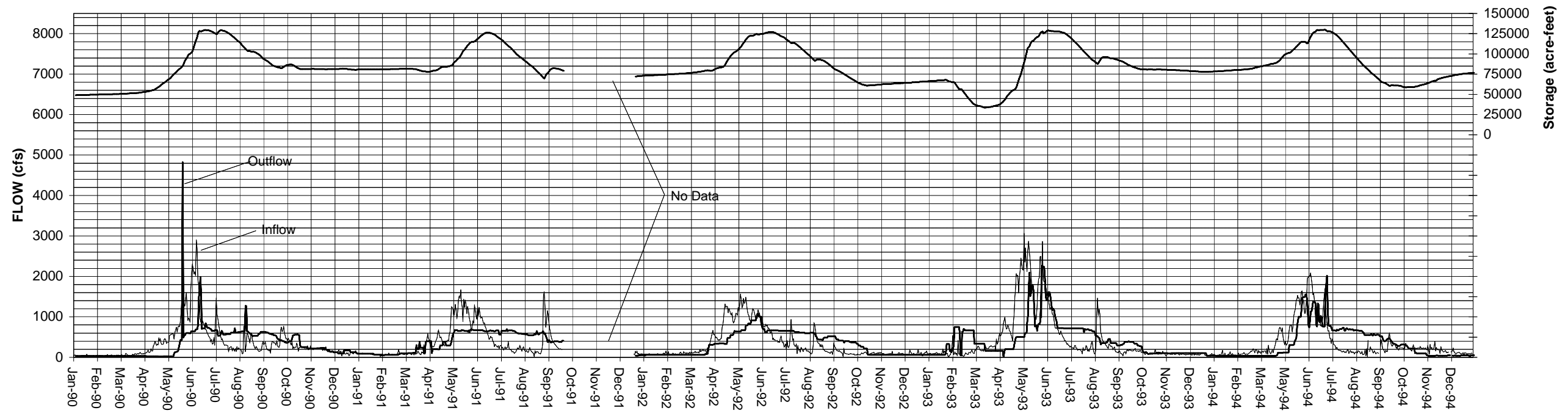
Prepared by CESPA



Note:
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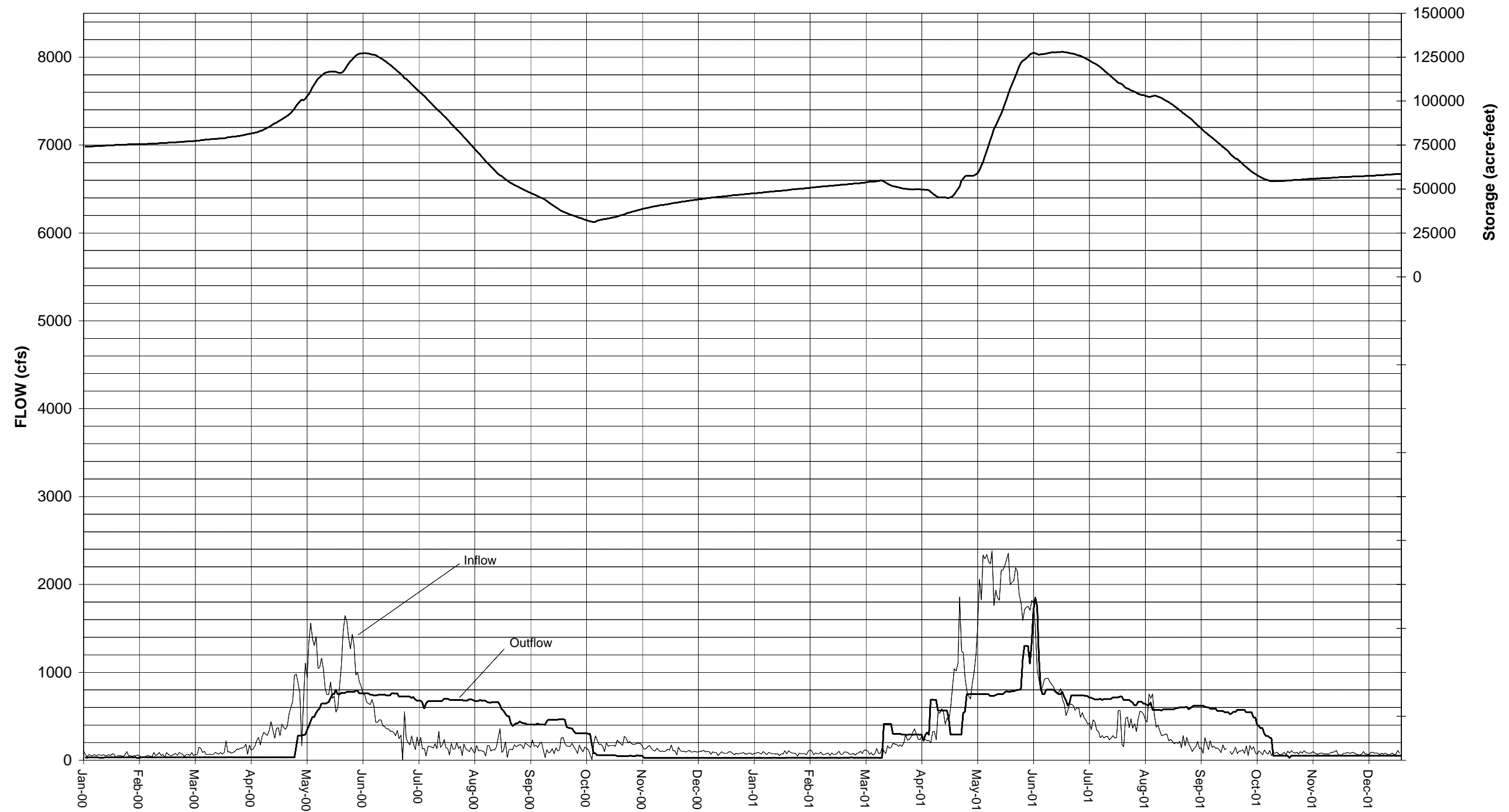
<p>VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO</p>
<p>HISTORICAL OPERATION</p>
<p>U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT</p>

Prepared by CESPA



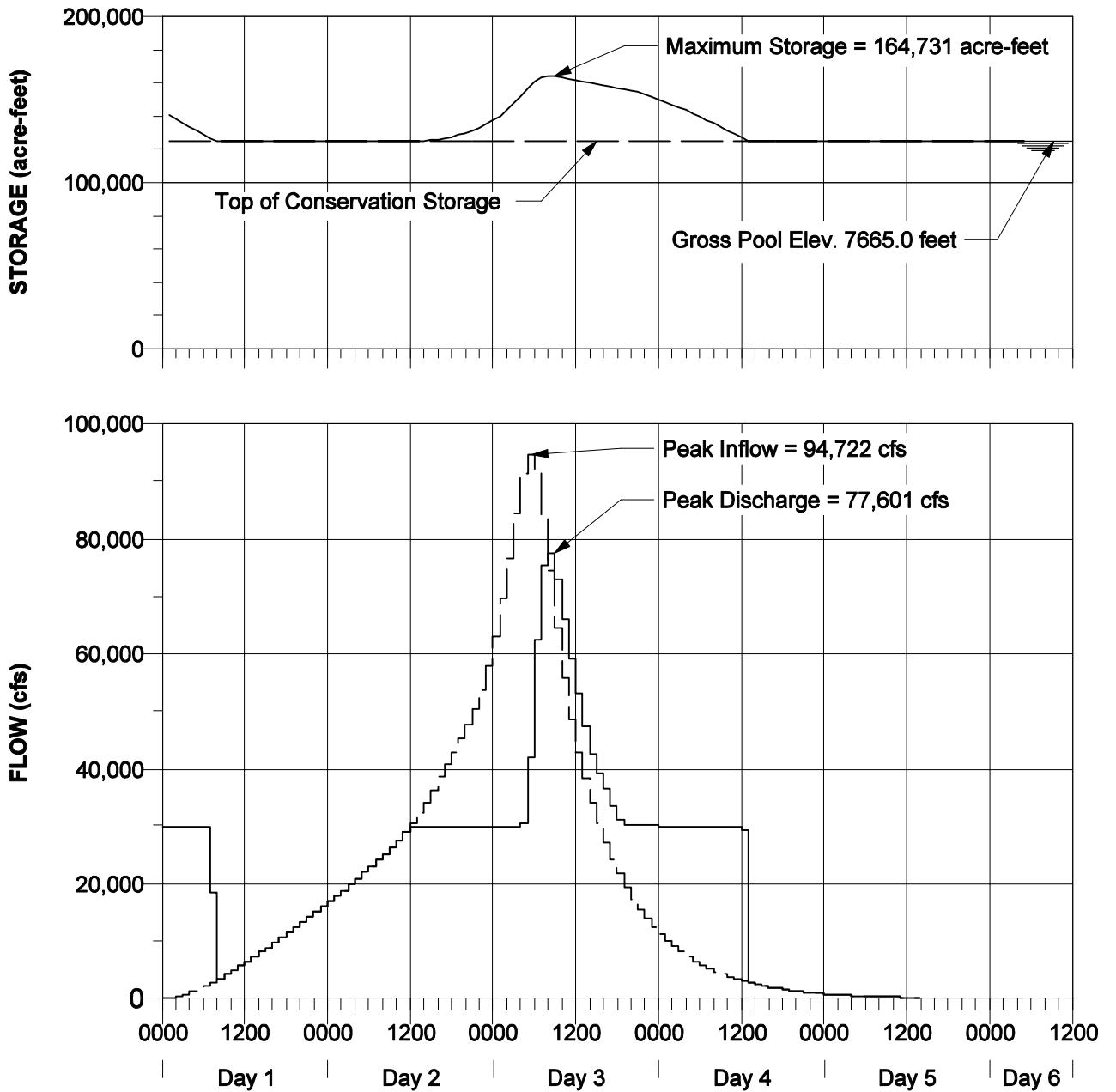
Note:
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VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO
HISTORICAL OPERATION
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT



Note:
1. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO
HISTORICAL OPERATION
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT



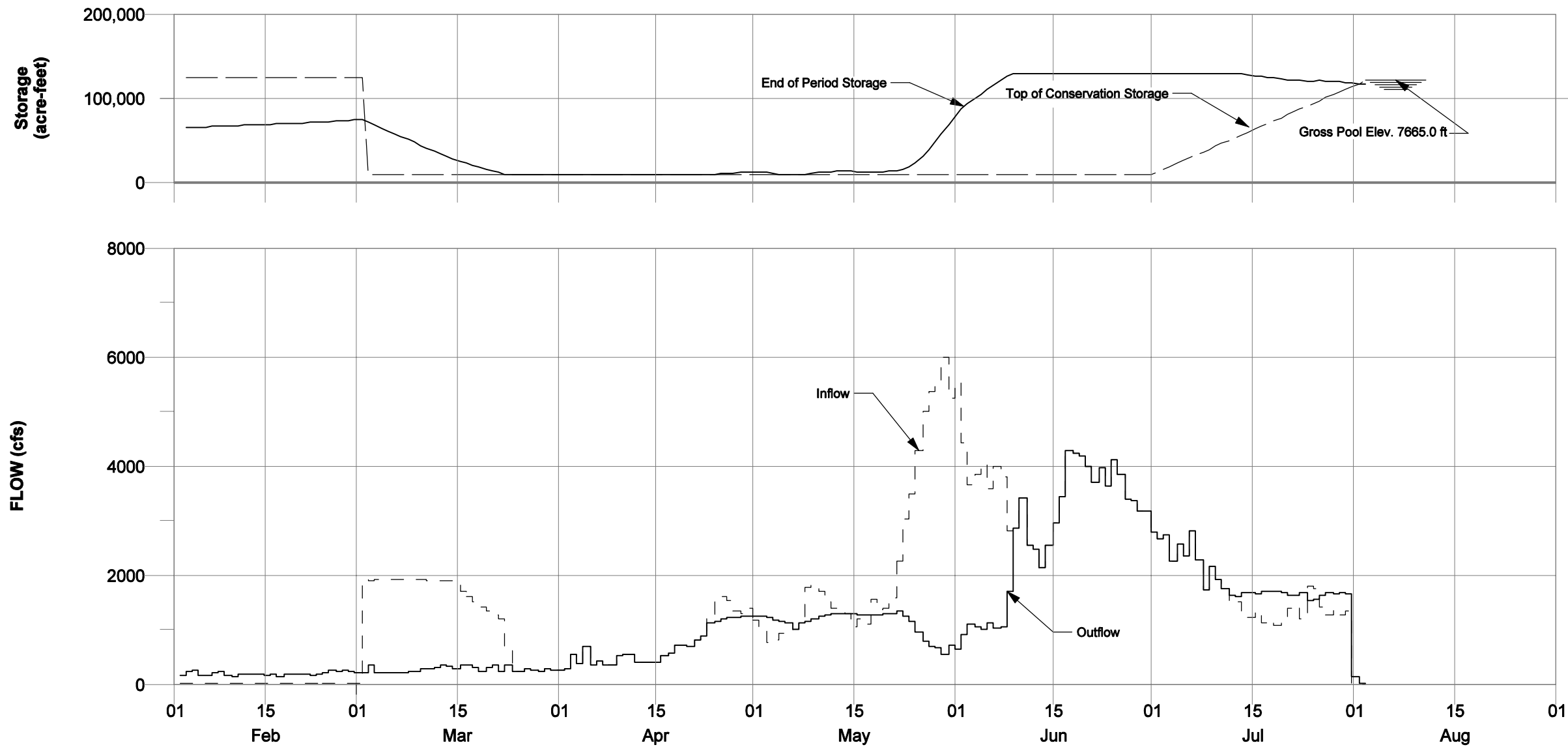
Fall General Storm

NOTES:

1. Assumption: Reservoir level at elev.7665.0 feet, at begining of storm.
2. Maximum outflow = 77,601 cfs overtops dam by 1.4 feet.
3. Flow through the outlet works = 2,900 cfs.
4. Data provided by USBR.

VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO
PROBABLE MAXIMUM FLOOD
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by CESPA



Notes:

1. Starting storage elevation on 1 February is 25% greater than average.
2. Routing conforms to the Water Control Diagram, Plate A-8.
3. Perfect forecast was assumed.
4. Routing is hypothetical and represents one of several possible operations.
5. Data furnished by USBR.

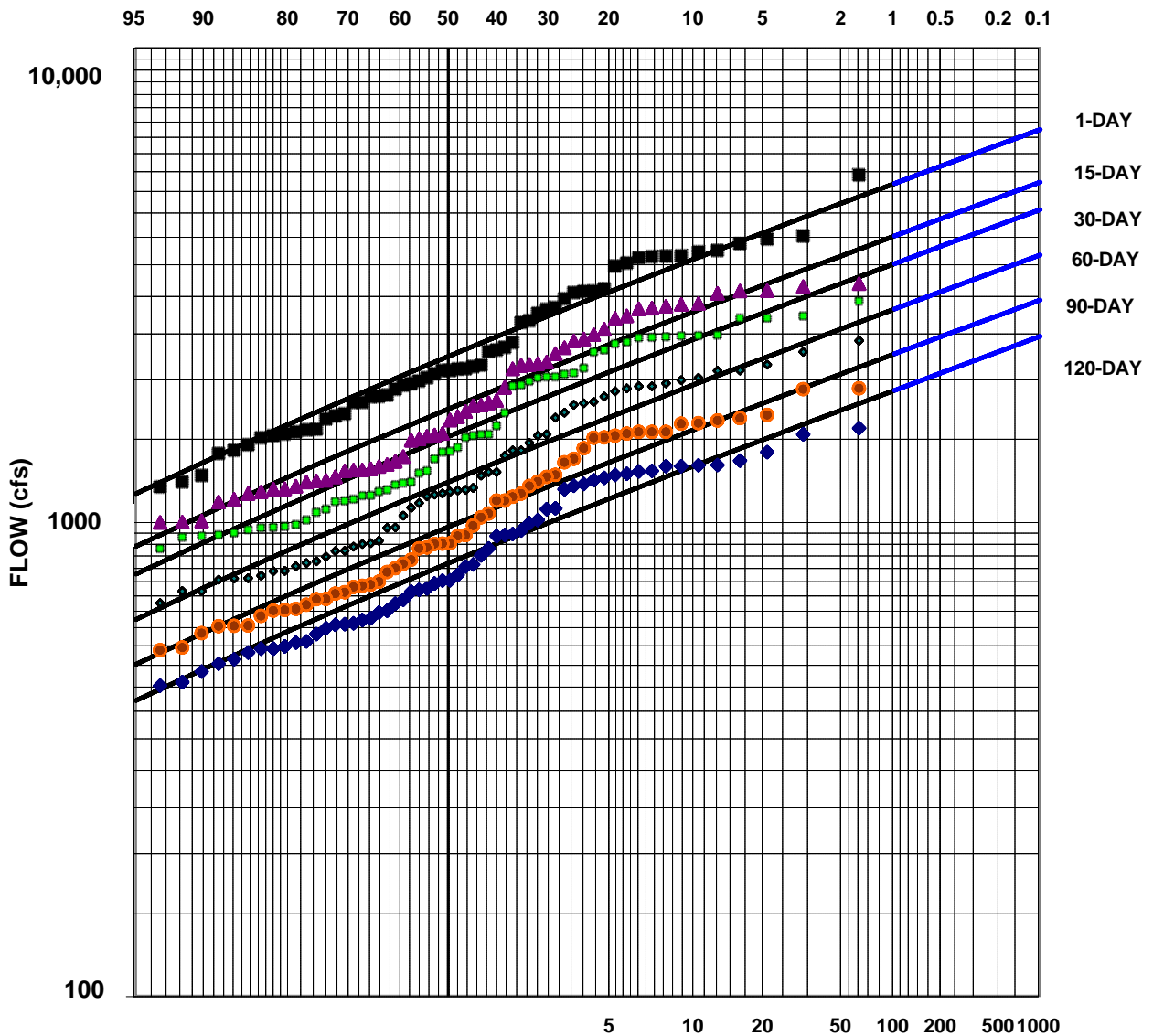
VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

**HYPOTHETICAL ROUTING
OF
100 – YEAR SNOWMELT FLOOD**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESP

EXCEEDENCE FREQUENCY PER 100 YEARS



STATISTICS:

	<u>Mean</u>	<u>Std.Dev.</u>	<u>Skew</u>
1 Day	3.3449	0.164	-0.200
15-day	3.2340	0.164	-0.200
30-day	3.1757	0.164	-0.200
60-day	3.0800	0.164	-0.200
90-day	2.9851	0.164	-0.200
120-day	2.9085	0.164	-0.200

EXCEEDENCE INTERVAL IN YEARS

NOTES:

1. WY 1977 is a low outlier.
2. Weibull plotting positions
3. Drainage area 270 sq. mi.
4. Period of record: 1941-2001
5. The three lowest peak values in the period of record are not shown.

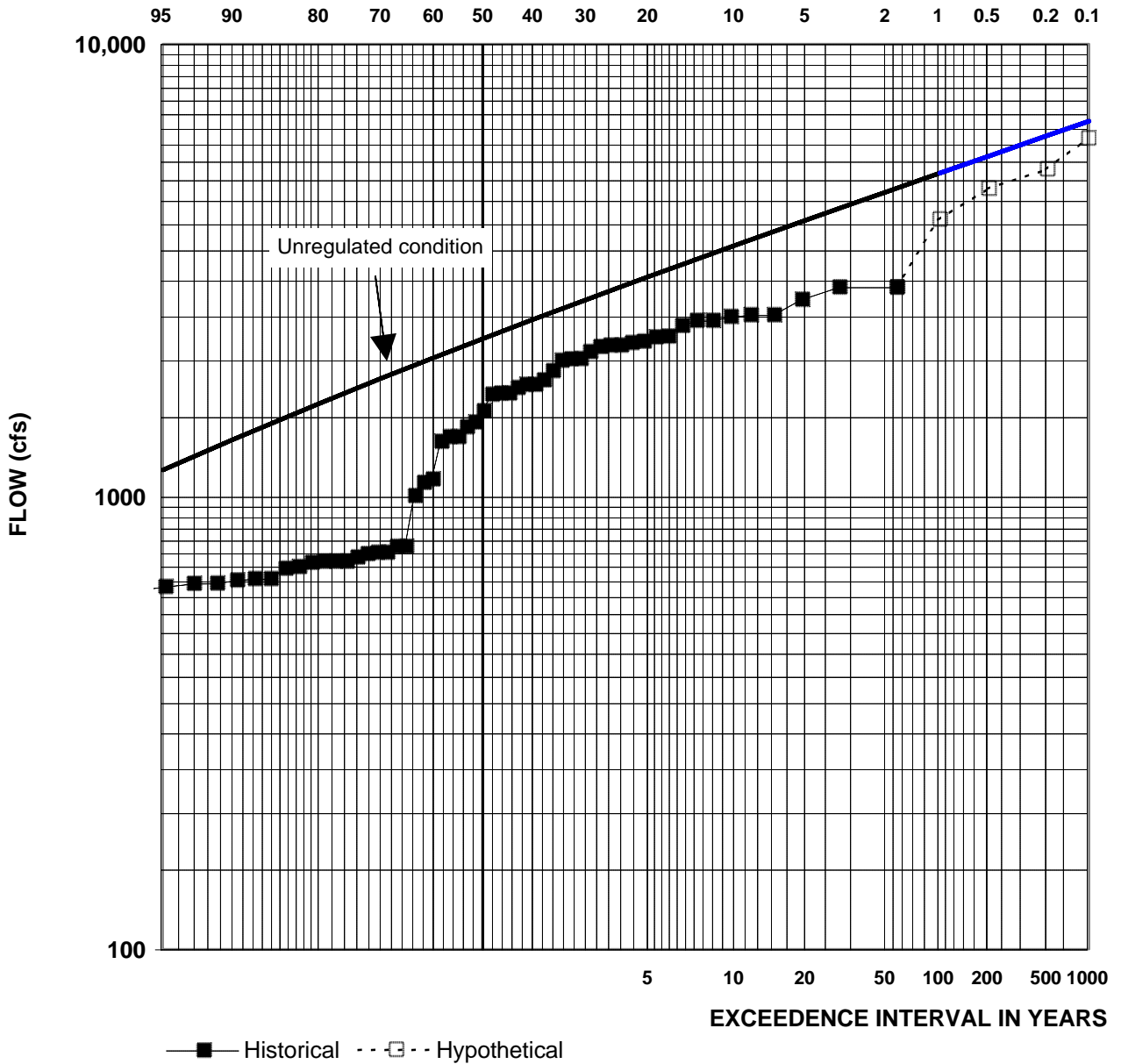
VALLECITO RESERVOIR LOS PIÑOS RIVER, COLORADO
SNOWMELT FREQUENCY CURVES UNREGULATED CONDITIONS AT VALLECITO DAM
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by DFCE

Revised June 2002

PLATE 8-3

EXCEEDENCE FREQUENCY PER 100 YEARS



NOTES:

1. Weibull plotting positions
2. Period of record: 1941-2001
3. Drainage area: 270 sq. mi.

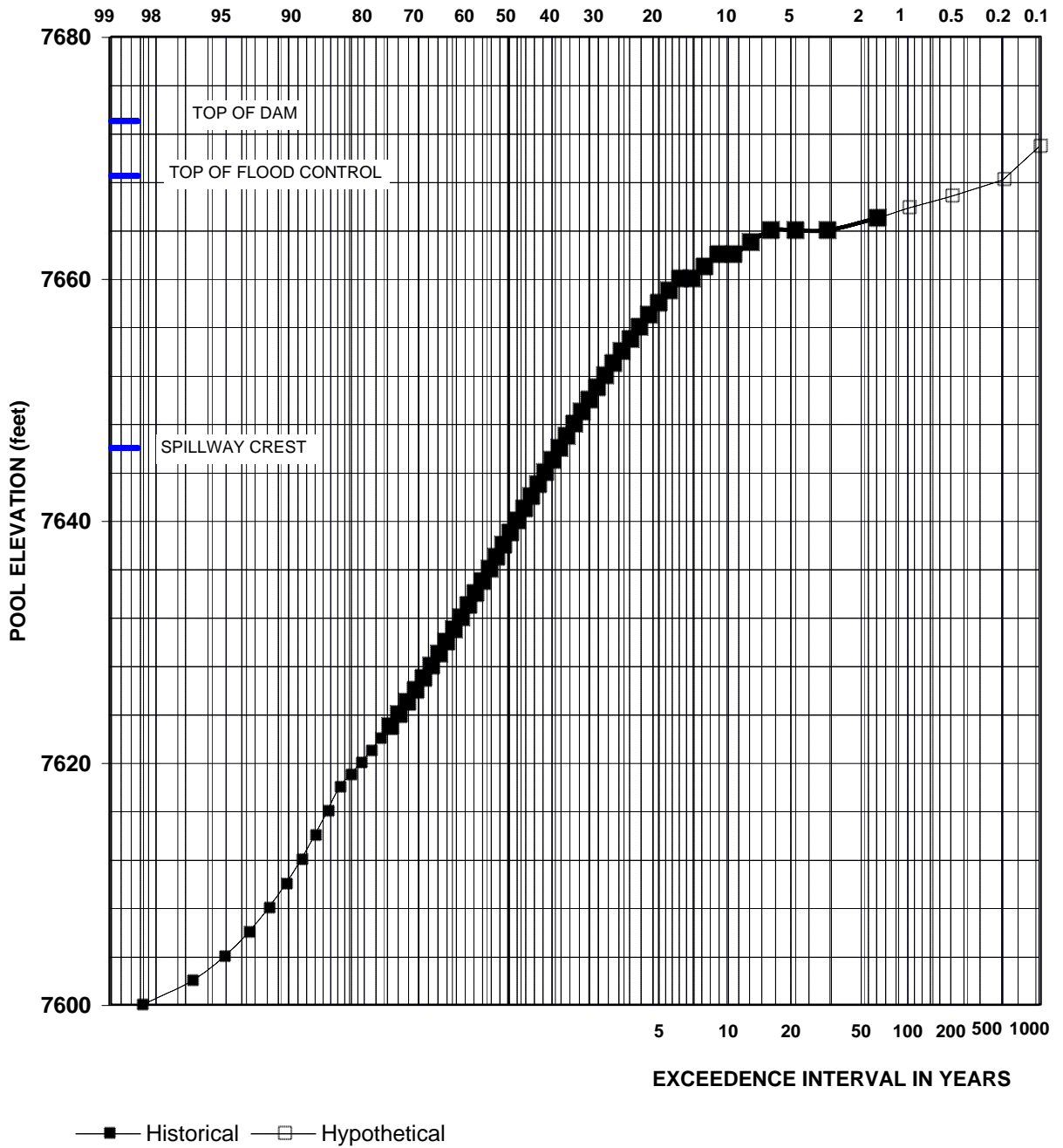
VALLECITO RESERVOIR LOS PIÑOS RIVER, COLORADO
SNOWMELT FREQUENCY CURVES REGULATED CONDITIONS AT VALLECITO DAM
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by DFCE

Revised June 2002

PLATE 8-4

Exceedence frequency per 100 years



- Notes:
1. Based on operation for WY 1941-2001
 2. Data provided by the USBR
 3. Weibull plotting position used

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

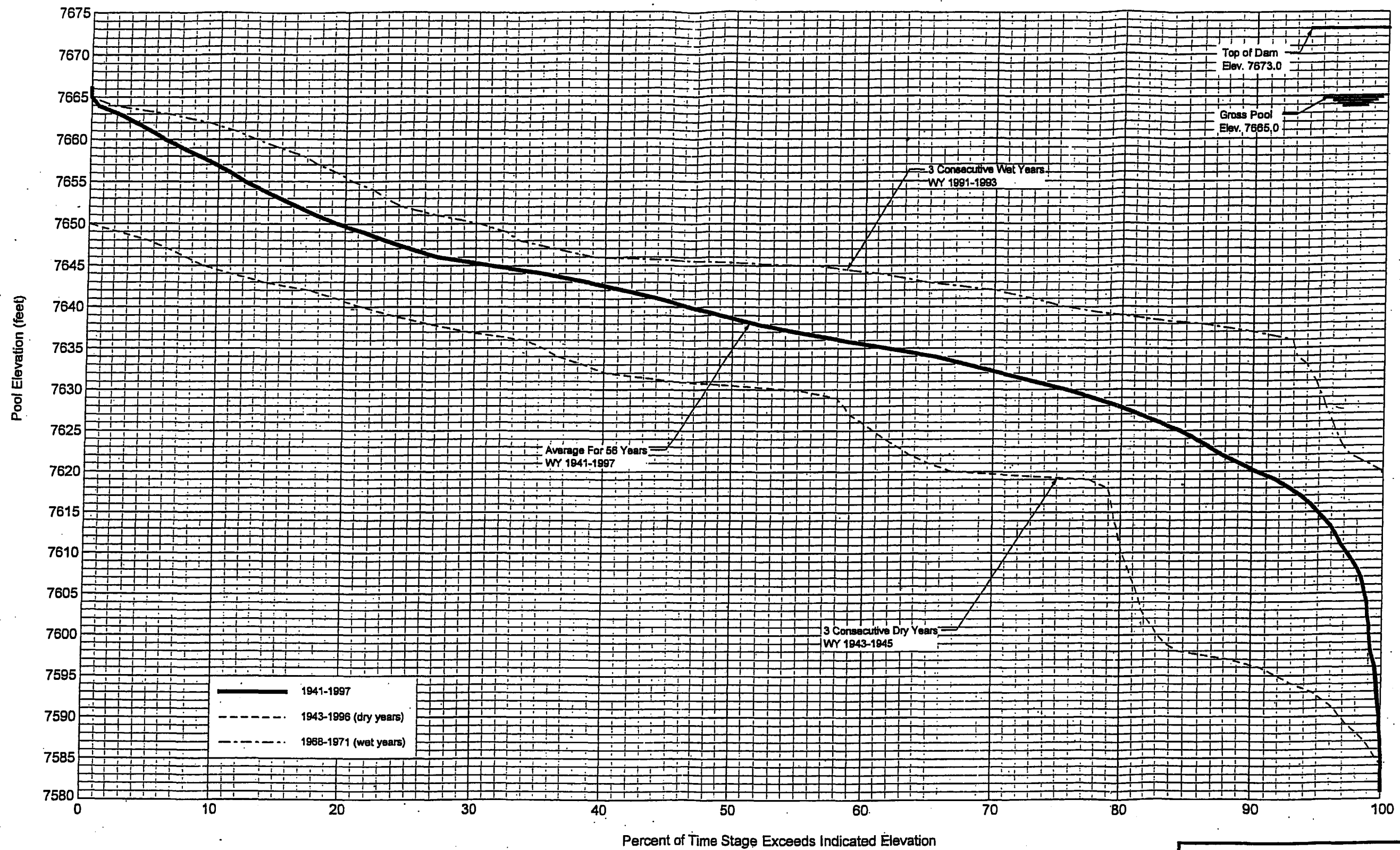
**POOL ELEVATION-FREQUENCY
CURVE**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by DFCE

Revised June 2002

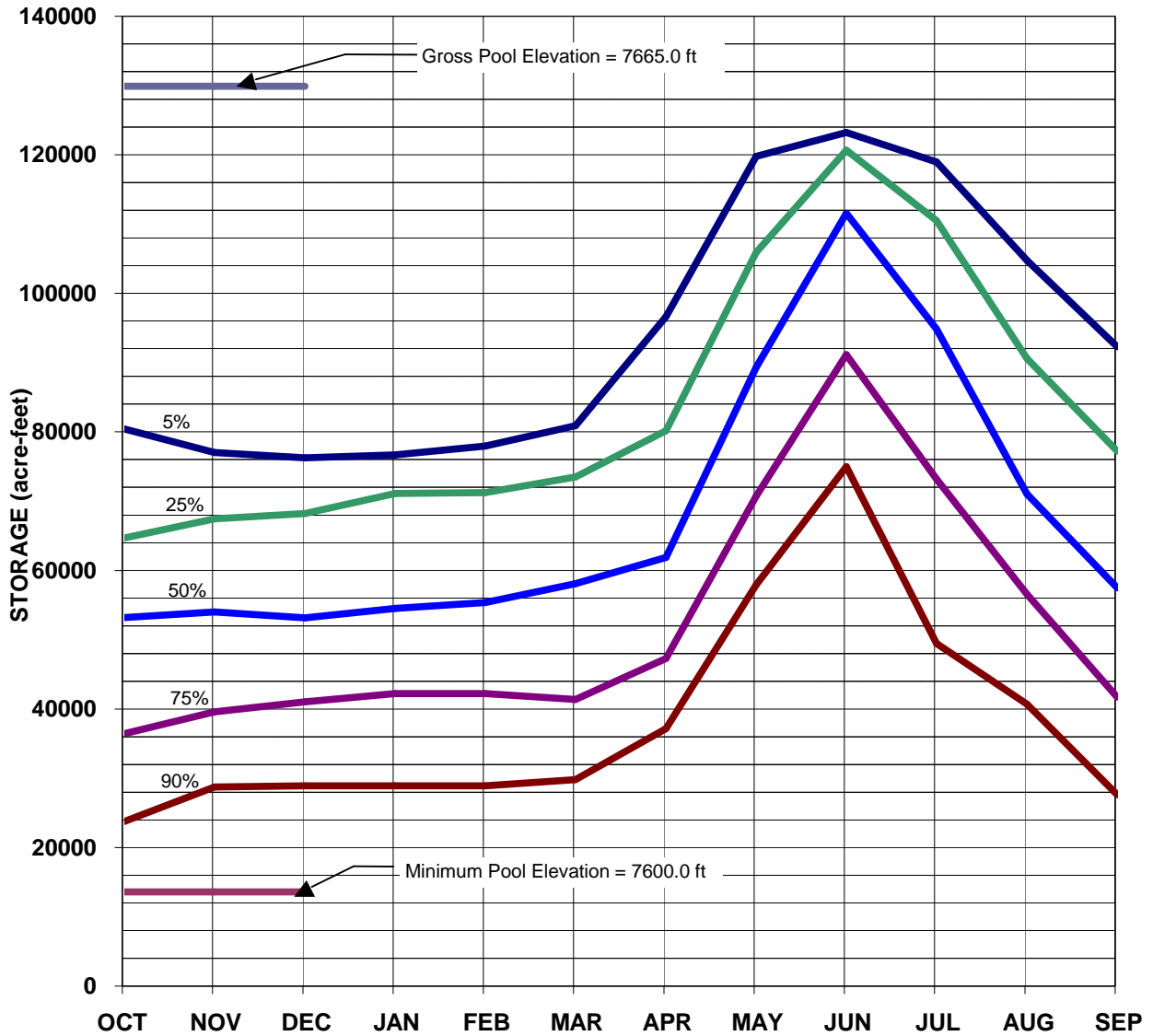
PLATE 8-5



Note:
1. Data furnished by USBR.

<p>VALLECITO DAM AND RESERVOIR LOS PINOS RIVER, COLORADO</p>
<p>POOL ELEVATION-DURATION CURVES</p>
<p>U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT</p>

Prepared by: CESPA



NOTES:

1. Percentages indicate end of month storages that would be equaled or exceeded.
2. Period of record is 1964 to 2001.
3. Live reservoir content in acre-feet (add dead storage of 4247 acre-feet to obtain total storage)
4. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

**SEASONAL VARIATION
OF
STORAGE FREQUENCY**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by DFCE

Revised June 2002

PLATE 8-7

VALLECITO DAM AND RESERVOIR
WATER CONTROL MANUAL

Los Piños River, Colorado

EXHIBIT A

STANDING INSTRUCTIONS TO THE PROJECT OPERATORS
FOR
VALLECITO DAM AND RESERVOIR

U.S. Army Corps of Engineers
Sacramento District
Sacramento, California

December 1973
Revised June 2002

EXHIBIT A

STANDING INSTRUCTIONS TO THE PROJECT OPERATORS
FOR
VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

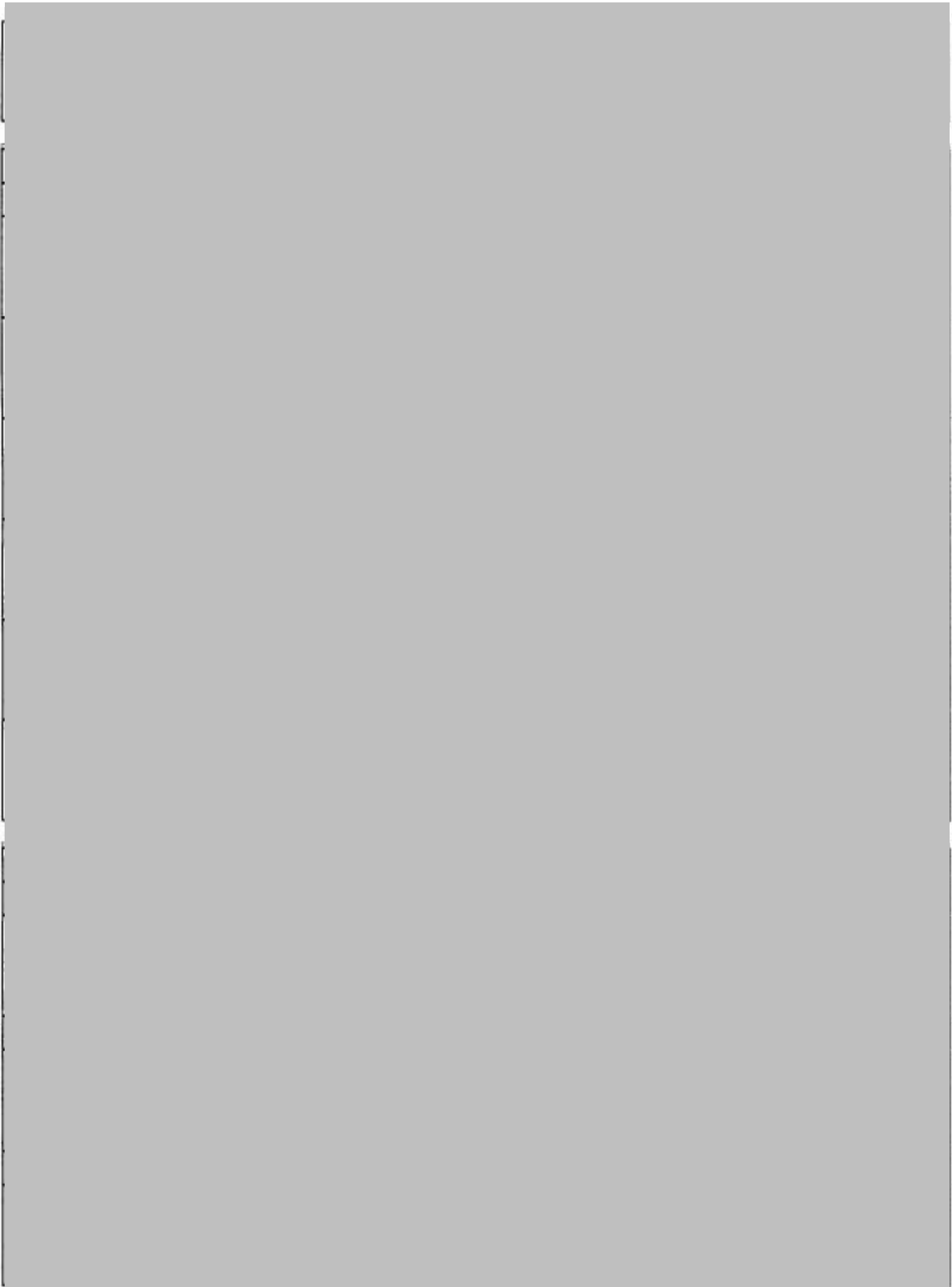
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A-6	Discharge Rating Curve-Los Piños River Below Vallecito Dam
A-7	Discharge Rating Curve-Los Piños River at La Boca
A-8	Water Control Diagram for Vallecito Reservoir
A-9	Spillway Gates Operation Curve

Revised June 2002







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EXHIBIT A

STANDING INSTRUCTIONS TO THE PROJECT OPERATORS FOR VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO

A-01. Background and Responsibilities

a. General Information

(1) "Standing Instructions to the Project Operators for Water Control" are essential to ensure efficient and safe operation of the project at all times. The instructions apply to Project Operators, Power Plant Superintendents, Resource Managers, and other operators in a similar position. Any physical operating constraints should be within design limitations and clearly outlined to ensure that water control features are operated in a safe manner during all phases of the project's life, including the construction phase.

This exhibit to the "Vallecito Dam and Reservoir, Los Piños River, Colorado, Water Control Manual" is prepared in accordance with instructions contained in EM 1110-2-3600 (paragraph 9-2, Standing Instructions to the Project Operators for Water Control) and ER 1110-2-241. All elevations in this manual are based on the National Geodetic Vertical Datum of 1929 (NGVD29). As directed by EM 1110-1-1004, Geodetic and Control Surveying, the datum has been changed to the North American Vertical Datum of 1988 (NAVD88). The elevations in this manual do not reflect NAVD88.

This exhibit pertains to duties and responsibilities of the Project Operator, in connection with the flood control operation of Vallecito Dam, and the reporting of required hydrologic data. A copy of these Standing Instructions must be kept on hand at all times. Any deviation from the Standing Instructions will require approval of the District Engineer or designee. For information on personnel telephone numbers and addresses, refer to the "Personnel Concerned with the Project Operation" in the front of this exhibit.

Operational instructions to the Project Operator are briefly outlined with specific emphasis on the Project Operator's duties and responsibilities during extreme flood emergencies when communication facilities between the operator and the USBR's Facilities Resource Group, Southern Division, Western Colorado Area Office (WCAO-SD), located in Durango, Colorado, may have been disrupted. It is designed to be used independently as the water control regulation guide, or as published, in conjunction with the Water Control Manual. To facilitate independent use of this exhibit for flood control operation of Vallecito Dam and Reservoir, Plates A-1 through A-9 are included herein.

Revised June 2002

(2) Vallecito Dam and Reservoir will be operated for flood control in accordance with rules and regulations prescribed by the Code of Federal Regulations Title 33, Part 222.5 and Part 208.11, and the Field Working Agreement for Vallecito Dam and Reservoir. Copies of these regulations are contained in this manual as Exhibit B and C, respectively. In conjunction with these regulations is the Water Control Diagram, which defines the requirements for flood control regulation of Vallecito Reservoir. The flood control objectives are:

(a) To control flows into Los Piños River below Vallecito Dam near Bayfield, Colorado, insofar as possible, not to exceed the current estimated non-damaging safe channel capacity of 2,000 cfs ($56.6 \text{ m}^3/\text{s}$), thus not endangering life and property in the flood plain.

(b) To restrict the rate of release by limiting increases or decreases to no more than 500 cfs ($14.1 \text{ m}^3/\text{s}$) in any two-hour period.

(c) To permit use of the maximum practical amount of storage reservation for conservation without impairing the flood control functions.

(3) The operation of Vallecito Dam and Reservoir is performed by the Pine River Irrigation District (PRID), under the direction of the U.S. Bureau of Reclamation (USBR), Durango, Colorado. Therefore, the communication chain in this project is as follows:

(a) Western Colorado Area Office - Southern Division (WCAO-SD),
Durango, Colorado

(b) Upper Colorado Regional Office, Salt Lake City, Utah

(c) Denver Office, Denver, Colorado

(d) Commissioner's Office, Washington, D.C.

(4) The Vallecito Dam and Reservoir is located in La Plata County on the Los Piños River, about 32.6 miles (52.5 RKM) upstream from its confluence with Navajo Reservoir. It is about 18 miles (26.7 km) northeast of Durango and 15 miles (24.1 km) north of Bayfield, Colorado.

(5) The required flood control reservation varies up to a maximum of 115,400 acre-feet (142 hm^3) from 1 March to 31 July. This reservation varies according to snowmelt parameters, based on the remaining forecasted snowmelt runoff issued by the NWS through 31 July. A 50 percent exceedence forecast is used for computing the top of conservation storage for the Water Control Diagram; however, the maximum (90 percent exceedence) and minimum (10 percent exceedence) forecasts are also considered. Consultation with the CBRFC on forecasts is also done. The parameter is computed daily by subtracting the previous day's runoff from the remaining forecasted runoff through 31 July. The variable storage provides for the required flood control reservation, while allowing the space below the flood control pool to

be filled for conservation purposes. When available from measured inflow, a minimum of 25 cfs (0.14 m³/s) is voluntarily released for fish downstream of the dam. The Area and Capacity Curve and Table is located on Plates A-1 and A-2, respectively.

(6) The physical operation and maintenance of Vallecito Reservoir is made by the PRID. All operational reports are provided to the USBR's WCAO-SD in Durango, Colorado.

b. Role of U.S. Bureau of Reclamation. The USBR's WCAO-SD is responsible for the following, which apply to both normal conditions (not dependent on day-to-day instruction) and all emergency conditions (flood or drought):

(1) Overseeing and directing the PRID in the operation of Vallecito Dam and Reservoir in accordance with official regulations.

(2) Following the deviation procedures process explicitly for any proposed or emergency deviations from the Water Control Plan. See Exhibit E for types of deviations and process.

(3) Reporting to the District Engineer or designee, U.S. Army Corps of Engineers, Sacramento District any unusual condition in the reservoir, or along downstream channels, that might interfere with the approved flood control operation of the reservoir.

(4) Taking reasonable steps to inform the public of significant changes in flood control releases.

(5) Providing to the Water Management Section, U.S. Army Corps of Engineers, Sacramento District, data as outlined in Exhibit A, Section A-02, and other data and at other times that may be required.

(6) Keeping informed of the rules and regulations contained in this Water Control Manual and bringing to the attention of the District Engineer or designee, Sacramento District, U.S. Army Corps of Engineers, any feature of the manual that may require clarification or revision.

c. Role of U.S. Army Corps of Engineers. The Sacramento District, U.S. Army Corps of Engineers, is responsible for the following, which apply to both normal and emergency conditions:

(1) Monitoring storage, inflow, and outflow for Vallecito Reservoir on a day-to-day basis to ensure that the operation is in accordance to the Water Control Plan. The Corps also coordinates with the USBR and the NWS, so that agreement on the forecasted inflow volumes is reached. The 50 percent frequency forecast is the basis used in the Water Control Diagram.

(2) Advising operating agencies and the Division Engineers of any departure from this Water Control Plan.

(3) Reviewing and reporting to the Division Engineer any emergency or planned deviations from the prescribed Water Control Plan. Refer to Exhibit E for more detailed information on deviations.

(4) Preparing short period, daily, and monthly operation, and other special reports relative to operation of the project required by the Office, Chief of Engineers.

(5) Preparing revisions to the Water Control Manual and the Water Control Plan found herein.

A-02. Data Collection and Reporting

a. Normal Conditions. The USBR will provide to the Water Management Section, Sacramento District, U.S. Army Corps of Engineers, by phone or "electronic media," as early as possible each and every day, and at other times as requested, the following data:

(1) The amount of flood control reservation required in Vallecito Reservoir based on the current forecasted inflow.

(2) Midnight elevation and storage, calculated mean daily inflow and outflow, and anticipated outflow changes for the next 72 hours at the project.

(3) Daily precipitation, and daily maximum and minimum temperatures at the dam.

Immediately after the end of each month, the Project Operator will provide, by mail or "electronic media," to the Water Management Section, Sacramento District, U.S. Army Corps of Engineers, a monthly summary of the data outlined in this section in its final archival quality. The District Engineer or designee, Sacramento District, U.S. Army Corps of Engineers, shall prepare monthly operation reports and other special reports relative to the operation, as required by the Chief of Engineers, U.S. Army Corps of Engineers.

b. Emergency Conditions. The USBR will immediately notify the appropriate agencies, as well as the U.S. Army Corps of Engineers, of the flooding or emergency conditions. For flood events and other emergency conditions, the information required in paragraph A-02a above will be provided by the USBR at a frequency required by the U.S. Army Corps of Engineers.

c. Regional Hydrometeorological Conditions. The Project Operator will be informed by WCAO-SD of the USBR of regional hydrometeorological conditions that could impact the structure.

A-03. Water Control Action and Reporting

a. Normal Conditions. The water control operation each day consists of determining the required flood control reservation and scheduling releases in order to provide the required reservation by the end of day. This procedure requires a forecast of reservoir inflow for the next 24 hours.

Storage reservation in Vallecito Reservoir shall be on the basis of the Water Control Diagram, Plate A-8, which indicates required storage reservation according to the current flood hazard, as measured by the remaining snowmelt runoff over the basin. Whenever encroachment into the currently required flood control reservation occurs, this water should be released as rapidly as possible, in accordance with criteria contained on the Water Control Diagram, Plate A-8.

Releases from Vallecito Dam, insofar as possible, will be restricted so that the flows into Los Piños River below the dam near Bayfield, Colorado, do not exceed the current estimated non-damaging safe channel capacity of 2,000 cfs (56.6 m³/s). So, if channel losses and/or irrigation diversions of at least 500 cfs occur between Vallecito and Bayfield, then releases of up to 2,500 cfs could be made from Vallecito to meet the objective of releasing flood waters as "rapidly as possible." The rate of change of release is restricted to no more than a change of 500 cfs (14.1 m³/s) in any 2-hour period. For normal operation, the drawdown rate should be limited to one foot (30.5 cm) per day to provide time for evaluation of the performance of the embankment, foundation, and natural slopes within the reservoir area. For emergency conditions, prior approval of drawdown greater than one foot (30.5 cm) per day must be obtained from the USBR, Denver office.

Whenever the reservoir pool approaches gross pool elevation of 7,665.0 feet (2,336.3 m) and is rising because of flood inflows, the necessity for emergency spillway releases should be determined. The Spillway Gates Operation Curve, accompanying the Water Control Diagram, indicates the minimum gate openings to be made when the reservoir is above gross pool elevation, in order to avoid risk of overtopping and possible failure of the embankment. When the diagram indicates such gate openings, it is essential that they be made immediately in order that it will not subsequently become necessary to make larger openings. For this reason, the reservoir operators at the dam should be thoroughly familiar with the spillway gate operation curve and should be supplied with standing instructions to initiate spillway gate openings in accordance with that curve if required when communication with the WCAO-SD of the USBR in Durango is disrupted.

As the pool rises and the spillway flow begins, flow through the outlet works should be decreased so that total flow does not exceed the downstream channel capacity of 2,000 cfs (56.6 m³/s). As the spillway flow decreases, the controlled releases are to be increased as needed according to the Water Control Diagram. Discharge Rating Curves for Two Gates are located on Plate A-3. The Spillway Rating Curve is located on Plate A-5. The Spillway Gates Operation

Curve is located on Plate A-9.

The key control point of Los Piños River is one mile downstream of the Vallecito Dam, which provides protection for the reach between Los Piños River and the confluence with Navajo Reservoir. A minimum of 25 cfs (1 m³/s) is voluntarily released for fish. The Discharge Rating Curve for Los Piños River, below the dam, is found on Plate A-6. For information on reporting responsibilities and requirements for deviations, refer to Section A-04.

Once the reservoir surface is frozen over solid, any appreciable lowering of water level causes the ice near the edge to break into large slabs that drop abruptly, thus killing many small fish that spend the winter near the shore. By avoiding these reductions in water level, insofar as possible, until about 1 April when the ice begins to melt, it is possible to create larger secondary fishery benefits than would otherwise occur. Rating Curves for Los Piños River below Vallecito Dam and at La Boca are shown on Plates A-6 and A-7, respectively.

b. Emergency Conditions. Instructions are the same as above during flood events and other emergency conditions. However, the official regulations are subject to temporary modifications during flood emergencies by the District Engineer or designee, Sacramento District, U.S. Army Corps of Engineers. The Water Control Plan will be revised by the U.S. Army Corps of Engineers as necessary, to reflect changed conditions that come to bear upon flood control operation of the reservoir.

Permanent revisions of the Water Control Plan are subject to prior approval of the Chief of Engineers, or designee.

c. Inquiries. All significant inquiries received by the Project Operator, from citizens, constituents, or interest groups regarding water control procedures or actions, must be referred directly to the project's Water Managers. The managers will provide a courtesy copy of their response and the inquiries to the District Engineer, U.S. Army Corps of Engineers, Sacramento District or designee, Chief, Water Management Section.

d. Water Control Problems. When water control problems occur, such as in the event that an operational malfunction, erosion, or an incident occurs, WCAO-SD of the USBR must be contacted immediately by the most rapid means available. The USBR will then forward a description of the problem with the executed or recommended resolution to the District Engineer, U.S. Army Corps of Engineers, Sacramento District or designee, Chief, Water Management Section.

e. Communication Outage. During emergencies, if communication between the Project Operator and the WCAO-SD of the USBR in Durango is lost, then the Project Operator should continue flood control releases in accordance with the last instructions received and try to re-establish communications. However, if communication between the Project Operator and the WCAO-SD of the USBR in Durango is lost and cannot be re-established, then releases should be

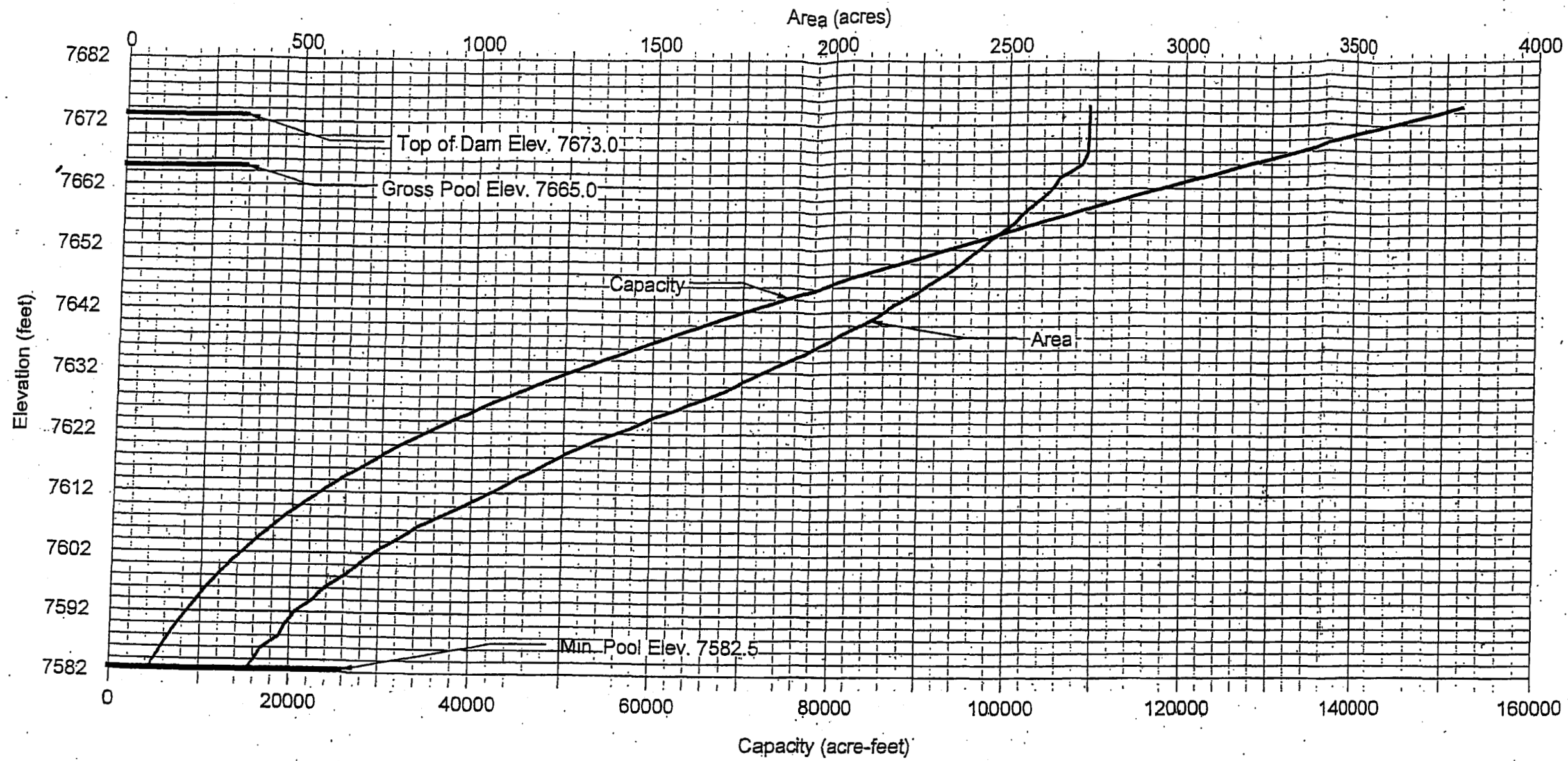
made in accordance with the Water Control Diagram on Plate A-8.

A-04. Deviation from Normal Regulation. Deviations from approved Water Control Plans occur because every possible circumstance cannot be accounted for in a Water Control Plan. Because of the often competing goals and complex interactions of interested groups/agencies, even seemingly inconsequential deviations from an approved plan can lead to unforeseen environmental and legal complications. The CESPDP regulation, CESPDP R 1110-2-8 dated 12 September 2002, serves to assist CESPDP in preparing their deviation requests. It outlines a minimum set of considerations that need to be addressed when making a recommendation to deviate from an approved Water Control Plan.

Deviations from approved Water Control Plans are intended, therefore, to address unforeseen and unique circumstances. They are not intended as a means for identifying or initiating new opportunities to re-operate or reallocate storage in response to new and changing public needs.

Deviations are discussed in Exhibit E.

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- NOTES:
1. Data furnished by USBR.
 2. This Area Capacity Curve represents live storage only and corresponds to Plate A-2, Area Capacity Table.
 3. Trashrack structure intake sill elev. = 7580.0.

VALLECITO DAM AND RESERVOIR
LOS PINOS RIVER, COLORADO

AREA CAPACITY CURVE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by: CESPA

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7582.5	4247 378	4249 378	4252 378	4254 378	4256 378	4259 379	4261 379	4263 379	4265 379	4268 379
7582.6	4270 379	4274 379	4278 379	4281 379	4285 379	4289 380	4293 380	4297 380	4300 380	4304 380
7582.7	4308 380	4312 380	4316 380	4319 381	4323 381	4327 381	4331 381	4335 381	4338 382	4342 382
7582.8	4346 382	4350 382	4354 382	4357 382	4361 382	4365 383	4369 383	4373 383	4376 383	4380 383
7582.9	4384 383	4388 383	4392 383	4396 384	4400 384	4403 384	4407 384	4411 384	4415 385	4419 385
7583.0	4423 385	4427 385	4431 385	4434 386	4438 386	4442 386	4446 386	4450 386	4453 387	4457 387
7583.1	4461 387	4465 387	4469 387	4473 387	4477 387	4480 388	4484 388	4488 388	4492 388	4496 388
7583.2	4500 388	4504 388	4508 388	4512 389	4516 389	4519 389	4523 389	4527 389	4531 390	4535 390
7583.3	4539 390	4543 390	4547 390	4551 390	4555 390	4558 391	4562 391	4566 391	4570 391	4574 391
7583.4	4578 391	4582 391	4586 391	4590 392	4594 392	4597 392	4601 392	4605 392	4609 393	4613 393
7583.5	4617 393	4621 393	4625 393	4629 393	4633 393	4636 394	4640 394	4644 394	4648 394	4652 394
7583.6	4656 394	4660 394	4664 394	4668 395	4672 395	4676 395	4680 395	4684 395	4688 396	4692 396
7583.7	4696 396	4700 396	4704 396	4708 396	4712 396	4715 397	4719 397	4723 397	4727 397	4731 397
7583.8	4735 397	4739 397	4743 397	4747 398	4751 398	4755 398	4759 398	4763 398	4767 399	4771 399
7583.9	4775 399	4779 399	4783 399	4787 399	4791 399	4795 400	4799 400	4803 400	4807 400	4811 400
7584.0	4815 400	4819 400	4823 400	4827 400	4831 400	4835 401	4839 401	4843 401	4847 401	4851 401

Note: Elevation 7582.5 is the top of dead storage.

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7584.1	4855 401	4859 401	4863 401	4867 401	4871 401	4875 402	4879 402	4883 402	4887 402	4891 402
7584.2	4895 402	4899 402	4903 402	4907 402	4911 402	4915 403	4919 403	4923 403	4927 403	4931 403
7584.3	4935 403	4939 403	4943 403	4947 403	4951 403	4956 404	4960 404	4964 404	4968 404	4972 404
7584.4	4976 404	4980 404	4984 404	4988 404	4992 404	4996 405	5000 405	5004 405	5008 405	5012 405
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7584.5	5016 405	5020 405	5024 405	5028 405	5032 405	5037 406	5041 406	5045 406	5049 406	5053 406
7584.6	5057 406	5061 406	5065 406	5069 406	5073 406	5077 407	5081 407	5085 407	5089 407	5093 407
7584.7	5097 407	5101 407	5105 407	5109 407	5113 407	5118 408	5122 408	5126 408	5130 408	5134 408
7584.8	5138 408	5142 408	5146 408	5150 408	5154 408	5159 409	5163 409	5167 409	5171 409	5175 409
7584.9	5179 409	5183 409	5187 409	5191 409	5195 409	5200 410	5204 410	5208 410	5212 410	5216 410
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7585.0	5220 410	5224 410	5228 410	5232 410	5236 410	5241 411	5245 411	5249 411	5253 411	5257 411
7585.1	5261 411	5265 411	5269 411	5273 411	5277 411	5282 412	5286 412	5290 412	5294 412	5298 412
7585.2	5302 412	5306 412	5310 412	5314 412	5318 412	5323 413	5327 413	5331 413	5335 413	5339 413
7585.3	5343 413	5347 413	5351 413	5356 413	5360 413	5364 414	5368 414	5372 414	5377 414	5381 414
7585.4	5385 414	5389 414	5393 414	5397 414	5401 414	5406 415	5410 415	5414 415	5418 415	5422 415
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7585.5	5426 415	5430 415	5434 415	5439 415	5443 415	5447 416	5451 416	5455 416	5460 416	5464 416
7585.6	5468 416	5472 416	5476 416	5480 416	5484 416	5489 417	5493 417	5497 417	5501 417	5505 417
7585.7	5509 417	5513 417	5517 417	5522 417	5526 417	5530 418	5534 418	5538 418	5543 418	5547 418
7585.8	5551 418	5555 418	5559 418	5564 418	5568 418	5572 419	5576 419	5580 419	5585 419	5589 419
7585.9	5593 419	5597 419	5601 419	5606 419	5610 419	5614 420	5618 420	5622 420	5627 420	5631 420
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7586.0	5635 420	5639 420	5643 420	5648 421	5652 421	5656 421	5660 421	5664 421	5669 422	5673 422
7586.1	5677	5681	5686	5690	5694	5699	5703	5707	5711	5716

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	422	422	423	423	423	424	424	424	424	425
7586.2	5720 425	5724 425	5728 425	5733 426	5737 426	5741 426	5745 426	5749 426	5754 427	5758 427
7586.3	5762 427	5766 427	5771 428	5775 428	5779 428	5784 429	5788 429	5792 429	5796 429	5801 430
7586.4	5805 430	5809 430	5814 430	5818 431	5822 431	5827 431	5831 431	5835 431	5839 432	5844 432
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7586.5	5848 432	5852 432	5857 433	5861 433	5866 433	5870 434	5874 434	5879 434	5883 434	5888 435
7586.6	5892 435	5896 435	5901 435	5905 436	5909 436	5914 436	5918 436	5922 436	5926 437	5931 437
7586.7	5935 437	5939 437	5944 438	5948 438	5953 438	5957 439	5961 439	5966 439	5970 439	5975 440
7586.8	5979 440	5983 440	5988 440	5992 441	5997 441	6001 441	6005 441	6010 441	6014 442	6019 442
7586.9	6023 442	6028 442	6032 443	6036 443	6041 443	6046 444	6050 444	6054 444	6059 444	6064 445
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7587.0	6068 445	6072 445	6077 446	6081 446	6086 446	6090 447	6094 447	6099 447	6103 447	6108 448
7587.1	6112 448	6116 448	6121 448	6126 449	6130 449	6134 449	6139 449	6144 449	6148 450	6152 450
7587.2	6157 450	6162 450	6166 451	6170 451	6175 451	6180 452	6184 452	6188 452	6193 452	6198 453
7587.3	6202 453	6207 453	6211 453	6216 454	6220 454	6225 454	6230 454	6234 454	6239 455	6243 455
7587.4	6248 455	6252 455	6257 456	6262 456	6266 456	6270 457	6275 457	6280 457	6284 457	6288 458
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7587.5	6293 458	6298 458	6302 458	6307 459	6311 459	6316 459	6321 459	6325 459	6330 460	6334 460
7587.6	6339 460	6344 460	6348 461	6353 461	6357 461	6362 462	6367 462	6371 462	6376 462	6380 463
7587.7	6385 463	6390 463	6394 463	6399 464	6404 464	6408 464	6413 464	6418 464	6423 465	6427 465
7587.8	6432 465	6437 465	6441 466	6446 466	6450 466	6455 467	6460 467	6464 467	6469 467	6473 468
7587.9	6478 468	6483 468	6487 468	6492 469	6497 469	6501 469	6506 469	6511 469	6516 470	6520 470
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7588.0	6525 470	6530 470	6534 470	6539 470	6544 470	6548 471	6553 471	6558 471	6563 471	6567 471
7588.1	6572 471	6577 471	6581 471	6586 471	6591 471	6595 472	6600 472	6605 472	6610 472	6614 472

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7588.2	6619 472	6624 472	6628 472	6633 472	6638 472	6642 473	6647 473	6652 473	6657 473	6661 473
7588.3	6666 473	6671 473	6676 473	6680 473	6685 473	6690 474	6695 474	6700 474	6704 474	6709 474
7588.4	6714 474	6719 474	6723 474	6728 474	6733 474	6737 475	6742 475	6747 475	6752 475	6756 475
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7588.5	6761 475	6766 475	6771 475	6775 475	6780 475	6785 476	6790 476	6795 476	6799 476	6804 476
7588.6	6809 476	6814 476	6818 476	6823 476	6828 476	6832 477	6837 477	6842 477	6847 477	6851 477
7588.7	6856 477	6861 477	6866 477	6870 477	6875 477	6880 478	6885 478	6890 478	6894 478	6899 478
7588.8	6904 478	6909 478	6914 478	6918 478	6923 478	6928 479	6933 479	6938 479	6942 479	6947 479
7588.9	6952 479	6957 479	6962 479	6966 479	6971 479	6976 480	6981 480	6986 480	6990 480	6995 480
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7589.0	7000 480	7005 480	7010 480	7014 480	7019 480	7024 481	7029 481	7034 481	7038 481	7043 481
7589.1	7048 481	7053 481	7058 481	7062 481	7067 481	7072 482	7077 482	7082 482	7086 482	7091 482
7589.2	7096 482	7101 482	7106 482	7110 482	7115 482	7120 483	7125 483	7130 483	7134 483	7139 483
7589.3	7144 483	7149 483	7154 483	7159 483	7164 483	7168 484	7173 484	7178 484	7183 484	7188 484
7589.4	7193 484	7198 484	7203 484	7207 484	7212 484	7217 485	7222 485	7227 485	7231 485	7236 485
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7589.5	7241 485	7246 485	7251 485	7256 485	7261 485	7265 486	7270 486	7275 486	7280 486	7285 486
7589.6	7290 486	7295 486	7300 486	7304 486	7309 486	7314 487	7319 487	7324 487	7328 487	7333 487
7589.7	7338 487	7343 487	7348 487	7353 487	7358 487	7362 488	7367 488	7372 488	7377 488	7382 488
7589.8	7387 488	7392 488	7397 488	7402 488	7407 488	7411 489	7416 489	7421 489	7426 489	7431 489
7589.9	7436 489	7441 489	7446 489	7451 489	7456 489	7460 490	7465 490	7470 490	7475 490	7480 490
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7590.0	7485 490	7490 490	7495 490	7500 490	7505 490	7509 491	7514 491	7519 491	7524 491	7529 491
7590.1	7534 491	7539 491	7544 491	7549 491	7554 491	7558 492	7563 492	7568 492	7573 492	7578 492
7590.2	7583 492	7588 492	7593 492	7598 493	7603 493	7608 493	7613 493	7618 493	7623 494	7628 494

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7590.3	7633 494	7638 494	7643 494	7648 494	7653 494	7657 495	7662 495	7667 495	7672 495	7677 495
7590.4	7682 495	7687 495	7692 495	7697 495	7702 495	7707 496	7712 496	7717 496	7722 496	7727 496
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7590.5	7732 496	7737 496	7742 496	7747 496	7752 496	7756 497	7761 497	7766 497	7771 497	7776 497
7590.6	7781 497	7786 497	7791 497	7796 498	7801 498	7806 498	7811 498	7816 498	7821 499	7826 499
7590.7	7831 499	7836 499	7841 499	7846 499	7851 499	7856 500	7861 500	7866 500	7871 500	7876 500
7590.8	7881 500	7886 500	7891 500	7896 500	7901 500	7906 501	7911 501	7916 501	7921 501	7926 501
7590.9	7931 501	7936 501	7941 501	7946 502	7951 502	7956 502	7961 502	7966 502	7971 503	7976 503
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7591.0	7981 503	7986 503	7991 503	7996 503	8001 503	8007 504	8012 504	8017 504	8022 504	8027 504
7591.1	8032 504	8037 504	8042 504	8047 504	8052 504	8057 505	8062 505	8067 505	8072 505	8077 505
7591.2	8082 505	8087 505	8092 505	8097 505	8102 505	8108 506	8113 506	8118 506	8123 506	8128 506
7591.3	8133 506	8138 506	8143 506	8148 507	8153 507	8158 507	8163 507	8168 507	8173 508	8178 508
7591.4	8183 508	8188 508	8193 508	8198 508	8203 508	8209 509	8214 509	8219 509	8224 509	8229 509
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7591.5	8234 509	8239 509	8244 509	8249 509	8254 509	8260 510	8265 510	8270 510	8275 510	8280 510
7591.6	8285 510	8290 510	8295 510	8300 510	8305 510	8311 511	8316 511	8321 511	8326 511	8331 511
7591.7	8336 511	8341 511	8346 511	8351 512	8356 512	8362 512	8367 512	8372 512	8377 513	8382 513
7591.8	8387 513	8392 513	8397 513	8403 513	8408 513	8413 514	8418 514	8423 514	8429 514	8434 514
7591.9	8439 514	8444 514	8449 514	8454 514	8459 514	8465 515	8470 515	8475 515	8480 515	8485 515
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7592.0	8490 515	8495 515	8500 515	8506 516	8511 516	8516 516	8521 516	8526 516	8532 517	8537 517
7592.1	8542 517	8547 517	8552 518	8558 518	8563 518	8568 518	8573 519	8578 519	8584 519	8589 520
7592.2	8594 520	8599 520	8604 520	8610 521	8615 521	8620 521	8625 521	8630 521	8636 522	8641 522
7592.3	8646	8651	8656	8662	8667	8672	8677	8682	8688	8693

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	522	522	523	523	523	523	524	524	524	525
7592.4	8698 525	8703 525	8709 525	8714 526	8719 526	8724 526	8730 526	8735 526	8740 527	8746 527
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7592.5	8751 527	8756 527	8762 528	8767 528	8772 528	8777 528	8783 529	8788 529	8793 529	8799 530
7592.6	8804 530	8809 530	8815 530	8820 531	8825 531	8830 531	8836 531	8841 531	8846 532	8852 532
7592.7	8857 532	8862 532	8868 533	8873 533	8878 533	8883 533	8889 534	8894 534	8899 534	8905 535
7592.8	8910 535	8915 535	8921 535	8926 536	8932 536	8937 536	8942 536	8948 536	8953 537	8959 537
7592.9	8964 537	8969 537	8975 538	8980 538	8986 538	8991 538	8996 539	9002 539	9007 539	9013 540
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7593.0	9018 540	9023 540	9029 541	9034 541	9040 541	9045 541	9050 542	9056 542	9061 542	9067 543
7593.1	9072 543	9077 543	9083 543	9088 544	9094 544	9099 544	9104 544	9110 544	9115 545	9121 545
7593.2	9126 545	9132 545	9137 546	9142 546	9148 546	9154 546	9159 547	9164 547	9170 547	9176 548
7593.3	9181 548	9186 548	9192 548	9198 549	9203 549	9208 549	9214 549	9220 549	9225 550	9230 550
7593.4	9236 550	9242 550	9247 551	9252 551	9258 551	9264 551	9269 552	9274 552	9280 552	9286 553
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7593.5	9291 553	9296 553	9302 553	9308 554	9313 554	9318 554	9324 554	9330 554	9335 555	9340 555
7593.6	9346 555	9352 555	9357 556	9363 556	9368 556	9374 556	9380 557	9385 557	9391 557	9396 558
7593.7	9402 558	9408 558	9413 558	9419 559	9424 559	9430 559	9436 559	9441 559	9447 560	9452 560
7593.8	9458 560	9464 560	9469 561	9475 561	9480 561	9486 561	9492 562	9497 562	9503 562	9508 563
7593.9	9514 563	9520 563	9525 563	9531 564	9536 564	9542 564	9548 564	9553 564	9559 565	9564 565
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7594.0	9570 565	9576 565	9581 565	9587 566	9593 566	9599 566	9604 566	9610 566	9616 567	9621 567
7594.1	9627 567	9633 567	9638 567	9644 567	9649 567	9655 568	9661 568	9666 568	9672 568	9677 568
7594.2	9683 568	9689 568	9694 568	9700 569	9706 569	9712 569	9717 569	9723 569	9729 570	9734 570
7594.3	9740 570	9746 570	9751 570	9757 570	9763 570	9769 571	9774 571	9780 571	9786 571	9791 571

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7594.4	9797 571	9803 571	9808 571	9814 571	9820 571	9826 572	9831 572	9837 572	9843 572	9848 572
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7594.5	9854 572	9860 572	9866 572	9871 573	9877 573	9883 573	9889 573	9895 573	9900 574	9906 574
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7594.6	9912 574	9918 574	9923 574	9929 574	9935 574	9941 575	9946 575	9952 575	9958 575	9963 575
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7594.7	9969 575	9975 575	9981 575	9986 576	9992 576	9998 576	10004 576	10010 576	10015 577	10021 577
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7594.8	10027 577	10033 577	10039 577	10044 577	10050 577	10056 578	10062 578	10068 578	10073 578	10079 578
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7594.9	10085 578	10091 578	10097 578	10102 579	10108 579	10114 579	10120 579	10126 579	10131 580	10137 580
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7595.0	10143 580	10149 580	10155 580	10160 581	10166 581	10172 581	10178 581	10184 581	10189 582	10195 582
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7595.1	10201 582	10207 582	10213 582	10218 583	10224 583	10230 583	10236 583	10242 583	10247 584	10253 584
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7595.2	10259 584	10265 584	10271 584	10276 585	10282 585	10288 585	10294 585	10300 585	10305 586	10311 586
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7595.3	10317 586	10323 586	10329 586	10335 587	10341 587	10346 587	10352 587	10358 587	10364 588	10370 588
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7595.4	10376 588	10382 588	10388 588	10394 589	10400 589	10405 589	10411 589	10417 589	10423 590	10429 590
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7595.5	10435 590	10441 590	10447 590	10453 591	10459 591	10464 591	10470 591	10476 591	10482 592	10488 592
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7595.6	10494 592	10500 592	10506 592	10512 593	10518 593	10523 593	10529 593	10535 593	10541 594	10547 594
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7595.7	10553 594	10559 594	10565 594	10571 595	10577 595	10583 595	10589 595	10595 595	10601 596	10607 596
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7595.8	10613 596	10619 596	10625 596	10631 597	10637 597	10643 597	10649 597	10655 597	10661 598	10667 598
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7595.9	10673 598	10679 598	10685 598	10691 599	10697 599	10703 599	10709 599	10715 599	10721 600	10727 600
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7596.0	10733 600	10739 600	10745 601	10751 601	10757 601	10763 601	10769 602	10775 602	10781 602	10787 603
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7596.1	10793 603	10799 603	10805 603	10811 604	10817 604	10823 604	10829 604	10835 604	10841 605	10847 605
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7596.2	10853 605	10859 605	10865 606	10871 606	10877 606	10884 606	10890 607	10896 607	10902 607	10908 608
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7596.3	10914 608	10920 608	10926 609	10932 609	10938 609	10945 609	10951 610	10957 610	10963 610	10969 611
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7596.4	10975 611	10981 611	10987 612	10993 612	10999 612	11006 612	11012 613	11018 613	11024 613	11030 614

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7596.5	11036 614	11042 614	11048 614	11054 615	11060 615	11067 615	11073 615	11079 615	11085 616	11091 616
7596.6	11097 616	11103 616	11109 617	11116 617	11122 617	11128 617	11134 618	11140 618	11147 618	11153 619
7596.7	11159 619	11165 619	11171 620	11178 620	11184 620	11190 620	11196 621	11202 621	11209 621	11215 622
7596.8	11221 622	11227 622	11234 623	11240 623	11246 623	11252 623	11259 624	11265 624	11271 624	11278 625
7596.9	11284 625	11290 625	11296 626	11303 626	11309 626	11315 626	11321 627	11327 627	11334 627	11340 628
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7597.0	11346 628	11352 628	11359 628	11365 629	11371 629	11377 629	11384 629	11390 629	11396 630	11403 630
7597.1	11409 630	11415 630	11422 631	11428 631	11434 631	11440 631	11447 632	11453 632	11459 632	11466 633
7597.2	11472 633	11478 633	11485 634	11491 634	11498 634	11504 634	11510 635	11517 635	11523 635	11530 636
7597.3	11536 636	11542 636	11549 637	11555 637	11561 637	11567 637	11574 638	11580 638	11586 638	11593 639
7597.4	11599 639	11605 639	11612 639	11618 640	11625 640	11631 640	11637 640	11644 640	11650 641	11657 641
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7597.5	11663 641	11670 641	11676 642	11682 642	11689 642	11696 642	11702 643	11708 643	11715 643	11722 644
7597.6	11728 644	11734 644	11741 645	11747 645	11754 645	11760 645	11766 646	11773 646	11779 646	11786 647
7597.7	11792 647	11798 647	11805 648	11812 648	11818 648	11824 648	11831 649	11838 649	11844 649	11850 650
7597.8	11857 650	11864 650	11870 650	11876 651	11883 651	11890 651	11896 651	11902 651	11909 652	11916 652
7597.9	11922 652	11929 652	11935 653	11942 653	11948 653	11955 653	11962 654	11968 654	11975 654	11981 655
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7598.0	11988 655	11994 655	12001 655	12008 656	12014 656	12020 656	12027 656	12034 656	12040 657	12046 657
7598.1	12053 657	12060 657	12066 657	12073 658	12079 658	12086 658	12093 658	12099 658	12106 659	12112 659
7598.2	12119 659	12126 659	12132 659	12139 660	12145 660	12152 660	12159 660	12165 660	12172 661	12178 661
7598.3	12185 661	12192 661	12198 661	12205 662	12211 662	12218 662	12225 662	12231 662	12238 663	12244 663
7598.4	12251 663	12258 663	12264 663	12271 664	12278 664	12285 664	12291 664	12298 664	12305 665	12311 665
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7598.5	12318	12325	12331	12338	12344	12351	12358	12364	12371	12377

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	665	665	665	666	666	666	666	666	667	667
7598.6	12384 667	12391 667	12397 667	12404 668	12411 668	12418 668	12424 668	12431 668	12438 669	12444 669
7598.7	12451 669	12458 669	12464 669	12471 670	12478 670	12485 670	12491 670	12498 670	12505 671	12511 671
7598.8	12518 671	12525 671	12531 671	12538 672	12545 672	12552 672	12558 672	12565 672	12572 673	12578 673
7598.9	12585 673	12592 673	12599 673	12605 674	12612 674	12619 674	12626 674	12633 674	12639 675	12646 675
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7599.0	12653 675	12660 675	12666 675	12673 676	12680 676	12687 676	12693 676	12700 676	12707 677	12713 677
7599.1	12720 677	12727 677	12734 677	12740 678	12747 678	12754 678	12761 678	12768 678	12774 679	12781 679
7599.2	12788 679	12795 679	12802 679	12808 680	12815 680	12822 680	12829 680	12836 680	12842 681	12849 681
7599.3	12856 681	12863 681	12870 681	12876 682	12883 682	12890 682	12897 682	12904 682	12910 683	12917 683
7599.4	12924 683	12931 683	12938 683	12945 684	12952 684	12958 684	12965 684	12972 684	12979 685	12986 685
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7599.5	12993 685	13000 685	13007 685	13013 686	13020 686	13027 686	13034 686	13041 686	13047 687	13054 687
7599.6	13061 687	13068 687	13075 687	13082 688	13089 688	13095 688	13102 688	13109 688	13116 689	13123 689
7599.7	13130 689	13137 689	13144 689	13151 690	13158 690	13164 690	13171 690	13178 690	13185 691	13192 691
7599.8	13199 691	13206 691	13213 691	13220 692	13227 692	13233 692	13240 692	13247 692	13254 693	13261 693
7599.9	13268 693	13275 693	13282 693	13289 694	13296 694	13303 694	13310 694	13317 694	13324 695	13331 695
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7600.0	13338 695	13345 695	13352 695	13359 696	13366 696	13372 696	13379 696	13386 696	13393 697	13400 697
7600.1	13407 697	13414 697	13421 697	13428 698	13435 698	13442 698	13449 698	13456 698	13463 699	13470 699
7600.2	13477 699	13484 699	13491 700	13498 700	13505 700	13512 700	13519 701	13526 701	13533 701	13540 702
7600.3	13547 702	13554 702	13561 702	13568 703	13575 703	13582 703	13589 703	13596 703	13603 704	13610 704
7600.4	13617 704	13624 704	13631 704	13638 705	13645 705	13653 705	13660 705	13667 705	13674 706	13681 706
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7600.5	13688 706	13695 706	13702 706	13709 707	13716 707	13724 707	13731 707	13738 707	13745 708	13752 708

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7600.6	13759 708	13766 708	13773 709	13780 709	13787 709	13795 709	13802 710	13809 710	13816 710	13823 711
7600.7	13830 711	13837 711	13844 711	13851 712	13858 712	13866 712	13873 712	13880 712	13887 713	13894 713
7600.8	13901 713	13908 713	13915 713	13922 714	13929 714	13937 714	13944 714	13951 714	13958 715	13965 715
7600.9	13972 715	13979 715	13986 716	13994 716	14001 716	14008 716	14015 717	14022 717	14030 717	14037 718
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7601.0	14044 718	14051 718	14058 718	14066 719	14073 719	14080 719	14087 719	14094 719	14102 720	14109 720
7601.1	14116 720	14123 720	14130 720	14138 721	14145 721	14152 721	14159 721	14166 721	14174 722	14181 722
7601.2	14188 722	14195 722	14202 722	14210 723	14217 723	14224 723	14231 723	14238 723	14246 724	14253 724
7601.3	14260 724	14267 724	14275 725	14282 725	14289 725	14296 725	14304 726	14311 726	14318 726	14326 727
7601.4	14333 727	14340 727	14347 727	14355 728	14362 728	14369 728	14376 728	14383 728	14391 729	14398 729
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7601.5	14405 729	14412 729	14420 729	14427 730	14434 730	14441 730	14449 730	14456 730	14463 731	14471 731
7601.6	14478 731	14485 731	14493 731	14500 732	14508 732	14515 732	14522 732	14530 732	14537 733	14545 733
7601.7	14552 733	14559 733	14567 734	14574 734	14581 734	14588 734	14596 735	14603 735	14610 735	14618 736
7601.8	14625 736	14632 736	14640 736	14647 737	14655 737	14662 737	14669 737	14677 737	14684 738	14692 738
7601.9	14699 738	14706 738	14714 738	14721 739	14729 739	14736 739	14743 739	14751 739	14758 740	14766 740
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7602.0	14773 740	14780 740	14788 741	14795 741	14803 741	14810 741	14817 742	14825 742	14832 742	14840 743
7602.1	14847 743	14854 743	14862 744	14869 744	14877 744	14884 744	14891 745	14899 745	14906 745	14914 746
7602.2	14921 746	14928 746	14936 747	14944 747	14951 748	14958 748	14966 748	14974 749	14981 749	14988 750
7602.3	14996 750	15004 750	15011 751	15018 751	15026 751	15034 751	15041 752	15048 752	15056 752	15064 753
7602.4	15071 753	15079 753	15086 754	15094 754	15101 754	15109 754	15117 755	15124 755	15132 755	15139 756
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7602.5	15147 756	15154 756	15162 757	15170 757	15177 757	15184 757	15192 758	15200 758	15207 758	15214 759
7602.6	15222 759	15230 759	15237 760	15245 760	15252 761	15260 761	15268 761	15275 762	15283 762	15290 763

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7602.7	15298 763	15306 763	15313 764	15321 764	15329 764	15337 764	15344 765	15352 765	15360 765	15367 766
7602.8	15375 766	15383 766	15390 767	15398 767	15406 767	15414 767	15421 768	15429 768	15437 768	15444 769
7602.9	15452 769	15460 769	15467 770	15475 770	15483 771	15491 771	15498 771	15506 772	15514 772	15521 773
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7603.0	15529 773	15537 773	15544 774	15552 774	15560 774	15568 774	15575 775	15583 775	15591 775	15598 776
7603.1	15606 776	15614 776	15622 777	15629 777	15637 777	15645 777	15653 778	15661 778	15668 778	15676 779
7603.2	15684 779	15692 779	15700 780	15707 780	15715 780	15723 780	15731 781	15739 781	15746 781	15754 782
7603.3	15762 782	15770 782	15778 783	15785 783	15793 784	15801 784	15809 784	15817 785	15824 785	15832 786
7603.4	15840 786	15848 786	15856 787	15864 787	15872 787	15879 787	15887 788	15895 788	15903 788	15911 789
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7603.5	15919 789	15927 789	15935 790	15943 790	15951 790	15958 790	15966 791	15974 791	15982 791	15990 792
7603.6	15998 792	16006 792	16014 793	16022 793	16030 793	16037 793	16045 794	16053 794	16061 794	16069 795
7603.7	16077 795	16085 795	16093 796	16101 796	16109 797	16117 797	16125 797	16133 798	16141 798	16149 799
7603.8	16157 799	16165 799	16173 800	16181 800	16189 800	16197 800	16205 801	16213 801	16221 801	16229 802
7603.9	16237 802	16245 802	16253 803	16261 803	16269 803	16278 803	16286 804	16294 804	16302 804	16310 805
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7604.0	16318 805	16326 805	16334 805	16342 806	16350 806	16358 806	16366 806	16374 806	16382 807	16390 807
7604.1	16398 807	16406 807	16414 808	16422 808	16430 808	16438 808	16447 809	16455 809	16463 809	16471 810
7604.2	16479 810	16487 810	16495 810	16503 811	16511 811	16519 811	16528 811	16536 811	16544 812	16552 812
7604.3	16560 812	16568 812	16576 813	16585 813	16593 813	16601 813	16609 814	16617 814	16626 814	16634 815
7604.4	16642 815	16650 815	16658 815	16666 816	16674 816	16682 816	16691 816	16699 816	16707 817	16715 817
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7604.5	16723 817	16731 817	16739 818	16748 818	16756 818	16764 818	16772 819	16780 819	16789 819	16797 820
7604.6	16805 820	16813 820	16821 820	16830 821	16838 821	16846 821	16854 821	16862 821	16871 822	16879 822
7604.7	16887	16895	16904	16912	16920	16928	16937	16945	16953	16962

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	822	822	823	823	823	823	824	824	824	825
7604.8	16970 825	16978 825	16986 825	16995 826	17003 826	17011 826	17019 826	17027 826	17036 827	17044 827
7604.9	17052 827	17060 827	17069 828	17077 828	17085 828	17093 828	17102 829	17110 829	17118 829	17127 830
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7605.0	17135 830	17143 830	17152 831	17160 831	17168 831	17176 831	17185 832	17193 832	17201 832	17210 833
7605.1	17218 833	17226 833	17235 833	17243 834	17252 834	17260 834	17268 834	17277 834	17285 835	17294 835
7605.2	17302 835	17310 835	17319 836	17327 836	17335 836	17343 836	17352 837	17360 837	17368 837	17377 838
7605.3	17385 838	17393 838	17402 838	17410 839	17419 839	17427 839	17435 839	17444 839	17452 840	17461 840
7605.4	17469 840	17477 840	17486 841	17494 841	17503 841	17511 841	17519 842	17528 842	17536 842	17545 843
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7605.5	17553 843	17562 843	17570 843	17578 844	17587 844	17596 844	17604 844	17612 844	17621 845	17630 845
7605.6	17638 845	17646 845	17655 846	17663 846	17672 846	17680 846	17688 847	17697 847	17705 847	17714 848
7605.7	17722 848	17730 848	17739 848	17748 849	17756 849	17764 849	17773 849	17782 849	17790 850	17798 850
7605.8	17807 850	17816 850	17824 851	17832 851	17841 851	17850 851	17858 852	17866 852	17875 852	17884 853
7605.9	17892 853	17901 853	17909 853	17918 854	17926 854	17935 854	17944 854	17952 854	17961 855	17969 855
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7606.0	17978 855	17986 855	17995 856	18004 856	18012 857	18020 857	18029 857	18038 858	18046 858	18054 859
7606.1	18063 859	18072 859	18080 860	18089 860	18097 860	18106 860	18115 861	18123 861	18132 861	18140 862
7606.2	18149 862	18158 862	18166 863	18175 863	18184 864	18193 864	18201 864	18210 865	18219 865	18227 866
7606.3	18236 866	18245 866	18253 867	18262 867	18271 868	18280 868	18288 868	18297 869	18306 869	18314 870
7606.4	18323 870	18332 870	18340 871	18349 871	18358 872	18367 872	18375 872	18384 873	18393 873	18401 874
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7606.5	18410 874	18419 874	18427 875	18436 875	18445 875	18454 875	18462 876	18471 876	18480 876	18488 877
7606.6	18497 877	18506 877	18515 878	18523 878	18532 879	18541 879	18550 879	18559 880	18567 880	18576 881
7606.7	18585 881	18594 881	18603 882	18612 882	18621 883	18630 883	18638 883	18647 884	18656 884	18665 885

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7606.8	18674 885	18683 885	18692 886	18700 886	18709 887	18718 887	18727 887	18736 888	18744 888	18753 889
7606.9	18762 889	18771 889	18780 890	18789 890	18798 891	18807 891	18815 891	18824 892	18833 892	18842 893
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7607.0	18851 893	18860 893	18869 894	18878 894	18887 894	18896 894	18905 895	18914 895	18923 895	18932 896
7607.1	18941 896	18950 896	18959 897	18968 897	18977 898	18986 898	18995 898	19004 899	19013 899	19022 900
7607.2	19031 900	19040 900	19049 901	19058 901	19067 902	19076 902	19085 902	19094 903	19103 903	19112 904
7607.3	19121 904	19130 904	19139 905	19148 905	19157 906	19166 906	19175 906	19184 907	19193 907	19202 908
7607.4	19211 908	19220 908	19229 909	19238 909	19247 909	19256 909	19266 910	19275 910	19284 910	19293 911
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7607.5	19302 911	19311 911	19320 912	19330 912	19339 913	19348 913	19357 913	19366 914	19376 914	19385 915
7607.6	19394 915	19403 915	19412 916	19421 916	19430 917	19439 917	19449 917	19458 918	19467 918	19476 919
7607.7	19485 919	19494 919	19503 920	19513 920	19522 921	19531 921	19540 921	19549 922	19559 922	19568 923
7607.8	19577 923	19586 923	19596 924	19605 924	19614 924	19623 924	19633 925	19642 925	19651 925	19661 926
7607.9	19670 926	19679 926	19689 927	19698 927	19707 928	19716 928	19726 928	19735 929	19744 929	19754 930
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7608.0	19763 930	19772 930	19782 931	19791 931	19800 931	19809 931	19819 932	19828 932	19837 932	19847 933
7608.1	19856 933	19865 933	19875 934	19884 934	19893 935	19902 935	19912 935	19921 936	19930 936	19940 937
7608.2	19949 937	19958 937	19968 938	19977 938	19987 938	19996 938	20005 939	20015 939	20024 939	20034 940
7608.3	20043 940	20052 940	20062 941	20071 941	20081 942	20090 942	20099 942	20109 943	20118 943	20128 944
7608.4	20137 944	20146 944	20156 945	20166 945	20175 945	20184 945	20194 946	20204 946	20213 946	20222 947
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7608.5	20232 947	20242 947	20251 948	20260 948	20270 949	20280 949	20289 949	20298 950	20308 950	20318 951
7608.6	20327 951	20336 951	20346 952	20356 952	20365 952	20374 952	20384 953	20394 953	20403 953	20412 954
7608.7	20422 954	20432 954	20441 955	20451 955	20460 956	20470 956	20480 956	20489 957	20499 957	20508 958
7608.8	20518 958	20528 958	20537 959	20547 959	20556 959	20566 959	20576 960	20585 960	20595 960	20604 961

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7608.9	20614 961	20624 961	20633 962	20643 962	20652 963	20662 963	20672 963	20681 964	20691 964	20700 965
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7609.0	20710 965	20720 965	20729 966	20739 966	20749 966	20759 966	20768 967	20778 967	20788 967	20797 968
7609.1	20807 968	20817 968	20826 969	20836 969	20846 970	20856 970	20865 970	20875 971	20885 971	20894 972
7609.2	20904 972	20914 972	20923 973	20933 973	20943 973	20953 973	20962 974	20972 974	20982 974	20991 975
7609.3	21001 975	21011 975	21021 976	21030 976	21040 977	21050 977	21060 977	21070 978	21079 978	21089 979
7609.4	21099 979	21109 979	21119 980	21128 980	21138 980	21148 980	21158 981	21168 981	21177 981	21187 982
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7609.5	21197 982	21207 982	21217 983	21226 983	21236 984	21246 984	21256 984	21266 985	21275 985	21285 986
7609.6	21295 986	21305 986	21315 987	21325 987	21335 987	21345 987	21354 988	21364 988	21374 988	21384 989
7609.7	21394 989	21404 989	21414 990	21424 990	21434 991	21444 991	21453 991	21463 992	21473 992	21483 993
7609.8	21493 993	21503 993	21513 994	21523 994	21533 994	21543 994	21553 995	21563 995	21573 995	21583 996
7609.9	21593 996	21603 996	21613 997	21623 997	21633 998	21643 998	21653 998	21663 999	21673 999	21683 1000
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7610.0	21693 1000	21703 1000	21713 1001	21723 1001	21733 1002	21743 1002	21753 1002	21763 1003	21773 1003	21783 1004
7610.1	21793 1004	21803 1004	21813 1005	21823 1005	21833 1005	21843 1005	21853 1006	21863 1006	21873 1006	21883 1007
7610.2	21893 1007	21903 1007	21913 1008	21923 1008	21933 1009	21943 1009	21954 1009	21964 1010	21974 1010	21984 1011
7610.3	21994 1011	22004 1011	22014 1012	22024 1012	22034 1012	22044 1012	22055 1013	22065 1013	22075 1013	22085 1014
7610.4	22095 1014	22105 1014	22115 1015	22126 1015	22136 1016	22146 1016	22156 1016	22166 1017	22177 1017	22187 1018
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7610.5	22197 1018	22207 1018	22217 1019	22228 1019	22238 1019	22248 1019	22258 1020	22268 1020	22279 1020	22289 1021
7610.6	22299 1021	22309 1021	22319 1022	22330 1022	22340 1023	22350 1023	22360 1023	22370 1024	22381 1024	22391 1025
7610.7	22401 1025	22411 1025	22422 1026	22432 1026	22442 1026	22452 1026	22463 1027	22473 1027	22483 1027	22494 1028
7610.8	22504 1028	22514 1028	22525 1029	22535 1029	22545 1030	22555 1030	22566 1030	22576 1031	22586 1031	22597 1032
7610.9	22607	22617	22628	22638	22648	22658	22669	22679	22689	22700

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Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	1032	1032	1033	1033	1033	1033	1034	1034	1034	1035
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7611.0	22710 1035	22720 1035	22731 1036	22741 1036	22752 1037	22762 1037	22772 1037	22783 1038	22793 1038	22804 1039
7611.1	22814 1039	22824 1039	22835 1040	22845 1040	22856 1040	22866 1040	22876 1041	22887 1041	22897 1041	22908 1042
7611.2	22918 1042	22928 1042	22939 1043	22949 1043	22960 1044	22970 1044	22980 1044	22991 1045	23001 1045	23012 1046
7611.3	23022 1046	23032 1046	23043 1047	23054 1047	23064 1047	23074 1047	23085 1048	23096 1048	23106 1048	23116 1049
7611.4	23127 1049	23138 1049	23148 1050	23158 1050	23169 1051	23180 1051	23190 1051	23200 1052	23211 1052	23222 1053
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7611.5	23232 1053	23242 1053	23253 1054	23264 1054	23274 1054	23284 1054	23295 1055	23306 1055	23316 1055	23326 1056
7611.6	23337 1056	23348 1056	23358 1057	23369 1057	23379 1058	23390 1058	23401 1058	23411 1059	23422 1059	23432 1060
7611.7	23443 1060	23454 1060	23464 1061	23475 1061	23485 1061	23496 1061	23507 1062	23517 1062	23528 1062	23538 1063
7611.8	23549 1063	23560 1063	23570 1064	23581 1064	23592 1065	23603 1065	23613 1065	23624 1066	23635 1066	23645 1067
7611.9	23656 1067	23667 1067	23677 1068	23688 1068	23699 1068	23710 1068	23720 1069	23731 1069	23742 1069	23752 1070
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7612.0	23763 1070	23774 1070	23784 1071	23795 1071	23806 1071	23817 1071	23827 1072	23838 1072	23849 1072	23859 1073
7612.1	23870 1073	23881 1073	23891 1074	23902 1074	23913 1074	23924 1074	23934 1075	23945 1075	23956 1075	23966 1076
7612.2	23977 1076	23988 1076	23999 1077	24009 1077	24020 1077	24031 1077	24042 1078	24053 1078	24063 1078	24074 1079
7612.3	24085 1079	24096 1079	24107 1080	24117 1080	24128 1080	24139 1080	24150 1081	24161 1081	24171 1081	24182 1082
7612.4	24193 1082	24204 1082	24215 1083	24225 1083	24236 1083	24247 1083	24258 1084	24269 1084	24279 1084	24290 1085
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7612.5	24301 1085	24312 1085	24323 1086	24334 1086	24345 1086	24356 1086	24366 1087	24377 1087	24388 1087	24399 1088
7612.6	24410 1088	24421 1088	24432 1089	24443 1089	24454 1089	24465 1089	24475 1090	24486 1090	24497 1090	24508 1091
7612.7	24519 1091	24530 1091	24541 1092	24552 1092	24563 1092	24574 1092	24584 1093	24595 1093	24606 1093	24617 1094
7612.8	24628 1094	24639 1094	24650 1095	24661 1095	24672 1095	24683 1095	24694 1096	24705 1096	24716 1096	24727 1097
7612.9	24738 1097	24749 1097	24760 1098	24771 1098	24782 1098	24793 1098	24804 1099	24815 1099	24826 1099	24837 1100
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Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7613.0	24848 1100	24859 1100	24870 1101	24881 1101	24892 1101	24903 1101	24914 1102	24925 1102	24936 1102	24947 1103
7613.1	24958 1103	24969 1103	24980 1104	24991 1104	25002 1104	25013 1104	25024 1105	25035 1105	25046 1105	25057 1106
7613.2	25068 1106	25079 1106	25090 1107	25101 1107	25112 1107	25123 1107	25135 1108	25146 1108	25157 1108	25168 1109
7613.3	25179 1109	25190 1109	25201 1110	25212 1110	25223 1110	25234 1110	25246 1111	25257 1111	25268 1111	25279 1112
7613.4	25290 1112	25301 1112	25312 1113	25323 1113	25334 1113	25345 1113	25357 1114	25368 1114	25379 1114	25390 1115
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7613.5	25401 1115	25412 1115	25423 1116	25435 1116	25446 1116	25457 1116	25468 1117	25479 1117	25491 1117	25502 1118
7613.6	25513 1118	25524 1118	25535 1119	25547 1119	25558 1119	25569 1119	25580 1120	25591 1120	25603 1120	25614 1121
7613.7	25625 1121	25636 1121	25647 1122	25659 1122	25670 1122	25681 1122	25692 1123	25703 1123	25715 1123	25726 1124
7613.8	25737 1124	25748 1124	25760 1125	25771 1125	25782 1125	25793 1125	25805 1126	25816 1126	25827 1126	25839 1127
7613.9	25850 1127	25861 1127	25873 1128	25884 1128	25895 1128	25906 1128	25918 1129	25929 1129	25940 1129	25952 1130
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7614.0	25963 1130	25974 1130	25986 1131	25997 1131	26008 1132	26019 1132	26031 1132	26042 1133	26053 1133	26065 1134
7614.1	26076 1134	26087 1134	26099 1135	26110 1135	26121 1136	26132 1136	26144 1136	26155 1137	26166 1137	26178 1138
7614.2	26189 1138	26200 1138	26212 1139	26223 1139	26235 1140	26246 1140	26257 1140	26269 1141	26280 1141	26292 1142
7614.3	26303 1142	26314 1142	26326 1143	26338 1143	26349 1144	26360 1144	26372 1144	26384 1145	26395 1145	26406 1146
7614.4	26418 1146	26430 1146	26441 1147	26452 1147	26464 1148	26476 1148	26487 1148	26498 1149	26510 1149	26522 1150
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7614.5	26533 1150	26544 1150	26556 1151	26568 1151	26579 1152	26590 1152	26602 1152	26614 1153	26625 1153	26636 1154
7614.6	26648 1154	26660 1154	26671 1155	26682 1155	26694 1156	26706 1156	26717 1156	26728 1157	26740 1157	26752 1158
7614.7	26763 1158	26775 1158	26786 1159	26798 1159	26809 1160	26821 1160	26833 1160	26844 1161	26856 1161	26867 1162
7614.8	26879 1162	26891 1162	26902 1163	26914 1163	26926 1164	26938 1164	26949 1164	26961 1165	26973 1165	26984 1166
7614.9	26996 1166	27008 1166	27019 1167	27031 1167	27043 1168	27055 1168	27066 1168	27078 1169	27090 1169	27101 1170
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7615.0	27113 1170	27125 1170	27136 1171	27148 1171	27160 1171	27172 1171	27183 1172	27195 1172	27207 1172	27218 1173

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7615.1	27230 1173	27242 1173	27253 1174	27265 1174	27277 1174	27289 1174	27300 1175	27312 1175	27324 1175	27335 1176
7615.2	27347 1176	27359 1176	27371 1177	27382 1177	27394 1177	27406 1177	27418 1178	27430 1178	27441 1178	27453 1179
7615.3	27465 1179	27477 1179	27489 1180	27500 1180	27512 1180	27524 1180	27536 1181	27548 1181	27559 1181	27571 1182
7615.4	27583 1182	27595 1182	27607 1183	27618 1183	27630 1183	27642 1183	27654 1184	27666 1184	27677 1184	27689 1185
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7615.5	27701 1185	27713 1185	27725 1186	27737 1186	27749 1186	27761 1186	27772 1187	27784 1187	27796 1187	27808 1188
7615.6	27820 1188	27832 1188	27844 1189	27856 1189	27868 1189	27880 1189	27891 1190	27903 1190	27915 1190	27927 1191
7615.7	27939 1191	27951 1191	27963 1192	27975 1192	27987 1192	27999 1192	28010 1193	28022 1193	28034 1193	28046 1194
7615.8	28058 1194	28070 1194	28082 1195	28094 1195	28106 1195	28118 1195	28130 1196	28142 1196	28154 1196	28166 1197
7615.9	28178 1197	28190 1197	28202 1198	28214 1198	28226 1198	28238 1198	28250 1199	28262 1199	28274 1199	28286 1200
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7616.0	28298 1200	28310 1200	28322 1201	28334 1201	28346 1201	28358 1201	28370 1202	28382 1202	28394 1202	28406 1203
7616.1	28418 1203	28430 1203	28442 1204	28454 1204	28466 1204	28478 1204	28490 1205	28502 1205	28514 1205	28526 1206
7616.2	28538 1206	28550 1206	28562 1207	28574 1207	28586 1208	28598 1208	28611 1208	28623 1209	28635 1209	28647 1210
7616.3	28659 1210	28671 1210	28683 1211	28695 1211	28707 1211	28719 1211	28732 1212	28744 1212	28756 1212	28768 1213
7616.4	28780 1213	28792 1213	28804 1214	28817 1214	28829 1214	28841 1214	28853 1215	28865 1215	28878 1215	28890 1216
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7616.5	28902 1216	28914 1216	28926 1217	28938 1217	28950 1218	28962 1218	28975 1218	28987 1219	28999 1219	29011 1220
7616.6	29023 1220	29035 1220	29047 1221	29060 1221	29072 1221	29084 1221	29096 1222	29108 1222	29121 1222	29133 1223
7616.7	29145 1223	29157 1223	29170 1224	29182 1224	29194 1224	29206 1224	29219 1225	29231 1225	29243 1225	29256 1226
7616.8	29268 1226	29280 1226	29293 1227	29305 1227	29317 1227	29329 1227	29342 1228	29354 1228	29366 1228	29379 1229
7616.9	29391 1229	29403 1229	29416 1230	29428 1230	29440 1231	29452 1231	29465 1231	29477 1232	29489 1232	29502 1233
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7617.0	29514 1233	29526 1233	29539 1234	29551 1234	29563 1234	29575 1234	29588 1235	29600 1235	29612 1235	29625 1236
7617.1	29637	29649	29662	29674	29687	29699	29711	29724	29736	29749

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	1236	1236	1237	1237	1237	1237	1238	1238	1238	1239
7617.2	29761 1239	29773 1239	29786 1240	29798 1240	29811 1240	29823 1240	29835 1241	29848 1241	29860 1241	29873 1242
7617.3	29885 1242	29897 1242	29910 1243	29922 1243	29935 1244	29947 1244	29959 1244	29972 1245	29984 1245	29997 1246
7617.4	30009 1246	30022 1246	30034 1247	30046 1247	30059 1247	30072 1247	30084 1248	30096 1248	30109 1248	30122 1249
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7617.5	30134 1249	30146 1249	30159 1250	30172 1250	30184 1250	30196 1250	30209 1251	30222 1251	30234 1251	30246 1252
7617.6	30259 1252	30272 1252	30284 1253	30296 1253	30309 1253	30322 1253	30334 1254	30346 1254	30359 1254	30372 1255
7617.7	30384 1255	30397 1255	30409 1256	30422 1256	30434 1257	30447 1257	30460 1257	30472 1258	30485 1258	30497 1259
7617.8	30510 1259	30523 1259	30535 1260	30548 1260	30560 1260	30573 1260	30586 1261	30598 1261	30611 1261	30623 1262
7617.9	30636 1262	30649 1262	30661 1263	30674 1263	30687 1263	30700 1263	30712 1264	30725 1264	30738 1264	30750 1265
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7618.0	30763 1265	30776 1265	30788 1266	30801 1266	30813 1267	30826 1267	30839 1267	30851 1268	30864 1268	30876 1269
7618.1	30889 1269	30902 1269	30914 1270	30927 1270	30940 1270	30953 1270	30965 1271	30978 1271	30991 1271	31003 1272
7618.2	31016 1272	31029 1272	31042 1273	31054 1273	31067 1274	31080 1274	31093 1274	31106 1275	31118 1275	31131 1276
7618.3	31144 1276	31157 1276	31170 1277	31182 1277	31195 1278	31208 1278	31221 1278	31234 1279	31246 1279	31259 1280
7618.4	31272 1280	31285 1280	31298 1281	31310 1281	31323 1282	31336 1282	31349 1282	31362 1283	31374 1283	31387 1284
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7618.5	31400 1284	31413 1284	31426 1285	31438 1285	31451 1285	31464 1285	31477 1286	31490 1286	31502 1286	31515 1287
7618.6	31528 1287	31541 1287	31554 1288	31567 1288	31580 1289	31593 1289	31605 1289	31618 1290	31631 1290	31644 1291
7618.7	31657 1291	31670 1291	31683 1292	31696 1292	31709 1293	31722 1293	31735 1293	31748 1294	31761 1294	31774 1295
7618.8	31787 1295	31800 1295	31813 1296	31826 1296	31839 1297	31852 1297	31864 1297	31877 1298	31890 1298	31903 1299
7618.9	31916 1299	31929 1299	31942 1300	31955 1300	31968 1301	31981 1301	31994 1301	32007 1302	32020 1302	32033 1303
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7619.0	32046 1303	32059 1303	32072 1304	32085 1304	32098 1304	32111 1304	32125 1305	32138 1305	32151 1305	32164 1306
7619.1	32177 1306	32190 1306	32203 1307	32216 1307	32229 1308	32242 1308	32256 1308	32269 1309	32282 1309	32295 1310

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7619.2	32308 1310	32321 1310	32334 1311	32347 1311	32360 1312	32373 1312	32387 1312	32400 1313	32413 1313	32426 1314
7619.3	32439 1314	32452 1314	32465 1315	32478 1315	32491 1316	32504 1316	32518 1316	32531 1317	32544 1317	32557 1318
7619.4	32570 1318	32583 1318	32596 1319	32610 1319	32623 1319	32636 1319	32649 1320	32662 1320	32676 1320	32689 1321
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7619.5	32702 1321	32715 1321	32729 1322	32742 1322	32755 1323	32768 1323	32782 1323	32795 1324	32808 1324	32822 1325
7619.6	32835 1325	32848 1325	32861 1326	32875 1326	32888 1327	32901 1327	32914 1327	32927 1328	32941 1328	32954 1329
7619.7	32967 1329	32980 1329	32994 1330	33007 1330	33020 1331	33034 1331	33047 1331	33060 1332	33073 1332	33087 1333
7619.8	33100 1333	33113 1333	33127 1334	33140 1334	33154 1334	33167 1334	33180 1335	33194 1335	33207 1335	33221 1336
7619.9	33234 1336	33247 1336	33261 1337	33274 1337	33288 1338	33301 1338	33314 1338	33328 1339	33341 1339	33355 1340
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7620.0	33368 1340	33381 1340	33395 1341	33408 1342	33422 1342	33435 1342	33448 1343	33462 1344	33475 1344	33489 1344
7620.1	33502 1345	33516 1346	33529 1346	33542 1346	33556 1347	33570 1348	33583 1348	33596 1348	33610 1349	33624 1350
7620.2	33637 1350	33650 1350	33664 1351	33678 1352	33691 1352	33704 1352	33718 1353	33732 1354	33745 1354	33758 1354
7620.3	33772 1355	33786 1356	33799 1356	33813 1356	33826 1357	33840 1358	33854 1358	33867 1358	33881 1359	33894 1360
7620.4	33908 1360	33922 1360	33935 1361	33949 1362	33962 1362	33976 1362	33990 1363	34003 1364	34017 1364	34030 1364
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7620.5	34044 1365	34058 1366	34071 1366	34085 1366	34099 1367	34112 1368	34126 1368	34140 1368	34154 1369	34167 1370
7620.6	34181 1370	34195 1370	34208 1371	34222 1372	34236 1372	34249 1372	34263 1373	34277 1374	34291 1374	34304 1374
7620.7	34318 1375	34332 1376	34346 1376	34359 1376	34373 1377	34387 1378	34401 1378	34415 1378	34428 1379	34442 1380
7620.8	34456 1380	34470 1380	34484 1381	34497 1382	34511 1382	34525 1382	34539 1383	34553 1384	34566 1384	34580 1384
7620.9	34594 1385	34608 1386	34622 1386	34636 1386	34650 1387	34664 1388	34677 1388	34691 1388	34705 1389	34719 1390
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7621.0	34733 1390	34747 1390	34761 1391	34775 1392	34789 1392	34803 1392	34816 1393	34830 1394	34844 1394	34858 1394
7621.1	34872 1395	34886 1396	34900 1396	34914 1396	34928 1397	34942 1398	34956 1398	34970 1398	34984 1399	34998 1400
7621.2	35012 1400	35026 1400	35040 1401	35054 1402	35068 1402	35082 1402	35096 1403	35110 1404	35124 1404	35138 1404

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
7621.3	35152 1405	35166 1406	35180 1406	35194 1406	35208 1407	35222 1408	35237 1408	35251 1408	35265 1409	35279 1410
7621.4	35293 1410	35307 1410	35321 1411	35335 1412	35349 1412	35363 1412	35378 1413	35392 1414	35406 1414	35420 1414
7621.5	35434 1415	35448 1416	35462 1416	35477 1416	35491 1417	35505 1418	35519 1418	35533 1418	35548 1419	35562 1420
7621.6	35576 1420	35590 1420	35604 1421	35619 1422	35633 1422	35647 1422	35661 1423	35675 1424	35690 1424	35704 1424
7621.7	35718 1425	35732 1426	35747 1426	35761 1426	35775 1427	35790 1428	35804 1428	35818 1428	35832 1429	35847 1430
7621.8	35861 1430	35875 1430	35890 1431	35904 1432	35918 1432	35933 1432	35947 1433	35961 1434	35975 1434	35990 1434
7621.9	36004 1435	36018 1436	36033 1436	36047 1436	36062 1437	36076 1438	36090 1438	36105 1438	36119 1439	36134 1440
7622.0	36148 1440	36162 1440	36177 1441	36191 1441	36206 1442	36220 1442	36234 1442	36249 1443	36263 1443	36278 1444
7622.1	36292 1444	36306 1444	36321 1445	36335 1445	36350 1445	36364 1445	36378 1446	36393 1446	36407 1446	36422 1447
7622.2	36436 1447	36450 1447	36465 1448	36480 1448	36494 1449	36508 1449	36523 1449	36538 1450	36552 1450	36566 1451
7622.3	36581 1451	36596 1451	36610 1452	36625 1452	36639 1453	36654 1453	36669 1453	36683 1454	36698 1454	36712 1455
7622.4	36727 1455	36742 1455	36756 1456	36770 1456	36785 1457	36800 1457	36814 1457	36828 1458	36843 1458	36858 1459
7622.5	36872 1459	36887 1459	36901 1460	36916 1460	36930 1460	36945 1460	36960 1461	36974 1461	36989 1461	37003 1462
7622.6	37018 1462	37033 1462	37047 1463	37062 1463	37077 1464	37091 1464	37106 1464	37121 1465	37136 1465	37150 1466
7622.7	37165 1466	37180 1466	37194 1467	37209 1467	37224 1468	37238 1468	37253 1468	37268 1469	37283 1469	37297 1470
7622.8	37312 1470	37327 1470	37341 1471	37356 1471	37371 1472	37385 1472	37400 1472	37415 1473	37430 1473	37444 1474
7622.9	37459 1474	37474 1474	37488 1475	37503 1475	37518 1476	37532 1476	37547 1476	37562 1477	37577 1477	37591 1478
7623.0	37606 1478	37621 1478	37636 1479	37650 1479	37665 1479	37680 1479	37695 1480	37710 1480	37724 1480	37739 1481
7623.1	37754 1481	37769 1481	37784 1482	37799 1482	37814 1483	37829 1483	37843 1483	37858 1484	37873 1484	37888 1485
7623.2	37903 1485	37918 1485	37933 1486	37947 1486	37962 1487	37977 1487	37992 1487	38007 1488	38021 1488	38036 1489
7623.3	38051	38066	38081	38096	38111	38126	38140	38155	38170	38185

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	1489	1489	1490	1490	1491	1491	1491	1492	1492	1493
7623.4	38200 1493	38215 1493	38230 1494	38245 1494	38260 1494	38275 1494	38290 1495	38305 1495	38320 1495	38335 1496
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7623.5	38350 1496	38365 1496	38380 1497	38395 1497	38410 1498	38425 1498	38440 1498	38455 1499	38470 1499	38485 1500
7623.6	38500 1500	38515 1500	38530 1501	38545 1501	38560 1502	38575 1502	38590 1502	38605 1503	38620 1503	38635 1504
7623.7	38650 1504	38665 1504	38680 1505	38695 1505	38710 1506	38725 1506	38740 1506	38755 1507	38770 1507	38785 1508
7623.8	38800 1508	38815 1508	38830 1509	38845 1509	38860 1509	38875 1509	38891 1510	38906 1510	38921 1510	38936 1511
7623.9	38951 1511	38966 1511	38981 1512	38997 1512	39012 1513	39027 1513	39042 1513	39057 1514	39073 1514	39088 1515
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7624.0	39103 1515	39118 1516	39133 1516	39148 1517	39163 1517	39178 1518	39194 1519	39209 1519	39224 1520	39239 1520
7624.1	39254 1521	39269 1522	39285 1522	39300 1522	39315 1523	39331 1524	39346 1524	39361 1524	39376 1525	39392 1526
7624.2	39407 1526	39422 1527	39437 1527	39453 1528	39468 1528	39483 1529	39498 1530	39513 1530	39529 1531	39544 1531
7624.3	39559 1532	39574 1532	39590 1533	39605 1534	39621 1534	39636 1534	39651 1535	39667 1536	39682 1536	39698 1536
7624.4	39713 1537	39728 1538	39744 1538	39759 1538	39775 1539	39790 1540	39805 1540	39821 1540	39836 1541	39852 1542
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7624.5	39867 1542	39882 1543	39898 1543	39913 1544	39929 1544	39944 1545	39959 1546	39975 1546	39990 1547	40006 1547
7624.6	40021 1548	40036 1548	40052 1549	40068 1550	40083 1550	40098 1550	40114 1551	40130 1552	40145 1552	40160 1552
7624.7	40176 1553	40192 1554	40207 1554	40223 1555	40238 1555	40254 1556	40270 1557	40285 1557	40301 1558	40316 1558
7624.8	40332 1559	40348 1560	40363 1560	40379 1560	40394 1561	40410 1562	40426 1562	40441 1562	40457 1563	40472 1564
7624.9	40488 1564	40504 1565	40519 1565	40535 1566	40551 1566	40566 1567	40582 1568	40598 1568	40614 1569	40629 1569
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7625.0	40645 1570	40661 1570	40676 1571	40692 1571	40708 1572	40723 1572	40739 1572	40755 1573	40771 1573	40786 1574
7625.1	40802 1574	40818 1574	40834 1575	40849 1575	40865 1576	40881 1576	40897 1576	40913 1577	40928 1577	40944 1578
7625.2	40960 1578	40976 1578	40992 1579	41007 1579	41023 1580	41039 1580	41055 1580	41071 1581	41086 1581	41102 1582
7625.3	41118 1582	41134 1582	41150 1583	41165 1583	41181 1584	41197 1584	41213 1584	41229 1585	41244 1585	41260 1586

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7625.4	41276 1586	41292 1586	41308 1587	41324 1587	41340 1588	41356 1588	41371 1588	41387 1589	41403 1589	41419 1590
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7625.5	41435 1590	41451 1590	41467 1591	41483 1591	41499 1592	41515 1592	41530 1592	41546 1593	41562 1593	41578 1594
7625.6	41594 1594	41610 1594	41626 1595	41642 1595	41658 1596	41674 1596	41690 1596	41706 1597	41722 1597	41738 1598
7625.7	41754 1598	41770 1598	41786 1599	41802 1599	41818 1600	41834 1600	41850 1600	41866 1601	41882 1601	41898 1602
7625.8	41914 1602	41930 1602	41946 1603	41962 1603	41978 1604	41994 1604	42010 1604	42026 1605	42042 1605	42058 1606
7625.9	42074 1606	42090 1606	42106 1607	42122 1607	42138 1608	42154 1608	42171 1608	42187 1609	42203 1609	42219 1610
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7626.0	42235 1610	42251 1610	42267 1611	42283 1611	42299 1612	42315 1612	42332 1612	42348 1613	42364 1613	42380 1614
7626.1	42396 1614	42412 1614	42428 1615	42445 1616	42461 1616	42477 1616	42493 1617	42509 1618	42526 1618	42542 1618
7626.2	42558 1619	42574 1619	42590 1620	42607 1620	42623 1621	42639 1621	42655 1621	42671 1622	42688 1622	42704 1623
7626.3	42720 1623	42736 1624	42753 1624	42769 1624	42785 1625	42802 1626	42818 1626	42834 1626	42850 1627	42867 1628
7626.4	42883 1628	42899 1628	42916 1629	42932 1629	42948 1630	42965 1630	42981 1630	42997 1631	43013 1631	43030 1632
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7626.5	43046 1632	43062 1632	43079 1633	43095 1634	43111 1634	43128 1634	43144 1635	43160 1636	43176 1636	43193 1636
7626.6	43209 1637	43225 1637	43242 1638	43258 1638	43275 1639	43291 1639	43307 1639	43324 1640	43340 1640	43357 1641
7626.7	43373 1641	43389 1642	43406 1642	43422 1642	43439 1643	43455 1644	43471 1644	43488 1644	43504 1645	43521 1646
7626.8	43537 1646	43554 1646	43570 1647	43586 1647	43603 1648	43620 1648	43636 1648	43652 1649	43669 1649	43686 1650
7626.9	43702 1650	43719 1650	43735 1651	43752 1652	43768 1652	43785 1652	43802 1653	43818 1654	43835 1654	43851 1654
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7627.0	43868 1655	43884 1656	43901 1656	43918 1656	43934 1657	43950 1658	43967 1658	43984 1658	44000 1659	44016 1660
7627.1	44033 1660	44050 1660	44066 1661	44083 1661	44099 1662	44116 1662	44133 1662	44149 1663	44166 1663	44182 1664
7627.2	44199 1664	44216 1664	44232 1665	44249 1666	44266 1666	44282 1666	44299 1667	44316 1668	44333 1668	44349 1668
7627.3	44366 1669	44383 1669	44399 1670	44416 1670	44433 1671	44449 1671	44466 1671	44483 1672	44500 1672	44516 1673
7627.4	44533 1673	44550 1674	44567 1674	44583 1674	44600 1675	44617 1676	44634 1676	44651 1676	44667 1677	44684 1678

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7627.5	44701 1678	44718 1678	44735 1679	44751 1679	44768 1680	44785 1680	44802 1680	44819 1681	44835 1681	44852 1682
7627.6	44869 1682	44886 1682	44903 1683	44919 1684	44936 1684	44953 1684	44970 1685	44987 1686	45003 1686	45020 1686
7627.7	45037 1687	45054 1687	45071 1688	45088 1688	45105 1689	45122 1689	45138 1689	45155 1690	45172 1690	45189 1691
7627.8	45206 1691	45223 1692	45240 1692	45257 1692	45274 1693	45291 1694	45307 1694	45324 1694	45341 1695	45358 1696
7627.9	45375 1696	45392 1696	45409 1697	45426 1697	45443 1698	45460 1698	45477 1698	45494 1699	45511 1699	45528 1700
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7628.0	45545 1700	45562 1700	45579 1701	45596 1701	45613 1702	45630 1702	45647 1702	45664 1703	45681 1703	45698 1704
7628.1	45715 1704	45732 1704	45749 1705	45766 1705	45783 1705	45800 1705	45818 1706	45835 1706	45852 1706	45869 1707
7628.2	45886 1707	45903 1707	45920 1708	45937 1708	45954 1709	45971 1709	45989 1709	46006 1710	46023 1710	46040 1711
7628.3	46057 1711	46074 1711	46091 1712	46108 1712	46125 1712	46142 1712	46160 1713	46177 1713	46194 1713	46211 1714
7628.4	46228 1714	46245 1714	46262 1715	46279 1715	46296 1716	46313 1716	46331 1716	46348 1717	46365 1717	46382 1718
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7628.5	46399 1718	46416 1718	46433 1719	46451 1719	46468 1719	46485 1719	46502 1720	46519 1720	46537 1720	46554 1721
7628.6	46571 1721	46588 1721	46606 1722	46623 1722	46640 1723	46658 1723	46675 1723	46692 1724	46709 1724	46727 1725
7628.7	46744 1725	46761 1725	46778 1726	46796 1726	46813 1726	46830 1726	46847 1727	46864 1727	46882 1727	46899 1728
7628.8	46916 1728	46933 1728	46951 1729	46968 1729	46985 1730	47003 1730	47020 1730	47037 1731	47054 1731	47072 1732
7628.9	47089 1732	47106 1732	47124 1733	47141 1733	47159 1733	47176 1733	47193 1734	47211 1734	47228 1734	47246 1735
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7629.0	47263 1735	47280 1735	47298 1736	47315 1736	47332 1737	47350 1737	47367 1737	47384 1738	47401 1738	47419 1739
7629.1	47436 1739	47453 1739	47471 1740	47488 1740	47506 1740	47523 1740	47540 1741	47558 1741	47575 1741	47593 1742
7629.2	47610 1742	47628 1742	47645 1743	47662 1743	47680 1744	47698 1744	47715 1744	47732 1745	47750 1745	47768 1746
7629.3	47785 1746	47802 1746	47820 1747	47837 1747	47855 1747	47872 1747	47889 1748	47907 1748	47924 1748	47942 1749
7629.4	47959 1749	47976 1749	47994 1750	48012 1750	48029 1751	48046 1751	48064 1751	48082 1752	48099 1752	48116 1753
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7629.5	48134	48152	48169	48187	48204	48222	48240	48257	48275	48292

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	1753	1753	1754	1754	1754	1754	1755	1755	1755	1756
7629.6	48310 1756	48328 1756	48345 1757	48363 1757	48380 1758	48398 1758	48416 1758	48433 1759	48451 1759	48468 1760
7629.7	48486 1760	48504 1760	48521 1761	48539 1761	48556 1761	48574 1761	48592 1762	48609 1762	48627 1762	48644 1763
7629.8	48662 1763	48680 1763	48697 1764	48715 1764	48732 1765	48750 1765	48768 1765	48785 1766	48803 1766	48820 1767
7629.9	48838 1767	48856 1767	48873 1768	48891 1768	48909 1768	48926 1768	48944 1769	48962 1769	48980 1769	48997 1770
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7630.0	49015 1770	49033 1770	49050 1771	49068 1771	49086 1772	49103 1772	49121 1772	49139 1773	49157 1773	49174 1774
7630.1	49192 1774	49210 1774	49228 1775	49245 1775	49263 1775	49281 1775	49299 1776	49317 1776	49334 1776	49352 1777
7630.2	49370 1777	49388 1777	49406 1778	49423 1778	49441 1779	49459 1779	49477 1779	49495 1780	49512 1780	49530 1781
7630.3	49548 1781	49566 1781	49584 1782	49601 1782	49619 1782	49637 1782	49655 1783	49673 1783	49690 1783	49708 1784
7630.4	49726 1784	49744 1784	49762 1785	49779 1785	49797 1786	49815 1786	49833 1786	49851 1787	49868 1787	49886 1788
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7630.5	49904 1788	49922 1788	49940 1789	49958 1789	49976 1789	49994 1789	50011 1790	50029 1790	50047 1790	50065 1791
7630.6	50083 1791	50101 1791	50119 1792	50137 1792	50155 1793	50173 1793	50191 1793	50209 1794	50227 1794	50245 1795
7630.7	50263 1795	50281 1795	50299 1796	50317 1796	50335 1796	50353 1796	50370 1797	50388 1797	50406 1797	50424 1798
7630.8	50442 1798	50460 1798	50478 1799	50496 1799	50514 1799	50532 1799	50550 1800	50568 1800	50586 1800	50604 1801
7630.9	50622 1801	50640 1801	50658 1802	50676 1802	50694 1803	50712 1803	50731 1803	50749 1804	50767 1804	50785 1805
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7631.0	50803 1805	50821 1805	50839 1806	50857 1806	50875 1807	50893 1807	50911 1807	50929 1808	50947 1808	50965 1809
7631.1	50983 1809	51001 1809	51019 1810	51037 1810	51055 1810	51073 1810	51092 1811	51110 1811	51128 1811	51146 1812
7631.2	51164 1812	51182 1812	51200 1813	51219 1813	51237 1814	51255 1814	51273 1814	51291 1815	51310 1815	51328 1816
7631.3	51346 1816	51364 1816	51382 1817	51400 1817	51418 1817	51436 1817	51455 1818	51473 1818	51491 1818	51509 1819
7631.4	51527 1819	51545 1819	51563 1820	51582 1820	51600 1821	51618 1821	51636 1821	51654 1822	51673 1822	51691 1823
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7631.5	51709 1823	51727 1823	51746 1824	51764 1824	51782 1824	51801 1824	51819 1825	51837 1825	51855 1825	51874 1826

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7631.6	51892 1826	51910 1826	51929 1827	51947 1827	51965 1828	51984 1828	52002 1828	52020 1829	52038 1829	52057 1830
7631.7	52075 1830	52093 1830	52112 1831	52130 1831	52148 1831	52167 1831	52185 1832	52203 1832	52221 1832	52240 1833
7631.8	52258 1833	52276 1833	52295 1834	52313 1834	52331 1834	52350 1834	52368 1835	52386 1835	52404 1835	52423 1836
7631.9	52441 1836	52459 1836	52478 1837	52496 1837	52515 1838	52533 1838	52551 1838	52570 1839	52588 1839	52607 1840
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7632.0	52625 1840	52643 1840	52662 1841	52680 1841	52699 1842	52717 1842	52735 1842	52754 1843	52772 1843	52791 1844
7632.1	52809 1844	52828 1844	52846 1845	52864 1845	52883 1846	52902 1846	52920 1846	52938 1847	52957 1847	52976 1848
7632.2	52994 1848	53012 1848	53031 1849	53050 1849	53068 1850	53086 1850	53105 1850	53124 1851	53142 1851	53160 1852
7632.3	53179 1852	53198 1852	53216 1853	53234 1853	53253 1854	53272 1854	53290 1854	53308 1855	53327 1855	53346 1856
7632.4	53364 1856	53383 1856	53401 1857	53420 1857	53438 1858	53457 1858	53476 1858	53494 1859	53513 1859	53531 1860
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7632.5	53550 1860	53569 1860	53587 1861	53606 1861	53624 1862	53643 1862	53662 1862	53680 1863	53699 1863	53717 1864
7632.6	53736 1864	53755 1864	53773 1865	53792 1865	53811 1866	53829 1866	53848 1866	53867 1867	53886 1867	53904 1868
7632.7	53923 1868	53942 1868	53960 1869	53979 1869	53998 1870	54016 1870	54035 1870	54054 1871	54073 1871	54091 1872
7632.8	54110 1872	54129 1872	54147 1873	54166 1873	54185 1874	54203 1874	54222 1874	54241 1875	54260 1875	54278 1876
7632.9	54297 1876	54316 1876	54335 1877	54353 1877	54372 1878	54391 1878	54410 1878	54429 1879	54447 1879	54466 1880
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7633.0	54485 1880	54504 1880	54523 1881	54541 1881	54560 1882	54579 1882	54598 1882	54617 1883	54635 1883	54654 1884
7633.1	54673 1884	54692 1884	54711 1885	54730 1885	54749 1886	54768 1886	54786 1886	54805 1887	54824 1887	54843 1888
7633.2	54862 1888	54881 1888	54900 1889	54919 1889	54938 1890	54957 1890	54975 1890	54994 1891	55013 1891	55032 1892
7633.3	55051 1892	55070 1892	55089 1893	55108 1893	55127 1894	55146 1894	55164 1894	55183 1895	55202 1895	55221 1896
7633.4	55240 1896	55259 1896	55278 1897	55297 1897	55316 1898	55335 1898	55354 1898	55373 1899	55392 1899	55411 1900
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7633.5	55430 1900	55449 1900	55468 1901	55487 1901	55506 1902	55525 1902	55544 1902	55563 1903	55582 1903	55601 1904
7633.6	55620 1904	55639 1904	55658 1905	55677 1905	55696 1906	55715 1906	55735 1906	55754 1907	55773 1907	55792 1908

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7633.7	55811 1908	55830 1908	55849 1909	55868 1909	55887 1910	55906 1910	55926 1910	55945 1911	55964 1911	55983 1912
7633.8	56002 1912	56021 1912	56040 1913	56059 1913	56078 1914	56097 1914	56117 1914	56136 1915	56155 1915	56174 1916
7633.9	56193 1916	56212 1916	56231 1917	56251 1917	56270 1918	56289 1918	56308 1918	56327 1919	56347 1919	56366 1920
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7634.0	56385 1920	56404 1920	56423 1921	56443 1921	56462 1921	56481 1921	56500 1922	56519 1922	56539 1922	56558 1923
7634.1	56577 1923	56596 1923	56616 1924	56635 1924	56654 1924	56674 1924	56693 1925	56712 1925	56731 1925	56751 1926
7634.2	56770 1926	56789 1926	56808 1927	56828 1927	56847 1927	56866 1927	56885 1928	56904 1928	56924 1928	56943 1929
7634.3	56962 1929	56981 1929	57001 1930	57020 1930	57039 1930	57059 1930	57078 1931	57097 1931	57116 1931	57136 1932
7634.4	57155 1932	57174 1932	57194 1933	57213 1933	57233 1933	57252 1933	57271 1934	57291 1934	57310 1934	57330 1935
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7634.5	57349 1935	57368 1935	57388 1936	57407 1936	57426 1936	57446 1936	57465 1937	57484 1937	57503 1937	57523 1938
7634.6	57542 1938	57561 1938	57581 1939	57600 1939	57620 1939	57639 1939	57658 1940	57678 1940	57697 1940	57717 1941
7634.7	57736 1941	57756 1941	57775 1942	57794 1942	57814 1942	57834 1942	57853 1943	57872 1943	57892 1943	57912 1944
7634.8	57931 1944	57950 1944	57970 1945	57989 1945	58009 1945	58028 1945	58047 1946	58067 1946	58086 1946	58106 1947
7634.9	58125 1947	58144 1947	58164 1948	58184 1948	58203 1948	58222 1948	58242 1949	58262 1949	58281 1949	58300 1950
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7635.0	58320 1950	58340 1950	58359 1951	58378 1951	58398 1952	58418 1952	58437 1952	58456 1953	58476 1953	58496 1954
7635.1	58515 1954	58535 1954	58554 1955	58574 1955	58593 1956	58613 1956	58633 1956	58652 1957	58672 1957	58691 1958
7635.2	58711 1958	58731 1958	58750 1959	58770 1959	58789 1960	58809 1960	58829 1960	58848 1961	58868 1961	58887 1962
7635.3	58907 1962	58927 1962	58946 1963	58966 1963	58985 1964	59005 1964	59025 1964	59044 1965	59064 1965	59083 1966
7635.4	59103 1966	59123 1966	59142 1967	59162 1967	59182 1968	59201 1968	59221 1968	59241 1969	59261 1969	59280 1970
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7635.5	59300 1970	59320 1970	59339 1971	59359 1971	59379 1972	59398 1972	59418 1972	59438 1973	59458 1973	59477 1974
7635.6	59497 1974	59517 1974	59537 1975	59556 1975	59576 1976	59596 1976	59616 1976	59636 1977	59655 1977	59675 1978
7635.7	59695	59715	59735	59754	59774	59794	59814	59834	59853	59873

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	1978	1978	1979	1979	1980	1980	1980	1981	1981	1982
7635.8	59893 1982	59913 1982	59933 1983	59952 1983	59972 1984	59992 1984	60012 1984	60032 1985	60051 1985	60071 1986
7635.9	60091 1986	60111 1986	60131 1987	60151 1987	60171 1988	60191 1988	60210 1988	60230 1989	60250 1989	60270 1990
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7636.0	60290 1990	60310 1990	60330 1991	60350 1991	60370 1992	60390 1992	60409 1992	60429 1993	60449 1993	60469 1994
7636.1	60489 1994	60509 1994	60529 1995	60549 1995	60569 1995	60589 1995	60609 1996	60629 1996	60649 1996	60669 1997
7636.2	60689 1997	60709 1997	60729 1998	60749 1998	60769 1999	60789 1999	60809 1999	60829 2000	60849 2000	60869 2001
7636.3	60889 2001	60909 2001	60929 2002	60949 2002	60969 2002	60989 2002	61009 2003	61029 2003	61049 2003	61069 2004
7636.4	61089 2004	61109 2004	61129 2005	61149 2005	61169 2006	61189 2006	61209 2006	61229 2007	61249 2007	61269 2008
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7636.5	61289 2008	61309 2008	61329 2009	61349 2009	61369 2009	61389 2009	61410 2010	61430 2010	61450 2010	61470 2011
7636.6	61490 2011	61510 2011	61530 2012	61551 2012	61571 2013	61591 2013	61611 2013	61631 2014	61652 2014	61672 2015
7636.7	61692 2015	61712 2015	61732 2016	61752 2016	61772 2016	61792 2016	61813 2017	61833 2017	61853 2017	61873 2018
7636.8	61893 2018	61913 2018	61933 2019	61954 2019	61974 2020	61994 2020	62014 2020	62034 2021	62055 2021	62075 2022
7636.9	62095 2022	62115 2022	62136 2023	62156 2023	62176 2023	62197 2023	62217 2024	62237 2024	62257 2024	62278 2025
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7637.0	62298 2025	62318 2025	62338 2026	62359 2026	62379 2027	62399 2027	62419 2027	62439 2028	62460 2028	62480 2029
7637.1	62500 2029	62520 2029	62541 2030	62561 2030	62581 2030	62602 2030	62622 2031	62642 2031	62662 2031	62683 2032
7637.2	62703 2032	62723 2032	62744 2033	62764 2033	62785 2034	62805 2034	62825 2034	62846 2035	62866 2035	62887 2036
7637.3	62907 2036	62927 2036	62948 2037	62968 2037	62988 2037	63009 2037	63029 2038	63049 2038	63069 2038	63090 2039
7637.4	63110 2039	63130 2039	63151 2040	63171 2040	63192 2041	63212 2041	63232 2041	63253 2042	63273 2042	63294 2043
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7637.5	63314 2043	63334 2043	63355 2044	63376 2044	63396 2044	63416 2044	63437 2045	63458 2045	63478 2045	63498 2046
7637.6	63519 2046	63540 2046	63560 2047	63580 2047	63601 2048	63622 2048	63642 2048	63662 2049	63683 2049	63704 2050
7637.7	63724 2050	63744 2050	63765 2051	63786 2051	63806 2051	63826 2052	63847 2052	63868 2052	63888 2052	63908 2053

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7637.8	63929 2053	63950 2053	63970 2054	63990 2054	64011 2055	64032 2055	64052 2055	64072 2056	64093 2056	64114 2057
7637.9	64134 2057	64155 2057	64175 2058	64196 2058	64216 2058	64237 2059	64258 2059	64278 2059	64299 2059	64319 2060
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7638.0	64340 2060	64361 2060	64381 2061	64402 2061	64422 2062	64443 2062	64464 2062	64484 2063	64505 2063	64525 2064
7638.1	64546 2064	64567 2064	64587 2065	64608 2065	64629 2065	64649 2066	64670 2066	64691 2066	64712 2066	64732 2067
7638.2	64753 2067	64774 2067	64794 2068	64815 2068	64836 2069	64856 2069	64877 2069	64898 2070	64919 2070	64939 2071
7638.3	64960 2071	64981 2071	65001 2072	65022 2072	65043 2072	65063 2073	65084 2073	65105 2073	65126 2073	65146 2074
7638.4	65167 2074	65188 2074	65208 2075	65229 2075	65250 2076	65270 2076	65291 2076	65312 2077	65333 2077	65353 2078
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7638.5	65374 2078	65395 2078	65416 2079	65436 2079	65457 2079	65478 2080	65499 2080	65520 2080	65540 2080	65561 2081
7638.6	65582 2081	65603 2081	65624 2082	65645 2082	65666 2083	65686 2083	65707 2083	65728 2084	65749 2084	65770 2085
7638.7	65791 2085	65812 2085	65833 2086	65853 2086	65874 2086	65895 2087	65916 2087	65937 2087	65957 2087	65978 2088
7638.8	65999 2088	66020 2088	66041 2089	66062 2089	66083 2089	66103 2090	66124 2090	66145 2090	66166 2090	66187 2091
7638.9	66208 2091	66229 2091	66250 2092	66271 2092	66292 2093	66313 2093	66334 2093	66355 2094	66376 2094	66397 2095
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7639.0	66418 2095	66439 2095	66460 2096	66481 2096	66502 2097	66522 2097	66543 2097	66564 2098	66585 2098	66606 2099
7639.1	66627 2099	66648 2099	66669 2100	66690 2100	66711 2100	66732 2101	66753 2101	66774 2101	66795 2101	66816 2102
7639.2	66837 2102	66858 2102	66879 2103	66900 2103	66921 2103	66943 2104	66964 2104	66985 2104	67006 2104	67027 2105
7639.3	67048 2105	67069 2105	67090 2106	67111 2106	67132 2107	67153 2107	67174 2107	67195 2108	67216 2108	67237 2109
7639.4	67258 2109	67279 2109	67300 2110	67321 2110	67342 2110	67364 2111	67385 2111	67406 2111	67427 2111	67448 2112
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7639.5	67469 2112	67490 2112	67511 2113	67533 2113	67554 2114	67575 2114	67596 2114	67617 2115	67639 2115	67660 2116
7639.6	67681 2116	67702 2116	67723 2117	67745 2117	67766 2117	67787 2118	67808 2118	67829 2118	67851 2118	67872 2119
7639.7	67893 2119	67914 2119	67935 2120	67957 2120	67978 2121	67999 2121	68020 2121	68041 2122	68063 2122	68084 2123
7639.8	68105 2123	68126 2123	68147 2124	68169 2124	68190 2124	68211 2125	68232 2125	68253 2125	68275 2125	68296 2126

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
7639.9	68317 2126	68338 2126	68360 2127	68381 2127	68402 2128	68424 2128	68445 2128	68466 2129	68487 2129	68509 2130
7640.0	68530 2130	68551 2130	68573 2130	68594 2131	68615 2131	68637 2131	68658 2131	68679 2131	68700 2132	68722 2132
7640.1	68743 2132	68764 2132	68786 2133	68807 2133	68829 2133	68850 2134	68871 2134	68893 2134	68914 2134	68936 2135
7640.2	68957 2135	68978 2135	69000 2135	69021 2136	69042 2136	69064 2136	69085 2136	69106 2136	69127 2137	69149 2137
7640.3	69170 2137	69191 2137	69213 2138	69234 2138	69256 2138	69277 2139	69298 2139	69320 2139	69341 2139	69363 2140
7640.4	69384 2140	69405 2140	69427 2140	69448 2141	69470 2141	69491 2141	69512 2141	69534 2141	69555 2142	69577 2142
7640.5	69598 2142	69620 2142	69641 2143	69662 2143	69684 2143	69706 2144	69727 2144	69748 2144	69770 2144	69792 2145
7640.6	69813 2145	69834 2145	69856 2145	69877 2146	69899 2146	69920 2146	69941 2146	69963 2146	69984 2147	70006 2147
7640.7	70027 2147	70048 2147	70070 2148	70092 2148	70113 2148	70134 2149	70156 2149	70178 2149	70199 2149	70220 2150
7640.8	70242 2150	70264 2150	70285 2150	70306 2151	70328 2151	70350 2151	70371 2151	70392 2151	70414 2152	70436 2152
7640.9	70457 2152	70479 2152	70500 2153	70522 2153	70543 2153	70565 2154	70587 2154	70608 2154	70630 2154	70651 2155
7641.0	70673 2155	70694 2155	70716 2156	70738 2156	70759 2156	70780 2157	70802 2157	70824 2157	70845 2157	70866 2158
7641.1	70888 2158	70910 2158	70931 2158	70953 2159	70974 2159	70996 2159	71018 2159	71039 2159	71061 2160	71082 2160
7641.2	71104 2160	71126 2160	71147 2161	71169 2161	71190 2161	71212 2162	71234 2162	71255 2162	71277 2162	71298 2163
7641.3	71320 2163	71342 2163	71363 2163	71385 2164	71407 2164	71428 2164	71450 2164	71472 2164	71494 2165	71515 2165
7641.4	71537 2165	71559 2165	71580 2166	71602 2166	71623 2166	71645 2167	71667 2167	71688 2167	71710 2167	71731 2168
7641.5	71753 2168	71775 2168	71796 2168	71818 2169	71840 2169	71861 2169	71883 2169	71905 2169	71927 2170	71948 2170
7641.6	71970 2170	71992 2170	72013 2171	72035 2171	72057 2171	72078 2172	72100 2172	72122 2172	72144 2172	72165 2173
7641.7	72187 2173	72209 2173	72231 2173	72252 2174	72274 2174	72296 2174	72318 2174	72340 2174	72361 2175	72383 2175
7641.8	72405 2175	72427 2175	72448 2176	72470 2176	72492 2176	72513 2177	72535 2177	72557 2177	72579 2177	72600 2178
7641.9	72622	72644	72666	72687	72709	72731	72753	72775	72796	72818

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	2178	2178	2178	2179	2179	2179	2179	2179	2180	2180
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7642.0	72840 2180	72862 2180	72884 2181	72905 2181	72927 2181	72949 2182	72971 2182	72993 2182	73014 2182	73036 2183
7642.1	73058 2183	73080 2183	73102 2184	73124 2184	73146 2185	73167 2185	73189 2185	73211 2186	73233 2186	73255 2187
7642.2	73277 2187	73299 2187	73321 2188	73342 2188	73364 2188	73386 2189	73408 2189	73430 2189	73451 2189	73473 2190
7642.3	73495 2190	73517 2190	73539 2191	73561 2191	73583 2191	73605 2192	73627 2192	73649 2192	73671 2192	73693 2193
7642.4	73715 2193	73737 2193	73759 2194	73781 2194	73803 2194	73824 2195	73846 2195	73868 2195	73890 2195	73912 2196
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7642.5	73934 2196	73956 2196	73978 2197	74000 2197	74022 2198	74044 2198	74066 2198	74088 2199	74110 2199	74132 2200
7642.6	74154 2200	74176 2200	74198 2201	74220 2201	74242 2201	74264 2202	74286 2202	74308 2202	74330 2202	74352 2203
7642.7	74374 2203	74396 2203	74418 2204	74440 2204	74462 2204	74484 2205	74506 2205	74528 2205	74550 2205	74572 2206
7642.8	74594 2206	74616 2206	74638 2207	74660 2207	74682 2207	74705 2208	74727 2208	74749 2208	74771 2208	74793 2209
7642.9	74815 2209	74837 2209	74859 2210	74881 2210	74903 2211	74926 2211	74948 2211	74970 2212	74992 2212	75014 2213
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7643.0	75036 2213	75058 2213	75080 2214	75103 2214	75125 2214	75147 2215	75169 2215	75191 2215	75214 2215	75236 2216
7643.1	75258 2216	75280 2216	75302 2217	75324 2217	75346 2217	75369 2218	75391 2218	75413 2218	75435 2218	75457 2219
7643.2	75479 2219	75501 2219	75523 2220	75546 2220	75568 2220	75590 2221	75612 2221	75634 2221	75657 2221	75679 2222
7643.3	75701 2222	75723 2222	75746 2223	75768 2223	75790 2223	75813 2224	75835 2224	75857 2224	75879 2224	75902 2225
7643.4	75924 2225	75946 2225	75969 2226	75991 2226	76013 2227	76036 2227	76058 2227	76080 2228	76102 2228	76125 2229
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7643.5	76147 2229	76169 2229	76192 2230	76214 2230	76236 2230	76259 2231	76281 2231	76303 2231	76325 2231	76348 2232
7643.6	76370 2232	76392 2232	76415 2233	76437 2233	76459 2233	76482 2234	76504 2234	76526 2234	76548 2234	76571 2235
7643.7	76593 2235	76615 2235	76638 2236	76660 2236	76683 2236	76705 2237	76727 2237	76750 2237	76772 2237	76795 2238
7643.8	76817 2238	76839 2238	76862 2239	76884 2239	76907 2240	76929 2240	76951 2240	76974 2241	76996 2241	77019 2242
7643.9	77041 2242	77063 2242	77086 2243	77108 2243	77131 2243	77153 2244	77175 2244	77198 2244	77220 2244	77243 2245
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Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7644.0	77265 2245	77288 2245	77310 2246	77332 2246	77355 2246	77378 2247	77400 2247	77422 2247	77445 2247	77468 2248
7644.1	77490 2248	77512 2248	77535 2248	77558 2249	77580 2249	77602 2249	77625 2249	77648 2249	77670 2250	77692 2250
7644.2	77715 2250	77738 2250	77760 2251	77782 2251	77805 2251	77828 2252	77850 2252	77872 2252	77895 2252	77918 2253
7644.3	77940 2253	77962 2253	77985 2253	78008 2254	78030 2254	78052 2254	78075 2254	78098 2254	78120 2255	78142 2255
7644.4	78165 2255	78188 2255	78210 2256	78233 2256	78255 2256	78278 2257	78301 2257	78323 2257	78346 2257	78368 2258
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7644.5	78391 2258	78414 2258	78436 2258	78459 2259	78481 2259	78504 2259	78527 2259	78549 2259	78572 2260	78594 2260
7644.6	78617 2260	78640 2260	78662 2260	78685 2261	78707 2261	78730 2261	78753 2261	78775 2261	78798 2262	78820 2262
7644.7	78843 2262	78866 2262	78888 2263	78911 2263	78933 2263	78956 2264	78979 2264	79001 2264	79024 2264	79046 2265
7644.8	79069 2265	79092 2265	79114 2265	79137 2266	79160 2266	79182 2266	79205 2266	79228 2266	79251 2267	79273 2267
7644.9	79296 2267	79319 2267	79341 2268	79364 2268	79387 2268	79409 2269	79432 2269	79455 2269	79478 2269	79500 2270
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7645.0	79523 2270	79546 2270	79568 2271	79591 2271	79614 2271	79636 2272	79659 2272	79682 2272	79705 2272	79727 2273
7645.1	79750 2273	79773 2273	79795 2274	79818 2274	79841 2274	79863 2275	79886 2275	79909 2275	79932 2275	79954 2276
7645.2	79977 2276	80000 2276	80023 2277	80045 2277	80068 2277	80091 2278	80114 2278	80137 2278	80159 2278	80182 2279
7645.3	80205 2279	80228 2279	80251 2280	80273 2280	80296 2280	80319 2281	80342 2281	80365 2281	80387 2281	80410 2282
7645.4	80433 2282	80456 2282	80479 2283	80501 2283	80524 2283	80547 2284	80570 2284	80593 2284	80615 2284	80638 2285
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7645.5	80661 2285	80684 2285	80707 2286	80730 2286	80753 2286	80775 2287	80798 2287	80821 2287	80844 2287	80867 2288
7645.6	80890 2288	80913 2288	80936 2289	80959 2289	80982 2289	81004 2290	81027 2290	81050 2290	81073 2290	81096 2291
7645.7	81119 2291	81142 2291	81165 2292	81188 2292	81211 2292	81233 2293	81256 2293	81279 2293	81302 2293	81325 2294
7645.8	81348 2294	81371 2294	81394 2295	81417 2295	81440 2295	81463 2296	81486 2296	81509 2296	81532 2296	81555 2297
7645.9	81578 2297	81601 2297	81624 2298	81647 2298	81670 2298	81693 2299	81716 2299	81739 2299	81762 2299	81785 2300
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7646.0	81808 2300	81831 2300	81854 2301	81877 2301	81900 2301	81923 2302	81946 2302	81969 2302	81992 2302	82015 2303

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7646.1	82038 2303	82061 2303	82084 2303	82107 2304	82130 2304	82153 2304	82176 2304	82199 2304	82222 2305	82245 2305
7646.2	82268 2305	82291 2305	82314 2306	82337 2306	82360 2306	82384 2307	82407 2307	82430 2307	82453 2307	82476 2308
7646.3	82499 2308	82522 2308	82545 2309	82568 2309	82591 2309	82615 2310	82638 2310	82661 2310	82684 2310	82707 2311
7646.4	82730 2311	82753 2311	82776 2312	82799 2312	82822 2312	82846 2313	82869 2313	82892 2313	82915 2313	82938 2314
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7646.5	82961 2314	82984 2314	83007 2314	83030 2315	83053 2315	83077 2315	83100 2315	83123 2315	83146 2316	83169 2316
7646.6	83192 2316	83215 2316	83238 2317	83262 2317	83285 2317	83308 2318	83331 2318	83354 2318	83378 2318	83401 2319
7646.7	83424 2319	83447 2319	83470 2320	83494 2320	83517 2320	83540 2321	83563 2321	83586 2321	83610 2321	83633 2322
7646.8	83656 2322	83679 2322	83703 2323	83726 2323	83749 2323	83773 2324	83796 2324	83819 2324	83842 2324	83866 2325
7646.9	83889 2325	83912 2325	83935 2326	83959 2326	83982 2326	84005 2327	84028 2327	84051 2327	84075 2327	84098 2328
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7647.0	84121 2328	84144 2328	84168 2328	84191 2329	84214 2329	84238 2329	84261 2329	84284 2329	84307 2330	84331 2330
7647.1	84354 2330	84377 2330	84401 2331	84424 2331	84447 2331	84471 2332	84494 2332	84517 2332	84540 2332	84564 2333
7647.2	84587 2333	84610 2333	84634 2334	84657 2334	84681 2334	84704 2335	84727 2335	84751 2335	84774 2335	84798 2336
7647.3	84821 2336	84844 2336	84868 2337	84891 2337	84914 2337	84938 2338	84961 2338	84984 2338	85007 2338	85031 2339
7647.4	85054 2339	85077 2339	85101 2339	85124 2340	85148 2340	85171 2340	85194 2340	85218 2340	85241 2341	85265 2341
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7647.5	85288 2341	85312 2341	85335 2342	85358 2342	85382 2342	85406 2343	85429 2343	85452 2343	85476 2343	85500 2344
7647.6	85523 2344	85546 2344	85570 2345	85593 2345	85617 2345	85640 2346	85663 2346	85687 2346	85710 2346	85734 2347
7647.7	85757 2347	85780 2347	85804 2348	85828 2348	85851 2348	85874 2349	85898 2349	85922 2349	85945 2349	85968 2350
7647.8	85992 2350	86016 2350	86039 2350	86062 2351	86086 2351	86110 2351	86133 2351	86156 2351	86180 2352	86204 2352
7647.9	86227 2352	86251 2352	86274 2353	86298 2353	86321 2353	86345 2354	86369 2354	86392 2354	86416 2354	86439 2355
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7648.0	86463 2355	86486 2355	86510 2355	86534 2356	86557 2356	86580 2356	86604 2356	86628 2356	86651 2357	86674 2357
7648.1	86698	86722	86745	86769	86792	86816	86840	86863	86887	86910

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Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	2357	2357	2358	2358	2358	2359	2359	2359	2359	2360
7648.2	86934 2360	86958 2360	86981 2360	87005 2361	87028 2361	87052 2361	87076 2361	87099 2361	87123 2362	87146 2362
7648.3	87170 2362	87194 2362	87217 2362	87241 2363	87264 2363	87288 2363	87312 2363	87335 2363	87359 2364	87382 2364
7648.4	87406 2364	87430 2364	87453 2364	87477 2365	87501 2365	87524 2365	87548 2365	87572 2365	87596 2366	87619 2366
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7648.5	87643 2366	87667 2366	87690 2367	87714 2367	87738 2367	87761 2368	87785 2368	87809 2368	87833 2368	87856 2369
7648.6	87880 2369	87904 2369	87927 2369	87951 2370	87975 2370	87998 2370	88022 2370	88046 2370	88070 2371	88093 2371
7648.7	88117 2371	88141 2371	88164 2371	88188 2372	88212 2372	88235 2372	88259 2372	88283 2372	88307 2373	88330 2373
7648.8	88354 2373	88378 2373	88401 2373	88425 2374	88449 2374	88472 2374	88496 2374	88520 2374	88544 2375	88567 2375
7648.9	88591 2375	88615 2375	88639 2376	88662 2376	88686 2376	88710 2377	88734 2377	88758 2377	88781 2377	88805 2378
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7649.0	88829 2378	88853 2378	88877 2378	88900 2379	88924 2379	88948 2379	88972 2379	88996 2379	89019 2380	89043 2380
7649.1	89067 2380	89091 2380	89115 2380	89138 2381	89162 2381	89186 2381	89210 2381	89234 2381	89257 2382	89281 2382
7649.2	89305 2382	89329 2382	89353 2382	89376 2383	89400 2383	89424 2383	89448 2383	89472 2383	89495 2384	89519 2384
7649.3	89543 2384	89567 2384	89591 2385	89615 2385	89639 2385	89662 2386	89686 2386	89710 2386	89734 2386	89758 2387
7649.4	89782 2387	89806 2387	89830 2387	89853 2388	89877 2388	89901 2388	89925 2388	89949 2388	89972 2389	89996 2389
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7649.5	90020 2389	90044 2389	90068 2389	90092 2390	90116 2390	90139 2390	90163 2390	90187 2390	90211 2391	90235 2391
7649.6	90259 2391	90283 2391	90307 2391	90331 2392	90355 2392	90379 2392	90403 2392	90427 2392	90451 2393	90475 2393
7649.7	90499 2393	90523 2393	90547 2394	90571 2394	90595 2394	90618 2395	90642 2395	90666 2395	90690 2395	90714 2396
7649.8	90738 2396	90762 2396	90786 2396	90810 2397	90834 2397	90858 2397	90882 2397	90906 2397	90930 2398	90954 2398
7649.9	90978 2398	91002 2398	91026 2398	91050 2399	91074 2399	91098 2399	91122 2399	91146 2399	91170 2400	91194 2400
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7650.0	91218 2400	91242 2400	91266 2400	91290 2401	91314 2401	91338 2401	91362 2401	91386 2401	91410 2402	91434 2402
7650.1	91458 2402	91482 2402	91506 2403	91530 2403	91554 2403	91578 2404	91602 2404	91626 2404	91650 2404	91674 2405

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7650.2	91698 2405	91722 2405	91746 2405	91770 2406	91794 2406	91819 2406	91843 2406	91867 2406	91891 2407	91915 2407
7650.3	91939 2407	91963 2407	91987 2407	92011 2408	92035 2408	92059 2408	92083 2408	92107 2408	92131 2409	92155 2409
7650.4	92179 2409	92203 2409	92227 2409	92251 2410	92275 2410	92300 2410	92324 2410	92348 2410	92372 2411	92396 2411
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7650.5	92420 2411	92444 2411	92468 2412	92493 2412	92517 2412	92541 2413	92565 2413	92589 2413	92614 2413	92638 2414
7650.6	92662 2414	92686 2414	92710 2414	92734 2415	92758 2415	92783 2415	92807 2415	92831 2415	92855 2416	92879 2416
7650.7	92903 2416	92927 2416	92951 2416	92976 2417	93000 2417	93024 2417	93048 2417	93072 2417	93097 2418	93121 2418
7650.8	93145 2418	93169 2418	93193 2418	93218 2419	93242 2419	93266 2419	93290 2419	93314 2419	93339 2420	93363 2420
7650.9	93387 2420	93411 2420	93435 2421	93460 2421	93484 2421	93508 2422	93532 2422	93556 2422	93581 2422	93605 2423
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7651.0	93629 2423	93653 2423	93677 2423	93702 2424	93726 2424	93750 2424	93774 2424	93798 2424	93823 2425	93847 2425
7651.1	93871 2425	93895 2425	93920 2425	93944 2426	93968 2426	93993 2426	94017 2426	94041 2426	94065 2427	94090 2427
7651.2	94114 2427	94138 2427	94163 2427	94187 2428	94211 2428	94236 2428	94260 2428	94284 2428	94308 2429	94333 2429
7651.3	94357 2429	94381 2429	94406 2430	94430 2430	94454 2430	94479 2431	94503 2431	94527 2431	94551 2431	94576 2432
7651.4	94600 2432	94624 2432	94649 2432	94673 2433	94697 2433	94722 2433	94746 2433	94770 2433	94794 2434	94819 2434
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7651.5	94843 2434	94867 2434	94892 2434	94916 2435	94940 2435	94965 2435	94989 2435	95013 2435	95037 2436	95062 2436
7651.6	95086 2436	95110 2436	95135 2436	95159 2437	95184 2437	95208 2437	95232 2437	95257 2437	95281 2438	95306 2438
7651.7	95330 2438	95354 2438	95379 2439	95403 2439	95428 2439	95452 2440	95476 2440	95501 2440	95525 2440	95550 2441
7651.8	95574 2441	95598 2441	95623 2441	95647 2442	95672 2442	95696 2442	95720 2442	95745 2442	95769 2443	95794 2443
7651.9	95818 2443	95842 2443	95867 2443	95892 2444	95916 2444	95940 2444	95965 2444	95990 2444	96014 2445	96038 2445
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7652.0	96063 2445	96087 2445	96112 2445	96136 2446	96161 2446	96185 2446	96209 2446	96234 2446	96258 2447	96283 2447
7652.1	96307 2447	96332 2447	96356 2448	96380 2448	96405 2448	96430 2449	96454 2449	96478 2449	96503 2449	96528 2450
7652.2	96552 2450	96576 2450	96601 2450	96626 2451	96650 2451	96674 2451	96699 2451	96724 2451	96748 2452	96772 2452

Vallecito Dam and Reservoir, Los Piños River, Colorado

Area - Capacity Table

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
7652.3	96797 2452	96822 2452	96846 2453	96871 2453	96895 2453	96920 2454	96945 2454	96969 2454	96994 2454	97018 2455
7652.4	97043 2455	97068 2455	97092 2455	97116 2456	97141 2456	97166 2456	97190 2456	97214 2456	97239 2457	97264 2457
7652.5	97288 2457	97313 2457	97337 2458	97362 2458	97386 2458	97411 2459	97436 2459	97460 2459	97485 2459	97509 2460
7652.6	97534 2460	97559 2460	97583 2460	97608 2461	97632 2461	97657 2461	97682 2461	97706 2461	97731 2462	97755 2462
7652.7	97780 2462	97805 2462	97829 2463	97854 2463	97879 2463	97903 2464	97928 2464	97953 2464	97978 2464	98002 2465
7652.8	98027 2465	98052 2465	98076 2465	98101 2466	98125 2466	98150 2466	98175 2466	98199 2466	98224 2467	98248 2467
7652.9	98273 2467	98298 2467	98322 2468	98347 2468	98372 2468	98396 2469	98421 2469	98446 2469	98471 2469	98495 2470
7653.0	98520 2470	98545 2470	98569 2470	98594 2471	98619 2471	98643 2471	98668 2471	98693 2471	98718 2472	98742 2472
7653.1	98767 2472	98792 2472	98817 2473	98841 2473	98866 2473	98891 2474	98916 2474	98941 2474	98965 2474	98990 2475
7653.2	99015 2475	99040 2475	99064 2475	99089 2476	99114 2476	99138 2476	99163 2476	99188 2476	99213 2477	99237 2477
7653.3	99262 2477	99287 2477	99312 2478	99336 2478	99361 2478	99386 2479	99411 2479	99436 2479	99460 2479	99485 2480
7653.4	99510 2480	99535 2480	99560 2481	99584 2481	99609 2481	99634 2482	99659 2482	99684 2482	99708 2482	99733 2483
7653.5	99758 2483	99783 2483	99808 2483	99833 2484	99858 2484	99882 2484	99907 2484	99932 2484	99957 2485	99982 2485
7653.6	100007 2485	100032 2485	100057 2486	100081 2486	100106 2486	100131 2487	100156 2487	100181 2487	100205 2487	100230 2488
7653.7	100255 2488	100280 2488	100305 2488	100330 2489	100355 2489	100379 2489	100404 2489	100429 2489	100454 2490	100479 2490
7653.8	100504 2490	100529 2490	100554 2491	100579 2491	100604 2491	100628 2492	100653 2492	100678 2492	100703 2492	100728 2493
7653.9	100753 2493	100778 2493	100803 2493	100828 2494	100853 2494	100878 2494	100903 2494	100928 2494	100953 2495	100978 2495
7654.0	101003 2495	101028 2495	101053 2496	101078 2496	101103 2496	101127 2497	101152 2497	101177 2497	101202 2497	101227 2498
7654.1	101252 2498	101277 2498	101302 2498	101327 2499	101352 2499	101377 2499	101402 2499	101427 2499	101452 2500	101477 2500
7654.2	101502 2500	101527 2500	101552 2501	101577 2501	101602 2501	101627 2502	101652 2502	101677 2502	101702 2502	101727 2503
7654.3	101752	101777	101802	101827	101852	101878	101903	101928	101953	101978

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	2503	2503	2503	2504	2504	2504	2504	2504	2505	2505
7654.4	102003 2505	102028 2505	102053 2506	102078 2506	102103 2506	102128 2507	102153 2507	102178 2507	102203 2507	102228 2508
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7654.5	102253 2508	102278 2508	102303 2508	102328 2509	102353 2509	102379 2509	102404 2509	102429 2509	102454 2510	102479 2510
7654.6	102504 2510	102529 2510	102554 2511	102579 2511	102604 2511	102630 2512	102655 2512	102680 2512	102705 2512	102730 2513
7654.7	102755 2513	102780 2513	102805 2513	102831 2514	102856 2514	102881 2514	102906 2514	102931 2514	102957 2515	102982 2515
7654.8	103007 2515	103032 2515	103057 2516	103082 2516	103107 2516	103133 2517	103158 2517	103183 2517	103208 2517	103233 2518
7654.9	103258 2518	103283 2518	103308 2518	103334 2519	103359 2519	103384 2519	103409 2519	103434 2519	103460 2520	103485 2520
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7655.0	103510 2520	103535 2520	103560 2520	103586 2521	103611 2521	103636 2521	103661 2521	103686 2521	103712 2522	103737 2522
7655.1	103762 2522	103787 2522	103812 2522	103838 2522	103863 2522	103888 2522	103913 2523	103938 2523	103964 2523	103989 2523
7655.2	104014 2523	104039 2523	104065 2523	104090 2524	104115 2524	104141 2524	104166 2524	104191 2524	104216 2525	104242 2525
7655.3	104267 2525	104292 2525	104317 2525	104343 2525	104368 2525	104393 2525	104418 2526	104443 2526	104469 2526	104494 2526
7655.4	104519 2526	104544 2526	104570 2526	104595 2527	104620 2527	104646 2527	104671 2527	104696 2527	104721 2528	104747 2528
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7655.5	104772 2528	104797 2528	104823 2528	104848 2528	104873 2528	104899 2528	104924 2529	104949 2529	104974 2529	105000 2529
7655.6	105025 2529	105050 2529	105076 2529	105101 2529	105126 2529	105152 2529	105177 2530	105202 2530	105227 2530	105253 2530
7655.7	105278 2530	105303 2530	105329 2530	105354 2531	105379 2531	105405 2531	105430 2531	105455 2531	105480 2532	105506 2532
7655.8	105531 2532	105556 2532	105582 2532	105607 2532	105632 2532	105658 2532	105683 2533	105708 2533	105733 2533	105759 2533
7655.9	105784 2533	105809 2533	105835 2533	105860 2534	105886 2534	105911 2534	105936 2534	105962 2534	105987 2535	106013 2535
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7656.0	106038 2535	106063 2535	106089 2535	106114 2536	106139 2536	106165 2536	106190 2536	106215 2536	106240 2537	106266 2537
7656.1	106291 2537	106316 2537	106342 2537	106367 2538	106393 2538	106418 2538	106443 2538	106469 2538	106494 2539	106520 2539
7656.2	106545 2539	106570 2539	106596 2539	106621 2540	106647 2540	106672 2540	106697 2540	106723 2540	106748 2541	106774 2541
7656.3	106799 2541	106824 2541	106850 2541	106875 2542	106901 2542	106926 2542	106951 2542	106977 2542	107002 2543	107028 2543

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7656.4	107053 2543	107078 2543	107104 2543	107130 2544	107155 2544	107180 2544	107206 2544	107232 2544	107257 2545	107282 2545
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7656.5	107308 2545	107333 2545	107359 2545	107384 2546	107410 2546	107435 2546	107460 2546	107486 2546	107511 2547	107537 2547
7656.6	107562 2547	107588 2547	107613 2547	107638 2548	107664 2548	107690 2548	107715 2548	107740 2548	107766 2549	107792 2549
7656.7	107817 2549	107842 2549	107868 2549	107894 2550	107919 2550	107944 2550	107970 2550	107996 2550	108021 2551	108046 2551
7656.8	108072 2551	108098 2551	108123 2551	108148 2552	108174 2552	108200 2552	108225 2552	108250 2552	108276 2553	108302 2553
7656.9	108327 2553	108353 2553	108378 2553	108404 2554	108429 2554	108455 2554	108481 2554	108506 2554	108532 2555	108557 2555
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7657.0	108583 2555	108608 2555	108634 2555	108660 2556	108685 2556	108710 2556	108736 2556	108762 2556	108787 2557	108812 2557
7657.1	108838 2557	108864 2557	108889 2557	108915 2558	108940 2558	108966 2558	108992 2558	109017 2558	109043 2559	109068 2559
7657.2	109094 2559	109120 2559	109145 2559	109171 2560	109196 2560	109222 2560	109248 2560	109273 2560	109299 2561	109324 2561
7657.3	109350 2561	109376 2561	109401 2561	109427 2562	109452 2562	109478 2562	109504 2562	109529 2562	109555 2563	109580 2563
7657.4	109606 2563	109632 2563	109657 2563	109683 2564	109709 2564	109734 2564	109760 2564	109786 2564	109812 2565	109837 2565
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7657.5	109863 2565	109889 2565	109914 2565	109940 2566	109965 2566	109991 2566	110017 2566	110042 2566	110068 2567	110093 2567
7657.6	110119 2567	110145 2567	110170 2567	110196 2568	110222 2568	110247 2568	110273 2568	110299 2568	110325 2569	110350 2569
7657.7	110376 2569	110402 2569	110427 2569	110453 2570	110479 2570	110504 2570	110530 2570	110556 2570	110582 2571	110607 2571
7657.8	110633 2571	110659 2571	110684 2571	110710 2572	110736 2572	110761 2572	110787 2572	110813 2572	110839 2573	110864 2573
7657.9	110890 2573	110916 2573	110942 2573	110967 2574	110993 2574	111019 2574	111045 2574	111071 2574	111096 2575	111122 2575
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7658.0	111148 2575	111174 2575	111199 2575	111225 2576	111251 2576	111276 2576	111302 2576	111328 2576	111354 2577	111379 2577
7658.1	111405 2577	111431 2577	111457 2578	111482 2578	111508 2578	111534 2579	111560 2579	111586 2579	111611 2579	111637 2580
7658.2	111663 2580	111689 2580	111715 2580	111740 2581	111766 2581	111792 2581	111818 2581	111844 2581	111869 2582	111895 2582
7658.3	111921 2582	111947 2582	111973 2582	111998 2583	112024 2583	112050 2583	112076 2583	112102 2583	112127 2584	112153 2584
7658.4	112179 2584	112205 2584	112231 2584	112257 2585	112283 2585	112308 2585	112334 2585	112360 2585	112386 2586	112412 2586

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7658.5	112438 2586	112464 2586	112490 2587	112516 2587	112542 2587	112567 2588	112593 2588	112619 2588	112645 2588	112671 2589
7658.6	112697 2589	112723 2589	112749 2589	112775 2590	112801 2590	112826 2590	112852 2590	112878 2590	112904 2591	112930 2591
7658.7	112956 2591	112982 2591	113008 2591	113034 2592	113060 2592	113085 2592	113111 2592	113137 2592	113163 2593	113189 2593
7658.8	113215 2593	113241 2593	113267 2593	113293 2594	113319 2594	113344 2594	113370 2594	113396 2594	113422 2595	113448 2595
7658.9	113474 2595	113500 2595	113526 2596	113552 2596	113578 2596	113604 2597	113630 2597	113656 2597	113682 2597	113708 2598
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7659.0	113734 2598	113760 2598	113786 2598	113812 2599	113838 2599	113864 2599	113890 2599	113916 2599	113942 2600	113968 2600
7659.1	113994 2600	114020 2600	114046 2600	114072 2601	114098 2601	114124 2601	114150 2601	114176 2601	114202 2602	114228 2602
7659.2	114254 2602	114280 2602	114306 2602	114332 2603	114358 2603	114384 2603	114410 2603	114436 2603	114462 2604	114488 2604
7659.3	114514 2604	114540 2604	114566 2605	114592 2605	114618 2605	114645 2606	114671 2606	114697 2606	114723 2606	114749 2607
7659.4	114775 2607	114801 2607	114827 2607	114853 2608	114879 2608	114905 2608	114931 2608	114957 2608	114983 2609	115009 2609
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7659.5	115035 2609	115061 2609	115087 2609	115113 2610	115139 2610	115166 2610	115192 2610	115218 2610	115244 2611	115270 2611
7659.6	115296 2611	115322 2611	115348 2611	115375 2612	115401 2612	115427 2612	115453 2612	115479 2612	115506 2613	115532 2613
7659.7	115558 2613	115584 2613	115610 2614	115636 2614	115662 2614	115689 2615	115715 2615	115741 2615	115767 2615	115793 2616
7659.8	115819 2616	115845 2616	115871 2616	115898 2617	115924 2617	115950 2617	115976 2617	116002 2617	116029 2618	116055 2618
7659.9	116081 2618	116107 2618	116133 2618	116160 2619	116186 2619	116212 2619	116238 2619	116264 2619	116291 2620	116317 2620
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7660.0	116343 2620	116369 2620	116395 2620	116422 2620	116448 2620	116474 2620	116500 2621	116526 2621	116553 2621	116579 2621
7660.1	116605 2621	116631 2621	116657 2621	116684 2621	116710 2621	116736 2621	116762 2622	116788 2622	116815 2622	116841 2622
7660.2	116867 2622	116893 2622	116919 2622	116946 2623	116972 2623	116998 2623	117024 2623	117050 2623	117077 2624	117103 2624
7660.3	117129 2624	117155 2624	117182 2624	117208 2624	117234 2624	117261 2624	117287 2625	117313 2625	117339 2625	117366 2625
7660.4	117392 2625	117418 2625	117444 2625	117471 2625	117497 2625	117523 2625	117549 2626	117575 2626	117602 2626	117628 2626
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7660.5	117654	117680	117707	117733	117759	117786	117812	117838	117864	117891

Vallecito Dam and Reservoir, Los Piños River, Colorado

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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	2626	2626	2626	2626	2626	2626	2627	2627	2627	2627
7660.6	117917 2627	117943 2627	117970 2627	117996 2628	118022 2628	118049 2628	118075 2628	118101 2628	118127 2629	118154 2629
7660.7	118180 2629	118206 2629	118233 2629	118259 2629	118285 2629	118312 2629	118338 2630	118364 2630	118390 2630	118417 2630
7660.8	118443 2630	118469 2630	118496 2630	118522 2630	118548 2630	118575 2630	118601 2631	118627 2631	118653 2631	118680 2631
7660.9	118706 2631	118732 2631	118759 2631	118785 2632	118811 2632	118838 2632	118864 2632	118890 2632	118916 2633	118943 2633
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7661.0	118969 2633	118995 2633	119022 2633	119048 2633	119074 2633	119101 2633	119127 2634	119153 2634	119179 2634	119206 2634
7661.1	119232 2634	119258 2634	119285 2634	119311 2634	119338 2634	119364 2634	119390 2635	119417 2635	119443 2635	119470 2635
7661.2	119496 2635	119522 2635	119549 2635	119575 2635	119601 2635	119628 2635	119654 2636	119680 2636	119706 2636	119733 2636
7661.3	119759 2636	119785 2636	119812 2636	119838 2637	119865 2637	119891 2637	119917 2637	119944 2637	119970 2638	119997 2638
7661.4	120023 2638	120049 2638	120076 2638	120102 2638	120129 2638	120155 2638	120181 2639	120208 2639	120234 2639	120261 2639
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7661.5	120287 2639	120313 2639	120340 2639	120366 2639	120393 2639	120419 2639	120445 2640	120472 2640	120498 2640	120525 2640
7661.6	120551 2640	120577 2640	120604 2640	120630 2640	120657 2640	120683 2640	120709 2641	120736 2641	120762 2641	120789 2641
7661.7	120815 2641	120841 2641	120868 2641	120894 2642	120921 2642	120947 2642	120973 2642	121000 2642	121026 2643	121053 2643
7661.8	121079 2643	121105 2643	121132 2643	121158 2643	121185 2643	121211 2643	121237 2644	121264 2644	121290 2644	121317 2644
7661.9	121343 2644	121370 2644	121396 2644	121422 2644	121449 2644	121476 2644	121502 2645	121528 2645	121555 2645	121582 2645
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7662.0	121608 2645	121634 2645	121661 2646	121687 2646	121714 2646	121740 2647	121766 2647	121793 2647	121819 2647	121846 2648
7662.1	121872 2648	121898 2648	121925 2649	121952 2649	121978 2650	122004 2650	122031 2650	122058 2651	122084 2651	122110 2652
7662.2	122137 2652	122164 2652	122190 2653	122216 2653	122243 2653	122270 2654	122296 2654	122322 2654	122349 2654	122376 2655
7662.3	122402 2655	122429 2655	122455 2656	122482 2656	122508 2656	122535 2657	122562 2657	122588 2657	122615 2657	122641 2658
7662.4	122668 2658	122695 2658	122721 2659	122748 2659	122774 2659	122801 2660	122828 2660	122854 2660	122881 2660	122907 2661
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7662.5	122934 2661	122961 2661	122987 2662	123014 2662	123040 2663	123067 2663	123094 2663	123120 2664	123147 2664	123173 2665

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Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
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7662.6	123200 2665	123227 2665	123253 2666	123280 2666	123307 2666	123333 2667	123360 2667	123387 2667	123414 2667	123440 2668
7662.7	123467 2668	123494 2668	123520 2669	123547 2669	123574 2669	123600 2670	123627 2670	123654 2670	123681 2670	123707 2671
7662.8	123734 2671	123761 2671	123787 2672	123814 2672	123841 2672	123867 2673	123894 2673	123921 2673	123948 2673	123974 2674
7662.9	124001 2674	124028 2674	124055 2675	124081 2675	124108 2676	124135 2676	124162 2676	124189 2677	124215 2677	124242 2678
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7663.0	124269 2678	124296 2678	124323 2679	124349 2679	124376 2679	124403 2680	124430 2680	124457 2680	124483 2680	124510 2681
7663.1	124537 2681	124564 2681	124591 2682	124617 2682	124644 2682	124671 2683	124698 2683	124725 2683	124751 2683	124778 2684
7663.2	124805 2684	124832 2684	124859 2685	124885 2685	124912 2685	124939 2686	124966 2686	124993 2686	125019 2686	125046 2687
7663.3	125073 2687	125100 2687	125127 2688	125154 2688	125181 2689	125207 2689	125234 2689	125261 2690	125288 2690	125315 2691
7663.4	125342 2691	125369 2691	125396 2692	125423 2692	125450 2692	125477 2693	125504 2693	125531 2693	125558 2693	125585 2694
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7663.5	125612 2694	125639 2694	125666 2695	125693 2695	125720 2695	125746 2696	125773 2696	125800 2696	125827 2696	125854 2697
7663.6	125881 2697	125908 2697	125935 2698	125962 2698	125989 2698	126016 2699	126043 2699	126070 2699	126097 2699	126124 2700
7663.7	126151 2700	126178 2700	126205 2701	126232 2701	126259 2701	126286 2702	126313 2702	126340 2702	126367 2702	126394 2703
7663.8	126421 2703	126448 2703	126475 2704	126502 2704	126529 2705	126557 2705	126584 2705	126611 2706	126638 2706	126665 2707
7663.9	126692 2707	126719 2707	126746 2708	126773 2708	126800 2708	126828 2709	126855 2709	126882 2709	126909 2709	126936 2710
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7664.0	126963 2710	126990 2710	127017 2710	127044 2710	127071 2710	127099 2710	127126 2711	127153 2711	127180 2711	127207 2711
7664.1	127234 2711	127261 2711	127288 2711	127315 2711	127342 2711	127370 2711	127397 2712	127424 2712	127451 2712	127478 2712
7664.2	127505 2712	127532 2712	127559 2712	127586 2712	127613 2712	127641 2712	127668 2713	127695 2713	127722 2713	127749 2713
7664.3	127776 2713	127803 2713	127830 2713	127857 2713	127884 2713	127912 2713	127939 2714	127966 2714	127993 2714	128020 2714
7664.4	128047 2714	128074 2714	128101 2714	128129 2714	128156 2714	128183 2714	128210 2715	128237 2715	128265 2715	128292 2715
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
7664.5	128319 2715	128346 2715	128373 2715	128400 2715	128427 2715	128455 2715	128482 2716	128509 2716	128536 2716	128563 2716
7664.6	128590 2716	128617 2716	128644 2716	128672 2716	128699 2716	128726 2716	128753 2717	128780 2717	128808 2717	128835 2717

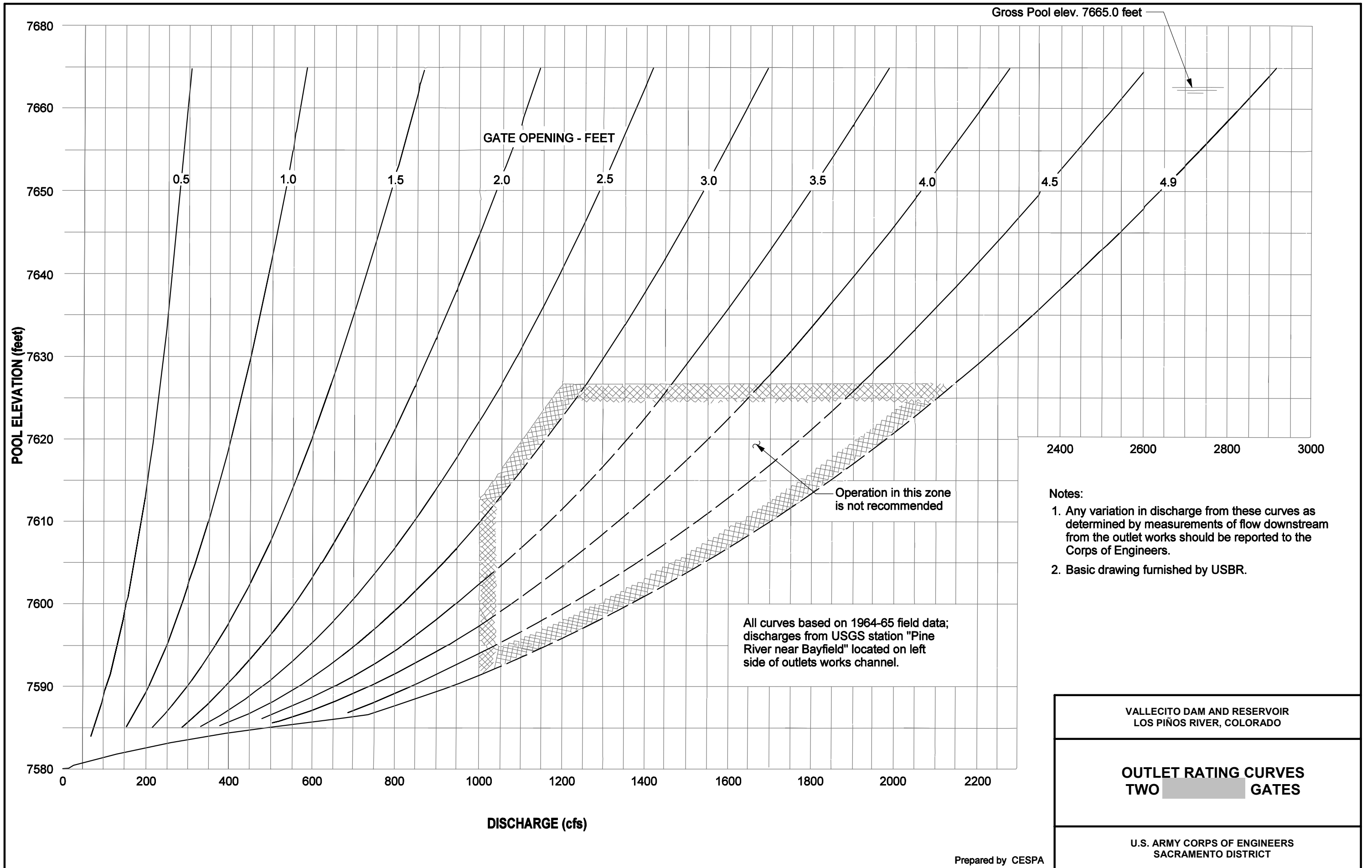
Vallecito Dam and Reservoir, Los Piños River, Colorado

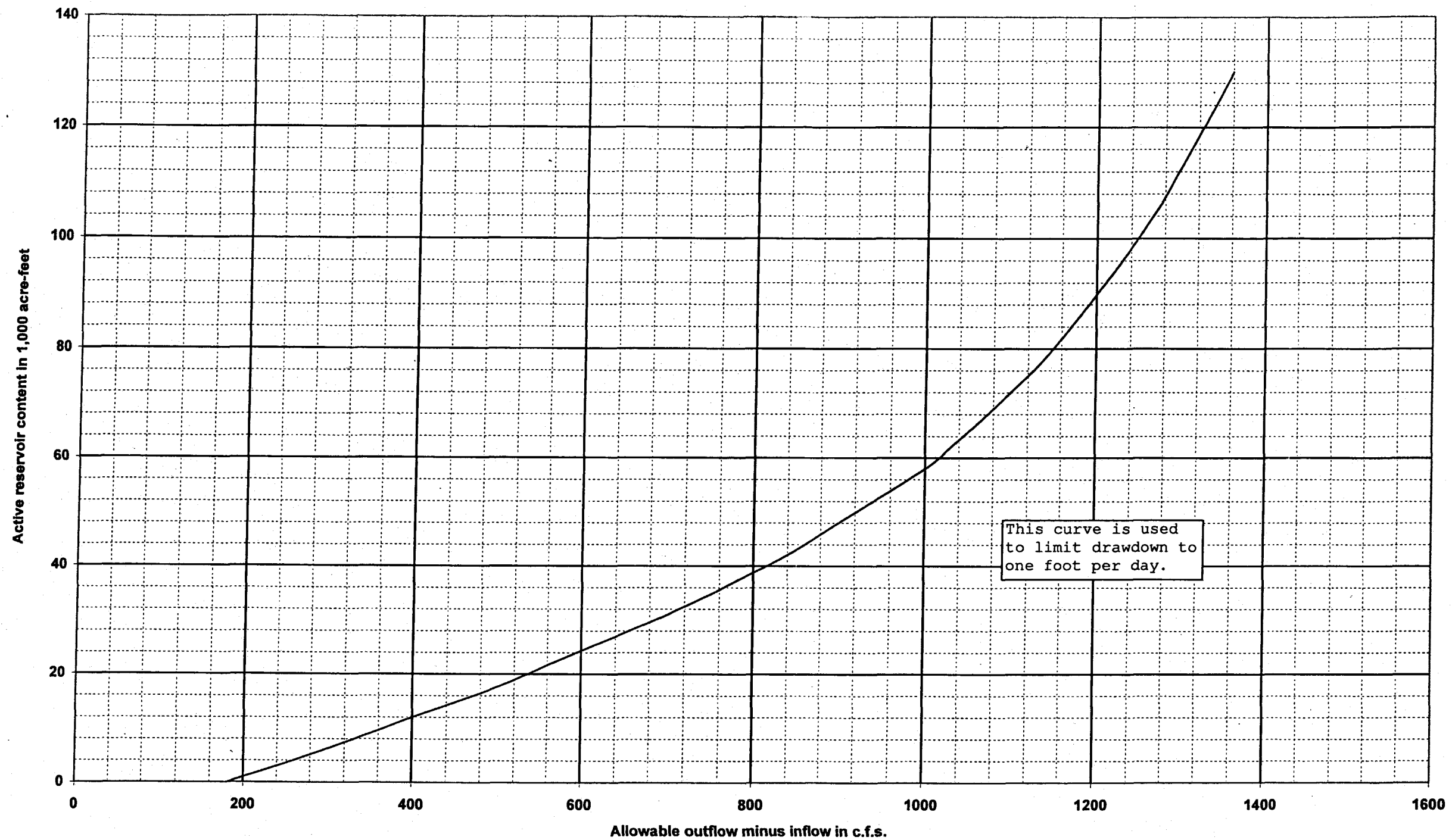
Area - Capacity Table

Surveyed March 1943, Revised March 1969

Elev	CAP AREA .00	CAP AREA .01	CAP AREA .02	CAP AREA .03	CAP AREA .04	CAP AREA .05	CAP AREA .06	CAP AREA .07	CAP AREA .08	CAP AREA .09
7664.7	128862 2717	128889 2717	128916 2717	128944 2717	128971 2717	128998 2717	129025 2718	129052 2718	129080 2718	129107 2718
7664.8	129134 2718	129161 2718	129188 2718	129216 2718	129243 2718	129270 2718	129297 2719	129324 2719	129352 2719	129379 2719
7664.9	129406 2719	129433 2719	129460 2719	129488 2719	129515 2719	129542 2719	129569 2720	129596 2720	129624 2720	129651 2720
7665.0	129678 2720									

Example: Elev .00 .01
 7582.7 4308 4312 ← This is the capacity in ac-ft at elev 7582.71
 380 380 ← This is the corresponding area in acres





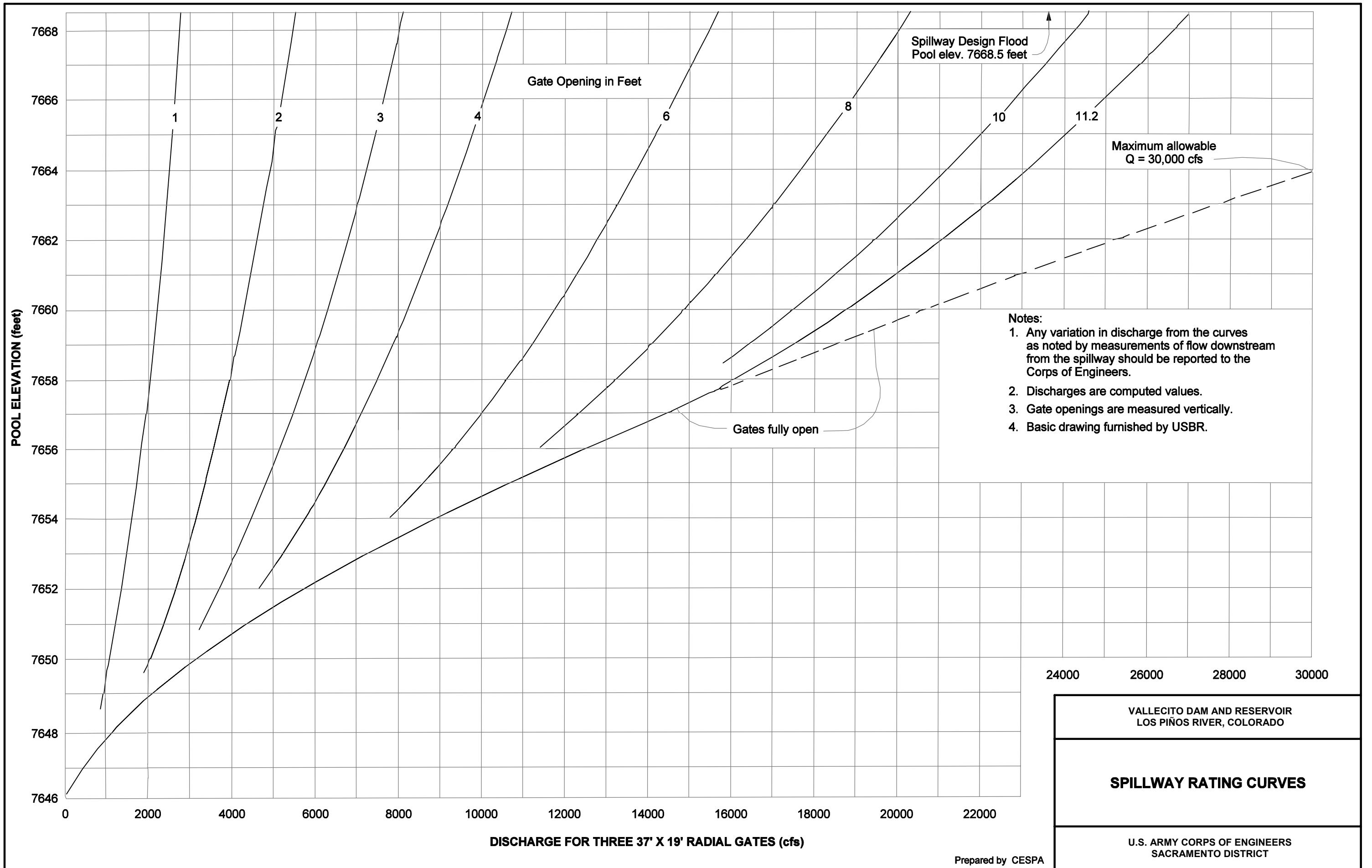
Note:
1. Data furnished by USBR.

VALLECITO DAM AND RESERVOIR LOS PINOS RIVER, COLORADO
DRAW DOWN LIMIT DIAGRAM
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by BJA

Revised June 2002

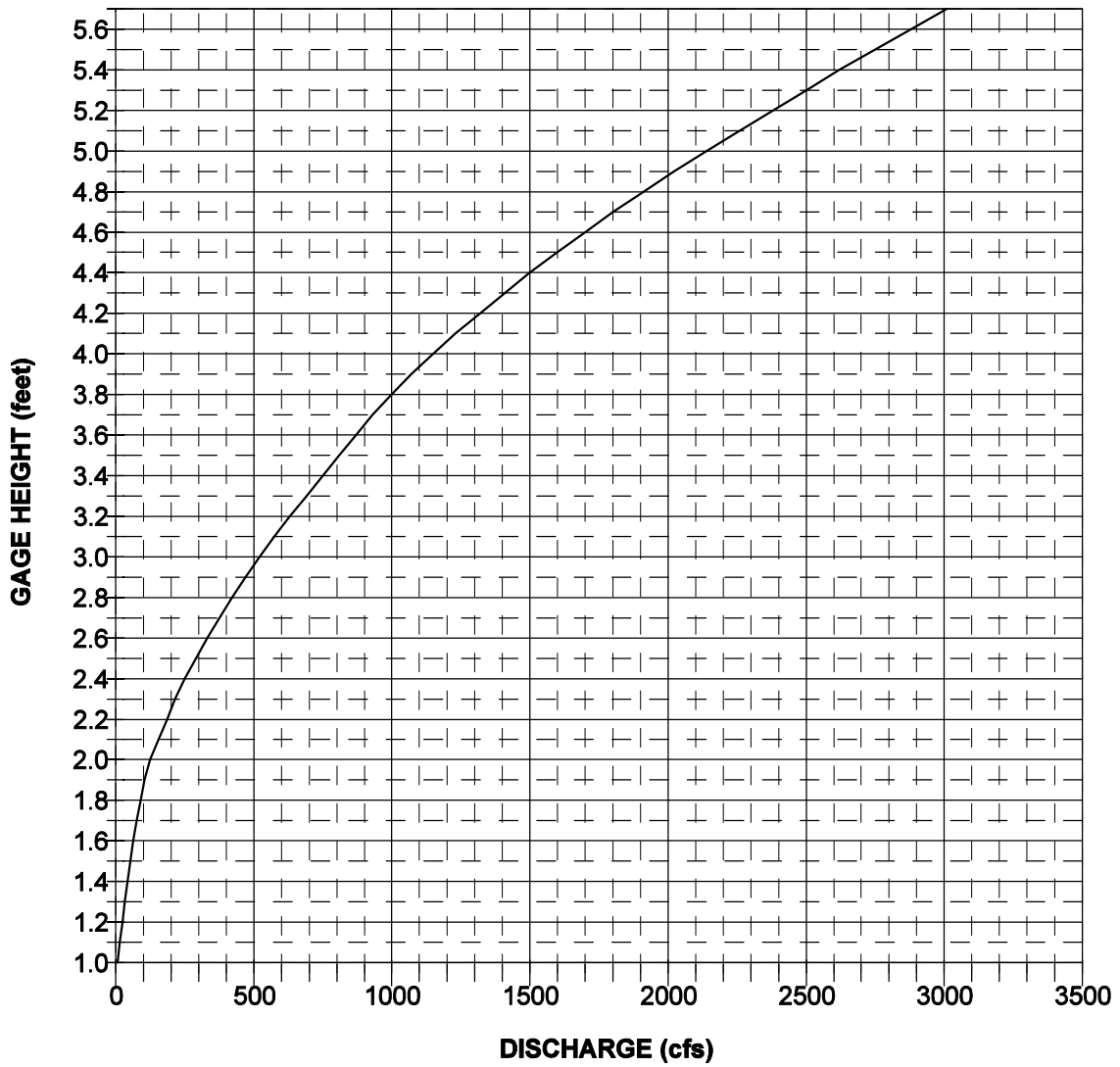
PLATE A-4



24000 26000 28000 30000

<p>VALLECITO DAM AND RESERVOIR LOS PIÑOS RIVER, COLORADO</p>
<p>SPILLWAY RATING CURVES</p>
<p>U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT</p>

Prepared by CESPA



NOTE:

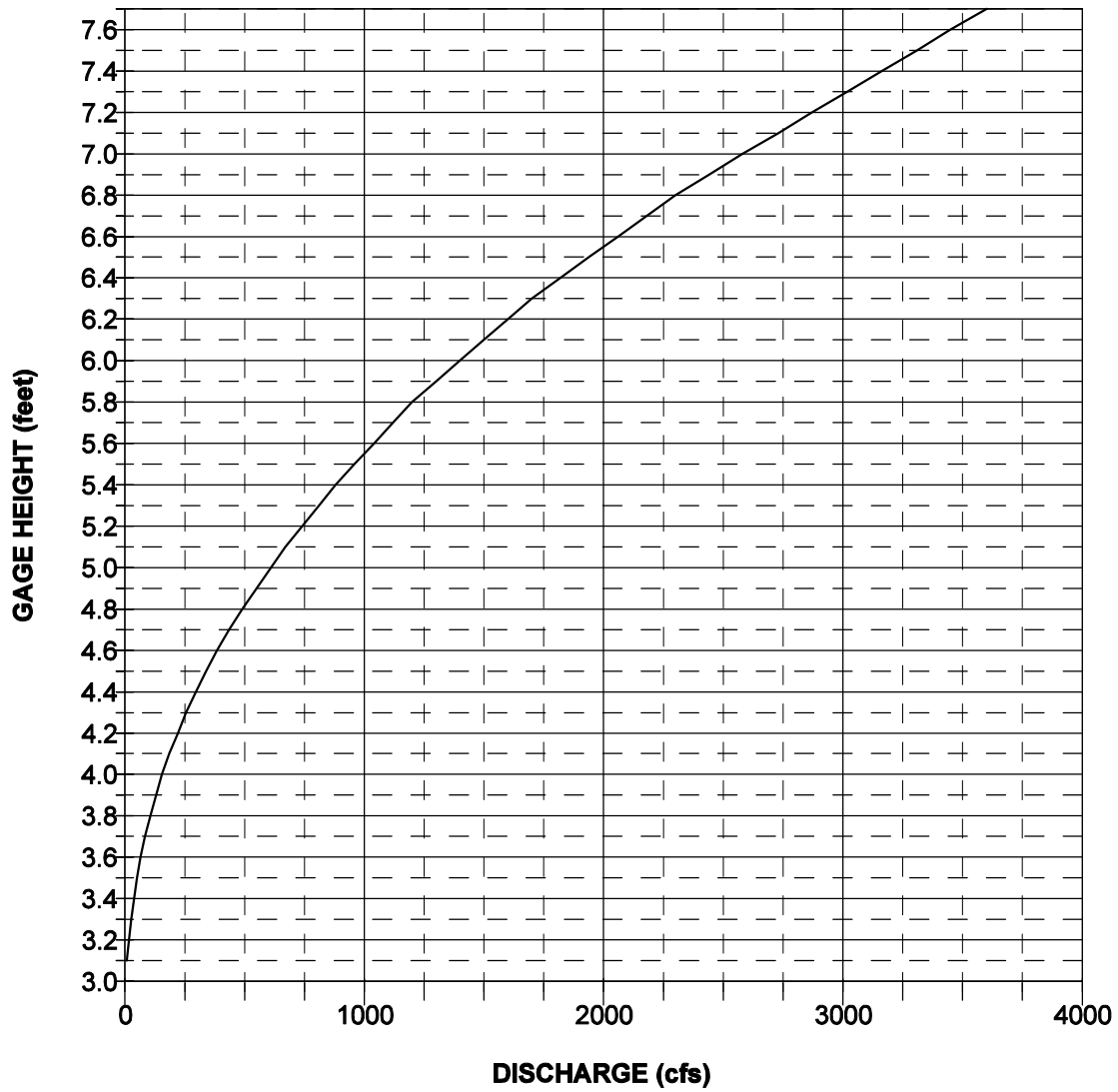
1. Data furnished by USGS.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

**DISCHARGE RATING CURVE FOR
LOS PINOS RIVER
BELOW VALLECITO DAM**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESPA



NOTE:

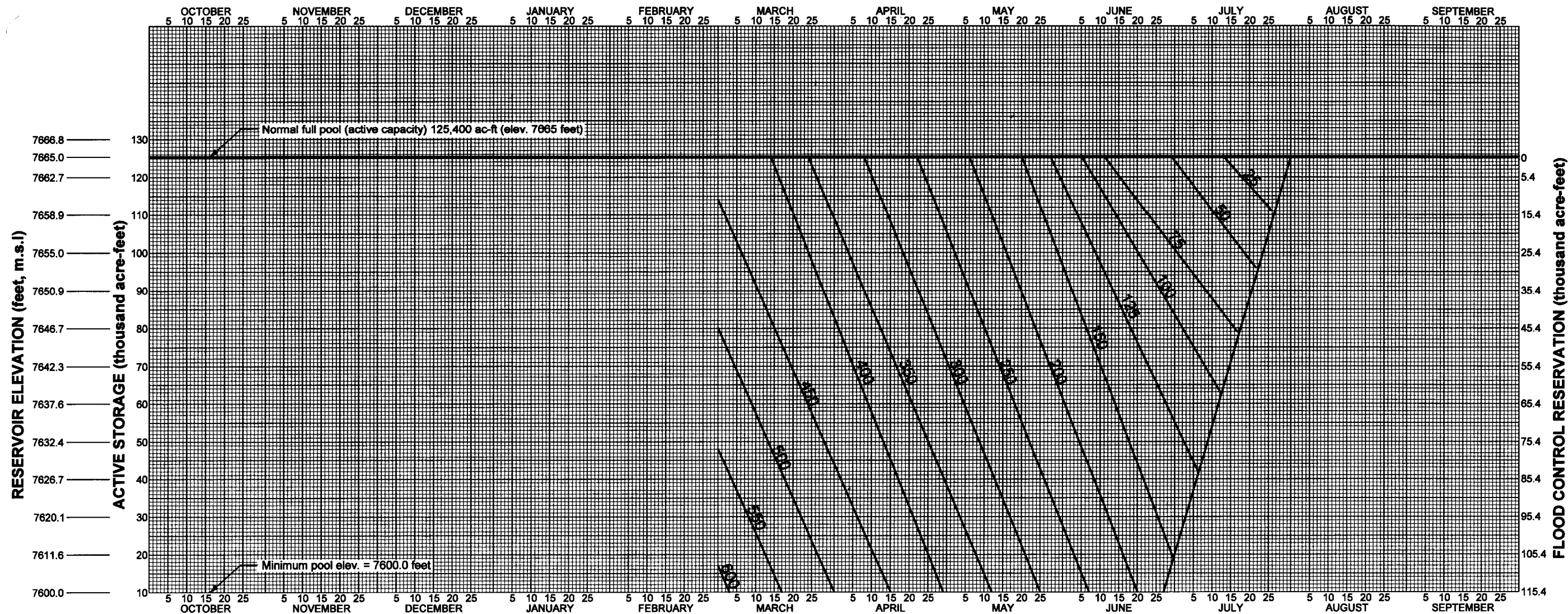
1. Data furnished by USGS.

VALLECITO DAM AND RESERVOIR
LOS PIÑOS RIVER, COLORADO

**DISCHARGE RATING CURVE FOR
LOS PINOS RIVER AT
LA BOCA, COLORADO**

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by CESPA



Notes:

1. Parameter value is the forecasted remaining natural inflow in thousand acre-feet into Vallecito Reservoir between the given date and 31 July.
2. When available storage space is less than the required flood control space determined by use of this diagram, water shall be released as rapidly as possible without causing flows in Los Pinos River near Bayfield, Colorado, to exceed 2,000 c.f.s. insofar as possible.
3. Releases shall not be changed more than 500 c.f.s. in any 2-hour period.
4. After 30 June, when it has been determined from criteria developed by the Regional Director, U.S. Bureau of Reclamation, and concurred in by the District Engineer, Corps of Engineers, that the snowmelt season will no longer exceed 2,000 c.f.s., the flood control space requirements may be decreased by 20,000 acre-feet.
5. Drawdown of the reservoir water surface shall not exceed a rate of one foot in 24 hours without prior approval of the Director of Design and Construction, Bureau of Reclamation, Denver, Colorado.
6. Operation within the surcharge zone is subject to limitations on gate opening specified on the spillway gate operation curve.

Original signature block added 05/08 (signed 03/23/78)

**VALLECITO DAM AND RESERVOIR
LOS PINOS RIVER, COLORADO**

FLOOD CONTROL DIAGRAM
Prepared Pursuant to Flood Control Regulations for
Vallecito Dam and Reservoir in Accordance with the
Code of Federal Regulations Title 33 Part 208.11

APPROVED: *William E. Vandenberg*
Colonel, USA, Division Engineer,
South Pacific Division

APPROVED: *O. L. Crandall*
Regional Director, Upper Colorado Region,
U.S.B.R.

APPROVED: *Frank W. Morrison*
President, Board of Directors,
Pine River Irrigation District

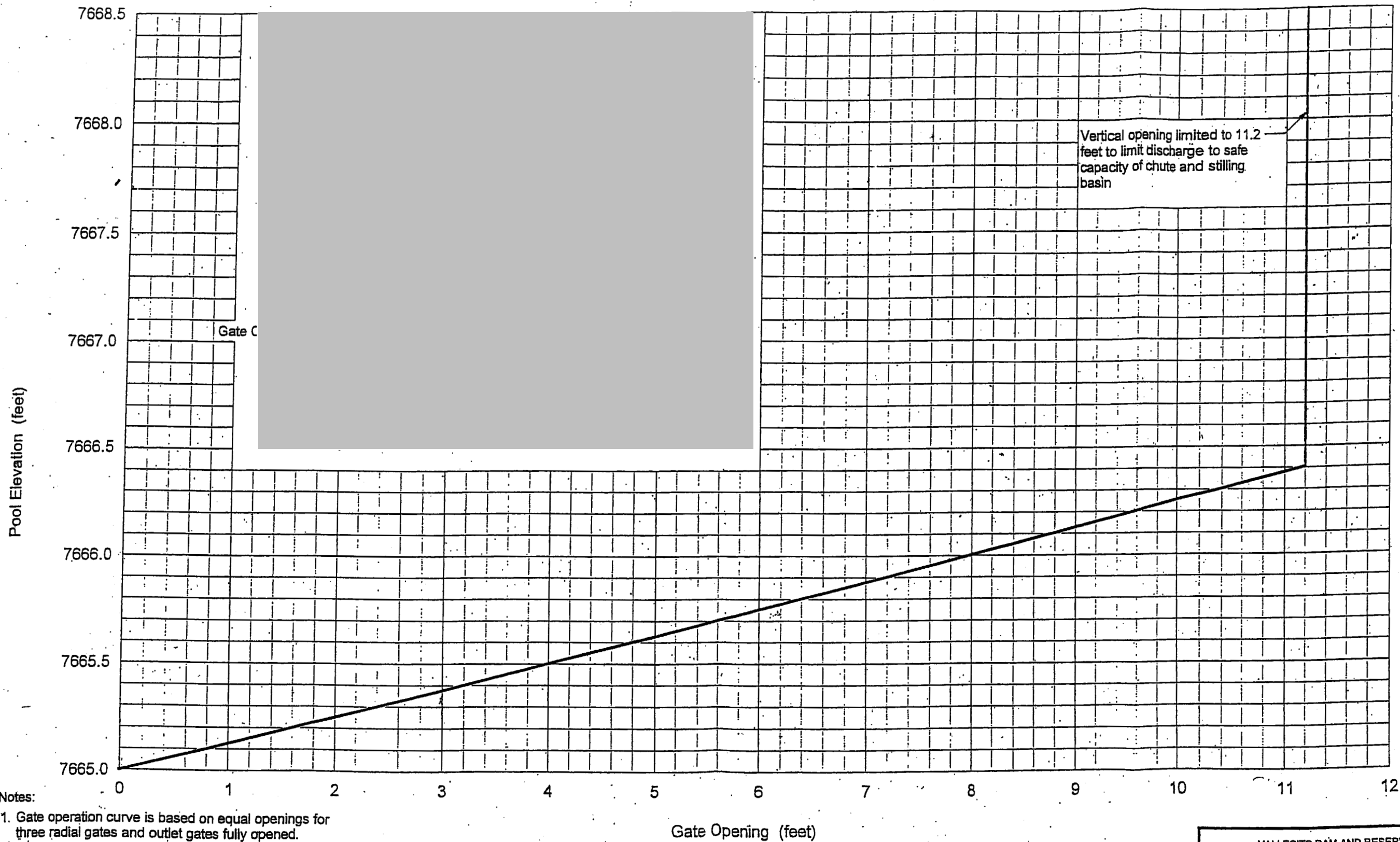
Effective Date: _____ File No. **SJR 2-19-1**

**VALLECITO DAM AND RESERVOIR
LOS PINOS RIVER, COLORADO**

WATER CONTROL DIAGRAM

**U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT**

Prepared by CESPA



Notes:

1. Gate operation curve is based on equal openings for three radial gates and outlet gates fully opened.
2. Openings shown are minimum allowable.
3. Operation with smaller openings could result in over topping and subsequent failure of dam embankment.
4. Spillway discharge may be substituted for outlet works discharge (2,900 cfs) until safe capacity (27,100 cfs) of the spillway chute is reached.
5. The combined discharge of the outlet works and spillway should not exceed 30,000 cfs.
6. Basic drawing furnished by USBR.

VALLECITO DAM AND RESERVOIR LOS PINOS RIVER, COLORADO
SPILLWAY GATES OPERATION CURVE
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

Prepared by: CESPA

WATER CONTROL MANUAL
VALLECITO DAM AND RESERVOIR

Los Piños River, Colorado

EXHIBIT B

CODE OF FEDERAL REGULATIONS TITLE 33
PART 208.11
AND
PART 222.5

U.S. Army Corps of Engineers
Sacramento District
Sacramento, California

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TITLE 33--NAVIGATION AND NAVIGABLE WATERS

CHAPTER II--CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

PART 208--FLOOD CONTROL REGULATIONS--Table of Contents

Sec. 208.11 Regulations for use of storage allocated for flood control or navigation and/or project operation at reservoirs subject to prescription of rules and regulations by the Secretary of the Army in the interest of flood control and navigation.

(a) Purpose. This regulation prescribes the responsibilities and general procedures for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States, and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding between project owners, operating agencies, and the Corps of Engineers.

(b) Responsibilities. The basic responsibilities of the Corps of Engineers regarding project operation are set out in the cited authority and described in the following paragraphs:

(1) Section 7 of the Flood Control Act of 1944 (58 Stat. 890, 33 U.S.C. 709) directs the Secretary of the Army to prescribe regulations for flood control and navigation in the following manner:

Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: Provided, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department.

(2) Section 9 of Public Law 436-83d Congress (68 Stat. 303) provides for the development of the Coosa River, Alabama and Georgia, and directs the Secretary of the Army to prescribe rules and regulations for project operation in the interest of flood control and navigation as follows:

The operation and maintenance of the dams shall be subject to reasonable rules and regulations of the Secretary of the Army in the interest of flood control and navigation.

Note: This Regulation will also be applicable to dam and reservoir projects operated under provisions of future legislative acts wherein the Secretary of the Army is directed to prescribe

rules and regulations in the interest of flood control and navigation. The Chief of Engineers, U.S. Army Corps of Engineers, is designated the duly authorized representative of the Secretary of the Army to exercise the authority set out in the Congressional Acts. This Regulation will normally be implemented by letters of understanding between the Corps of Engineers and project owner and will incorporate the provisions of such letters of understanding prior to the time construction renders the project capable of significant impoundment of water. A water control agreement signed by both parties will follow when deliberate impoundment first begins or at such time as the responsibilities of any Corps-owned projects may be transferred to another entity. Promulgation of this Regulation for a given project will occur at such time as the name of the project appears in the Federal Register in accordance with the requirements of paragraph 6k. When agreement on a water control plan cannot be reached between the Corps and the project owner after coordination with all interested parties, the project name will be entered in the Federal Register and the Corps of Engineers plan will be the official water control plan until such time as differences can be resolved.

(3) Federal Energy Regulatory Commission (FERC), formerly Federal Power Commission (FPC), Licenses.

(i) Responsibilities of the Secretary of the Army and/or the Chief of Engineers in FERC licensing actions are set forth in reference 3c above and pertinent sections are cited herein. The Commission may further stipulate as a licensing condition, that a licensee enter into an agreement with the Department of the Army providing for operation of the project during flood times, in accordance with rules and regulations prescribed by the Secretary of the Army.

(A) Section 4(e) of the Federal Power Act requires approval by the Chief of Engineers and the Secretary of the Army of plans of dams or other structures affecting the navigable capacity of any navigable waters of the United States, prior to issuance of a license by the Commission as follows:

The Commission is hereby authorized and empowered to issue licenses to citizens * * * for the purpose of constructing, operating and maintaining dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction * * * Provided further, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of the Army.

(B) Sections 10(a) and 10(c) of the Federal Power Act specify conditions of project licenses including the following:

(1) Section 10(a). "That the project adopted * * * shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of waterpower development, and for other beneficial public uses * * *."

(2) Section 10(c). "That the licensee shall * * * so maintain and operate said works as not to impair navigation, and shall conform to such rules and regulations as the Commission may from time to time prescribe for the protection of life, health, and property * * *."

(C) Section 18 of the Federal Power Act directs the operation of any navigation facilities built under the provision of that Act, be controlled by rules and regulations prescribed by the Secretary of the Army as follows:

The operation of any navigation facilities which may be constructed as part of or in connection with any dam or diversion structure built under the provisions of this Act, whether at the expense of a licensee hereunder or of the United States, shall at all times be controlled by such reasonable rules and regulations in the interest of navigation; including the control of the pool caused by such dam or diversion structure as may be made from time to time by the Secretary of the Army, * * *

(ii) Federal Power Commission Order No. 540 issued October 31, 1975, and published November 7, 1975 (40 FR 51998), amending Sec. 2.9 of the Commission's General Policy and Interpretations prescribed Standardized Conditions (Forms) for Inclusion in Preliminary Permits and Licenses Issued Under part I of the Federal Power Act. As an example, Article 12 of Standard Form L-3, titled: "Terms and Conditions of License for Constructed Major Projects Affecting Navigable Waters of the United States," sets forth the Commission's interpretation of appropriate sections of the Act, which deal with navigation aspects, and attendant responsibilities of the Secretary of the Army in licensing actions as follows:

The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, * * * and the Licensee shall release water from the project reservoir at such rate * * * as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

(c) Scope and terminology. This regulation applies to Federal authorized flood control and/or navigation storage projects, and to non-Federal projects which require the Secretary of the Army to prescribe regulations as a condition of the license, permit or legislation, during the planning,

design and construction phases, and throughout the life of the project. In compliance with the authority cited above, this regulation defines certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. In carrying out the conditions of this regulation, the owner and/or operating agency will comply with applicable provisions of Pub. L. 85-624, the Fish and Wildlife Coordination Act of 1958, and Pub. L. 92-500, the Federal Water Pollution Control Act Amendments of 1972. This regulation does not apply to local flood protection works governed by Sec. 208.10, or to navigation facilities and associated structures which are otherwise covered by part 207 (Navigation Regulations) of title 33 of the code. Small reservoirs, containing less than 12,500 acre-feet of flood control or navigation storage, may be excluded from this regulation and covered under Sec. 208.10, unless specifically required by law or conditions of the license or permit.

(1) The terms reservoir and project as used herein include all water resource impoundment projects constructed or modified, including natural lakes, that are subject to this regulation.

(2) The term project owner refers to the entity responsible for maintenance, physical operation, and safety of the project, and for carrying out the water control plan in the interest of flood control and/or navigation as prescribed by the Corps of Engineers. Special arrangements may be made by the project owner for "operating agencies" to perform these tasks.

(3) The term letter of understanding as used herein includes statements which consummate this regulation for any given project and define the general provisions or conditions of the local sponsor, or owner, cooperation agreed to in the authorizing legislative document, and the requirements for compliance with section 7 of the 1944 Flood Control Act, the Federal Power Act or other special congressional act. This information will be specified in the water control plan and manual. The letter of understanding will be signed by a duly authorized representative of the Chief of Engineers and the project owner. A "field working agreement" may be substituted for a letter of understanding, provided that the specified minimum requirements of the latter, as stated above, are met.

(4) The term water control agreement refers to a compilation of water control criteria, guidelines, diagrams, release schedules, rule curves and specifications that basically govern the use of reservoir storage space allocated for flood control or navigation and/or release functions of a water control project for these purposes. In general, they indicate controlling or limiting rates of discharge and storage space required for flood control and/or navigation, based on the runoff potential during various seasons of the year.

(5) For the purpose of this regulation, the term water control plan is limited to the plan of regulation for a water resources project in the interest of flood control and/or navigation. The water control plan must conform with proposed allocations of storage capacity and downstream conditions or other requirements to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system.

(6) The term real-time denotes the processing of current information or data in a sufficiently timely manner to influence a physical response in the system being monitored and controlled. As used herein the term connotes * * * the analyses for and execution of water control decisions for both minor and major flood events and for navigation, based on prevailing hydrometeorological and other conditions and constraints, to achieve efficient management of water resource systems.

(d) Procedures--(1) Conditions during project formulation. During the planning and design phases, the project owner should consult with the Corps of Engineers regarding the quantity and value of space to reserve in the reservoir for flood control and/or navigation purposes, and for utilization of the space, and other requirements of the license, permit or conditions of the law. Relevant matters that bear upon flood control and navigation accomplishment include: Runoff potential, reservoir discharge capability, downstream channel characteristics, hydrometeorological data collection, flood hazard, flood damage characteristics, real estate acquisition for flowage requirements (fee and easement), and resources required to carry out the water control plan. Advice may also be sought on determination of and regulation for the probable maximum or other design flood under consideration by the project owner to establish the quantity of surcharge storage space, and freeboard elevation of top of dam or embankment for safety of the project.

(2) Corps of Engineers involvement. If the project owner is responsible for real-time implementation of the water control plan, consultation and assistance will be provided by the Corps of Engineers when appropriate and to the extent possible. During any emergency that affects flood control and/or navigation, the Corps of Engineers may temporarily prescribe regulation of flood control or navigation storage space on a day-to-day (real-time) basis without request of the project owner. Appropriate consideration will be given for other authorized project functions. Upon refusal of the project owner to comply with regulations prescribed by the Corps of Engineers, a letter will be sent to the project owner by the Chief of Engineers or his duly authorized representative describing the reason for the regulations prescribed, events that have transpired, and notification that the project owner is in violation of the Code of Federal Regulations. Should an impasse arise, in that the project owner or the designated operating entity persists in noncompliance with regulations prescribed by the Corps of Engineers, measures may be taken to assure compliance.

(3) Corps of Engineers implementation of real-time water control decisions. The Corps of Engineers may prescribe the continuing regulation of flood control storage space for any project subject to this regulation on a day-to-day (real-time) basis. When this is the case, consultation and assistance from the project owner to the extent possible will be expected. Special requests by the project owner, or appropriate operating entity, are preferred before the Corps of Engineers offers advice on real-time regulation during surcharge storage utilization.

(4) Water control plan and manual. Prior to project completion, water control managers from the Corps of Engineers will visit the project and the area served by the project to become familiar with the water control facilities, and to insure sound formulation of the water control plan. The

formal plan of regulation for flood control and/or navigation, referred to herein as the water control plan, will be developed and documented in a water control manual prepared by the Corps of Engineers. Development of the manual will be coordinated with the project owner to obtain the necessary pertinent information, and to insure compatibility with other project purposes and with surcharge regulation. Major topics in the manual will include: Authorization and description of the project, hydrometeorology, data collection and communication networks, hydrologic forecasting, the water control plan, and water resource management functions, including responsibilities and coordination for water control decisionmaking. Special instructions to the dam tender or reservoir manager on data collection, reporting to higher Federal authority, and on procedures to be followed in the event of a communication outage under emergency conditions, will be prepared as an exhibit in the manual. Other exhibits will include copies of this regulation, letters of understanding consummating this regulation, and the water control agreements. After approval by the Chief of Engineers or his duly authorized representative, the manual will be furnished the project owner.

(5) Water control agreement. (i) A water control diagram (graphical) will be prepared by the Corps of Engineers for each project having variable space reservation for flood control and/or navigation during the year; e.g., variable seasonal storage, joint-use space, or other rule curve designation. Reservoir inflow parameters will be included on the diagrams when appropriate. Concise notes will be included on the diagrams prescribing the use of storage space in terms of release schedules, runoff, nondamaging or other controlling flow rates downstream of the damsite, and other major factors as appropriate. A water control release schedule will be prepared in tabular form for projects that do not have variable space reservation for flood control and/or navigation. The water control diagram or release schedule will be signed by a duly authorized representative of the Chief of Engineers, the project owner, and the designated operating agency, and will be used as the basis for carrying out this regulation. Each diagram or schedule will contain a reference to this regulation.

(ii) When deemed necessary by the Corps of Engineers, information given on the water control diagram or release schedule will be supplemented by appropriate text to assure mutual understanding on certain details or other important aspects of the water control plan not covered in this regulation, on the water control diagram or in the release schedule. This material will include clarification of any aspects that might otherwise result in unsatisfactory project performance in the interest of flood control and/or navigation. Supplementation of the agreement will be necessary for each project where the Corps of Engineers exercises the discretionary authority to prescribe the flood control regulation on a day-to-day (real-time) basis. The agreement will include delegation of the responsibility. The document should also cite, as appropriate, section 7 of the 1944 Flood Control Act, the Federal Power Act and/or other congressional legislation authorizing construction and/or directing operation of the project.

(iii) All flood control regulations published in the Federal Register under this section (part 208) of the code prior to the date of this publication which are listed in Sec. 208.11(e) are hereby superseded.

(iv) Nothing in this regulation prohibits the promulgation of specific regulations for a project in compliance with the authorizing acts, when agreement on acceptable regulations cannot be reached between the Corps of Engineers and the owner.

(6) Hydrometeorological instrumentation. The project owner will provide instrumentation in the vicinity of the damsite and will provide communication equipment necessary to record and transmit hydrometeorological and reservoir data to all appropriate Federal authorities on a real-time basis unless there are extenuating circumstances or are otherwise provided for as a condition of the license or permit. For those projects where the owner retains responsibility for real-time implementation of the water control plan, the owner will also provide or arrange for the measurement and reporting of hydrometeorological parameters required within and adjacent to the watershed and downstream of the damsite, sufficient to regulate the project for flood control and/or navigation in an efficient manner. When data collection stations outside the immediate vicinity of the damsite are required, and funds for installation, observation, and maintenance are not available from other sources, the Corps of Engineers may agree to share the costs for such stations with the project owner. Availability of funds and urgency of data needs are factors which will be considered in reaching decisions on cost sharing. (7) Project safety. The project owner is responsible for the safety of the dam and appurtenant facilities and for regulation of the project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the project owner, and does not relieve the owner of the responsibility for safety of the project.

(8) Notification of the general public. The Corps of Engineers and other interested Federal and State agencies, and the project owner will jointly sponsor public involvement activities, as appropriate, to fully apprise the general public of the water control plan. Public meetings or other effective means of notification and involvement will be held, with the initial meeting being conducted as early as practicable but not later than the time the project first becomes operational. Notice of the initial public meeting shall be published once a week for 3 consecutive weeks in one or more newspapers of general circulation published in each county covered by the water control plan. Such notice shall also be used when appropriate to inform the public of modifications in the water control plan. If no newspaper is published in a county, the notice shall be published in one or more newspapers of general circulation within that county. For the purposes of this section a newspaper is one qualified to publish public notices under applicable State law. Notice shall be given in the event significant problems are anticipated or experienced that will prevent carrying out the approved water control plan or in the event that an extreme water condition is expected that could produce severe damage to property or loss of life. The means for conveying this information shall be commensurate with the urgency of the situation. The water control manual will be made available for examination by the general public upon request at the appropriate office of the Corps of Engineers, project owner or designated operating agency.

(9) Other generalized requirements for flood control and navigation.

(i) Storage space in the reservoirs allocated for flood control and navigation purposes shall be kept available for those purposes in accordance with the water control agreement, and the plan of regulation in the water control manual.

(ii) Any water impounded in the flood control space defined by the water control agreement shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from reservoirs shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dam, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan or regulation may require releases to be completely curtailed in the interest of flood control or safety of the project.

(iii) Nothing in the plan of regulation for flood control shall be construed to require or allow dangerously rapid changes in magnitudes of releases. Releases will be made in a manner consistent with requirements for protecting the dam and reservoir from major damage during passage of the maximum design flood for the project.

(iv) The project owner shall monitor current reservoir and hydro- meteorological conditions in and adjacent to the watershed and downstream of the damsite, as necessary. This and any other pertinent information shall be reported to the Corps of Engineers on a timely basis, in accordance with standing instructions to the damtender or other means requested by the Corps of Engineers.

(v) In all cases where the project owner retains responsibility for real-time implementation of the water control plan, he shall make current determinations of: Reservoir inflow, flood control storage utilized, and scheduled releases. He shall also determine storage space and releases required to comply with the water control plan prescribed by the Corps of Engineers. The owner shall report this information on a timely basis as requested by the Corps of Engineers.

(vi) The water control plan is subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the project owner and shall include justification for the action.

(vii) The project owner may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Chief of Engineers, or his duly authorized representative.

(viii) Advance approval of the Chief of Engineers, or his duly authorized representative, is required prior to any deviation from the plan of regulation prescribed or approved by the Corps of Engineers in the interest of flood control and/or navigation, except in emergency situations provided for in paragraph (d)(9)(vii) of this section. When conditions appear to warrant a prolonged deviation from the approved plan, the project owner and the Corps of Engineers will jointly investigate and evaluate the proposed deviation to insure that the overall integrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigations and evaluations have been conducted to the extent deemed necessary by the Chief of Engineers, or his designated representatives, to fully substantiate the deviation.

(10) Revisions. The water control plan and all associated documents will be revised by the Corps of Engineers as necessary, to reflect changed conditions that come to bear upon flood control and navigation, e.g., reallocation of reservoir storage space due to sedimentation or transfer of storage space to a neighboring project. Revision of the water control plan, water control agreement, water control diagram, or release schedule requires approval of the Chief of Engineers or his duly authorized representative. Each such revision shall be effective upon the date specified in the approval. The original (signed document) water control agreement shall be kept on file in the respective Office the Division Engineer, Corps of Engineers, Department of the Army, located at division offices throughout the continental USA. Copies of these agreements may be obtained from the office of the project owner, or from the office of the appropriate Division Engineer, Corps of Engineers.

(11) Federal Register. The following information for each project subject to section 7 of the 1944 Flood Control Act and other applicable congressional acts shall be published in the Federal Register prior to the time the projects becomes operational and prior to any significant impoundment before project completion or * * * at such time as the responsibility for physical operation and maintenance of the Corps of Engineers owned projects is transferred to another entity:

- (i) Reservoir, dam, and lake names,
 - (ii) Stream, county, and State corresponding to the damsite location,
 - (iii) The maximum current storage space in acre-feet to be reserved exclusively for flood control and/or navigation purposes, or any multiple-use space (intermingled) when flood control or navigation is one of the purposes, with corresponding elevations in feet above mean sea level, and area in acres, at the upper and lower limits of said space,
 - (iv) The name of the project owner, and
 - (v) Congressional legislation authorizing the project for Federal participation.
- (e) List of projects. The following tables, "Pertinent Project Data--Section 208.11 Regulation," show the pertinent data for projects which are subject to this regulation.

List of Projects
(Non-Corps projects with Corps Regulation Requirements)

Project name (1)	State	County	Stream (1)	Project purpose (2)	Storage 1000 AF	Elev limits feet M.S.L.		Area in acres		Authorizing legis. (3)	Proj. owner (4)
						Upper	Lower	Upper	Lower		
Col. No. 1	2	3	4	5	6	7	8	9	10	11	12
Agency Valley Dam & Res.	OR	Malheur	N Fork Malheur R	FICR	60.0	3340.0	3263.0	1900	0	PL 68-292	USBR.
Alpine Dam	IL	Winnebago	Keith Cr	F	0.6	796.0	760.0	52	0	FWA Proj	Rkfd, IL.
Altus Dam & Res.	OK	Jackson	N Fork Red R	F	19.6	1562.0	1559.0	6800	6260	PL 761	USBR.
Anderson Ranch Dam & Res.	ID	Elmore	S Fk Boise R	IMR	132.6	1559.0	1517.5P	6260	735	Act of 1939	USBR.
Arbuckle Dam & Res.	OK	Murray	Rock Cr	FEI	423.2	4196.0	4039.6	4740	1150	53 Stat 1187	USBR.
Arrowrock Dam & Res.	ID	Elmore	Boise R	F	36.4	885.3	872.0	3130	2350	PL 594	USBR.
Bear Cr Dam	MO	Marion Falls	Bear Cr	MRC	62.5	872.0	827.0	2350	606	Act of 1902	USBR.
Bear Swamp	MA	Franklin	Deerfield R	FI	286.6	3216.0	2974.0	3100	200	32 Stat 388	USBR.
Fife Brook (Lo)	MA	Franklin	Deerfield R	F	8.7	546.5	520.0	540	0	PL 83-780	Hnbl, MO.
Bear Swamp PS (Upper)	MA	Franklin	Deerfield R	E	6.9	870.0	830.0	152	115	FERC 2669	NEPC.
Bellows Falls Dam & Lk.	VT	Cheshire	Connecticut R	E	8.9	1600.0	1550.0	118	102	Fed Pwr Act	NEPC.
Big Dry Creek and Div.	CA	Fresno	Big Dry Cr & Dog Cr	E	7.5	291.6	273.6	2804	836	FERC 1885	NEPC.
Blue Mesa Dam & Res.	CO	Gunnison	Gunnison R	F	16.2	425.0	393.0	1530	0	PL 77-228	Rclm, B CA.
Boca Dam & Res.	CA	Nevada	Little Truckee R	FER	748.5	7519.4	7393.0	9180	2790	PL 84-485	USBR
Bonny Dam & Res.	CO	Yuma	S Fork Republic R	I	32.8	5596.5	5521.0	873	52	PL 61-289	USBR.
Boysen Dam & Res.	WY	Fremont	Wild R	FI	8.0	5605.0	5596.0	980	873	PL 68-292	USBR.
Brantley Dam & Res.	NM	Eddy	Pecos R	F	128.2	3710.0	3672.0	5036	2042	PL 78-534	USBR.
Brownlee Dam & Res.	OR	Baker	Snake R	ICR	39.2	3672.0	3638.0	2042	331	PL 79-732	USBR.
Bully Cr Dam & Res.	OR	Malheur	Bully Cr	F	150.4	4732.2	4725.0	22170	19560	PL 78-534	USBR.
Camanche Dam & Res.	CA	San Joaquin	Mokelumne R	FEIQ	146.1	4725.0	4717.0	19560	16960		
Canyon Ferry Dam & Lk.	MT	Lewis Clark	Missouri R	EIQ	403.8	4717.0	4685.0	16960	9280		
Cedar Bluff Dam & Res.	KS	Trego	Smoky Hill R	FIRQ	348.5	3283.0	3210.7	21294	38	PL 92-515	USBR.
Cheney Dam & Res.	KS	Sedgwick	N Fork Ninnescah R	FE	975.3	2077.0	1976.0	13840	6650	FERC No 1971 -C	ID Pwr.
				FI	31.6	2516.0	2456.8	1082	140	PL 86-248	USBR.
				FRIE	200.0	235.5	205.1	7600	5507	PL 86-645	EE-MUD.
				RIE	230.9	205.1	92.0	5507	0		
				F	99.5	3800.0	3797.0	33535	32800	PL 78-534	USBR.
				FEI	795.1	3797.0	3770.0	32800	24125		
				EI	711.5	3770.0	3728.0	24125	11480		
				F	191.9	2166.0	2144.0	10790	6869	PL 78-534	USBR.
				IMCR	149.8	2144.0	2107.8	6869	2086		
				F	80.9	1429.9	1421.6	12420	9540	PL 86-787	USBR.
				MC	151.8	1421.6	1392.9	9540	1970		
					0.0	0.0	0.0	0	0		

Clark Canyon Dam & Res.	MT.....	Beaverhead..	Beaverhead R	F.....	79.1	5560.4	5546.1	5900	5160	PL 78-534...	USBR.
				FI.....	50.4	5546.1	5535.7	5160	4495		
				I.....	126.1	5535.7	5470.6	4495	220		
Del Valle Dam & Res.	CA.....	Alameda.....	Alameda Cr..	F.....	37.0	745.0	703.1	1060	710	PL 87-874...	DWR. CA.
				FIM.....	1.0	703.1	702.2	710	700		
				IMR.....	29.0	702.2	635.0	700	275		
Don Pedro Dam & Lk.	CA.....	Tuolumne....	Tuolumne R..	FIER.....	140.0	830.0	802.0	12900	11260	PL 78-534...	M&T. Irr.
				EIR.....	1381.0	802.0	600.0	11260	3520		
					308.0	600.0	342.0	3520	29		
				FEIM.....	48.0	5705.5	5578.0	684	130	PL 81-273...	USBR.
East Canyon Dam & Res.	UT.....	Morgan.....	East Canyon Cr								
Echo Dam & Res.	UT.....	Summit.....	Weber R.....	FEIM.....	74.0	5560.0	5450.0	1455	0	PL 81-83....	USBR.
Emigrant Dam & Res.	OR.....	Jackson.....	Emigrant Cr.	FIR.....	39.0	2241.0	2131.5	801	80	PL 83-606...	USBR.
Enders Dam & Res.	NE.....	Chase.....	Frenchman Cr	F.....	30.0	3127.0	3112.3	2405	1707	PL 78-534...	USBR.
				ICR.....	34.5	3112.3	3082.4	1707	658	PL 84-505...	
Folsom Dam & Lk.	CA.....	Sacramento..	American R..	FEIM.....	400.0	466.0	427.0	11450	9040		USBR.
				EIM.....	610.0	427.0	210.0	9040	0		
Fort Cobb Dam & Res.	OK.....	Caddo.....	Pond (Cobb) Cr	F.....	63.7	1354.8	1342.0	5980	4100	PL 419.....	USBR.
				IMCR.....	78.3	1342.0	1300.0	4100	337		
Foss Dam & Res.	OK.....	Custer.....	Washita R...	F.....	180.6	1668.6	1652.0	13140	8800	PL 419.....	USBR.
				IMRC.....	243.8	1652.0	1597.2	8800	1360		
Friant Dam & Millerton Lk.	CA.....	Fresno.....	San Joaquin R	FEIM.....	390.5	578.0	466.3	4850	2101	PL 75-392... PL 76-868...	USBR.
Galesville Dam.	OR.....	Douglas.....	Cow Cr.....	FEMCR.....	42.2	1881.5	1780.0	760	150	FERC No. 71. 61001.....	Dgls. CO.
Gaston Dam & Res.	NC.....	Halifax.....	Roanoke R...	FE.....	63.0	203.0	200.0	22500	20300	Fed Pwr Act.	VA Pwr.
		Northampton.									
Glen Elder Dam & Waconda Lk.	KS.....	Mitchel.....	Solomon R...	F.....	722.3	1488.3	1455.6	33682	12602	PL 78-534...	USBR.
				IM.....	204.8	1455.6	1428.0	12602	3341	PL 79-526...	
Glendo Dam & Res.	WY.....	Platte.....	N Platte R..	F.....	271.9	4653.0	4635.0	17990	12370	PL 78-534...	USBR.
				EIM.....	454.3	4635.0	4570.0	12370	3130		
Grand Coulee Dam & FDR Lk.	WA.....	Okanogan Grant	Columbia R..	FEI.....	5185.5	1290.0	1208.0	82280	45592	PL 89-561...	USBR.
H Neely Henry Dam & Res.	AL.....	Calhoun St. Clair	Coosa R.....	FE.....	49.7	508.0	502.5	11235	7632	PL 83-436...	AL Pwr.
Harris Dam & Res.	AL.....	Randolph....	Tallapoosa R	FE.....	215.0	793.0	785.0	10661	9012	PL 89-789...	AL Pwr.
Heart Butte Dam & Lk. Tschida.	ND.....	Grant.....	Heart R.....	F.....	147.9	2094.5	2064.5	6580	3400	PL 78-534...	USBR.
				IQ.....	69.0	2064.5	2030.0	3400	810		
Hells Canyon Dam & Res.	OR.....	Wallowa.....	Snake R.....	EN.....	11.7	1688.0	1683.0	2380	2280	FERC No 1971 -A	ID Pwr.
Hoover Dam & Lk Mead.	NV.....	Adams Mohave	Colorado R..	F.....	1500.0	1229.0	1219.6	162700	156500	PL 70-642 ..	USBR.
	AZ.....	Clark Mohave		FEIMCAR	15.8	1219.6	1083.0	156500	83500		
Hungry Horse Dam & Res.	MT.....	Flathead ...	S Fork Flathead R	FEI.....	2982.0	3560.0	3336.0	23800	5400	PL 78-329 ..	USBR.
Indian Valley Dam & Res.	CA.....	Lake.....	N Fork Cache Cr	FIMR.....	40.0	1485.0	1474.0	3975	3734	PL 84-984 ..	Yolo FC&W.
				IMR.....	260.0	1474.0	1334.0	3734	308		
Jamestown Dam & Res.	ND.....	Stutsman ...	James R.....	F.....	185.4	1454.0	1429.8	13210	2090	PL 78-534 ..	USBR.
				IQ.....	28.1	1429.8	1400.0	2090	160		
Jocassee Dam & Res.	SC.....	Pickens.....	Keowee R...	PRFC.....	1160.0	1110.0	1080.0	7565	6815	FERC 2503 ..	USBR Pwr.
Keowee Dam & Lk.	SC.....	Pickens.....	Keowee R...	FPMCAR	392.0	800.0	775.0	18372	13072	FERC 2503 ..	Duke Pwr.

Kerr Dam	MT	Lake	Flathead R	FER	1219.0	2893.0	2883.0	125560	120000	FERC No 5	MT Pwr.
Flathead Lk											
Kerr Dam & Lk Hudson. (Markham Ferry Project).	OK	Mayes	Grand Neosho R	F	244.2	636.0	619.0	18800	10900	PL 76-476	GRD Auth.
Keyhole Dam & Res.	WY	Crook	Belle Fourche R	F	140.5	4111.5	4099.3	13730	9410	PL 78-534	USBR.
Kirwin Dam & Res.	KS	Phillips	N Fork Solomon R	IQ	185.8	4099.3	4051.0	9410	820		
				F	215.1	1757.3	1729.3	10640	5080	PL 78-534	USBR.
				ICR	89.6	1729.2	1697.0	5080	1010	PL 79-732; PL 79-526	
Lake Kemp Dam & Res.	TX	Wichita	Wichita R	F	234.9	1156.0	1144.0	23830	15590	SD 144	WF&C.
Leesville Dam & Res.	VA	Campbell	Roanoke R	MI	268.0	1144.0	1114.0	15590	3350		WID2.
Lemon Dam & Res.	CO	Pttsylvania	Florida R	EQ	37.8	613.0	600.0	3235	2400	Fed Pwr Act	Appl Pwr.
Lewis M Smith Dam & Res.	AL	Walker	Sipsey Fork; Black Warrior R	FIM	39.0	8148.0	8023.0	622	62	PL 84-485	USBR.
Little Wood	ID	Culman	Blain	F	280.6	522.0	510.0	25700	21200	Fed Pwr Act	AL Pwr.
				E	394.3	510.0	488.0	21200	15097		
Logan Martin Dam & Res.	AL	Blain	Little Wood R	FI	30.0	5237.3	5127.4	572	0	PL 84-993	USBR.
Los Banos Dam & Detention.	CA	Talladega	Cossa R	F	245.3	477.0	465.0	26310	15260	PL 83-436	AL Pwr.
Los Banos Dam & Detention Res.	CA	Merced	Los Banos Cr	E	67.0	465.0	460.0	15263	11887		
Lost Creek Dam & Res.	UT	Merced	Los Banos Cr	R	20.6	327.8	231.2	467	0		USBR.
Lovewell Dam & Res.	KS	Morgan	Lost Cr	F	14.0	353.5	327.8	619	467	PL 86-488	USBR.
Marshall Ford Dam & Res.	TX	Jewell	White Rock Cr	FEIM	20.0	6005.0	5912.0	365	93	PL 81-273	USBR.
Mayfield Dam & Res.	WA	Travis	Colorado R	F	50.5	1595.3	1582.6	5025	2986	PL 78-534	USBR.
McGee Creek Dam & Res.	OK	Lewis	Cowlitz R	ICR	24.9	1582.6	1571.7	2986	1704	PL 79-732	USBR.
Medicine Cr Dam Harry. Strunk Lk.	NE	Atoka	McGee Cr	F	779.8	714.0	681.0	29060	18955	PL 73-392	USBR.
Mossyrock Dam.	WA	Frontier	Medicine Cr.	NEIM	810.5	681.0	618.0	18955	8050	PL 78-534	USBR.
Davisson Lk	WA	Lewis	Cowlitz R	FER	21.4	425.0	415.0	2250	2030	FPC No 2016-A	Tac WN.
				F	85.3	595.5	577.1	5540	3810	PL 94-423	USBR.
Mt Park Dam Tom Steed. Res.	OK	Atoka	McGee Cr	MCR	108.0	577.7	515.1	3810	370		
Navajo Dam & Res.	NM	Frontier	Medicine Cr.	F	52.7	2386.2	2366.1	3483	1840	PL 78-534	USBR.
New Bullards Bar Dam & Res.	CA	Lewis	Cowlitz R	ICR	26.8	2366.1	2343.0	1840	701	PL 84-505	USBR.
New Exchequer Dam & Lk.	CA	Lewis	Cowlitz R	FER	1397.0	778.5	600.0	11830	4250	FERC No 2016-B	Tac, WN
				F	20.3	1414.0	1411.0	7130	6400	PL 90-503	USBR.
				MRC	89.0	1411.0	1386.3	6400	1270		
				FEIRQ	1036.1	6085.0	5990.0	15610	7400	PL 84-485	USBR.
				FEIMR	170.0	1956.0	1918.3	4809	4225	PL 89-298	YCWA.
				EIMR	790.9	1918.3	1447.5	4225	129		
				FEIR	400.0	867.0	799.7	7110	4849	PL 86-645	Mrcd, Irr.
				EIR	451.6	799.7	660.0	4849	1900		
				IR	171.0	660.0	467.0	1900	150		

New Melones Dam & Lk.	CA	Tuolumne ... Calaveras...	Stanislaus R	FEIMR..... EIMR..... IMR..... E.....	450.0 1670.0 300.0 14.0	1088.0 1049.5 808.0 965.0	1049.5 808.0 540.0 938.0	12500 10900 3500 0 196	10900 3500 0 134	PL 87-874... FERC 1889...	USBR. WMEC.
Northfield Mt (Up) PS.	MA	Franklin....	Connecticut.	F..... IMRC.....	98.8 30.7	2331.4 2304.3	2304.3 2280.4	5316 2181	2181 587	PL 78-534... PL 79-526... PL 79-732...	USBR.
Norton Dam & Kieth. Sebelius Lk	KS	Norton.....	Prairie Dog Cr	F..... IMRC.....	98.8 30.7	2331.4 2304.3	2304.3 2280.4	5316 2181	2181 587	PL 78-534... PL 79-526... PL 79-732...	USBR.
Ochoco Dam & Res.	OR	Crook.....	Ochoco Cr...	FICR.....	52.5	3136.2	0.0	1130	130	PL 84-992...	USBR.
Oroville Dam & Lk.	CA	Butte.....	Feather R...	FEIMAR..... EIMAR.....	750.0 2788.0	900.0 848.5	848.5 210.0	15800 13346	13346 0	PL 85-500...	CA.
Pactola Dam & Res.	SD	Pennington..	Rapid Cr....	F..... IM.....	43.1 55.0	4621.5 4580.2	4580.2 4456.1	1230 860	860 100	PL 78-534...	USBR.
Palisades Dam & Res.	ID	Bonneville..	Snake R.....	FIE.....	1202.0	5620.0	5452.0	16100	2170	PL 81-864...	USBR.
Paonia Dam & Res.	CO	Gunnison ..	Muddy Cr....	FIR.....	17.0	6447.5	6373.0	334	120	PL 80-177... PL 84-485... PL 77-228...	USBR. Grd. Auth.
Pensacola Dam Grand. Lake O' the Cherokees.	OK	Mayes.....	Grand (Neosho) R	F..... E.....	525.0 1192.0	755.0 745.0	745.0 705.0	59200 46500	46500 17000	PL 77-228...	Grd. Auth.
Pineview Dam & Res.	UT	Weber.....	Odgen R.....	FEIM.....	110.0	4900.0	4818.0	2874	0	PL 81-273...	USBR.
Platoro Dam & Res.	CO	Conejos.....	Conejos R...	F..... IR.....	6.0 54.0	10034.0 10027.5	10027.5 9911.0	947 920	920 0	PL 76-640...	USBR.
Priest Rapids Dam. & Res.	WA	Grant.....	Columbia R..	FER.....	44.0	488.0	481.5	7600	6500	FERC No 2114 -A	Grnt, PUD.
Prineville Dam & Res.	OR	Crook.....	Crooked R...	FIRC.....	233.0	3257.9	3114.0	3997	140	PL-84-992...	USBR.
Prosser Cr Dam & Res.	CA	Nevada.....	Prosser Cr..	C..... FC.....	8.6 20.0	5703.7 5761.0	5661.0 5703.7	334 745	86 334	PL 84-858... PL 85-706...	USBR.
Pueblo Dam & Res.	CO	Pueblo	Arkansas R .	F..... IR.....	93.0 261.4	4898.7 4880.5	4880.5 4764.0	5671 4640	4640 421	PL 87-590 ..	USBR.
Red Willow Dam Hugh. Butler Lk.	NE	Frontier ...	Red Willow Cr	F..... IRC.....	48.9 27.3	2604.9 2581.8	2581.8 2558.0	2682 1629	1629 787	PL 78-534 .. PL 85-783 .. PL 84-505 ..	USBR.
Ririe Dam & Res.	ID	Bonneville .	Willow Cr ..	FIRC	99.0	5119.0	5023.0	150	360	PL 87-874 ..	USBR.
Roanoke Rapids Dam & Res.	NC	Halifax	Roanoke R ..	EC	16.8	132.0	128.0	4600	4100	FPC 2009 ...	VA, Pwr.
Rocky Reach Dam Lk Entiat.	WA	Chelan	Columbia R .	FER	36.0	707.0	703.0	9920	9490	FERC No 2145	Chln PUD.
Rocky River PS Lk Candlewood.	CT	Litchfield .	Housatonic R	E	142.5	430.0	418.0	5608	4692	FERC 2576 ..	CLPC.
Ross Dam & Res.	WA	Whatcom	Skagit R ...	E	1052.0	1602.5	1475.0	11700	4450	FERC 553 ...	Sttl.
Sanford Dam & Lk. Meredith.	TX	Hutchison ..	Canadian R .	F..... IMCRQ	462.1 761.3	2965.0 2941.3	2941.3 2860.0	21640 17320	17320 4500	PL 81-898 ..	USBR.
Savage River Dam & Res.	MD	Garrett	Savage R ...	FMA	20.0	1468.5	1317.0	366	0	PL 78-534 ..	Ptmc Comm.
Scoggins Dam Henry Hagg Lk.	.....?	.....	Scoggins Cr	FIR	56.3	305.8	235.3	116	4	PL 89-596 ..	USBR.
Shadehill Dam & Res.	SD	Perkins	Grand R	F..... IQ	218.3 80.9	2302.0 2271.9	2271.9 2250.8	9900 4800	4800 2800	PL 78-534 ..	USBR.

Shasta Dam Lk.	CA	Shasta	Sacramento R	FEIA	1300.0	1067.0	1018.6	29570	23894	PL 75-392	USBR.
Shepaug Dam & Lk.	CT	Litchfield	Housatonic R	EIA	3241.0	1018.6	735.8	23894	2200		
Smith Mtn Dam & Res.	VA	Bedford	Roanoke R	E	5.0	200.0	172.0	1882	1125	FERC 2576	CLPC.
		Franklin								Fed Pwr Act	Appl Pwr.
		Roanoke			40.8	795.0	793.0	20600	20200		
		Pttsylvania									
Stampede Dam & Res.	CA	Sierra	Little Truckee R	FEM	22.0	5949.0	5942.1	3430	3230	PL 84-858	USBR.
Starvation Dam and Res	UT	Duchesne	Strawberry R	EM	199.4	5942.0	5798.0	3230	210		
Stevens Creek Dam & Res.	GA	Columbia	Savannah River	FIM	165.3	5712.0	5595.0	3310	689	PL 84-485	USBR.
Stevenson Dam Lk Zoar	CT	Litchfield	Housatonic R	P	10.5	187.5	183.0	4300	0	FERC 2535	SC E&G.
Summer Dam & Lk.	NM	De Baca	Pecos R	E	5.0	108.0	80.0	1148	516	FERC 2576	CLPC.
Tat Momolikot. Dam & Lake.	AZ	Pinal	Santa Rosa Wash	FI	51.4	4261.0	4200.0	2835	0	PL 83-780	USBR.
Tiber Dam & Res.	MT	Libert Toole	Marias R	FIC	198.5	1539.0	1480.0	11790	0	PL 89-298	BIA.
				F	400.9	3012.5	2993.0	23150	17890	PL 78-534	USBR.
				FIQ	268.0	2993.0	2976.0	17890	13790		
				IQ	121.7	2976.0	2966.4	13790	11710		
Trenton Dam & Res.	NB	Hitchcock	Republican R	F	134.1	2773.0	2752.0	7940	4922	PL 78-534	USBR.
Turners Falls (Low) Dam & Lk.	MA	Franklin	Connecticut R	IRC	99.8	2752.0	2720.0	4922	1572	PL 84-505	USBR.
Twin Buttes Dam & Lake.	TX	Tom Green	Concho R	E	8.7	185.0	176.0	2110	1880	FERC 1889	WMEC
Twitchell Dam & Res.	CA	Santa Barbara	Cuyama R	F	454.4	1969.1	1940.2	23510	23510	PL 85-152	USBR
Upper Baker Dam Baker. Lk.	WA	Whatcom	Baker R	IM	150.0	1940.2	1885.0	9080	670	PL 78-534	USBR
Vallecito Dam & Res.	CO	La Plata	Los Pinos R	F	89.8	651.5	623.0	3671	2556	PL 83-774	USBR
Vernon Dam & Lk.	VT	Windham	Connecticut R	IM	135.6	623.0	504.0	2556	0		
Wanapum Dam & Res.	WA	Grant	Columbia R	FE	184.6	724.0	674.0	4985	2375	PL 89-298	Fgt P&L
Wanship Dam & Rockport.	UT	Summit	Weber R	FEI	125.4	7665.0	7582.5	2720	350	PL 61-288	USBR
Warm Springs Dam & Res.	OR	Malheur	Middle Fork Malheur R	E	18.3	220.1	212.1	2550	1980	PL 68-292	NEPC
Waterbury Dam & Res.	VT	Washington	Little R	FER	151.6	571.5	560.0	14300	13350	FERC No 2114 -B	Grnt FUD
Webster Dam & Res.	KS	Rocks	S Fork Solomon R	FEIM	61.0	6037.0	5930.0	1077	121	PL 81-273	USBR
Weiss Dam & Res.	AL	Cherokee	Coosa R	FICR	191.0	3406.0	3327.0	460	90	PL 78-534	Vale USBR
Wells Dam L Pateros.	WA	Douglas	Columbia R	FP	27.7	617.5	592.0	1330	890	PL 78-534	VT
				F	183.4	1923.7	1892.5	8480	3772	PL 78-534	USBR
				IRC	72.1	1892.5	1860.0	3772	906	PL 79-526	USBR
				F	397.0	574.0	564.0	50000	30200	PL 79-732	
				E	148.4	564.0	558.0	30200	19545	PL 83-436	AL Pwr
				FER	74.0	781.0	771.0	10000	8000	FERC No 2149	Dgls FUD
Wilder Dam & Lk.	VT	Windsor	Connecticut R	E	13.3	385.0	380.0	3100	2240	FERC 1893	NEPC
Yellowtail Dam & Bighorn Lk.	MT	Big Horn	Bighorn R	F	258.3	3657.0	3640.0	17280	12600	PL 78-534	USBR
				FEIQ	240.3	3640.0	3614.0	12600	6915		FUD
				EQ	336.1	3614.0	3547.0	6915	4150		

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- (1) Cr-Creek; CS-Control Structure; Div-Diversion; DS-Drainage Structure; FG-Floodgate; Fk-Fork; GIWW-Gulf Intercoastal Waterway; Lk-Lake; L&D-Lock & Dam; PS-Pump Station; R-River; Res-Reservoir
- (2) F-Flood Control; N-Navigation; P-Corps Hydropower; E-Non Corps Hydropower; I-Irrigation; M-Municipal and/or Industrial Water Supply; C-Fish and Wildlife Conservation; A-Low Flow Augmentation or Pollution Abatement; R-Recreation; Q-Water Quality or Silt Control
- (3) FCA-Flood Control Act; FERF-Federal Energy Regulatory Comm; HD-House Document; PL-Public Law; PW-Public Works; RHA-River & Harbor Act; SD-Senate Document; WSA-Water Supply Act
- (4) Appl Pwr-Appalachian Power; Chln PUD-Chelan Cnty PUD 1; CLPC-CT Light & Power Co; Dgls PUD-Douglas Cnty PUD 1; DWR-Department of Water Resources; EB-MUD-East Bay Municipal Utility Dist; GRD-Grand River Dam Auth; Grnt PUD-Grant Cnty PUD 2; Hnbl-city of Hannibal; M&T Irr-Modesto & Turlock Irr; Mrcd Irr-Merced Irr; NEPC-New England Power Co; Pgnt P&L-Pugent Sound Power & Light; Ptmc Comm-Upper Potomac R Comm; Rclm B-Reclamation Board; Rkfd-city of Rockford; Sttl-city of Seattle; Tac-City of Tacoma; Vale USBR-50% Vale Irr 50% USBR; WF&CWID-City of Wichita Falls and Wichita Cnty Water Improvement District No. 2; WMEC-Western MA Electric Co; YCWA-Yuba City Water Auth; Yolo FC&W-Yolo Flood Control & Water Conserv Dist

(Sec. 7, Pub. L. 78-534, 58 Stat. 890 (33 U.S.C. 709); the Federal Power Act, 41 Stat. 1063 (16 U.S.C. 791(A)); and sec. 9, Pub. L. 83-436, 68 Stat. 303)
[43 FR 47184, Oct. 13, 1978, as amended at 46 FR 58075, Nov. 30, 1981; 55 FR 21508, May 24, 1990]

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TITLE 33--NAVIGATION AND NAVIGABLE WATERS

CHAPTER II--CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

PART 222--ENGINEERING AND DESIGN--Table of Contents

Sec. 222.5 Water control management (ER 1110-2-240).

(a) Purpose. This regulation prescribes policies and procedures to be followed by the U.S. Army Corps of Engineers in carrying out water control management activities, including establishment of water control plans for Corps and non-Corps projects, as required by Federal laws and directives.

(b) Applicability. This regulation is applicable to all field operating activities having civil works responsibilities.

(c) References. Appendix A lists U.S. Army Corps of Engineers publications and sections of Federal statutes and regulations that are referenced herein. (d) Authorities--(1) U.S. Army Corps of Engineers projects. Authorities for allocation of storage and regulation of projects owned and operated by the Corps of Engineers are contained in legislative authorization acts and referenced project documents. These public laws and project documents usually contain provisions for development of water control plans, and appropriate revisions thereto, under the discretionary authority of the Chief of Engineers. Some modifications in project operation are permitted under congressional enactments subsequent to original project authorization. Questions that require interpretations of authorizations affecting regulation of specific reservoirs will be referred to CDR USACE (DAEN-CWE-HW), WASH DC 20314, with appropriate background information and analysis, for resolution.

(2) Non-Corps projects. The Corps of Engineers is responsible for prescribing flood control and navigation regulations for certain reservoir projects constructed or operated by other Federal, non-Federal or private agencies. There are several classes of such projects: Those authorized by special acts of Congress; those for which licenses issued by the Federal Energy Regulatory Commission (formerly Federal Power Commission) provide that operation shall be in accordance with instructions of the Secretary of the Army; those covered by agreements between the operating agency and the Corps of Engineers; and those that fall under the terms of general legislative and administrative provisions. These authorities, of illustrative examples, are described briefly in Appendix B.

(e) Terminology: Water control plans and reservoir regulation schedules. (1) Water control plans include coordinated regulation schedules for project/system regulation and such additional provisions as may be required to collect, analyze and disseminate basic data, prepare detailed operating instructions, assure project safety and carry out regulation of projects in an appropriate manner.

(2) The term "reservoir regulation schedule" refers to a compilation of operating criteria, guidelines, rule curves and specifications that govern basically the storage and release functions of a reservoir. In general, schedules indicate limiting rates of reservoir releases required during various seasons of the year to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system. Schedules are usually expressed in the form of graphs and tabulations, supplemented by concise specifications.

(f) General policies. (1) Water control plans will be developed for reservoirs, locks and dams, reregulation and major control structures and interrelated systems to conform with objectives and specific provisions of authorizing legislation and applicable Corps of Engineers reports. They will include any applicable authorities established after project construction. The water control plans will be prepared giving appropriate consideration to all applicable Congressional Acts relating to operation of Federal facilities, i.e., Fish and Wildlife Coordination Act (Pub. L. 85-624), Federal Water Project Recreation Act-Uniform Policies (Pub. L. 89-72), National Environmental Policy Act of 1969 (Pub. L. 91-190), and Clean Water Act of 1977 (Pub. L. 95-217). Thorough analysis and testing studies will be made as necessary to establish the optimum water control plans possible within prevailing constraints.

(2) Necessary actions will be taken to keep approved water control plans up-to-date. For this purpose, plans will be subject to continuing and progressive study by personnel in field offices of the Corps of Engineers. These personnel will be professionally qualified in technical areas involved and familiar with comprehensive project objectives and other factors affecting water control. Organizational requirements for water control management are further discussed in ER 1110-2-1400.

(3) Water control plans developed for specific projects and reservoir systems will be clearly documented in appropriate water control manuals. These manuals will be prepared to meet initial requirements when storage in the reservoir begins. They will be revised as necessary to conform with changing requirements resulting from developments in the project area and downstream, improvements in technology, new legislation and other relevant factors, provided such revisions comply with existing Federal regulations and established Corps of Engineers policy.

(4) Development and execution of water control plans will include appropriate consideration for efficient water management in conformance with the emphasis on water conservation as a national priority. The objectives of efficient water control management are to produce beneficial water savings and improvements in the availability and quality of water resulting from project regulation/operation. Balanced resource use through improved regulation should be developed to conserve as much water as possible and maximize all project functions consistent with project/system management. Continuous examination should be made of regulation schedules, possible need for storage reallocation (within existing authority and constraints) and to identify needed changes in normal regulation. Emphasis should be placed on evaluating conditions that could require deviation from normal release schedules as part of drought contingency plans (ER 1110-2-1941).

(5) Adequate provisions for collection, analysis and dissemination of basic data, the formulation of specific project regulation directives, and the performance of project regulation will be established at field level.

(6) Appropriate provisions will be made for monitoring project operations, formulating advisories to higher authorities, and disseminating information to others concerned. These actions are required to facilitate proper regulation of systems and to keep the public fully informed regarding all pertinent water control matters.

(7) In development and execution of water control plans, appropriate attention will be given to project safety in accordance with ER 1130-2-417 and ER 1130-2-419 so as to insure that all water impounding structures are operated for the safety of users of the facilities and the general public. Care will be exercised in the development of reservoir regulation schedules to assure that controlled releases minimize project impacts and do not jeopardize the safety of persons engaged in activities downstream of the facility. Water control plans will include provisions for issuing adequate warnings or otherwise alerting all affected interests to possible hazards from project regulation activities.

(8) In carrying out water control activities, Corps of Engineers personnel must recognize and observe the legal responsibility of the National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), for issuing weather forecasts and flood warnings, including river discharges and stages. River forecasts prepared by the Corps of Engineers in the execution of its responsibilities should not be released to the general public, unless the NWS is willing to make the release or agrees to such dissemination. However, release to interested parties of factual information on current storms or river conditions and properly quoted NWS forecasts is permissible. District offices are encouraged to provide assistance to communities and individuals regarding the impact of forecasted floods. Typical advice would be to provide approximate water surface elevations at locations upstream and downstream of the NWS forecasting stream gages. Announcement of anticipated changes in reservoir release rates as far in advance as possible to the general public is the responsibility of Corps of Engineers water control managers for projects under their jurisdiction.

(9) Water control plans will be developed in concert with all basin interests which are or could be impacted by or have an influence on project regulation. Close coordination will be maintained with all appropriate international, Federal, State, regional and local agencies in the development and execution of water control plans. Effective public information programs will be developed and maintained so as to inform and educate the public regarding Corps of Engineers water control management activities.

(10) Fiscal year budget requests for water control management activities will be prepared and submitted to the Office of the Chief of Engineers in accordance with requirements established in Engineer Circular on Annual Budget Requests for Civil Works Activities. The total annual costs of all activities and facilities that support the water control functions, (excluding physical

operation of projects, but including flood control and navigation regulation of projects subject to 33 CFR 208.11) are to be reported. Information on the Water Control Data Systems and associated Communications Category of the Plant Replacement and Improvement Program will be submitted with the annual budget. Reporting will be in accordance with the annual Engineer Circular on Civil Works Operations and Maintenance, General Program.

(g) Responsibilities: US Army Corps of Engineers projects--(1) Preparation of water control plans and manuals. Normally, district commanders are primarily responsible for background studies and for developing plans and manuals required for reservoirs, locks and dams, reregulation and major control structures and interrelated systems in their respective district areas. Policies and general guidelines are prescribed by OCE engineer regulations while specific requirements to implement OCE guidance are established by the division commanders concerned. Master Water Control Manuals for river basins that include more than one district are usually prepared by or under direct supervision of division representatives. Division commanders are responsible for providing such management and technical assistance as may be required to assure that plans and manuals are prepared on a timely and adequate basis to meet water control requirements in the division area, and for pertinent coordination among districts, divisions, and other appropriate entities.

(2) Public involvement and information--(i) Public meeting and public involvement. The Corps of Engineers will sponsor public involvement activities, as appropriate, to appraise the general public of the water control plan. In developing or modifying water control manuals, the following criteria is applicable.

(A) Conditions that require public involvement and public meetings include: Development of a new water control manual that includes a water control plan; or revision or update of a water control manual that changes the water control plan.

(B) Revisions to water control manuals that are administratively or informational in nature and that do not change the water control plan do not require public meetings.

(C) For those conditions described in paragraph (g)(2)(i)(A) of this section, the Corps will provide information to the public concerning proposed water control management decisions at least 30 days in advance of a public meeting. In so doing, a separate document(s) should be prepared that explains the recommended water control plan or change, and provides technical information explaining the basis for the recommendation. It should include a description of its impacts (both monetary and nonmonetary) for various purposes, and the comparisons with alternative plans or changes and their effects. The plan or manual will be prepared only after the public involvement process associated with its development or change is complete.

(D) For those conditions described in paragraph (g)(2)(i)(A) of this section, the responsible division office will send each proposed water control manual to the Army Corps of Engineers

Headquarters, Attn: CECW-EH-W for review and comments prior to approval by the responsible division office.

(ii) Information availability. The water control manual will be made available for examination by the general public upon request at the appropriate office of the Corps of Engineers. Public notice shall be given in the event of occurring or anticipated significant changes in reservoir storage or flow releases. The method of conveying this information shall be commensurate with the urgency of the situation and the lead time available.

(3) Authority for approval of plans and manuals. Division commanders are delegated authority for approval of water control plans and manuals, and associated activities.

(4) OCE role in water control activities. OCE will establish policies and guidelines applicable to all field offices and for such actions as are necessary to assure a reasonable degree of consistency in basic policies and practices in all Division areas. Assistance will be provided to field offices during emergencies and upon special request.

(5) Methods improvement and staff training. Division and district commanders are responsible for conducting appropriate programs for improving technical methods applicable to water control activities in their respective areas. Suitable training programs should be maintained to assure a satisfactory performance capability in water control activities. Appropriate coordination of such programs with similar activities in other areas will be accomplished to avoid duplication of effort, and to foster desirable exchange of ideas and developments. Initiative in re-evaluating methods and guidelines previously established in official documents referred to in paragraph (e) of this section is encouraged where needs are evident. However, proposals for major deviations from basic concepts, policies and general practices reflected in official publications will be submitted to CDR USACE (DAEN-CWE) WASH DC 20314 for concurrence or comment before being adopted for substantial application in actual project regulation at field level.

(h) Directives and technical instruction manuals. (1) Directives issued through OCE Engineer Regulations will be used to foster consistency in policies and basic practices. They will be supplemented as needed by other forms of communication.

(2) Engineering Manuals (EM) and Engineer Technical Letters (ETL) are issued by OCE to serve as general guidelines and technical aids in developing water control plans and manuals for individual projects or systems.

(3) EM 1110-2-3600 discusses principles and concepts involved in developing water control plans. Instructions relating to preparation of "Water Control Manuals for specific projects" are included. EM 1110-2-3600 should be used as a general guide to water control activities. The instructions are sufficiently flexible to permit adaptation to specific regions. Supplemental information regarding technical methods is provided in numerous documents distributed to field offices as "hydrologic references."

(4) Special assistance in technical studies is available from the Hydrologic Engineering Center, Corps of Engineers, 609 Second Street, Davis, California 95616 and DAEN-CWE-HW.

(i) Water control manuals for US Army Corps of Engineers projects. (1) As used herein, the term "water control manual" refers to manuals that relate primarily to the functional regulation of an individual project or system of projects. Although such manuals normally include background information concerning physical features of projects, they do not prescribe rules or methods for physical maintenance or care of facilities, which are covered in other documents. (References 15 and 23, Appendix A.)

(2) Water control manuals prepared in substantially the detail and format specified in instructions referred to in paragraph 8 are required for all reservoirs under the supervision of the Corps of Engineers, regardless of the purpose or size of the project. Water Control manuals are also required for lock and dam, reregulation and major control structure projects that are physically regulated by the Corps of Engineers. Where there are several projects in a drainage basin with interrelated purposes, a "Master Manual" shall be prepared. The effects of non-Corps projects will be considered in appropriate detail, including an indication of provisions for interagency coordination.

(3) "Preliminary water control manuals," for projects regulated by the Corps of Engineers should contain regulation schedules in sufficient detail to establish the basic plan of initial project regulation.

(4) As a general rule, preliminary manuals should be superseded by more detailed interim or "final" manuals within approximately one year after the project is placed in operation.

(5) Each water control manual will contain a section on special regulations to be conducted during emergency situations, including droughts. Preplanned operations and coordination are essential to effective relief or assistance.

(6) One copy of all water control manuals and subsequent revisions shall be forwarded to DAEN-CWE-HW for file purposes as soon as practicable after completion, preferably within 30 days from date of approval at the division level.

(j) Policies and requirements for preparing regulations for non-Corps projects. (1) Division and district commanders will develop water control plans as required by section 7 of the 1944 Flood Control Act, the Federal Power Act and section 9 of Pub. L. 436-83 for all projects located within their areas, in conformance with ER 1110-2-241, 33 CFR part 208. That regulation prescribes the policy and general procedures for regulating reservoir projects capable of regulation for flood control or navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; those under the jurisdiction of the International Joint Commission, United States and Canada, and the

Columbia River Treaty. ER 1110-2-241, 33 CFR part 208 permits the promulgation of specific regulations for a project in compliance with the authorizing acts. when agreement on acceptable regulations cannot be reached between the Corps Engineers and the owners. Appendix B provides a summary of the Corps of Engineers responsibilities for prescribing regulations for non-Corps reservoir projects.

(2) Water control plans will be developed and processed as soon as possible for applicable projects already completed and being operated by other entities, including projects built by the Corps of Engineers and turned over to others for operation.

(3) In so far as practicable, water control plans for non-Corps projects should be developed in cooperation with owning/operating agencies involved during project planning stages. Thus, tentative agreements on contents, including pertinent regulation schedules and diagrams, can be accomplished prior to completion of the project.

(4) The magnitude and nature of storage allocations for flood control or navigation purposes in non-Corps projects are governed basically by conditions of project authorizations or other legislative provisions and may include any or all of the following types of storage assignments:

(i) Year-round allocations: Storage remains the same all year.

(ii) Seasonal allocations: Storage varies on a fixed seasonal basis.

(iii) Variable allocations of flood control from year to year, depending on hydrologic parameters, such as snow cover.

(5) Water control plans should be developed to attain maximum flood control or navigation benefits, consistent with other project requirements, from the storage space provided for these purposes. When reservoir storage capacity of the category referred to in paragraph (j)(4)(iii) is utilized for flood control or navigation, jointly with other objectives, the hydrologic parameters and related rules developed under provisions of ER 1110-2-241, 33 CFR part 208 should conform as equitably as possible with the multiple-purpose objectives established in project authorizations and other pertinent legislation.

(6) Storage allocations made for flood control or navigation purposes in non-Corps projects are not subject to modifications by the Corps of Engineers as a prerequisite for prescribing 33 CFR 208.11 regulations. However, regulations developed for use of such storage should be predicated on a mutual understanding between representatives of the Corps and the operating agency concerning the conditions of the allocations in order to assure reasonable achievement of basic objectives intended. In the event field representatives of the Corps of Engineers, and the operating agency are unable to reach necessary agreements after all reasonable possibilities have been explored, appropriate background explanations and recommendations should be submitted to DAEN-CWE-HW for consideration.

(7) The Chief of Engineers is responsible for prescribing regulations for use of flood control or navigation storage and/or project operation under the provisions of the referenced legislative acts. Accordingly, any regulations established should designate the division/district commander who is responsible to the Chief of Engineers as the representative to issue any special instructions required under the regulation. However, to the extent practicable, project regulations should be written to permit operation of the project by the owner without interpretations of the regulations by the designated representative of the Commander during operating periods.

(8) Responsibility for compliance with 33 CFR 208.11 regulations rests with the operating agency. The division or district commander of the area in which the project is located will be kept informed regarding project operations to verify reasonable conformance with the regulations. The Chief of Engineers or his designated representative may authorize or direct deviation from the established water control plan when conditions warrant such deviation. In the event unapproved deviations from the prescribed regulations seem evident, the division or district commander concerned will bring the matter to the attention of the operating agency by appropriate means. If corrective actions are not taken promptly, the operating agency should be notified of the apparent deviation in writing as a matter of record. Should an impasse arise, in the event the project owner or the designated operating entity persists in noncompliance with regulations prescribed by the Corps of Engineers, the Office of Chief Counsel should be advised through normal channels and requested to take necessary measures to assure compliance.

(9) Regulations should contain information regarding the required exchange of basic data between the representative of the operating agency and the U.S. Army Corps of Engineers, that pertinent to regulation and coordination of interrelated projects in the region.

(10) All 33 CFR 208.11 regulations shall contain provisions authorizing the operating agency to temporarily deviate from the regulations in the event that it is necessary for emergency reasons to protect the safety of the dam, to avoid health hazards, and to alleviate other critical situations.

(k) Developing and processing regulations for non-Corps projects. Guidelines concerning technical studies and development of regulations are contained in ER 1110-2-241, 33 CFR part 8 and EM 1110-2-3600. Appendix C of this regulation summarizes steps normally followed in developing and processing regulations for non-Corps projects.

(l) Water control during project construction stage. Water control plans discussed in preceding paragraphs are intended primarily for application after the dam, spillway and outlet structures; major relocations; land acquisitions, administrative arrangements and other project requirements have reached stages that permit relatively normal project regulation. With respect to non-Corps projects, regulations normally become applicable when water control agreements have been signed by the designated signatories, subject to special provisions in specific cases. In some instances, implementation of regulations has been delayed by legal provisions, contract limitations, or other considerations. These delays can result in loss of potential project benefits and possible hazards. Accordingly, it is essential that appropriate water control and contingency

plans be established for use from the date any storage may accumulate behind a partially completed dam until the project is formally accepted for normal operations. Division commanders shall make certain that construction-stage regulation plans are established and maintained in a timely and adequate manner for projects under the supervision of the Corps of Engineers. In addition, the problems referred to should be discussed with authorities who are responsible for non-Corps projects, with the objective of assuring that such projects operate as safely and effectively as possible during the critical construction stage and any period that may elapse before regular operating arrangements have been established. These special regulation plans should include consideration for protection of construction operations; safety of downstream interests that might be jeopardized by failure of partially completed embankments; requirements for minimizing adverse effects on partially completed relocations or incomplete land acquisition; and the need for obtaining benefits from project storage that can be safely achieved during the construction and early operation period. --

(m) Advisories to OCE regarding water control activities--(1) General. Division commanders will keep the Chief of Engineers currently informed of any unusual problems or activities associated with water control that impact on his responsibilities.

(2) Annual division water control management report (RCS DAEN-CWE-16(R1)). Division commanders will submit an annual report on water control management activities within their division. The annual report will be submitted to (DAEN-CWE-HW) by 1 February each year and cover significant activities of the previous water year and a description of activities to be accomplished for the current year. Funding information for water control activities will be provided in the letter of transmittal for in-house use only. The primary-objective of this summary is to keep the Chief of Engineers informed regarding overall water management activities Corps-wide, thus providing a basis to carry out OCE responsibilities set forth in paragraph (g)(4) of this section.

(3) Status of water control manuals. A brief discussion shall be prepared annually by each division commander, as a separate section of the annual report on water control management activities discussed in paragraph (m)(2) of this section listing all projects currently in operation in his area, or expected to begin operation within one-year, with a designation of the status of water control manuals. The report should also list projects for which the Corps of Engineers is responsible for prescribing regulations, as defined in ER 1110-2-241, 33 CFR part 208.

(4) Monthly water control charts (RCS DAEN-CWE-6 (R1)). A monthly record of reservoirs/lakes operated by the Corps of Engineers and other agencies, in accordance with 33 CFR 208.11, will be promptly prepared and maintained by district/division commanders in a form readily available for transmittal to the Chief of Engineers, or others, upon request. Record data may be prepared in either graphical form as shown in EM 1110-2-3600, or tabular form as shown in the sample tabulation in Appendix D.

(5) Annual division water quality reports (RCS DAEN-CWE-15). By Executive Order 12088, the President ordered the head of each Executive Agency to be responsible for ensuring that all necessary actions are taken for prevention, control, and abatement of environmental pollution with respect to Federal facilities and activities under control of the agency. General guidance is provided in references 24 and 25, Appendix A, for carrying out this agency's responsibility. Annual division water quality reports are required by reference 24, Appendix A. The report is submitted in two parts. The first part addresses the division Water quality management plan while the second part presents specific project information. A major objective of this report is to summarize information pertinent to water quality aspects of overall water management responsibilities. The annual division water quality report may be submitted along with the annual report on water control management activities discussed in paragraph 13b above.

(6) Master plans for water control data systems (RCS DAEN-CWE-21). (i) A water control data system is all of the equipment within a division which is used to acquire, process, display and distribute information for real-time project regulation and associated interagency coordination. A subsystem is all equipment as defined previously within a district. A network is all equipment as defined previously which is used to regulate a single project or a group of projects which must be regulated interdependently.

(ii) Master plans for water control data systems and significant revisions thereto will be prepared by division water control managers and submitted to DAEN-CWE-HW by 1 February each year for review and approval of engineering aspects. Engineering approval does not constitute funding approval. After engineering approval is obtained, equipment in the master plan is eligible for consideration in the funding processes described in ER 1125-2-301 and engineering circulars on the annual budget request for civil works activities. Master plans will be maintained current and will:

(A) Outline the system performance requirements, including those resulting from any expected expansions of Corps missions.

(B) Describe the extent to which existing facilities fulfill performance requirements.

(C) Describe alternative approaches which will upgrade the system to meet the requirements not fulfilled by existing facilities, or are more cost effective than the existing system.

(D) Justify and recommend a system considering timeliness, reliability, economics and other factors deemed important.

(E) Delineate system scope, implementation schedules, proposed annual capital expenditures by district, total costs, and sources of funding.

(iii) Modified master plans should be submitted to DAEN-CWE-HW by 1 February, whenever revisions are required, to include equipment not previously approved or changes in scope or

approach. Submittal by the February date will allow adequate time for OCE review and approval prior to annual budget submittals.

(iv) Division commanders are delegated authority to approve detailed plans for subsystems and networks of approved master plans. Plans approved by the division commander should meet the following conditions:

(A) The plan conforms to an approved master plan.

(B) The equipment is capable of functioning independently.

(C) An evaluation of alternatives has been completed considering reliability, cost and other important factors.

(D) The plan is economically justified, except in special cases where legal requirements dictate performance standards which cannot be economically justified.

(v) Copies of plans approved by the division commander shall be forwarded to appropriate elements in OCE in support of funding requests and to obtain approval of Automatic Data Processing Equipment (ADPE), when applicable.

(vi) Water control data systems may be funded from Plant Revolving Fund; O&M General; Flood Control, MR&T, and Construction, General. Funding for water control equipment that serves two or more projects will be from Plant Revolving Fund in accordance with ER 1125-2-301. District and division water control managers will coordinate plant revolving fund requests with their respective Plant Replacement and Improvement Program (PRIP) representatives following guidance provided in ER 1125-2-301. Budget funding requests under the proper appropriation title should be submitted only if the equipment is identified in an approved master plan.

(vii) Justification for the Automatic Data Processing Equipment (ADPE) aspects of water control data systems must conform to AR 18-1, Appendix I or J as required. The "Funding for ADPE" paragraph in Appendixes I and J must cite the source of funds and reference relevant information in the approved master plan and detailed plan.

(viii) Division water control managers will submit annual letter summaries of the status of their respective water control systems and five-year plan for improvements. These summaries will be submitted to DAEN-CWE by 1 June for coordination with DAEN-CWO, CWB and DSZ-A, prior to the annual budget request. Summaries should not be used to obtain approval of significant changes in master plans. Sources of funding for all items for each district and for the division should be delineated so that total system expenditures and funding requests are identified. Changes in the master plan submitted 1 February should be documented in this letter summary if the changes were approved.

(7) Summary of runoff potentials in current season (RCS DAEN-CWO-2). (i) The Chief of Engineers and staff require information to respond to inquiries from members of Congress and others regarding runoff potentials. Therefore, the division commander will submit a snowmelt runoff and flood potential letter report covering the snow accumulation and runoff period, beginning generally in February and continuing monthly, until the potential no longer exist. Dispatch of supplemental reports will be determined by the urgencies of situations as they occur. The reports will be forwarded as soon as hydrologic data are available, but not later than the 10th of the month. For further information on reporting refer to ER 500-1-1, 33 CFR part 203.

(ii) During major drought situations or low-flow conditions, narrative summaries of the situation should be furnished to alert the Chief of Engineers regarding the possibility of serious runoff deficiencies that are likely to call for actions associated with Corps of Engineers reservoirs.

(iii) The reports referred to in paragraphs (m)(7) (i) and (ii) of this section will include general summaries regarding the status of reservoir storage, existing and forecasted at the time of the reports.

(8) Reports on project operations during flood emergencies. Information on project regulations to be included in reports submitted to the Chief of Engineers during flood emergencies in accordance with ER 500-1-1 include rate of inflow and outflow in CFS, reservoir levels, predicted maximum level and anticipated date, and percent of flood control storage utilized to date. Maximum use should be made of computerized communication facilities in reporting project status to DAEN-CWO-E/CWE-HW in accordance with the requirements of ER 500-1-1, 33 CFR part 203.

(9) Post-flood summaries of project regulation. Project regulation effects including evaluation of the stage reductions at key stations and estimates of damages prevented by projects will be included in the post flood reports required by ER 500-1-1, 33 CFR part 203.

(n) Water Control Management Boards. (1) The Columbia River Treaty Permanent Engineering Board was formed in accordance with the Columbia River Treaty with Canada. This board, composed of U.S. and Canadian members, oversees the implementation of the Treaty as carried out by the U.S. and Canadian Entities.

(2) The Mississippi River Water Control Management Board was established by ER 15-2-13. It consists of the Division Commanders from LMVD, MRD, NCD, ORD, and SWD with the Director of Civil Works serving as chairman. The purposes of the Board are:

(i) To provide oversight and guidance during the development of basin-wide management plans for Mississippi River Basin projects for which the US Army Corps of Engineers has operation/regulation responsibilities.

(ii) To serve as a forum for resolution of water control problems among US Army Corps of Engineers Divisions within the Mississippi River Basin when agreement is otherwise unobtainable.

(o) List of projects. Projects owned and operated by the Corps of Engineers subject to this regulation are listed with pertinent data in Appendix E. This list will be updated periodically to include Corps projects completed in the future. Federal legislation, Federal regulations and local agreements have given the Corps of Engineers wide responsibilities for operating projects which it does not own. Non-Corps projects subject to this regulation are included in Appendix A of ER 1110-2-241.

Appendix A to Sec. 222.5--References

1. The Federal Power Act, Pub. L. 436-83, approved 10 June 1920, as amended (41 Stat. 1063; 16 U.S.C. 791(a))
2. Section 3 of the Flood Control Act approved 22 June 1936, as amended (49 Stat. 1571; 33 U.S.C. 701(c))
3. Section 9(b) of Reclamation Project Act of 1939, approved 4 August 1939 (53 Stat. 1187; 43 U.S.C. 485)
4. Section 7 of the Flood Control Act approved 22 December 1944 (58 Stat. 890; 33 U.S.C. 709)
5. Section 5 of Small Reclamation Projects Act of 6 August 1956, as amended (70 Stat. 1046; 43 U.S.C. 422(e))
6. Section 9 of Pub. L. 436-83d Congress (68 Stat. 303)
7. The Fish and Wildlife Coordination Act of 1958, Pub. L. 85-624
8. The Federal Water Project Recreation Act Uniform Policies, Pub. L. 89-72
9. The National Environmental Policy Act of 1969, Pub. L. 91-190
10. The Clean Water Act of 1977, Pub. L. 95-217
11. Executive Order 12088, Federal Compliance with Pollution Control Standards, 13 October 1978
12. 33 CFR 208.10, Local flood protection works; maintenance and operation of structures and facilities (9 FR 9999; 9 FR 10203)
13. 33 CFR 208.11, Regulations for use of Storage Allocated for Flood Control or Navigation and/or Project Operation at Reservoirs subject to Prescription of Rules and Regulations by the Secretary of the Army in the Interest of Flood Control and Navigation (43 FR 47184)
14. AR 18-1
15. ER 11-2-101
16. ER 15-2-13
17. ER 500-1-1, 33 CFR part 203
18. ER 1110-2-241, 33 CFR part 208
19. ER 1110-2-1400
20. ER 1110-2-1402
21. ER 1110-2-1941

- 22. ER 1125-2-301
- 23. ER 1130-2-303
- 24. ER 1130-2-334
- 25. ER 1130-2-415
- 26. ER 1130-2-417
- 27. ER 1130-2-419
- 28. EM 1110-2-3600

**Appendix B to Sec. 222.5--Summary of Corps of Engineers Responsibilities
for Prescribing Regulations for Non-Corps Reservoir Projects**

Summary

1. (a) "Regulations for Use of Storage Allocated for Flood Control or Navigation and/or Project Operation at Reservoirs subject to Prescription of Rules and Regulations by the Secretary of the Army in the Interest of Flood Control and Navigation" (33 CFR 208.11) prescribe the responsibilities and general procedures for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States and Canada, and the Columbia River Treaty.

(b) Pertinent information on projects for which regulations are prescribed under Section 7 of the 1944 Flood Control Act, (Pub. L. 78-58 Stat. 890 (33 U.S.C. 709)) the Federal Power Act (41 Stat. 1063 (16 U.S.C. 791(A))) and Section 9 of Pub. L. 436-83d Congress (68 Stat. 303) is published in the Federal Register in accordance with 33 CFR 208.11.

Publication in the Federal Register establishes the fact and the date of a project's regulation plan promulgation.

2. Section 7 of Act of Congress approved 22 December 1944 (58 Stat. 890; 33 U.S.C. 709), reads as follows:

"Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: Provided, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the Lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department."

3. Section 9(b) of the Reclamation Project Act of 1939, approved 4 August 1939 (53 Stat. 1189, 43 U.S.C. 485), provides that the Secretary of the Interior may allocate to flood control or navigation as part of the cost of new projects or supplemental works; and that in connection therewith he shall consult with the Chief of Engineers and may perform any necessary investigations under a cooperative agreement with the Secretary of the Army. These projects are subject to 33 CFR 208.11 regulations.

4. Several dams have been constructed by State agencies under provisions of legislative acts wherein the Secretary of the Army is directed to prescribe rules and regulations for project operation in the interest of flood control and navigation. These projects are subject to 33 CFR 208.11 regulations.

5. There are few dams constructed under Emergency Conservation work authority or similar programs, where the Corps of Engineers has performed major repairs or rehabilitation, that are operated and maintained by local agencies which are subject to 33 CFR 208.11 regulations.

6. The Federal Power Act, approved 10 June 1920, as amended (41 Stat. 1063, 16 U.S.C. 791 (A)), established the Federal Power Commission, now Federal Energy Regulatory Commission (FERC), with authority to issue licenses for constructing, operating, and maintaining dams or other project works for the development of navigation, for utilization of water power and for other beneficial public uses in any streams over which Congress has jurisdiction. The Chief of Engineers is called upon for advice and assistance as needed in formulating reservoir regulation requirements somewhat as follows:

a. In response to requests from the FERC, opinions and technical appraisals are furnished by the Corps of Engineers for consideration prior to issuance of licenses by the FERC. Such assistance may be limited to general presentations, or may include relatively detailed proposals for water control plans, depending upon the nature and scope of projects under consideration. The information furnished is subject to such consideration and use as the Chairman, FERC, deems appropriate. This may result in inclusion of simple provisions in licenses without elaboration, or relatively detailed requirements for reservoir regulation schedules and plans.

b. Some special acts of Congress provide for construction of dams and reservoirs by non-Federal agencies or private firms under licenses issued by the FERC, subject to stipulation that the operation and maintenance of the dams shall be subject to reasonable rules and regulations of the Secretary of the Army in the interest of flood control and navigation. Ordinarily no Federal funds are involved, thus Section 7 of the 1944 Flood Control Act does not apply. However, if issuance of regulations by the Secretary of the Army is required by the authority under which flood control or navigation provisions are included as functions of the specific project or otherwise specified in the FERC license, regulation plans will be prescribed in accordance with 33 CFR 208.11 regulations.

7. Projects constructed by the Corps of Engineers for local flood protection purposes are subject to conditions of local cooperation as provided in Section 3 of the Flood Control Act approved 22 June 1936, as amended. One of those conditions is that a responsible local agency will maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army. Most such projects consist mainly of levees and flood walls with appurtenant drainage structures. Regulations for operation and maintenance of these projects has been prescribed by the Secretary of the Army in 33 CFR 208.10. When a reservoir is included in such a project, it may be appropriate to apply 33 CFR 208.10 in establishing regulations for operation, without requiring their publication in the Federal Register. For example, if the reservoir controls a small drainage area, has an uncontrolled flood control outlet with automatic operation or contains less than 12,500 acre-feet of flood control or navigation storage, 33 CFR 208.10 may be suitable. However, 33 CFR 208.11 regulations normally would be applicable in prescribing flood control regulations for the individual reservoir, if the project has a gated flood control outlet by which the local agency can regulate floods.

8. Regulation plans for projects owned by the Corps of Engineers are not prescribed in accordance with 33 CFR 208.11. However, regulation plans for projects constructed by the Corps of Engineers and turned over to other agencies or local interests for operation may be prescribed in accordance with 33 CFR 208.11.

9. The Small Reclamation Projects Act of 6 August 1956 provides that the Secretary of the Interior may make loans or grants to local agencies for the construction of reclamation projects. Section 5 of the Act provides in part that the contract covering any such grant shall set forth that operation be in accordance with regulations prescribed by the head of the Federal department or agency primarily concerned. Normally, 33 CFR 208.11 is not applicable to these projects.

Appendix C to Sec. 222.5--Procedures for Developing and Processing

Regulations for Non-Corps Projects in Conformance with 33 CFR 208.11

1. Sequence of actions. a. Discussions leading to a clarification of conditions governing allocations of storage capacity to flood control or navigation purposes and project regulation are initiated by District/Division Engineers through contacts with owners and/or operating agencies concerned at regional level.

b. Background information on the project and conditions requiring flood control or navigation services, and other relevant factors, are assembled by the District Engineer and incorporated in a "Preliminary Information Report". The Preliminary Information Report will be submitted to the Division Engineer for review and approval. Normally, the agency having jurisdiction over the particular project is expected to furnish information on project features, the basis for storage allocations and any other available data pertinent to the studies. The Corps of Engineers supplements this information as required.

c. Studies required to develop reservoir regulation schedules and plans usually will be conducted by Corps of Engineers personnel at District level, except where the project regulation affects flows in more than one district, in which case the studies will be conducted by or under supervision of Division personnel. Assistance as may be available from the project operating agency or others concerned will be solicited.

d. When necessary agreements are reached at district level, and regulations developed in accordance with 33 CFR 208.11 and EM 1110-2-3600, they will be submitted to the Division Commander for review and approval, with information copies for DAEN-CWE-HW. Usually the regulations include diagrams of operating parameters.

e. For projects owned by the Bureau of Reclamation, the respective Regional Directors are designated as duly authorized representatives of the Commissioner of Reclamation. By letter of 20 October 1976, the Commissioner delegated responsibilities to the Regional Directors as follows: "Regarding the designated authorization of representatives of the Commissioner of Reclamation in matters relating to the development and processing of Section 7 flood control regulations, we are designating each Regional Director as our duly authorized representative to sign all letters of understanding, water control agreements, water control diagrams, water control release schedules and other documents which may become part of the prescribed regulations. The Regional Director also will be responsible for obtaining the signature of the designated operating agency on these documents where such is required. Regarding internal coordination within the Bureau of Reclamation, the Regional Directors will obtain the review and approval of this office and at appropriate offices with our Engineering and Research Center, Denver, Colorado, prior to signing water control documents."

f. In accordance with the delegation cited in paragraph e, 33 CFR 208.11 regulations pertaining to Bureau of Reclamation projects will be processed as follows:

(1) After regulation documents submitted by District Commanders are reviewed and approved by the Division Commander they are transmitted to the respective Regional Director of the Bureau of Reclamation for concurrence of comment, with a request that tracings of regulation diagrams be signed and returned to the Division Commander.

(2) If any questions arise at this stage appropriate actions are taken to resolve differences. Otherwise, the duplicate tracings of the regulation diagram are signed by the Division Commander and transmitted to the office of the project owner for filing.

(3) After full agreement has been reached in steps (1) and (2), the text of proposed regulations is prepared in final form. Copies of any diagrams involved are included for information only.

(4) A letter announcing completion of action on processing the regulations, with pertinent project data as specified in paragraph 208.11(d)(11) of 33 CFR 208.11, and one copy of the signed tracings of diagrams are forwarded to HQDA (DAEN-CWE-HW) WASH DC 20314 for promulgation and filing. The office of the Chief of Engineers will forward the pertinent project

data to the Liaison Officer with the Federal Register, requesting publication in the Federal Register.

g. Regulations developed in accordance with 33 CFR 208.11 and applicable to projects that are not under supervision of the Bureau of Reclamation are processed in substantially the manner described above. All coordination required between the Corps of Engineers and the operating agency will be accomplished at field level.

h. Upon completion of actions listed above, Division Commanders are responsible for informing the operating agencies at field level that regulations have been promulgated.

2. Signature blocks: Some 33 CFR 208.11 regulations contain diagrams of parameter curves that cannot be published in the Federal Register, but are made a part thereof by appropriate reference. Each diagram bears a title block with spaces for the signature of authenticating officials of the Corps of Engineers and the owner/operating agency of the project involved.

3. Designation of Corps of Engineers Representatives. Division Commanders are designated representatives of the Chief of Engineers in matters relating to development and processing of 33 CFR 208.11 regulations for eventual promulgation through publication of selected data specified in paragraph (d)(11) Sec. 208.11. Division Commanders are designated as the Corps of Engineers signee on all letters of understanding, water control agreements and other documents which may become part of prescribed regulations for projects located in their respective geographic areas, and which are subject to the provisions of 33 CFR 208.11.

Appendix D to Sec. 222.5--Sample Tabulation

Bardwell Lake, Monthly Lake Report, May 1975

Day	Elevations 0800: 2,400 feet-MSL		Storage 2400 A-F	Evap DSF	Pump DSF	Release DSF	Inflow adj. DSF	Rain, inch
1.....	421.30	421.31	55979	28	2.0	0	84	0.00
2.....	421.32	421.37	56196	5	2.0	0	117	.00
3.....	421.43	421.44	56449	23	1.9	0	152	.14
4.....	421.45	421.47	56558	1	1.8	0	58	.00
5.....	421.49	421.34	56088	1	2.0	324	50	.00
6.....	421.20	421.01	54902	14	1.9	632	50	.00
7.....	420.88	420.89	54473	4	2.0	269	59	.09
8.....	420.89	420.91	54544	5	2.3	0	44	.00
9.....	420.90	420.89	54473	11	1.5	0	38	.00
10.....	420.90	420.90	54509	28	3.0	0	27	.00
11.....	420.91	421.35	56124	26	1.8	0	824	.00
12.....	421.54	421.65	57213	31	2.1	0	582	1.61
13.....	421.70	421.75	57578	29	2.2	0	216	.00
14.....	421.78	421.76	57614	34	1.9	249	303	.03
15.....	421.69	421.52	56739	22	1.9	643	225	.57
16.....	421.39	421.28	55871	39	2.1	535	138	.00
17.....	421.19	421.09	55188	10	2.2	393	119	.00
18.....	421.03	421.05	55045	46	2.0	143	60	.00
19.....	421.04	421.07	55116	17	2.3	0	55	.00
20.....	421.06	421.30	55943	21	2.1	0	440	.21
21.....	421.39	421.47	56558	20	2.1	0	332	.97
22.....	421.50	421.39	56268	42	2.1	247	145	.00
23.....	421.37	424.91	69726	31	2.0	328	7146	.22
24.....	425.61	426.15	74825	22	2.0	0	2595	2.38
25.....	426.15	426.55	76523	18	2.3	0	876	.11
26.....	426.72	426.80	77598	42	2.1	0	586	.00
27.....	426.95	427.00	78465	23	2.0	0	462	.00
28.....	427.14	427.15	79116	31	2.1	0	361	.19
29.....	427.31	427.70	81528	61	1.9	0	1279	.20
30.....	427.94	428.05	83082	11	2.0	0	796	1.02
31.....	428.20	428.22	83837	7	2.1	0	389	.00
Monthly total:								
(DSF).....				700	64	3763	18626	7.74
(A-F).....			27966	1389	126	7464	36945

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Appendix E to Sec. 222-5--List of Projects

Project Name \1\	State/county	Stream\1\	Project purpose\	Storage 1,000 AF	Elev limits feet		Area in acres		Auth legis \3\	
					MSL		Upper	Lower		
					Upper	Lower				
South Pacific Division										
Alamo Dam & Lk	AZ	Mohave, Yuma	Bill Williams R.	F	1,046.2	1,235.0	1,174.0	13,307	7,045	PL 78-534
Bear Dam	CA	Mariposa	Bear Cr.	F	7.7	413.5	344.0	265	0	PL 78-534
Black Butte Lk	CA	Tehama	Stony Cr.	FI	137.1	473.5	414.6	4,453	577	PL 78-534
Brea Dam & Res	CA	Orange	Brea Cr.	F	4.0	279.0	208.0	163	0	FCA -1936
Buchanan Dam H.V. Eastman Lk.	CA	Madera	Chowchilla R.	F	45.0	587.0	559.0	1,785	1,482	PL 78-874
				FI	140.0	587.0	466.0	1,785	484	
Burns Dam	CA	Merced	Burns Cr.	F	6.8	300.0	266.0	662	0	PL 78-534
Carbon Canyon Dam & Res	CA	Orange	Carbon Cr.	F	6.6	475.0	403.0	225	0	PL 74-738
Coyote Valley Dam Lk. Mendocino	CA	Mendocino	EF Russian R.	F	50.1	764.8	737.5	1,922	1,740	PL 75-761
				IM	72.3	737.5	637.0	1,740	20	
Dry Cr (Warm Springs) Lk	CA	Sonoma	Dry Cr.	F	136.0	495.0	451.1	3,600	2,600	PL 87-874
				MR	225.0	451.1	291.0	2,600	500	
Farmington Dam	CA	San Joaquin, Stanislaus	Littlejohn Cr.	F	52.0	156.5	120.0	4,107	0	PL 78-534
Fullerton Dam & Res	CA	Orange	Fullerton Cr.	F	0.8	290.0	261.0	62	0	FCA -1936
Hansen Dam & Res	CA	Los Angeles	Tujunga Wash	F	25.4	1,060.0	990.0	781	0	FCA -1936
Hidden Dam Hensley Lk.	CA	Madera	Fresno R.	F	65.0	540.0	485.8	1,567	811	PL 87-874
				FI	85.0	540.0	448.0	1,567	280	
Isabella Lk	CA	Kern	Kern R.	FI	568.1	2,605.5	2,470.0	11,454	26	PL 785-34
Lopez Dam & Res	CA	Los Angeles	Pocoima Wash	F	0.4	1,272.9	1,253.7	40	0	FCA -1936
Mariposa Dam	CA	Mariposa	Mariposa Cr.	F	15.0	439.5	370.0	512	0	PL 78-534
Martis Cr Lk	CA	Nevada	Martis Cr.	F	19.6	5,838.0	5,780.0	762	61	PL 87-874
Mathews Canyon Dam & Res	NV	Lincoln	Mathews Canyon	F	6.3	5,461.0	5,420.0	300	0	PL 81-516
Mojave River Dam & Res	CA	San Bernardino	Mojave R.	F	89.7	3,134.0	2,988.0	1,978	0	PL 86-645
New Hogan Lk	CA	Calaveras	Calaveras R.	F	165.0	713.0	666.2	4,333	2,818	PL 78-534
				FI	302.2	713.0	586.0	4,333	702	
Owens Dam	CA	Mariposa	Owens Cr.	F	3.6	407.0	347.0	174	0	PL 78-534
Painted Rock Dam & Res	AZ	Maricopa	Gila R.	F	2,491.5	661.0	524.0	53,200	0	PL 81-516
Pine Canyon Dam & Res	NV	Lincoln	Pine Canyon	F	7.8	5,675.0	5,604.0	254	0	PL 81-516
Pine Flat Lk Kings R	CA	Fresno	Kings R.	F	1,000.0	951.5	565.5	5,956	0	PL 78-534
Prado Dam & Res	CA	Riverside	Santa Ana R.	F	196.2	543.0	460.0	6,630	0	FCA -1936
San Antonio Dam & Res	CA	Los Angeles	San Antonio Cr.	F	7.7	2,238.0	2,125.0	145	0	FCA -1936
Santa Fe Dam & Res	CA	Los Angeles	San Gabriel R.	F	32.1	496.0	421.0	1,084	0	FCA 1936, 1941
Sepulveda Dam & Res	CA	Los Angeles	Los Angeles R.	F	17.4	710.0	668.0	1,335	0	FCA -1936
Success Lk	CA	Tulare	Tule R.	FI	75.0	652.5	588.9	2,477	409	PL 78-534
Terminus Dam Lk Kaweah	CA	Tulare	Kaweah R.	FI	136.1	694.0	570.0	1,913	276	PL 78-534
Whitlow Ranch Dam & Res	AZ	Pinal	Queen Cr.	F	35.6	2,166.0	2,056.0	828	0	PL 79-526
Whittier Narrows Dam & Res	CA	Los Angeles	San Gabriel Rio Hodo R.	F	34.9	228.5	184.0	2,411	0	FCA -1936

\1\ Res--Reservoir; Lk--Lake; Div--Diversion; R--River; Cr--Creek; Fk--Fork; L&D--Lock & Dam; GIWW--Gulf Intercoastal Waterway; FG--Floodgate; CS--
Control Structure; DS--Drainage Structure; PS--Pump Station.
\2\ F--Flood Control; N--Navigation; P--Hydropower; I--Irrigation; M--Municipal and/or Industrial Water/Supply; C--Fish and Wildlife Conservation; R--
Recreation; A--Low Flow Augmentation or Pollution Abatement; Q--Quality or Silt Control.
\3\ PL--Public Law; HD--House Document; RHA--River & Harbor Act; PW--Public Works; FCA--Flood Control Act; WSA--Water Supply Act.

[47 FR 44544, Oct. 8, 1982, as amended at 52 FR 15804, Apr. 30, 1987; 52 FR 23816, June 25, 1987; 57 FR 35757, Aug. 11, 1992. Redesignated at 60 FR
19851, Apr. 21, 1995]

This Appendix E is only a portion of the full Appendix to CFR 222.5. The Complete listing can be viewed at <http://www.access.gpo.gov/cgi-bin/get-cfr.cgi>

**WATER CONTROL MANUAL
VALLECITO DAM AND RESERVOIR**

Los Pinos River, Colorado

EXHIBIT C

**FIELD WORKING AGREEMENT
BETWEEN
DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION
AND
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
FOR
FLOOD CONTROL OPERATION
OF
UPPER COLORADO BASIN DAMS AND RESERVOIRS
IN COLORADO, NEW MEXICO, UTAH, AND WYOMING**

**U.S. Army Corps of Engineers
Sacramento District
Sacramento, California**

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FIELD WORKING AGREEMENT
BETWEEN
DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION
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UPPER COLORADO BASIN DAMS AND RESERVOIRS
IN
COLORADO, NEW MEXICO, UTAH AND WYOMING

THIS agreement, made and entered into this 23RD day of March
1978, between the Bureau of Reclamation and the Corps of Engineers,

WITNESSETH THAT:

WHEREAS, the Department of the Interior, acting through the Bureau of Reclamation, represented by its appropriate Regional Director, has constructed dams and reservoirs on the Upper Colorado Basin Rivers and their tributaries, and is responsible for normal operation and structural safety of the projects, and

WHEREAS, the Department of the Army, acting through the Corps of Engineers, represented by its appropriate District and Division Engineers, is responsible for the flood control operation plans of said dams and reservoirs in accordance with Section 7 of the 1944 Flood Control Act, (33 U.S.C. 709) and as promulgated in Code of Federal Regulations, Title 33, Part 208.11, 15 May 1976, and

WHEREAS, there is a need for a working agreement to insure a clear understanding of the flood control regulations and information exchange required for the projects operation.

NOW, THEREFORE, it is mutually understood and agreed by and between the parties hereto that the Upper Colorado Basin Projects will be operated in accordance with the following criteria:

(a) Conservation operations shall be in accordance with Bureau of Reclamation criteria as determined by the Regional Director or his designated representative.

(b) Storage space in the Upper Colorado Basin Projects shall be made available on a seasonal basis and operated for flood control in accordance with the Flood Control Diagrams currently in force.

(c) Emergency operation shall be in accordance with the procedure set forth on the Spillway Gate Operation Curves or procedures currently in force.

(d) The Regional Director is responsible for the safety of the dam and appurtenant facilities and for regulation of the Upper Colorado Basin Projects during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the Regional Director, and does not relieve the Regional Director of the responsibility for safety of the Upper Colorado Basin Projects.

(e) Revisions of the Flood Control or Spillway Gate Operation Curves and procedures may be developed as necessary by parties of this agreement. Each such revision shall be effective on the date specified.

(f) Except as necessary in order to comply with Emergency Operation procedures, the flood control regulations shall not be construed to require dangerously rapid changes in magnitude of releases. Releases will be made in a manner consistent with requirements for protecting the dam, reservoir and appurtenances from major damages.

(g) Any water impounded in the flood control space defined by the Flood Control Diagrams shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from the reservoir shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dams, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan or regulation may require releases to be completely curtailed in the interest of flood control or safety of the projects.

(h) The Regional Director shall procure such current basic hydrologic data and make such current determinations of required flood control space and releases at the reservoir as are required to accomplish the flood control objectives.

(i) The Regional Director shall keep the District Engineer advised of such reservoir operating data as the District Engineer may request. The minimum data required is reservoir storage, inflow, releases and streamflow at control points designated by the Flood Control Diagrams on a daily basis.

(j) The flood control regulations are subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the office of the Regional Director and shall include justification for the action.

(k) The Regional Director may temporarily deviate from the flood control regulations in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Division Engineer.

IN WITNESS WHEREOF, the parties hereto have caused this memorandum of agreement to be executed as the day and date first above written.

CORPS OF ENGINEERS

BUREAU OF RECLAMATION

By: William E. Vandenberg
Division Engineer
South Pacific Division

By: Donald
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**WATER CONTROL MANUAL
VALLECITO DAM AND RESERVOIR**

Los Pinos River, Colorado

EXHIBIT D

ENVIRONMENTAL INVENTORY PAPER

**U.S. Army Corps of Engineers
Sacramento District
Sacramento, California**

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**Vallecito Dam and Reservoir
Los Pinos River, Colorado**

Environmental Inventory Paper



**US Army Corps
of Engineers**
Sacramento District

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Metric Abbreviations

cm	centimeter
dm ³ /s	cubic decimeter per second
ha	hectare
hm	hectometer
hm ³	cubic hectometer
km	kilometer
km ²	square kilometer
m ³ /s	cubic meters per second
m	meter

Environmental Inventory Paper

Vallecito Dam and Reservoir Los Pinos River, Colorado

1.0 PURPOSE OF THE ENVIRONMENTAL INVENTORY PAPER

This Environmental Inventory Paper (EIP) has been prepared to provide a baseline environmental inventory and to update information on environmental resources and potential environmental issues in the vicinity of Vallecito Dam and Reservoir, Los Pinos River, Colorado. Baseline information provided will assist managers in the Water Management Section, dam operators at Vallecito Dam, and other decisionmakers in managing the environmental resources in and near the project site. The Water Management Section is updating the Vallecito Dam and Reservoir, Los Pinos River Basin, Colorado, Reservoir Regulation Manual, December 1973, and this EIP is intended for use as an exhibit to the updated Water Control Manual.

Field surveys were conducted by a Corps biologist in July 1997 as a basis of research for this EIP.

This EIP is not a National Environmental Policy Act (NEPA) document.

2.0 AUTHORIZED PURPOSE OF THE DAM/RESERVOIR

Vallecito Dam and Reservoir, Los Pinos (Pine) River, a tributary to San Juan River, Colorado, was authorized by the Flood Control Act of 1944. Vallecito Dam and Reservoir is designed to protect the rural towns of Gem Village, Bayfield, Oxford, Ignacio, and adjoining agricultural areas from flood damage by reducing the floodflows of the Los Pinos River and tributaries. The primary purposes of the Vallecito Dam and Reservoir project are (1) to provide supplemental and full irrigation service for about 18,500 acres (7,487 ha) of Southern Ute land and 45,000 acres (18,211 ha) of land outside the Southern Ute reservation and (2) to provide flood control for agricultural property, infrastructure, and some low areas (Corps, 1973). Irrigation water is distributed through privately owned systems under jurisdiction of the Bureau of Indian Affairs. The Pine River Irrigation District manages water operation at Vallecito Dam. However, the U.S. Bureau of Reclamation owns the dam and reservoir and is responsible for operation.

2.1 Flood Control Operation

The U.S. Army Corps of Engineers (Corps) monitors the operation of the Vallecito Dam and Reservoir for flood control. The Vallecito project was financed by the Pine River Irrigation District and the Federal Government, including the Bureau of Indian Affairs. The Pine River Irrigation District operates the Vallecito project for water supply, recreation, and fish and wildlife.

River Irrigation District operates the Vallecito project for water supply, recreation, and fish and wildlife.

Vallecito Dam and Reservoir is operated for flood control in accordance with flood control regulations prescribed by the Secretary of the Army. The primary objective of flood control operation is to minimize flood damages downstream by limiting discharges from Vallecito Reservoir, insofar as possible, to the existing nondamaging safe channel capacity of 2,000 cfs (57 m³/s). Water stored in the flood control space as determined from the Corps' water control diagram will be released as rapidly as possible without causing flows in Los Pinos River downstream from Vallecito Dam to exceed the existing nondamaging safe channel capacity of 2,000 cfs (57 m³/s) according to the Vallecito Dam and Reservoir Water Control Manual.

Vallecito Reservoir is operated to provide conditional storage space for control of forecasted snowmelt runoff. Authorized project objectives do not provide for reservation of space exclusively for control of rain floods. Space for rain floods is provided only to the extent it is incidentally available as a result of withdrawal of water for conservation. Such incidental storage, together with the surcharge, is of considerable value in reducing rain flood peaks.

3.0 DAM/RESERVOIR LOCATION AND DESCRIPTION

Vallecito Dam and Reservoir is in southwest Colorado approximately 15 miles (24 km) north of Bayfield, Colorado, on U.S. Highway 160 at the confluence of Vallecito Creek and Los Pinos River (see plate 1).

Vallecito Reservoir is located in the San Juan National Forest. The reservoir area has facilities for camping, picnicking, swimming, boating, and fishing. Several resorts operate on private lands adjoining the reservoir area.

Construction of Vallecito Dam by the U.S. Bureau of Reclamation commenced May 14, 1938, and was completed in early 1941. Features of the Vallecito project include a dam and reservoir and recreational facilities (see plate 2). Vallecito Dam is a zoned, earth and rockfill structure rising 126 feet (38 m) above the streambed. The dam contains 3,738, 000 cubic yards (2.9x10¹² hm³) of fill. The crest of the dam at elevation 7673.0 feet (2,339 m) is about 4,010 feet (1,222 m) long and 35 feet (11 m) wide. The spillway structure is located in the right abutment of the dam. Three radial gates, each 37 feet (11 m) high by 19 feet (6 m) wide, control discharges into the 2,300-foot-long (701-m-long) concrete-lined channel. The spillway design capacity is 30,000 cubic feet per second (850 m³/s). The outlet works consist of a twin-section concrete conduit through the right abutment, controlled by two slide gates 5-feet (1.5 m) by 5 feet (1.5 m). Capacity at elevation 7,665.0 feet (2,336 m) is 2,910 cubic feet per second (82 m³/s). Vallecito Reservoir has a capacity of 129,700 acre-feet (160 hm³) at gross pool, of which 125,400 acre-feet (155 hm³) is active capacity for joint irrigation and flood control purposes. The maximum flood space available is 115,400 acre-feet (142 hm³). The reservoir has a maximum surface area of 2,720 acres (1,101 ha) at elevation 7,665 feet (2,336 m) (gross pool).

4.0 EXISTING CONDITIONS AND TRENDS - PHYSICAL FACTORS

4.1 Surface Water

Hydrology. Vallecito Reservoir is located in the Pine River watershed, which has a drainage area of 270 square miles (699 km²). Perennial drainages flowing into the reservoir include Pine River, Freeman Creek, Grimes Creek, D Creek, Vallecito Creek, Berri Creek, North Canyon, and Graham Creek. The watershed consists of densely forested land. Spring snowmelt generates the largest inflow volume, beginning in late March or early April in the lower elevations of the watershed. In May, when snow begins to melt in the higher mountains, the runoff increases and normally reaches a peak in late May or early June. Heavy rainstorms, which may occur any time from mid-June through December, may also cause peak inflows (USBR, 1996).

Water levels in the reservoir are influenced by seasonal inflows and obligatory releases. Reservoir surface elevations were reviewed during the period 1942-92, and an average monthly water level was calculated. When the reservoir is at capacity, there are 2,720 surface water acres (1,101 ha) at the gross pool elevation of 7,665 feet (2,336 m) above mean sea level. On average, the reservoir drops 6 feet (1.8 m) by the beginning of July, another 8 feet (2.4 m) by the beginning of August, and 6 more feet (1.8 m) by early September, for a total of 20 feet (6 m) during the primary recreation-use season. The total annual drawdown averages 24 feet (7 m) (USBR, 1996).

An average of 253,500 acre-feet (313 hm³) of water is released each year from Vallecito Reservoir. Approximately 166,200 acre-feet (205 hm³) is diverted for irrigating about 18,500 acres (7,487 ha) of land administered by the Bureau of Indian Affairs and about 45,000 acres (18,211 ha) of land privately owned, for a total of about 63,500 acres (USBR, 1983).

Water Quality. An extensive water-quality database exists for a U.S. Geological Survey (USGS) site on Vallecito Creek about 3.5 miles (6 km) upstream from the confluence with Vallecito Reservoir. Water chemistry samples have been collected four times each year from 1963 to the present. Results of samples collected in water years 1991 and 1992 indicated good water-quality conditions of the incoming water supply (USGS, 1992 and 1993). Since releases from the reservoir into Pine River are eventually used as drinking water for the towns of Bayfield and Ignacio, Maximum Contaminant Levels (M.C.L.) recommended by the U.S. Environmental Protection Agency (USEPA, 1993) were compared to the sampling results from Vallecito Creek. For those parameters with M.C.L. values, concentrations in Vallecito Creek were well below the recommended standards except for coliform bacteria. The goal for coliform bacteria is zero, but a count of 38 was reported for streptococci bacteria in August 1991. Other counts exceeded 1, but the counting conditions were not ideal, indicating that sample holding times or some other conditions were not optimum (USBR, 1996).

USBR conducted a surface- and ground-water quality study during 1992 and 1993 within and adjacent to Vallecito Reservoir to determine the extent of fecal coliform and nutrient contamination of the reservoir and to determine baseline water-quality data for the area. This program was conducted under a technical assistance agreement with the Colorado Department of Health. Fecal coliform and trace metal samples were taken from domestic wells and monitoring wells at various locations along the shoreline, from reservoir surface-water tributaries, and from reservoir open-water locations. For purposes of this study, a standard of 240 fecal coliform colonies per 100 ml was considered to be a threshold value for contamination of untreated surface waters.

The USBR study indicated that the reservoir currently does not have a large-scale problem with fecal coliform contamination. However, several specific surface-water locations were identified where fecal coliform contamination was evident: Root Creek; Five Branches Marina area; vicinity of Graham Creek Campground; and Gut Canyon. Most of these locations are in the southern part of the reservoir area. No fecal contamination problems were identified for domestic wells sampled. USBR monitoring wells and reservoir surface-water samples generally showed no detectable contamination. A preliminary conclusion of the study was that the high transmissivity of the groundwater system serves to rapidly dilute fecal contamination from human sources. Metals concentrations were within drinking water standards for all sampling locations.

The Colorado Division of Wildlife (CDOW) has identified a concern with elevated mercury levels in fish tissue. One northern pike in the 3- to 42-inch (8- to 107-cm) size class that was collected from the reservoir in 1991 showed a concentration of 0.598 mg/liter. This value, which represented a fillet sample, exceeded the Colorado Department of Health hazard level of 0.5 mg/liter.

Based on a field reconnaissance conducted October 27-28, 1993, and discussions with USBR and the Pine River Irrigation District personnel, the following water quality issues were identified for Vallecito Reservoir:

-Algal blooms are evident in the reservoir during the summer and fall; periodically, dense algae grow in the outlet works.

-Livestock grazing in areas adjacent to Vallecito Creek at the north end of the reservoir contributes to erosion and possible nutrient and coliform concerns.

[REDACTED]

-Leakage is possible from domestic septic systems from cabins near the reservoir.

4.2 Climate

The climate of the project area is characterized by strong seasonal variation, which reflects its mid-elevation setting and proximity to both the relatively warm and arid desert plateau to the south and the alpine influences of the San Juan Mountains to the north. The mean annual temperature is 43 degrees Fahrenheit, with recorded extremes of 101 °F and minus 38 °F. The average daily maximum temperature exceeds 70 °F from June through September and reaches 81.4 °F in July. January, the coldest month, has an average daily maximum of 37.6 °F and average low of 5.7 °F. The frost-free season lasts approximately 90 days.

Annual precipitation averages approximately 25 inches (64 cm), with most falling in the winter months as snow. Average annual snowfall is 131 inches (333 cm), enough to maintain a snow cover throughout much of the winter. December and January are the snowiest months, each averaging approximately 28 inches (71 cm). June is the driest month, but the remainder of the summer is fairly moist, reaching an average monthly total of nearly 3 inches (8 cm) in August. Much of the summer precipitation is associated with thunderstorms, which occur on about 45 days each summer. Strong winds are associated with some of the thunderstorm activity, occasionally resulting in hazardous boating conditions. The prevailing winds are from the southwest.

4.3 Soils/Slope

The great majority of land area at Vallecito is classified as having severe soil limitations, which the Natural Resources Conservation Service (NRCS) defines as soils with limitations that can only be offset with costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures. For the most part, the severe limitations are based on slope considerations. Many areas within the project vicinity have slopes in excess of 10 percent, a steepness that presents limitations to many land uses. Areas with slopes less than 10 percent are concentrated in a few areas, including the area below the dam, the wetlands in the northern portion of the USBR property, and the eastern shoreline vicinity between the Pine River and Wilson Creek. Other small areas with slopes of less than 10 percent are scattered throughout the project area; however, they are usually isolated and too small to support more intensive uses. Slope is a limiting factor for many uses on the west side of the reservoir where slopes in excess of 10 percent predominate.

Other limitations include wetness and the presence of large stones or rock outcrops. Areas near the northern portion of the USBR property boundary and near the inlet of Freeman Creek are poorly drained. Rock outcrops/shallow depth to bedrock occur in many of the areas with slopes in some of the alluvial deposit areas, including the area below the dam.

Shoreline erosion is evident in various locations around the reservoir where a combination of erosive soils and wave action has led to slope failure and a loss of trees. Near Aspen Point, a steeply eroding slope threatens the stability of County Road 501. Another problem area near the inlet of Vallecito Creek is an area used by kokanee salmon for spawning. Recreationists have

contributed to the problem along Vallecito Creek by scrambling down the steep bank to reach the creek. The breakdown of the bank at this location threatens a stately grove of ponderosa pine (USBR, 1996).

Uncontrolled vehicular use has also removed vegetation in some areas near the north and northeastern shoreline, causing localized increases in erosion.

5.0 EXISTING CONDITIONS AND TRENDS - BIOLOGICAL FACTORS

5.1 Vegetation

The regional-scale natural vegetation in the Vallecito Reservoir area is the southwestern spruce-fir forest. Five local vegetation types occur within the area: mixed coniferous forest, grasslands, wetlands, and riparian and disturbed areas.

Mixed coniferous. Mixed coniferous vegetation is the predominant type within the study area. The overstory is dominated by ponderosa pine, Douglas fir, white fir, and quaking aspen. Common shrubs include Gambel's oak, mountain snowberry, and Oregon grape. The understory consists of various forb, grass, and grass-like species which include western yarrow, meadowrue, pussytoes, junegrass, smooth brome, bluegrass, and sedge.

The prevalence of moderate-sized to mature ponderosa pine, Douglas fir, white fir, and quaking aspen within the study area suggests that the majority of mixed coniferous forest areas have reached or nearly reached community climax. Some areas within the mixed coniferous forest include young saplings that typically grow in the lower portions of the overstory with Gambel's oak, mountain snowberry, and Oregon grape. Based on observations completed during field reconnaissance, the mixed coniferous forest is in good ecological condition.

Grasslands. Grasslands within the area are small, isolated populations that are concentrated in the southwestern, western, northwestern, and northeastern portions of the Vallecito Project area. This vegetation type is characterized by a dominant herbaceous layer, but may also include a scattered distribution of shrub species. Herbaceous species commonly present within this type include golden hairy aster, common dandelion, white Dutch clover, salisfy, western yarrow, narrowleaf plantain, wild rye, bluegrass, smooth brome, and foxtail barley.

Although the majority of grasslands in the area are in fair to good ecological condition, some in the northeastern and northwestern portions of the area have been heavily grazed by livestock. The presence of ruderal species, such as the common dandelion and hound's tongue, in some of the grasslands indicates that disturbances resulting from livestock grazing and other activities may be facilitating the establishment of ruderal species. Livestock that graze in USFS range allotments adjacent to the reservoir are allowed to graze within the area during September and early October. Roads created by uncontrolled vehicle travel were also observed along the

northeastern portion of the study area adjacent to Vallecito Reservoir and may facilitate the establishment of weedy species.

Wetlands. Palustrine, emergent wetlands (wet meadows) occur in the northwestern portion of the Vallecito Project area and support a prevalence of herbaceous species. Herbaceous, hydrophytic species present in these wetlands include curly dock, field horsetail, sedge, broad-leaved cattail, Baltic rush, foxtail barley, and redtop. Several willows are also present along the margins of these wetlands. Shrub/scrub wetlands or willow bottom lands occur in the northern and eastern portions of the area. Shrub/scrub wetlands primarily occur in the northern and eastern portions of the area between Vallecito and Freeman Creeks. Soils present in this area are classified as hydric soils and support a prevalence of hydrophytic species. A small shrub/scrub wetland also occurs along the eastern shore of Vallecito Reservoir south of the Pine River inlet. These wetlands are characterized by a dominant shrub overstory and a minor understory of herbaceous species. Dominant shrub species include willow and Wood's rose. Herbaceous species commonly present in these wetlands include curly dock, field horsetail, sedges, Baltic rush, redtop, and bluegrass.

Wetlands in the area are in generally good ecological condition. Observations of vegetation in a wetland in the northwestern portion of the area indicated that livestock have intensively grazed wetland plants. The presence of Canada thistle in some of the wetlands indicates that disturbances resulting from livestock grazing and other activities may be facilitating the establishment of ruderal species.

Riparian Areas. The riparian community occurs along the margins of the Pine River and Vallecito, Grimes, Lost, and Freeman Creeks. These areas are characterized by a dominant overstory consisting of deciduous trees and shrubs and a subdominant herbaceous layer. Common tree and shrub species include narrowleaf cottonwood and willows. Dominant herbaceous species include curly dock, common plantain, sedges, Baltic rush, and redtop.

Riparian areas are in good condition ecologically. The presence of several ruderal species, such as Canada thistle and hound's tongue, in some of the riparian areas indicates that disturbances resulting from livestock grazing and other activities may be facilitating the establishment of ruderal species.

Disturbed Areas. These areas have been disturbed by construction of the dam and by other activities, such as concessions, marinas, campgrounds, homes, ranches, cabins, kiosks, pull-offs, and day-use (picnic) areas; therefore, the diversity of plant species supported is now limited. Plant species typically present in these areas include weedy species such as hound's tongue, yellow sweet clover, white sweet clover, and mullein. Introduced weed species are more prevalent in disturbed lands than other vegetation types present within the study area.

5.2 Wildlife

A number of habitat types associated with Vallecito Reservoir support a variety of wildlife resources. Important to the terrestrial habitats associated with the reservoir area are the aquatic habitats along the perennial and intermittent tributaries to the reservoir. The types range between deciduous stands, wetland and riparian areas, mixed coniferous forest, and grasslands, all of which contribute to the habitat mosaic available for area wildlife use.

The riparian habitat associated with Vallecito, Grimes, Lost, and Freeman Creeks and along the Pine River provides important habitat for a wide range of vertebrate and invertebrate species. The wetland areas that are found around the reservoir margin are also important for species diversity and support of viable populations.

Elk occupy the Vallecito Reservoir area year round. The Colorado Division of Wildlife (CDOW) has identified a portion of the western slope of Middle Mountain above the northeastern shoreline down to the Los Pinos River as elk winter range. Winter range is defined as the part of the home range that is occupied by 90 percent of the individuals of a specific area in 5 winters out of 10. Approximately 25 to 50 animals use this area. A much larger area is listed as an elk calving area, extending over Middle Mountain to the northeast. Cattle currently graze within these areas.

Mule deer are present throughout the entire area. The CDOW has designated the surrounding habitat as deer summer range with general migration movements. However, no designated fawning areas or migration corridors have been identified.

Black bears are present along the reservoir. Improper trash disposal by humans has caused conflicts between bears and humans. Mountain lions are also likely in the area, based on the amount of suitable habitat.

Furbearers expected in the area include coyote, bobcat, marten, beaver, muskrat, and raccoon. Although fur trapping has been done along the Pine River in the past, State law no longer allows the practice.

A number of waterfowl species nest along the reservoir. Water depletion during the spring can result in decreased brood rearing capabilities along the northern shore. Harassment of geese by OHVs (motorcycles) has been documented in this same area. Canada goose nesting may have been affected by periodic gravel operations along the northern portion of the reservoir. Available waterfowl nesting habitat is a limiting factor.

Osprey have nested along the southeastern shore of Vallecito Reservoir for several years. Three active nests were recorded in 1992; two nests successfully fledged young. Adult birds were present in 1993 and 1994, but no nesting activity was documented. It is unknown why the osprey nesting was absent in 1993 and 1994.

5.3 Fish

Vallecito Reservoir is considered a coldwater fishery. Eight recreational game species include kokanee salmon, rainbow trout, Snake River cutthroat trout, brown trout, brook trout, northern pike, walleye, and smallmouth bass. The only nongame species found in the reservoir is the white sucker. The following discussion focuses on the species that are found in Vallecito Reservoir. Separate discussions also are provided for such populations in the Pine River and threatened and endangered fish species that are known to occur in the downstream areas of the San Juan River drainage.

Game Fish. Kokanee salmon or landlocked Pacific sockeye salmon represents the primary game fish species in Vallecito Reservoir in terms of management. Since their initial introduction in 1955, kokanee have been stocked annually in April as fingerlings (2-inch [5-cm] length) in Vallecito Creek just upstream from the reservoir. The number of stocked fingerlings has ranged from about 200,000 to 350,000 during the past 10 years; the average is about 300,000 fish. The stocked fingerlings imprint upon the waters of the stream, which enables them to return to the release site in 3 to 5 years. After kokanee move into the reservoir, they feed on zooplankton throughout most of the year. Kokanee are vulnerable to fishing pressure in the reservoir, as indicated by the CDOW's estimate that about 2 percent of the stocked fish return as spawners.

Spawning runs of kokanee salmon are managed for both natural reproduction and artificial propagation. During the early spawning run in September, fish are allowed to move upstream into Vallecito and Grimes Creeks to use gravel substrates. A kokanee spawning survey conducted in 1993 identified habitat in both Grimes Creek (0.36 acre [0.14 ha]) and Vallecito Creek (0.46 acre/0.19 ha). The percentage of the available spawning habitat compared to the total area surveyed was 1.8 percent in Vallecito Creek and 6.2 percent in Grimes Creek. Check dams on Grimes Creek blocked access to about 50 percent of the kokanee spawning habitat until they were removed in 1994. These dams contributed to declines in the natural recruitment of fish to the kokanee population in Vallecito Reservoir. Other factors that have affected kokanee returns in recent years include surface releases from the spillway at the dam and reduced numbers of stocked fish. Surface releases in 1987 and 1988 resulted in an unknown number of kokanee and other game fish escaping from the reservoir. Young kokanee fingerlings exhibit a downstream migratory tendency which makes them prone to leave the reservoir during surface releases.

Although natural reproduction is estimated to produce about 75,000 to 100,000 fingerlings each year, this effort by itself would not sustain the kokanee population. As a result, fish are collected by the CDOW in October for an artificial propagation program. After installing a weir on the Vallecito Creek, CDOW collected the fish by seining and electrofishing techniques. An average of 1.2 million eggs (25-year period) are removed each year for fertilization and subsequent rearing in hatcheries. However, the number of eggs taken has declined dramatically, from about 410,500 in 1991 to 17,150 in 1992. The spawning program in Vallecito Creek helps provide hatchery stocks for Vallecito, Blue Mesa, and Granby Reservoirs in Colorado, and occasionally for hatcheries in New Mexico (USBR, 1996).

Rainbow trout has consistently represented an important part of the stocking program since 1952. During the past 10 years, the number of stocked rainbow trout has ranged from about 51,000 to 63,000 annually. The fish stocked as juveniles in May (9 to 10 inches [23 to 25 cm] in length) could reach 12 to 14 inches (30 to 36 cm) by the end of the first summer. However, most rainbow appear to be caught by fishermen during the first year after stocking, as indicated by the relatively low number of fish collected in annual gill net surveys (1 to 5 percent of the catch) and their dominance in creel harvests. As juvenile fish, rainbow trout feed on aquatic and terrestrial insects. Adults continue to feed mainly on invertebrates, as well as on smaller fish. Rainbow trout spawn in the spring (May through July); however, surveys by the Colorado Division of Wildlife show that there is no natural reproduction of rainbow trout in Vallecito Reservoir.

The relative abundance of Snake River cutthroat trout in Vallecito Reservoir varies annually depending upon the stocking program. This species has been stocked sporadically since 1977. Snake River cutthroat were stocked in 1994 and 1995 in an effort to increase shoreline fishing success and add variety to the reservoir fishery. The growth rate and feeding habits of Snake River cutthroat trout are generally similar to rainbow trout. Cutthroat trout spawn in streams from about April through June. According to surveys by the Colorado Division of Wildlife, cutthroat trout are not currently known to spawn in Vallecito Reservoir tributaries, but there is potential for successful spawning.

Relatively low numbers of brown trout also occur in Vallecito Reservoir. The presence of brown trout is the result of stocking in 1961-68, 1975, and 1977. Brown trout usually comprise less than 5 percent of the catch. In lakes, small brown trout feed heavily on zooplankton, gradually switching to bottom-dwelling insects as the fish grows. Fish greater than about 10 inches (25 cm) feed mainly on other fish. Brown trout usually mature in years 3 though 5 after hatching. Brown trout spawn in running water in the fall. Since this species is present in the reservoir without recent stocking, some limited natural reproduction is likely in the tributaries.

Brook trout also comprise a relatively small portion of the trout population in the reservoir. Since this species has not been stocked in Vallecito Reservoir since 1956, existing populations probably originated from Vallecito Creek, Grimes Creek, and Pine River. Brook trout are opportunistic sight-feeders that utilize both bottom-dwelling and drifting invertebrates. Although brook trout can spawn in ponds or lakes in areas of groundwater upwelling during the fall, spawning is not known to occur in the reservoir, according to surveys by the Colorado Division of Wildlife.

Three species—northern pike, walleye, and smallmouth bass—naturally reproduce in Vallecito Reservoir. Of these three species, northern pike is the most abundant, based on gill net surveys and creel census. The first and only planting of northern pike took place in 1962, when 8,400 fingerlings were released. Northern pike use flooded, grassy areas at the north end of the reservoir and an area near the islands by Graham Creek Campground for spawning during the spring immediately after ice-out. An important requirement is the presence of submerged tree stumps. The predominant food in the diet of northern pike is fish. This species is important for

keeping the white sucker densities under control. Walleye and smallmouth bass comprise a relatively small portion of the fish community in the reservoir. Surveys using gill nets (nets suspended vertically in the water) have shown that both species comprise less than 5 percent of the total catch. Walleye are spring spawners that utilize riprap substrates found along the face of the dam. Spawning habitat for smallmouth bass consists of nest structures that are built over sand and gravel substrates near instream cover. These fish spawn at the north end of the reservoir in late May and June. The predominant food items for walleye are fish, while insects and smaller fish are used by smallmouth bass.

The white sucker is considered to be the most abundant species in the reservoir, as indicated by its dominance in gill net surveys (52 to 58 percent of the total catch). The importance of white sucker in the reservoir is that they provide an important food source for predatory fish species such as northern pike, walleye, and smallmouth bass. These species spawn in spring and early summer in inlet areas or mouths of creeks. Coarse sand or gravel is the preferred substrate type.

The types of habitat in Vallecito Reservoir include shoreline and open water. Cover is generally limited to scattered cobble and boulders in the shoreline areas and along the original creek channels and submerged stumps. The predominant type of bottom is silt, sand, and gravel. During high-water levels in the reservoir, submerged terrestrial vegetation provides additional cover for fish. Riprap along the dam also is used as cover throughout the year. The habitat requirements of the river trout species in Vallecito Reservoir are generally similar for juvenile fish, which tend to use the shallow areas where there is cover and an abundance of food. Adult rainbow, brook, and brown trout prefer deeper portions of the reservoir during the day, and then use the shoreline areas in the morning and evening for feeding. Kokanee salmon and walleye tend to concentrate in the deeper portions of the reservoir in the summer. In contrast, adult Snake River cutthroat are concentrated along the shoreline of the reservoir. Northern pike and smallmouth bass are found near areas with cover. Important habitat used by these species for spawning was discussed previously.

Recreational fishing in the reservoir includes both shoreline and boat fishing. Although most of the shoreline areas are accessible, fishing pressure is concentrated near pull-off areas, campgrounds, boat launches, and areas near the dam. The majority of the fishing effort is in boats (e.g., 32,530 hours from boats versus 15,200 hours from the shoreline in 1992). Vallecito Reservoir holds the State record for northern pike (1971) and once held the record for brown trout (1972). The results of creel surveys demonstrated that rainbow trout and kokanee salmon are the primary species harvested. Total harvest from Vallecito Reservoir declined in 1992 as a result of (1) new opportunities to fishermen such as McPhee Reservoir; (2) mandated cuts in catchable rainbow trout stocking because percent returns were less than 60; and (3) kokanee escapement losses in 1987 and 1988 during surface releases from the dam spillway. The Pine River Irrigation District has agreed to make water releases through the bottom outlets whenever possible. Ice fishing at the reservoir from about December through March does not contribute significantly to the fish take.

Fish populations in the Pine River upstream from the reservoir are comprised of a mixture of trout (i.e., brown, rainbow, and cutthroat), white sucker, and sculpin. Cutthroats were the most abundant trout species found in recent sampling.

5.4 Threatened and Endangered Species

The species listed in the tabulation were identified through informal consultation with the Colorado Division of Wildlife and the U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service also provided a species list on June 25, 1997 (appendix A). These listed species can be found at Vallecito Dam and Reservoir area.

Federally Listed Species for Vallecito Reservoir

Bald eagle	<i>Haliaeetus leucocephalus</i>
American peregrine falcon	<i>Falco peregrinus anatum</i>
Colorado squawfish	<i>Ptychocheilus lucius</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>
Lynx	<i>Felix lynx Canadensis</i>

Bald eagle (*Haliaeetus leucocephalus*).

Status: State and Federal threatened.

Occurrence: The bald eagle is a winter resident at Vallecito Reservoir. The CDOW designated the reservoir and the lands along the shoreline as bald eagle winter range and the northern portion of the reservoir near Vallecito Creek as a bald eagle winter concentration area. The CDOW defines a concentration area as an area where the density of animals is 200 percent greater in 5 out of 10 winters. The eagles typically concentrate in the area from October 1 to about January 1, when the kokanee salmon spawn. Eagles occupy the reservoir area extensively during this period, with up to 30 bald eagles observed. Eagles use communal roost sites in large ponderosa pines along the reservoir shore and often use partly submerged tree stumps within the shallow-water area in the northern portion of the reservoir.

Bald eagles occupy this area until the winter freeze, although the adjacent Pine River drainage supports year-long eagle use. Bald eagle nesting has not been confirmed along the reservoir; however, individuals have been observed in the area during the spring and summer months, and nesting may have been attempted. Problems identified to date for Vallecito Reservoir include the presence of people inhibiting eagles' foraging along the northeastern perimeter of the reservoir. However, the current level of use does not significantly alter the eagles' foraging behavior to limit their food intake (USBR).

Background: Bald eagles winter along rivers, lakes, and reservoirs that support adequate fish or waterbird prey and have mature trees or large snags available for perch sites.

Bald eagles often roost communally during the winter in areas isolated from human disturbance. Factors causing declines in eagle populations include human persecution; the destruction of riparian, wetland, and coniferous forest habitats; and application of agricultural pesticides.

American Peregrine Falcon (*Falco peregrinus anatum*)

Status: State threatened and Federal endangered.

Occurrence: The American peregrine falcon occurs in the area, and the Arctic peregrine falcon may migrate through the area. An active peregrine eyrie is located approximately one-half mile (0.8 km) above the Pine River Campground. The birds successfully fledged young for the last 4 and possibly 5 years. In 1993, three young were confirmed to have fledged, and in 1994 two young successfully fledged. Cliff swallows appear to be the main prey item near the eyrie. However, peregrine falcons also have been observed foraging near the dam (USBR, 1996).

Background: Frequents bodies of water in open areas with cliffs and canyons nearby for cover and nesting. Drastic population decline in recent years is associated mostly with pesticide contamination (Zeiner, 1990).

Southwestern willow flycatcher (*Empidonax traillii extimus*)

Status: State (no listing) and Federal endangered.

Occurrence: The Southwestern willow flycatcher may occur in the Vallecito area. This flycatcher is associated with willow thickets and other shrub species along riparian areas. No surveys have been conducted for this species, and its status near Vallecito Reservoir is unknown. Appropriate habitat grows along the northern and southeastern shore of the reservoir and along both Vallecito and Grimes Creeks.

Background: Preferred habitats include dense willow thickets for nesting and roosting. Low-lying, exposed branches are used for singing posts and hunting perches. The species is consistently absent from otherwise apparently suitable areas where the lower branches of willows had been browsed heavily by livestock and most numerous where extensive thickets of low, dense willows edge on wet meadows, ponds, or backwaters. It is frequently parasitized by the brown-headed cowbird; that is, the cowbird lays its eggs in the willow flycatcher's nest (Zeiner, 1990).

River Otter (*Lutra canadensis*)

Status: State endangered and Federal proposed threatened.

Occurrence: The river otter occurs both in and around Vallecito Reservoir and along the Pine River. A population of otters was released along the Piedra River and has moved down the Pine River into Vallecito during the last few years. Four otters were recorded along the

Pine in 1993. Additional otters were observed in the reservoir and along the wetland areas northwest of the reservoir in 1994.

Background: Preferred habitats include thickets, tall wetland plants, hollow logs, stumps, snags, burrows, and other cavities. Suitable habitat consists of riparian and other wetland vegetation associated with a large, permanent water source (Zeiner, 1990).

The following species may be found within one-half mile (0.8 km) of the Vallecito Dam and Reservoir area:

Colorado squawfish (*Ptychocheilus lucius*).

Status: State and Federal endangered.

Occurrence: Colorado squawfish are found in the San Juan River drainage downstream from Vallecito Reservoir. These protected species could be affected by changes in existing water release patterns from Vallecito Reservoir. Adult and juvenile Colorado squawfish occur in the San Juan River from Lake Powell upstream to Hogback Diversion in New Mexico. In recent years (1987-90), young-of-the-year (that is, newly hatched) squawfish were collected near Shiprock, New Mexico, and Bluff, Utah; in the San Juan River; and in Lake Powell. The spawning period for squawfish is July and August, since young-of-the-year were collected in August through September. The USFWS has designated six reaches in the Colorado River drainage as critical habitat for the Colorado squawfish. The reaches are limited to the Upper Basin, with locations in portions of the Colorado, Green, Yampa, White, and San Juan Rivers. One critical habitat reach is located in the San Juan River downstream from the Pine River confluence. The location of this reach is defined as the San Juan River and its 100-year flood plain from the State Route Highway 371 Bridge near Farmington, New Mexico, to the San Juan arm of Lake Powell in Utah (USBR, 1996).

Background: The largest numbers of Colorado squawfish in the Colorado River Basin are in the Green River, where their numbers may be rising. Populations in the Colorado and Yampa Rivers are small but appear stable. Elsewhere, Colorado squawfish populations are small, although several recent discoveries have been made: A handful of larval squawfish were captured in 1995 for the first time in the Gunnison River upstream from the Redlands Diversion Dam and in 1995 in the Colorado River's Grand Valley. A small number of young squawfish were discovered about 30 miles (48 km) up the Price River in Utah in 1996. Recovery goals for this fish species are to establish naturally self-sustaining populations in the Green River and Colorado River sub-basins (USFWS, 1997).

Razorback sucker (*Xyrauchen texanus*).

Status: State and Federal endangered.

Occurrence: The razorback sucker is found in the San Juan River drainage downstream from Vallecito Reservoir. This protected fish species could be affected by changes in existing water release patterns from Vallecito Reservoir. The razorback sucker is known to occur at only one location in the San Juan River. In 1988, one razorback sucker was documented as far upstream in the San Juan River as Bluff, Utah. Razorback suckers have also been collected in the San Juan arm of Lake Powell. The primary period of use is the spawning season from April through June. Critical habitat for razorback sucker has been designated at 15 reaches in the Colorado River drainage. One of the critical habitat reaches is in an area downstream from Navajo Dam and Reservoir and the Pine River confluence with the San Juan River. The reach is located in the San Juan River from the Hogback Diversion to the San Juan arm of Lake Powell in Utah (USBR, 1996).

Background: Biologists recently discovered a spawning population of razorback suckers in the lower Green River. However, most razorbacks captured in recent years in the Green, Colorado, and Yampa Rivers are thought to be more than 20 years old, with very little known "recruitment" of young fish into the adult population, meaning few young are surviving to adulthood. Razorback populations are considered critical. The first priority for the razorback is to prevent their extinction in the wild (USFWS, 1997).

Lynx (Felis Lynx Canadensis)

Status: State and Federal Endangered.

Occurrence: The lynx was recorded by the Colorado Natural Heritage Program in the Vallecito area in 1911.

Background: The lynx prefers forests in high mountains in southwestern Colorado. Northern coniferous forests are the preferred habitat. Uneven stands with relatively open canopies and well developed understories, favorable habitat for snowshoe hares, are ideal. Studies of lynx in Colorado suggest a preference for dense spruce-fir stands in association with rock outcrops and large boulders. Their habitat includes dense coniferous forests in the subalpine zone and timberline where they use caves, rock crevices, overhanging banks, or hollow logs for denning. Providing good hare habitat can benefit lynx. This habitat includes shrubs and saplings which provide food as well as cover from predators. Lynx prefer mature forest with deadfall for denning. Preferred lynx hunting habitat consists of 20- to 30-year-old pole-size stands of timber.

Special Status Plant Species. According to information obtained from the U.S. Fish and Wildlife Service (USFWS) and the Colorado Natural Heritage Program (CNHP), the area does not include known or potential habitat for Federally listed, proposed, or Federal candidate plant species (USFWS, 1997; CNHP, 1997).

Pictureleaf wintergreen (*Pyrola Picta*), a State-listed sensitive species, was recorded in 1934 as occurring at Vallecito Reservoir. *Pyrola picta* is found on moist, mossy, and shaded conifer woods and streambanks to dry, open, sunny clearing and slopes, and from deep soils rich

in humus and leaf litter to gravelly, sandy, and rocky substrates and outcrops that include granite, quartz, and diorite periotite. Its current occurrence at Vallecito Reservoir is unknown.

6.0 EXISTING CONDITIONS AND TRENDS - SOCIOECONOMIC FACTORS

6.1 Land Use

Of the approximately 3,650 acres (1,477 ha) within the USBR project boundary for Vallecito Reservoir, 2,720 acres (1,101 ha) are occupied by the reservoir. The remaining 930 acres (376 ha) are above the reservoir boundary. The USFS owns and administers as public campgrounds about 93 acres (38 ha) within the project boundary. Another 10 acres (4 ha) within the project boundary has been developed for public recreational use, including the three marinas and several day use sites. About 792 acres (321 ha) are used as open space primarily for dispersed recreational use. The dam, spillway, Pine River Irrigation District headquarters, and other areas associated with reservoir operations take up the remaining 35 acres (14 ha).

USBR has also obtained flood easements on 200 acres (81 ha) at the north end of the project boundary, extending up the Pine River, to allow inundation of some adjacent lands when the reservoir reaches extreme high-water levels above gross pool.

USBR has also granted access across project lands to adjacent private lands and has also licensed several areas to private individuals for resort, camping, and other recreational uses. At several locations, including most of the east side of the reservoir and on the west side near Aspen Point, USFS lands abut USBR land. The USFS has grazing allotments adjacent to the reservoir. Project lands are used briefly in the spring and fall for moving cattle to and from summer pastures.

Many private lands abut USBR property along the Pine River below the dam, at Sawmill Point, along most of the northern portion of the USBR property, and on the east side of the reservoir along the Pine River. Extensive subdivisions have been built on adjacent private lands, particularly along the northern boundary and adjacent to Sawmill Point. Smaller subdivisions are located along Wilson Creek, the Pine River as it enters the project area, and in the area below the dam.

6.2 Socioeconomics

In the immediate Vallecito area, population is about 2,800 to 3,500 year-round, primarily seasonal residents. The Colorado Municipal Population Estimates (1996) indicate a population of 1,155 in Bayfield, the address for residents at Vallecito Reservoir.

Vallecito Reservoir is in La Plata County, which has the greatest number of people of the five counties in the extreme southwest of Colorado, usually called the Four Corners (the fifth county is San Juan County in New Mexico). The Colorado Division of Local Government predicts a 64 percent increase in employment in the Four Corners region in the next 30 years. The

increase is attributed to the strength of the tourism industry and proximity to numerous public lands. Most of the labor force in the region is employed in services, retail, and government. The State of Colorado (1994) estimated that the 86,000 visitors to Vallecito Reservoir contributed about \$2 million to the local economy through purchases of gasoline, groceries, lodging, meals, and other items.

6.3 Recreation

Recreational activities at Vallecito Reservoir include camping, nature watching, hiking, picnicking, shoreline fishing, boat fishing, pleasure boating, horseback riding, bicycling, waterskiing, swimming, canoeing or kayaking, and sailing. Some use during the winter includes cross-country skiing, snowmobiling, and ice fishing. Six sites on the reservoir have been developed as day-use facilities. The reservoir has three marinas (Shorty's and Mountain Marina at Sawmill Point and Angler's Wharf Marina) and three picnic areas (Aspen Point, Old Timers Day Use Area, and the picnic area at the north end of the dam).

Sawmill Point, on the west side of the reservoir, has the highest level of facility development, including two marinas, flush toilets, a single-lane concrete slab boat ramp (open early in the season); a three-lane concrete boat ramp (open all season), car and boat trailer parking, and a boat trailer storage area. A restaurant and other businesses abut the project boundary, making this area a major activity center on the reservoir.

Visitors access the shoreline of the reservoir via County Road 501, Forest Road 603 along the east side, and from the USFS campgrounds and private residences on the east side. Vehicles are allowed nearly down to the water's edge at the mouth of Vallecito Creek. Access is also allowed throughout the wetlands on the north end. It is estimated that approximately 125 cars can currently park around the reservoir to access the shoreline.

All overnight camping facilities are located on the east side of the reservoir. The USFS manages four campgrounds: Graham Creek, North Canyon, Pine Point, and Middle Mountain. Old Timers, once a campground, was closed in 1994 due to suspected contamination of the reservoir from the campground toilet. The USFS plans to convert Old Timers to a day use area with a boat ramp, parking, and picnic tables.

A private campground, Five Branches, is located at the mouth of the Pine River. Another resort, Elk Point Lodge, operates on a private inholding just north of Pine River. Both the lodge and the campground hold dock permits from the USBR, which allow them to operate a courtesy dock for their paying customers. Other private campgrounds, resorts, restaurants, and hotels are scattered around the north and east sides of the reservoir on private lands. Resorts with horse stables are located on both the northeast and northwest ends with access to trails on USFS and USBR lands.

The entire reservoir is available for all types of water sports, with the exception of a small (5.2-acre [2 ha]) restricted area at the outlet of the dam. The three marinas operate concessions at

Vallecito. Mountain Marina (with 143 allowed moorings) and Shorty's Marina (with 55 allowed moorings) are both at Sawmill Point. Their moorings cover an area of approximately 50 acres (20 ha). Angler's Wharf, on the northwest end, is allowed a maximum of 99 moorings, which occupy approximately 33 acres (13 ha).

Boats can be launched at each of the marina locations: at the three-lane concrete ramp at Sawmill Point north of Mountain Marina, at the one-lane concrete block ramp at Sawmill Point just south of Shorty's Marina, and at the gravel ramp at Angler's Wharf. A fourth dirt ramp is provided for USFS campers at Graham Creek Campground. The ramp at Angler's Wharf typically becomes unusable by Labor Day of each year as water levels recede. Additionally, approximately every 3-4 years when the water level is so low that moorings become unusable, Angler's Wharf relocates its operations to Aspen Point. This move enables the business to remain open for the remainder of the season. The three-lane ramp at Sawmill Point remains open throughout the boating season; however, the ramp south of Shorty's becomes unusable by late summer.

7.0 CULTURAL RESOURCES

Information on recorded cultural resources was reviewed (State Historic Preservation Office files), and all recorded cultural resources on project lands were mapped for the USBR Resource Management Plan in 1996. (This map does not appear in the Resource Management Plan to avoid increased potential for disturbance to these sites.)

At the time of Vallecito's construction during the late 1930's and early 1940's, no legislation had been enacted requiring surveys to identify cultural resources that might be affected by project construction. However, several cultural inventories of small areas related to specific projects around the reservoir have been carried out. For the most part, minimal cultural materials have been identified in these surveys (USBR, 1996).

Of the surveys that have been conducted in the Vallecito study area, three resulted in cultural finds. The first, in 1990, surveyed a total of 70 acres (28 ha) for a proposed phone line and located three sites. Two of these sites were possible Anasazi seasonal hunting/habitat sites, consisting of ceramic/lithic scatter, possible adobe fragments, suspected hearth remnants, and projectile points. The third site consisted of a rock cairn of unknown age and affinity. In 1991, in anticipation of construction of a pedestrian trail, approximately 170 acres (69 ha) along the entire shoreline of the reservoir was surveyed. No cultural resources were discovered; however, a small group of culturally scarred ponderosa pine were found. Culturally scarred trees are those that have been peeled by native populations for their bark. The bark was used for building materials, the cambium layer was used as a food source, and the resin and pitch were used as an adhesive and waterproofing agent. In 1992 the USFS completed a survey of the area that would be affected by the Vallecito Recreation Enhancement Project, including the campgrounds and road alignment below the dam. Nine sites were identified, seven of which were culturally scarred trees. The remaining two sites were isolated finds, including chert fragments. None of the sites were

considered eligible for listing on the National Register of Historic Places. The dam at Vallecito Reservoir is currently being studied for eligibility for the National Register of Historic Places listing (USBR, 1996).

8.0 POTENTIAL ISSUES

Vallecito Reservoir provides habitat for fish, such as trout; waterfowl, including the Aleutian Canada goose; predatory birds, such as the bald eagle; songbirds; and wildlife associated with water. The waterfowl and predatory birds prefer and are attracted to the still waters provided by the reservoir environment. During high water, the reservoir also provides additional cover for fish. Adult fish prefer the deeper areas, whereas juvenile fish prefer shallow areas where stumps and submerged vegetation provide cover.

This section discusses the potential environmental issues related to the existence and operation of Vallecito Dam and Reservoir for flood control. These issues are:

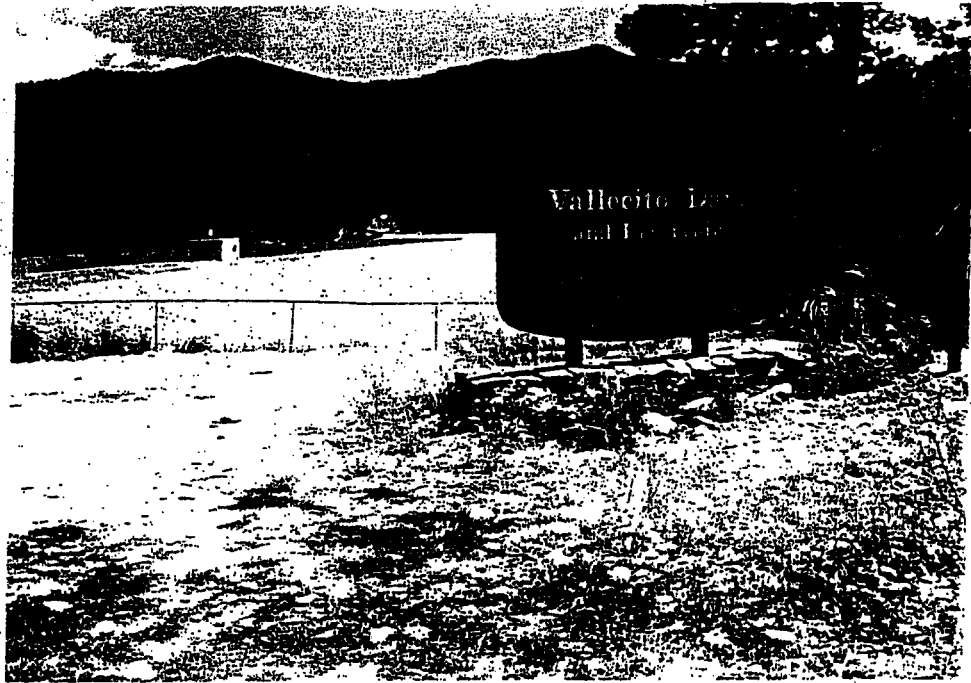
- **Reservoir fluctuations.** Fluctuations in the level of the reservoir, especially in the spring, may adversely affect the primary productivity of the reservoir by decreasing populations of phytoplankton and zooplankton. Phytoplankton and zooplankton are the primary food source of most fish species such as the kokanee salmon.
- **Shoreline erosion.** Wave action at Vallecito Reservoir causes extensive shoreline erosion each year. Shoreline erosion reduces the visual quality of the area and decreases water quality. Shoreline erosion increases turbidity in the reservoir which creates an unfavorable environment for fish, especially if the reservoir rises above gross pool.
- **Surface releases.** Stocked kokanee salmon, one of the primary game fish species in Vallecito in terms of management, are highly migratory and escape the reservoir during surface releases from the dam spillway. As a result, the total harvest from Vallecito Reservoir is significantly reduced. Once they enter the Pine River, kokanee salmon are short-lived; sometimes they are found stranded in farmers fields during the irrigation season.
- **Fish weir and stream gage.** The silt substrate of the reservoir is not good habitat for natural reproduction of fish species. Kokanee salmon spawn in Vallecito Creek where there is a cobblestone substrate. A permanent fish weir and stream gage on Vallecito Creek would help manage reproducing fish populations.
- **Willow flycatcher surveys.** Surveys should be conducted to determine if the willow flycatcher is present and if it is being adversely affected by the fluctuating water level in the Vallecito Dam and Reservoir area.

- **Bald eagle surveys.** Surveys should be conducted to determine the extent of eagle disturbance by angling activities, the importance of managing reservoir fish populations as a food source, and the effect of the fluctuating water level in the Vallecito Dam and Reservoir area.

Other issues discussed in this document, such as landowner violations, livestock grazing, fecal coliform, algal blooms, wildlife harassment, and vehicular damage, are not directly related to flood control operation.

9.0 REFERENCES

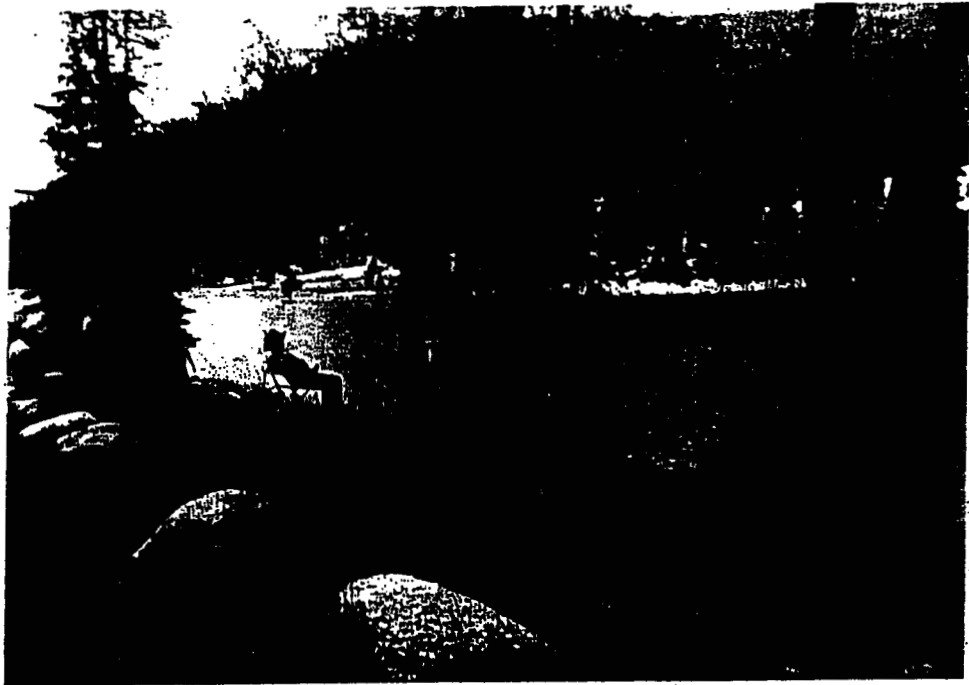
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Entry to Vallecito Dam and Reservoir Area



Spillway Gate at Vallecito Dam



Day-use Area near Wetlands



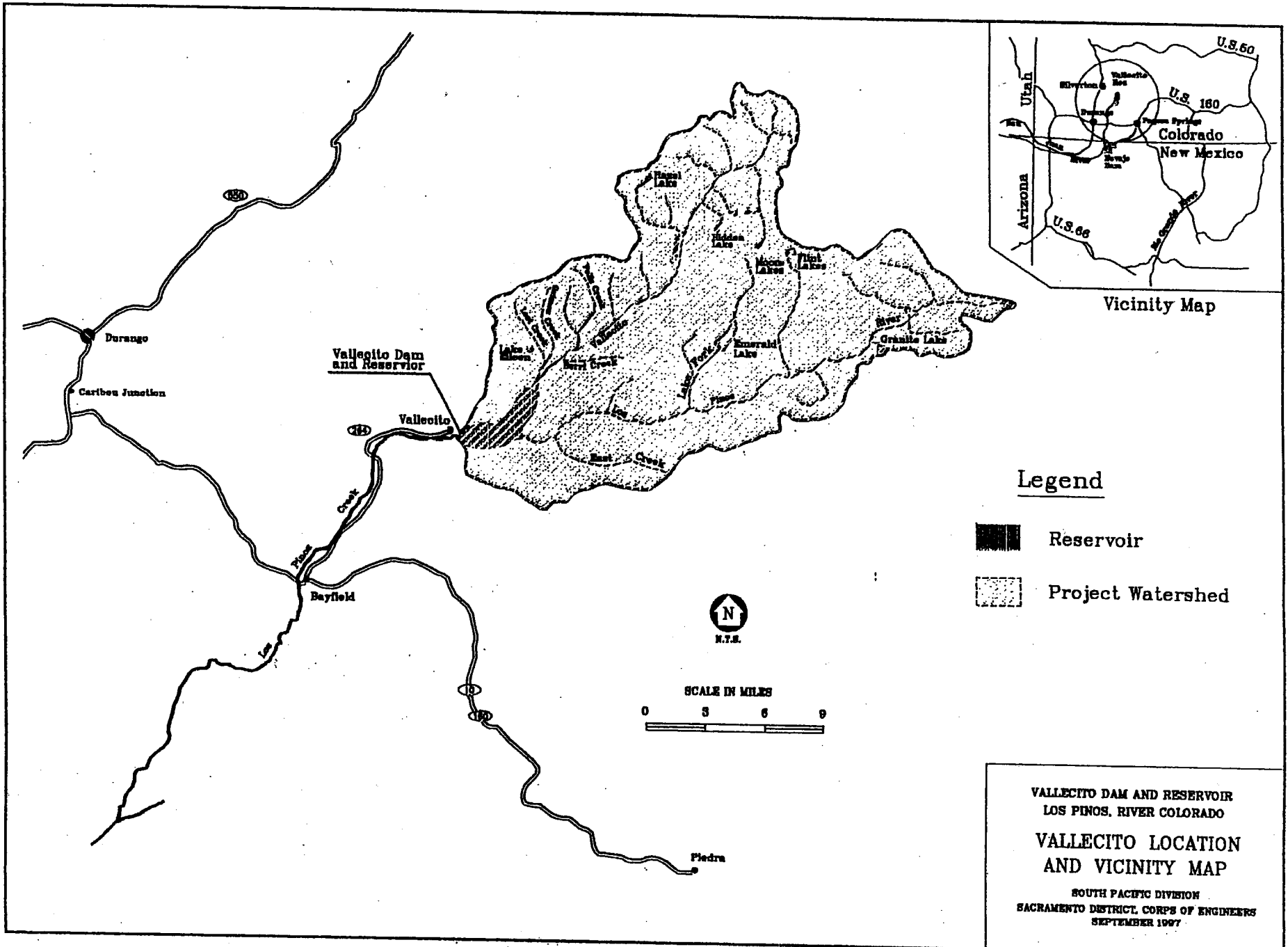
Emerging Vegetation, Wetlands, and Canada Geese
Near the East Side of Vallecito Dam and Reservoir

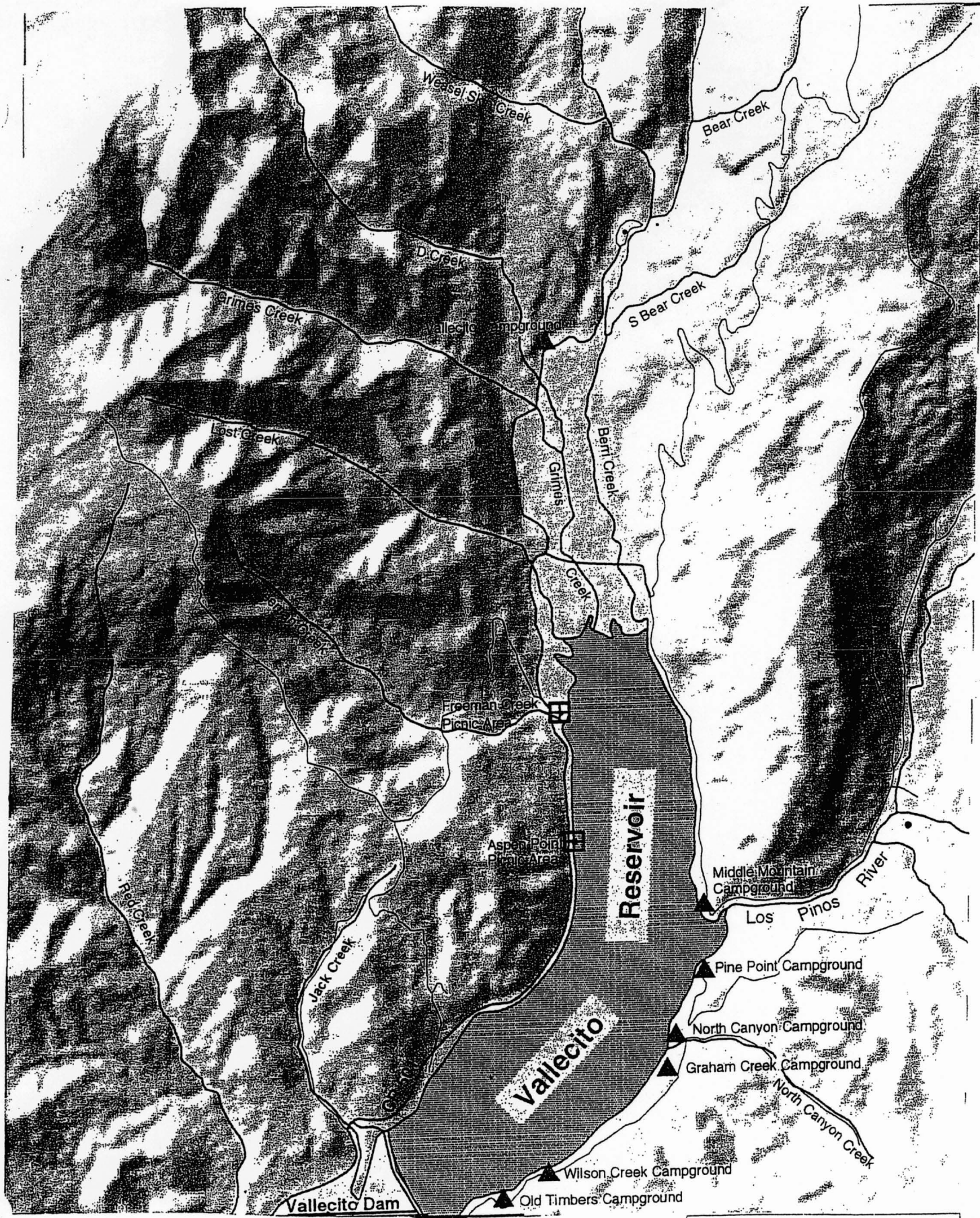


Wetlands, Northwest Side of Vallecito Reservoir

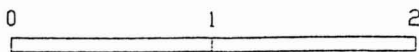


Hillside Slopes at Vallecito Reservoir





SCALE IN MILES



N.T.S.

VALLECITO DAM AND RESERVOIR
 LOS PINOS RIVER COLORADO
**GENERAL SITE PLAN AND
 RECREATIONAL DEVELOPMENT**

SOUTH PACIFIC DIVISION
 SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 SEPTEMBER 1957

**U.S. FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES LIST**



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Western Colorado Office
764 Horizon Drive, South Annex A
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:

ES/CO:COE
MS 65412 GJ

June 25, 1997

Walter Yep, Chief, Planning Division
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Yep:

This responds to three letters dated June 4, 1997, requesting species lists for three existing water projects in Colorado. Therefore, we are providing the following information on Federally listed species that may occur within the influence of Paonia Reservoir (Muddy Creek, Gunnison County), Lemon Reservoir (Florida River, La Plata County), and Vallecito Reservoir (Los Pinos River, La Plata County).

FEDERALLY LISTED SPECIES FOR LEMON AND VALLECITO RESERVOIRS

Bald eagle	<i>Haliaeetus leucocephalus</i>
Peregrine falcon	<i>Falco peregrinus</i>
Colorado squawfish	<i>Ptychocheilus lucius</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>

FEDERALLY LISTED SPECIES FOR PAONIA RESERVOIR

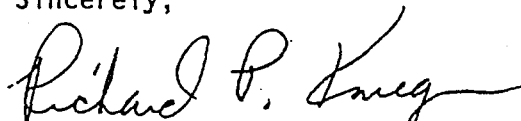
Bald eagle	<i>Haliaeetus leucocephalus</i>
Peregrine falcon	<i>Falco peregrinus</i>
Colorado squawfish	<i>Ptychocheilus lucius</i>
Razorback sucker	<i>Xyrauchen texanus</i>
Humpback chub	<i>Gila cypha</i>
Bonytail	<i>Gila elegans</i>
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>
Whooping crane	<i>Grus americana</i>

There are not any candidate species within the influence of the three subject reservoirs.

We appreciate your interest in threatened and endangered species, if the Fish

and Wildlife Service can be of further assistance, please contact Patty Schrader at the letterhead address or 970-243-2778.

Sincerely,

A handwritten signature in cursive script that reads "Richard P. Krueger". The signature is written in dark ink and is positioned above the typed name.

Richard P. Krueger
Acting Assistant Field Supervisor, Colorado

pc: FWS/ES, Lakewood
CDOW, Grand Junction
CDOW, Montrose
BR, Grand Junction

PSchrader:COERes.SL:062597

WATER CONTROL MANUAL
VALLECITO DAM AND RESERVOIR

Los Piños River, Colorado

EXHIBIT E

CESPD-R-1110-2-8
GUIDANCE ON THE PREPARATION OF DEVIATIONS
FROM APPROVED WATER CONTROL PLANS

U.S. Army Corps of Engineers
Sacramento District
Sacramento, California

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DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION CORPS OF ENGINEERS
333 Market Street
San Francisco, California 94105-2195

CESPD-MT-E

REGULATION
No. 1110-2-8

12 September 2002

Engineering and Design
GUIDANCE ON THE PREPARATION OF DEVIATIONS
FROM APPROVED WATER CONTROL PLANS

1. **PURPOSE.** This document establishes the protocol for reporting deviations from approved Water Control Plans for water control projects within the South Pacific Division. It defines coordination, review, and approval procedures between the Division and District offices. Approval from Division must be obtained from all deviations (reference e., paragraph 6.b.)¹

2. **APPLICABILITY.** The following is applicable to all South Pacific Division Districts and field-operating activities having civil works responsibilities.

3. **REFERENCES.** Authority and guidance can be found in:

- a. ER 200-2-2 (33 CFR 230), 4 March 1988, subject: Procedures for Implementing NEPA.
- b. ER 1105-2-100, 22 April 2000, subject: Guidance for Conducting Civil Works Planning Studies.
- c. ER 1110-2-240 (33 CFR 222.5), 8 October 1982, subject: Water Control Management.
- d. ER 1110-2-241 (33 CFR 208.1), 24 May 1990, subject: Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects.
- e. ER 1110-2-1400, 30 September 1993, subject: Reservoir Water Control Centers.
- f. ER 1110-2-8156, 31 August 1995, subject: Preparation of Water Control Manuals.
- g. ER 1165-2-501, 30 September 1999, subject: Civil Works Ecosystem Restoration Policy.

¹ This regulation supercedes CESPD-ET-EW Regulation, Subject: Guidance On The Preparation Of Deviations From Approved Water Control Plans dated 1 August 1999.

- h. EP 1165-2-502, 30 September 1999, subject: Ecosystem Restoration – Supporting Policy Information.
- i. EM 1110-2-3600, 30 November 1987, subject: Management of Water Control Systems.
- j. CESPD R 1110-2-8, August 1999, subject: Guidance on the Preparation of Deviations From Approved Water Control Plans.

4. OVERVIEW.

a. Water Control Plans are prepared for all Corps projects and non-Corps projects within Federal flood control space. For Corps projects, the Water Control Plan is all encompassing in that it covers regulation of the project over the entire regime of pool elevations and conditions. The Corps' responsibility regarding non-Corps reservoirs is defined by Section 7 of the Flood Control Act of 1944 (58 Stat 890), which directs the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds.

b. Water Control Plans define the regulation criteria and guidelines that govern how and when water will be stored and released from a project. The process of formulation and eventual approval of the Water Control Plan is a complex and time-consuming process because the plan must account for diverse goals (flood control, the environment, water quality, recreation, water supply, hydropower, etc.) and situations (e.g. normal, flood, drought, and emergency operations). Formulation of these plans requires a comprehensive knowledge of such diverse items as: project goals, project history, authorizing legislation, Corps policies and regulations, how a project interacts with other reservoirs within a basin, the role of other water interests/agencies, the effects to the general public in relation to environmental and aesthetic considerations, basin meteorology and hydrology, changing conditions (e.g. sedimentation, channel capacity, scour, etc.), and the physical capabilities of project features, such as outlet works, spillways, flood routing characteristics, etc.). Prior to approval and implementation, the proposed Water Control Plan is released for public review and comment. The public review process normally occurs concurrently with the NEPA public review process.

c. Deviations from approved Water Control Plans occur because every possible circumstance cannot be accounted for in a Water Control Plan. The competing goals and complex interactions of interested groups/agencies can cause even seemingly inconsequential deviations from an approved plan to lead to unforeseen environmental and legal complications. This regulation serves to assist a District in preparing their deviation requests. It outlines a minimum set of considerations that need to be addressed when making a recommendation to deviate from an approved Water Control Plan.

d. Deviations from approved Water Control Plans are intended, therefore, to address unforeseen and unique circumstances. They are not intended as a means for identifying or

initiating new opportunities to re-operate or reallocate storage in response to new and changing public needs.

5. DEFINITIONS.

a. Emergency Deviations. An emergency deviation from an approved Water Control Plan is one that is required due to an emergency situation. An emergency situation is defined herein as a situation in which there is a potential for injury, loss of life, threat to the project, or other serious hazards; but furthermore, also demanding immediate action, such that time constraints render impractical notification to the division. Depending upon the need for immediate action, an emergency situation could include: drowning and other accidents, assistance to local authorities responding to an emergency (e.g. police and fire departments), failure of operations facilities, chemical spills, treatment plant failures, and other temporary pollution or water quality problems. Water control actions necessary to abate the problem are taken immediately unless such action would create equal or worse conditions.

b. Planned Deviations. Planned deviations cover all other deviations not addresses by an emergency deviation.

6. OFFICE OF RECORD. The originating District's water control management office will be responsible for maintaining all relevant records documenting the deviation.

7. GENERAL INFORMATION FOR PREPARING ALL DEVIATIONS.

a. Approval of Deviations. Approval for all deviations must be obtained from the Division Commander or delegated representative prior to their implementation. As noted in paragraph 5.a, an emergency deviation situation may warrant an immediate action, delegated to the Leader, Water Management Team or his designated representative. The Leader of the Water Management Team shall consult with the Chief of Engineering and Construction and appropriate SPD staff and subsequently advise the Director, Military and Technical Services Directorate of the temporary change. Approval may be made by telephone, E-mail, or FAX.

b. Preparation of Deviations. Processing of a deviation request originates at the District water control management office. The District Commander may delegate signature authority for requesting deviations from approved water control plans to the appropriate functional division head or designated representative. Consultation with the District staffs, including engineering, planning, environmental, economics, operations, construction and legal must take place.

c. Costs and Charges for Preparing Deviations. Deviations from approved Water Control Plans require a similar level of scrutiny as applied to permanent changes to a water control plan. Any District charges incurred for processing a deviation are to be assessed and collected from the agency/entity requesting the deviation. The District should estimate the cost to process the deviation and provide that estimate to the requesting agency/entity. The District must collect the funds (in a revolving fund advance account under Support for Others) prior to processing the deviation request. Examples of costs for which the requesting entity would be responsible include costs for any required reviews or studies concerning associated hydrologic, water

control, legal, real estate, and environmental matters. After the deviation work is completed, any amount of funds left over in the account would be paid back to the requesting entity.

d. Fees for Water Supply Deviations. Deviations that result in Corps project flood control space being used for water supply purposes must address reimbursement by the sponsor to the Federal government for use of the flood control space. The district's deviation request package must include an economic analysis that determines a value for the reallocated flood control space. Section 7 projects will not require the economic analysis, as water supply charges are under the authority of the project owner.

e. Time to Prepare Deviations. District offices should also inform potential agencies/entities that the lead time required to assemble the necessary information required to evaluate a deviation request may be on the order of months (normally due to the required environmental analysis and the public review process). Thus, the request to the District should be made well in advance of the proposed initiation date for the deviation. The requesting agency/entity should also be made aware that approval of the deviation request would depend upon such things as a review of the impacts (e.g., environmental, hydrologic, legal, etc.).

f. Coordinating with Division Staff. Preparation of a deviation package is a time consuming and costly undertaking, and incomplete or inadequate package can delay approval. District personnel are encouraged to coordinate any questions or concerns about potential deviations and to discuss any atypical situations with their Division counterparts early in the process and before the package submittal. All technical review will be conducted at the District level and will provide a review certification. In an emergency situation, a formal quality certification will most likely not be required. Appendix D lists the Division staff with which deviation-related issues are to be coordinated. Division will provide updates to Appendix A as needed.

g. Non-Corps Projects. Deviation requests for non-Corps (Section 7) projects must be prepared with the approval of the project owner. This is required because project owners are responsible for assuring that the project is operated as prescribed in the Water Control Plan developed in concert with the Corps' flood control interest. The owner is also ultimately responsible for dam safety at the project and for funding the project.

h. Environmental Requirements. Each deviation request shall include a summary of the environmental effects of the proposed deviation and a statement of how the proposal is in compliance with pertinent environmental requirements, including but not limited to the National Environmental Policy Act (NEPA), Endangered Species Act, the Clean Water Act, and the Clean Air Act and Section 176 Conformity Determination. NEPA documentation requirements ordinarily are met by an Environmental Assessment (EA) of the proposed action with a Finding of No Significant Impact (FONSI) signed by the District Commander. If an existing Environmental Impact Statement/Record of Decision or EA/FONSI accurately covers the action, and if there have been no environmental changes since that documentation, this can be cited. Supporting environmental documents shall be included in the deviation request package when it is submitted. Typically these will include an EA, a signed FONSI, a Biological Assessment, and a final Biological Opinion or a letter from Fish & Wildlife or National Marine and Fishery

Service concurring that there is not likely to be adverse effect on listed species. Sometimes other documents, such as 404(b)(1) evaluation are required. In the case of emergency deviation, the emergency provisions and requirements of the various environmental laws should be followed.

i. Required Information/Analysis. Table 1 outlines the information and analysis that are required in a deviation request package that is submitted to Division.

TABLE 1
Information and Analysis Required in a Deviation Request Package

- a. Copy of sponsor's/project owner's letter requesting a deviation.
 - b. A description of the deviation.
 - c. Its effects on the operational objectives or project purposes.
 - d. A description of the potential flood threat over the period of the deviation.
 - e. The current and predicted maximum reservoir storage and elevation.
 - f. Documentation that the proposed deviation is in compliance with all pertinent environmental laws.
 - g. The effect on other agencies and individual interest.
 - h. The coordination that has taken place with other agencies.
 - i. Alternative measures that could be taken.
 - j. Recommendation/rationale on whether a permanent change to the Water Control Plan for this situation is warranted.
 - k. A District legal opinion.
 - l. Any recommended fees or reimbursements to the Federal Government.
 - m. Any other information that may be pertinent to the deviation request.
 - n. The District Commander's recommendation.
 - o. Quality Control Certification
-

8. PREPARING EMERGENCY DEVIATIONS

a. Emergency deviations are the only type of deviation that do not require prior approval from Division, and must only be used if events warrant an immediate emergency action, such that time constraints render impractical notification to the Division. However, even in an emergency situation, the District shall notify the Division of the action as soon as possible, and shall comply with all applicable requirements.

b. A record of the emergency deviation shall be developed at the district office and transmitted to the Division office within a day of the action taken.

c. Procedures for emergency deviations:

(1) Take the necessary action.

(2) Contact Division as soon as possible (See Appendix A for telephone numbers) to describe the action taken and the cause (NOTE: The order of (1) and (2) may be reversed depending on the nature of the emergency). Continuation of the deviation will require Division approval.

(3) The District shall provide written conformation to the Division office within 7 days of the deviation. The correspondence shall include the items outlined in Table 1 (as applicable).

(4) The Division shall respond within 3 days of the district's notification of the emergency deviation.

9. PREPARING PLANNED DEVIATIONS.

a. The District shall inform Division within 2 days of receiving a request for a proposed deviation.

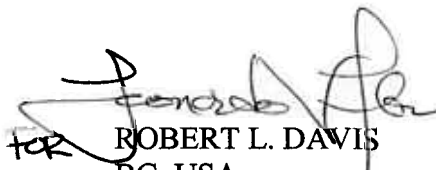
b. At least 7 days prior to the proposed action, the District shall transmit a deviation request package to the Division office. The deviation request package shall include the items in Table 1. This package may be initially transmitted electronically.

c. The Division shall review the proposal and approve or disapprove the District's deviation request within 5 days, assuming a complete package with all required documentation has been received. Early, detailed, coordination and transmittal of documents to Division may reduce the processing time.

d. The District and Division shall follow-up with formal correspondence within 3 days of their electronically transmitted request (District) and approval/disapproval (Division).

10. SPECIAL CIRCUMSTANCES.

Per reference 3.c, Water Control Plans are subject to continuing and progressive study in order to keep them current. Should a new re-operation or reallocation opportunity be identified for a Corps project, then it should be addressed under authority of Section 216 of Public Law 911-611, an Initial Appraisal Report can be conducted with O&M funding to determine whether or not a study, if deemed appropriate, among other things, could initiate the process to incorporate the new opportunity in the project's Water Control Plan. Re-operation or reallocation studies for non-Corps projects would need to be initiated by the project owner.


FOR ROBERT L. DAVIS
BG, USA
Commanding

COL, EN
DEPCDR

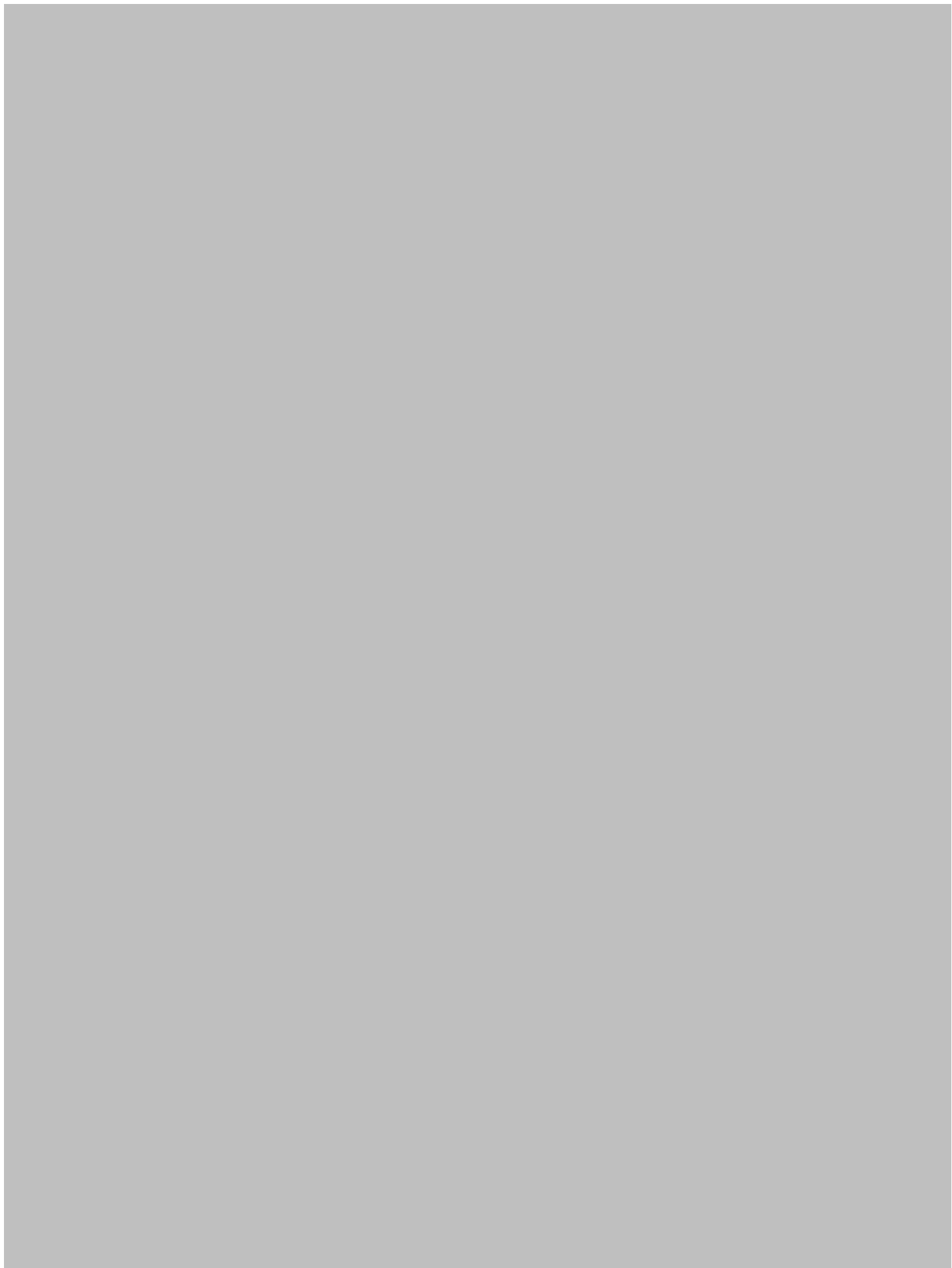
1 Appendix

APP A – CESPD Phone list for Coordination of Water Control Plan Deviations

APP B - Quality Control Certification

DISTRIBUTION:

Electronic Copy Available



APPENDIX B

DISTRICT ENGINEER'S QUALITY CERTIFICATION

COMPLETION OF QUALITY CONTROL ACTIVITIES

The District has completed the review/analysis of the water control deviation from the Approved Water Control Plan for (Project Name and Location). Certification is hereby given that all quality control activities appropriate to the level of risk and complexity inherent in this analysis have been completed.

GENERAL FINDINGS

Compliance with clearly established policy principles and procedures, utilizing clearly justified and valid assumptions, data and the reasonableness of the results. The undersigned recommends certification of the quality control certification for this deviation request.

(Signature)
Chief, Responsible Functional Element

(Date)

CERTIFICATION OF LEGAL REVIEW*

The request for a water control deviation from the approved Water Control Plan report for indicate name of project, has been fully reviewed by the Office of Counsel, and is approved as legally sufficient.

(Signature)
District Counsel

(Date)

QUALITY CERTIFICATION

All issues and concerns resulting from technical review of the water control deviation have been resolved. This deviation is recommended for approval.

(Signature)
District Commander

(Date)