VOLUMETRIC SURVEY
OF
SQUAW CREEK RESERVOIR

Prepared for:

BRAZOS RIVER AUTHORITY AND TEXAS UTILITIES

Prepared by:

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INTRODUCTION

Staff of the Hydrographic Survey Unit of the Texas Water Development Board (TWDB) conducted a hydrographic survey of Squaw Creek Reservoir during the period May 6 - 15, 1997. The purpose of the survey was to determine the capacity of the lake at the conservation pool elevation. In addition, the survey was to determine the amount of water stored behind the mini-dam for emergency purposes in the Squaw Creek Safe Shutdown Impoundment (SSI) facility. From this information, future surveys will be able to determine the location and rates of sediment deposition in the conservation pool over time. Survey results are presented in the following pages in both graphical and tabular form. All elevations presented in this report will be reported in feet above mean sea level based on the National Geodetic Vertical Datum of 1929 (NGVD '29) unless noted otherwise. The conservation pool elevation for Squaw Creek Reservoir is 775.0 feet. The original design information estimates the lake=s original surface area at this elevation to be 3,228 acres and the storage volume to be 151,047 acre-feet of water. The storage volume in the SSI facility was originally estimated at 558 acre feet with an area of 39.8 acres at elevation 775.0.

HISTORY AND GENERAL INFORMATION OF THE RESERVOIR

Squaw Creek Dam and Reservoir are owned by Texas Utilities Electric Company and operated by Texas Utilities Generating Company. The reservoir is located on Squaw Creek in Somervell and Hood Counties, approximately four miles north of Glen Rose (see Figure 1). Records indicate the drainage area is approximately 64 square miles. At the conservation pool elevation, the lake has approximately 36 miles of shoreline and is five miles long. The widest point of the reservoir is approximately two miles (located about 0.40 miles upstream of the dam).

The Texas Water Commission issued Permit No. 2871 on September 11, 1973 to Dallas Power and Light Company, Texas Electric Service Company, Texas Power and Light Company and

Texas Utilities Services, Incorporated, Agent. This original permit authorized the permitees to construct a dam and reservoir on Squaw Creek having an impoundment capacity of 151,500 acre-feet of water. Permitees were also granted the right to construct a dam and reservoir (mini-reservoir) on Panther Branch. The impoundment of this mini-reservoir was not to exceed 367 acre-feet of water and was to be included in the total capacity of 151,500 acre-feet of water in the main reservoir. Permitees were authorized to maintain the reservoirs with available waters from Squaw Creek and to divert supplemental water from Lake Granbury. The permitees were authorized to divert, circulate and recirculate water and to use consumptively, not to exceed, 20,780 acre-feet of water annually for industrial (condenser cooling) purposes. Authorization was granted to divert and use 2,400 acre-feet of water annually for ancillary purposes in the operation of the permitees= nuclear-fueled electric power generating plant. The permit was amended several times since it was granted. In November of 1982, the permitees, Dallas Power and Light Co., Texas Electric Service Co., and Texas Power and Light Co., merged into Texas Utilities Electric Co. In February of 1986, Certificate of Adjudication No. 12-4097 was issued by the Texas Water Commission. The certificate re-affirms the rights of Texas Utilities Electric Co. regarding the impoundment capacities and water uses stated in Permit 2871 for Squaw Creek Reservoir.

Records indicate the construction for Squaw Creek Dam began on November 17, 1974 and was completed on June 16, 1977. Freese and Nichols Consulting Engineers of Fort Worth designed the facility and Brown and Root, Inc., managed the construction project. Squaw Creek Dam and appurtenant structures consist of an earthfill embankment 4,360 feet in length with a maximum height of 159 feet and a crest elevation of 796.0 feet. The service spillway is an uncontrolled concrete ogee type located between the right (southwest) end of the embankment and abutment. The crest of the spillway is 100 feet in width at elevation 775.0 feet. The emergency spillway is an earthcut channel through bedrock located at the left abutment, northeast of the embankment. The width of the channel is 2,200 feet with a crest elevation of 783.0 feet. The service outlet structure consists of a concrete tower housing three gate-controlled outlets with invert elevations of 764.0 feet, 715.0 feet and 666.5 feet. The 30 inch diameter low-flow outlet has an invert elevation of 653.0 feet. All discharges from the outlet tower pass through a six foot diameter concrete encased conduit and are released downstream of the embankment.

Contained within Squaw Creek Reservoir, is a smaller reservoir. The smaller reservoir is designed to provide cooling water during an emergency situation to safely shutdown the Comanche Peak Steam Electric Station. This facility will be referred to as the mini-dam and the Squaw Creek Safe Shutdown Impoundment (SSI) facility. The mini-dam is located on Panther Branch, a tributary of Squaw Creek. The dam is composed of an earthfill embankment, approximately 1,520 feet in length. The maximum height of the embankment is 70 feet above the natural streambed. The 40 feet wide crest is at elevation 796.0 feet. The service/emergency spillway is a 40 feet wide by 400 feet long earthcut channel connecting the SSI facility to the main reservoir. This ingress/egress channel, located to the right (south) of the mini-dam, is also referred to as the equalization channel for the two reservoirs. The flow of water between the two reservoirs is controlled by a three feet tall by three feet wide concrete weir that extends the width of the channel with a flowline elevation of 769.5 feet.

HYDROGRAPHIC SURVEYING TECHNOLOGY

The following sections will describe the theory behind Global Positioning System (GPS) technology and its accuracy. Equipment and methodology used to conduct the subject survey and previous hydrographic surveys are also addressed.

GPS Information

The following is a brief and simple description of Global Positioning System (GPS) technology. GPS is a relatively new technology that uses a network of satellites, maintained in precise orbits around the earth, to determine locations on the surface of the earth. GPS receivers continuously monitor the broadcasts from the satellites to determine the position of the receiver. With only one satellite being monitored, the point in question could be located anywhere on a sphere surrounding the satellite with a radius of the distance measured. The observation of two satellites decreases the possible location to a finite number of points on a circle where the two spheres intersect. With a third satellite observation, the unknown location is reduced to two points where all three spheres intersect. One of these points is obviously in error because its location is in space, and it is ignored. Although three satellite measurements can fairly accurately locate a point on the earth, the minimum number of satellites required to determine a three dimensional position within the required accuracy is four. The fourth measurement compensates for any time discrepancies between the clock on board the satellites and the clock within the GPS receiver.

GPS technology was developed in the 1960's by the United States Air Force and the defense establishment. After program funding in the early 1970's, the initial satellite was launched on February 22, 1978. A four year delay in the launching program occurred after the Challenger space shuttle disaster. In 1989, the launch schedule was resumed. Full operational capability was reached on April 27, 1995 when the NAVSTAR (NAVigation System with Time And Ranging) satellite constellation was composed of 24 Block II satellites. Initial operational capability, a full constellation of 24 satellites, in a combination of Block I (prototype) and Block II satellites, was achieved December 8, 1993. The NAVSTAR satellites provide data based on the World Geodetic System (WGS '84) spherical datum. WGS '84 is essentially identical to the 1983 North American Datum (NAD '83).

The United States Department of Defense (DOD) is currently responsible for implementing and maintaining the satellite constellation. In an attempt to discourage the use of these survey units as a guidance tool by hostile forces, the DOD has implemented means of false signal projection called Selective Availability (S/A). Positions determined by a single receiver when S/A is active result in errors to the actual position of up to 100 meters. These errors can be reduced to centimeters by performing a static survey with two GPS receivers, one of which is set over a point with known coordinates. The errors induced by S/A are time-constant. By monitoring the movements of the satellites over time (one to three hours), the errors can be minimized during post processing of the collected data and the unknown position computed accurately.

Differential GPS (DGPS) can determine positions of moving objects in real-time or "on-the-fly." In the early stages of this program, one GPS receiver was set up over a benchmark with known coordinates established by the hydrographic survey crew. This receiver remained stationary during the survey and monitored the movements of the satellites overhead. Position corrections were determined and transmitted via a radio link once per second to another GPS receiver located on the moving boat. The boat receiver used these corrections, or differences, in combination with the satellite information it received to determine its differential location. The large positional errors experienced by a single receiver when S/A is active are greatly reduced by utilizing DGPS. The reference receiver calculates satellite corrections based on its known fixed position, which results in positional accuracies within three meters for the moving receiver. DGPS was used to determine horizontal position only. Vertical information was supplied by the depth sounder.

The need for setting up a stationary shore receiver for current surveys has been eliminated with the development of fee-based reference position networks. These networks use a small network of GPS receivers to create differential corrections for a large network of transmitting stations, Wide Area Differential GPS (WADGPS). The TWDB receives this service from ACCQPOINT, a WADGPS correction network over a FM radio broadcast. A small radio receiver purchased from ACCQPOINT, collects positional correction information from the closest broadcast station and provides the data to the GPS receiver on board the hydrographic surveying boat to allow the position to be differentially corrected.

Equipment and Methodology

The equipment used in the performance of the hydrographic survey consisted of a 23-foot aluminum tri-hull SeaArk craft with cabin, equipped with twin 90-Horsepower Johnson outboard motors. Installed within the enclosed cabin are an Innerspace Helmsman Display (for navigation), an Innerspace Technology Model 449 Depth Sounder and Model 443 Velocity Profiler, a Trimble Navigation, Inc. 4000SE GPS receiver, an ACCQPOINT FM receiver, and an on-board 486 computer. Power was provided by a water-cooled generator through an in-line uninterruptible power supply. Reference to brand names does not imply endorsement by the TWDB.

The GPS equipment, survey vessel, and depth sounder combine together to provide an efficient hydrographic survey system. As the boat travels across the lake surface, the depth sounder gathers approximately ten readings of the lake bottom each second. The depth readings are stored on the survey vessel's on-board computer along with the corrected positional data generated by the boat's GPS receiver. The daily data files collected are downloaded from the computer and brought to the office for editing after the survey is completed. During editing, bad data is removed or corrected, multiple data points are averaged to get one data point per second, and average depths are converted to elevation readings based on the daily recorded lake elevation on the day the survey was performed. Accurate estimates of the lake volume can be quickly determined by building a 3-D model of the reservoir from the collected data. The level of accuracy is equivalent to or better than previous methods used to determine lake volumes, some of which are discussed below.

Previous Survey Procedures

Originally, reservoir surveys were conducted with a rope stretched across the reservoir along pre-determined range lines. A small boat would manually pole the depth at selected intervals along the rope. Over time, aircraft cable replaced the rope and electronic depth sounders replaced the pole. The boat was hooked to the cable, and depths were again recorded at selected intervals. This method, used mainly by the Soil Conservation Service, worked well for small reservoirs.

Larger bodies of water required more involved means to accomplish the survey, mainly due to increased size. Cables could not be stretched across the body of water, so surveying instruments were utilized to determine the path of the boat. Monumentation was set for the end points of each line so the same lines could be used on subsequent surveys. Prior to a survey, each end point had to be located (and sometimes reestablished) in the field and vegetation cleared so that line of sight could be maintained. One surveyor monitored the path of the boat and issued commands via radio to insure that it remained on line while a second surveyor determined depth measurement locations by turning angles. Since it took a major effort to determine each of the points along the line, the depth readings were spaced quite a distance apart. Another major cost was the land surveying required prior to the reservoir survey to locate the range line monuments and clear vegetation.

Electronic positioning systems were the next improvement. If triangulation could determine the boat location by electronic means, then the boat could take continuous depth soundings. A set of microwave transmitters positioned around the lake at known coordinates would allow the boat to receive data and calculate its position. Line of site was required, and the configuration of the transmitters had to be such that the boat remained within the angles of 30 and 150 degrees with respect to the shore stations. The maximum range of most of these systems was about 20 miles. Each shore station had to be accurately located by survey, and the location monumented for future use. Any errors in the land surveying resulted in significant errors that were difficult to detect. Large reservoirs required multiple shore stations and a crew to move the shore stations to the next location as the survey progressed. Land surveying remained a major cost with this method.

More recently, aerial photography has been used prior to construction, to generate elevation contours from which to calculate the volume of the reservoir. Fairly accurate results could be obtained, although the vertical accuracy of the aerial topography was generally one-half of the contour interval or ± five feet for a ten-foot contour interval. This method could be quite costly and was only applicable in areas that were not inundated.

PRE-SURVEY PROCEDURES

The reservoir's surface area was determined prior to the survey by digitizing with AutoCad software the lake's pool boundary (elevation 775.0) from a Jones and Boyd, Inc., 1" = 1,000 feet, work map of the newly formed reservoir and 1987 sedimentation range lines. The work map was created from 7.5 minute USGS quadrangle maps, ANemo,≅ and AHill City.≅ The graphic boundary file created was then transformed into the proper datum, from NAD '27 datum to NAD '83, using Environmental Systems Research Institutes's (ESRI) Arc/Info project command with the NADCOM (standard conversion method within the United States) parameters. The area of the lake boundary was checked to verify that the area was the same in both datums.

The survey layout was designed by placing survey track lines at 500 foot intervals across the lake. The survey design for this lake required approximately 150 survey lines to be placed along the length of the lake. Survey setup files were created using Coastal Oceangraphics, Inc. Hypack software for each group of track lines that represented a specific section of the lake. The setup files were copied onto diskettes for use during the field survey.

SURVEY PROCEDURES

The following procedures were followed during the hydrographic survey of Squaw Creek Reservoir performed by the TWDB. Information regarding equipment calibration and operation, the field survey, and data processing is presented.

Equipment Calibration and Operation

At the beginning of each surveying day, the depth sounder was calibrated with the Innerspace Velocity Profiler. The Velocity Profiler calculates an average speed of sound through the water column of interest for a designated draft value of the boat (draft is the vertical distance that the boat penetrates the water surface). The draft of the boat was previously determined to average 1.2 ft. The velocity profiler probe is placed in the water to moisten and acclimate the probe. The probe is then raised to the water surface where the depth is zeroed. The probe is lowered on a cable to just below the maximum depth set for the water column, and then raised to the surface. The unit displays an average speed of sound for a given water depth and draft, which is entered into the depth sounder. The depth value on the depth sounder was then checked manually with a measuring tape to ensure that the depth sounder was properly calibrated and operating correctly. During the survey of Squaw Creek Reservoir, the speed of sound in the water column varied daily between 4806 and 4966 feet per second. Based on the measured speed of sound for various depths, and the average speed of sound calculated for the entire water column, the depth sounder is accurate to within ±0.2 feet, plus an estimated error of ±0.3 feet due to the plane of the boat for a total accuracy of ±0.5 feet for any instantaneous reading. These errors tend to be minimized over the entire survey, since some are positive readings and some are negative readings. Further information on these calculations is presented in Appendix A.

During the survey, the onboard GPS receiver was set to a horizontal mask of 10° and a PDOP (Position Dilution of Precision) limit of 7 to maximize the accuracy of horizontal positions. An internal alarm sounds if the PDOP rises above seven to advise the field crew that the horizontal position has degraded to an unacceptable level. The lake=s initialization file used by the Hypack data collection program was setup to convert the collected DGPS positions on-the-fly to state plane coordinates. Both sets of coordinates were then stored in the survey data file.

Field Survey

Data were collected at Squaw Creek Reservoir during the period of May 6 through May 15, 1997. Weather conditions were excellent with moderate temperatures and mild winds. Approximately 63,375 data points were collected over the 102 miles traveled along the pre-planned survey lines and the random data-collection lines. (Note: On October 9, 1997, 6,429 additional points were collected to clarify a questionable area within the lake.) These points were stored digitally on the boat's computer in 188 data files. Data were not collected in areas of shallow water (depths less than 3.0 feet) or with significant obstructions unless these areas represented a large amount of water. Random data lines were also collected parallel to the original stream bed in the main body of the lake. Extra data were collected in the SSI facility and on both sides of the mini-dam. Figure 2 shows the actual location of all data collection points.

TWDB staff observed many different distinct features above and below the water during the field survey. The land surface around the lake was generally rolling hills with some limestone cliffs along various portions of the south bank. Below the water, a rapid drop off of the lake bottom occurred to a depth of around 105 feet, as the boat traveled from south to north across the lake near the dam. The bottom was then fairly level as the boat traveled across the old river flood plain. Within this flood plain, the original river and creek channels were easily distinguishable on the depth sounder chart when they were crossed. Also noted within this flood plain, from the dam upstream about 1.5 miles to the power plant, were various borrow pits with water depths of over 125 feet. A steady upward slope occurred as the boat approached the north side of the lake, but the slope was not as severe as on the south side.

Navigational hazards such as standing trees, brush, submerged trees and stumps were encountered mostly upstream of Squaw Creek Park. Sediment deposits and aquatic vegetation were observed mainly in the upper reaches of the lake. The crew was able to collect data in these areas, but at a much slower pace. Data collection in the headwaters were discontinued when the boat could no longer cross the lake due to shallow water and extensive vegetation. The collected data were stored in individual data files for each pre-plotted range line or random data collection event. These files were downloaded to diskettes at the end of each day for future processing.

Data Processing

The collected data were down-loaded from diskettes onto the TWDB's computer network. Tape backups were made for future reference as needed. To process the data, the EDIT routine in the Hypack Program was run on each raw data file. Data points such as depth spikes or data with missing depth or positional information were deleted from the file. The depth information collected every 0.1 seconds was averaged to get one reading for each second of data collection. A correction for the lake elevation at the time of data collection was also applied to each file during the EDIT routine. During the survey, the water surface varied between 775.02 and 775.62 feet. After all changes had been made to the raw data file, the edited file was saved with a different extension. The edited files were combined into a single X,Y,Z data file, representative of the lake, to be used with the GIS software to develop a model of the lake's bottom surface.

The resulting data file was imported into the UNIX operating system used to run Environmental System Research Institutes's (ESRI) Arc/Info GIS software and converted to a MASS points file. The MASS points and the boundary file were then used to create a Digital Terrain Model (DTM) of the reservoir's bottom surface using Arc/Info's TIN software module. The module builds an irregular triangulated network from the data points and the boundary file. This software uses a method known as Delauney's criteria for triangulation. A triangle is formed between three non-uniformly spaced points, including all points along the boundary. If there is another point within the triangle, additional triangles are created until all points lie on the vertex of a triangle. All of the data points are preserved for use in determining the solution of the model by using this method. The generated network of three-dimensional triangular planes represents the actual bottom surface. Once the triangulated irregular network (TIN) is formed, the software then calculates elevations along the triangle surface plane by solving the equations for elevation along each leg of the triangle. Information for the entire reservoir area can be determined from the triangulated irregular network created using this method of interpolation.

If data points were collected outside the boundary file, the boundary was modified to include the data points. The boundary file in areas of significant sedimentation was also down-sized as deemed necessary based on the data points and the observations of the field crew. The resulting boundary shape was used to develop each of the map presentations of the lake in this report.

There were some areas where volume and area values could not be calculated by interpolation because of a lack of information within the reservoir. "Flat triangles" were drawn at these locations. Arc/Info does not use flat triangle areas in the volume or contouring features of the model. A review of these areas determined them to be insignificant on Squaw Creek Reservoir. Therefore no additional points were required to be added to the data file for interpolation and contouring of the entire lake surface. Volumes and areas were calculated from the TIN for the entire reservoir at one-tenth of a foot intervals. The area of lake computed from the TIN, was calculated to be 3,297 surface acres. The computed area was 69 surface acres more than originally calculated in 1977. The computed reservoir volume table is presented in Appendix B and the area table in Appendix C. An elevation-area-volume graph is presented in Appendix D.

Other presentations developed from the model include a shaded relief map and a shaded depth range map. To develop these maps, the TIN was converted to a lattice using the TINLATTICE command and then to a polygon coverage using the LATTICEPOLY command. Using the POLYSHADE command, colors were assigned to the range of elevations represented by the polygons that varied from navy to yellow. The lower elevation was assigned the color of navy, and the 775.0 lake elevation was assigned the color of yellow. Different color shades were assigned to the intermediate depths. Figure 3 presents the resulting depth shaded representation of the lake. Figure 4 presents a similar version of the same map, using bands of color for selected depth intervals. The color increases in intensity from the shallow contour bands to the deep water bands.

Linear filtration algorithms were then applied to the DTM smooth cartographic contours versus using the sharp engineered contours. The resulting contour map of the bottom surface at two-foot intervals is presented in Figure 5.

RESULTS

Results from the 1997 TWDB survey indicate Squaw Creek Reservoir encompasses 3,297 surface acres and contains a volume of 151,418 acre-feet at the conservation pool elevation of 775.0 feet. The shoreline at this elevation was calculated to be 36.14 miles. The deepest point of the lake, elevation 644.69 or 130.31 feet of depth, was located approximately 3,350 feet upstream from the center of the dam. The dead storage volume, or the amount of water below the lowest outlet in the dam, was calculated to be 51 acre-feet based on the low flow outlet invert elevation of 653.0 feet. The conservation storage capacity, or the amount of water between the spillway and the lowest outlet, is therefore calculated to be, 151,370 acre-feet.

Results of the survey of the mini-dam and SSI facility indicate that at elevation 775.0, the surface area is 53 acres and the storage capacity is 701 acre-feet.

SUMMARY

Squaw Creek Reservoir was formed in 1977. Initial storage calculations estimated the volume at the conservation pool elevation of 775.0 feet to be 151,047 acre-feet with a surface area of 3,228 acres.

A sedimentation survey was performed in 1987 by Jones and Boyd, Inc., Consulting Engineers. Results from the survey indicated that the surface area of the lake was 3,189 acres, and the storage volume had decreased to 150,569 acre-feet.

During the period of May 6 - 15, 1997, a hydrographic survey of Squaw Creek Reservoir was performed by the Texas Water Development Board's Hydrographic Survey Program. The 1997 survey used technological advances such as differential global positioning system and geographical information system technology to build a model of the reservoir's bathemetry. These advances allowed a survey to be performed quickly and to collect significantly more data of the bathemetry of Squaw Creek Reservoir than previous survey methods. Results indicate that the lake's capacity at the conservation pool elevation of 775.0 feet was 151,418 acre-feet and the area was 3,297 acres. Within the lake, the survey determined that the Squaw Creek Safe Shutdown Impoundment held 701 acre-feet, spread over a surface area of 53 acres. The total capacity of Squaw Creek Reservoir was slightly higher (849 acre-feet) than was determined by the 1987 sedimentation survey. This slight difference can be attributed to the amount of data collected by each survey. The 1987 survey collected data on 25 survey lines across the lake, while the 1997 survey collected data across 150 survey lines. The increased coverage of the 1997 survey made a significant change to the overall bottom profile of the lake versus the profile determined by the 1987 survey. While no estimates of sedimentation or sedimentation rates can be made from the two surveys due to the differences of each survey, the TWDB considers the 1997 survey to be a significant improvement over previous survey procedures and recommends that the same methodology be used in five to ten years or after major flood events to monitor changes to the lake's storage capacity.

CALCULATION OF DEPTH SOUNDER ACCURACY

This methodology was extracted from the Innerspace Technology, Inc. Operation Manual for the Model 443 Velocity Profiler.

For the following examples, $t = (D - d)/V$

where: t_D = travel time of the sound pulse, in seconds (at depth = D)
D = depth, in feet
d = draft = 1.2 feet
V = speed of sound, in feet per second

To calculate the error of a measurement based on differences in the actual versus average speed of sound, the same equation is used, in this format:

$$D = [t(V)]+d$$

For the water column from 2 to 30 feet: V = 4832 fps

$t_{30} = (30-1.2)/4832$
$= 0.00596$ sec.

For the water column from 2 to 45 feet: V = 4808 fps

$t_{45} = (45-1.2)/4808$
$= 0.00911$ sec.

For a measurement at 20 feet (within the 2 to 30 foot column with V = 4832 fps):

$D_{20} = [((20-1.2)/4832)(4808)]+1.2$
$= 19.9'$ (-0.1')

For a measurement at 30 feet (within the 2 to 30 foot column with V = 4832 fps):

$D_{30} = [((30-1.2)/4832)(4808)]+1.2$
$= 29.9'$ (-0.1')

For a measurement at 50 feet (within the 2 to 60 foot column with V = 4799 fps):

$D_{50} = [((50-1.2)/4799)(4808)]+1.2$
$= 50.1'$ (+0.1')

For the water column from 2 to 60 feet: $V = 4799$ fps Assumed $V_{80} = 4785$ fps

$t_{60} = (60-1.2)/4799$
$= 0.01225$ sec.

For a measurement at 10 feet (within the 2 to 30 foot column with V = 4832 fps):

$D_{10} = [((10-1.2)/4832)(4799)]+1.2$
$= 9.9'$ $(-0.1')$

For a measurement at 30 feet (within the 2 to 30 foot column with V = 4832 fps):

$D_{30} = [((30-1.2)/4832)(4799)]+1.2$
$= 29.8'$ $(-0.2')$

For a measurement at 45 feet (within the 2 to 45 foot column with V = 4808 fps):

$D_{45} = [((45-1.2)/4808)(4799)]+1.2$
$= 44.9'$ $(-0.1')$

For a measurement at 80 feet (outside the 2 to 60 foot column, assumed V = 4785 fps):

$D_{80} = [((80-1.2)/4785)(4799)]+1.2$
$= 80.2'$ $(+0.2')$

TEXAS WATER DEVELOPMENT BOARD   Oct 14 1997

RESERVOIR VOLUME TABLE

SQUAW CREEK RESERVOIR   MAY 1997 SURVEY

VOLUME IN ACRE-FEET   ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
644										
645										
646										
647										
648				1	1	1	1	1	1	2
649	2	2	3	3	4	4	5	6	7	8
650	9	10	11	12	13	14	15	17	18	19
651	20	21	23	24	25	27	28	30	31	32
652	34	35	37	39	40	42	44	46	48	50
653	51	53	56	58	60	62	64	66	68	70
654	73	75	77	79	82	84	86	89	91	93
655	96	98	101	103	106	108	111	113	116	118
656	121	124	126	129	131	134	137	140	142	145
657	148	151	154	157	160	163	166	169	173	176
658	179	183	186	190	194	197	201	205	209	213
659	217	221	225	229	234	238	243	247	252	257
660	262	267	272	277	282	288	293	299	305	310
661	316	322	329	335	341	348	354	361	368	375
662	382	390	397	405	413	420	429	437	445	453
663	462	471	480	489	498	507	517	527	536	546
664	557	567	577	588	599	610	621	632	644	655
665	667	679	691	704	716	729	742	755	768	781
666	795	809	823	837	851	866	881	896	911	926
667	942	958	974	990	1006	1023	1040	1057	1074	1092
668	1110	1127	1146	1164	1183	1201	1221	1240	1259	1279
669	1299	1319	1340	1360	1381	1402	1424	1445	1467	1489
670	1511	1533	1556	1579	1602	1625	1648	1672	1696	1720
671	1744	1769	1793	1818	1843	1868	1893	1919	1945	1971
672	1997	2023	2049	2076	2102	2129	2156	2184	2211	2239
673	2266	2294	2322	2350	2379	2407	2436	2465	2494	2523
674	2553	2582	2612	2642	2672	2702	2733	2763	2794	2825
675	2856	2887	2919	2950	2982	3014	3046	3079	3111	3144
676	3176	3209	3242	3275	3309	3342	3376	3409	3443	3477
677	3511	3546	3580	3615	3649	3684	3719	3754	3789	3825
678	3860	3896	3932	3968	4004	4040	4076	4113	4149	4186
679	4223	4261	4298	4335	4373	4411	4449	4487	4525	4563
680	4602	4640	4679	4718	4757	4796	4835	4874	4914	4954
681	4993	5033	5073	5114	5154	5195	5235	5276	5317	5358
682	5399	5440	5482	5523	5565	5607	5649	5691	5733	5775
683	5818	5860	5903	5946	5989	6032	6075	6119	6162	6206
684	6250	6294	6338	6382	6426	6471	6516	6560	6605	6650
685	6696	6741	6787	6832	6878	6924	6971	7017	7064	7111
686	7158	7205	7252	7300	7348	7395	7443	7491	7540	7588
687	7637	7685	7734	7783	7832	7882	7931	7981	8031	8081
688	8131	8181	8231	8282	8333	8384	8435	8486	8537	8589
689	8640	8692	8744	8796	8849	8901	8954	9007	9060	9113
690	9167	9220	9274	9328	9383	9437	9492	9546	9601	9656
691	9712	9767	9823	9879	9935	9991	10047	10104	10161	10218
692	10275	10332	10390	10447	10505	10563	10621	10679	10737	10796

SQUAW CREEK RESERVOIR MAY 1997 SURVEY

VOLUME IN ACRE-FEET ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
693	10855	10913	10972	11032	11091	11150	11210	11270	11330	11390
694	11451	11511	11572	11633	11694	11755	11817	11879	11941	12003
695	12065	12127	12190	12253	12316	12379	12442	12506	12569	12633
696	12697	12761	12826	12890	12955	13020	13085	13150	13216	13281
697	13347	13413	13480	13546	13613	13680	13747	13814	13881	13949
698	14017	14085	14154	14222	14291	14360	14429	14498	14568	14638
699	14708	14778	14849	14919	14990	15062	15133	15205	15276	15348
700	15421	15493	15566	15639	15713	15786	15860	15934	16009	16083
701	16158	16234	16309	16385	16461	16538	16615	16692	16769	16846
702	16924	17002	17081	17159	17238	17317	17396	17475	17555	17635
703	17715	17795	17876	17956	18037	18119	18200	18282	18364	18446
704	18528	18611	18694	18777	18860	18943	19027	19111	19195	19280
705	19364	19449	19534	19619	19705	19791	19877	19963	20049	20136
706	20223	20310	20397	20485	20573	20661	20749	20838	20926	21015
707	21105	21194	21284	21374	21464	21555	21645	21736	21828	21919
708	22011	22103	22195	22287	22380	22473	22566	22660	22753	22847
709	22942	23036	23131	23226	23321	23417	23513	23609	23705	23802
710	23898	23995	24092	24190	24288	24385	24483	24582	24680	24779
711	24878	24977	25077	25176	25276	25376	25476	25576	25677	25778
712	25879	25980	26081	26183	26285	26387	26489	26592	26694	26797
713	26901	27004	27108	27211	27316	27420	27524	27629	27734	27839
714	27945	28050	28156	28262	28368	28475	28581	28688	28795	28903
715	29010	29118	29226	29334	29443	29551	29660	29769	29879	29988
716	30098	30208	30318	30429	30540	30651	30762	30873	30985	31097
717	31209	31321	31433	31546	31659	31772	31886	32000	32114	32228
718	32342	32457	32572	32687	32803	32918	33034	33151	33267	33384
719	33500	33618	33735	33853	33970	34088	34207	34325	34444	34563
720	34682	34802	34921	35041	35162	35282	35403	35524	35645	35767
721	35888	36011	36133	36256	36379	36502	36625	36749	36873	36997
722	37122	37247	37372	37497	37623	37749	37875	38002	38129	38256
723	38383	38511	38639	38767	38896	39024	39153	39283	39412	39542
724	39672	39802	39933	40064	40195	40327	40459	40591	40723	40856
725	40989	41122	41256	41390	41524	41658	41793	41928	42064	42200
726	42336	42472	42609	42746	42884	43021	43159	43298	43436	43575
727	43715	43854	43994	44135	44276	44417	44558	44700	44841	44984
728	45126	45269	45412	45556	45700	45844	45988	46133	46278	46423
729	46569	46715	46862	47008	47155	47303	47450	47598	47747	47895
730	48044	48194	48343	48494	48644	48795	48946	49098	49250	49402
731	49555	49708	49861	50015	50169	50324	50479	50634	50790	50946
732	51103	51260	51417	51574	51732	51891	52049	52208	52368	52527
733	52687	52848	53009	53170	53331	53493	53655	53818	53980	54144
734	54307	54471	54635	54800	54965	55130	55296	55462	55628	55795
735	55962	56129	56296	56464	56633	56801	56970	57139	57309	57479
736	57649	57819	57990	58161	58332	58504	58676	58849	59021	59194
737	59368	59541	59715	59889	60064	60239	60414	60589	60765	60941
738	61118	61294	61471	61648	61826	62004	62182	62361	62540	62719
739	62899	63078	63259	63439	63620	63801	63982	64164	64346	64529
740	64712	64895	65078	65262	65446	65630	65814	65999	66184	66370
741	66556	66742	66929	67116	67303	67490	67678	67866	68055	68244
742	68433	68622	68812	69002	69193	69384	69575	69766	69958	70150

RESERVOIR VOLUME TABLE

SQUAW CREEK RESERVOIR MAY 1997 SURVEY

VOLUME IN ACRE-FEET ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
743	70343	70535	70729	70922	71116	71310	71505	71699	71895	72090
744	72286	72482	72679	72876	73073	73270	73468	73666	73865	74064
745	74263	74462	74662	74862	75063	75264	75465	75666	75868	76070
746	76272	76475	76678	76882	77085	77289	77494	77699	77904	78109
747	78315	78521	78727	78934	79141	79348	79556	79764	79972	80181
748	80390	80599	80809	81019	81229	81440	81651	81862	82074	82286
749	82498	82710	82923	83137	83350	83564	83778	83993	84207	84423
750	84638	84854	85070	85287	85504	85721	85938	86156	86375	86594
751	86813	87032	87252	87472	87693	87914	88135	88356	88578	88801
752	89024	89247	89471	89695	89919	90144	90369	90595	90821	91047
753	91274	91501	91728	91956	92185	92413	92642	92872	93102	93332
754	93562	93793	94024	94256	94488	94721	94953	95187	95420	95654
755	95888	96123	96358	96594	96830	97066	97302	97540	97777	98015
756	98253	98492	98731	98970	99210	99450	99691	99932	100173	100415
757	100657	100899	101142	101386	101629	101873	102118	102363	102608	102854
758	103100	103346	103593	103840	104088	104336	104584	104833	105082	105332
759	105582	105833	106084	106335	106586	106839	107091	107344	107597	107851
760	108106	108360	108615	108871	109127	109383	109640	109897	110155	110413
761	110672	110930	111190	111450	111710	111970	112231	112493	112755	113017
762	113280	113543	113807	114071	114336	114601	114866	115132	115398	115665
763	115932	116199	116467	116735	117004	117273	117543	117813	118083	118354
764	118626	118897	119170	119442	119715	119989	120263	120537	120812	121087
765	121363	121639	121915	122192	122470	122747	123026	123304	123584	123863
766	124143	124424	124705	124987	125269	125551	125834	126117	126401	126686
767	126971	127256	127542	127828	128115	128403	128690	128979	129268	129557
768	129847	130138	130429	130720	131012	131305	131598	131891	132185	132480
769	132775	133070	133366	133663	133960	134257	134555	134854	135152	135452
770	135752	136052	136353	136655	136957	137259	137562	137866	138170	138474
771	138779	139088	139394	139700	140008	140315	140624	140932	141242	141552
772	141862	142173	142484	142797	143109	143422	143736	144050	144365	144680
773	144996	145312	145629	145946	146264	146582	146901	147220	147540	147860
774	148181	148502	148824	149147	149469	149793	150117	150441	150766	151092
775	151418									

TEXAS WATER DEVELOPMENT BOARD Oct 14 1997

RESERVOIR AREA TABLE

SQUAW CREEK RESERVOIR MAY 1997 SURVEY

AREA IN ACRES ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
644										
645										
646										
647										
648		1	1	1	1	1	2	2	2	3
649	3	4	4	5	6	7	7	8	9	10
650	11	11	11	11	11	12	12	12	12	12
651	12	13	13	13	13	14	14	14	15	15
652	15	16	16	16	17	18	18	19	19	19
653	20	20	20	21	21	21	21	22	22	22
654	22	22	23	23	23	23	23	24	24	24
655	24	24	25	25	25	25	25	25	26	26
656	26	26	26	27	27	27	27	28	28	28
657	29	29	29	30	30	31	32	32	33	34
658	34	35	36	36	37	37	38	39	39	40
659	41	41	42	43	44	45	46	47	48	49
660	50	51	52	53	54	55	56	57	58	59
661	60	61	62	64	65	66	67	69	70	71
662	73	74	75	77	78	80	81	82	84	85
663	87	88	90	91	93	95	96	98	99	101
664	102	104	106	107	109	111	112	114	115	117
665	119	121	122	124	126	128	130	131	133	135
666	137	139	141	143	145	147	149	151	153	155
667	157	159	161	163	165	168	170	172	174	176
668	178	180	183	185	187	189	192	194	196	199
669	201	203	206	208	210	212	214	216	219	221
670	223	225	227	229	231	233	235	237	239	241
671	243	245	247	249	251	253	254	256	258	260
672	261	263	264	266	268	270	271	273	275	277
673	278	280	281	283	285	286	288	290	291	293
674	295	297	298	300	302	303	305	307	308	310
675	312	314	315	317	319	320	322	323	325	326
676	328	329	331	332	334	335	337	338	339	341
677	342	343	345	346	348	349	350	352	353	354
678	356	357	359	360	362	363	365	366	368	370
679	371	373	374	375	377	378	380	381	382	384
680	385	386	388	389	390	392	393	395	396	398
681	399	400	402	403	404	406	407	408	410	411
682	412	414	415	416	417	419	420	421	423	424
683	425	427	428	429	431	432	433	435	436	438
684	439	440	442	443	444	446	447	449	450	452
685	453	455	456	458	460	462	464	466	468	470
686	471	473	474	476	477	479	480	482	483	485
687	486	488	489	491	492	494	496	497	499	500
688	502	504	505	507	508	510	511	513	514	516
689	518	520	521	523	525	526	528	530	532	534
690	535	537	539	541	543	545	547	549	551	552
691	554	556	558	559	561	563	565	567	569	570
692	572	573	575	577	578	580	581	583	584	586

RESERVOIR AREA TABLE

SQUAW CREEK RESERVOIR MAY 1997 SURVEY

AREA IN ACRES ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
693	588	589	591	592	594	596	598	599	601	603
694	605	607	609	611	612	614	616	618	620	622
695	623	625	627	629	630	632	634	636	637	639
696	641	643	644	646	648	650	652	654	656	658
697	660	662	664	666	668	670	672	674	676	678
698	680	682	684	687	689	691	693	695	697	699
699	702	704	706	708	710	713	715	717	720	722
700	724	727	729	732	735	737	740	743	746	749
701	752	755	758	761	763	766	769	771	774	777
702	779	782	784	786	788	791	793	795	797	799
703	802	804	806	809	811	814	816	818	820	823
704	825	827	829	832	834	836	838	841	843	845
705	847	849	852	854	856	858	860	863	865	868
706	870	872	875	877	880	882	884	887	889	892
707	894	897	899	901	904	906	909	911	913	916
708	918	921	923	926	928	931	933	936	939	941
709	944	947	949	952	954	957	959	962	964	966
710	969	971	973	975	978	980	982	984	987	989
711	991	993	995	997	999	1001	1003	1005	1007	1009
712	1011	1013	1015	1017	1019	1022	1024	1026	1028	1031
713	1033	1035	1038	1040	1042	1044	1046	1048	1050	1053
714	1055	1057	1059	1061	1063	1066	1068	1070	1072	1074
715	1077	1079	1081	1083	1086	1088	1090	1092	1095	1097
716	1099	1102	1104	1106	1108	1111	1113	1115	1117	1119
717	1122	1124	1126	1129	1131	1134	1136	1139	1141	1144
718	1146	1148	1151	1153	1156	1158	1161	1163	1165	1168
719	1170	1172	1175	1177	1179	1182	1184	1186	1189	1191
720	1193	1196	1198	1201	1204	1206	1209	1211	1214	1217
721	1220	1222	1225	1228	1230	1233	1236	1239	1242	1244
722	1247	1250	1253	1256	1259	1262	1264	1267	1270	1273
723	1275	1278	1280	1283	1286	1289	1291	1294	1297	1300
724	1302	1305	1308	1311	1314	1317	1320	1323	1326	1328
725	1331	1334	1338	1341	1344	1347	1350	1353	1356	1360
726	1363	1366	1369	1372	1376	1379	1382	1386	1389	1392
727	1395	1399	1402	1405	1408	1412	1415	1418	1421	1424
728	1427	1430	1433	1437	1440	1443	1446	1449	1452	1455
729	1459	1462	1465	1468	1472	1475	1478	1482	1485	1489
730	1492	1496	1499	1503	1507	1510	1514	1518	1522	1526
731	1529	1533	1537	1540	1544	1548	1552	1555	1559	1563
732	1567	1570	1574	1578	1581	1585	1588	1592	1595	1599
733	1602	1606	1609	1613	1616	1620	1624	1627	1630	1634
734	1637	1641	1644	1648	1651	1654	1658	1661	1664	1668
735	1671	1674	1677	1681	1684	1687	1690	1694	1697	1700
736	1703	1706	1710	1713	1716	1719	1722	1725	1729	1732
737	1735	1738	1741	1744	1747	1750	1753	1756	1759	1762
738	1765	1768	1771	1775	1778	1781	1784	1787	1791	1794
739	1797	1800	1803	1807	1810	1813	1816	1819	1823	1826
740	1829	1832	1835	1838	1841	1844	1847	1850	1854	1857
741	1860	1864	1867	1870	1874	1877	1880	1884	1887	1890
742	1893	1897	1900	1903	1907	1910	1913	1917	1920	1923

SQUAW CREEK RESERVOIR MAY 1997 SURVEY

AREA IN ACRES ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
743	1926	1930	1933	1936	1940	1943	1947	1950	1954	1957
744	1960	1964	1967	1970	1974	1977	1980	1984	1987	1990
745	1993	1996	2000	2003	2006	2009	2013	2016	2019	2023
746	2026	2029	2032	2036	2039	2042	2046	2049	2052	2056
747	2059	2062	2065	2069	2072	2075	2079	2082	2085	2088
748	2092	2095	2098	2101	2105	2108	2111	2114	2117	2121
749	2124	2127	2130	2134	2137	2140	2143	2147	2150	2153
750	2157	2160	2164	2167	2171	2174	2178	2182	2185	2189
751	2193	2196	2200	2204	2207	2211	2215	2219	2222	2226
752	2230	2234	2238	2242	2246	2250	2254	2258	2262	2266
753	2270	2273	2277	2281	2285	2289	2292	2296	2300	2303
754	2307	2311	2315	2318	2322	2326	2330	2334	2338	2342
755	2345	2349	2353	2357	2361	2365	2368	2372	2376	2380
756	2384	2388	2392	2396	2400	2404	2408	2412	2416	2419
757	2423	2427	2431	2435	2439	2443	2447	2451	2455	2459
758	2463	2467	2471	2475	2479	2483	2487	2491	2495	2499
759	2503	2507	2511	2515	2519	2523	2527	2532	2536	2541
760	2545	2549	2553	2558	2562	2566	2570	2575	2579	2583
761	2587	2591	2596	2600	2604	2608	2613	2617	2621	2626
762	2630	2634	2639	2643	2647	2652	2656	2660	2664	2668
763	2673	2677	2681	2685	2690	2694	2698	2703	2707	2711
764	2716	2720	2724	2729	2733	2737	2741	2746	2750	2754
765	2758	2763	2767	2772	2776	2781	2785	2790	2794	2799
766	2804	2808	2813	2818	2822	2827	2832	2837	2842	2846
767	2851	2856	2861	2866	2871	2876	2882	2887	2892	2897
768	2902	2907	2912	2917	2922	2927	2932	2937	2942	2948
769	2953	2958	2963	2967	2972	2977	2982	2987	2992	2997
770	3002	3007	3012	3017	3022	3027	3032	3037	3042	3048
771	3053	3059	3065	3071	3077	3084	3090	3096	3102	3108
772	3114	3120	3126	3132	3138	3145	3151	3157	3163	3169
773	3175	3181	3187	3193	3199	3206	3212	3218	3224	3230
774	3236	3242	3248	3254	3260	3267	3273	3279	3285	3291
775	3297									

TEXAS WATER DEVELOPMENT BOARD
RESERVOIR VOLUME TABLE

Aug 6 1997

MINI-DAM(SQUAW CREEK) MAY 1997 SURVEY

VOLUME IN ACRE-FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
739										
740										
741										
742				1	1	1	1	1	1	1
743	1	1	1	1	1	2	2	2	2	2
744	2	3	3	3	3	3	4	4	4	4
745	5	5	5	6	6	6	7	7	7	8
746	8	8	9	9	10	10	10	11	11	12
747	12	13	13	14	14	15	15	16	16	17
748	17	18	19	19	20	20	21	22	22	23
749	23	24	25	25	26	27	27	28	29	29
750	30	31	32	32	33	34	35	35	36	37
751	38	38	39	40	41	42	43	43	44	45
752	46	47	48	49	50	51	52	53	54	56
753	57	58	59	60	62	63	64	66	67	68
754	70	71	73	74	75	77	78	80	82	83
755	85	86	88	89	91	93	94	96	98	100
756	101	103	105	107	108	110	112	114	116	118
757	120	122	123	125	127	129	131	133	135	137
758	139	141	143	145	147	149	151	153	156	158
759	160	162	164	166	168	170	173	175	177	179
760	181	184	186	188	190	193	195	197	200	202
761	204	207	209	211	214	216	219	221	223	226
762	228	231	233	236	239	241	244	246	249	252
763	254	257	259	262	265	267	270	273	276	278
764	281	284	287	289	292	295	298	301	304	306
765	309	312	315	318	321	324	327	330	333	336
766	339	342	345	349	352	355	358	361	364	368
767	371	374	377	381	384	387	391	394	397	401
768	404	408	411	415	418	422	425	429	432	436
769	440	443	447	451	454	458	462	466	469	473
770	477	481	485	489	493	497	501	505	509	513
771	517	521	525	529	534	538	542	546	551	555
772	559	564	568	572	577	581	586	590	595	599
773	604	609	613	618	622	627	632	637	641	646
774	651	656	661	666	671	676	681	686	691	696
775	701									

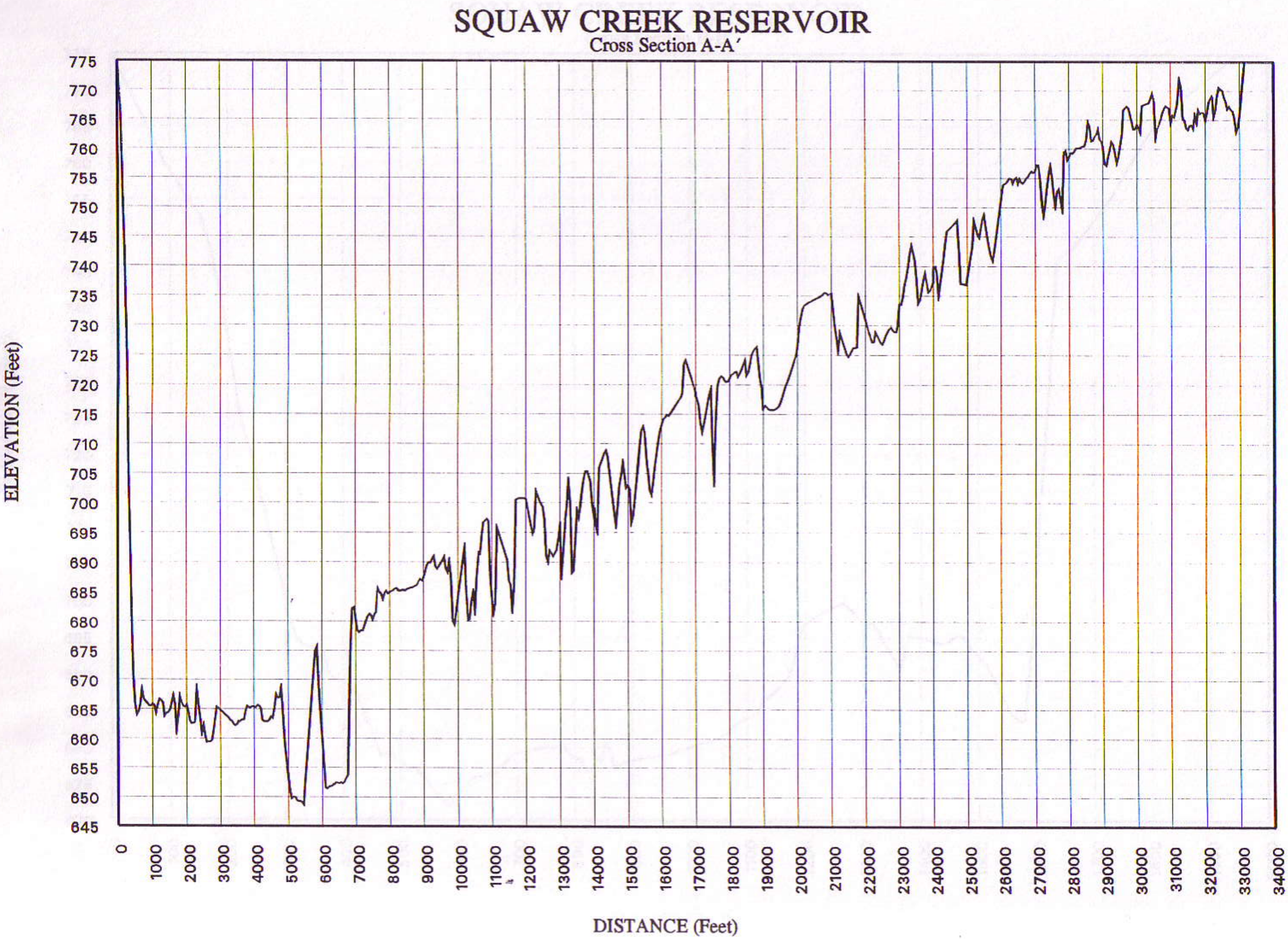
TEXAS WATER DEVELOPMENT BOARD
RESERVOIR AREA TABLE

Aug 6 1997

MINI-DAM(SQUAW CREEK) MAY 1997 SURVEY

AREA IN ACRES ELEVATION INCREMENT IS ONE TENTH FOOT

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
739										
740										
741										
742					1	1	1	1	1	1
743	1	1	1	1	1	1	2	2	2	2
744	2	2	2	2	2	2	2	2	3	3
745	3	3	3	3	3	3	3	3	4	4
746	4	4	4	4	4	4	4	4	4	5
747	5	5	5	5	5	5	5	5	6	6
748	6	6	6	6	6	6	6	6	6	6
749	6	6	7	7	7	7	7	7	7	7
750	7	7	7	7	7	7	8	8	8	8
751	8	8	8	8	8	8	9	9	9	9
752	9	9	10	10	10	11	11	11	12	12
753	12	12	12	13	13	13	13	13	14	14
754	14	14	14	15	15	15	15	15	15	16
755	16	16	16	16	16	17	17	17	17	17
756	17	18	18	18	18	18	19	19	19	19
757	19	19	19	19	19	20	20	20	20	20
758	20	20	20	20	20	21	21	21	21	21
759	21	21	21	21	22	22	22	22	22	22
760	22	22	22	23	23	23	23	23	23	23
761	23	24	24	24	24	24	24	25	25	25
762	25	25	25	25	26	26	26	26	26	26
763	26	26	27	27	27	27	27	27	27	27
764	28	28	28	28	28	28	28	29	29	29
765	29	29	29	29	30	30	30	30	30	31
766	31	31	31	31	31	32	32	32	32	32
767	32	33	33	33	33	33	34	34	34	34
768	34	35	35	35	35	35	36	36	36	36
769	36	37	37	37	37	37	38	38	38	38
770	39	39	39	39	40	40	40	40	41	41
771	41	41	42	42	42	42	43	43	43	43
772	44	44	44	44	44	45	45	45	45	46
773	46	46	46	47	47	47	47	48	48	48
774	48	49	49	49	49	50	50	50	50	51
775	53									



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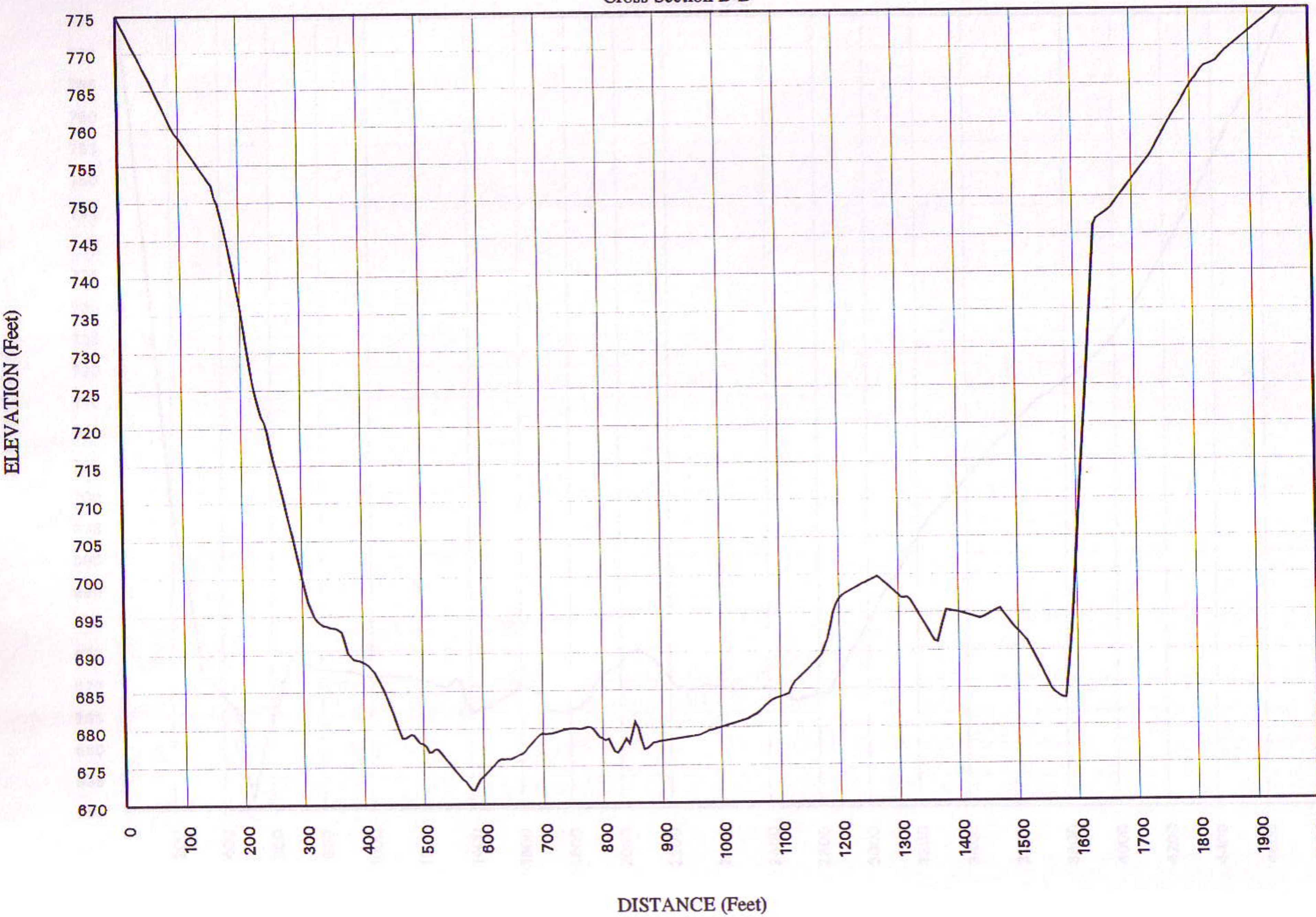
SQUAW CREEK RESERVOIR
Cross Section B-B′



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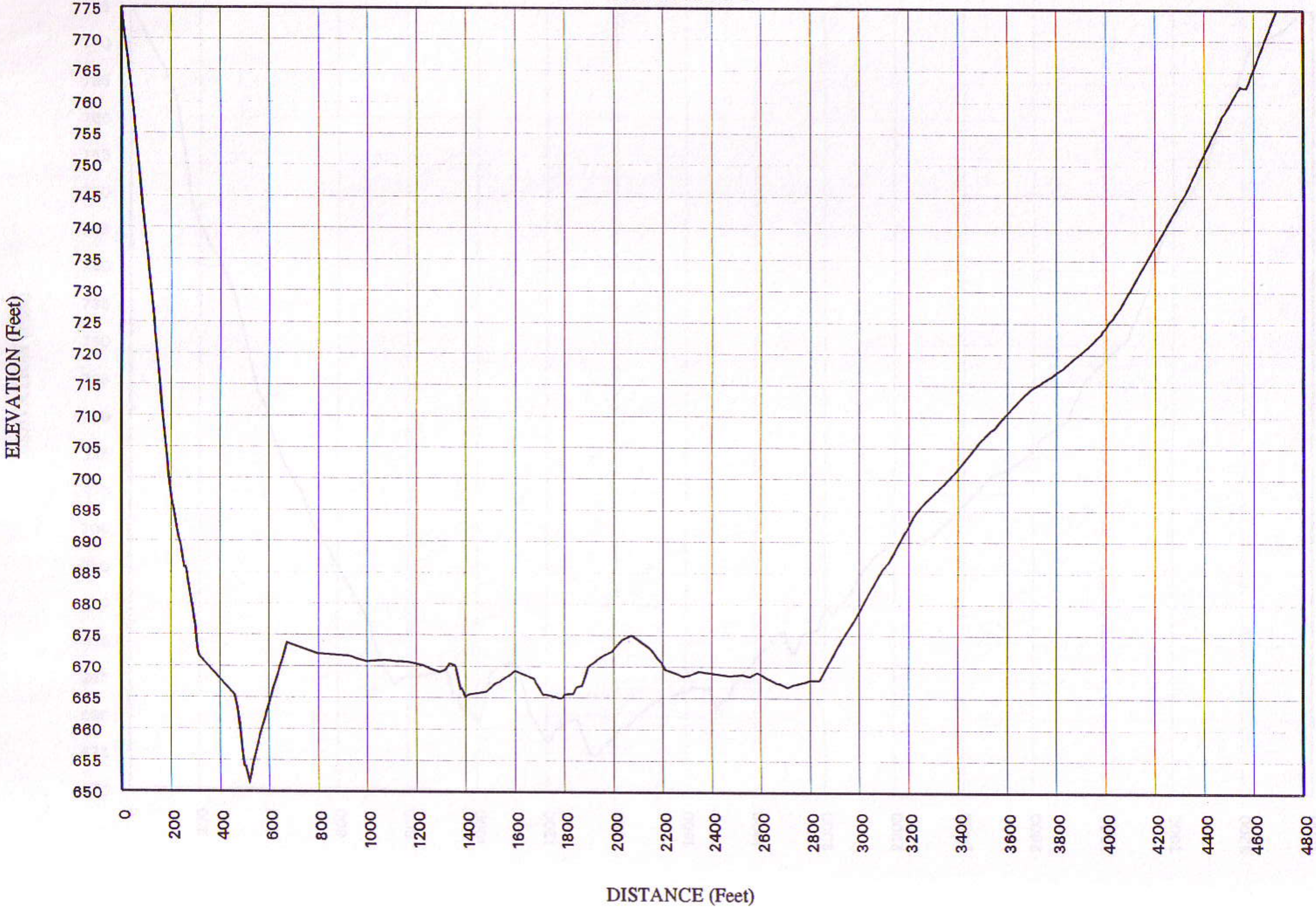
SQUAW CREEK RESERVOIR

Cross Section C-C′



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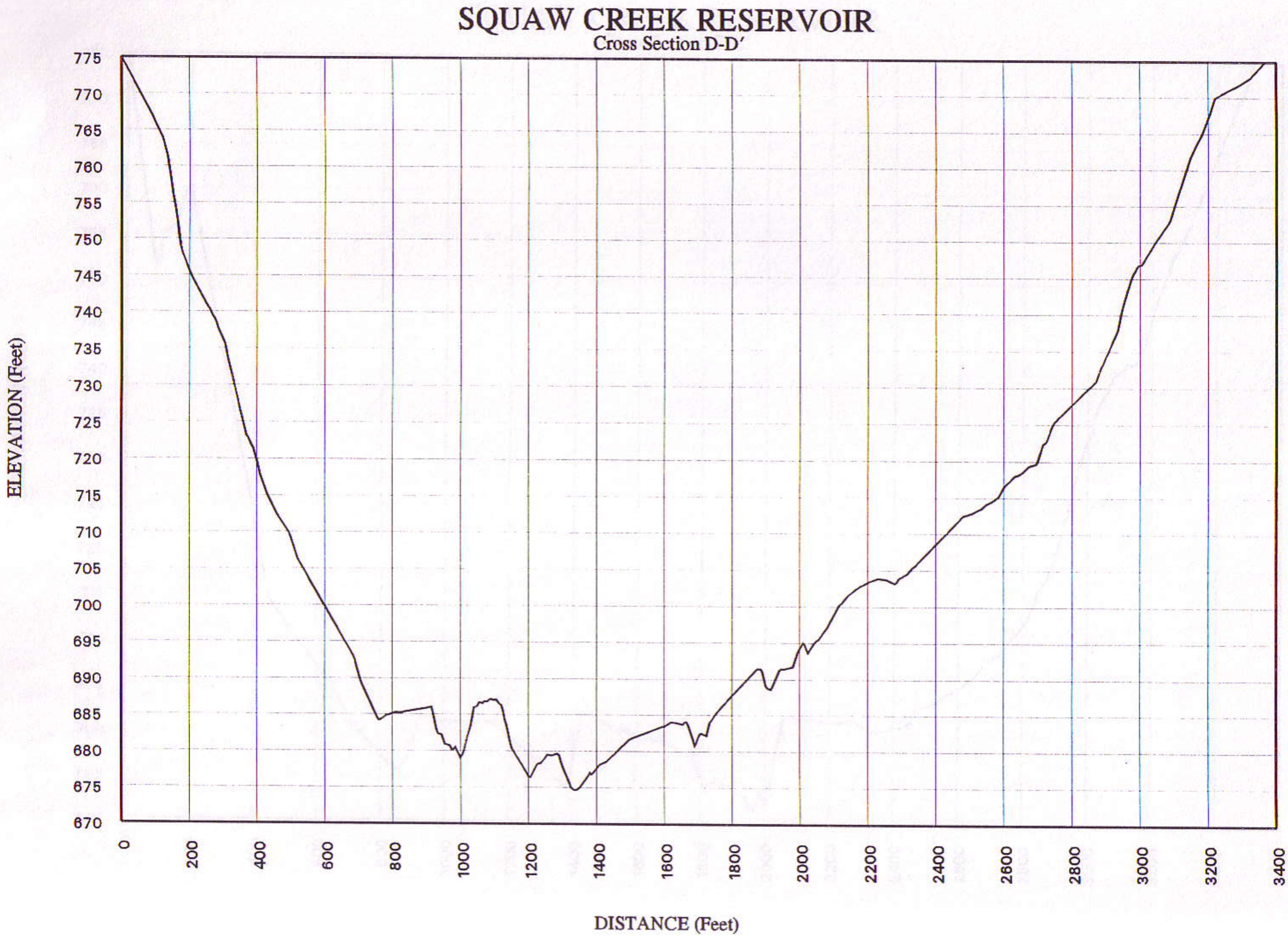

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SQUAW CREEK RESERVOIR
Cross Section E-E′

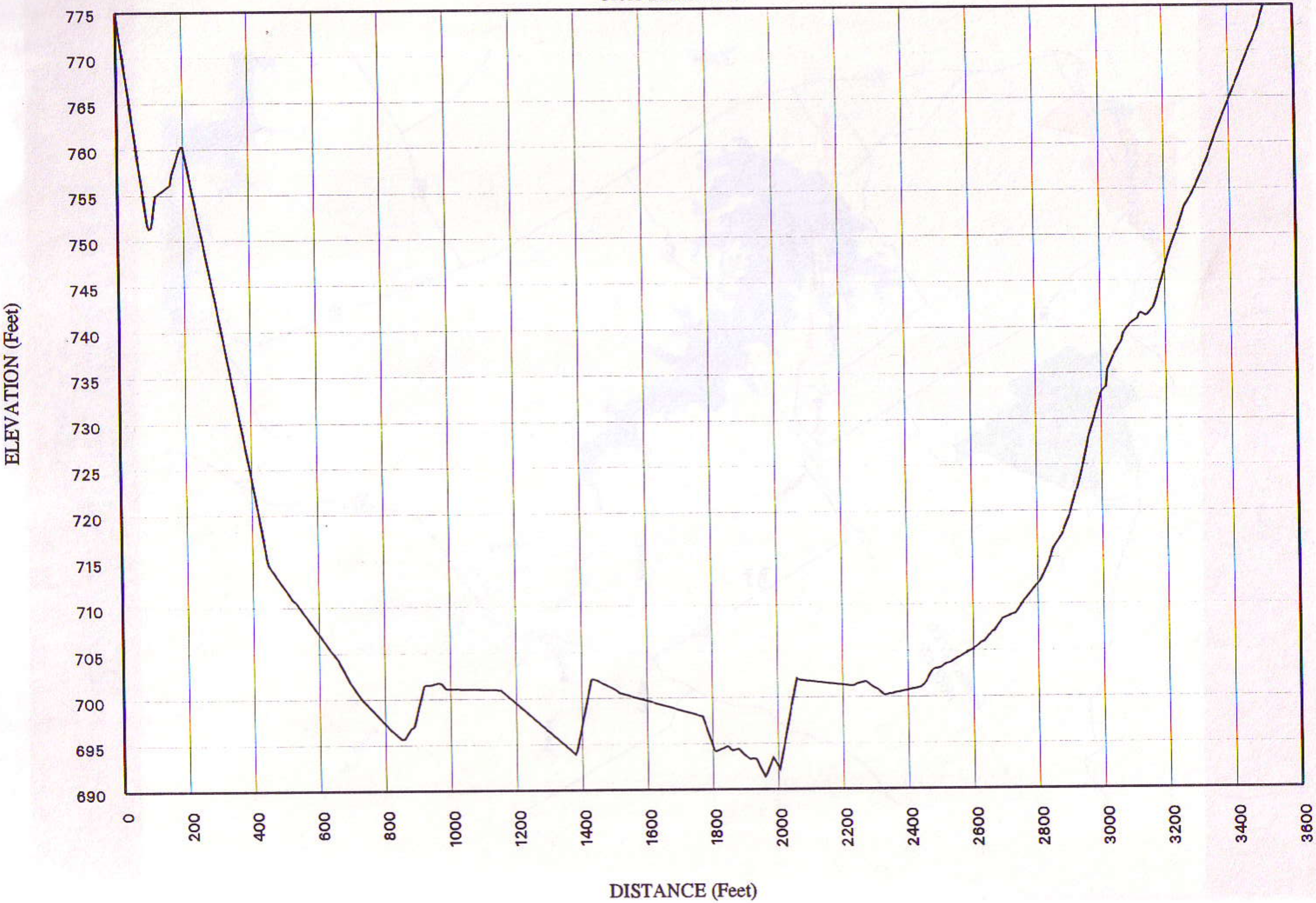

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FIGURE 1
SQUAW CREEK RESERVOIR
Location Map

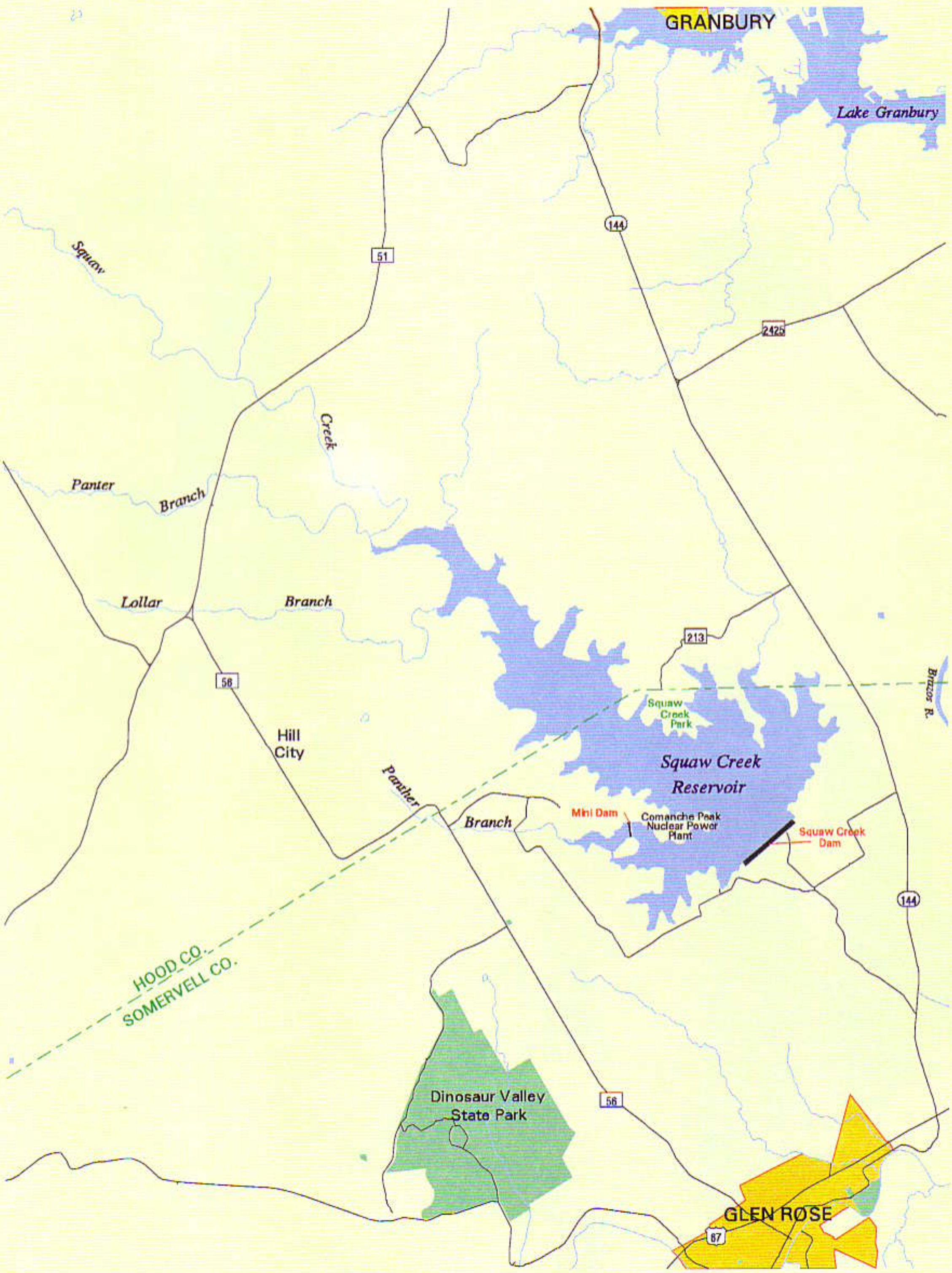

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FIGURE 2

SQUAW CREEK RESERVOIR

Location of Survey Data

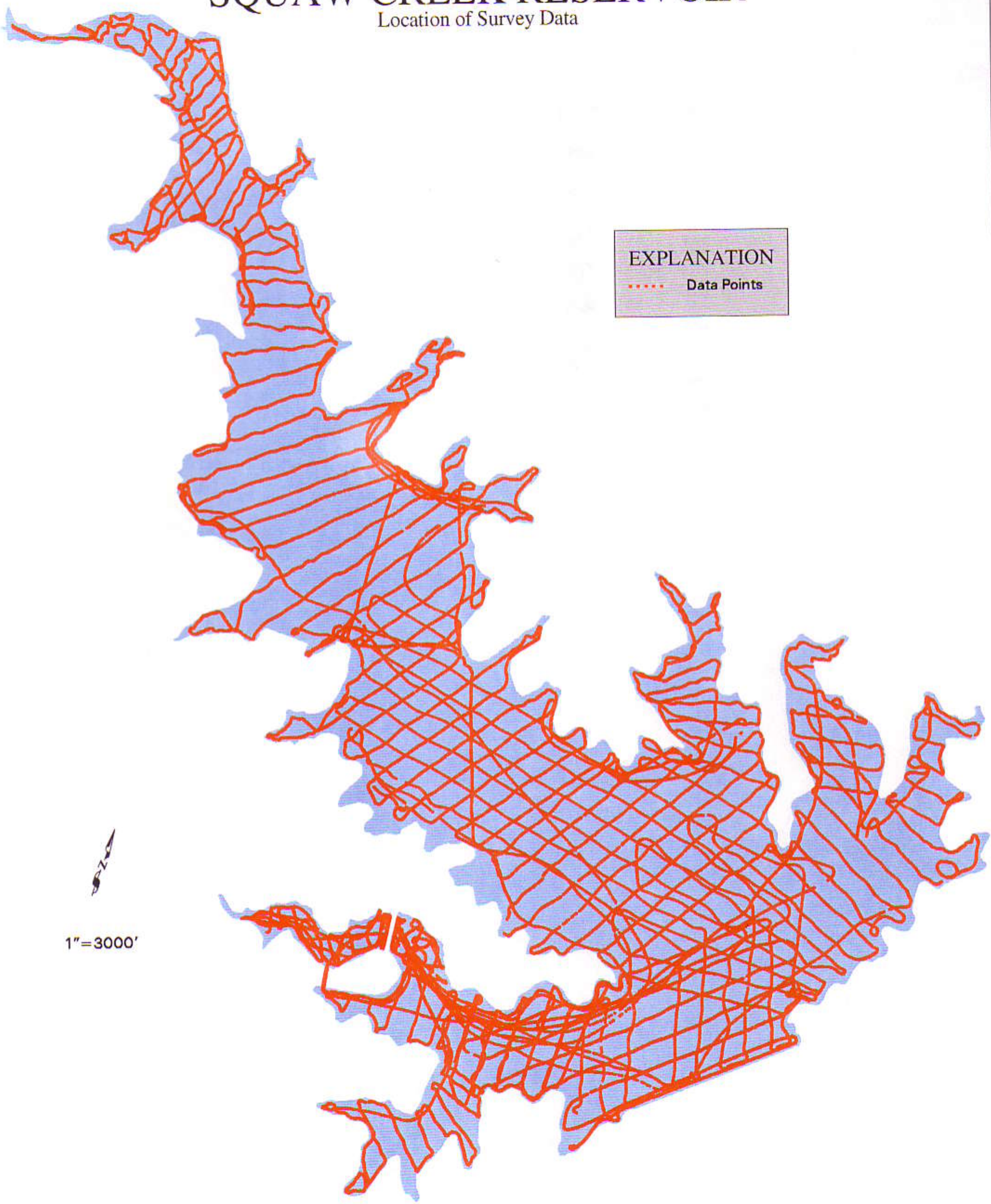

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FIGURE 3

SQUAW CREEK RESERVOIR

Shaded Relief

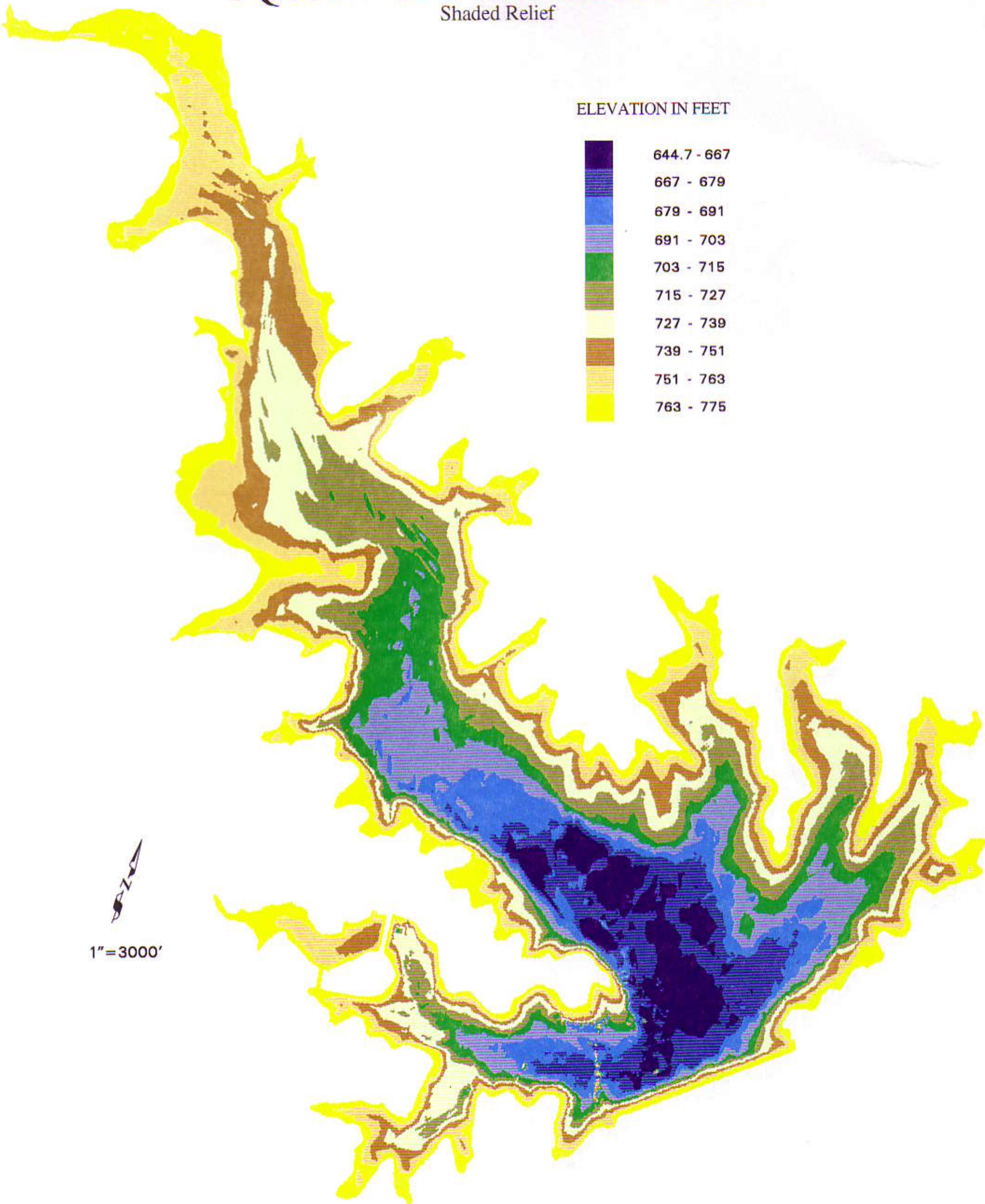

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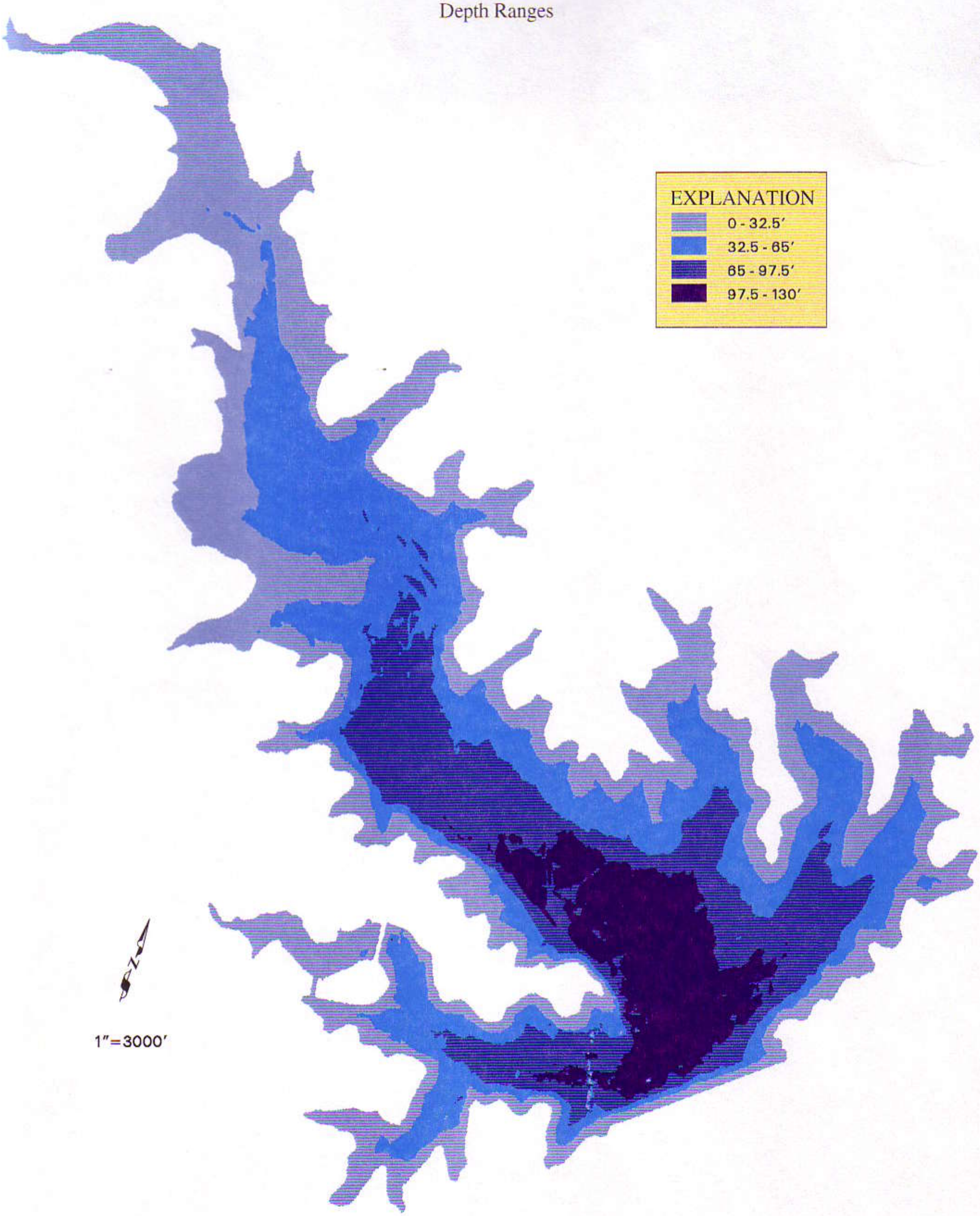
FIGURE 4
SQUAW CREEK RESERVOIR

Depth Ranges



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