FORT COBB RESERVOIR
1993 SEDIMENTATION SURVEY

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16. ABSTRACT

The Bureau of Reclamation completed a survey of Fort Cobb Reservoir in the spring of 1993. The survey report presents the results of an investigation to monitor changes caused by sediment accumulation in Fort Cobb Reservoir after 34.0 years of reservoir operation. The report also describes the surveying procedures and equipment used in the 1993 investigation and provides data for future surveys. The primary purpose of the 1993 survey was the collection of data to compute the area-capacity relationships for operation of Fort Cobb Reservoir.

As of April 1993, the survey determined that the reservoir has a storage capacity of 135,898 acre-feet and a surface area of 5,882 acres at spillway crest elevation 1354.8. Since closure in March 1959, the reservoir has accumulated a volume of 6,966 acre-feet of sediment below spillway crest elevation 1354.8. This volume represents a 4.88-percent loss in total capacity and an average annual loss of 204.9 acre-feet for the operation period of March 1959 through May 1993.

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1993 SEDIMENTATION SURVEY

by

Ronald L. Ferrari

Sedimentation Section
Surface Water Branch
Division of Earth Sciences
Denver Office
Denver, Colorado

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The Bureau of Reclamation's Sedimentation Section prepared and published this report. The hydrographic survey was supervised by Ronald Ferrari, Hydraulic Engineer, and assisted by Charles Feuerboun and Carol Newcomb of the Oklahoma-Texas Projects Office and personnel from the FCRMCD (Fort Cobb Reservoir Master Conservancy District of Anadarko, Oklahoma). The preliminary field work of locating and flagging the existing sediment range end markers and surveying the above-water portions of the sediment range lines was performed by Charles Feuerboun and Carol Newcomb of the Oklahoma-Texas Projects Office and personnel from the FCRMCD. Ronald Ferrari completed the data processing, sediment computations, area-capacity tables, and the report. Gerald Schultz assisted in the processing of the collected range line data.

U.S. Department of the Interior
Mission Statement

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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INTRODUCTION

Fort Cobb Dam and Reservoir are major features of the Washita Basin Projects in southwestern Oklahoma. Other principal features are Foss Dam and Reservoir. The project supplies municipal and industrial water and provides flood control, fish and wildlife, and recreation benefits.

Fort Cobb Dam and reservoir are located in Caddo County, about 22 miles northwest of Anadarko and 5 miles north of Fort Cobb, Oklahoma. The dam is on Pond (Cobb) Creek, roughly 5 miles above the confluence of Cobb Creek with the Washita River (fig. 1). The dam and reservoir are operated by the FCRMCD (Fort Cobb Reservoir Master Conservancy District).

Fort Cobb Dam was constructed during 1958 and 1959, and storage began on March 30, 1959. The conservation pool filled in June 1962, which is when normal operation began. The dam (fig. 2) is a nearly homogeneous, rolled earthfill structure 122 feet above the Pond Creek streambed. The dam crest has a maximum elevation of 1,380 feet mean sea level, a crest length of 9,900 feet, and a crest width of 30 feet.*

The spillway is an ungated morning-glory type located on the left abutment and has a capacity of 3,050 cubic feet per second at a water surface elevation of 1374.4 feet. A concrete inlet feeds into a 9.5-foot-diameter concrete conduit which passes through the abutment. The conduit empties into a concrete chute which feeds a stilling basin downstream from the dam.

The outlet works consists of a river outlet works (with a capacity of 2,570 cubic feet per second at water surface elevation 1374.4) and an adjacent municipal outlet works on the right abutment. The river outlet works, which has a crest elevation of 1300 feet, has a concrete intake structure fitted with trashracks. The intake structure feeds into a 9.0-foot-diameter concrete conduit which leads through the abutment to a gate chamber located about 60 feet upstream from centerline. The gate chamber contains two high-pressure regulating gates and two emergency gates which control flow into a concrete conduit which passes through the downstream portion of the dam into a concrete chute and stilling basin.

The upstream portion of the municipal outlet works consists of two 26-inch-diameter steel pipes encased in concrete which lead from the river outlet works intake structure to the above-mentioned gate chamber. The gate chamber contains two gate valves which control flow into a 26-inch-diameter steel pipe passing through the downstream portion of the dam. The steel pipe, contained in a 7.0-foot-high by 5.2-foot-wide concrete adit, continues through the control house at the dam toe to a stilling well at the intake of the Anadarko aqueduct.

The reservoir length is 12.5 miles, summation of Pond, Willow, and Lake Creeks, and has an average width of 0.51 miles at reservoir pool elevation 1342.0. Average width is determined by dividing the surface area by the reservoir length at elevation 1342.0. Total drainage area above the dam is 317 square miles, of which 262 square miles contributes sediment inflow. The sediment contributing area is the total drainage area minus 51 square miles as identified by the Bureau of Reclamation as probably noncontributing during a 1956 flood study.

* 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*.

At the beginning of reservoir storage in March 1959, Fort Cobb Reservoir had a calculated surface area of 5,915 acres and a capacity of 143,740 acre-feet at elevation 1354.8.

SUMMARY AND CONCLUSIONS

This report presents the results of an investigation to monitor changes caused by sediment accumulations in Fort Cobb Reservoir after 34.0 years of reservoir operations. The report also describes the surveying procedures and equipment used in the 1993 investigation and provides data for future surveys. The primary purpose of the 1993 survey was the collection of data to compute the area-capacity relationships for operation of Fort Cobb Reservoir.

Tables 1 and 2 contain a summary of reservoir sediment data for the 1993 survey. The 1993 survey determined that the reservoir has a storage capacity of 135,898 acre-feet and a surface area of 5,882 acres at spillway crest elevation 1354.8. Since closure in March 1959, the reservoir has accumulated a volume of 6,966 acre-feet of sediment below elevation 1354.8. This volume represents a 4.88-percent loss in total capacity and an average annual loss of 204.9 acre-feet for the operation period of March 1959 through April 1993.

SURVEYS

Survey History

The original sediment ranges were surveyed by the Bureau of Reclamation prior to inundation of water behind Fort Cobb Reservoir dam and are referred to as the original, or 1959, data. Figure 3 illustrates the range line network for Fort Cobb Reservoir. The original surface areas for Fort Cobb Reservoir were determined by planimetering topographic maps of the reservoir area developed prior to inundation. The reservoir topography consists of 28 maps (No. 853-500-16 through 853-500-43) with a scale of 1 inch equals 400 feet and 5-foot contour intervals.

1993 Resurvey

The preliminary field work of locating and flagging the existing sediment range end markers and surveying the above-water portions of the sediment range lines was performed by the Oklahoma-Texas Projects Office and FCRMCD. The hydrographic survey was performed from March 31 through April 2, 1993 (reservoir elevation 1341.88 through 1342.08), using Reclamation's small boat bathymetric survey system. The small boat system consisted of a sonic depth recorder and reflector prism mounted on the boat. The distances from a known point, usually one of the range end markers, to the small boat were determined as the boat proceeded along the range line by an EDM (electronic distance measuring) instrument set up on shore aimed at the mounted reflector target. Range distances were communicated, by radio, from shore to the boat at preselected intervals and marked on the sonar charts as the boat proceeded across the reservoir. The boat was held on course as closely as possible by radio communication from the EDM operator to the survey boat. This system was used to collect the data for range lines 1 through 6, 20, and 21. The rest of the range lines were located above water and collected by the Oklahoma-Texas Projects Office using standard surveying procedures.

RESERVOIR AREA AND CAPACITY

Development of 1993 Contour Areas

For the purposes of the 1993 sedimentation analysis and to better represent storage changes, the reservoir was subdivided into segments using the range lines to delineate the limit of each segmental boundary. The segmental surface areas of the 5-foot contours for elevations 1280.0 through 1375.0 were digitized and summarized to determine the original reservoir surface areas. This method was used to determine the original surface area of the reservoir, but the resulting segmented areas could not be located for the 1993 study. For the 1993 analysis the Reclamation Service Center redigitized the segmental areas of the 5-foot contours using microfilmed copies of the original 1 inch equals 400 feet topographic maps. The total segmented areas for the digitized 5-foot contours compared fairly well with the original areas and required only minor adjustments to match the original total areas. Table 3 gives a summary of the areas by segments and elevations.

The 1993 reservoir surface areas were computed by the width adjustment method described by Blanton (1982) and illustrated on figure 4. The method entails computing the new segmented contour area, A_1, between any two ranges by applying an adjustment factor to the original segmental contour area, A_0. The computed adjustment factor for each segment was the ratio of the new average width to the original average width for both the upstream and downstream ranges at the specified contour elevation. These calculations were completed by Reclamation's computer program RESSED. The input data included the original and 1993 range line data along with the segmented areas for the specified contour elevation. The program computes the 1993 surface area for each segment at the given contour elevations. A comparison of simultaneous plots of original and 1993 range profiles indicated the lateral distribution of sediment at the different measured contour elevations. Where these plots indicate changes have occurred on the side slopes of the reservoir, a decision was made to determine whether the change was caused by survey inaccuracies or actual deposition or erosion. The adjustment factor was set to 1.0 if the measured change was judged to be caused by survey inaccuracy. Additional modifications to the calculated width adjustment factor were done to better represent the contour surface area changes. Because the original topography of Fort Cobb Reservoir had only 5-foot contours, obtaining a better representation of the sediment surface areas was deemed necessary. These sediment surface areas were developed by calculating the 1993 average bottom profile versus the original thalweg profile and transferring the location of the 1993 contour crossing to the original topography, and digitizing the resulting sediment surface areas. This procedure was done for the contour crossings that terminated within a segment.

The RESSED program output listed the revised areas for each segment and noted where judgement led to overriding the adjustment factors. The output also noted where the adjustment factors were overridden to reflect the digitized surface areas of the contours that terminated within the segments. The 1993 total reservoir surface area at a given contour was the summation of all segmental areas at that elevation. The 1993 total area computation results are listed in column 4 of table 2.

1993 Revised Storage Capacity

The storage-elevation relationships based on the 1993 underwater survey data were developed using Reclamation's area-capacity computer program ACAP (Reclamation, 1985). The 1993 surface areas resulting from the RESSED computations at 5-foot contour intervals from elevation 1290.0 through 1375.0 were used as the control parameters for computing reservoir capacity. The 1993 study only surveyed ranges that measured changes from contour elevations 1280.0 through 1370.0. The original surface area for the 1375.0 contour was used for capacity calculations because it was judged that the reservoir has not affected this contour area. The program computes an area at 0.01- to 1.0-foot area increments by linear interpolation between the given 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 Fort Cobb 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 the basic area curve over that interval) begins testing 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 1993 Fort Cobb Reservoir area and capacity computations are listed in tables 1 and 2 and plotted on figure 5. A separate set of 1993 area and capacity tables was published for the 0.01-, 0.1-, and 1-foot elevation increments. The 1993 area and capacity computations results are listed in columns (4) and (5) of table 2. Column 2 in the table gives the original measured contour areas used in the original area and capacity computation, and column 3 gives the original capacity recomputed using ACAP. Both the original and 1993 area and capacity curves are plotted on figure 5 for a visual comparison of changes. The 1993 survey determined that the reservoir has a storage capacity of 135,898 acre-feet and a surface area of 5,882 acres at spillway crest elevation 1354.8.

SEDIMENT ANALYSES

Sedimentation Accumulation

Since storage began in March 1959, sediments have accumulated in Fort Cobb Reservoir to a estimated volume of 6,966 acre-feet below the spillway crest elevation of 1354.8. This volume represents a 4.88-percent loss in total capacity and an average annual accumulation rate of 204.9 acre-feet for the 34.0-year period of operation. The net sediment accumulation rate from the contributing basin was 0.782 acre-feet per square mile per year for the same period.

Sedimentation Summary

The results of the sediment data and volume computations for the 1993 survey are shown in table 1 and table 2. The data include a tabulation of incremental sediment inflow volume and sediment accumulation computed for the period between initial conditions and the 1993 resurvey. Table 1 includes information on the drainage basin, records of estimated inflow, reservoir operations, and reservoir storage.

RESERVOIR SEDIMENT DISTRIBUTION

Longitudinal Distribution

The distribution of sediment throughout the length of the reservoir is illustrated by plots of the thalweg profile representing the original and 1993 resurveyed profiles for the Pond and Willow Creeks as shown on figures 6 and 7. Thalweg elevations representing original and the resurveyed reservoir conditions were taken from the 1993 survey notes and large scale plots of the original range line data. Except for the possibility of some missed low points, the plotted profile should closely resemble actual channel bottom conditions during the original range survey completed prior to inundation of the reservoir. Except for some minor inaccuracies in sounding and being slightly off line, the bottom of the 1993 profiles should closely represent channel bottom conditions at the time of those resurveys. The channel distance used for range line location is the original river channel distance from the dam to each range line in an upstream direction on Pond Creek and from the confluence to each range line in an upstream direction on Willow Creek.

Lateral Distribution

The original survey notes or coordinate data were not available, so for this study, the original range line data were determined by scaling off break points from plots of the original range lines. Plan and profile plots of 23 original Fort Cobb range lines were available on Reclamation Drawing Numbers 853-522-95 through 853-522-117. Ground profiles for the original surveyed sediment ranges are shown on figures 8 through 22. The 1993 range profile data are superimposed on these plots to indicate the changes which have occurred and to represent in general the lateral distribution of sediment within the reservoir from elevation 1375.0 and below. Modification to the 1993 data included shifting stations slightly to better align features. For sediment computation purposes, a complete section was needed for all ranges. For this reason, the original data were inserted into the 1993 data file to complete the areas not surveyed in 1993.

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RESERVOIR SEDIMENT
DATA SUMMARY

Fort Cobb Reservoir
NAME OF RESERVOIR

1
DATA SHEET NO.

DAM	1. OWNER Bureau of Reclamation		2. STREAM Pond (Cobb) Creek		3. STATE Oklahoma	
	4. SEC. 22 TWP. 8N RANGE 12W		5. NEAREST P.O. Fort Cobb		6. COUNTY Caddo	
	7. LAT 35° 09′ 58″ LONG 98° 27′ 23″		8. TOP OF DAM ELEVATION 1380		9. SPILLWAY CREST EL. 1354.8[1]	
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. SURCHARGE	1374.4	9,422	148,650	292,390	
	b. FLOOD CONTROL	1354.8	5,915	63,730	143,740	3/30/59
	c. POWER					
	d. WATER SUPPLY					16. DATE NORMAL OPERATION BEGAN
	e. IRRIGATION					
	f. CONSERVATION	1342.0	4,070	78,346	80,010	6/1962
	g. INACTIVE	1300.0	340	1,664	1,644	
	17. LENGTH OF RESERVOIR 12.5[2] MILES			AVG. WIDTH OF RESERVOIR 0.51 MILES		
BASIN	18. TOTAL DRAINAGE AREA 317[3] SQUARE MILES			22. MEAN ANNUAL PRECIPITATION 23[4] INCHES		
	19. NET SEDIMENT CONTRIBUTING AREA 262 SQUARE MILES			23. MEAN ANNUAL RUNOFF 2.47[5] INCHES		
	20. LENGTH MILES	AV. WIDTH MILES		24. MEAN ANNUAL RUNOFF 41,708[6] ACRE-FEET		
	21. MAX. ELEVATION 1764	MIN. ELEVATION 1300		25. ANNUAL TEMP. MEAN 60°F[4] RANGE 120°F to -15°F[4]		

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
	3/30/59			Contour (D)	5-ft	5,915[7]	142,864[7]	3.42
						(9,422)[8]	(291,432)[8]	6.99
	4/2/93	34.0	34.0	Range (D)	15	5,882[9]	135,898[9]	3.26
						(9,421)	(284,079)	6.81

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
4/93	23	41,708[6]	130,665[6]	1,418,069[6]	41,708[6]	1,418,069[6]

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.
4/93	6,966	204.9	0.782	6,966	204.9	0.782
	(7,353)	(216.3)	(0.825)	(7,353)	(216.3)	(0.825)

26. DATE OF SURVEY	39. AV. DRY WT. (#/FT^3)	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.
4/93				0.143[10]	4.88[10]		
				(0.074)	(2.52)		

26. DATE OF SURVEY	43. DEPTH DESIGNATION RANGE IN FEET BELOW, AND ABOVE, CREST ELEVATION 1354.8											
	72.8-59.8	59.8-49.8	49.8-39.8	39.8-24.8	29.8-24.8	24.8-19.8	19.8-14.8	14.8-9.8	9.8-CREST	CREST-+19.6		
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION											
4/93	4.3	4.4	3.9	7.8	10.3	14.6	21.5	19.2	8.7	5.3		

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.[11]	MIN. ELEV.[11]	INFLOW, AF	YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AF
1959	1318.6	1279.0	10,603	1960	1330.3	1323.1	30,026
1961	1338.1	1332.6	25,980	1962	1338.5	1342.1	19,952
1963	1342.2	1340.7	14,955	1964	1342.2	1340.7	10,608
1965	1345.3	1340.6	46,263	1966	1342.2	1341.1	16,347
1967	1342.0	1340.3	10,994	1968	1342.5	1340.2	27,968
1969	1342.2	1340.2	32,838	1970	1340.7	1338.8	21,826
1971	1338.5	1337.2	22,274	1972	1338.8	1335.5	19,550
1973	1342.0	1335.2	46,769	1974	1343.2	1341.4	37,236
1975	1344.5	1341.2	72,135	1976	1343.1	1340.3	30,922
1977	1346.7	1340.3	50,618	1978	1342.8	1339.8	28,321
1979	1341.3	1338.9	24,758	1980	1342.1	1338.4	40,497
1981	1339.4	1337.2	21,196	1982	1349.3	1337.2	72,399
1983	1342.9	1340.2	27,391	1984	1343.3	1338.0	33,784
1985	1340.0	1337.4	25,539	1986	1346.6	1338.1	62,679
1987	1349.1	1342.0	114,578	1988	1343.6	1340.5	59,932
1989	1343.9	1341.3	72,351	1990	1344.4	1341.8	130,665
1991	1342.8	1341.4	46,043	1992	1342.5	1341.8	60,151
1993[12]	1342.7	1341.6	49,921				

46. ELEVATION - AREA - CAPACITY DATA FOR **ORIGINAL CAPACITY**[13]

ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY
1279	0	0	1280	1	0	1285	11	30
1290	30	133	1295	133	540	1300	350	1,748
1305	557	4,015	1310	872	7,588	1315	1,169	12,690
1320	1,548	19,483	1325	2,013	28,385	1330	2,516	39,708
1335	3,175	53,935	1340	3,844	71,483	1342	4,109	79,436
1345	4,506	92,358	1350	5,111	116,400	1354.8	5,915	142,864
1355	5,949	144,050	1360	6,728	175,743	1365	7,623	211,620
1370	8,516	251,968	1375	9,546	297,123			

46. ELEVATION - AREA - CAPACITY DATA FOR **1993 CAPACITY**

ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY
1290	0	0	1295	90.4	226	1300	323.1	1,260
1305	524.4	3,378	1310	848.3	6,810	1315	1,132.1	11,761
1320	1,513.9	18,376	1325	1,890.8	26,888	1330	2,334.5	37,451
1335	2,926.5	50,604	1340	3,459.0	66,567	1342	3,806	73,833
1345	4,327.5	86,034	1350	5,087.6	109,571	1354.8	5,882	135,898
1355	5,915	137,078	1360	6,704	168,625	1365	7,602.3	204,391
1370	8,501.3	244,650	1374.4	9,421	284,079			

47. REMARKS AND REFERENCES

[1] Crest elevation of morning-glory inlet structure with ungated crest.

[2] Total length includes Pond (Cobb) Creek, Willow Creek and Lake Creek at elevation 1342.0.

[3] Bureau of Reclamation 1956 flood study measured total drainage area above Fork Cobb Dam as 317 square miles with portions totaling 51 square miles as considered noncontributing.

[4] Bureau of Reclamation *Project Data Book*, 1981.

[5] Calculated from mean annual runoff value, 41,708 acre-feet, Item 24.

[6] Unregulated monthly inflow records for water years April 1959 through April 1993.

[7] Surface area and capacity at elevation 1354.8, spillway crest. Area and capacity recalculated to conform to current computational methods using Bureau of Reclamation program ACAP.

[8] All values enclosed in parentheses are maximum water surface values at elevation 1374.4.

[9] Surface area and capacity at elevation 1354.8, spillway crest. Area and capacity calculated by Bureau of Reclamation program ACAP.

[10] Average annual and total sediment deposits divided by 142,864 acre-feet, original capacity at elevation 1354.8, and 291,432 acre-feet, original capacity at elevation 1374.4.

[11] End-of-month elevations from USGS publications, by water year.

[12] For water year 1993 from October 1992 through March 1993.

[13] Original area and capacity recalculated for the 1993 sedimentation study using ACAP.

48. AGENCY MAKING SURVEY Bureau of Reclamation

49. AGENCY SUPPLYING DATA Bureau of Reclamation | DATE May 1994

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

(1) Elevation (feet)	(2) Original Area (acres)	(3) Original Capacity (acre-feet)	(4) 1993 Area (acres)	(5) 1993 Capacity (acre-feet)	(6) Measured Sediment Volume (acre-feet)	(7) Percent Measured Sediment	(8) Percent Reservoir Depth
1374.4	9,422	291,432	9,421	284,079	7,353	100.0	100.0
1370	8,516	251,968	8,501.3	244,650	7,318	99.5	95.4
1365	7,623	211,620	7,602.3	204,391	7,229	98.3	90.1
1360	6,728	175,743	6,704.0	168,625	7,118	96.8	84.9
1355	5,949	144,050	5,915.0	137,078	6,972	94.8	79.7
1354.8	5,915	142,864	5,882	135,898	6,966	94.7	79.4
1350	5,111	116,400	5,087.6	109,571	6,829	92.9	74.4
1345	4,506	92,358	4,327.5	86,034	6,324	86.0	69.2
1342	4,109	79,436	3,806	73,833	5,603	76.2	66.0
1340	3,844	71,483	3,459.0	66,567	4,916	66.8	63.9
1335	3,175	53,935	2,926.5	50,604	3,331	45.3	58.7
1330	2,516	39,708	2,334.5	37,451	2,257	30.7	53.4
1325	2,013	28,385	1,890.8	26,888	1,497	20.4	48.2
1320	1,548	19,483	1,513.9	18,376	1,107	15.0	43.0
1315	1,169	12,690	1,132.1	11,761	929	12.6	37.7
1310	872	7,588	848.3	6,810	778	10.6	32.5
1305	557	4,015	524.4	3,378	637	8.7	27.2
1300	350	1,748	323.1	1,260	488	6.6	22.0
1295	133	540	90.4	226	314	4.3	16.8
1290	30	133	0	0	133	1.8	11.5
1285	11	30	0	0	30	0.4	6.3
1280	1	0	0	0	0	0.0	1.0
1279	0	0	0	0	0	0.0	0.0

(1) Elevation of reservoir water surface.
(2) Original reservoir surface area.
(3) Original calculated reservoir capacity computed using ACAP from original measured surface areas.
(4) Reservoir surface area from 1993 survey.
(5) 1993 calculated reservoir capacity computed using ACAP from 1993 surface areas.
(6) Measured sediment volume = column (3) - column (5).
(7) Measured sediment expressed in percentage of total sediment (7,353).
(8) Depth of reservoir expressed in percentage of total depth (95.4 feet).

Table 2. - Summary of 1993 survey results.

	ELEVATION																			
SEGMENT	1375.0	1370.0	1365.0	1360.0	1355.0	1350.0	1345.0	1340.0	1335.0	1330.0	1325.0	1320.0	1315.0	1310.0	1305.0	1300.0	1295.0	1290.0	1285.0	1280.0
1	501.9	454.9	413.1	358.2	320.2	282.4	260.2	235.4	205.4	181.8	163.4	141.1	123.4	110.8	98.7	91.8	67.3	18.0	2.4	1.0
2	1383.1	1244.1	1148.3	1066.1	988.3	864.2	788.0	695.4	626.8	543.1	492.0	437.7	385.3	347.0	288.2	207.7	53.0	9.8	5.7	0.0
3	1281.2	1193.6	1124.1	1042.2	968.2	891.9	809.6	718.7	628.9	528.2	485.3	395.4	348.0	291.6	156.6	43.3	10.7	4.2	2.9	0.0
4	1213.7	1109.2	1002.6	916.1	832.4	781.1	716.0	637.9	576.4	506.5	438.3	377.0	295.3	112.6	13.1	7.2	2.1	0.0	0.0	0.0
5	973.6	882.1	819.9	733.0	675.7	631.0	587.7	532.3	487.0	430.9	381.5	190.9	18.1	10.1	0.4	0.0	0.0	0.0	0.0	0.0
6	1048.1	927.6	841.5	768.1	683.1	583.4	542.4	491.3	425.9	253.2	55.9	5.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	988.6	917.6	844.6	777.6	701.5	644.2	570.0	381.7	112.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	547.1	494.0	439.6	398.0	312.5	100.6	15.7	8.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	435.6	351.7	227.1	66.5	17.5	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	67.5	16.8	11.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	24.7	10.7	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	218.2	191.1	169.0	155.2	138.3	121.9	107.8	92.4	80.4	60.5	16.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	173.8	160.0	140.2	128.7	113.2	99.8	78.6	52.4	29.7	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	165.8	143.4	112.8	76.2	39.0	16.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	23.5	10.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	248.8	223.8	198.9	175.2	148.9	78.8	29.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	188.8	151.5	117.3	60.4	8.9	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	42.6	10.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	41.1	22.2	10.6	3.5	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	2.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	9546.0	8516.0	7623.0	6728.0	5949.0	5111.0	4506.0	3844.0	3175.0	2516.0	2013.0	1548.0	1169.0	872.0	557.0	350.0	133.0	30.0	11.0	1.0

Digitized areas in acres for segments of Fort Cobb Reservoir.

Table 3. - Segmented reservoir areas.

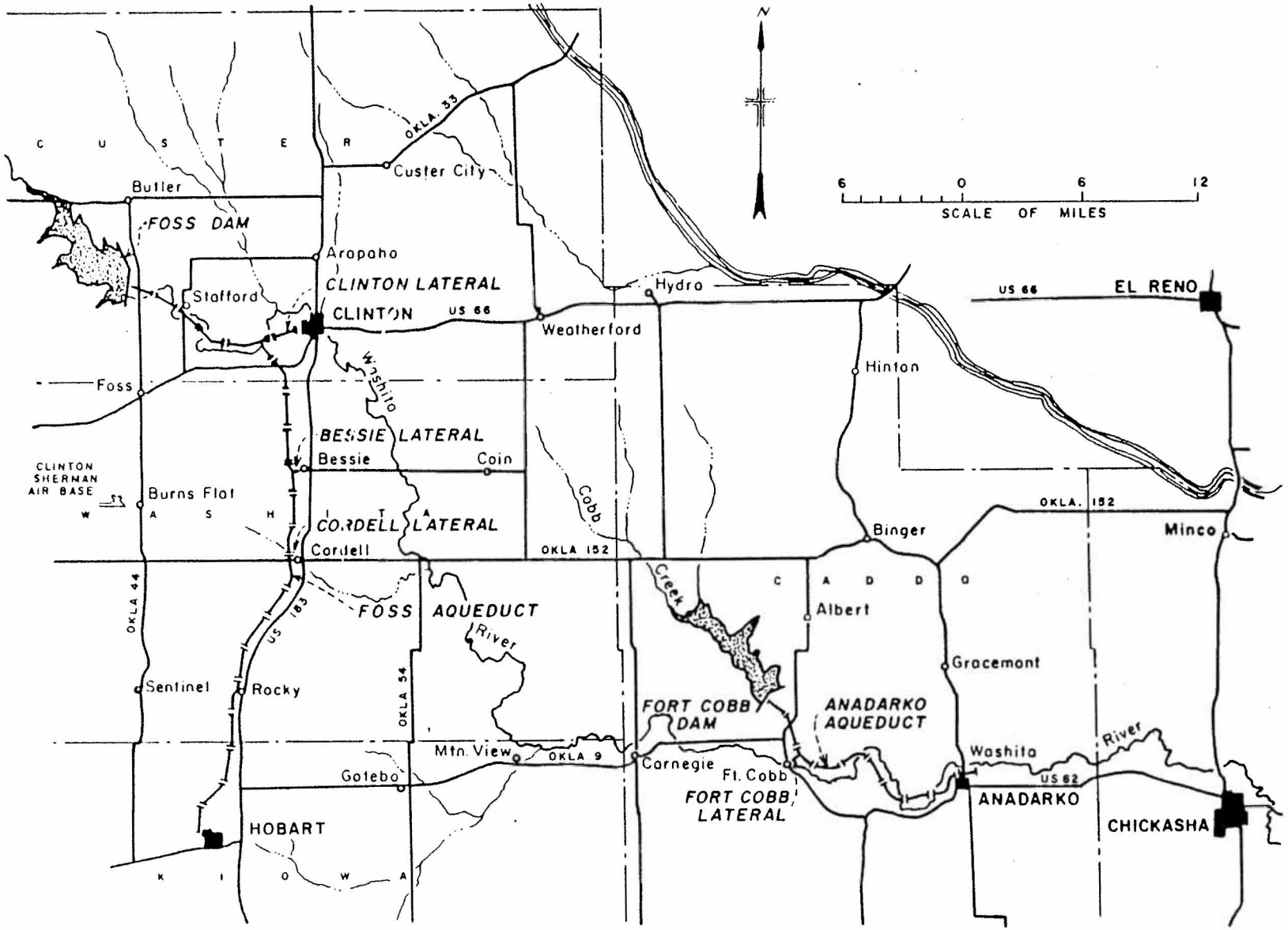

Figure 1. - Fort Cobb Reservoir location map.

Space intentionally left blank due to security concerns

RANGE LINE NUMBER	LEFT MONUMENT			RIGHT MONUMENT			REFERENCE DRAWING NUMBER
	COORDINATES		ELEVATION (M.S.L.)	COORDINATES		ELEVATION (M.S.L.)	
	NORTH	EAST		NORTH	EAST		
R-1	670,514.55	1,869,800.11	1393.03	663,609.21	1,858,251.88	1401.21	853-522-[illegible]
R-2	675,794.31	1,867,176.70	1413.55	668,000.78	1,856,005.19	1399.57	853-522-[illegible]
R-3	681,177.01	1,861,849.28	1390.87	672,440.73	1,854,733.77	1396.06	853-522-[illegible]
R-4	684,746.70	1,857,012.86	1399.32	676,759.87	1,851,122.93	1398.11	853-522-[illegible]
R-5	687,463.26	1,852,218.20	1446.85	681,166.12	1,846,782.13	1412.34	853-522-[illegible]
R-6	692,031.56	1,846,185.26	1383.31	686,105.78	1,842,786.92	1409.87	853-522-[illegible]
R-7	696,400.27	1,839,457.71	1436.73	688,645.65	1,839,013.02	1418.07	853-522-[illegible]
R-8	697,039.91	1,834,499.56	1402.16	692,010.37	1,831,640.73	1415.97	853-522-[illegible]
R-9	702,259.12	1,830,278.82	1414.85	700,746.64	1,828,290.89	1414.31	853-522-[illegible]
R-10	708,340.41	1,828,138.52	1433.49	706,283.21	1,825,756.40	1430.50	853-522-[illegible]
R-11	715,452.63	1,823,118.70	1442.00	712,712.35	1,819,446.63	1451.98	853-522-[illegible]
R-12	719,043.75	1,816,814.62	1458.50	716,054.19	1,815,392.83	1455.50	853-522-[illegible]
R-20	684,746.70	1,857,012.86	1399.32	686,454.16	1,854,429.80	1405.04	853-522-[illegible]
R-21	685,778.06	1,859,814.14	1404.72	689,002.24	1,856,605.31	1418.46	853-522-[illegible]
R-22	689,015.75	1,862,569.04	1422.37	691,031.13	1,859,277.29	1414.07	853-522-[illegible]
R-23	695,440.65	1,863,903.35	1447.79	696,856.76	1,861,215.41	1451.62	853-522-[illegible]
R-24	699,829.23	1,866,519.21	1489.00	701,177.[illegible]	1,863,675.05	1492.43	853-522-[illegible]
R-30	686,963.51	1,843,754.23	1402.47	690,470.[illegible]	1,839,407.71	1436.73	853-522-[illegible]
R-31	702,215.81	1,843,083.62	1417.52	701,870.22	1,839,614.54	1468.77	853-522-[illegible]
R-32	708,969.81	1,834,159.03	1438.50	710,120.94	1,840,789.80	1450.12	853-522-[illegible]
R-33	710,869.25	1,844,006.78	1492.17	713,987.[illegible]	1,842,471.64	1467.58	853-522-[illegible]
R-40	693,456.89	1,830,722.32	1431.41	692,[illegible]6.37	1,831,640.73	1415.97	853-522-[illegible]
R-41	692,006.26	1,826,304.81	1435.38	689,767.22	1,828,057.40	1435.19	853-522-[illegible]

Figure 3. - Fort Cobb Reservoir range location map.

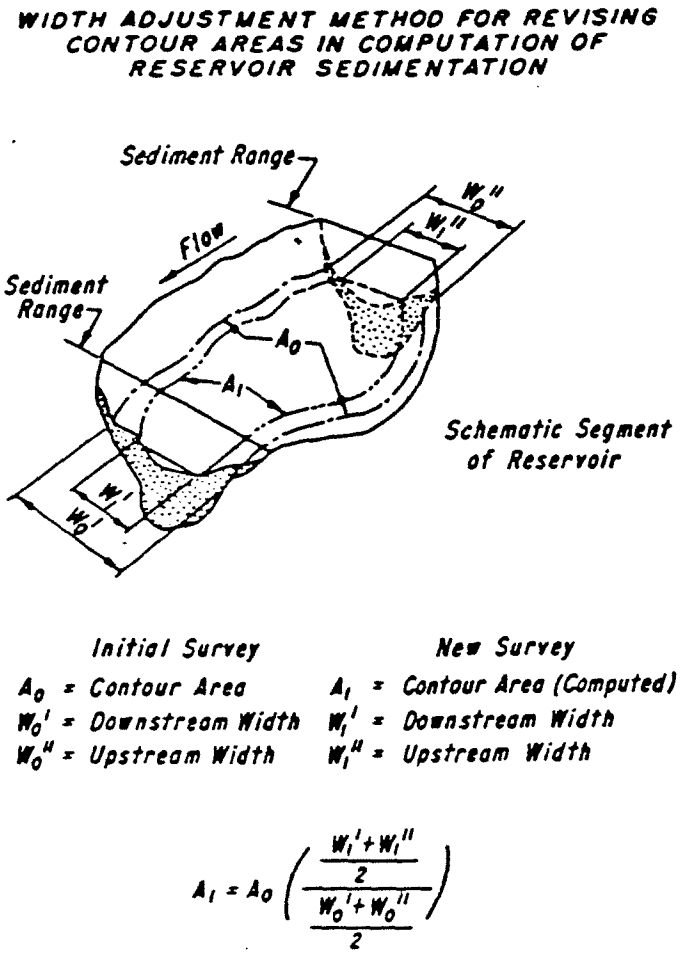

Figure 4. - Width adjustment method for revising contour areas.

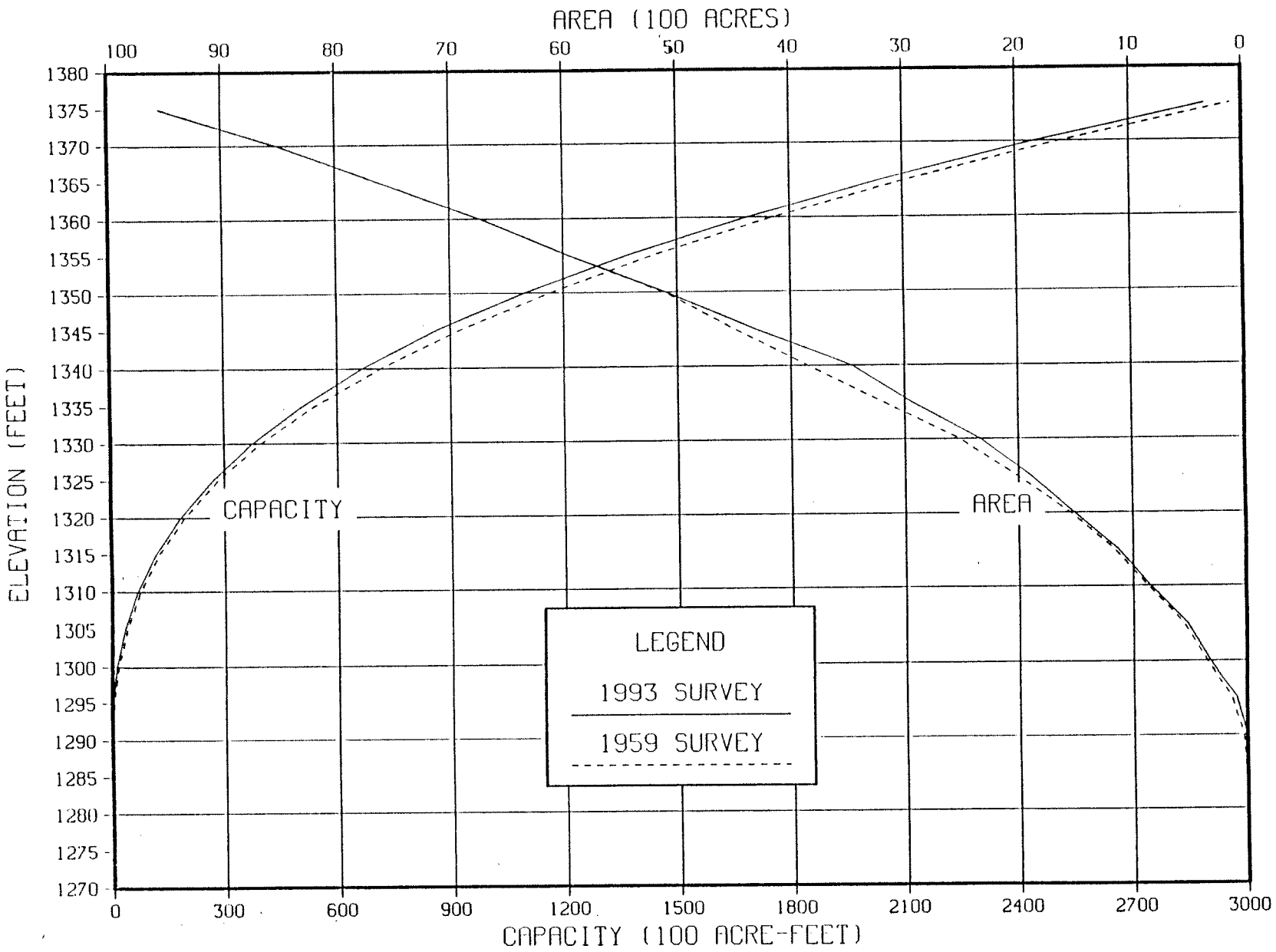

Figure 5. - Area and capacity curves — Fort Cobb Reservoir.

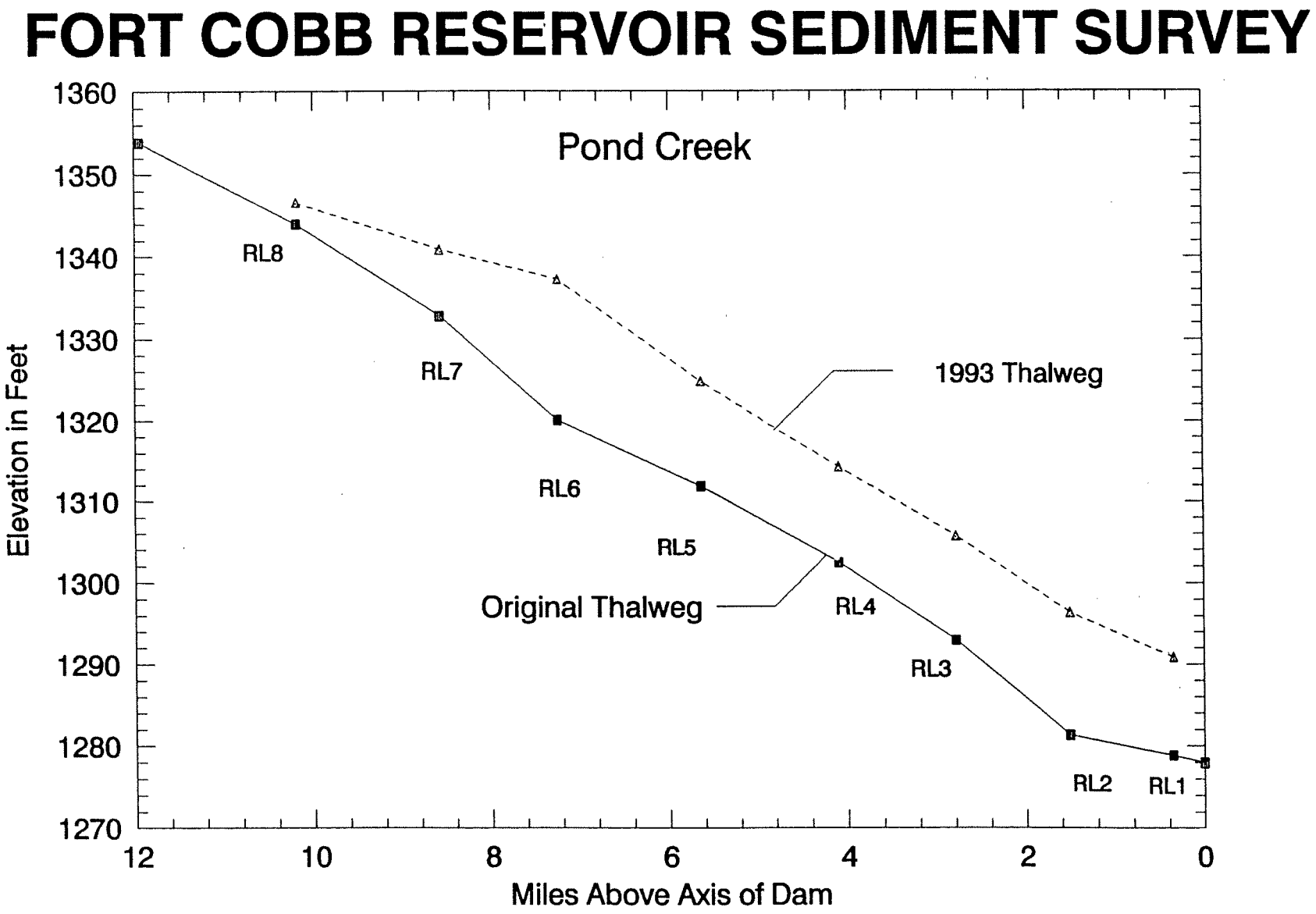

Figure 6. - Longitudinal profile — Pond (Cobb) Creek.

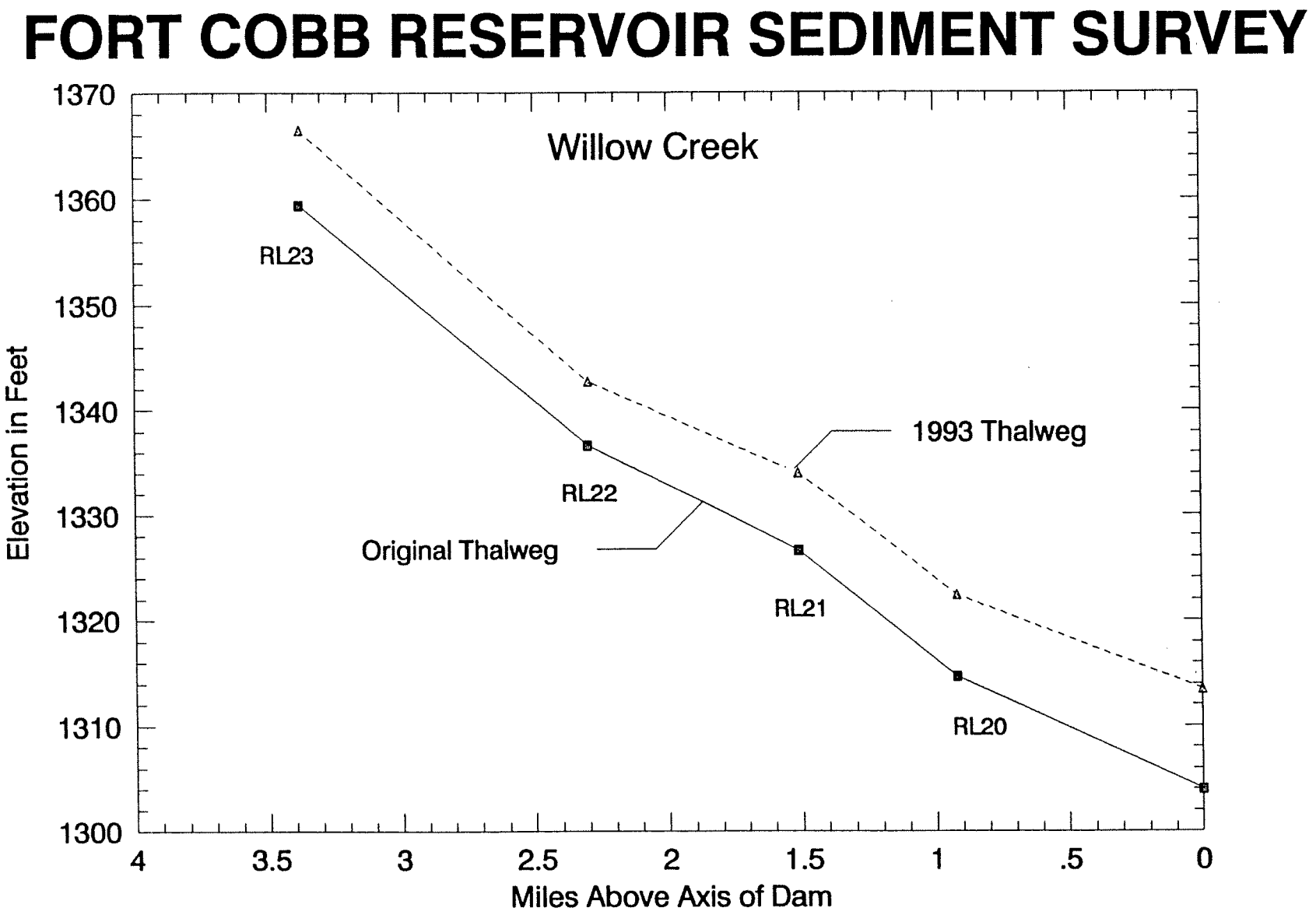

Figure 7. - Longitudinal profile - Willow Creek.

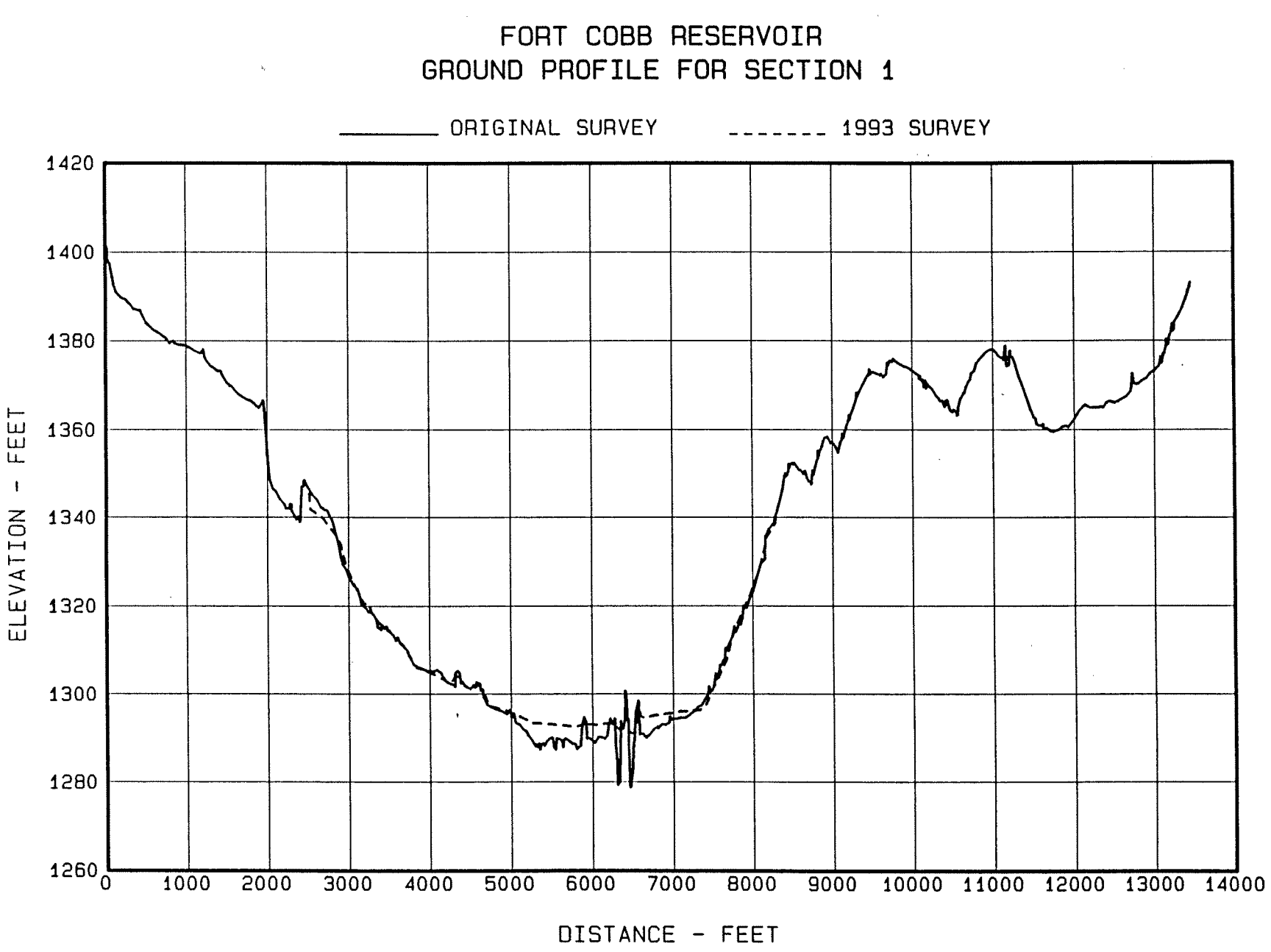

Figure 8. - Sediment Range 1 - Pond Creek.

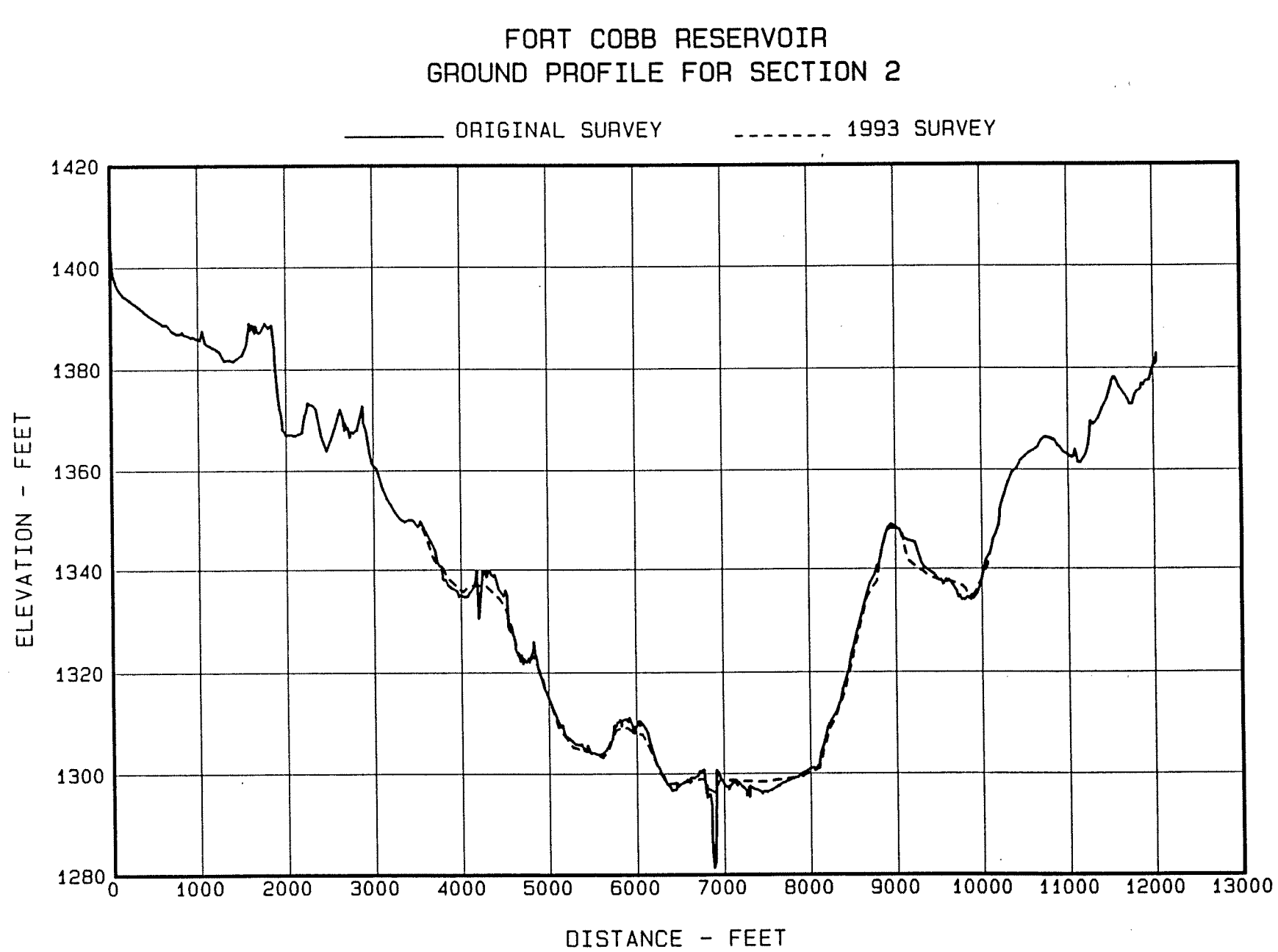

Figure 9. - Sediment Range 2 - Pond Creek.

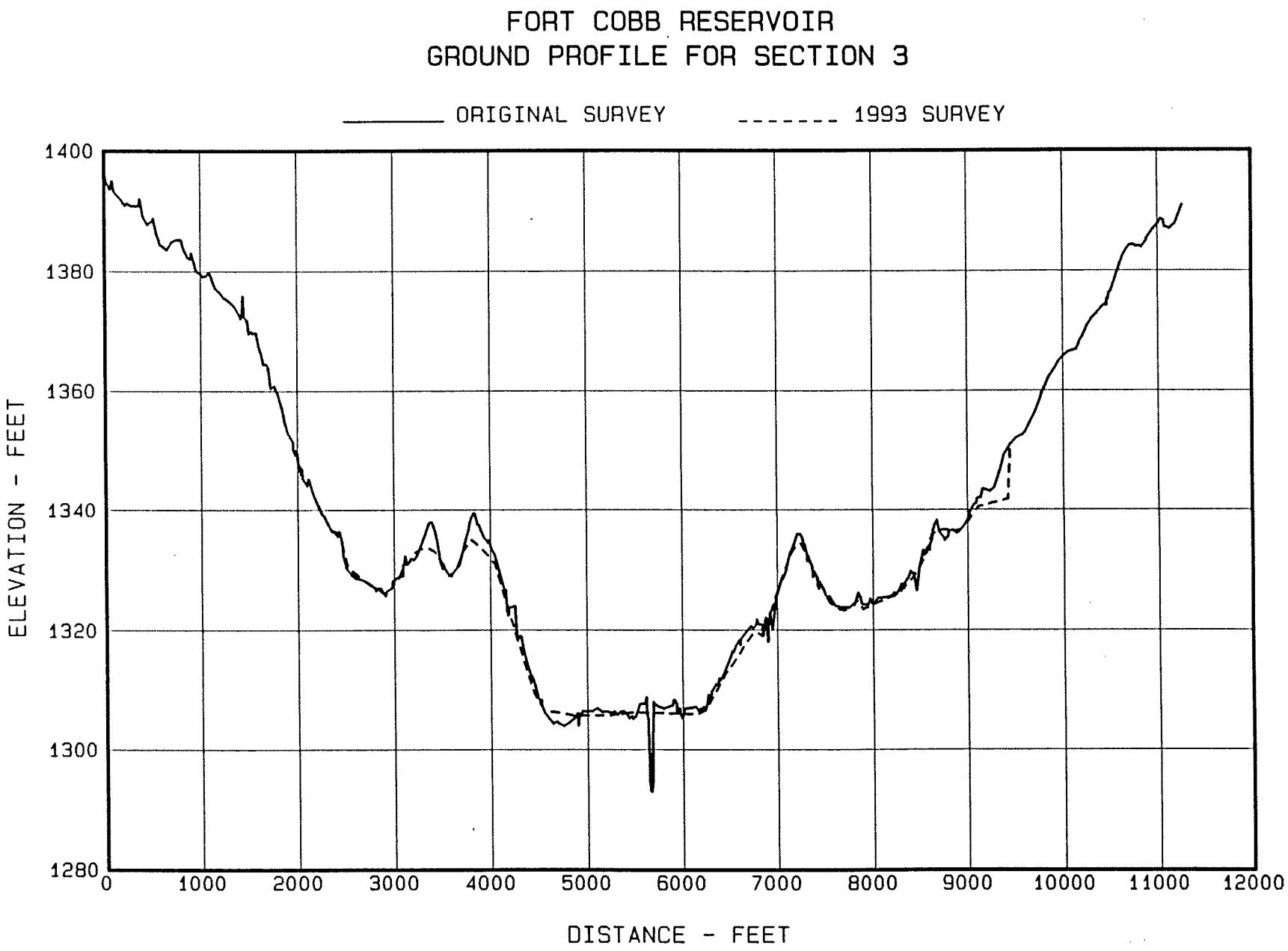

Figure 10. - Sediment Range 3 - Pond Creek.

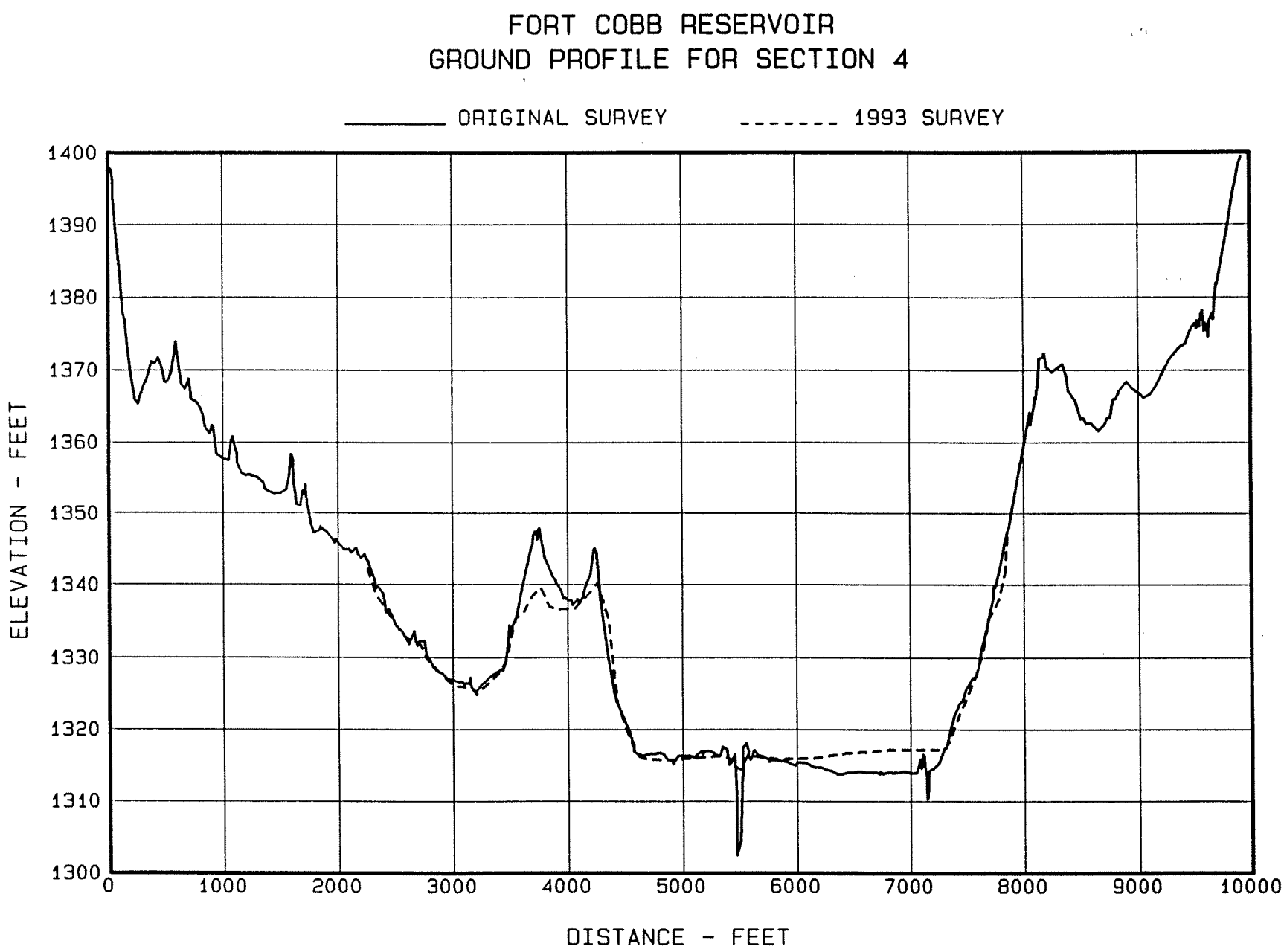

Figure 11. - Sediment Range 4 - Pond Creek.

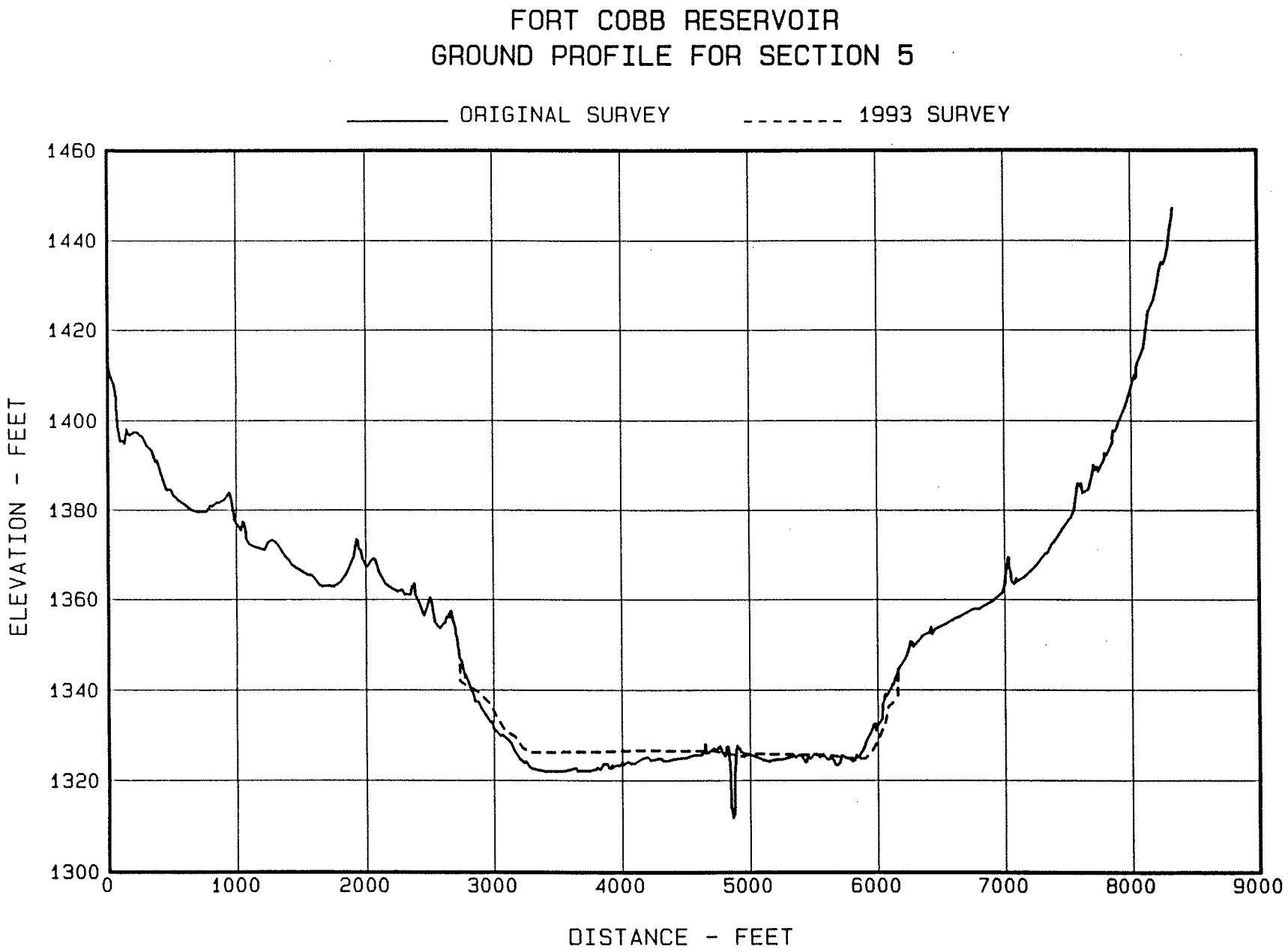

Figure 12. - Sediment Range 5 - Pond Creek.

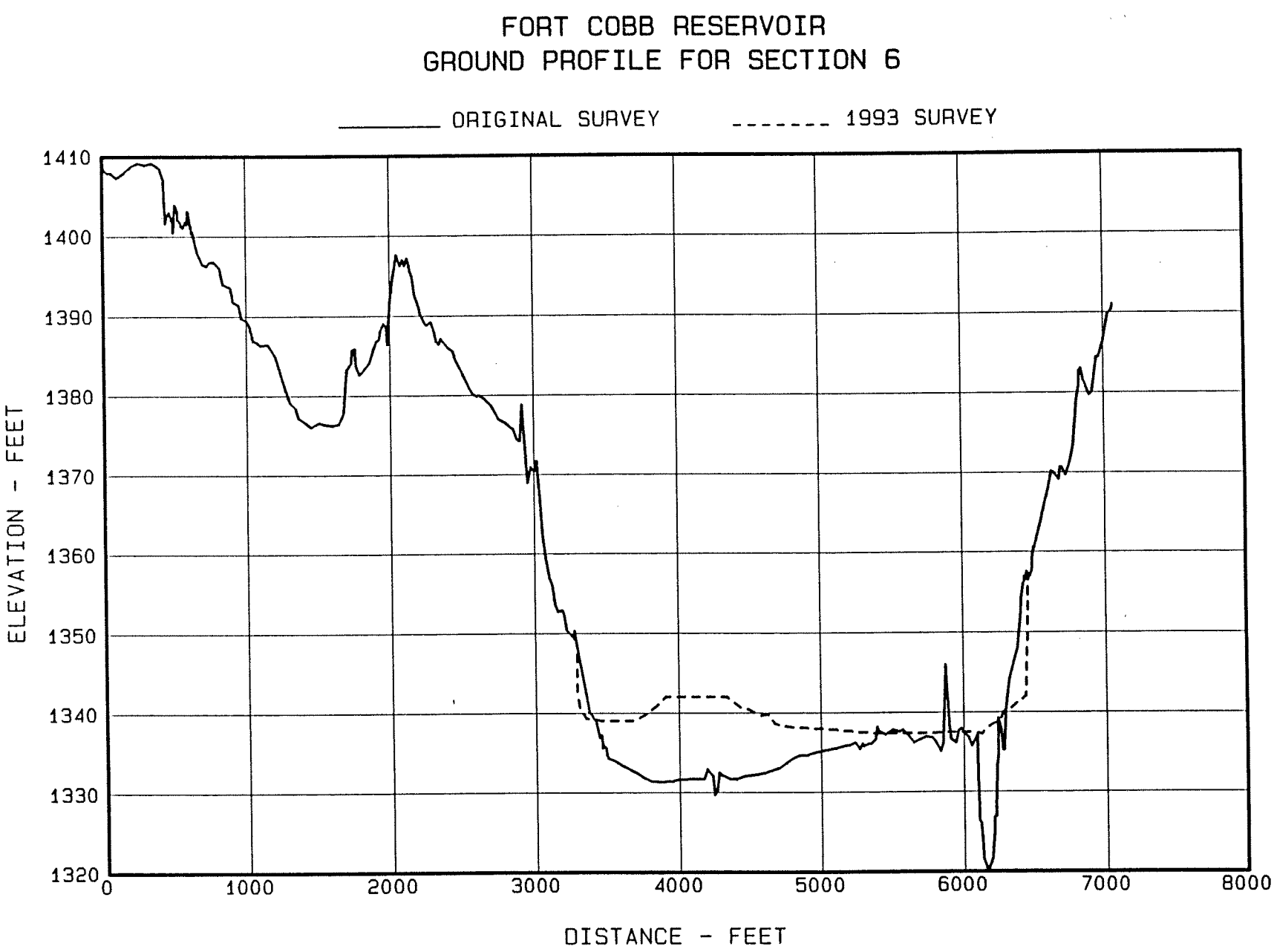

Figure 13. - Sediment Range 6 - Pond Creek.

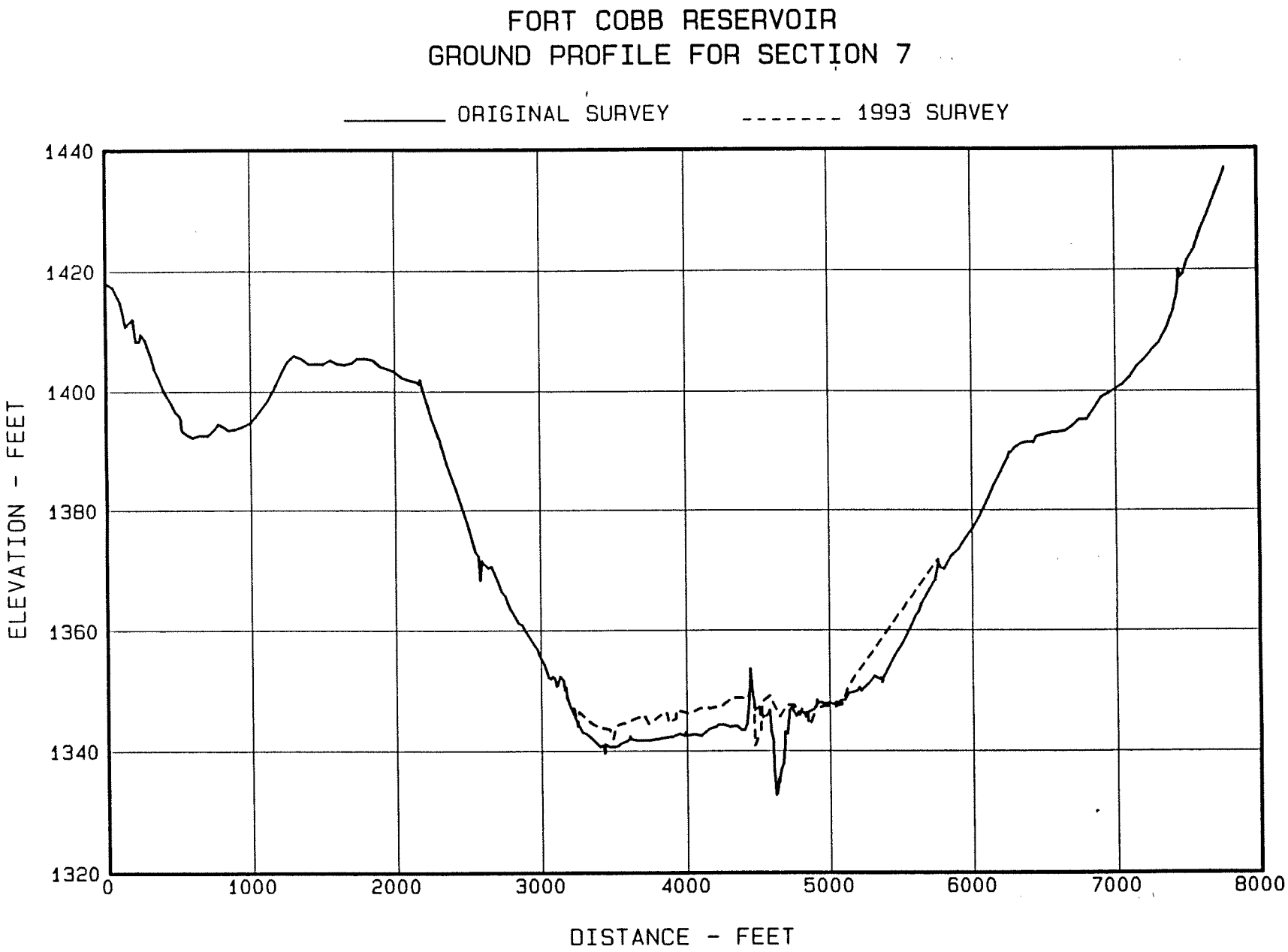

Figure 14. - Sediment Range 7 - Pond Creek.

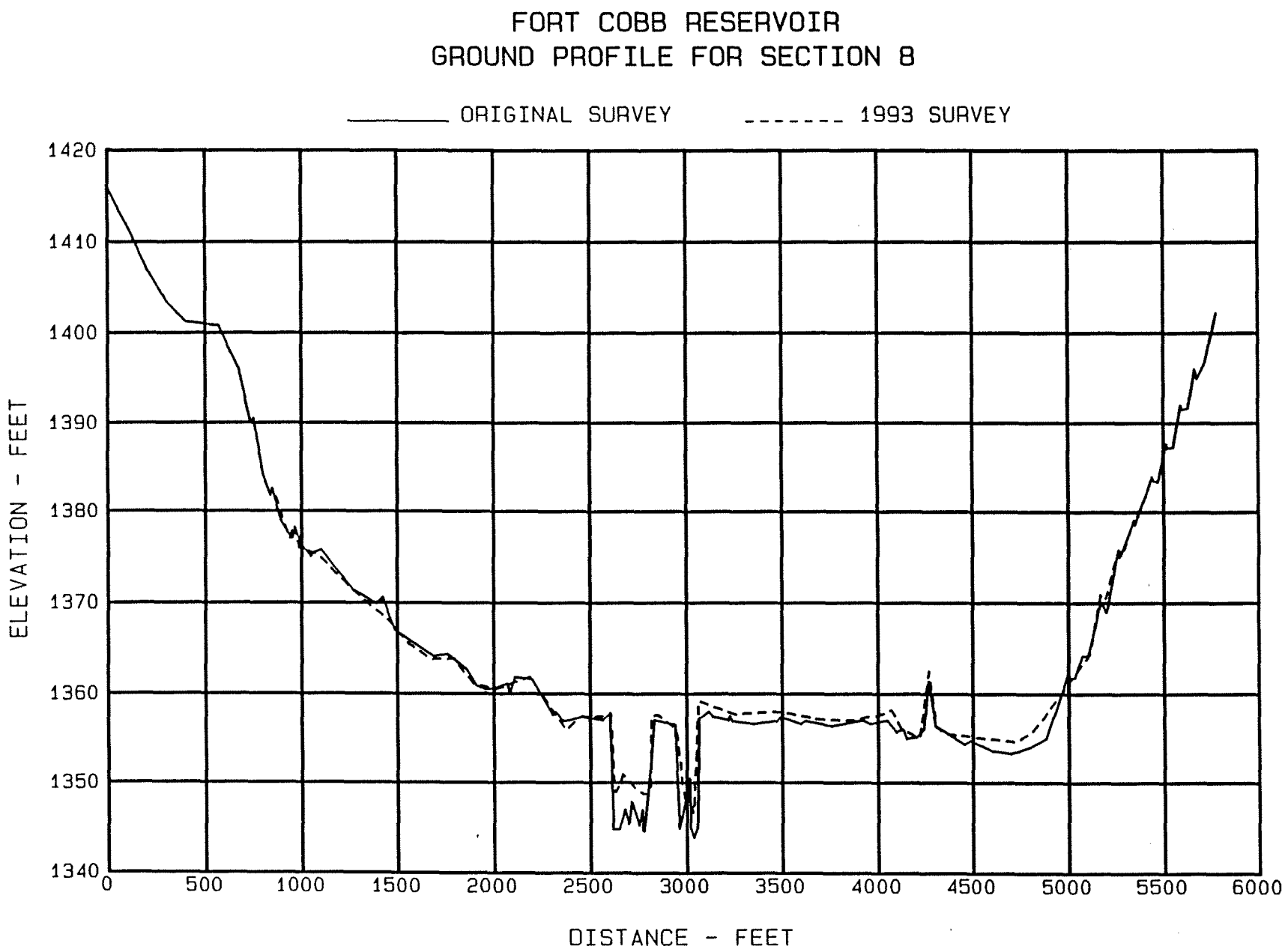

Figure 15. - Sediment Range 8 - Pond Creek.

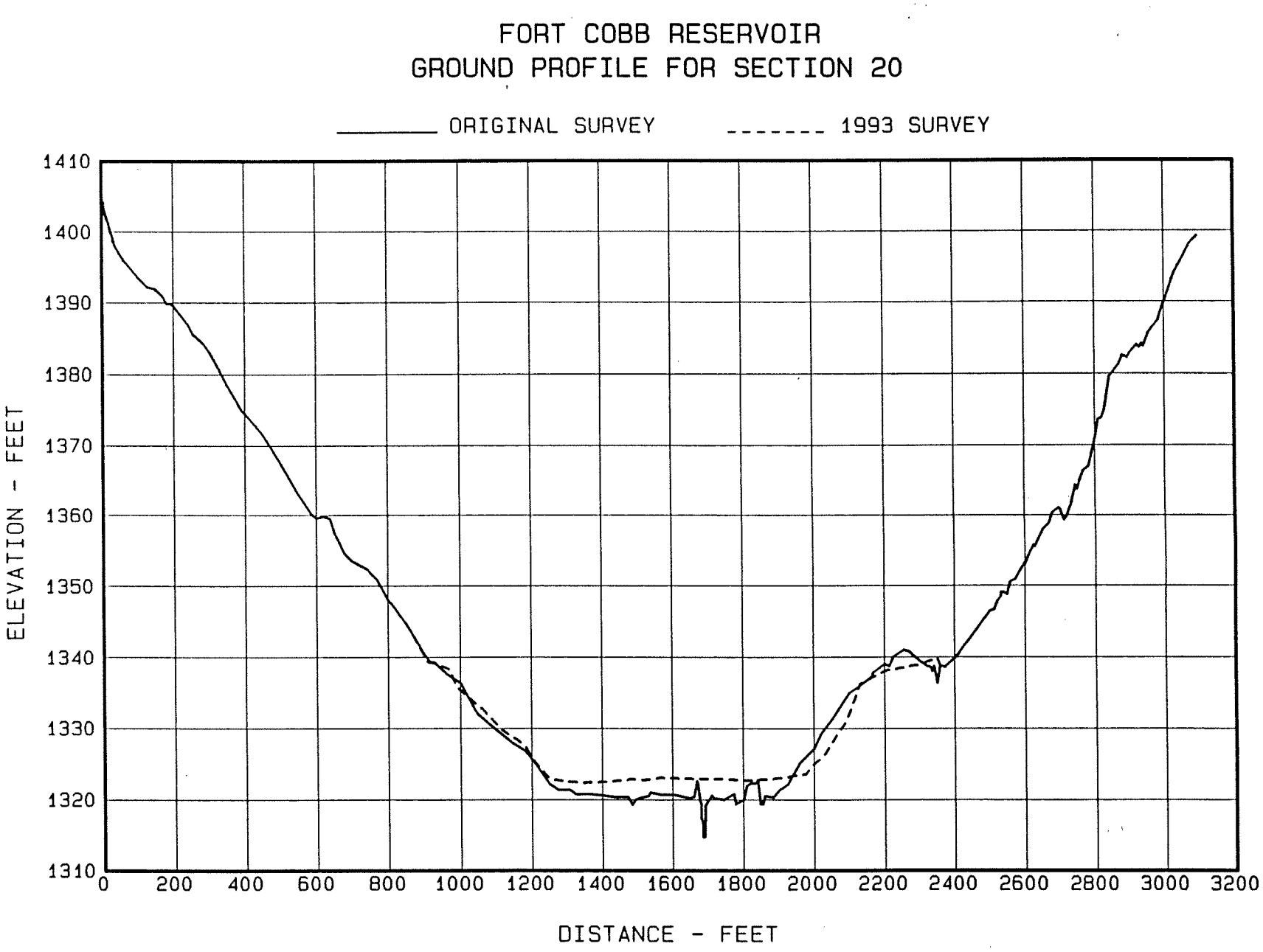

Figure 16. - Sediment Range 20 - Willow Creek.

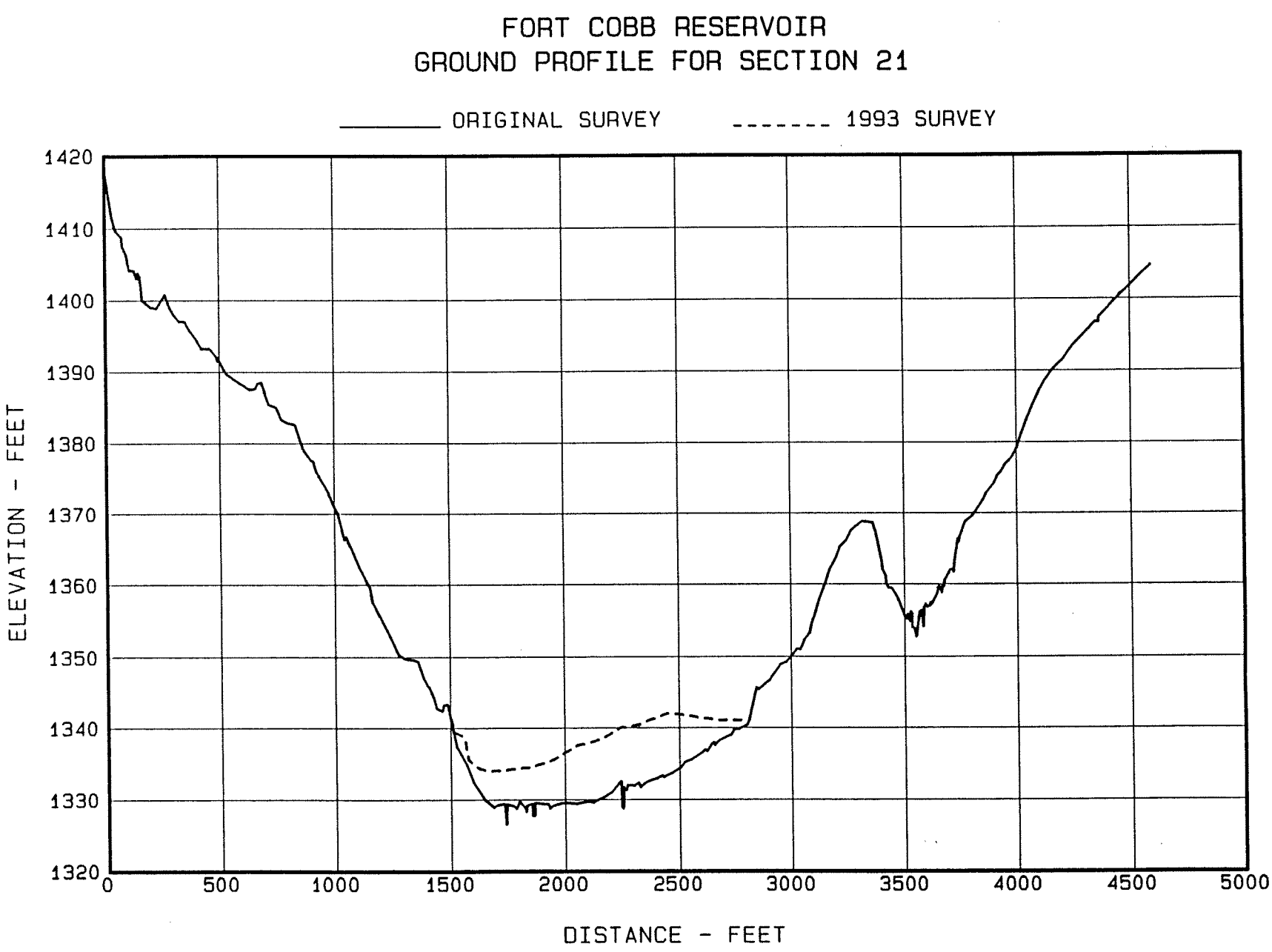

Figure 17. - Sediment Range 21 - Willow Creek.

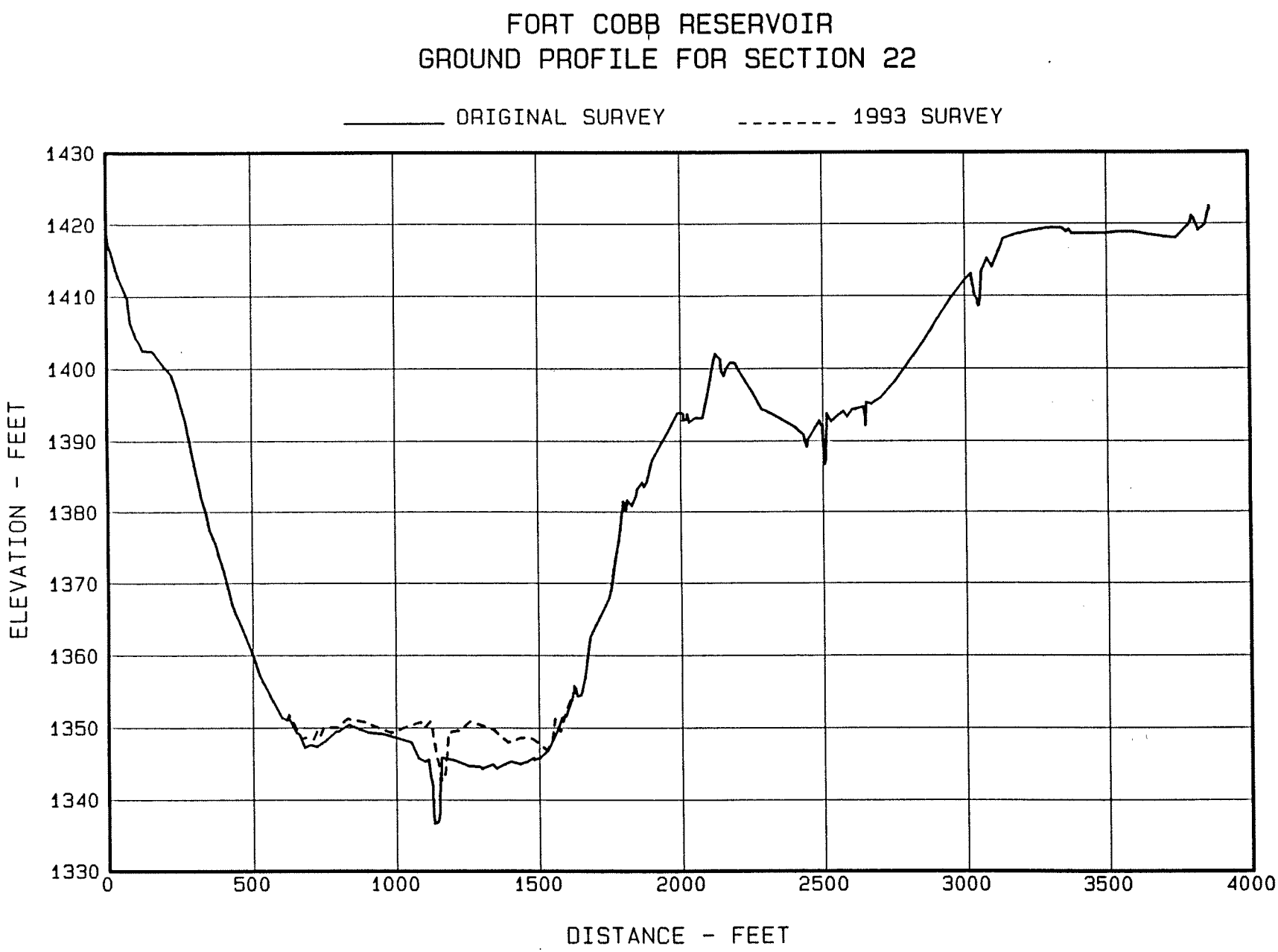

Figure 18. - Sediment Range 22 - Willow Creek.

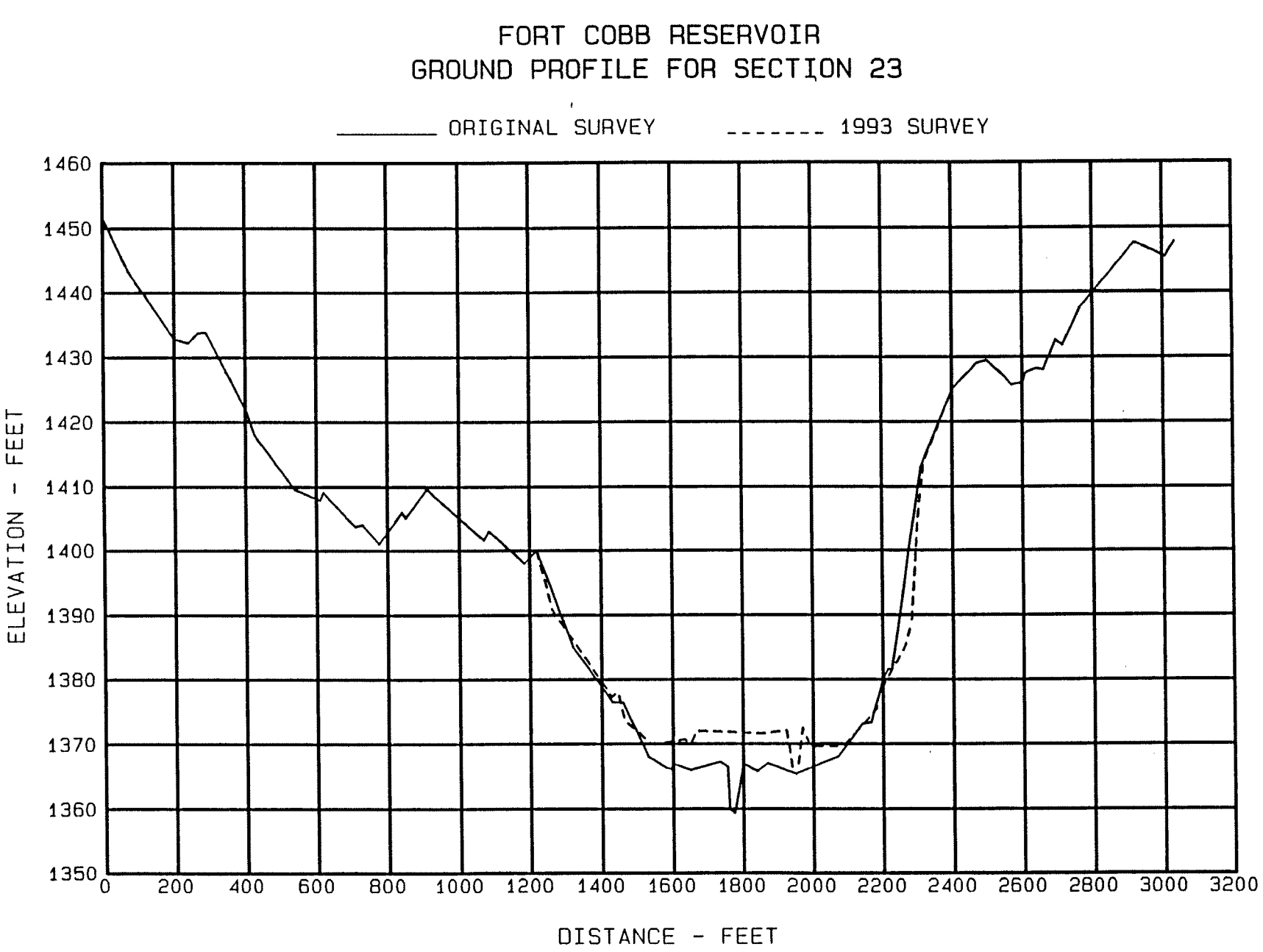

Figure 19. - Sediment Range 23 - Willow Creek.

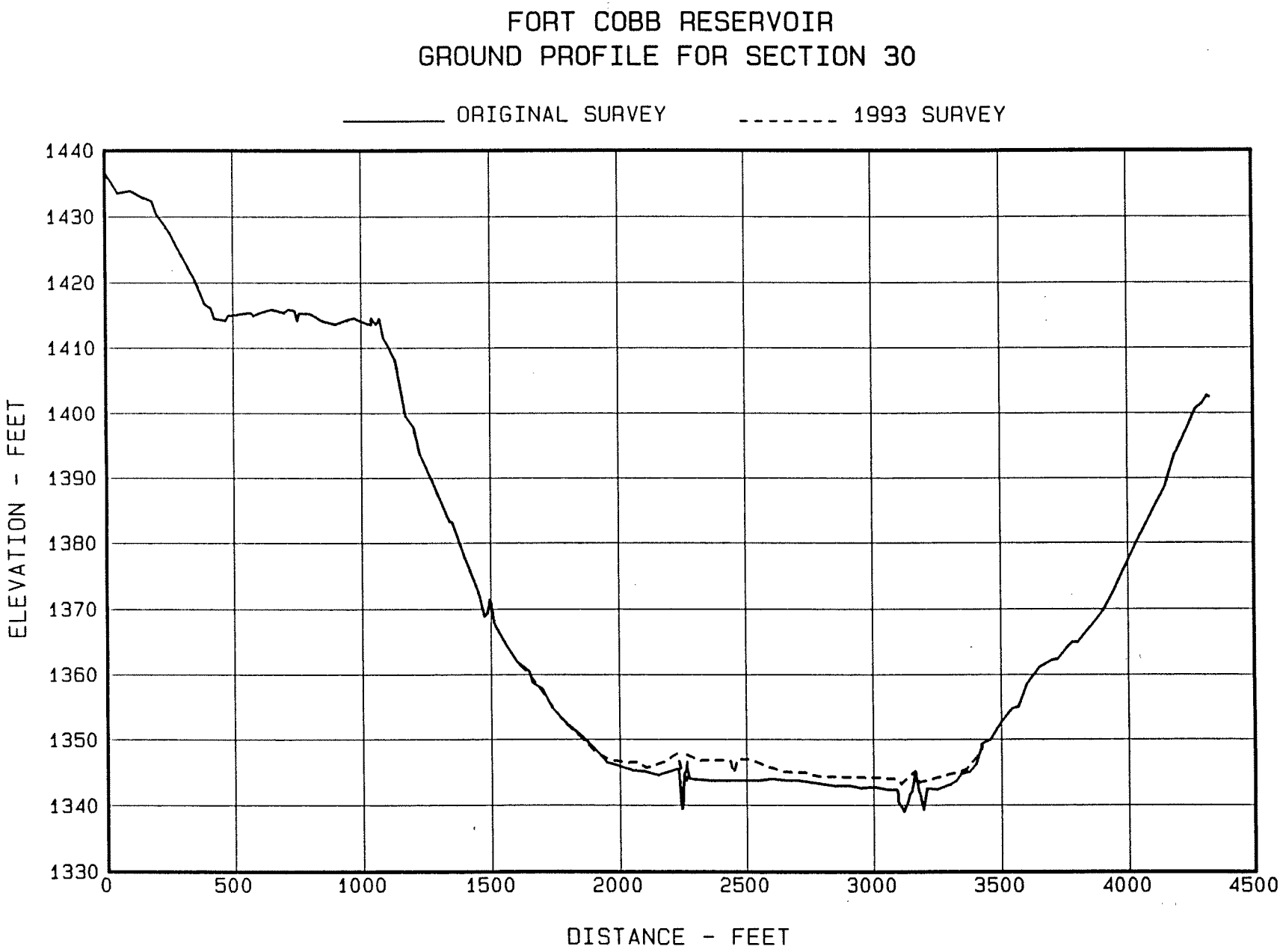

Figure 20. - Sediment Range 30 - Lake Creek.

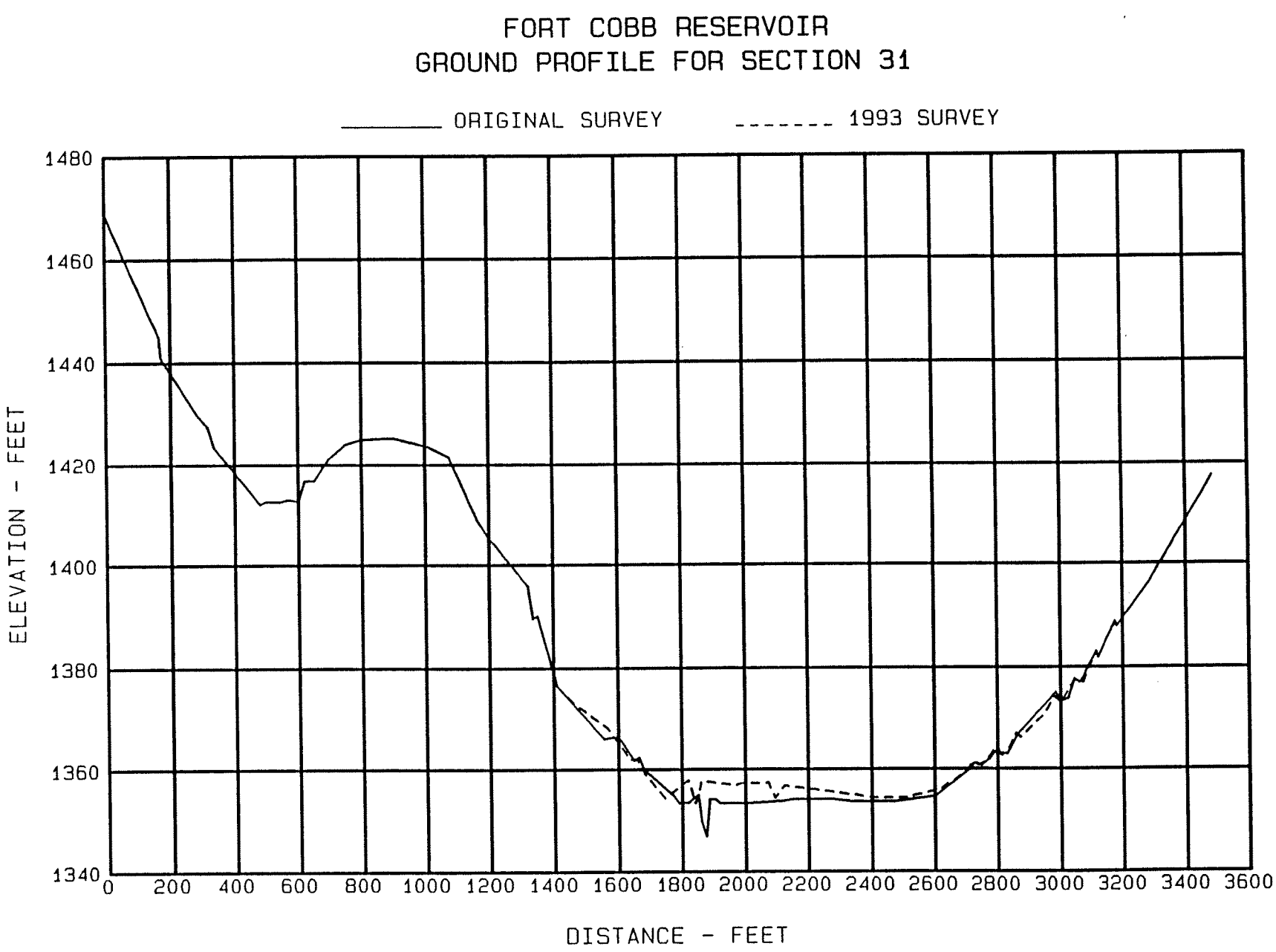

Figure 21. - Sediment Range 31 - Lake Creek.

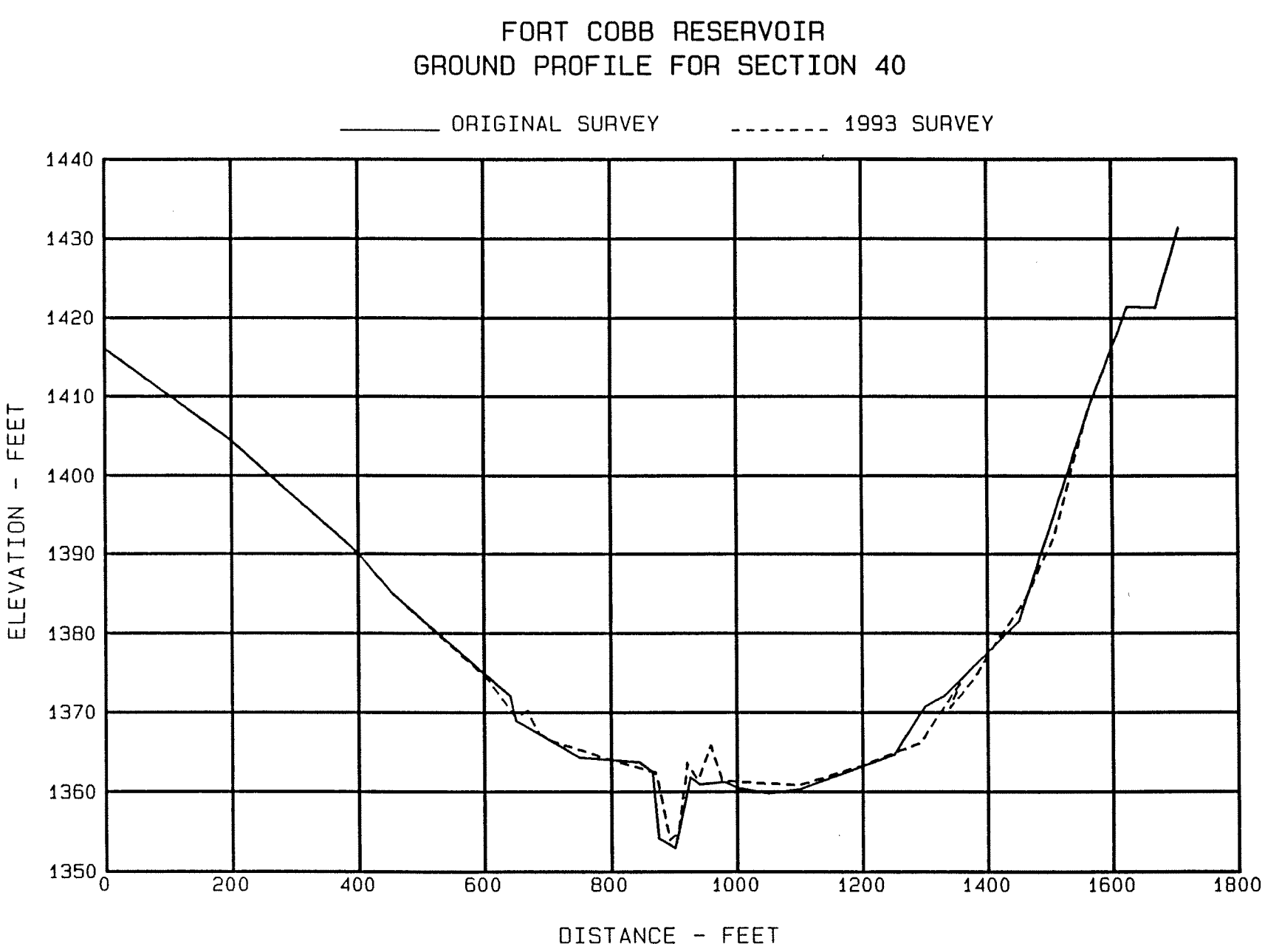

Figure 22. - Sediment Range 40 - Camp Creek.

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.