UNITY RESERVOIR

1991 Sedimentation Survey

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16. ABSTRACT

Unity Reservoir was surveyed in May 1991 to compile field data for developing a reservoir topographic map and computing a present storage-elevation relationship. The data were also used to calculate the volume of sediment that has accumulated in the reservoir since dam closure in February 1938. The 1991 bathymetric survey used sonic depth recording equipment interfaced with an automated microwave positioning system that gave continuous depth and sounding positions throughout the reservoir. The above-water reservoir area was calculated from close interval cross sections measured from aerial photography obtained in the fall of 1991. A new reservoir contour map was developed by the computer graphics program Surface II using the collected data.

As of May 1991, at reservoir top of spillway gate elevation (feet) 3820.0, the surface area was 943 acres with a total capacity of 25,502 acre-feet and an active capacity of 24,972 acre-feet. Since the reservoir's initial filling in February 1938, 1,565 acre-feet of sediment have been trapped in Unity Reservoir, resulting in 5.11 percent loss in reservoir capacity. The average annual rate of sediment accumulation since 1938 is 29.4 acre-feet.

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UNITY RESERVOIR

1991 SEDIMENTATION SURVEY

by

RONALD L. FERRARI

BUREAU OF RECLAMATION
EARTH SCIENCES DIVISION
SURFACE WATER BRANCH
SEDIMENTATION SECTION
DENVER OFFICE

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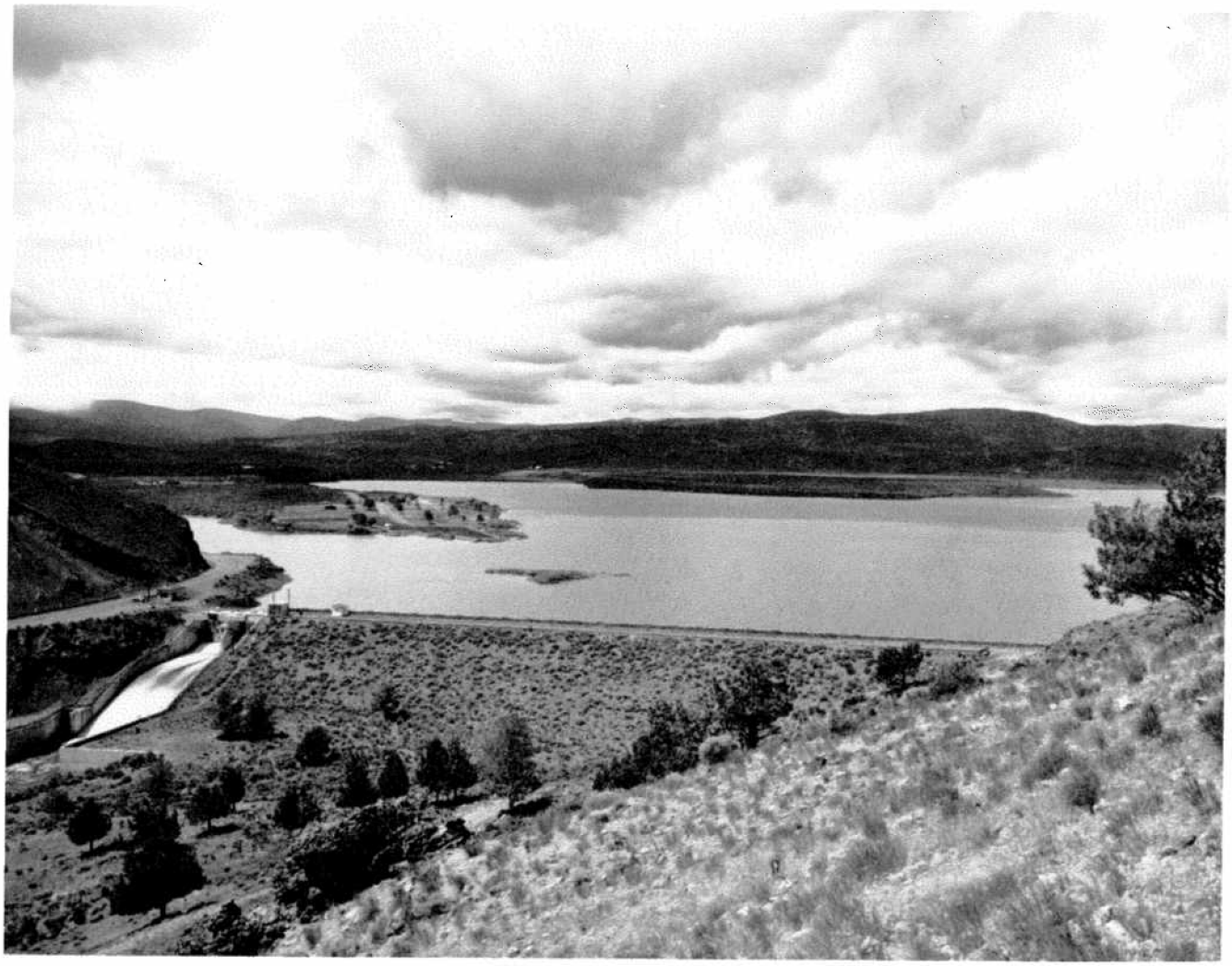
Mission

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.



View of Unity Dam and Reservoir
(from Project Data book)

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INTRODUCTION

Unity Dam and Reservoir, major features of the Burnt River Project, are located below the confluence of Job Creek and the North, South, and Middle Forks of the Burnt River. The dam, located in Baker County of east-central Oregon, is 5 miles north of Unity and 40 miles southwest of Baker, Oregon (fig. 1).

In 1933, the Bureau of Reclamation (Reclamation), in cooperation with the State of Oregon, investigated the possibility of developing a storage structure on the Burnt River to provide a late summer water supply. The Burnt River Project was found feasible by the Secretary of the Interior on September 25, 1935. Funds were provided by the President on August 13, 1935, under the Emergency Relief Act. Unity Dam construction began on August 13, 1936; water became available for irrigation on January 1, 1939. The dam was constructed as a rolled and earthfill zoned structure. The reservoir provides water for supplemental irrigation of about 15,300 acres that formerly depended entirely on the natural flow of the river.

At dam crest elevation 3827.3, Unity Dam (figure 2) has:

- a structural height* of 82 feet
- a hydraulic height of 58 feet
- a top crest width of 30 feet
- a crest length of 694 feet

The spillway, located at the right abutment, has a concrete-lined open channel controlled by two 24- by 16-foot radial gates with a top of gate elevation of 3820.0 and a spillway crest elevation of 3804.0. The design capacity of the spillway is 13,900 cubic feet per second at water surface elevation 3823.7. The outlet works, located through the right abutment, is controlled by two 2.75-foot square high pressure slide gates. The hydraulic capacity of the outlet works is 620 cubic feet per second at reservoir elevation 3820.0.

The 1991 reservoir survey measured a total storage capacity of 25,502 acre-feet and a surface area of 943 acres at reservoir top of spillway gate elevation 3820.0. During the 53.2 years since dam closure (February 1938 to May 1991), the capacity loss caused by sediment accumulation in the reservoir was measured to be 1,565 acre-feet.

SUMMARY AND CONCLUSIONS

This report presents the 1991 results of the first extensive sedimentation survey of Unity Reservoir by Reclamation since construction of Unity Dam. The primary objectives of the survey were to:

* The definition of terms such as "structural height," "hydraulic height," etc., may be found in manuals such as Reclamation's *Design of Small Dams* and *Guide for Preparation of Standing Operating Procedures for Dams and Reservoirs*, or ASCE's *Nomenclature for Hydraulics*.

- gather data needed for developing new reservoir topography
- compute area-capacity relationships
- estimate storage depletion caused by sediment deposition since closure of Unity Dam

Standard land surveying methods were used to establish horizontal and vertical control points for the aerial and hydrographic surveys. A horizontal grid system was established for both surveys using monumented control points located near the dam. The bathymetric survey was run using sonic depth recording equipment interfaced with an automated survey system consisting of a line-of-sight microwave positioning unit capable of determining sounding locations within the reservoir. The system continuously recorded reservoir depth and horizontal coordinates as the survey boat was steered across close spaced range lines covering the reservoir area. The positioning system provided information to allow the boat operator to maintain course along these range lines. Water surface elevations measured by the land surveyors at the time of data collection were used to convert the sonic depth measurements to true lake bottom elevations.

The 1991 surface areas at predetermined 5-foot contour intervals were generated by a computer graphics program that produced a new contour map of the reservoir (fig. 3). The revised area and capacity tables were produced by a computer program that uses measured contour surface areas and a curve-fitting technique to compute area and capacity at prescribed elevation increments.

Table 1 contains a summary of reservoir watershed characteristics and sediment data for the 1991 survey. The 1991 survey determined that the reservoir has a storage capacity of 25,502 acre-feet and a surface area of 943 acres at the top of spillway gate elevation of 3820.0. Since closure in 1938, the reservoir has accumulated a volume of 1,565 acre-feet of sediment below elevation 3810.0. This volume represents a 5.11 percent loss in total capacity and an average annual loss of 29.4 acre-feet. Because of the small amount of sediment that has accumulated in the reservoir since the original survey, a resurvey of Unity Reservoir should not be necessary unless major sediment inflow occurs in the future.

DESCRIPTION OF WATERSHED

The Burnt River that drains into Unity Reservoir is formed by the junction of its North, South, and Middle Forks, which have their origin in the southeastern slopes of the Blue Mountains. The basin rises from elevation 3776.5 at the outlet works to over 7,000 feet in the headwaters of the North and South Forks of the Burnt River. The drainage area above Unity Dam is 309 square miles. The net sediment contributing area was computed to be 232.6 square miles. This area excludes the surface area of Unity Reservoir and the reservoir surface area and basin on the South Fork above Whited Reservoir Dam because the sediment inflow above this dam is assumed to be trapped.

The area above Unity Dam is generally heavily timbered and mountainous. Most of the area above the dam is forested, with good grass cover beneath. About 30 percent of the watershed is nonforested and is either open meadows or agricultural lands. The upper South Fork area contained more than one-half of the 31,300 acres of the "Big Cow Burn" which occurred in August 1939. All of the burned area is now well covered with new growth and considered heavily forested.

RESERVOIR OPERATIONS

The reservoir is a multiuse facility having (following values are from May 1991 area-capacity tables):

- 3,625 acre-feet of exclusive flood control storage between elevations 3820.0 and 3823.7
- 24,972 acre-feet of active conservation storage between elevations 3776.5 and 3820.0
- 530 acre-feet of dead storage between elevations 3760.8 and 3776.5

Records for Unity Reservoir show an average unregulated inflow of 67,000 acre-feet per year. The estimated mean annual runoff from the basin is 4.06 inches. Unity Reservoir operation ranged from a minimum elevation of 3779.2 feet in September 1947 to a maximum elevation of 3820.7 in April 1972. The monthly inflow and end-of-month stage records in table 1 show the extreme annual fluctuation of the reservoir.

SURVEY METHOD AND EQUIPMENT

The Unity Reservoir survey was completed using the contour method as outlined by Blanton, 1982. The procedure involved collecting adequate coordinate data for developing a reliable contour map by photogrammetric and bathymetric survey methods. Standard land surveying methods were used by Columbia Basin Project Office personnel to establish horizontal and vertical control points for both survey methods. A horizontal grid system was established for both surveys using monumented points, with state plane coordinates, located in the reservoir area. The above water data was collected by aerial photography obtained in 1991 with the water surface at elevation 3795.3. The field survey work for the bathymetric survey involved establishing a triangulation network around the reservoir to provide horizontal and vertical control for all required range lines and shore station locations. No previous established range lines existed on the lake and permanent range lines were not established during this survey. Because of the size and shape of the reservoir, any future survey would also employ the contour method; therefore, permanent range line end markers were not necessary.

The hydrographic survey was run on May 1 through May 3, 1991, with the reservoir at water surface elevation 3817.7. The bathymetric survey was run using sonic depth recording equipment interfaced with an automated survey system consisting of a line-of-sight microwave positioning unit capable of determining sounding locations within the reservoir. This positioning system transmitted line-of-sight microwave signals to fixed shore stations and converted the reply time to range distances, which were used by the system data logger to compute the coordinate position of the sounding boat. The survey system continuously recorded reservoir depth and horizontal coordinates as the survey boat moved across close-spaced range lines covering the reservoir area. To produce adequate data for developing contours of Unity Reservoir, grid spacing of 200 feet was selected. The system gave directions to the boat operator to assist in maintaining course along the close-spaced range lines. During each run, the depth and position data were recorded on a floppy disk for subsequent processing by Denver Office personnel. A graph plotter was used in the field to track the boat and ensure adequate coverage during the collection process. Water surface elevations surveyed at the time of collection were used to convert the sonic depth measurements to true lake bottom elevations.

SEDIMENT ANALYSES

Sediments have accumulated in Unity Reservoir to a total volume of 1,565 acre-feet since dam closure in February 1938. Of the total deposited sediment, 1,219 acre-feet was deposited in the active pool and 346 acre-feet in the inactive pool storage areas. The average annual rate of sediment deposition between closure and May 1991 (53.2 years) was 29.4 acre-feet per year, or 0.13 acre-foot per square mile from the sediment contributing drainage area. The storage loss in terms of percent of original storage capacity was 5.11 percent. Tables 1 and 2 contain the Unity Reservoir sediment accumulation and water storage data based on the 1991 resurvey.

Because of the small amount of sediment that has accumulated in the reservoir since the original survey, a resurvey of Unity Reservoir should not be necessary unless major sediment inflow occurs in the future.

RESERVOIR AREA AND CAPACITY

Original Capacity

The original total capacity of Unity Reservoir was reported as 25,800 acre-feet at the spillway crest elevation of 3820.0. The surface areas for Unity Reservoir were originally developed from a Reclamation topographic map dated August 31, 1935 (Map No. 216-D-18). Based on correction surveys these areas were later adjusted by Reclamation in July 1938 and used to develop an adjusted original storage-elevation relationship. A comparison of the 1935 original and 1938 adjusted surface area values with the 1991 reservoir survey and digitized surface area values from the 1984 U.S. Geological Survey topography found some discrepancies. The upper surface areas for the 1935, 1984, and 1991 sources compared very well while the 1938 adjusted surface areas for the same elevations were found to be about 2 percent less. Also, the bottom elevation of the 1938 data was reported as 3765 and over 50 years later the 1991 survey measured the bottom elevation to be 3760.8, over 4 feet lower. The 1935 survey data reported the bottom elevation as 3750 which would seem more realistic. For determining change in reservoir storage, the original storage-elevation relationship was recomputed using the 1935 surface area values.

Results of the 1935 area and capacity computations are listed in columns (2) and (4) of table 2. The 1935 measured surface area values at elevations 3810 and 3820 were found to be slightly less than the 1991 survey values at the same elevation. This difference resulted in the 1991 survey showing a slight gain of volume in the upper reservoir area compared to the original survey. As illustrated in table 2 it also showed the largest measured sediment volume, column (7), being at elevation 3810. Elevation 3810 was used when computing all sediment accumulation values. These small gains in surface areas may be the result of some bank erosion and/or the different survey methods.

Development of 1991 Contour Areas

The 1991 contour surface areas for Unity Reservoir were developed by generating a contour map from the collected aerial and underwater coordinate data. Five-foot contour intervals of the lake area were

created by a computer graphics software program (Kansas Geological Survey, 1978). A modification of this program by the Denver Office calculated surface areas of the closed contours of the generated map. Because of the limited amount of aerial data above elevation 3830.0 the program generated only small portions of the elevation 3827.3 contour. The 3827.3 contour was completed by overlaying the computer generated contours over a plot of the collected data points and then visually tracing the contour. The surface area of the enclosed contour was calculated by a computer digitizing program. The final reservoir map shown on figure 3 was prepared by the Denver Office Computer Drafting Unit of the Drafting Section. The map has a scale of 1 inch equals 500 feet with a contour interval of 5 feet.

1991 Revised Storage Capacity

The storage-elevation relationships based on the 1991 aerial and underwater survey data were developed using the area-capacity computer program ACAP85 (Reclamation, 1985). Surface areas at 5-foot contour intervals computed from the aerial and underwater survey data were used as the control parameters for computing reservoir capacity. The program computes an area at elevation increments of 0.01- to 1.0-foot by linear interpolation between the 5-foot contour intervals. The program begins by testing the initial capacity equation over successive intervals to ensure that the equation fits within an allowable error limit, which was set at 0.000001 for Unity Reservoir. This capacity equation is then used over the full range of intervals fitting within this allowable error limit. For the first interval at which the initial allowable error limit is exceeded, a new capacity equation (integrated from basic area curve over that interval) tests the fit until it also exceeds the error limit. Thus, the capacity curve is defined by a series of curves, each fitting a certain region of data. Final area equations are derived by differentiating the capacity equations, which are of second order polynomial form:

$$y = a + a_2x + a_3x^2$$

where:

y = capacity,
x = elevation above a reference base,
a = intercept, and
a_2 and a_3 = coefficients

Results of the 1991 Unity Reservoir area and capacity computations are listed in table 1 and columns (5) and (6) of table 2. Listed in columns (2) and (4) of table 2 are the original surface areas and recomputed capacity values. A separate set of 1991 area and capacity tables has been published for the 0.01-, 0.1-, and 1-foot elevation increments (Reclamation, 1991). A description of the computations and coefficients output from the ACAP85 program is included with these tables. Both the original and 1991 area-capacity curves are plotted on figure 4. As of May 1991, at reservoir spillway crest elevation 3820.0, the surface area was 943 acres with a total capacity of 25,502 acre-feet and a active capacity of 24,972 acre-feet.

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RESERVOIR SEDIMENT
DATA SUMMARY

Unity Reservoir
NAME OF RESERVOIR

1
DATA SHEET NO.

DAM	1. OWNER Bureau of Reclamation[1]		2. STREAM Burnt River		3. STATE Oregon	
	4. SEC. 21 TWP. 12S RANGE 37E		5. NEAREST P.O. Unity		6. COUNTY Baker County	
	7. LAT 44° 30' 20" LONG 118° 11' 00"		8. TOP OF DAM ELEVATION 3827.3		9. SPILLWAY CREST 3804.0[2]	
RESERVOIR	10. STORAGE ALLOCATION	11. ELEVATION TOP OF POOL	12. ORIGINAL SURFACE AREA, Ac	13. ORIGINAL CAPACITY, AF	14. GROSS STORAGE ACRE- FEET	15. DATE STORAGE BEGAN
	a. FLOOD CONTROL	3823.7	1,015[3]	3,500	29,320	
	b. MULTIPLE USE					2/19/38
	c. POWER					
	d. WATER SUPPLY					16. DATE NORMAL OPERATION BEGAN
	e. IRRIGATION	3820.0	926[3]	25,220	25,820	
	f. CONSERVATION					
	g. INACTIVE	3776.5	142[3]	600	600	2/19/38
	17. LENGTH OF RESERVOIR 5.7[4] MILES			AVG. WIDTH OF RESERVOIR 0.25 MILES		
BASIN	18. TOTAL DRAINAGE AREA 309 SQUARE MILES			22. MEAN ANNUAL PRECIPITATION 11.5[5] INCHES		
	19. NET SEDIMENT CONTRIBUTING AREA 232.6[6] SQUARE MILES			23. MEAN ANNUAL RUNOFF 4.06[7] INCHES		
	20. LENGTH 23.6 MILES	AV. WIDTH 13.1 MILES		24. MEAN ANNUAL RUNOFF 67,000[8] ACRE-FEET		
	21. MAX. ELEVATION 7700(+)	MIN. ELEVATION 3776.5		25. ANNUAL TEMP. MEAN 45.1°F RANGE -25°F to 104°F[9]		

SURVEY DATA	26. DATE OF SURVEY	27. PER. YRS.	28. ACCL. YRS.	29. TYPE OF SURVEY	30. NO. OF RANGES OR INTERVAL	31. SURFACE AREA, AC.	32. CAPACITY ACRE-FEET	33. C/I RATIO AF/AF
	2/19/1938			Contour(R)	10-ft	941.5[10]	27,001[11]	0.40
	5/ 1/1991	53.2	53.2	Contour(D)	5-ft	943[12]	25,502	0.38

26. DATE OF SURVEY	34. PERIOD ANNUAL PRECIP.	35. PERIOD WATER INFLOW, ACRE FEET			WATER INFLOW TO DATE, AF	
		a. MEAN ANN.	b. MAX. ANN.	c. TOTAL	a. MEAN ANN.	b. TOTAL
5/1/1991	11.5	67,000[8]	129,700[8]	3,350,000[8]	67,000	3,350,000

26. DATE OF SURVEY	37. PERIOD CAPACITY LOSS, ACRE-FEET			38. TOTAL SEDIMENT DEPOSITS TO DATE, AF		
	a. TOTAL	b. AV. ANN.	c. /MI.²-YR.	a. TOTAL	b. AV. ANNUAL	c. /MI.²-YR.
5/1/1991	1,565[13]	29.4	0.13	1,565	29.4	0.13

26. DATE OF SURVEY	39. AV. DRY WT. (#/FT³)	40. SED. DEP. TONS/MI.²-YR.		41. STORAGE LOSS, PCT.		42. SEDIMENT INFLOW, PPM	
		a. PERIOD	b. TOTAL TO DATE	a. AV. ANNUAL	b. TOTAL TO DATE	a. PER.	b. TOT.
5/1/1991				0.096[14]	5.11[14]		

26. DATE OF SURVEY	43. DEPTH DESIGNATION RANGE IN FEET BELOW AND ABOVE CREST ELEVATION[15]												
	70.0-60.0	60.0-50.0	50.0-40.0	40.0-30.0	30.0-20.0	20.0-10.0	10.0-crest						
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION												
5/1/91	0.6	8.5	19.0	21.9	36.3	13.7	0						
26. DATE OF SURVEY	44. REACH DESIGNATION PERCENT OF TOTAL ORIGINAL LENGTH OF RESERVOIR												
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-105	105-110	110-115	115-120	120-125
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN REACH DESIGNATION												
	N/A												

Table 1. – Reservoir sediment data summary (page 1 of 2).

45. RANGE IN RESERVOIR OPERATION

WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AF	WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AF
1938	3806.2	3788.7	unavailable	1965	3820.0	3790.9	121,970
1939	3820.2	3790.3	43,460	1966	3820.1	3780.1	33,630
1940	3820.0	3792.6	41,340	1967	3819.4	3784.1	40,260
1941	3820.0	3796.7	58,760	1968	3820.3	3784.6	33,210
1942	3820.0	3796.1	75,520	1969	3820.0	3784.1	64,030
1943	3819.9	3793.0	105,450	1970	3820.4	3781.8	66,280
1944	3812.0	3785.2	30,440	1971	3819.4	3784.2	89,350
1945	3819.3	3788.0	49,090	1972	3820.7	3785.0	85,290
1946	3818.4	3789.7	80,300	1973	3818.0	3780.5	31,990
1947	3820.0	3779.2	53,750	1974	3820.5	3783.6	121,160
1948	3819.9	3783.2	83,630	1975	3819.3	3792.7	91,620
1949	3818.4	3786.0	77,050	1976	3819.2	3794.2	69,370
1950	3818.6	3780.5	70,790	1977	3808.8	3781.2	16,970
1951	3818.0	3787.6	73,410	1978	3820.5	3785.2	69,440
1952	3818.8	3787.2	86,610	1979	3820.3	3787.2	56,080
1953	3820.0	3783.3	90,130	1980	3820.0	3787.6	58,600
1954	3820.0	3783.5	48,980	1981	3820.2	3792.5	61,290
1955	3776.5	3809.0	29,550	1982	3820.2	3793.8	129,700
1956	3819.6	3780.8	102,080	1983	3819.9	3801.3	117,100
1957	3819.1	3782.8	75,260	1984	3819.8	3802.1	119,070
1958	3818.4	3788.2	105,700	1985	3819.0	3794.0	70,690
1959	3819.9	3783.4	46,000	1986	3820.1	3790.8	unavailable
1960	3820.3	3782.1	54,170	1987	3819.5	3784.1	32,380
1961	3820.4	3779.9	34,090	1988	3820.0	3782.6	unavailable
1962	3820.4	3781.1	45,650	1989	3820.0	3784.4	78,630
1963	3820.5	3785.7	51,220	1990	3820.5		31,250
1964	3820.0	3784.0	48,560	1991	3819.9	-	-

46. ELEVATION - AREA - CAPACITY DATA FOR ORIGINAL CAPACITY [16]

ELEV.	AREA	CAP.	ELEV.	AREA	CAP.	ELEV.	AREA	CAP.
3750	0	0	3780	233.9	1,574	3820	941.5	27,001
3760	2.0	10	3790	490.8	5,198	3823.7	(1,022)	30,634
3770	38.5	212	3800	664.4	10,974	3827.3	(1,100)	34,453
3776.5	(166)	876	3810	799.8	18,295			

46. ELEVATION - AREA - CAPACITY DATA FOR 1991 TOTAL CAPACITY

ELEV.	AREA	CAP.	ELEV.	AREA	CAP.	ELEV.	AREA	CAP.
3760.8	0	0	3785	332.6	2,497	3815	881.4	20,941
3765	7	14	3790	434.8	4,415	3820	943.0	25,502
3770	15.1	69	3795	516.3	6,793	3823.7	1,017	29,127
3775	99.3	355	3800	616.1	9,624	3827.3	1,088.7	32,917
3776.5	133	530	3805	711.6	12,943			
3780	212.3	1,134	3810	803.0	16,730			

47. REMARKS AND REFERENCES

[1] Project operated and maintained by Burnt River Irrigation District.
[2] Elevation of top of radial gates when closed is 3820.0.
[3] Area values from Reclamation corrected area-capacity tables (DWG. X-D-2100) dated 7/1/38. The areas for elevations 3776.5 and 3823.7 were interpolated.
[4] Summation of Job Creek (0.4 mi) and forks of Burnt River -- North (2.7 mi), West (0.5 mi), Middle (1.1 mi), and South (1.0 mi).
[5] Climatography of the U.S., 1941-70, No. 81, NOAA and Project Data Book of Burnt River Project, 1966-80, BOR.
[6] Total drainage area exclusive of reservoir surface area at El. 3820 and drainage area above Whited Reservoir (built prior to Unity Reservoir on South Fork of Burnt River).
[7] Calculated using mean annual runoff value of 67,000 AF (Item 24).
[8] Unregulated monthly inflow records for water years 1939-90, 1986 and 1988 not used due to missing records.
[9] Climates of the states, Volume 2, NOAA.
[10] Surface area at reservoir elevation 3820.0. The original area-capacity table was developed using 1938 adjusted surface areas. Research concluded the 1935 unadjusted original surface areas should be used for sediment computations.
[11] Capacity at elevation 3820. Computed by Reclamation's ACAP program using 1935 original surface areas.
[12] Difference from original is probably due to field collection methods and bank erosion.
[13] Total capacity loss calculated by comparing recomputed capacity (see remark #11) and 1991 capacity at elevation 3810. Maximum capacity loss recorded at this elevation. 1991 areas measured slightly greater then 1935 areas (<0.5%). Probably due to bank erosion and survey methods.
[14] Average annual and total sediment deposits of 29.4 AF and 1,565 AF respectfully divided by 30,634 AF. Capacity at El. 3823.7 computed by ACAP using 1935 surface area data.
[15] Used spillway crest of 3820.0, elevation of top of radial gates when closed.
[16] 1935 original areas. Capacity computed by ACAP. Areas in ( ) calculated by ACAP.

48. AGENCY MAKING SURVEY Bureau of Reclamation

49. AGENCY SUPPLYING DATA Bureau of Reclamation | DATE April 1992

Table 1. – Reservoir sediment data summary (page 2 of 2).

(1) Elevation (feet)	(2) 1935 Area (acres)	(3) 1935 Capacity (acre-feet)	(4) 1935 Adjusted Capacity (acre-feet)	(5) 1991 Area (acres)	(6) 1991 Capacity (acre-feet)	(7) Measured Sediment Volume (acre-feet)	(8) Percent Measured Sediment	(9) Percent Reservoir Depth
3823.7	(1022)		30,634	(1017)	29,127	1,507	100.0	
3820	941.5	26,999.5	27,001	943.0	25,502	1,499	100.0	100.0
3815	(871)		22,471	881.4	20,941	1,530	100.0	92.8
3810	799.8	18,293	18,295	803.0	16,730	1,565	100.0	85.7
3805	(722)		14,465	711.6	12,943	1,522	97.2	78.6
3800	664.4	10,972	10,974	616.1	9,624	1,350	86.3	71.4
3795	(578)		7,869	516.3	6,793	1,076	68.8	64.3
3790	490.8	5,196	5,198	434.8	4,415	783	50.0	57.1
3785	(362)		3,065	332.6	2,497	568	36.3	50.0
3780	233.9	1,572.5	1,574	212.3	1,134	440	28.1	42.8
3776.5	(166)		876	(133)	530	346	22.1	37.8
3775	(136)		649	99.3	355	294	18.8	35.7
3770	38.5	210.5	212	15.1	69	143	9.1	28.6
3765	(20)		66		14	52	3.3	21.4
3760.8	(5)		13	0	0	13	0.8	15.4
3760	2.0	8.0	10	0	0	10	0.6	14.2
3755	(1)		2	0	0	2	0.1	7.1
3750	0	0	0	0	0	0	0.0	0.0

1. Elevation of reservoir water surface.
2. Original reservoir surface area from 1935 survey. Values in ( ) computed by ACAP85.
3. Original reservoir capacity computed in 1935.
4. Original reservoir capacity recomputed using ACAP85.
5. Reservoir surface area from 1991 survey. Values in ( ) computed by ACAP85.
6. Reservoir capacity from 1991 survey.
7. Measured sediment volume = column (4) - column (6).
8. Measured sediment expressed in percentage of total sediment, column (7) ÷ 1,565 acre-feet, (1,565 acre-feet is maximum sediment volume at elevation 3810).
9. Depth of reservoir expressed in percentage of total depth (70 feet).

Table 2. – Summary of 1991 survey results

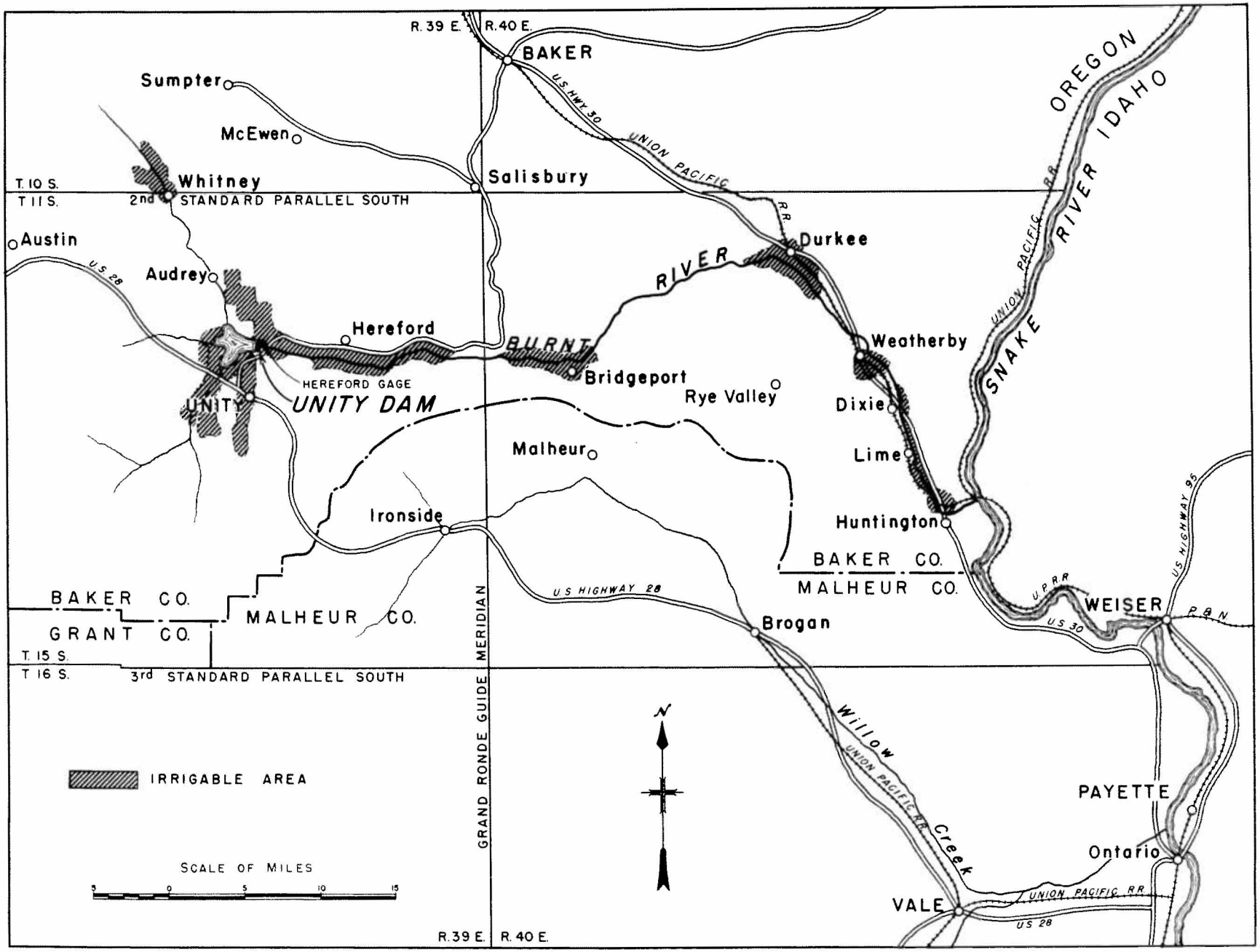

Figure 1. – Unity Reservoir location map.

Space intentionally left blank due to security concerns

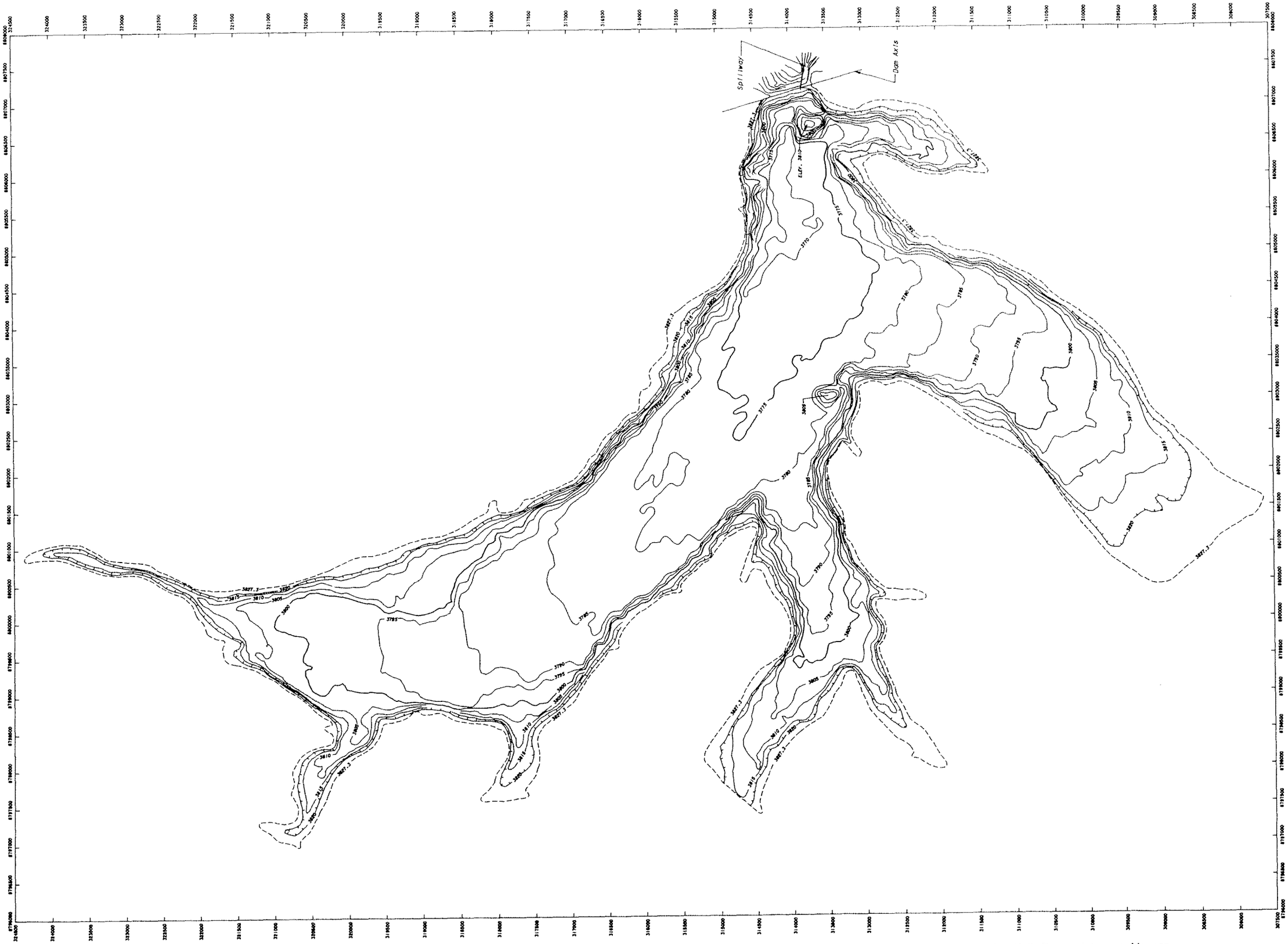

Figure 3. – Unity Reservoir topographic map.

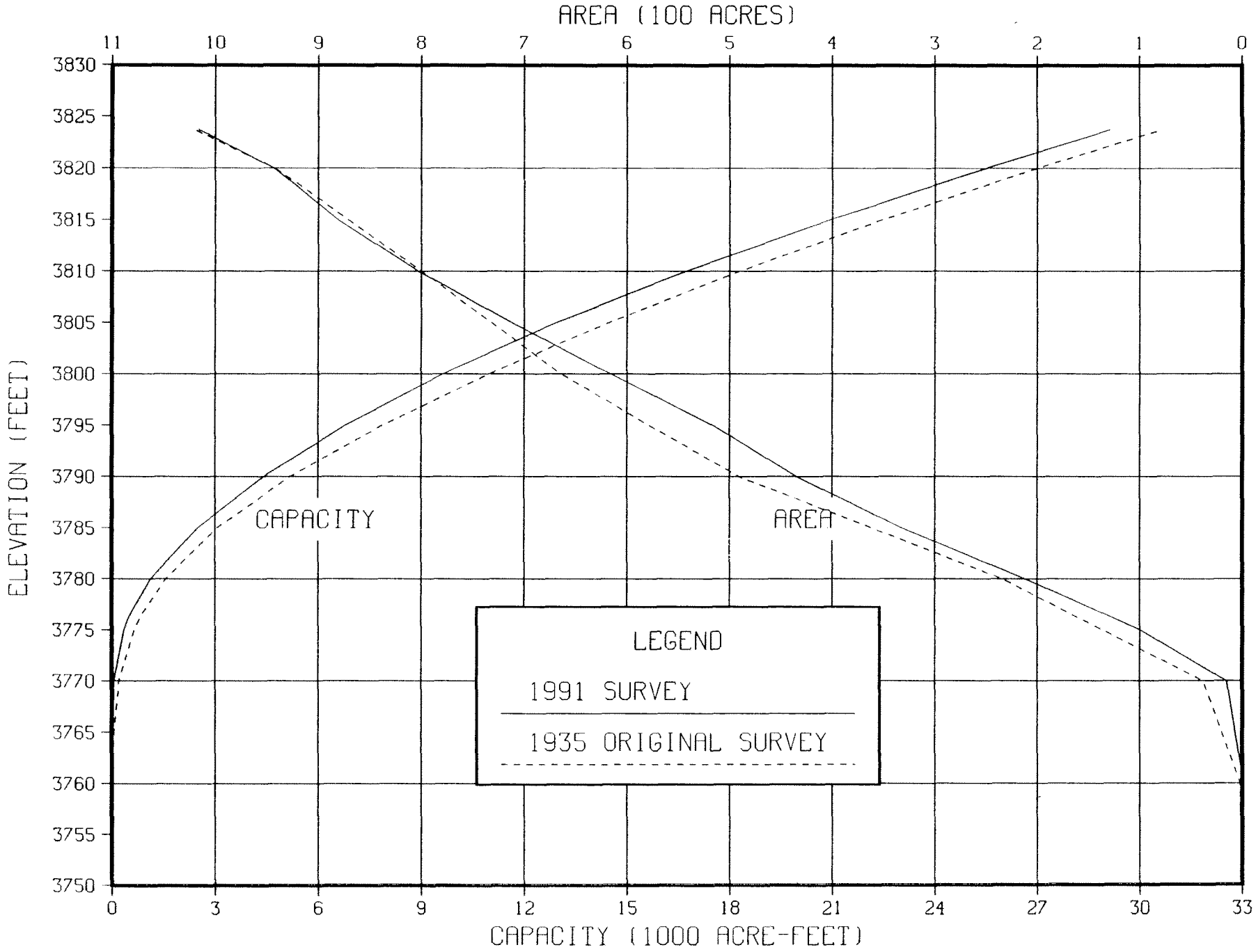

Figure 4. – 1991 area and capacity curves.

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