VOLUMETRIC SURVEY OF CANYON LAKE

Prepared for:
Guadalupe-Blanco River Authority

In cooperation with the
United States Army Corps of Engineers

Prepared by
Texas Water Development Board

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Texas Water Development Board

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INTRODUCTION

Staff of the Surface Water Section of the Texas Water Development Board (TWDB) conducted a volumetric survey of Canyon Lake between October 18 and November 14, 2000. The primary purpose of this survey was to determine the current volume of the lake at conservation pool elevation. Results from this survey will serve as a basis for comparison to future surveys to allow the location and rates of sediment deposition to be determined. Survey results are presented in the following pages in both graphical and tabular form.

The vertical datum used during this survey is that used by the United States Geological Survey (USGS) for the reservoir elevation gage at Canyon Lake (08167700 CANYON LAKE NEAR NEW BRAUNFELS, TX.). The datum for this gage is reported as mean sea level (msl) (USGS, 1999). Thus, elevations are reported here, according to the same datum, in feet above mean sea level (msl). Volume and area calculations in this report are referenced to water levels provided by the USGS gage.

The original design information estimates the surface area at conservation pool elevation, 909.0 feet, to be 8,240 acres and the total storage volume to be 386,200 acre-feet of water (U.S. Army Engineer District, Fort Worth Corps of Engineers. 1974). The U.S. Army Corps of Engineers (USACOE) conducted a sediment re-survey of Canyon Lake in 1972. The surface area at conservation pool elevation (909.0) was found to be 8,231 acres and the total volume was 382,000 acre-feet of water (U.S. Army Engineer District, Fort Worth Corp of Engineers. 1974). This report will compare the 2000 survey results with the original design information and the 1972 resurvey results.

LAKE HISTORY AND GENERAL INFORMATION

Historical information on Canyon Lake was obtained from TWDB (1966), TWDB (1973) USACOE (1974) and USGS (1999). The Canyon Lake project was originally designed to serve multiple purposes being flood control and water conservation. The United States Government owns the Canyon Lake facility including the dam, appurtenant structures and flowage easement (lands surrounding the lake up to contour elevation 948.0 ft). The United States Army Corps of Engineers (USACOE) is responsible for operating and maintaining the facility. The Guadalupe-Blanco River Authority owns the water rights up to conservation pool elevation 909.0 feet.

In the 1930's several major flood events occurred on the Guadalupe River that raised interest in the local communities for some type of flood control on the river. During the same period, field studies were made on the feasibility of a Guadalupe River Dam and in 1939 the USACOE presented to Congress its finding and recommendations for the project. The United States Congress passed the River and Harbor Act of 1945 and authorization was granted for the construction of the dam. In 1949 a project site was selected. Congress later passed the Flood Control Act of 1954 giving local agencies rights for conservation water control.

Water Rights Permit # 1886 (Application # 1964) was granted to the Guadalupe-Blanco River Authority (GBRA) on January 22, 1959 by the State Board of Water Engineers. The permit allow GBRA "to appropriate, divert and use public waters of the State, to consist of storm, flood and unappropriated public waters of the Guadalupe River in Comal County, Texas not to exceed 50,000 acre-feet of water per annum or so much thereof as may be necessary when beneficially used for the purpose of municipal use". The permit required GBRA to enter into a contract with the USACOE in order to impound the permitted water in conservation storage pool of the proposed reservoir known as Canyon Lake. Permit # 1886 was amended numerous times in the following years. GBRA's current authorization is based on Certificate of Adjudication # 18-2074E, issued by the Texas Natural Resource Conservation Commission on August 9, 2001.

The certificate authorizes GBRA to impound 740,900 acre-feet (ac-ft) of water in an existing dam and reservoir on the Guadalupe River (Canyon Reservoir). The owner is authorized to divert and use an average of 90,000 ac-ft of water per annum from Canyon Reservoir (Lake) for municipal, domestic, industrial, irrigation and recreation purposes. Copies of the Permits and Certificate of Adjudication (original and amended) may be obtained from the Texas Natural Resource Conservation Commission's Central Records or the TNRCC South Texas Water Master.

Canyon Lake is located on the Guadalupe River (Guadalupe River Basin) in Comal County, 12 miles northwest of New Braunfels, Texas (Figure 1). At conservation pool elevation the reservoir extends approximately 20 miles upstream in the Guadalupe River Valley. Records indicate the drainage area is approximately 1,432 square miles (USGS 1999). At conservation pool elevation (909.0 feet), the lake has approximately 93 miles of shoreline. Canyon Lake and Dam were designed for flood control and conservation water supply.

Construction for the Canyon Lake Project started June 27, 1958 and was completed in December 1965. Deliberate impoundment began June 16, 1964. The United States Army Corps of Engineers designed the project and the general contractor was Tecon Corporation of Dallas, Texas.

Engineering designs (TWDB, 1971) show Canyon Dam and appurtenant structures to consist of a rolled-earthfill embankment (main dam) approximately 4,410 feet in length with a maximum height of 224 feet and a crest elevation of 974.0 feet. An asphalt service road occupies the 20-foot wide crest. Rock riprap was placed on the upstream slope of the dam to protect from wave action and erosion. There is a 210-foot long earth dike located to the right (south) of the spillway channel. Canyon Dam is the tallest earth embankment built by the U. S. Army Corps of Engineers in Texas.

The spillway is a broad-crested weir 1,260 feet in length, cut in a natural saddle with concrete (side) retaining walls and is located at the right (south) bank of the dam. The crest of the spillway is at elevation 943.0 ft. Discharges flow to a pilot channel entering the Guadalupe River approximately one mile downstream of the dam. Historical records indicate the highest lake level recorded since

impoundment was within .33 of a foot from engaging the spillway on June 19, 1987.

The outlet works consist of a 225-foot tall concrete tower that house two hydraulically operated slide gates, each 5 feet 8 inches wide by 10 feet tall. The invert elevation for the openings is 775.0 feet. Releases in excess of 1,100-cfs flow through the dam via a 10-foot diameter conduit to a stilling basin and then to the original river channel. GBRA operates a hydroelectric power generating station on the downstream side of the dam. Releases at rates less than 1,100 cfs are normally made through the generating station. Releases are made for permitted uses, required downstream environmental and water rights flows, and flood control.

SURVEYING EQUIPMENT

The equipment used to perform the volumetric survey consists of a 23-foot aluminum tri-hull SeaArk craft with cabin, equipped with twin 90-Horsepower Honda outboard motors. (Reference to brand names throughout this report does not imply endorsement by TWDB). Installed within the enclosed cabin are a Coastal Oceanographics' Helmsman Display (for navigation), an Innerspace Technology Model 449 Depth Sounder and Model 443 Velocity Profiler, Trimble Navigation, Inc. 4000SE GPS receiver, an OmniSTAR receiver, and an on-board 486 computer. A water-cooled generator provides electrical power through an in-line uninterruptible power supply. In shallow areas and where navigational hazards (stumps) were present, a 20-foot aluminum shallow-draft flat bottom SeaArk craft with cabin and equipped with one 115-horsepower Evinrude outboard motor was used. The portable data collection equipment on-board the boat included a Knudsen 320 B/P Echosounder (depth sounder), a Trimble Navigation, Inc. 4000SE GPS receiver, an OmniSTAR receiver, and a 486 laptop computer.

The GPS equipment, survey vessel, and depth sounder in combination provide an efficient hydrographic survey system. As the boat travels across the lake surface, the depth sounder takes 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 data files collected are downloaded from the computer and brought to the office for editing after the survey is completed. During editing, poor-quality 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 lake elevation recorded 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.

PRE-SURVEY PROCEDURES

The reservoir's boundary was digitized using Environmental Systems Research Institute's (ESRI) Arcview from digital orthophoto quadrangle images (DOQ's). The DOQ's were produced by VARGIS of Texas LLC for the TEXAS Orthoimagery Program (TOP). The DOQ products produced for the Department of Information Resources and the GIS Planning Council under the Texas Orthoimagery Program reside in the public domain. More information can be obtained on the Internet at http://www.tnris.state.tx.us/DigitalData/doqs.htm. The map boundary was created from the SMITHSON VALLEY, DEVILS BACKBONE, SATLER and FISCHER, TEXAS DOQs. The lake elevations at the time the DOQs were photographed were 908.84 feet (January 16, 1995) and 908.77 feet (January 25, 1995).

The DOQ graphic boundary file was transformed from UTM Zone 14 datum to NAD '83, using Environmental Systems Research Institute's (ESRI) Arc/Info PROJECT command with the NADCOM (standard conversion method within the United States) parameters.

The survey layout was designed by placing survey track lines at 500-foot intervals within the digitized lake boundary using Coastal Oceanographics' HYPACK software. The survey design required the use of approximately 390 survey lines along the length of the lake.

SURVEY PROCEDURES

Equipment Calibration and Operation

At the beginning of each day of the survey, the depth sounder was calibrated with the Innerspace 443 Velocity Profiler, an instrument used to measure the variation in the speed of sound at different depths in the water column. The average speed of sound through the entire water column below the boat was determined by averaging local speed-of-sound measurements collected through the water column. The velocity profiler probe was first placed in the water to moisten and acclimate the probe. The probe was next raised to the water surface where the depth was zeroed. The probe was then gradually lowered on a cable to a depth just above the lake bottom, and then raised to the surface. During this lowering and raising procedure, local speed-of-sound measurements were collected, from which the average speed was computed by the velocity profiler. This average speed of sound was entered into the ITI449 depth sounder, which then provided the depth of the lake bottom. The depth was then checked manually with a measuring tape to ensure that the depth sounder was properly calibrated and operating correctly.

On the shallow draft boat the depth sounder was calibrated using the bar check feature in the Knudsen software program. This was accomplished by positioning the transducer over a known (measured) depth. The speed of sound was then adjusted (either higher or lower) until the displayed depths matched the known depth. The depth was then checked manually with a stadia (survey) rod to ensure that the depth sounder was properly calibrated and operating correctly.

While surveying Canyon Lake, the speed of sound in the water column ranged from 4,832 feet per second to 4,872 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 $\pm$0.2 feet. An additional estimated error of $\pm$0.3 feet arises from variation in boat inclination. These two factors combine to give an overall accuracy of $\pm$0.5 feet for any instantaneous reading. These errors tend to be minimized over the entire survey, since some readings are positive and some are negative. Further information on these calculations is presented in Appendix E.

During the survey, the horizontal mask setting on the on-board GPS receiver was set to

10°, and the PDOP (Position Dilution of Precision) limit was set to seven to maximize the accuracy of the horizontal positioning. An internal alarm sounds if 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 set up to convert the collected DGPS positions to state-plane coordinates on the fly.

Field Survey

TWDB staff collected data at Canyon Lake for approximately nine days during the period of October 18, through November 14, 2000. The lake-level elevations varied from 903.02 feet (Oct. 18) to 917.55 (Nov. 11). The fist three days of the nine days that data were collected, the water levels were below conservation pool elevation (909.0 feet). Weather conditions during the survey varied as dramatically as the water levels. At times the crew experienced temperatures in the 80's with little or no wind and the surface water conditions were calm. A series of disturbances from the Pacific brought flooding to the Guadalupe watershed upstream of Canyon Lake during October and November 2000. These storms caused the data collection to be postponed twice. The survey crew would resume data collection after the water levels stabilized.

Data were first collected in a 50-foot grid pattern around Comal Park along the south shore of Canyon Lake. Once this area was completed, the survey crew began collecting data on the 500-foot spacing pre-plotted survey range lines. As the crew started at the dam and worked upstream, data were also collected on the USACOE pre-established sediment range lines. These lines were established (1961-1963) to determine the original area and capacity of the lake and also used for sediment comparisons in the 1972 resurvey of Canyon Lake. TWDB were able to collect data on 30 of the 42 USACOE pre-established sediment range lines. By collecting data on these USACOE sediment range lines, representative comparisons can be made between the 1962 original data, the 1972 resurvey and the current 2000 survey for the three lines published in USACOE, 1974. The three comparisons and the remaining 27 pre-established sediment range lines modeled in the 2000 survey appear in Appendix E. Data were also collected on 370 of the 390 pre-plotted survey range lines. The survey crew would collect random data when navigational hazards (trees and stumps) or shallow depths were

encountered. Approximately 110,310 data points were collected over the 225 miles traveled during the survey. These points, shown in Figure 2, were stored digitally on the boat's computer in 509 data files.

The Guadalupe River meanders through the canyons of the Edwards Plateau in west to east direction with Canyon Dam located at the east-end of the lake. The basin of Canyon Lake was clear of any navigational hazards such as trees, stumps, submerged rocks and boulders. The shoreline of this pristine lake varied from steep canyon walls to gentle sloping flats. There were numerous inlets and coves along both north and south shores of the lake. Major tributaries that flow into the main basin of Canyon Lake and are located on the north shore are Jacobs, Sorrel, Potters, Devils Hollow, Schultz and Rebecca Creeks. Those creeks contributing to the main basin of Canyon Lake from the south shore are Tom and Jentsch Creeks. With the USACOE having a flowage easement at elevation 948.0 feet, there were no residential structures along the shoreline at conservation pool elevation 909.0 feet. There were several marinas, two military recreational areas and numerous parks located throughout the lake. Approximately 14 boat ramps that are maintained by the county are located at Canyon Lake. These structures had to meet USACOE permit requirements.

Attempts were made to design the pre-plotted range lines to be perpendicular to the original river and/or creek channels. Generally, when the survey crew collected data on these lines, a well-defined thalweg of the river and creeks were noted on the depth sounder's analog chart.

The survey crew observed the geographical transition of Canyon Lake from a basin to a riverine lake upstream of Cranes Mill Park. The shallow-water boat with the portable surveying equipment was used from that point on. As the survey crew collected data upstream on the meandering river, trees and stumps became more prominent. This data was collected after the first major flood event of the survey and the crew encountered a large amount of debris flowing down the river. Data collection seized due to shallow water and sandbars approximately 1.7 miles downstream where Rebecca Creek Road crosses the Guadalupe River.

Data Processing

The collected data was downloaded from diskettes onto TWDB's computer network. Tape backups were made for future reference. 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 each file. A correction for the lake elevation at the time of data collection was also applied to each file during the EDIT routine. During the August survey, the water surface varied from elevation 903.02 to 918.00 feet msl according to elevation data provided by USGS elevation gage (08167700 CANYON LAKE NEAR NEW BRAUNELS, TX). After all corrections were applied 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 which was used with the GIS software to develop a model of the lake's bottom surface.

The resulting data file was downloaded to a Sun Ultra 10 workstation running the UNIX operating system. Environmental System Research Institute's (ESRI) Arc/Info GIS software was used to convert the data to a MASS points file. The MASS points and the boundary file were then used to create a Digital Terrain Model (DTM) of the lake's bottom surface using Arc/Info's TIN software module. The module generates a triangulated irregular network (TIN) from the data points and the boundary file using 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 used in this method. The generated network of three-dimensional triangular planes represents the actual bottom surface. With this representation of the bottom, the software then calculates elevations along the triangle surface plane by determining the elevation along each leg of the triangle. The lake area and volume can be determined from the triangulated irregular network created using this method of interpolation. Volumes presented in Appendix A and surface areas in Appendix B were calculated below elevation 909.0 feet msl from the TIN using Arc/Info software.

Before the report was finalized, the TWDB were requested to extrapolate the elevation-volume table using results from a previous survey. This is a fairly simple procedure and involves taking the net volume differences above conservation pool elevation from the previous survey and adding them to the

reservoir volumes at conservation pool elevation from the present survey. The spatial resolution and accuracy of the extrapolation is the same as the original survey. This does not improve or change the accuracy of the previous survey and the TWDB cannot endorse these figures.

Other products developed from the model include a shaded elevation range map (Figure 3) and a shaded depth range map (Figure 4). 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. Linear filtration algorithms were applied to the DTM to produce smooth cartographic contours. The resulting elevation contour map of the bottom surface at five-foot intervals is presented in Figure 5.

RESULTS

Results from the 2000 TWDB survey indicate Canyon Lake encompasses 8,309 surface acres and contains a total volume of 378,852 acre-feet at the conservation pool elevation of 909.0 feet msl (gage datum). Dead pool storage, the volume below elevation 775.0 feet msl is 71 acre-feet. Thus, the usable conservation storage (total volume - dead storage) for Canyon Lake is 378,781 acre-feet. The shoreline at conservation pool elevation was calculated to be approximately 93 miles. The deepest point that was physically measured during the survey was at elevation 761.8 msl and corresponding to a depth of 147.2 feet, was located approximately 1,928 feet upstream from Canyon Dam in the old riverbed.

SUMMARY AND COMPARISONS

Impoundment of Canyon Lake began in June 1964 and completely filled by 1968. Storage calculations in 1952 (Corps of Engineers, 1974) reported the volume at conservation pool elevation 909.0 feet msl to be 386,200 acre-feet with a surface area of 8,240 acres. The dead pool below elevation 775.0 feet msl was reported as 640 acre-feet, and thus the usable conservation storage was 385,560 acre-feet.

In 1972 the U. S. Army Corps of Engineers performed a sedimentation re-survey of Canyon

Lake. Storage calculations in 1972 (Corps of Engineers, 1974) reported the volume at conservation pool elevation 909.0 feet msl to be 382,000 acre-feet with a surface area of 8,231 acres. The dead pool below elevation 775.0 feet msl was reported as 239 acre-feet, and thus the usable conservation storage was 381,761 acre-feet.

In November 2000, TWDB staff completed a volumetric survey of Canyon Lake utilizing differential global positioning system and geographical information system technologies to create a digital model of the lake's bathymetry. Results indicate that the lake's volume at the conservation pool elevation of 909.0 feet msl is 378,852 acre-feet, with a corresponding area of 8,309 acres. The dead pool below elevation 775.0 feet was found to be 71 acre-feet, and thus the usable conservation storage found in this survey is 378,781 acre-feet.

Comparing the findings from the original design (Table 1) and the current survey, the surface area at conservation pool elevation 909.0 feet msl increased by 69 surface acres. The reduction in volume at conservation pool elevation is 7,348 acre-feet (-1.9%) or 153.1 acre-feet/year (since 1964). The average annual deposition rate of sediment in the lake for this period is also estimated at 0.1 acre-feet/square mile of drainage area.

Comparing the findings from the 1972 sediment survey and the current survey, the surface area at conservation pool elevation 909.0 feet msl increased by 78 surface acres. The reduction in volume at conservation pool elevation is 3,148 acre-feet (-0.8%) or 112.4 acre-feet/year (since 1972). The average annual deposition rate of sediment in the lake can be estimated at 0.1 acre-feet/square mile of drainage area.

Based on the amount of data collected and the improved methods and technology used in the current survey, the current data set is considered to be an improvement over previous surveys. It is recommended that the same methodology be used in five to ten years or after major flood events to monitor changes to the lake's storage volume.

Table 1. Area and volume comparisons at elevation 909.0 feet msl.

Year	1952	1972	2000
Area (acres)	8,240	8,231	8,309
Volume (acre-feet)	386,200	382,000	378,852

REFERENCES

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3. Texas Water Development Board. 1966. Dams and Lakes in Texas, Historical and Descriptive Information. Report 48.

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Appendix A

Canyon Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

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

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
761									0	0
762	0	0	0	0	0	0	0	0	0	0
763	0	0	0	0	0	0	0	0	0	0
764	0	0	0	1	1	1	1	1	1	1
765	1	1	1	1	1	1	1	1	1	2
766	2	2	2	2	2	2	2	2	2	2
767	3	3	3	3	3	3	3	4	4	4
768	4	4	4	5	5	5	5	6	6	6
769	7	7	8	8	9	9	10	10	11	12
770	12	13	13	14	15	15	16	17	18	18
771	19	20	21	22	23	24	25	25	26	27
772	28	30	31	32	33	34	35	36	37	39
773	40	41	42	44	45	47	48	49	51	52
774	54	56	57	59	60	62	64	66	67	69
775	71	73	75	77	79	81	83	85	87	90
776	92	94	96	99	101	104	106	109	111	114
777	116	119	122	124	127	130	133	136	139	142
778	145	148	151	154	158	161	164	168	171	174
779	178	181	185	189	192	196	200	204	208	211
780	215	219	223	228	232	236	240	244	249	253
781	258	262	267	271	276	281	286	290	295	300
782	305	310	315	320	326	331	336	342	347	353
783	358	364	370	376	381	387	393	399	406	412
784	418	424	431	437	444	450	457	464	470	477
785	484	491	498	505	513	520	527	535	542	550
786	557	565	573	581	589	597	605	613	621	629
787	638	646	655	663	672	681	690	699	708	717
788	726	735	745	754	764	773	783	793	803	813
789	823	833	843	854	864	875	886	897	908	919
790	930	941	953	965	977	989	1001	1014	1026	1039
791	1052	1065	1078	1091	1105	1119	1132	1146	1161	1175
792	1189	1204	1219	1234	1249	1265	1280	1296	1312	1328
793	1344	1361	1377	1394	1411	1428	1446	1463	1481	1499
794	1517	1535	1554	1573	1591	1610	1629	1649	1668	1688
795	1708	1727	1747	1768	1788	1809	1829	1850	1871	1892
796	1914	1935	1957	1979	2001	2023	2045	2068	2090	2113
797	2136	2160	2183	2207	2230	2254	2279	2303	2327	2352
798	2377	2402	2428	2453	2479	2505	2531	2558	2585	2612
799	2639	2666	2694	2722	2750	2779	2808	2837	2866	2895
800	2925	2955	2985	3016	3047	3078	3109	3141	3172	3205
801	3237	3270	3303	3336	3369	3403	3436	3470	3505	3539
802	3574	3609	3644	3680	3715	3751	3788	3824	3861	3898
803	3935	3973	4011	4049	4088	4127	4166	4205	4245	4285
804	4325	4366	4407	4449	4490	4532	4575	4617	4660	4704
805	4747	4791	4836	4880	4925	4971	5016	5062	5108	5155
806	5202	5249	5297	5344	5392	5441	5489	5539	5588	5637
807	5687	5738	5788	5839	5890	5942	5994	6046	6099	6151
808	6205	6258	6312	6366	6420	6475	6530	6586	6641	6697
809	6754	6810	6867	6925	6982	7040	7099	7157	7216	7276
810	7335	7396	7456	7517	7578	7640	7702	7765	7828	7891
811	7955	8019	8084	8149	8214	8280	8347	8413	8481	8548
812	8616	8685	8754	8823	8893	8963	9034	9105	9176	9248
813	9321	9394	9467	9541	9615	9689	9764	9840	9916	9993
814	10069	10147	10225	10303	10382	10461	10540	10620	10701	10782
815	10863	10945	11027	11109	11192	11276	11360	11444	11529	11614
816	11700	11786	11873	11960	12048	12136	12224	12313	12402	12492
817	12582	12673	12764	12855	12947	13039	13132	13225	13319	13413

Appendix A (continued)

Canyon Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

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

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
818	13508	13603	13698	13794	13890	13987	14084	14182	14280	14379
819	14478	14577	14677	14777	14878	14980	15081	15183	15286	15389
820	15492	15596	15701	15805	15910	16016	16122	16228	16335	16442
821	16549	16657	16766	16874	16984	17093	17203	17313	17424	17535
822	17646	17758	17871	17983	18096	18210	18324	18438	18553	18668
823	18783	18899	19016	19132	19249	19367	19485	19603	19722	19841
824	19961	20081	20201	20322	20444	20566	20688	20811	20934	21057
825	21181	21306	21431	21556	21682	21808	21935	22063	22190	22318
826	22447	22576	22706	22836	22966	23097	23229	23361	23493	23626
827	23759	23893	24028	24163	24298	24434	24571	24708	24846	24984
828	25123	25263	25403	25544	25686	25828	25971	26115	26259	26404
829	26550	26696	26843	26991	27139	27287	27437	27587	27737	27888
830	28040	28192	28346	28499	28654	28808	28964	29120	29277	29434
831	29592	29750	29910	30069	30230	30390	30552	30714	30877	31041
832	31205	31370	31535	31701	31868	32035	32202	32370	32538	32707
833	32876	33046	33216	33387	33559	33730	33902	34075	34248	34422
834	34596	34771	34946	35121	35298	35474	35651	35829	36007	36185
835	36364	36544	36724	36904	37086	37267	37449	37632	37815	37999
836	38183	38368	38553	38739	38925	39112	39300	39488	39676	39865
837	40055	40245	40435	40626	40818	41010	41203	41396	41590	41785
838	41980	42175	42372	42569	42766	42964	43162	43361	43561	43761
839	43962	44163	44365	44567	44770	44974	45178	45383	45589	45795
840	46002	46209	46417	46625	46835	47044	47255	47466	47677	47890
841	48103	48317	48531	48746	48962	49179	49396	49614	49833	50052
842	50272	50493	50715	50937	51159	51383	51607	51831	52057	52283
843	52509	52737	52965	53193	53422	53652	53883	54114	54346	54578
844	54811	55045	55279	55514	55749	55985	56221	56459	56696	56935
845	57173	57413	57653	57894	58135	58377	58619	58863	59106	59351
846	59596	59841	60087	60334	60582	60830	61078	61328	61578	61828
847	62080	62331	62584	62837	63091	63345	63600	63856	64112	64369
848	64626	64884	65143	65402	65662	65923	66184	66446	66708	66972
849	67235	67500	67765	68031	68297	68564	68832	69100	69369	69639
850	69909	70180	70452	70724	70997	71270	71545	71820	72096	72372
851	72649	72927	73205	73485	73765	74045	74326	74608	74891	75174
852	75459	75743	76029	76315	76603	76890	77179	77468	77758	78049
853	78340	78632	78925	79218	79512	79807	80102	80398	80695	80993
854	81291	81590	81889	82189	82491	82792	83095	83398	83702	84007
855	84312	84618	84925	85233	85542	85851	86162	86473	86785	87098
856	87411	87725	88040	88356	88673	88990	89308	89627	89947	90267
857	90588	90910	91233	91556	91880	92205	92530	92857	93184	93511
858	93840	94169	94499	94830	95161	95494	95827	96161	96495	96831
859	97167	97505	97843	98182	98522	98863	99204	99547	99890	100234
860	100579	100925	101272	101619	101967	102316	102666	103017	103368	103720
861	104073	104427	104781	105137	105493	105850	106207	106566	106925	107285
862	107646	108007	108369	108732	109096	109460	109826	110192	110558	110926
863	111294	111664	112034	112404	112776	113148	113520	113894	114268	114643
864	115019	115396	115773	116151	116530	116909	117289	117670	118052	118434
865	118817	119201	119586	119971	120358	120745	121132	121521	121911	122301
866	122692	123084	123477	123870	124265	124660	125056	125453	125850	126249
867	126648	127048	127449	127851	128253	128657	129061	129466	129872	130279
868	130686	131095	131505	131915	132327	132739	133152	133566	133981	134398
869	134815	135233	135652	136072	136493	136915	137338	137762	138187	138613
870	139040	139467	139896	140325	140756	141187	141620	142053	142487	142923
871	143359	143796	144234	144672	145112	145553	145994	146437	146880	147325
872	147770	148217	148664	149112	149561	150011	150462	150914	151366	151820
873	152274	152729	153186	153643	154101	154559	155019	155479	155941	156403
874	156866	157330	157795	158261	158728	159195	159663	160133	160603	161074

Appendix A (continued)

Canyon Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

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

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
875	161546	162019	162493	162968	163444	163920	164398	164876	165356	165836
876	166317	166800	167283	167767	168252	168738	169225	169713	170201	170691
877	171181	171672	172165	172658	173152	173647	174142	174639	175137	175635
878	176134	176635	177136	177638	178141	178645	179149	179655	180162	180669
879	181177	181687	182197	182708	183221	183734	184248	184763	185279	185796
880	186313	186832	187352	187872	188394	188916	189439	189964	190489	191015
881	191542	192070	192599	193128	193659	194191	194723	195257	195791	196327
882	196863	197400	197938	198477	199017	199558	200100	200643	201186	201731
883	202277	202823	203371	203919	204468	205019	205570	206122	206675	207229
884	207784	208340	208897	209455	210013	210573	211134	211695	212258	212822
885	213386	213951	214518	215085	215654	216223	216793	217364	217936	218510
886	219084	219659	220235	220812	221391	221970	222550	223131	223713	224297
887	224881	225466	226052	226639	227228	227817	228407	228998	229590	230184
888	230778	231373	231969	232566	233164	233764	234364	234965	235567	236170
889	236774	237379	237986	238593	239201	239810	240421	241032	241644	242258
890	242872	243487	244103	244721	245339	245958	246579	247200	247823	248446
891	249070	249696	250322	250950	251579	252208	252838	253470	254103	254737
892	255371	256006	256643	257281	257920	258559	259200	259841	260484	261128
893	261772	262418	263065	263712	264361	265011	265661	266313	266966	267620
894	268275	268930	269587	270245	270904	271564	272225	272887	273550	274215
895	274880	275546	276213	276881	277551	278221	278892	279565	280238	280913
896	281588	282265	282942	283621	284301	284981	285663	286346	287029	287714
897	288400	289087	289775	290464	291154	291845	292537	293231	293925	294620
898	295317	296014	296713	297412	298113	298814	299517	300221	300926	301632
899	302339	303047	303757	304467	305179	305891	306604	307319	308035	308752
900	309470	310189	310910	311631	312354	313077	313802	314528	315255	315984
901	316713	317443	318175	318907	319641	320376	321112	321849	322587	323327
902	324067	324808	325551	326295	327040	327786	328534	329282	330032	330783
903	331535	332288	333043	333798	334555	335313	336072	336833	337594	338358
904	339122	339887	340654	341421	342191	342961	343732	344505	345279	346054
905	346831	347608	348387	349167	349949	350731	351514	352300	353085	353873
906	354661	355450	356241	357033	357826	358620	359416	360213	361010	361809
907	362609	363410	364213	365016	365821	366627	367434	368242	369051	369862
908	370673	371486	372300	373115	373931	374748	375567	376386	377207	378029
909	378852	379676	380501	381329	382157	382987	383819	384653	385487	386324
910	387162	388001	388842	389683	390525	391369	392213	393058	393904	394751
911	395599	396448	397298	398149	399000	399853	400707	401561	402417	403273
912	404130									
913	412757									
914	421491									
915	430337									
916	439302									
917	448396									
918	457617									
919	466958									
920	476409									
921	485982									
922	495692									
923	505531									
924	515505									
925	525633									
926	535915									
927	546351									
928	556924									
929	567636									
930	578503									
931	589526									

Volumes in Gray are calculated from the 1972 COE Report on Sedimnetation

Appendix A (continued)

Canyon Lake

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

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

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
932	600695									
933	612017									
934	623501									
935	635135									
936	646917									
937	658852									
938	670939									
939	683165									
940	695539									
941	708058									
942	720716									
943	733517									
944	746459									
945	759559									
946	772809									
947	786199									
948	799734									
949	813399									

Volumes in Gray are calculated from the 1972 COE Report on Sedimnetation

Appendix B

Canyon Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
761									0	0
762	0	0	0	0	0	0	0	0	0	0
763	0	0	0	0	0	0	0	0	0	0
764	0	0	0	0	0	0	1	1	1	1
765	1	1	1	1	1	1	1	1	1	1
766	1	1	1	1	1	1	1	1	1	1
767	1	1	1	1	1	1	1	2	2	2
768	2	2	2	2	3	3	3	3	4	4
769	4	5	5	5	5	5	6	6	6	6
770	6	6	7	7	7	7	7	7	8	8
771	8	8	9	9	9	9	9	10	10	10
772	10	10	11	11	11	11	12	12	12	12
773	13	13	13	14	14	14	14	15	15	15
774	16	16	16	16	17	17	17	18	18	18
775	19	19	20	20	20	21	21	21	22	22
776	23	23	23	24	24	25	25	25	26	26
777	27	27	27	28	28	29	29	29	30	30
778	31	31	32	32	33	33	33	34	34	35
779	35	36	36	37	37	37	38	38	39	39
780	40	40	41	41	42	42	43	43	44	44
781	45	45	46	46	47	47	48	48	49	50
782	50	51	51	52	52	53	54	54	55	56
783	56	57	58	58	59	60	60	61	62	62
784	63	64	64	65	66	66	67	68	68	69
785	70	70	71	72	72	73	74	75	75	76
786	77	77	78	79	80	80	81	82	83	83
787	84	85	86	87	87	88	89	90	91	92
788	92	93	94	95	96	97	98	99	100	101
789	102	103	104	105	106	107	108	110	111	112
790	114	115	117	119	120	122	123	125	127	128
791	130	131	133	134	136	137	139	141	142	144
792	146	148	150	151	153	155	157	158	160	162
793	164	166	167	169	171	173	175	177	179	180
794	182	184	186	187	189	190	192	194	195	197
795	198	200	201	203	204	206	208	209	211	213
796	214	216	218	219	221	223	224	226	228	230
797	231	233	235	237	239	241	243	245	247	249
798	251	253	255	257	259	261	264	266	269	271
799	274	276	278	281	284	286	289	291	294	296
800	299	301	304	307	309	312	315	318	320	323
801	325	328	330	332	335	337	339	341	344	346
802	349	351	354	356	359	361	364	367	369	372
803	375	378	381	384	387	390	393	396	399	402
804	405	409	412	415	418	422	425	428	432	435
805	439	442	445	448	452	455	458	461	464	467
806	470	473	476	479	482	485	489	492	495	498
807	501	504	507	511	514	517	520	524	527	530
808	533	536	540	543	546	549	552	555	559	562
809	565	568	571	575	578	582	585	589	592	596
810	599	603	607	611	615	620	624	628	632	636
811	640	644	648	652	657	662	666	670	674	678
812	683	687	691	696	700	705	709	713	718	722

Appendix B (continued)

Canyon Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
813	726	731	735	739	743	748	753	758	763	768
814	772	776	781	785	789	793	798	802	806	810
815	815	819	824	828	833	837	842	846	851	855
816	860	864	869	873	878	882	886	891	895	899
817	904	908	912	917	921	926	930	934	939	943
818	948	952	957	961	966	970	974	979	983	988
819	992	997	1002	1006	1011	1015	1019	1024	1028	1032
820	1036	1041	1045	1049	1053	1057	1061	1065	1069	1073
821	1077	1081	1085	1089	1093	1097	1101	1105	1109	1113
822	1117	1121	1125	1129	1133	1137	1141	1145	1149	1153
823	1157	1161	1165	1169	1173	1177	1182	1186	1190	1194
824	1199	1203	1207	1212	1216	1220	1225	1229	1234	1238
825	1243	1247	1252	1257	1261	1266	1270	1275	1280	1284
826	1289	1293	1298	1303	1307	1312	1317	1322	1327	1332
827	1337	1342	1347	1352	1358	1363	1369	1374	1380	1386
828	1393	1399	1407	1414	1421	1428	1434	1441	1447	1453
829	1459	1466	1472	1478	1484	1490	1496	1502	1509	1515
830	1521	1528	1534	1540	1546	1552	1558	1564	1570	1576
831	1582	1588	1594	1600	1606	1613	1620	1626	1633	1640
832	1646	1651	1656	1661	1666	1671	1676	1681	1686	1691
833	1696	1701	1705	1710	1715	1720	1725	1730	1734	1739
834	1744	1749	1754	1758	1763	1768	1773	1778	1783	1788
835	1793	1798	1803	1807	1812	1818	1823	1829	1835	1840
836	1846	1851	1857	1862	1867	1872	1877	1882	1887	1892
837	1898	1903	1908	1913	1919	1924	1930	1936	1942	1949
838	1954	1960	1965	1971	1976	1982	1987	1993	1999	2005
839	2010	2016	2021	2027	2033	2040	2046	2052	2058	2064
840	2070	2076	2082	2088	2095	2101	2107	2114	2120	2127
841	2134	2141	2148	2155	2163	2170	2177	2184	2191	2197
842	2204	2211	2217	2224	2230	2237	2243	2250	2256	2263
843	2270	2276	2283	2289	2296	2302	2309	2315	2321	2327
844	2333	2339	2345	2351	2356	2362	2368	2374	2380	2386
845	2392	2398	2404	2410	2416	2422	2428	2434	2440	2446
846	2453	2459	2465	2471	2478	2484	2490	2497	2503	2509
847	2515	2522	2528	2534	2540	2546	2553	2559	2565	2571
848	2578	2584	2590	2596	2603	2609	2616	2622	2628	2635
849	2641	2648	2654	2660	2667	2673	2680	2687	2693	2700
850	2706	2713	2720	2727	2733	2740	2747	2754	2761	2768
851	2774	2781	2788	2795	2802	2809	2816	2823	2831	2838
852	2845	2853	2860	2867	2874	2882	2889	2896	2902	2909
853	2916	2923	2930	2937	2944	2951	2958	2965	2972	2978
854	2985	2992	2999	3006	3013	3020	3028	3036	3044	3051
855	3059	3067	3075	3083	3091	3099	3107	3115	3123	3131
856	3139	3147	3155	3162	3170	3177	3185	3192	3200	3207
857	3215	3223	3230	3237	3244	3252	3259	3266	3273	3281
858	3288	3296	3304	3311	3319	3327	3335	3343	3351	3360
859	3368	3377	3386	3395	3403	3412	3421	3430	3438	3446
860	3454	3462	3470	3478	3486	3494	3502	3510	3518	3525
861	3533	3541	3549	3557	3565	3573	3580	3588	3596	3603
862	3611	3619	3626	3633	3641	3648	3656	3664	3672	3680
863	3688	3695	3703	3710	3717	3725	3732	3739	3747	3754
864	3761	3769	3776	3783	3791	3798	3806	3813	3820	3828

Appendix B (continued)

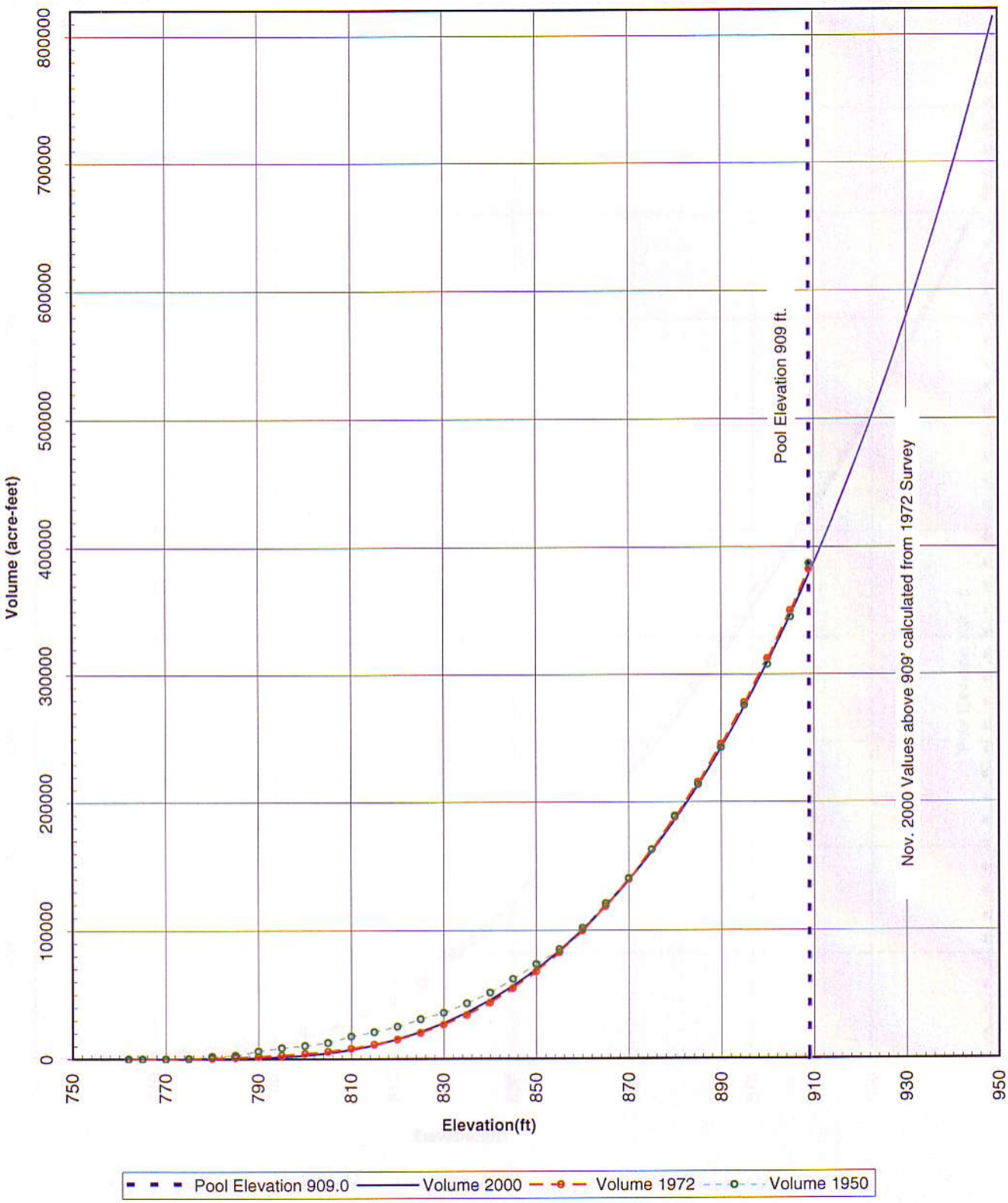
Canyon Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — November 2000 SURVEY

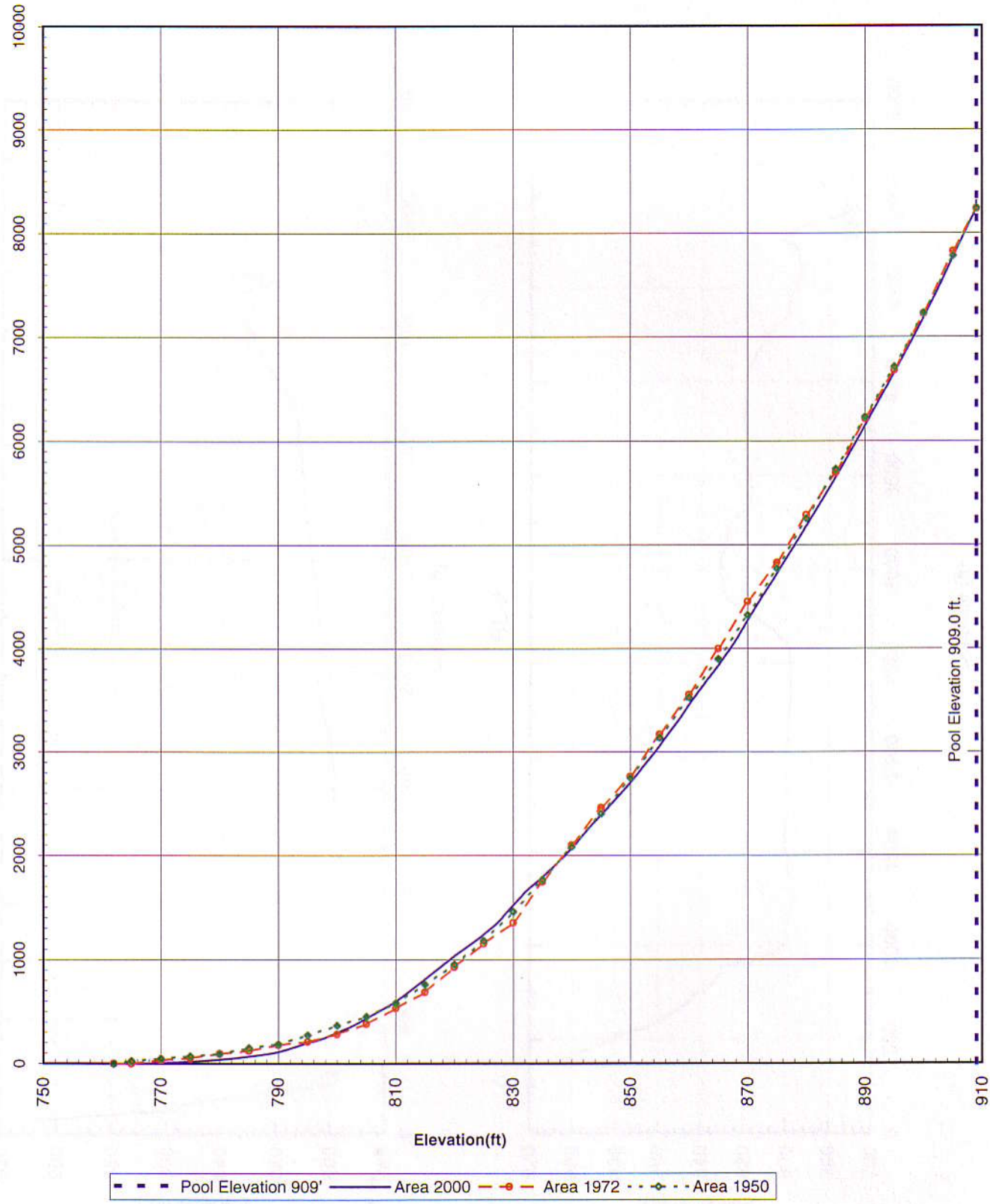
AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
865	3835	3843	3850	3858	3866	3874	3883	3891	3899	3907
866	3915	3923	3932	3940	3948	3956	3964	3972	3980	3988
867	3997	4005	4013	4021	4030	4038	4047	4055	4064	4073
868	4082	4091	4100	4109	4118	4128	4137	4147	4157	4167
869	4177	4187	4197	4206	4216	4225	4235	4244	4253	4263
870	4272	4281	4291	4301	4310	4319	4328	4338	4347	4356
871	4365	4374	4384	4393	4402	4412	4421	4430	4440	4450
872	4459	4468	4477	4487	4496	4504	4513	4522	4530	4539
873	4548	4556	4565	4574	4583	4592	4601	4610	4618	4627
874	4636	4644	4653	4662	4671	4680	4689	4698	4707	4716
875	4725	4734	4744	4753	4762	4771	4781	4790	4799	4809
876	4818	4827	4836	4846	4855	4864	4873	4882	4891	4900
877	4909	4918	4927	4935	4944	4953	4962	4971	4980	4989
878	4998	5007	5016	5025	5034	5043	5052	5061	5070	5080
879	5089	5099	5108	5117	5127	5136	5145	5155	5164	5173
880	5182	5192	5201	5210	5219	5228	5238	5247	5256	5266
881	5275	5284	5293	5303	5312	5321	5330	5340	5349	5358
882	5368	5377	5386	5395	5404	5413	5423	5432	5441	5451
883	5460	5470	5479	5489	5498	5508	5517	5526	5536	5545
884	5554	5564	5573	5583	5592	5602	5611	5621	5631	5640
885	5650	5659	5669	5679	5688	5698	5708	5717	5727	5737
886	5747	5757	5767	5777	5787	5797	5807	5817	5827	5837
887	5847	5857	5867	5877	5887	5897	5907	5917	5927	5937
888	5947	5957	5967	5977	5987	5997	6007	6017	6027	6037
889	6047	6057	6067	6077	6087	6097	6107	6117	6127	6138
890	6148	6158	6168	6178	6189	6199	6209	6219	6229	6239
891	6250	6260	6270	6280	6291	6301	6311	6321	6331	6341
892	6351	6361	6371	6381	6391	6401	6411	6421	6431	6441
893	6451	6461	6472	6482	6492	6502	6513	6523	6533	6543
894	6553	6564	6574	6584	6595	6605	6616	6626	6636	6647
895	6657	6667	6678	6688	6698	6709	6719	6729	6740	6750
896	6760	6770	6781	6791	6801	6812	6822	6833	6843	6853
897	6864	6874	6885	6895	6906	6916	6927	6937	6948	6959
898	6969	6980	6990	7001	7012	7023	7033	7044	7055	7066
899	7076	7087	7098	7109	7120	7131	7142	7153	7164	7175
900	7186	7197	7209	7220	7231	7242	7254	7265	7276	7287
901	7298	7310	7321	7332	7343	7354	7365	7377	7388	7399
902	7410	7422	7433	7445	7456	7468	7479	7491	7503	7515
903	7526	7538	7550	7562	7574	7587	7599	7611	7623	7636
904	7648	7660	7672	7685	7697	7709	7721	7734	7746	7758
905	7770	7782	7795	7807	7819	7830	7842	7854	7866	7877
906	7889	7901	7913	7925	7937	7948	7960	7972	7984	7995
907	8007	8018	8030	8041	8053	8064	8075	8087	8098	8110
908	8121	8133	8144	8156	8167	8179	8190	8202	8213	8225
909	8308									



Canyon Lake
November 2000
Prepared by: TWDB

Appendix C Elevation vs. Volume

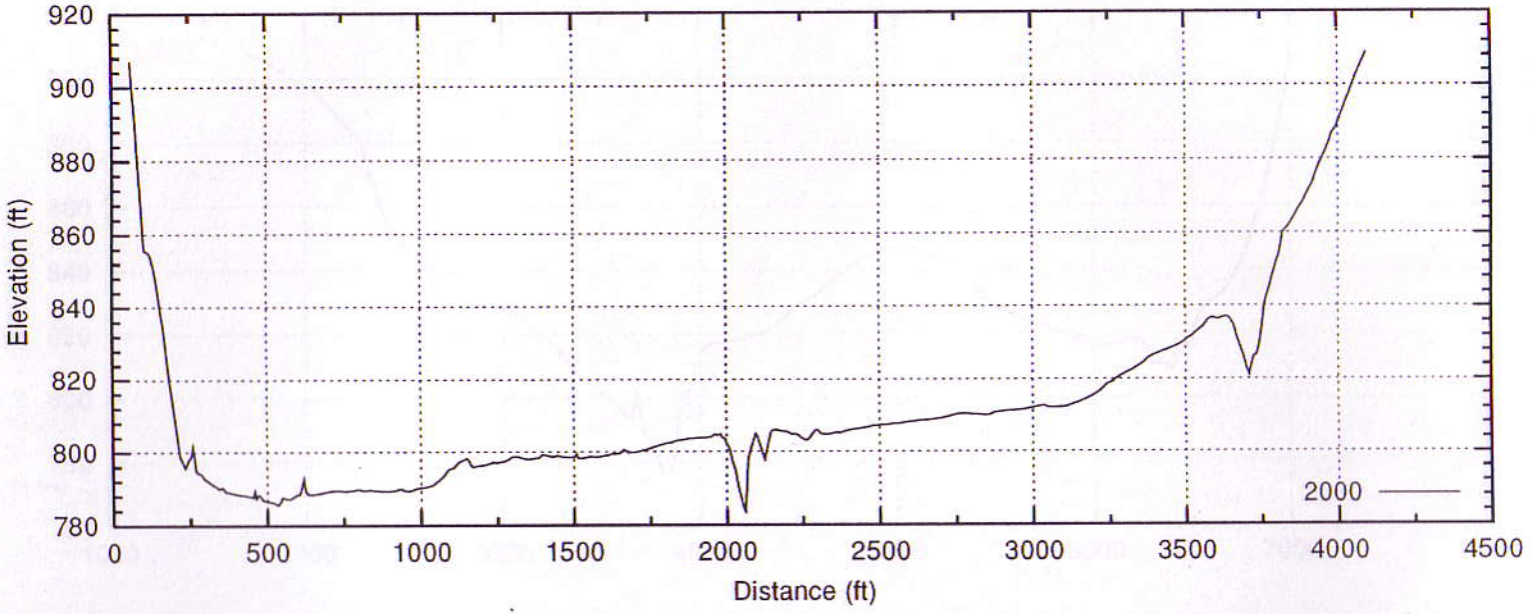


Canyon Lake
November 2000
Prepared by: TWDB

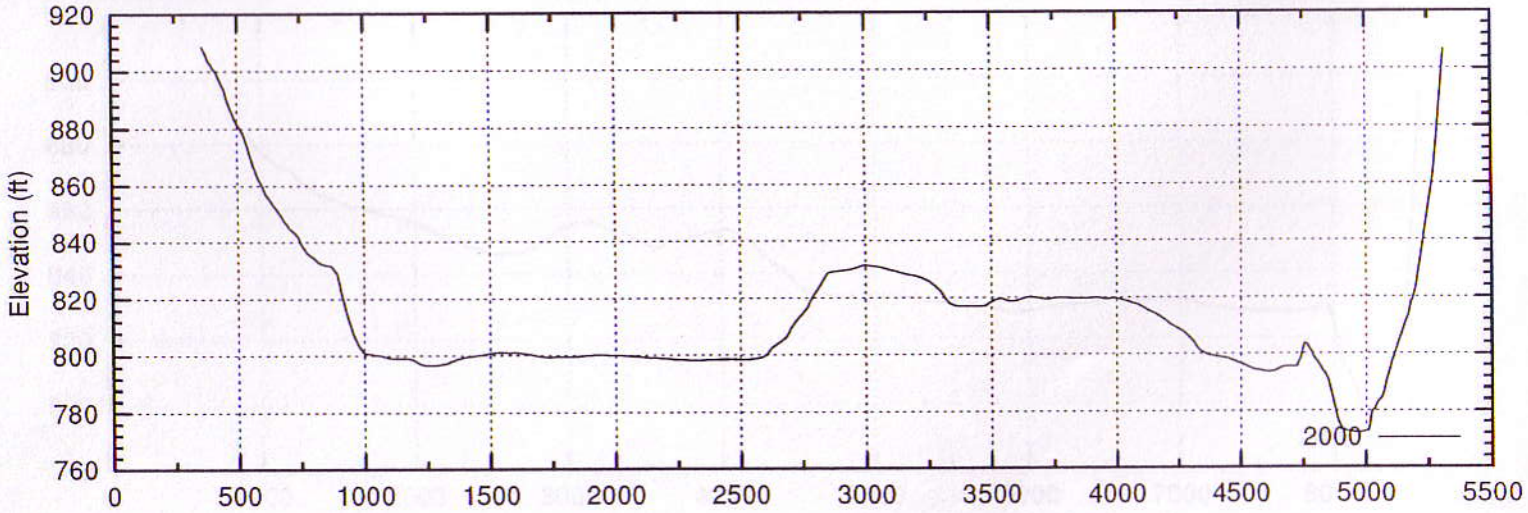
Appendix D Elevation vs. Area

Canyon Lake

RL-1



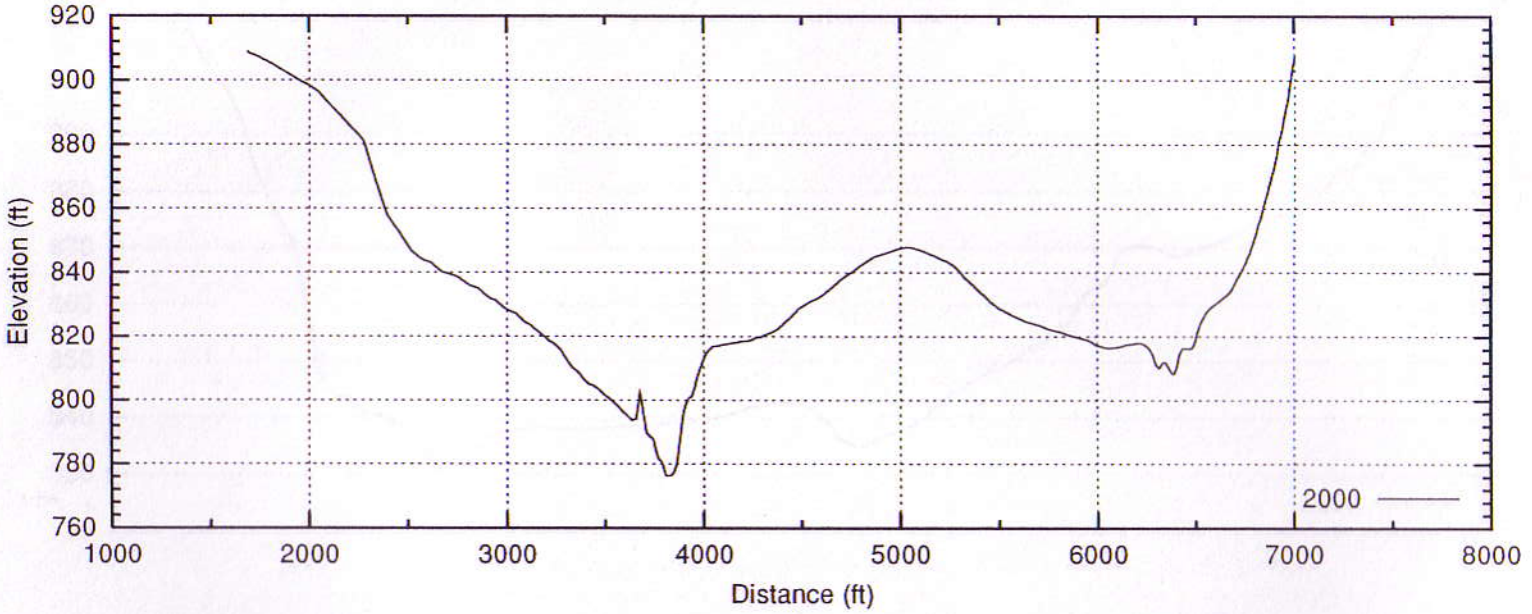
RL-2



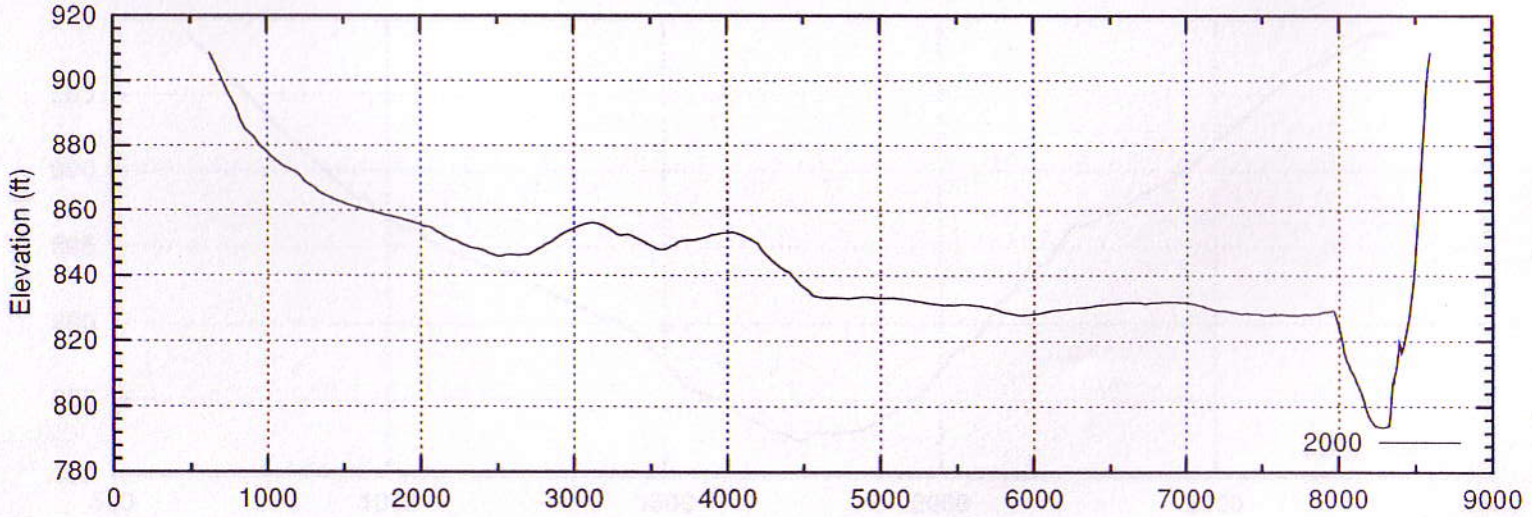
Appendix E

Canyon Lake

RL-3



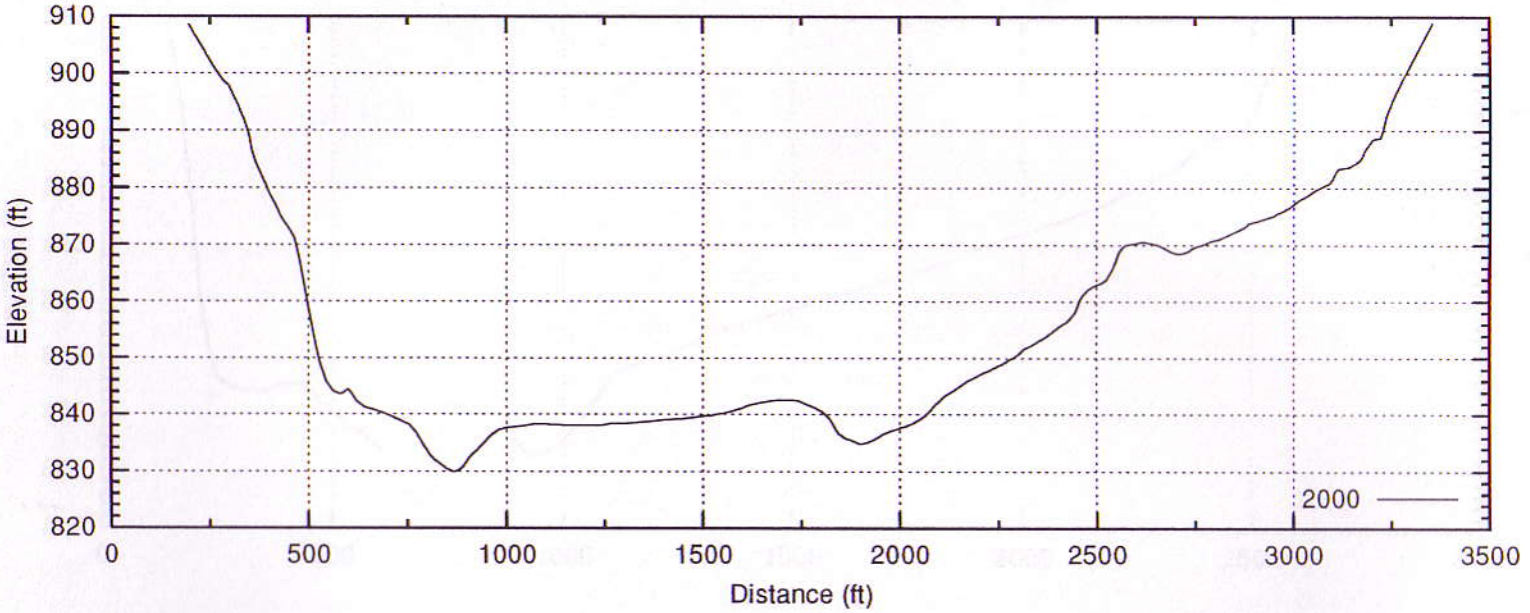
RL-4



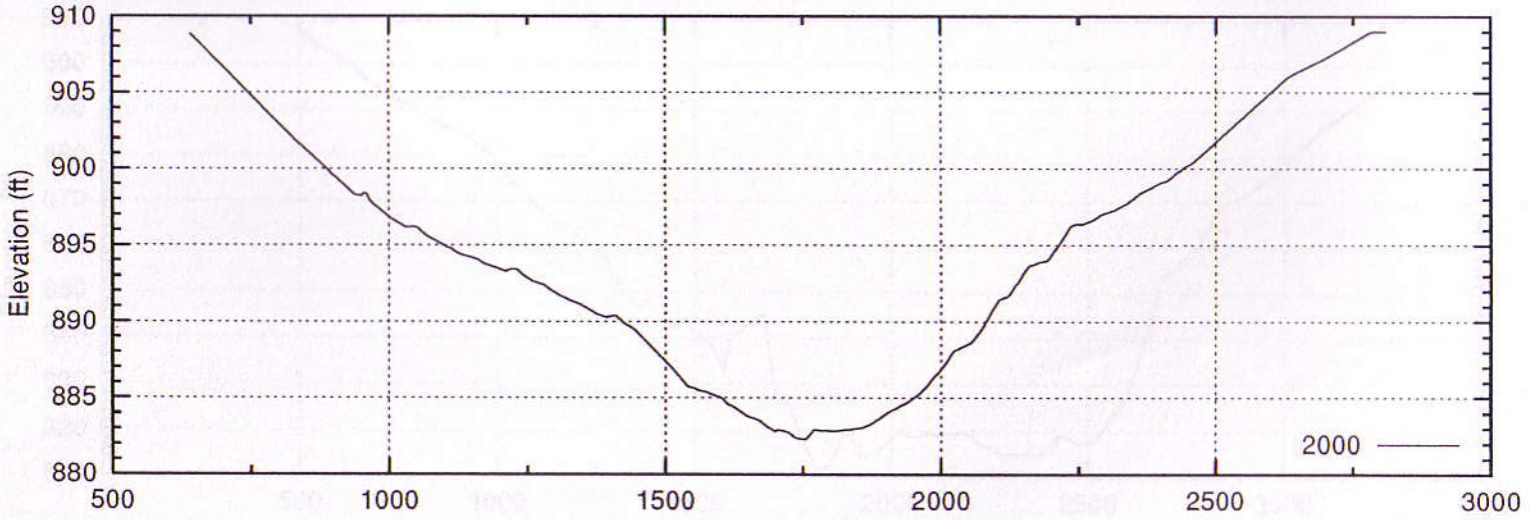
Appendix E

Canyon Lake

RL-5

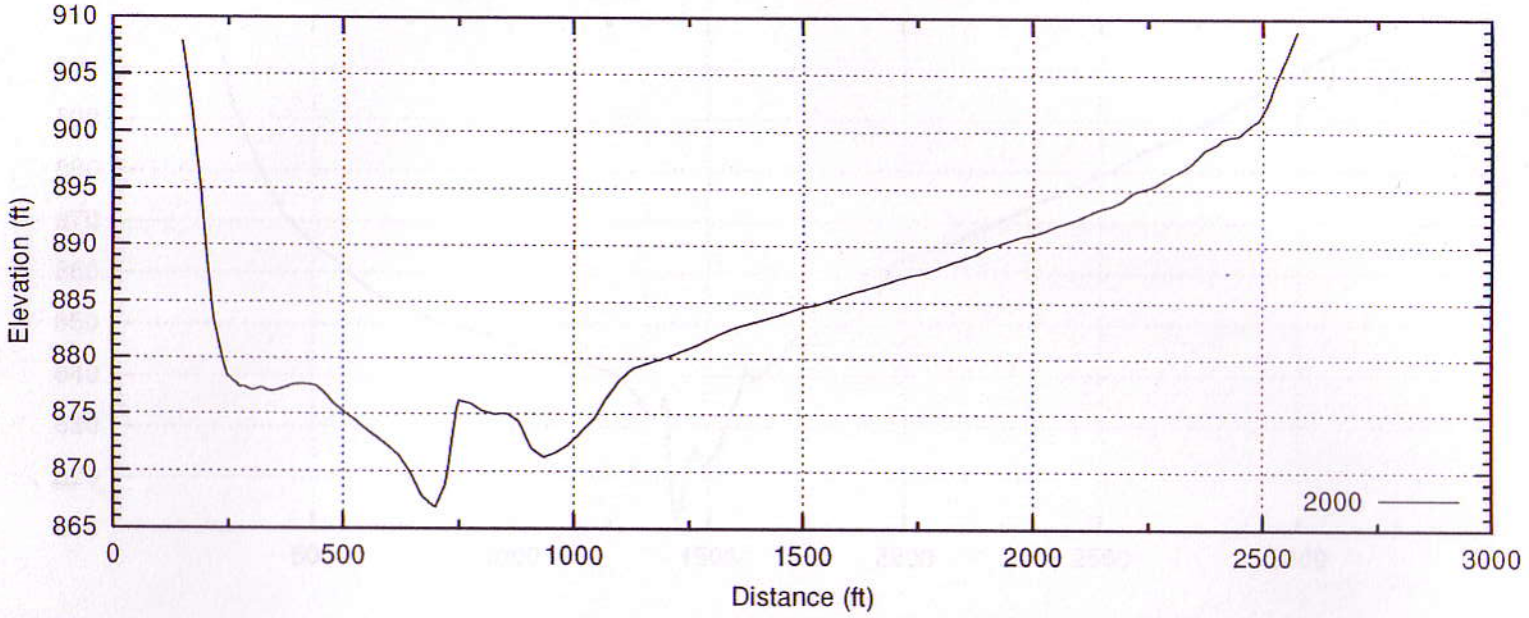


RL-6

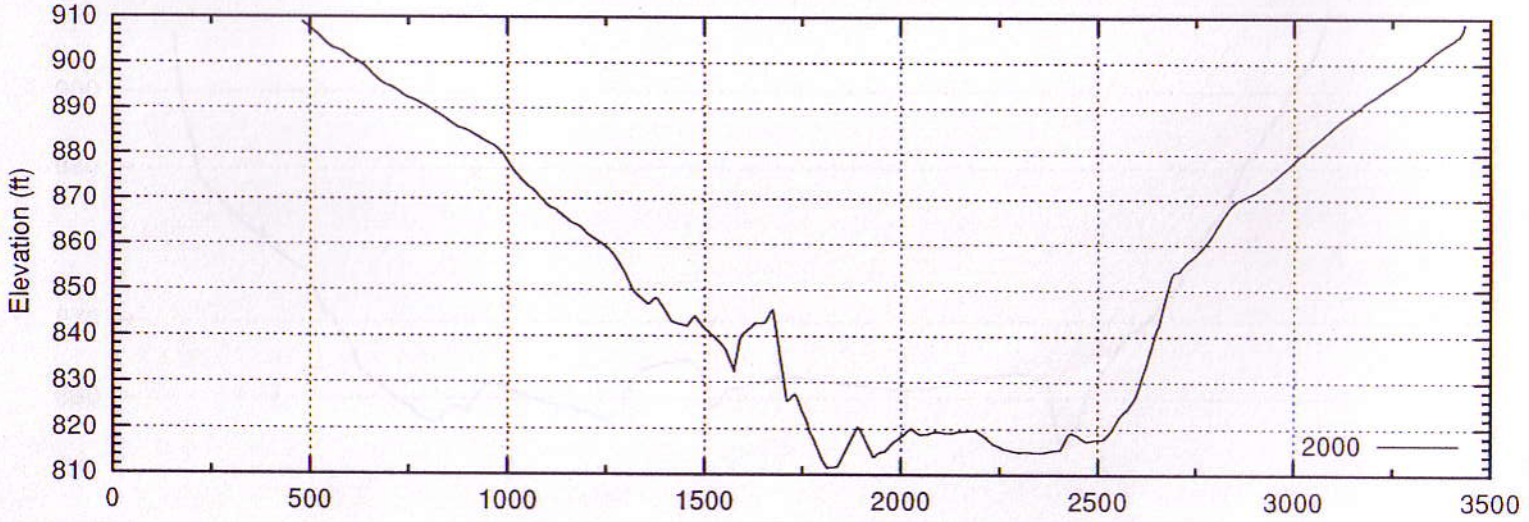


Canyon Lake

RL-7

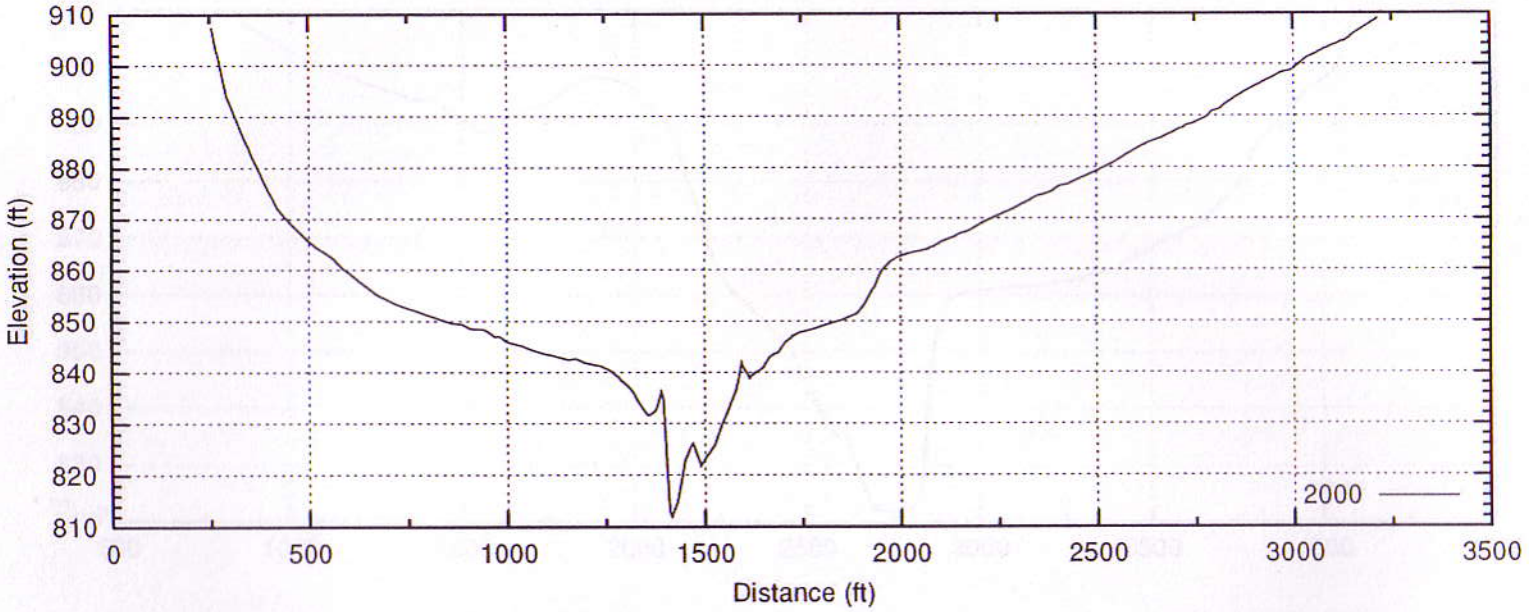


RL-8

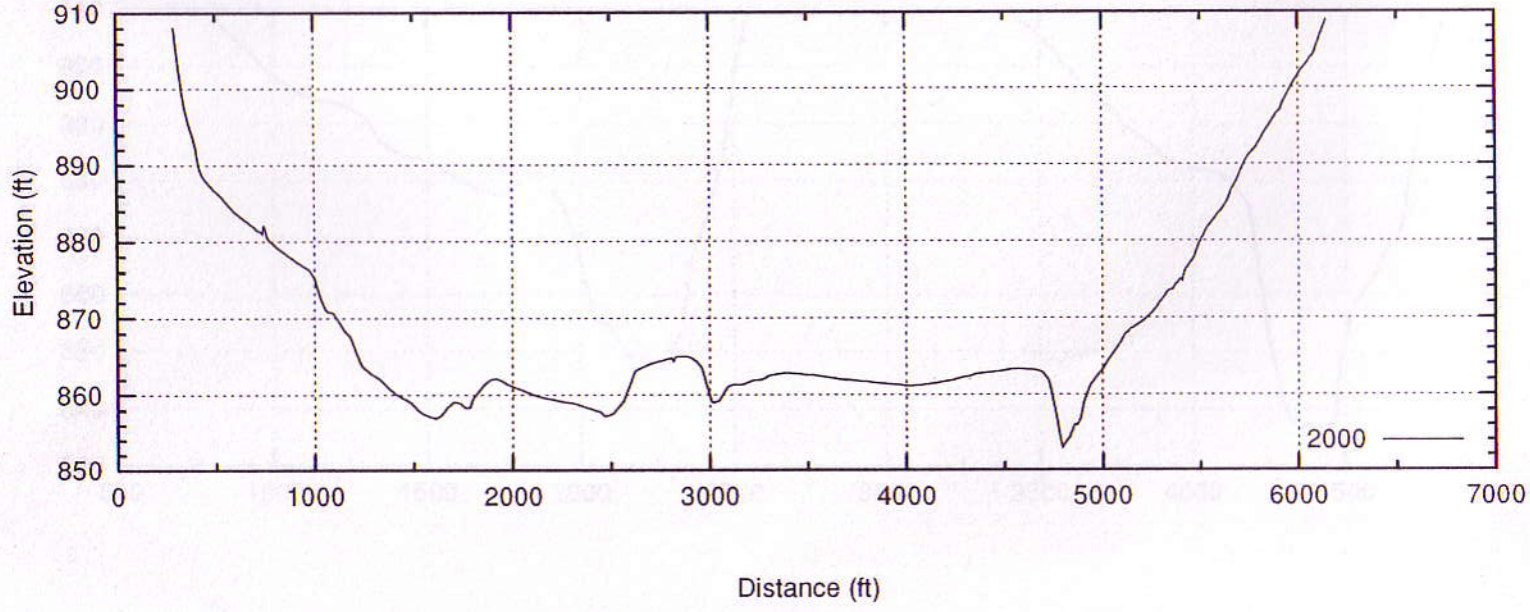


Canyon Lake

RL-9



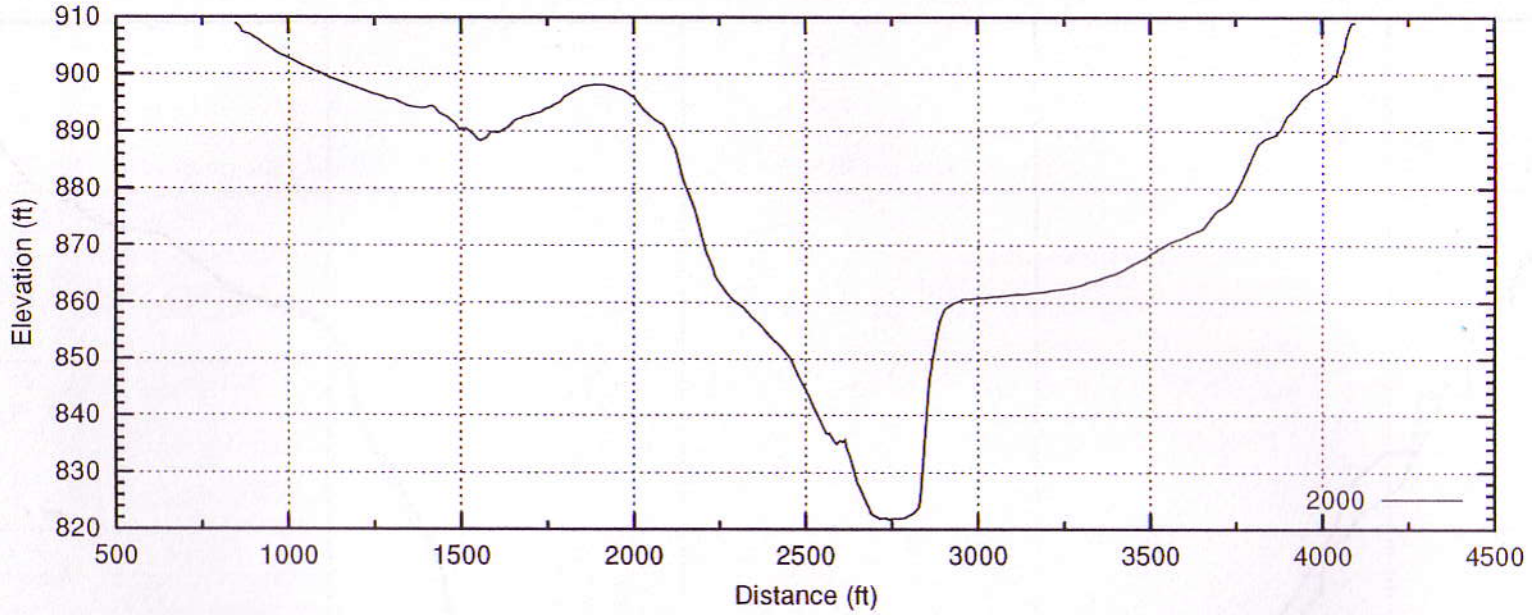
RL-10



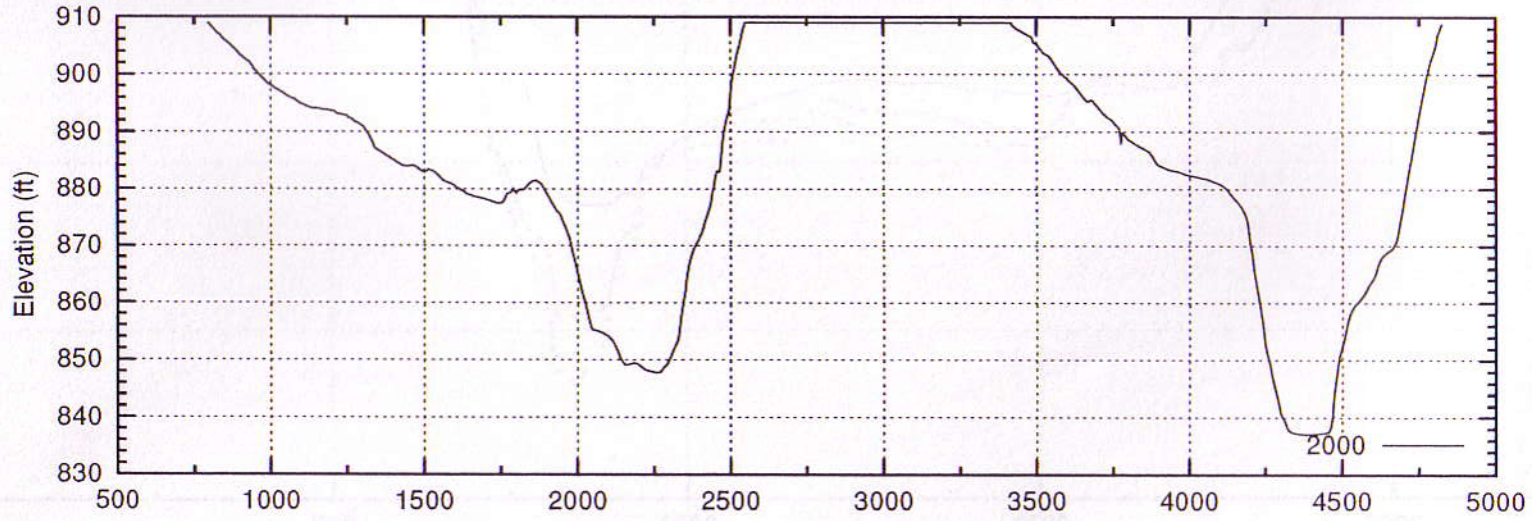
Appendix E

Canyon Lake

RL-11



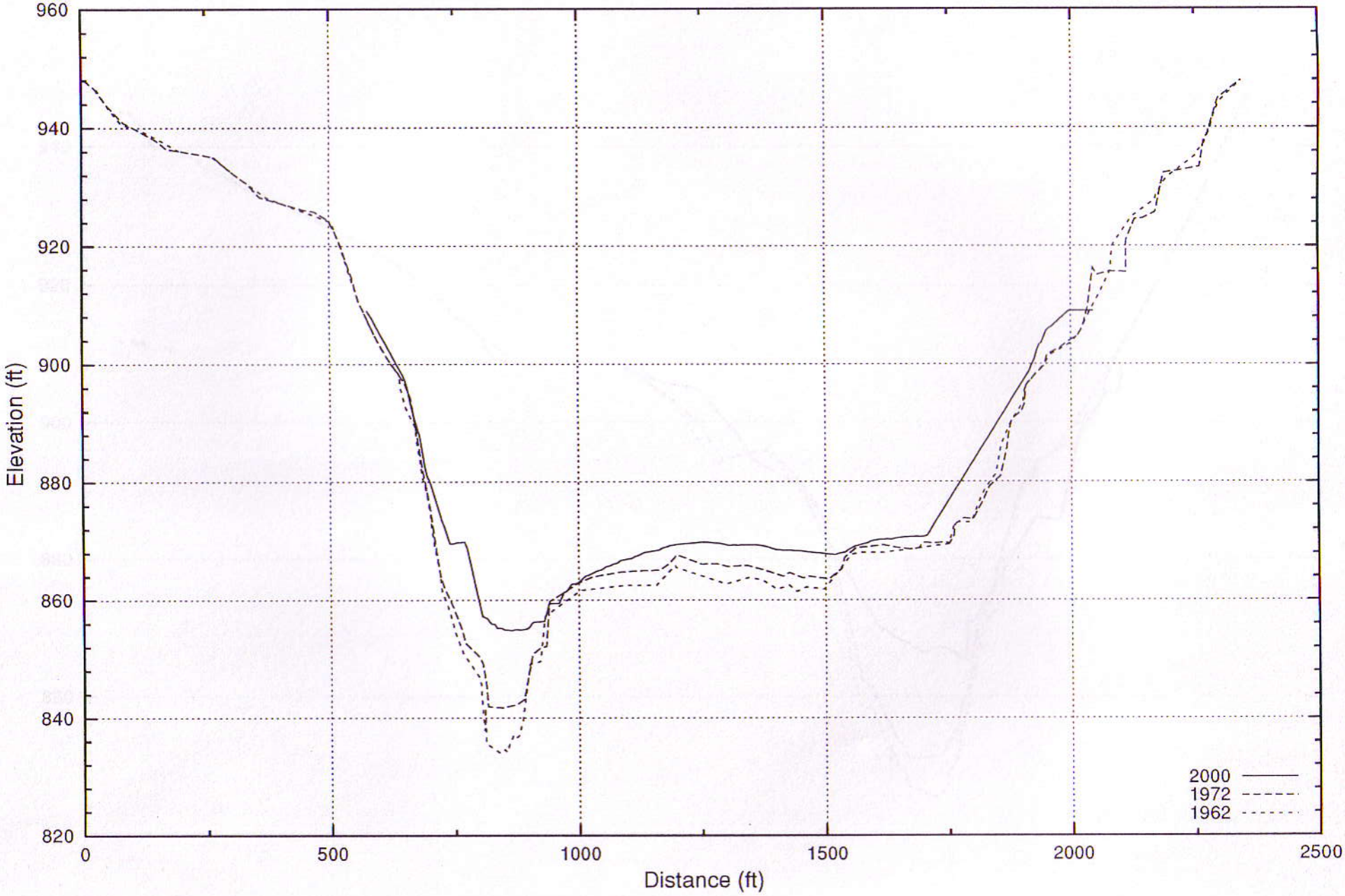
RL-12



Appendix E

Canyon Lake

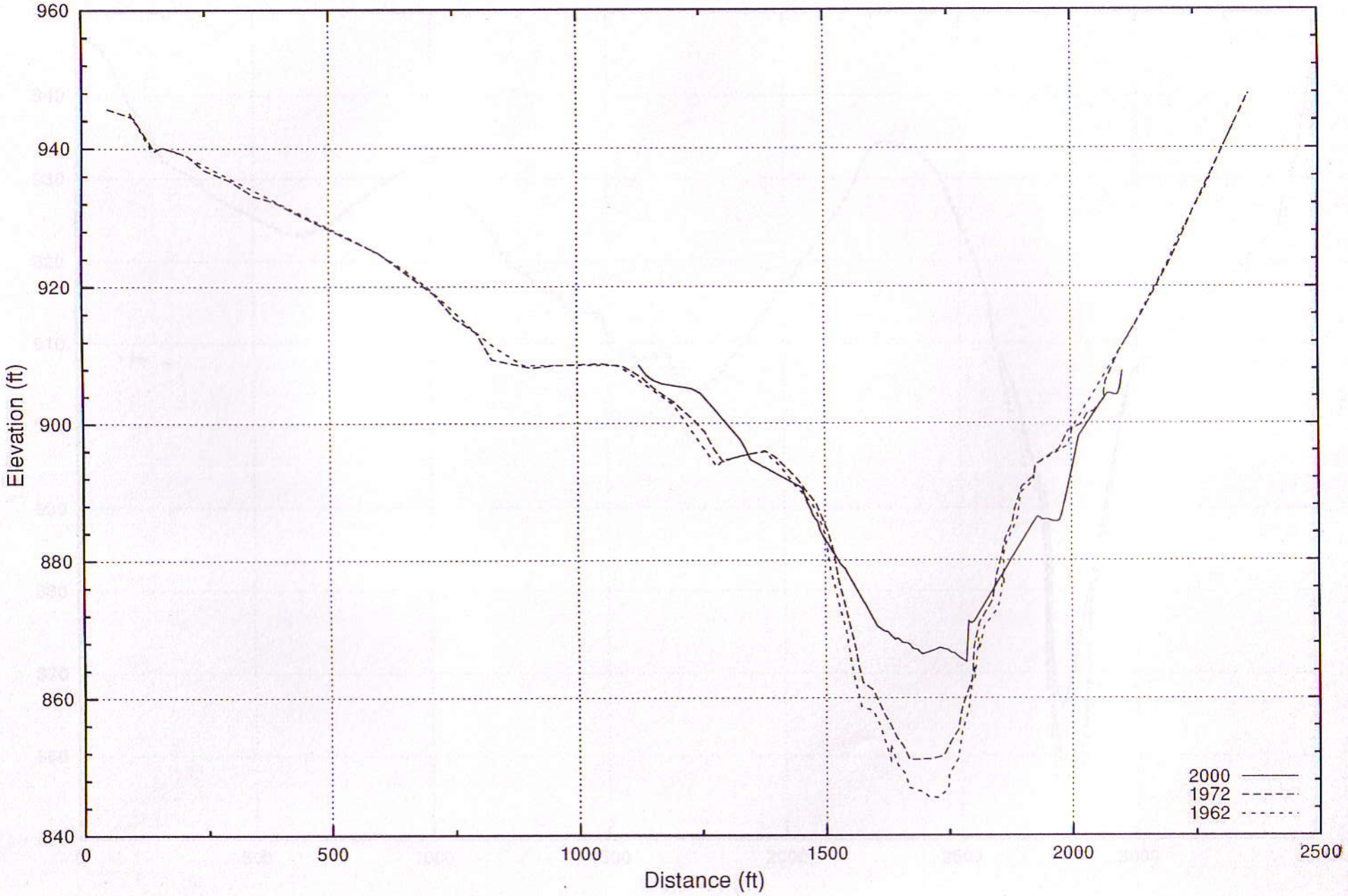
Cross Section RL-13



Appendix E

Canyon Lake

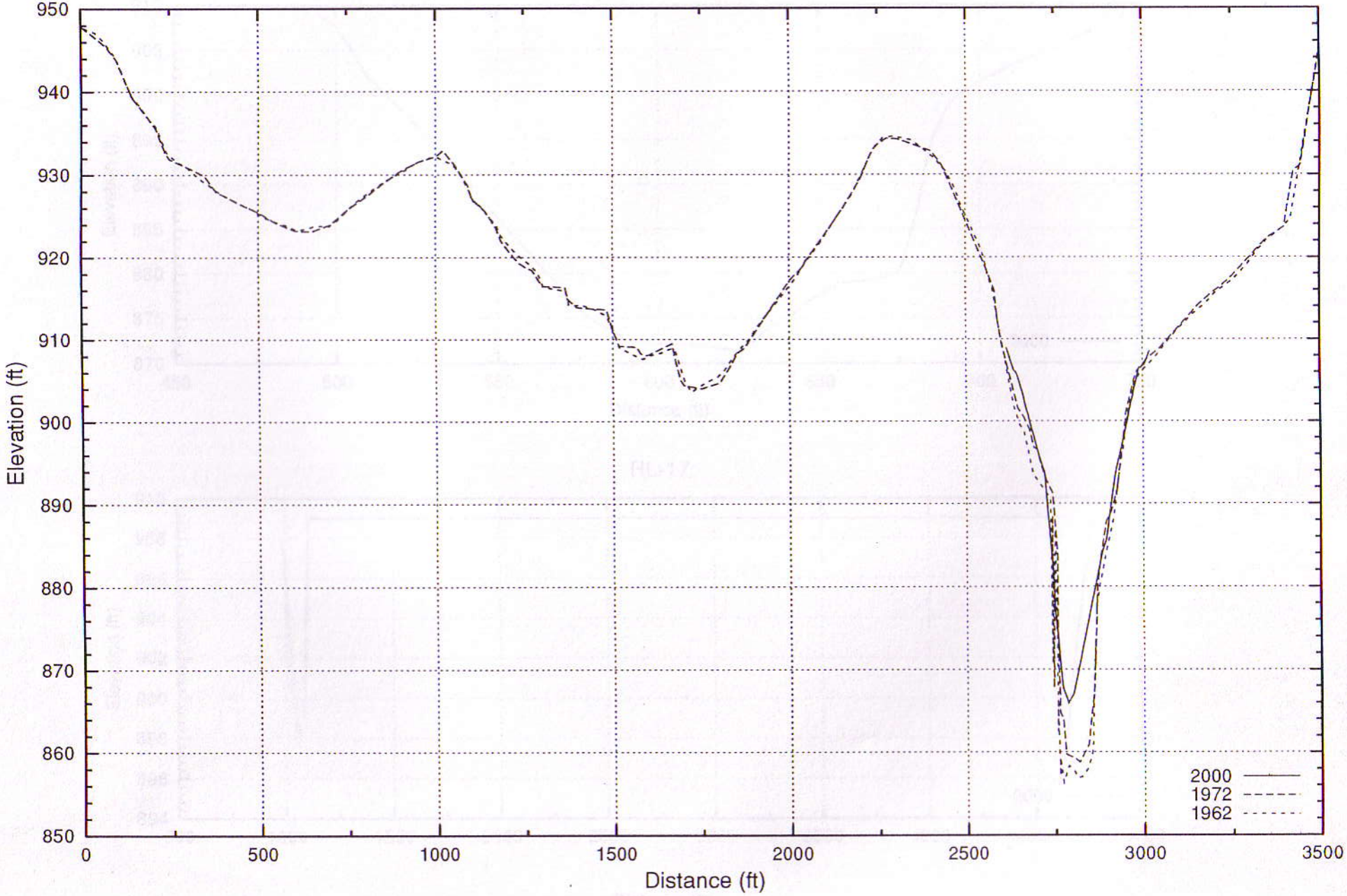
Cross Section RL-14



Appendix E

Canyon Lake

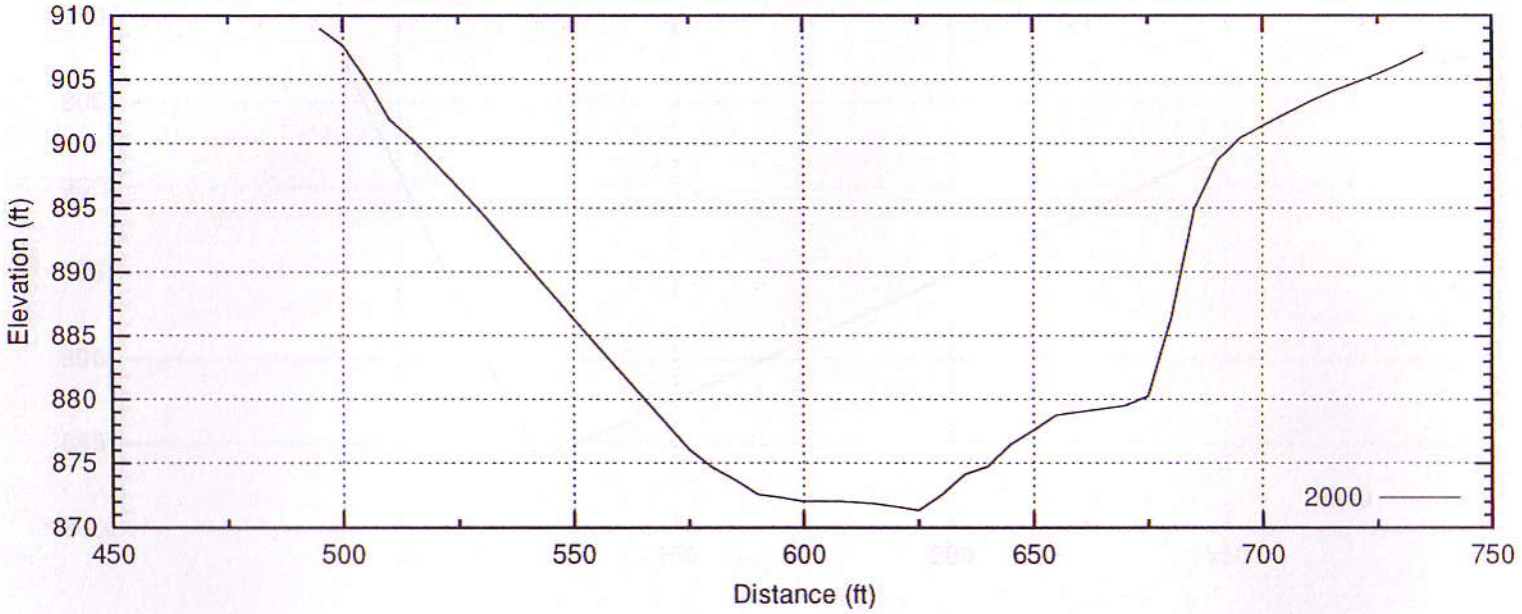
Cross Section RL-15



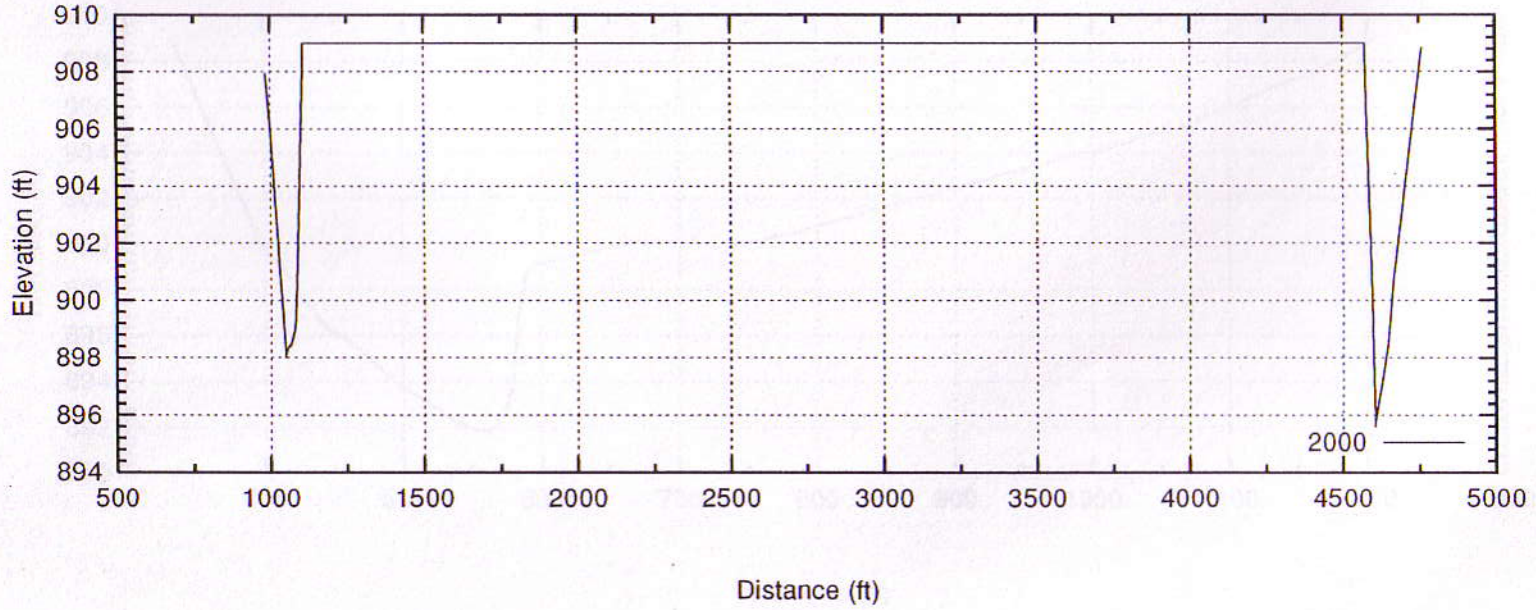
Appendix E

Canyon Lake

RL-16

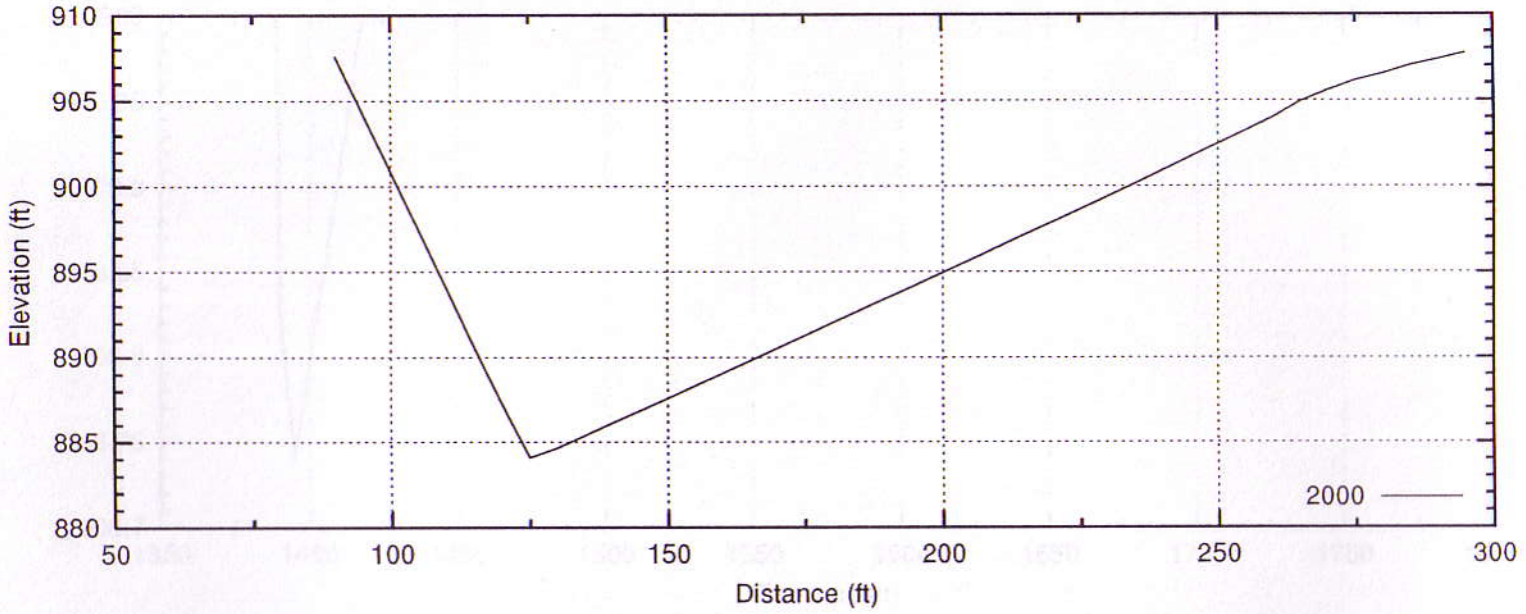


RL-17

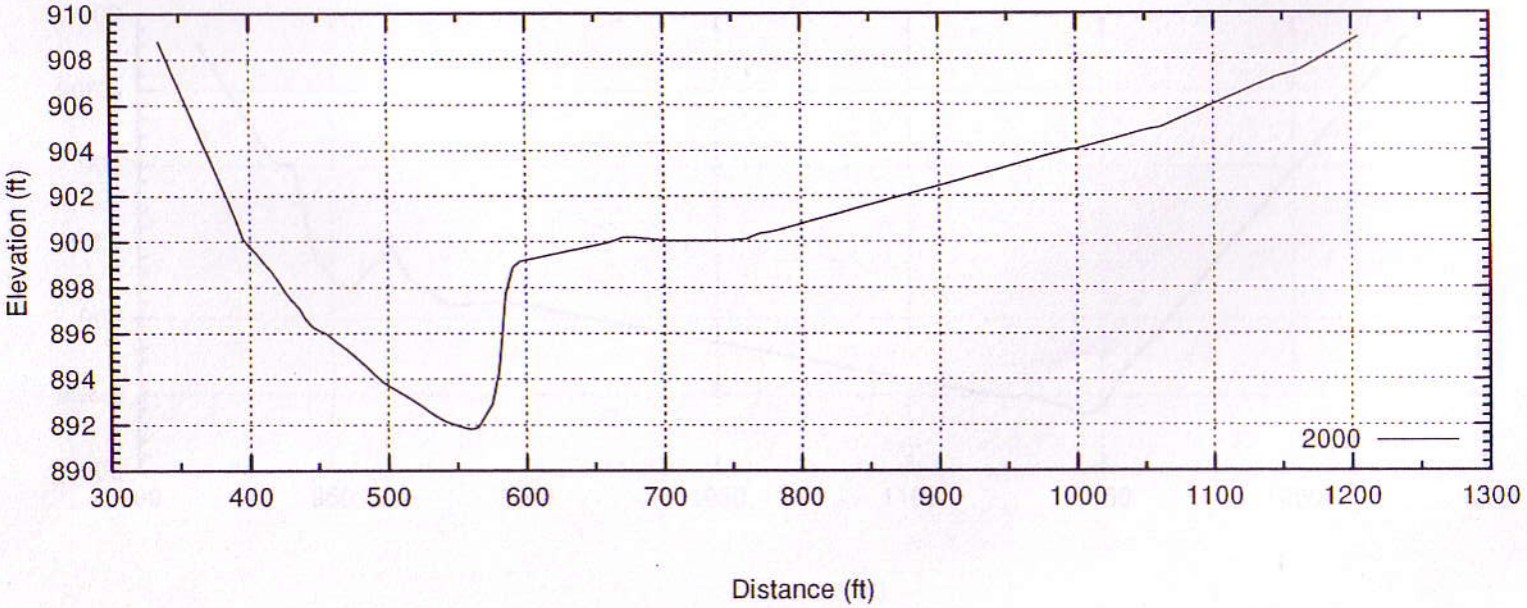


Canyon Lake

RL-18



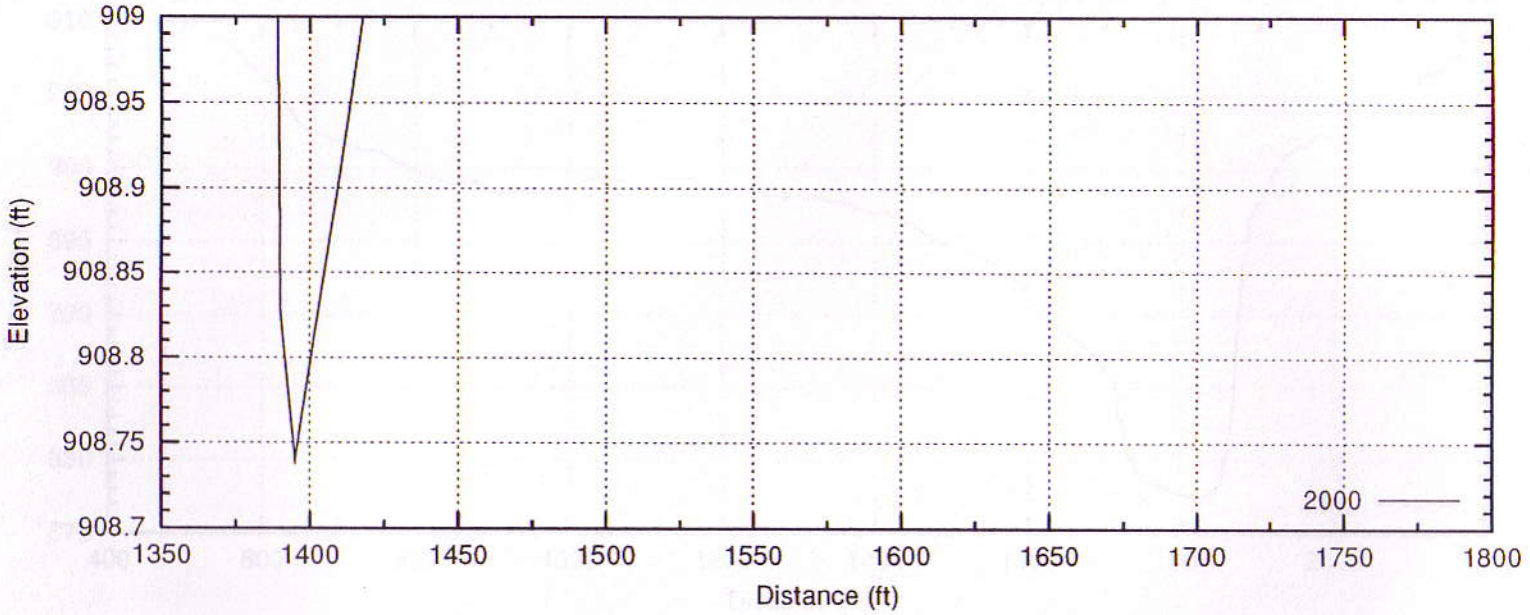
RL-28



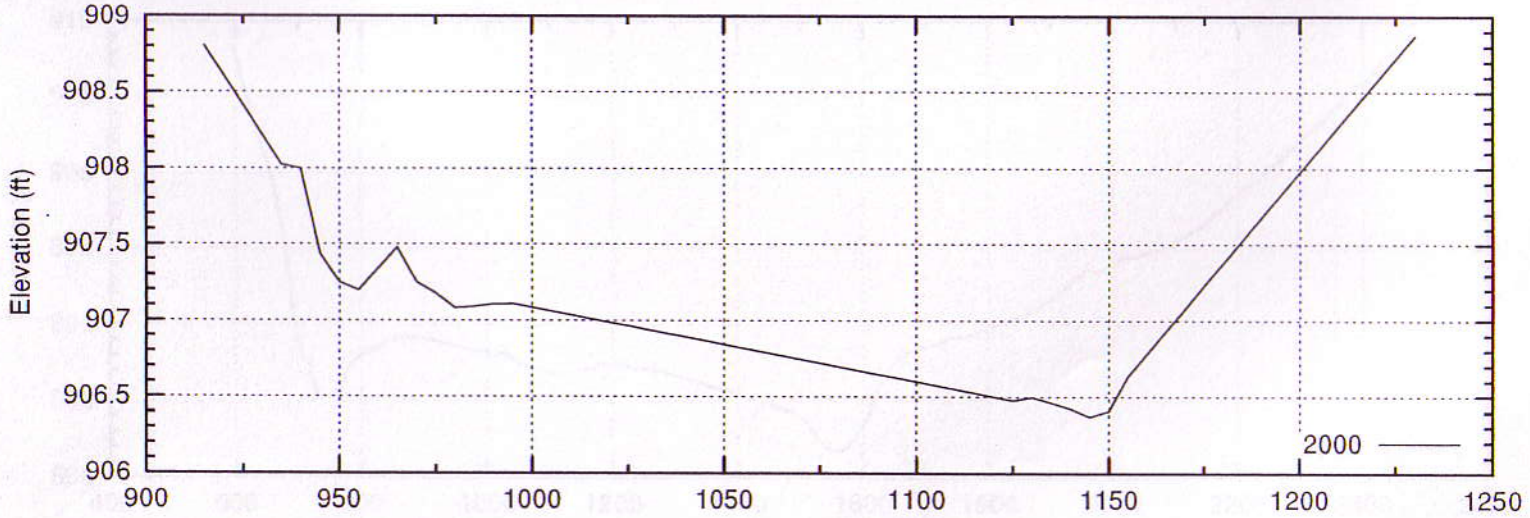
Appendix E

Canyon Lake

RL-29



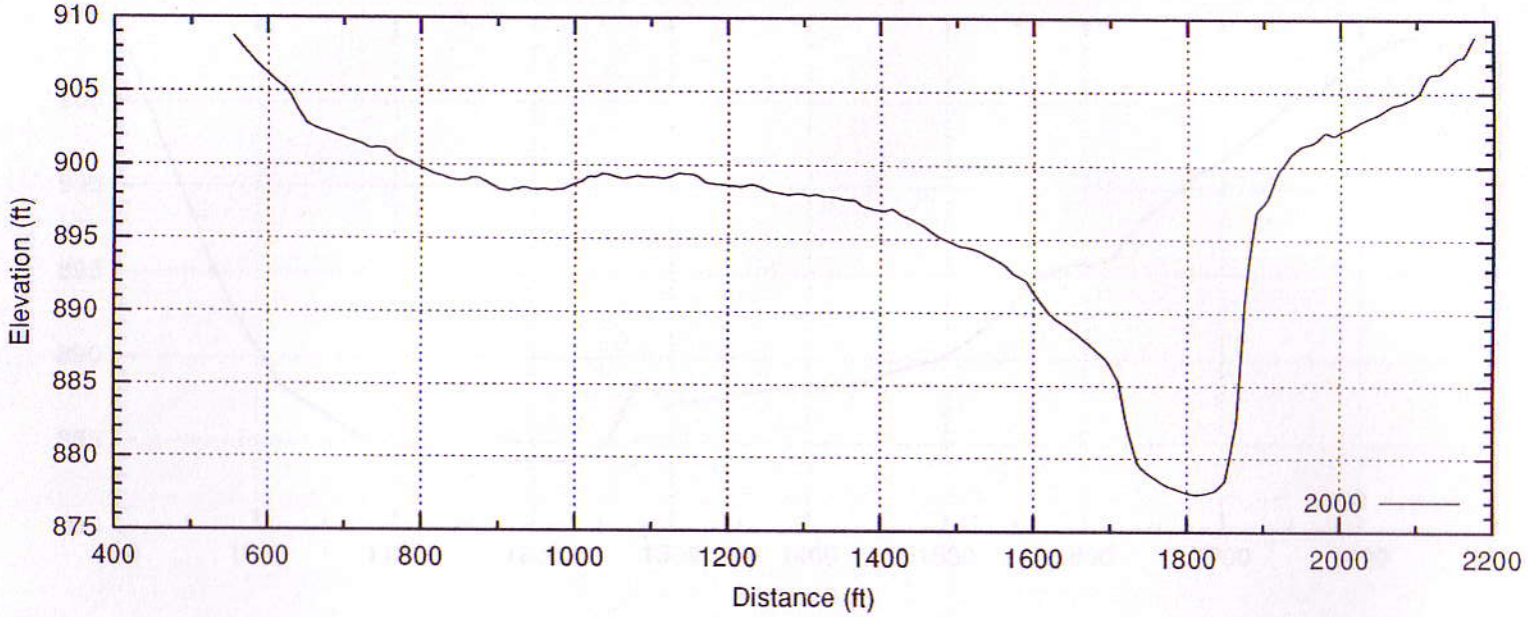
RL-30



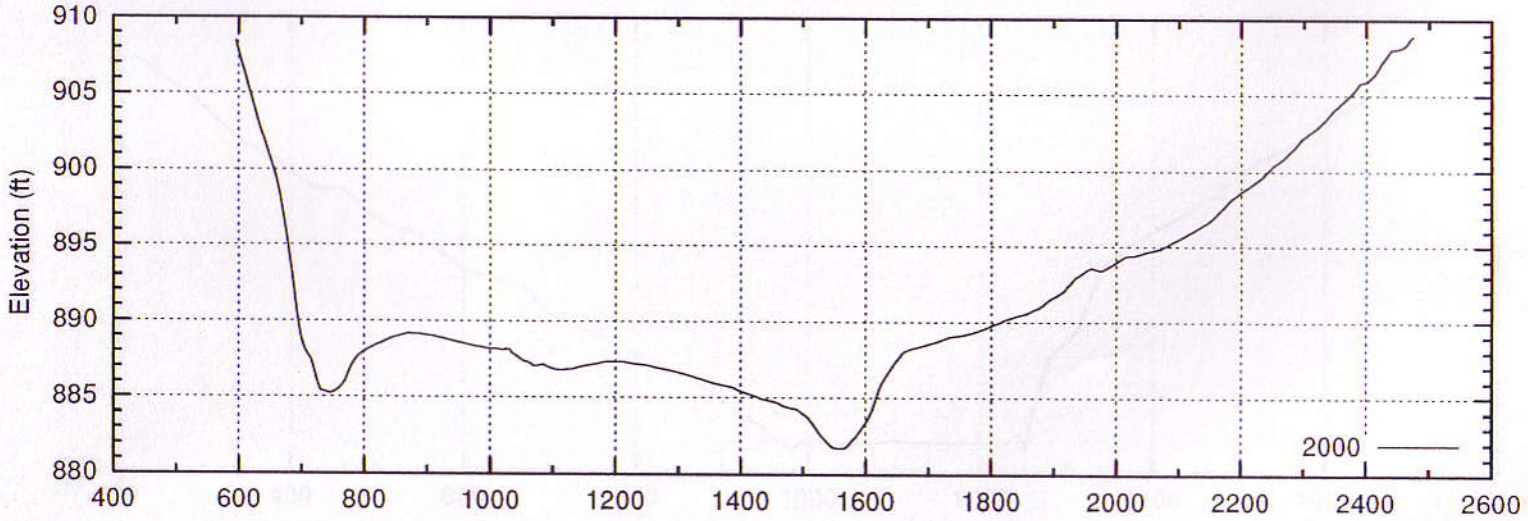
Appendix E

Canyon Lake

RL-31

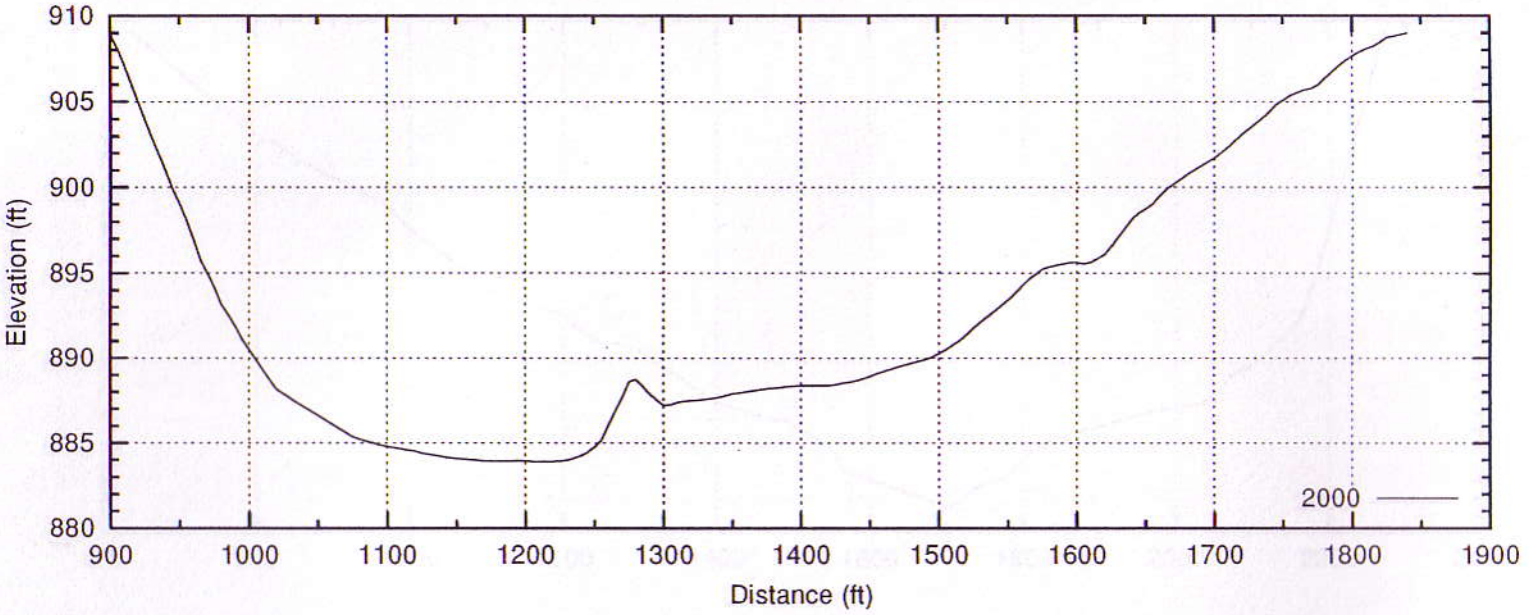


RL-32

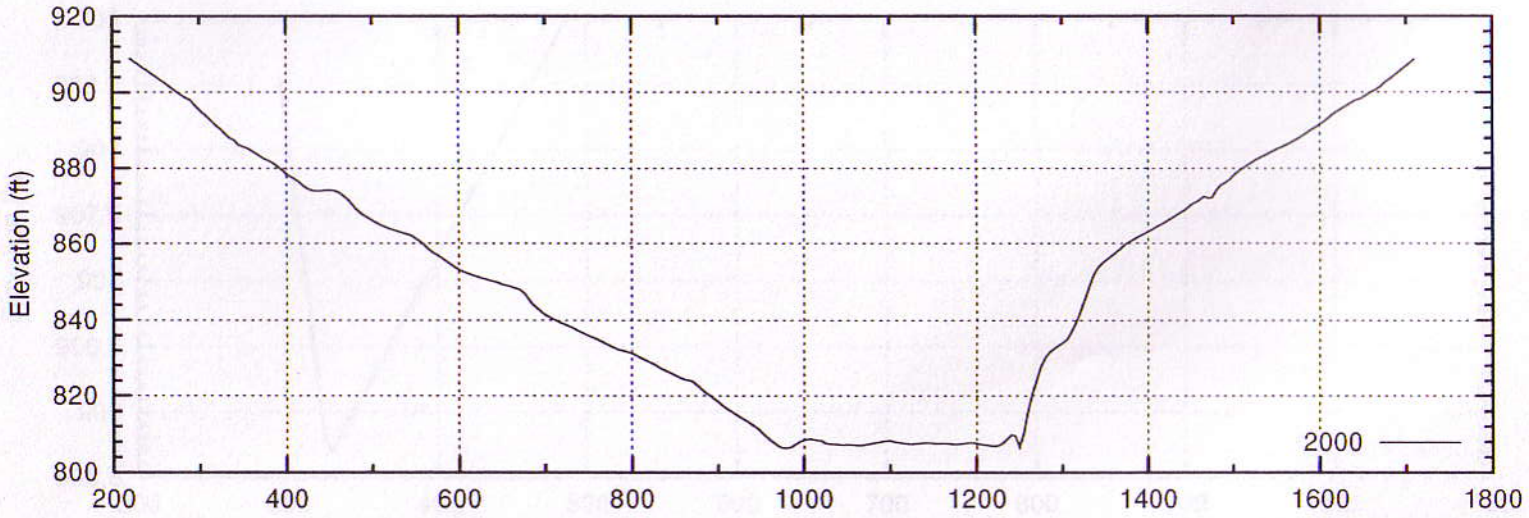


Canyon Lake

RL-33

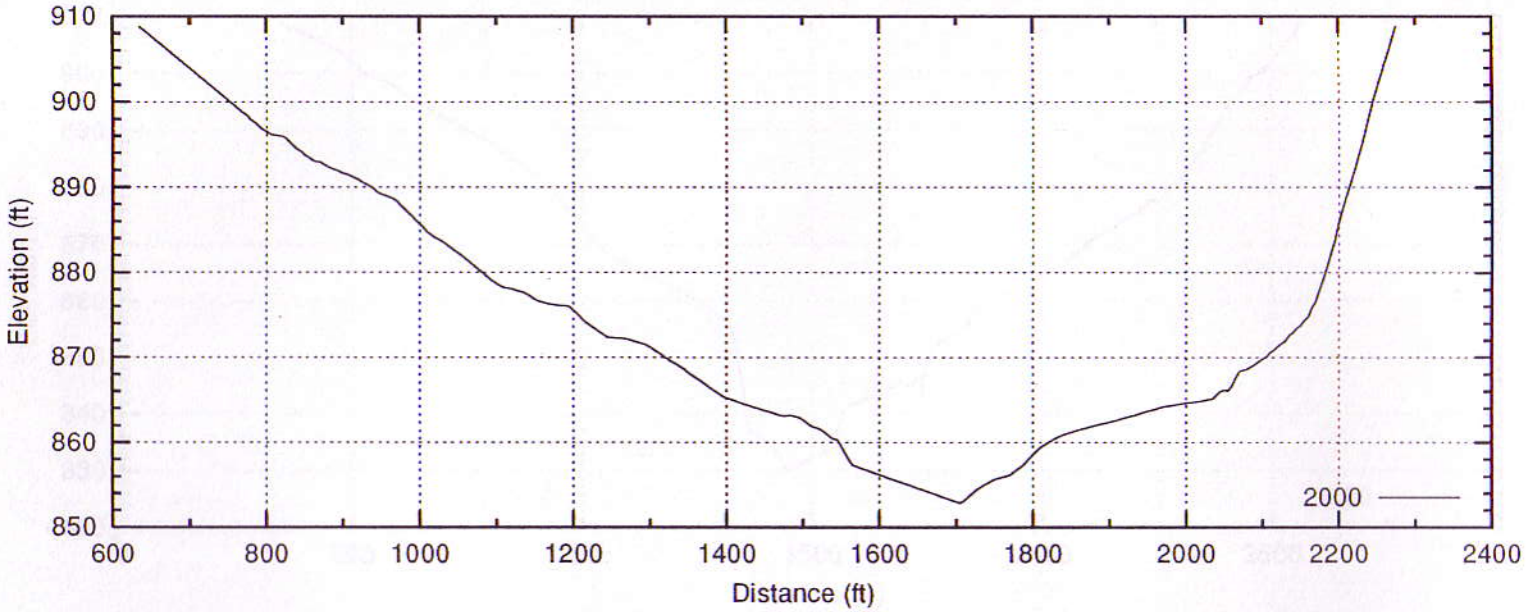


RL-34

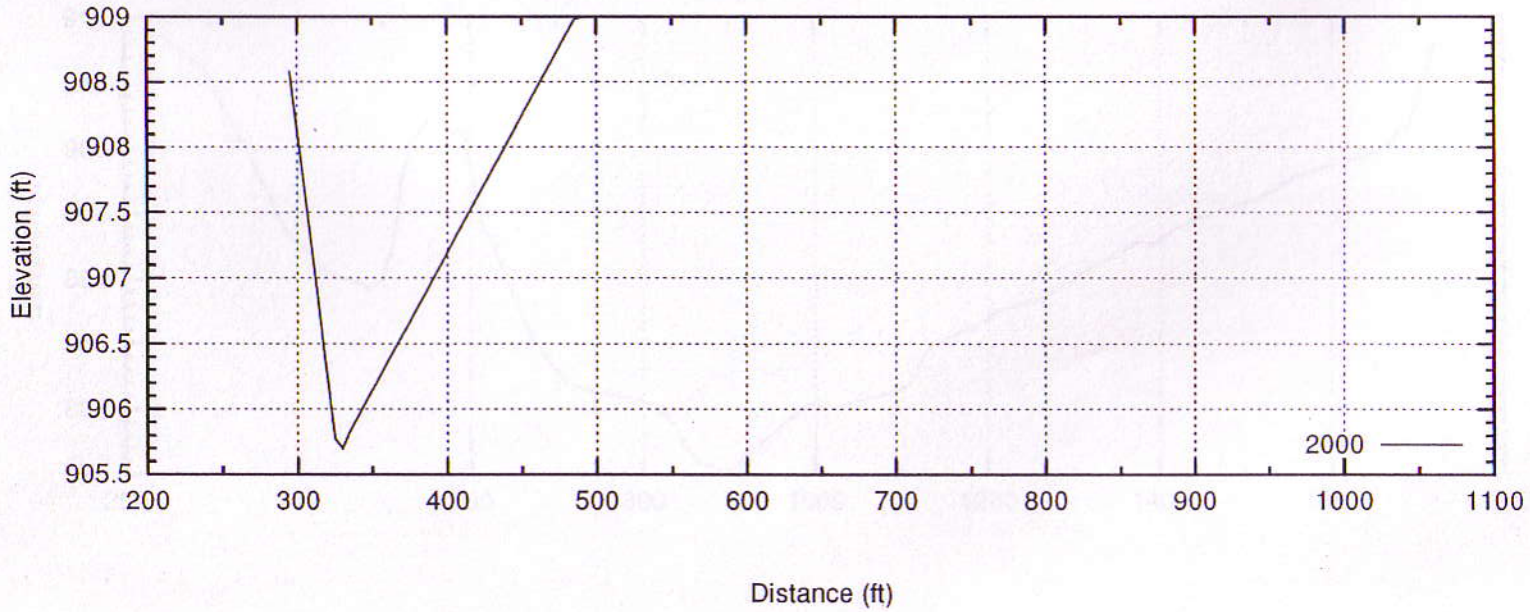


Canyon Lake

RL-35



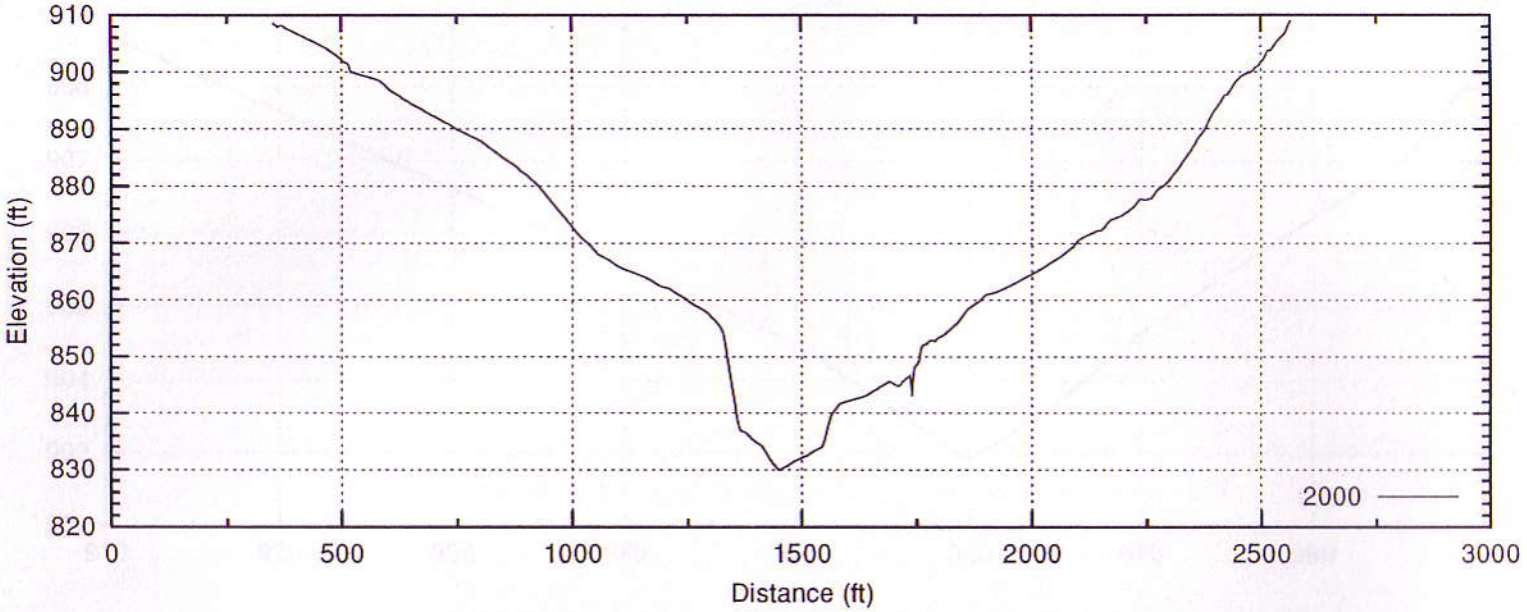
RL-36



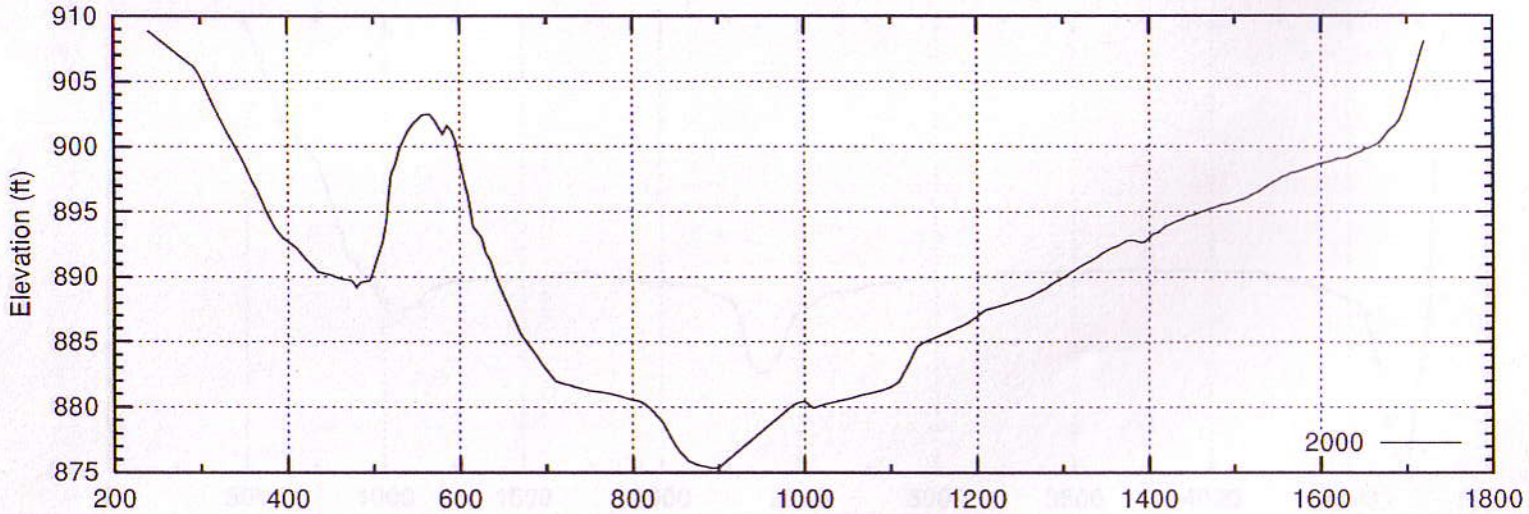
Appendix E

Canyon Lake

RL-37

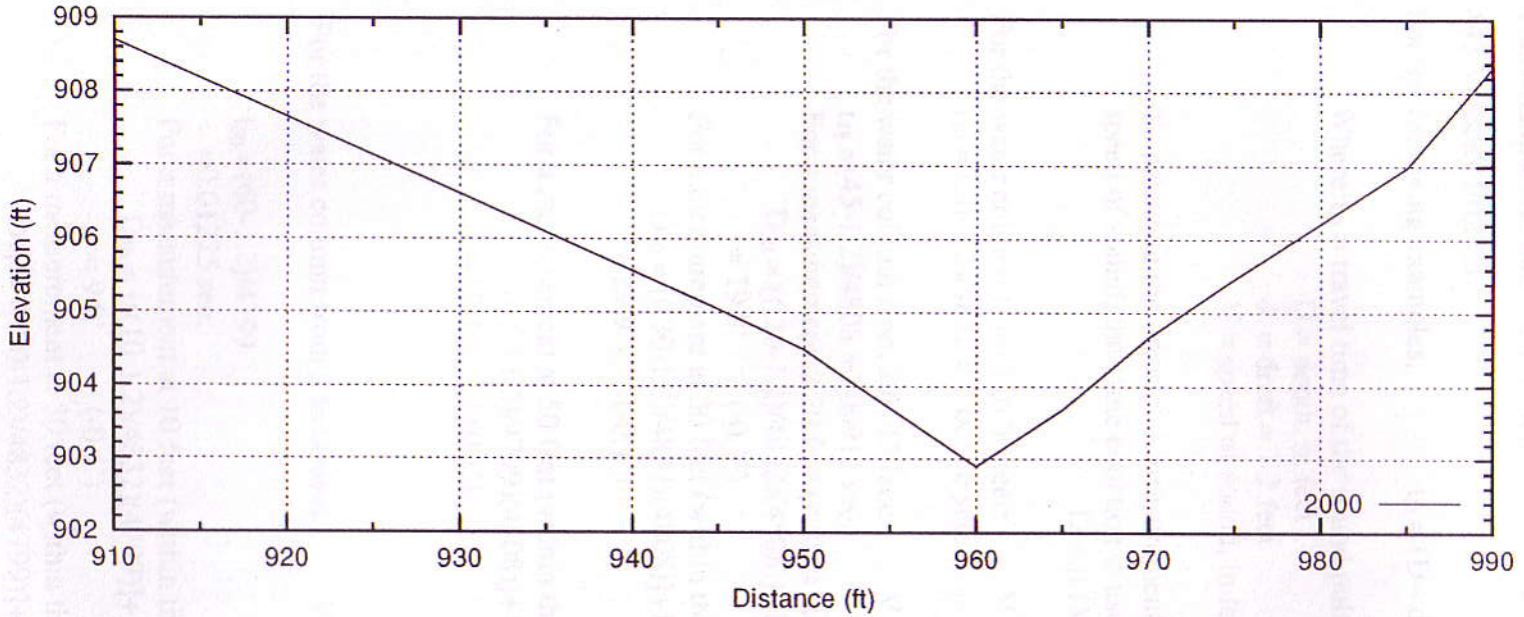


RL-38

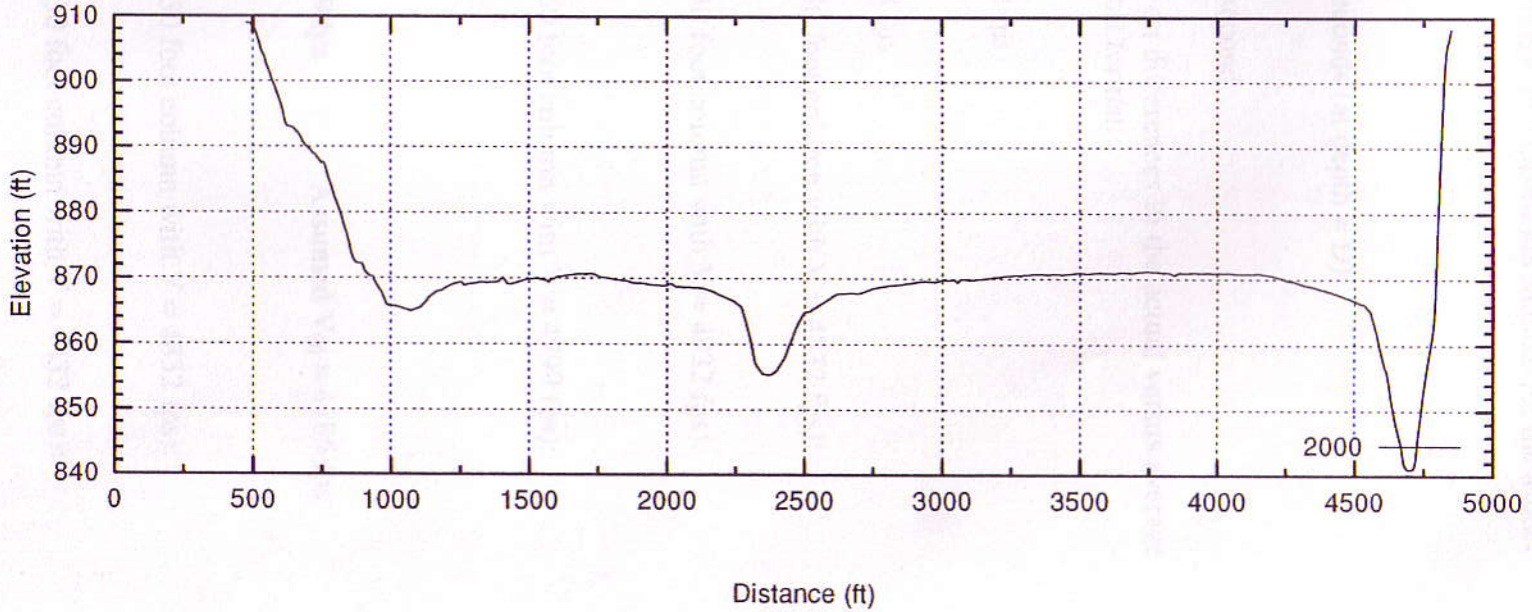


Canyon Lake

RL-39



RL-40



APPENDIX F - DEPTH SOUNDER ACCURACY

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

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

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):

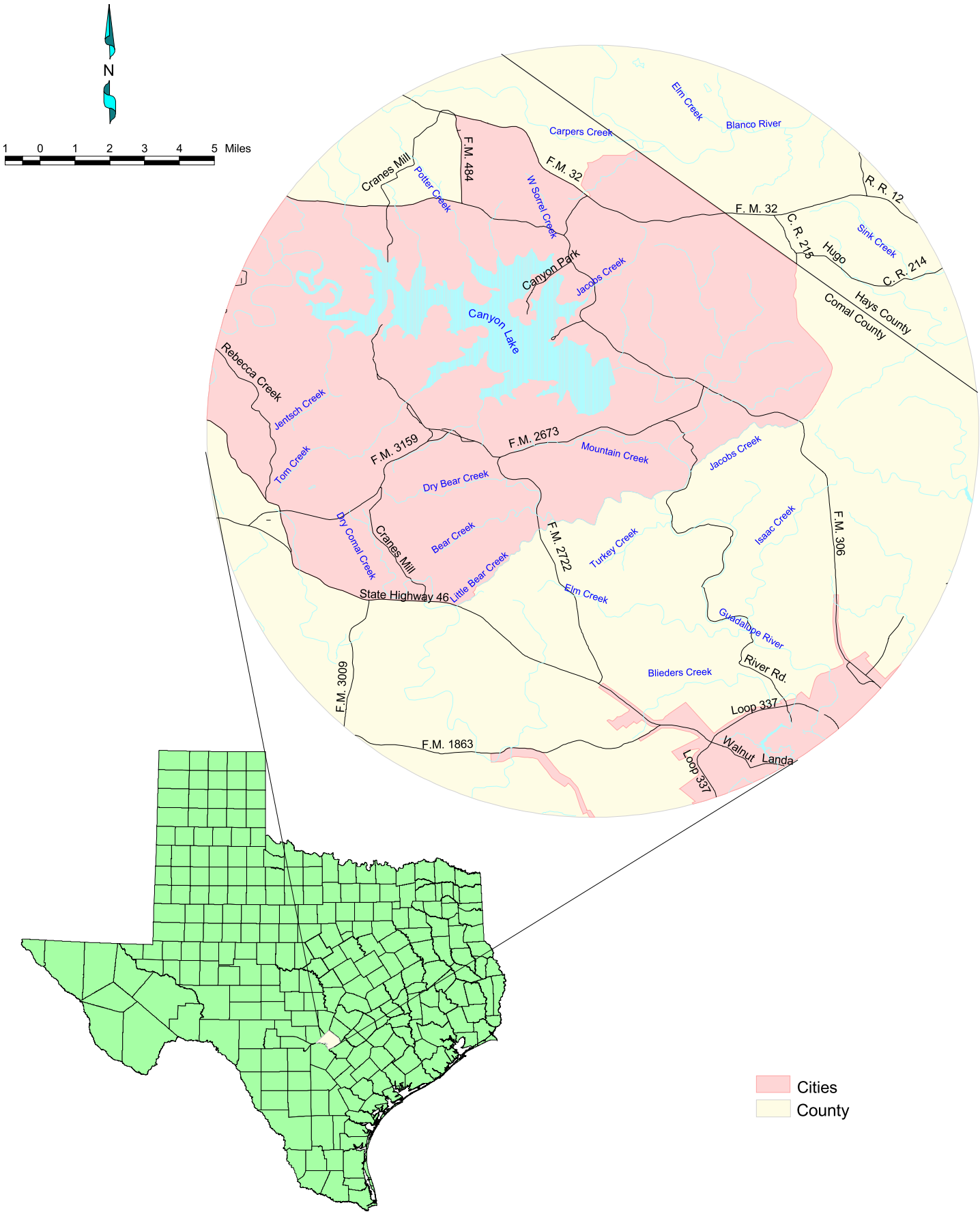
D_{80} = [((80-1.2)/4785)(4799)]+1.2

= 80.2’ (+0.2’)

Figure 1

CANYON LAKE

Location Map

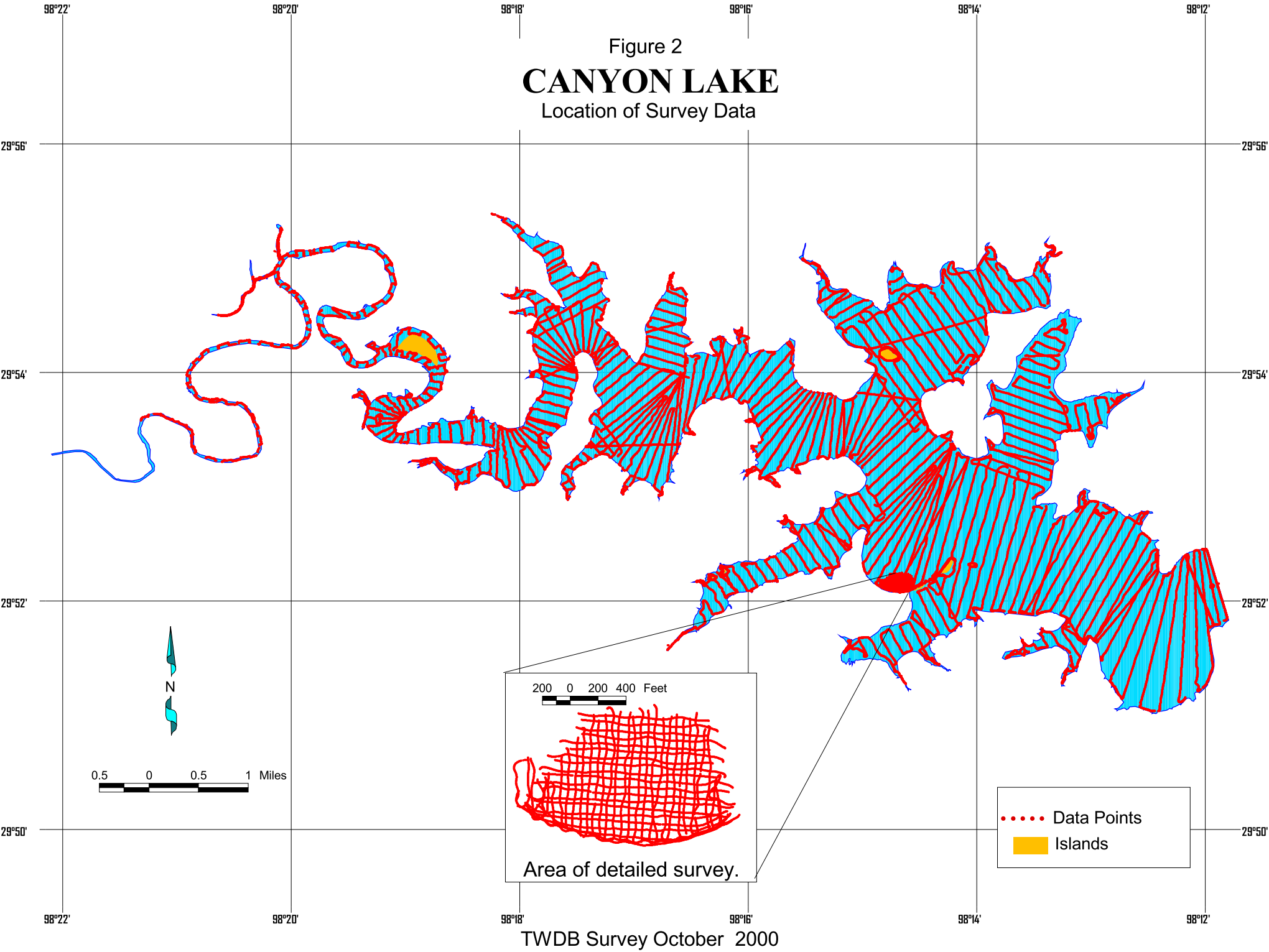


TWDB Survey October 2000

Figure 2

CANYON LAKE

Location of Survey Data

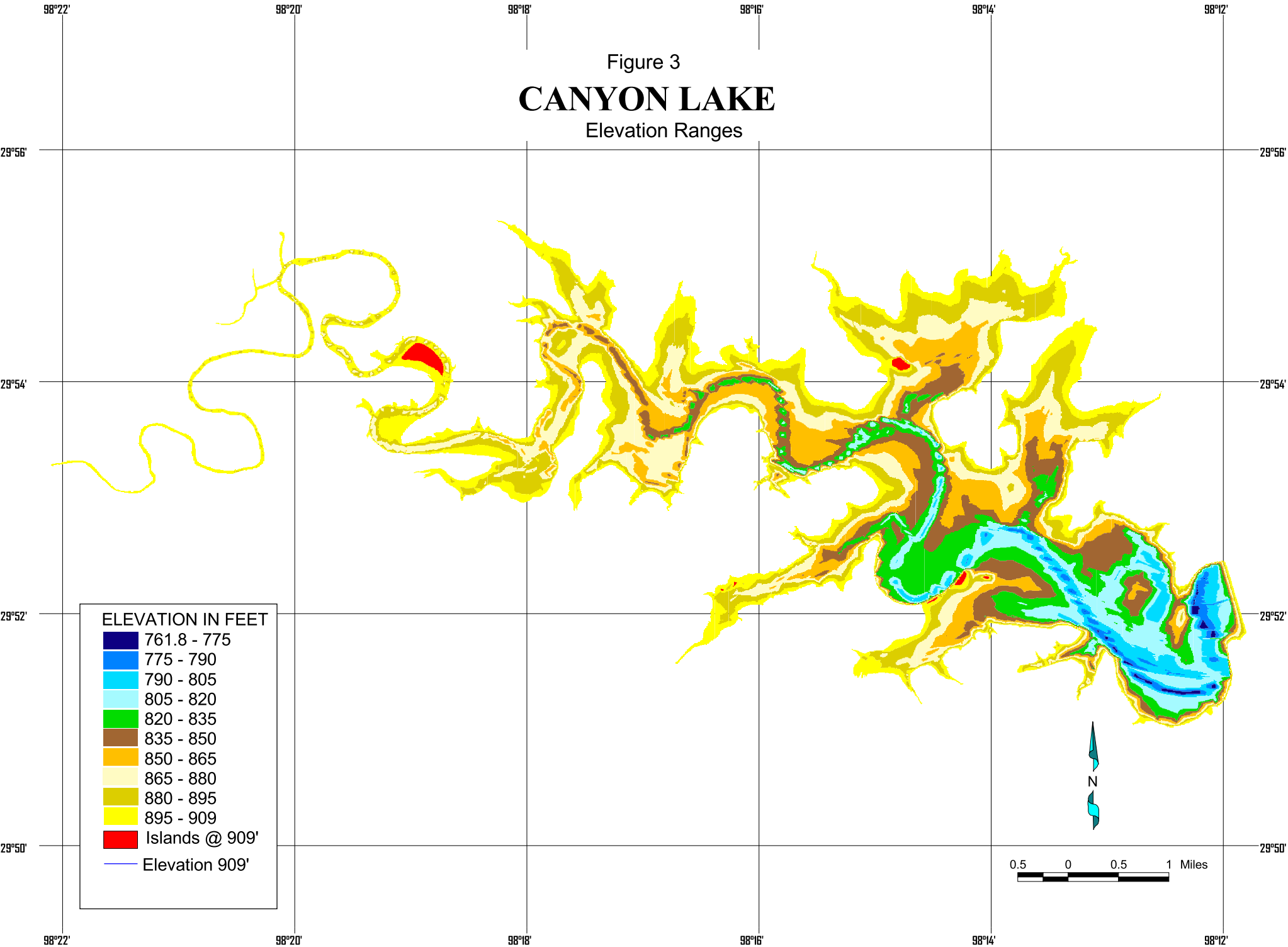


TWDB Survey October 2000

Figure 3

CANYON LAKE

Elevation Ranges

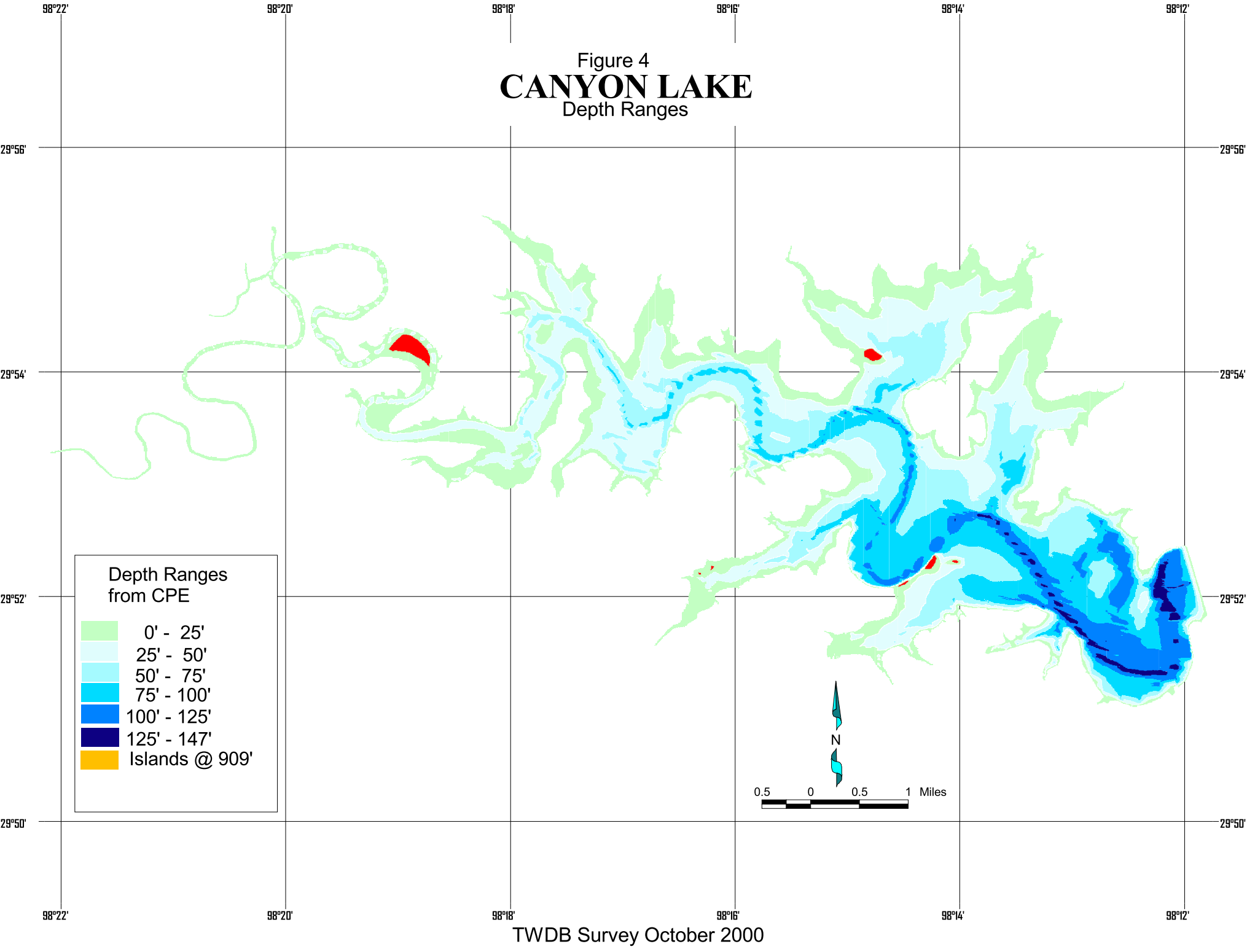


TWDB Survey October 2000

Figure 4

CANYON LAKE

Depth Ranges



TWDB Survey October 2000

Figure 5

CANYON LAKE

5' - Contour Map

N

0.5 0 0.5 Miles

Water Surface @ 909'

Islands

Conservation Pool 909'

Cross Sections

Contours

600
602
604
606
608
610
612
614
616
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622
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626
628
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632
634
636
638
640
642

98°20' 98°18' 98°16' 98°14' 98°12'

29°56' 29°54' 29°52' 29°50'

RL-16-R RL-16-L RL-17-L RL-17-R RL-15-L RL-15-R RL-18-R RL-18-L RL-14-L RL-14-R RL-33-L RL-33-R RL-12-L RL-12-R RL-32-L RL-32-R RL-13-L RL-13-R RL-40-L RL-40-R RL-11-L RL-11-R RL-7-L RL-7-R RL-29-R RL-29-L RL-30-L RL-30-R RL-31-L RL-31-R RL-10-L RL-10-R RL-6-R RL-6-L RL-9-L RL-9-R RL-8-L RL-8-R RL-28-R RL-28-L RL-5-L RL-5-R RL-4-L RL-4-R RL-3-L RL-3-R RL-2-L RL-2-R RL-1-L RL-1-R RL-34-L RL-34-R RL-35-L RL-35-R RL-36-L RL-36-R RL-37-L RL-37-R RL-38-L RL-38-R RL-39-L RL-39-R

TEXAS WATER DEVELOPMENT BOARD

This map is the product of a survey conducted by the Texas Water Development Board's Hydrographic Survey Program to determine the capacity of Canyon Lake. The Texas Water Development Board makes no representations or assumes any liability if this information is used for other purposes such as boating maps.

TEXAS WATER DEVELOPMENT BOARD OCTOBER 2000 SURVEY