AN ANALYSIS OF SEDIMENTATION IN JOHN H. KERR RESERVOIR

by

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CHAPTER 1

INTRODUCTION

In March 1981 the National Aeronautic and Space Administration (NASA) contracted with Virginia Polytechnic Institute and State University (VPI&SU) to collect suspended sediment and temperature distribution data at John H. Kerr Reservoir. This data was to be correlated with the passing of NASA's Landsat II, with the purpose of developing regression equations to determine surface Total Suspended Solids (TSS) from a comparison between Landsats' Multi-Spectral Scan (MSS) and VPI&SU research team data. In conjunction with the regression analysis, which is contained in volumes 2 and 3 of the 3 volume VPI&SU report, this report provides a historical look at the sedimentation problem as it applies to John H. Kerr Reservoir.

Included in this report is a discussion on the causes of initial sediment dislocation and movement, as well as the methods by which sediment is transported in a stream. Also included are the effects of sediment deposition in a reservoir, the most important of which is storage loss. An important parameter in determining the storage loss is the trap efficiency of a reservoir. Many factors are involved in the trap efficiency. These are discussed, and two trap efficiency models are given, each based on different watershed characteristics. The values given by these models are compared to the measured trap efficiency as given by the U.S. Army Corps of Engineers.

Following the generalized discussion of reservoir sedimentation is a sedimentation analysis of John H. Kerr Reservoir. The analysis is based on data obtained from the United States Geological Survey (U.S.G.S.) and the U.S. Army Corps of Engineers. The U.S.G.S. data consists of measured total load of suspended solids taken from a sampling station located on the Roanoke River above Kerr Reservoir, and a station located on the Dan River before it merges with the Roanoke River. The total measured load is compared with the total volume of sediment as measured on three occasions between 1952 and 1976 by the U.S. Army Engineers. The percent error is discussed as well as the factors involved in this error.

The VPI&SU data is analyzed in the Appendices. In Appendix A each trip is diagnosed, and the suspended sediment distribution for each trip is analyzed. Appendix B relates to one particular research trip in which the measurements were taken laterally at each station, thus providing a sediment distribution across the reservoir. Appendix C analyzes the pattern of sediment distribution at each station by comparing all of the data collected for each of the stations. Finally, Appendix D presents all of the relevant data as measured by the VPI&SU research team during the 11 month period of field operation.

CHAPTER 2

DESCRIPTION OF THE WATERSHED

The Roanoke River Basin is located in the southern part of Virginia and the northern part of North Carolina, including all or part of 15 counties in Virginia and 17 counties in North Carolina. The basin is roughly pear shaped, stretching a distance of approximately 220 miles in length and varying from 10 to 100 miles in width (see Figure 2.1). The basin area is 9,580 square miles above the mouth of the Roanoke river, and 7,800 square miles above John H. Kerr Reservoir. Although the upper part of the basin lies in the Blue Ridge and Allegheny Mountains, most of the area is in the Piedmont Plateau, whose main characteristic is that of rolling hills. Most of the streams in the basin are somewhat crooked and swift, traversing the area in well defined v-shaped valleys.

The Roanoke River itself rises in the Allegheny mountains to the west of Roanoke, Virginia, flows 400 miles in a southeasterly direction toward the Atlantic coast, and empties into Albemarle Sound, approximately 7 miles south of Plymouth, North Carolina.

2.1 Temperature

The climate of the Roanoke River Basin is moderate, characterized by warm summers and somewhat cold and snowy winters (although these are usually not severe). The average annual temperature for the basin is about 58°F (14.4°C) and average monthly temperatures vary between 38°F (3.3°C) and 77°F (25°C).

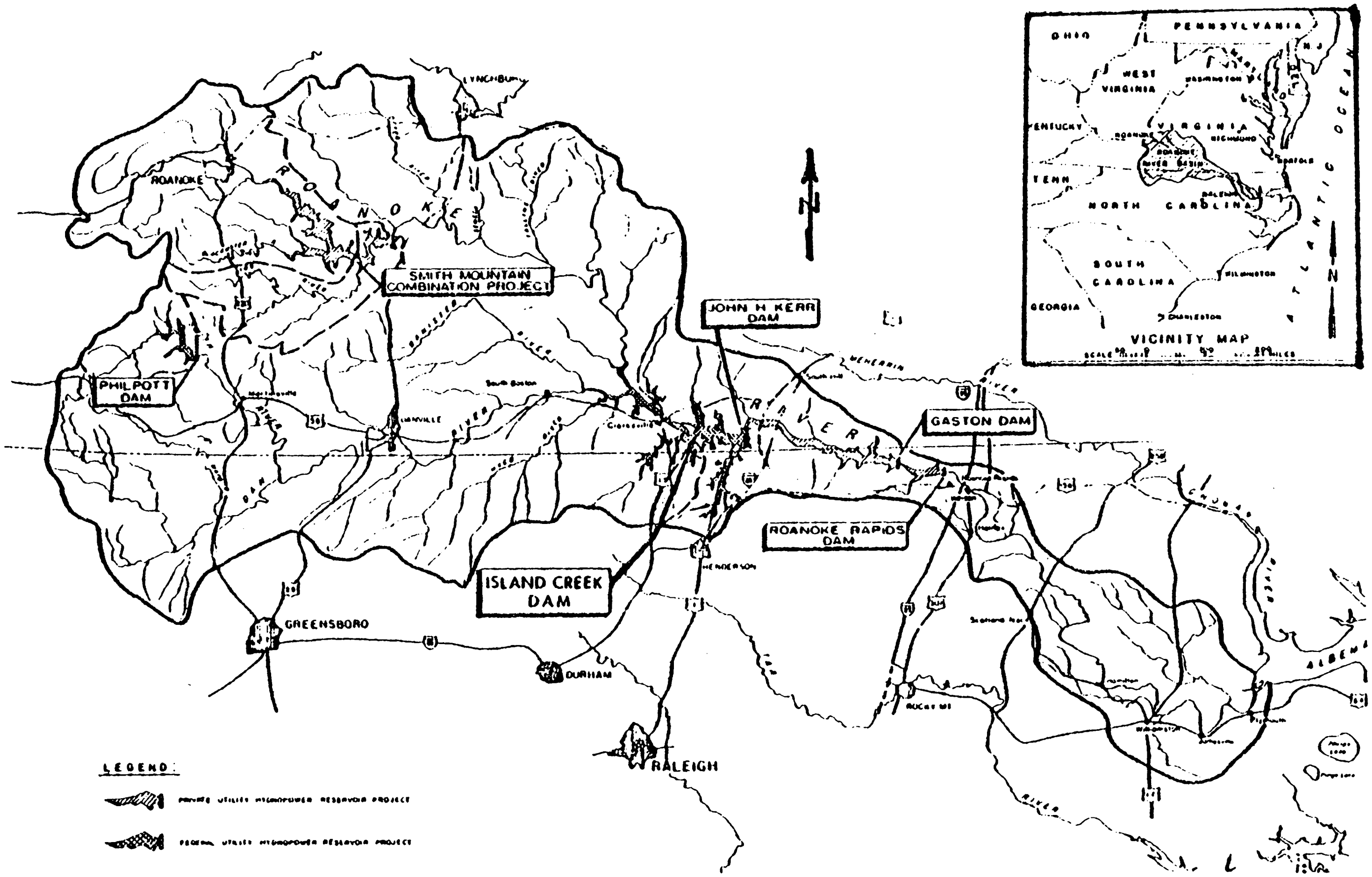

Figure 2.1 - Roanoke River Basin (7)

2.2 Precipitation

The average annual precipitation over the entire Roanoke River Basin is approximately 43 inches and is well distributed throughout the year. The annual precipitation extremes for the basin are 27 and 56 inches. Precipitation varies from 50 inches near the mouth of the Ronaoke River to 35 inches at the river's headwaters. The average annual snowfall for the entire basin is about 13 inches, which does not appreciably alter flood flows (13).

2.3 Runoff

The annual runoff from the Roanoke River Basin averages 14 inches or approximately 32 percent of the annual precipitation. The runoff of the basin varies from an average of 1.5 cubic feet per second per square mile in the mountain tributaries of the Dan River to 1.0 cubic foot per second per square mile at the headwaters of the Roanoke River as measured near Roanoke, Virginia (13).

2.4 River Flow

Several flow characteristics for the Roanoke River at the location of John H. Kerr Dam are shown below:

Roanoke River Flow - cfs

for the period January 1912-February 1982

Average	7,698
Maximum (17 August 1940)	270,000
Minimum (29 September 1970)	48
Maximum Monthly Average (August 1940)	36,980
Minimum Monthly Average (September 1954)	484

2.5 Vegetation

Over 60 percent of the drainage area in the Roanoke River Basin is forested by Virginia, Loblolly, and shortleaf pines. Mixed pine/hardwood stands are scattered throughout the basin. The area surrounding Kerr Reservoir is comprised of the above mentioned pines as well as a good number of small farms mainly growing either tobacco or corn. Vegetation on the lake margins and in the lake is severely limited due to the fluctuating water level.

2.6 Regional Geology

In the area surrounding Kerr Reservoir the soil is mostly igneous rocks and interlayered sedimentary rocks of uncertain age. These rocks are very susceptible to erosion. To the northwest of Kerr are large amounts of Granite, Horneblende Greiss including interlayered Mica, Quartz, and large portions of common metamorphic rocks such as Slates and Schists. These rocks are also very susceptible to erosive action. Further to the west is the area known as the Devonion Formation, almost entirely composed of sandstone and limestone. To the west of the Devonion Formation is the Calvert Formation consisting of mostly clay with small portions of sand. The Calvert Formation covers a large portion of the western side of the Roanoke River watershed. At the headwaters of the watershed the land consists of Granite, Dolomite, and large portions of Biotite Gneiss. This Gneiss is characterized by compositional layering, and is medium to coarse grained.

2.7 John H. Kerr Reservoir

The John H. Kerr Reservoir was designed and built by the U.S. Army Corps of Engineers for the reduction of flood damage, generation of hydroelectric power, maintenance of low water control for pollution abatement, and water based recreation. The growing importance of this last use can be seen in Table 2.1.

A total of 117,000 acres was acquired for the project, with 83,000 acres lying below the full pool elevation of 320 feet at the dam site. The reservoir can store 2,324,000 acre-feet of water up to elevation 320. This is equivalent to a depth of 5.6 inches over the entire watershed area above Kerr Dam. This value does not include 484,000 acre-feet of storage below elevation 268 since the reservoir must be maintained to least to this elevation for power generation.

Table 2.1. Attendance Figures

Year	Attendence at John H. Kerr Dam and Reservoir
1967	2,685,423
1968	2,737,400
1969	2,666,700
1970	3,007,100
1971	3,275,600
1972	3,008,000
1973	3,195,700
1974	3,276,700
1975	3,721,900

CHAPTER 3

FIELD MEASUREMENTS

The VPI&SU research team coordinated its data collection efforts in conjunction with the overhead passage of NASA Landsat II. The Landsat passes over the Kerr Reservoir area every 18 days, with the reservoir being visible for two consecutive passes on each of these days. The VPI&SU sampling was performed on ten separate occasions between April 1981 and March 1982. Thirteen stations, located along the entire length of Kerr Reservoir, were chosen so as to suitably monitor the distributions of suspended sediments and temperature fluctuations. These stations can be seen in Fig. 3.1. The stations were located near existing buoys for ease of relocation, as well as for assurance that the data collected each trip would be comparable.

Data collected at each designated station included water temperature and current velocity and direction at increments of 5 feet until a depth of 20 feet was reached. Below the 20 foot depth, each of these parameters was measured at 10 foot depth increments until the reservoir bottom was located. Also, any isothermal layers occurring between increments were traced to their existing location. Turbidity was measured at 1 meter increments, and similar to temperature, any large change between measured depths was investigated and specifically located. Air temperature, wind speed, and wind direction were also measured periodically, since a change in any of these parameters may result in an altered sediment pattern. Six Secchi depths were also obtained at each station using the following disks: 30 cm black, 30 cm white, 30 cm B/W and 20 cm B/W. Secchi depths provide a relative

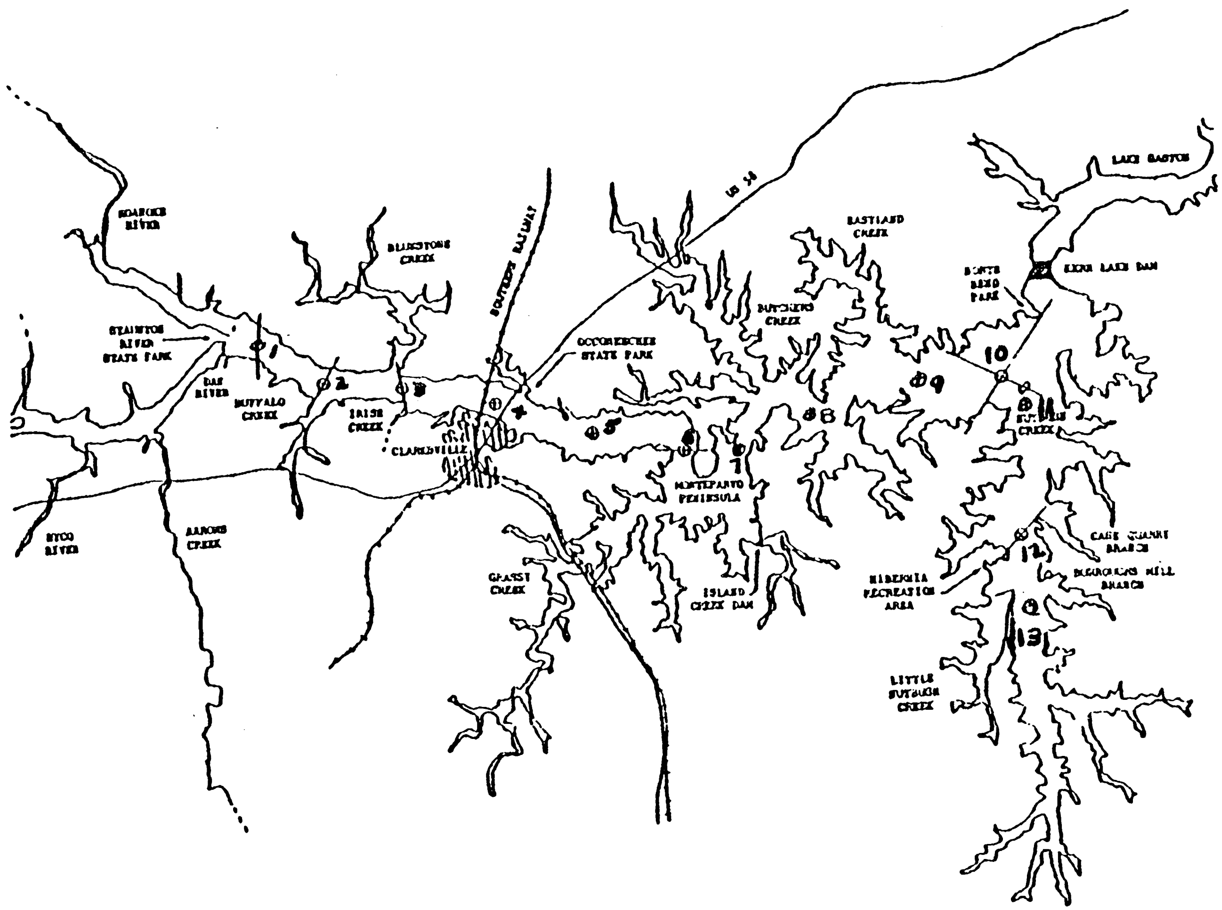

Figure 3.1 - Location of VPI&SU Sampling Stations

measure of the amount of suspended sediment in water. The deeper a secchi disk is visible, the clearer the water must be.

In addition to this, streamflow data for the Roanoke, Dan, Hyco and Bannister Rivers, as well as the sediment load carried by the Roanoke and Dan Rivers, were obtained from the U.S. Geological Surveys, Water Resources Division. The U.S. Army Corps of Engineers Wilmington District provided Kerr Dam discharges, lake levels and morphometric information.

Current speed, current direction, water temperature, and instrument depth were measured with an ENDECO Type 110 remote reading current meter. The meter is an axial flow, ducted impeller specifically designed for continental shelf and estuarine environmental monitoring.

Current speed was measured by a neutrally balanced impeller riding on glass ball bearings in delien races that turns a multipole, corrosion resistant ceramic magnet that is coupled to a magnetic reed switch. One rotation of the impellar provides four closures of the reed switch which are transmitted to the surface deck unit via a telemetering cable. However, current speed below 0.1 knots (as was almost always the case for Kerr Reservoir) must be monitored by visually counting the reed switch pulses for a given period of time. The conversion from pulses to knots is made as follows:

$$K = \frac{P}{S \times 3.56}$$

where K = knots

P = number of pulses

S = time period in seconds for pulse count

All field data were converted to ft/min as follows

$$\frac{ft}{min} = P(0.949)$$

where P = number of pulses over a 30 second period. A 2-inch cup mini Pygmy current meter was piggy-backed on the ENDECO meter for current speed measurements. The use of this device was later discontinued due to the insensitivity of recording small readings. Current direction was monitored using a potentiometric compass to sense magnetic north. The direction data was telemetered to the deck readout unit and was displayed by the meter.

Ambient temperature was monitored by a thermo-linear thermistar sensor in the subsurface unit. These data were also telemetered to the deck readout unit and displayed by a meter. The temperature displayed by the ENDECO 110 was checked at a depth of 3 feet in Kerr Reservoir and corresponded exactly with the readings of a standard thermometer.

Instrument depth was monitored by an oil filled pressure transducer. The transducer is a pressure operated potentiometer in which position of the potentiometer wiper provides a voltage that is telemetered to a meter in the surface deck unit.

Measurement of turbidity was made with the Monteduro-Whitney Corporations' Transmissometer. The instrument consists of two parts: (1) the deck unit (model TMU-1B) which houses the cable spool and the meter, control switches and battery and (2) the probe, which is comprised of a light source, light receiver, and prism. The instrument measures the percent difference in light received of the light transmitted, which is directly related to the level of total suspended solids (TSS). NASA Langley Research Center calibrated the instrument at three different path lengths (10 cm, 33 cm, 100 cm) in the Kerr Reservoir site and in the laboratory based primarily on results from using Kerr sediment and pure quartz deionized water. NASA results yielded a plot (of the three path lengths) from which TSS in parts per million (PPM) can be determined once the percent difference in light received is known. The NASA plot is shown in Figure 3.2.

To maintain assured accuracy of the transmissometer, two screens, one with large holes and one with smaller holes were initially held in front of the light receiving apparatus on the instrument. The percent of light received was recorded for each screen and subsequently checked before each research trip.

As previously mentioned, the results of each individual research trip are analyzed in Appendix A. An example of the lateral distribution of suspended sediment is given in Appendix B, while the characteristics displayed at each station are analyzed in Appendix C. Finally, all of the measured data are presented in Appendix D.

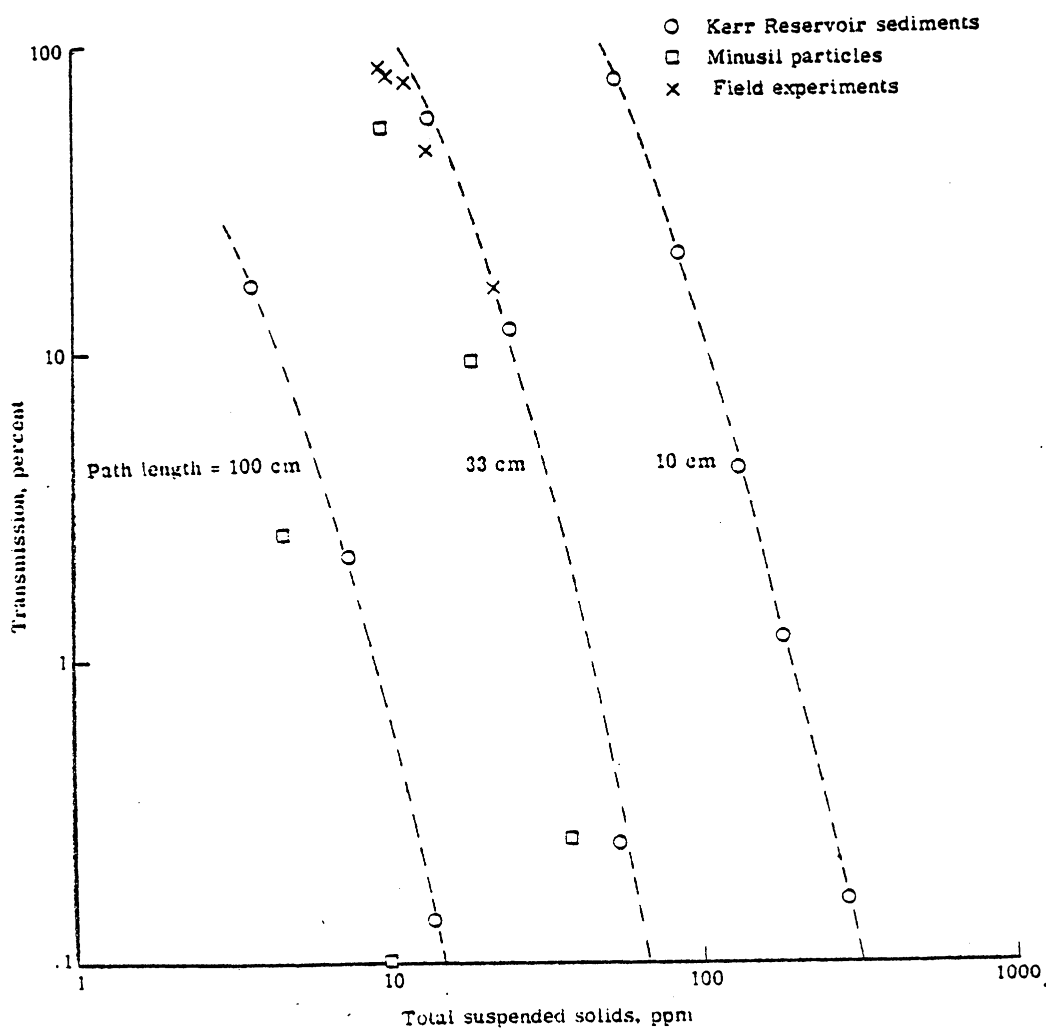

Figure 3.2 - Total Suspended Solids vs. Beam Transmission (11)

CHAPTER 4

Summary of VPI&SU Data

4.1 Suspended Sediment Data

As mentioned in Chapter 3, Appendix A consists of a trip by trip analysis of the VPI&SU research team data. For a more complete analysis than is included here, the reader is referred to Appendix A. Chapter 4 is merely a summary of the trends that were evident throughout the period that data was collected by the VPI&SU team.

The period during which this study was undertaken was one of severe drought conditions in Virginia. Of the nine research trips conducted by VPI&SU, seven had measured inflows less than 50 percent of the historical average flow as given in Chapter 2. It should be expected that higher flows would have affected the sediment distribution in Kerr Reservoir; however, most likely the effects would be reflected in higher values of Total Suspended Solids, and not in greatly altered sediment contour patterns.

On six of the nine research trips the data collected by the VPI&SU research team indicated a layered suspended sediment distribution. As is to be expected from reservoir sedimentation theory (as is discussed in Chapter 5 of this report) the values of suspended sediment are much higher at station 1 (see Figure 3.1) and decrease in the direction of the dam. On each of these occasions, the sediment contours had different magnitudes, but the patterns were very consistent. Also consistent for each trip was the fact that the sediment contour lines plunge from the water surface towards the bottom. This pattern is also to be expected from reservoir sedimentation theory.

Several of these data sets also indicated that a bottom layer of sediment (with a higher parts per million reading) was evident, extending almost the entire length of the reservoir. This bottom layer invariably developed into a large plume downstream from the largest vertical drop in the reservoir bottom. This plume is most obvious in Figures A3 and A7.

When a heavy sediment load was monitored in the upper reaches of the reservoir, the suspended sediment contour lines for each of the trips indicates that the sediment settled out of suspension rather quickly. The results are seen in each of the figures in Appendix A dealing with levels of suspended sediment. No matter what the levels of TSS measured in the upper reaches of the reservoir were, the TSS values near the dam were always 5 ppm or under. The value of 5 ppm indicates that the water is virtually free of suspended sediment. The one exception to this value of 5 ppm or less near the dam was on February 12, 1982. The reason for the trip being an exception to the normal pattern is discussed below, as well as in Appendix A.

Two of the remaining three research trips (4/30/81 and 10/8/81) had suspended sediment patterns similar to those discussed above. The difference arises from a turn in the sediment contour lines towards the dam near the water surface. The resulting configuration resembles layers of horseshoe shaped contours (see Figure A1).

The remaining trip to be discussed differs from the rest. This is a result of extreme weather conditions which are discussed in detail in Appendix A. In short, the Kerr Reservoir Watershed experienced severe flooding for the week prior to February 12, 1982, the day sampling was performed by the VPI&SU research team. The suspended sediment contours increase in value from station 1 in the direction of Kerr Dam. This trend continues until station 6 (see Figure 3.1) which is approximately thirteen miles downstream from station 1. At the approximate location of station 5, the contour lines begin to decrease in value in the direction of the dam.

It is interesting to note that the final research trip conducted only 18 days after the February 18, 1982 trip showed absolutely no effects of the high flows that were obvious in the preceding trip. As a matter of fact, the distribution of suspended sediment for March 3, 1982 was almost completely uniform throughout the reservoir. This indicates that the reservoir returns to normal conditions very quickly, even after severe flood events.

4.2 Water Temperature Data

It is not the purpose of this report to analyze the temperature distribution in Kerr Reservoir. However, some very inter esting results were evident in the data-collected by the VPI&SU research team. Note in Figure A2 that the water temperature for April 30, 1981 was basically horizontally distributed, with the warmest water being the inflow from the watershed. Figure A5 (June 24, 1981) indicates the same horizontal pattern; however, the water had warmed significantly. As Figure A9 shows, by October the temperature distribution has completely changed to vertical isotherms, with the coldest water being the inflow. Finally, on December 3, 1981 (Figure A11), the water temperature distribution is the same as in October, but with much lower values.

CHAPTER 5

RESERVOIR SEDIMENTATION

5.1 Introduction

Erosion, transportation, and deposition of sediment are natural processes which have occurred throughout geologic times. The degree of erosion, and consequently the amount of sediment that moves out of a watershed, vary greatly from one area to another depending upon physical, climatic, geologic, vegetative, and other conditions. Sedimentation of a reservoir created by a dam constructed on a natural watercourse is inevitable. The rapidity of sedimentation and the period of time which will elapse before the usefulness of the storage works is seriously impaired is a significant problem of concern to civil engineers. The replacement costs of storage lost to sediment accumulation in American reservoirs amounts to millions of dollars annually (5).

5.2 Sediment Dislocation

Initial sediment dislocation is a result of many different parameters. Land use patterns and vegetative growth (i.e. farming, meadowlands, forests, etc.) have a great deal to do with the amount of sediment that is dislocated. Local climate also affects sediment dislocation and movement to a large extent. Wind and rainfall are the two most important factors in the erosion and initial movement of sediment particles. Also, the heaving action caused by continual freezing and thawing can result in the breaking down of rocks and soil, thereby making erosion more likely. Even chemical composition and bonding properties can affect how easily sediment is initially dislocated.

5.3 Sediment Transportation

Sediment is carried by a river as bed load, suspended load, and wash load. Bed load is the portion of the material in nearly continuous contact with the bed, either through rolling, sliding, and sometimes jumping (saltating). This type of sediment transport is also referred to as contact load. The bed load is usually made up of the largest sediment particles. Suspended load is the finer material which is occasionally in contact with the bed, but is usually surrounded by fluid particles. Due to its weight, the sediment attempts to settle out of suspension, but this tendency is countered by the irregular motion of the fluid, i.e. the turbulent velocity components of the fluid. The wash load is the material that never touches the bed, and consists of the finest sediments. The washload originates from sheet wash and bank caving, etc., not from scour along the stream bottom. No set criteria has been forwarded to distinguish wash load from bed load and suspended load. Einstein (1950) suggested that the limiting sizes of washload and bed material load may be chosen quite arbitrarily from the mechanical size analyses as the grain diameter of which 10 percent of the bed mixture is finer. Kresser

(1964) reasons that the particle Froude number, u^2/gd is a useful criterion. When analyzing limited field data, a Froude number of $N_F = 360$ gave a surprisingly good correlation (3). Bed load, suspended load and wash load together make up the total load. Each watercourse situation may exhibit its own combination of these three total load components.

As a river approaches a reservoir, the flow depth increases and the velocity decreases. This causes a loss in the sediment transporting capacity of the river. In the deposition process, the coarsest material is affected first. This coarse material forms a delta at the head of the reservoir. The finer material is transported further into the reservoir, forming the bottom sediments (see Figure 5.1). However, the fine material, particularly if made up of cohesive material, has a tendency to form density currents, which move towards the dam either in suspension or along the bottom of the reservoir. Density flows differ from normal open channel mud flows because the bouyancy of the surrounding fluid reduces the gravity force by the normalized density difference; i.e. reduced gravity force = $\Delta\rho/(\rho g)$. $\Delta\rho = \rho_s - \rho$ is the density difference between the sediment density ρ_s and the ambient fluid density ρ, and g is the acceleration due to gravity. Vertical forces such as waves are therefore exaggerated at the density interface compared to the air-water interface.

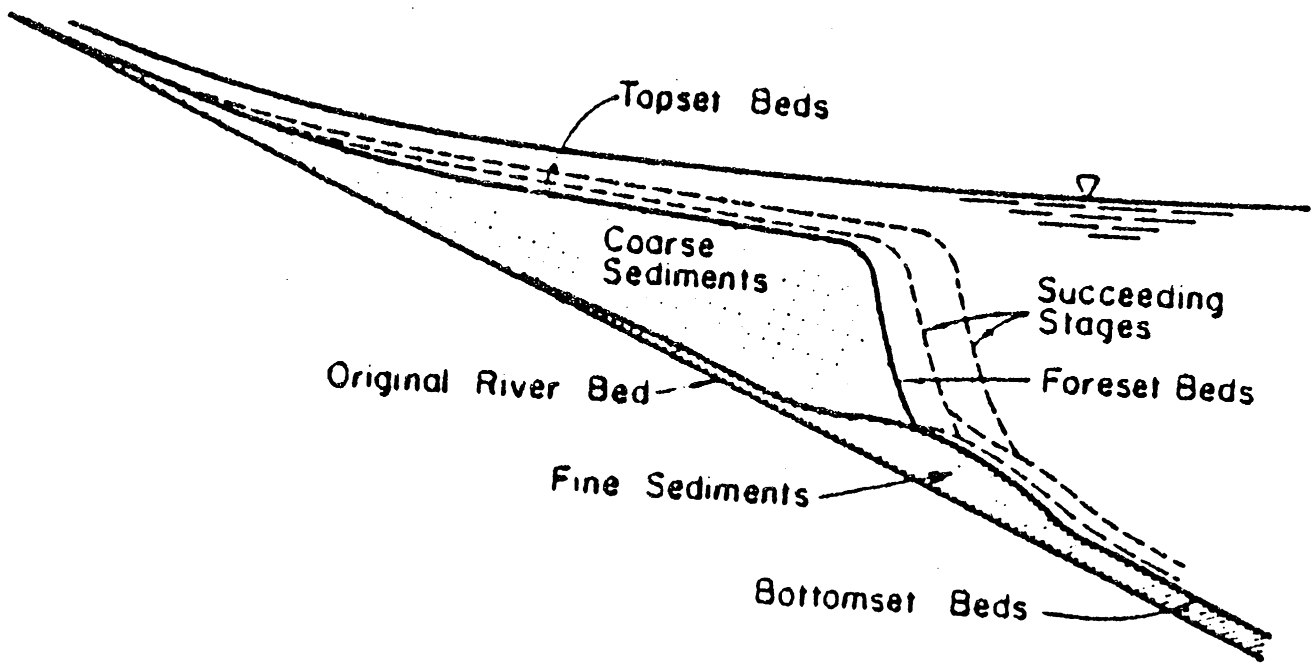

Figure 5.1 - Typical Reservoir Sedimentation Profile (4)

5.4 Storage Loss

An important consideration of any reservoir is the amount of storage lost due to sedimentation. It has been estimated that as of 1973, storage capacity costing $10,000,000 has been destroyed in the United States each year by reservoir sedimentation. Over 20 percent of the reservoirs in this country have an estimated useful life of less than 50 years, and 25 percent more have less than 100 years because of this factor (5).

Morris and Wiggert (1971) give the following formula:

$$V_s = EQ_s \qquad (1)$$

where

V_s = volume of useful capacity destroyed by silting each year.

Q_s = volume of sediment transported into the reservoir

E = the reservoir trap efficiency.

Obviously the trap efficiency is an important factor in the long term operation of any reservoir. The trap efficiency must be a function of the flow detention time in the reservoir (which depends on the reservoir capacity, shape, inflow, and outflow) and on the sediment characteristics. The sediment size distribution, and its ability to form density currents are especially important. The following formula has been developed by Carl Brown (5):

$$E = 1 - \frac{1}{1+K(\frac{C}{W})} \qquad (2)$$

where $\frac{C}{W}$ is the ratio of the reservoir capacity in acre-feet to the watershed area in square miles. The coefficient K varies with all the previously mentioned factors, ranging from 0.046 to 1.0, with a mean value of about 0.10.

An alternative method of correlating trap efficiency is in terms of the capacity-inflow ratio, instead of the capacity watershed ratio. This relationship is given in Table 5.1.

Table 5.1

Median Values of Trap Efficiency E (Morris & Wiggert, 1971)

$\frac{C}{I}$ (%)	E (%)	$\frac{C}{I}$ (%)	E (%)
0.2	2	2.0	60
0.3	13	3.0	68
0.4	20	4.0	74
0.5	27	6.0	80
0.6	31	10.0	86
0.8	38	20.0	93
1.0	44	100.0	97
1.5	52	1000.0	98

Table 5.1 indicates median values of trap efficiency in terms of the capacity-annual inflow ratio, $\frac{C}{I}$, as determined by Brune. The data approximately satisfies the following empirical equation (derived by D. M. Crim) except at very low values (5):

$$E = \frac{\frac{C}{I}}{0.012 + 0.0102\ (\frac{C}{I})} \qquad (3)$$

The sediment inflow, Q_s, can be estimated from sediment transport theory, or from actual reservoir sediment field measurements. The actual volume of reservoir sediment not only depends on the weight of sediment entering the reservoir, W_s, (dimensions of weight per unit time, i.e. lbs/year), but also on the unit weight of sediment. However, the unit weight of sediment is constantly changing due to time related compaction. For reservoir sedimentation calculations, it is desirable to use a time related mean unit weight. The following relation is given for sedimentation calculations:

$$Q_s = \frac{W_s}{\gamma_m} \tag{4}$$

where γ_m is the mean specific weight of sediment.

Lane and Koelzer (5) have proposed the following formula for the estimation of mean compacted unit weight of reservoir sediment over the time period T:

$$\gamma_m = \gamma_1 X_1 + (\gamma_2 + k_2 \log_{10} T) X_2 + (\gamma_3 + k_3 \log_{10} T) X_3$$

where

γ_m = average specific weight of sediment in reservoir after time T.

T = time in years, for T equal to or greater than one year.

γ_1 = specific weight of sand and coarser sediment after one year.

γ_2 = specific weight of silt after one year.

γ_3 = specific weight of clay after one year.

k_1 = constant for rate of compaction of sand.

k_2 = constant for rate of compaction of silt

k_3 = constant for rate of compaction of clay

X_1 = fractional part of total deposit composed of sand.

X_2 = fractional part of total deposit composed of silt.

X_3 = fractional part of total deposit composed of clay.

γ and k values are listed in Table 5.2.

Table 5.2

Values of γ and k for Sand, Silt, and Clay (Morris & Wiggert, 1971)

Reservoir Stage	Sand		Silt		Clay	
	γ_1(pcf)	k_1(pcf)	γ_2(pcf)	k_2(pcf)	γ_3(pcf)	k_3(pcf)
Sediment always submerged or nearly submerged	93	0	65	5.7	30	16.0
Normally a moderate reservoir drawdown	93	0	74	2.7	46	10.7
Normally considerable reservoir drawdown	93	0	79	1.7	60	6.0
Reservoir normally empty	93	0	82	0.0	78	0.0

Lara and Pemberton (5) have recommended a formula that represents an extensive quantity of data:

$$\gamma_m = \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 \qquad (6)$$

Table 5.3 gives values of γ_1, γ_2, and γ_3 to be used in equation (6) for different reservoir drawdown conditions.

5.5 KERR RESERVOIR SEDIMENTATION ANALYSIS

5.5.1 U.S. Army Corps of Engineers Data

During construction of Kerr Reservoir, 114 sediment ranges were established and marked with concrete monuments. The locations of these ranges are shown in Figure 5.2. Thirty-four of the ranges are on the main river, twenty are on the major tributary, and the remainder are on smaller tributaries.

Three surveys of these sediment ranges have been performed. The original was a tape and level survey, carried out between October 1950 and November 1952 while the dam was still under construction (8).

The second survey was made between September 1959 and February 1960. The ranges in the upper reaches were sounded by conventional methods, using lead line and sounding pole. Those in the lower reaches were sounded with a supersonic echo sounder and the horizontal distances were obtained with a special floating cable. The results of this resurvey indicated that a total of

Table 5.3

Initial unit weights (T=0) (Morris & Wiggert, 1971)

Type of Operation	γ_1(pcf)	γ_2(pcf)	γ_3(pcf)
Normally submerged	97	70	26
Moderate to considerable drawdown	97	71	35
Normally empty	97	72	40
Riverbed Sediments	97	73	60

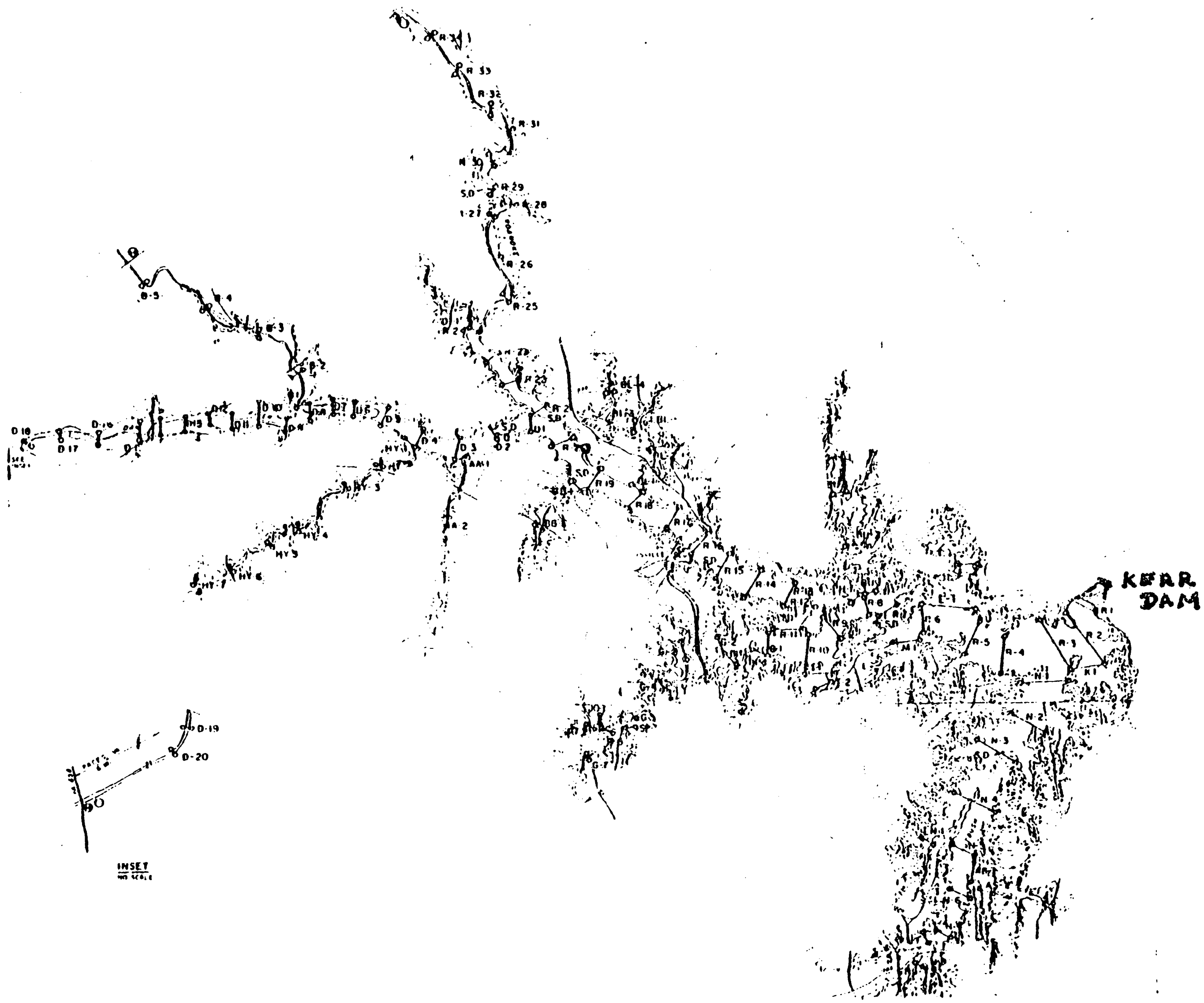

Figure 5.2 - U.S. Army Corps of Engineers Sediment Ranges (8)

58,051 acre-ft. had been deposited in the reservoir. This represents 2.8% of the original reservoir capacity (8).

The third sediment survey was performed between June and September 1976. Range profiles from the concrete monuments to a point of sufficient depth for an echo sounder to properly function were obtained by level and tape survey. The profiles of the underwater portions were obtained with a supersonic echo sounder. Based on this data, the total volume of sediment deposited in the reservoir in the 22 year period following the closure of the dam in July 1952 is estimated at 34,508 acre-ft (9). This value is considerably less than the 1959 survey. Two reasons for this discrepancy have been forwarded:

(1) Two major floods, in June 1972 and mid March/early April 1975, occurred after the 1959 survey with the potential for severe bank and bottom scour, and the capability to transport large amounts of sediment out of the reservoir.

(2) Measurements were made with a higher degree of accuracy in the 1976 survey than in the 1959 survey.

Although the flows occurred, their effects on the total sediment load cannot be documented.

The most severe flooding took place in March/April 1975. During this period of time, two separate flood events actually took place. The first started on March 13, 1975 when Kerr Reservoir inflow jumped from 9,371 cfs to 31,634 cfs in one day. A maximum inflow of 100,335 cfs was measured on March 21. This is the highest recorded inflow since Kerr Reservoir was constructed. The inflow reduced somewhat linearly to a value of 11,607 cfs on March 28. The average inflow for the 16 day period ending March 28 was 54,190 cfs, more than seven times the average Kerr Reservoir inflow.

On March 30, 1975, inflow again increased to 58,221 cfs and continued rising to a high of 78,000 cfs on April 1, finally subsiding to a value of 11,433 cfs by April 5, 1975. The average inflow during this period was 50,802 cfs. But more significantly, the stage reached an all time recorded high of 318.59 feet (April 2, 1975). Previously the highest recorded stage was during the 1972 flooding (June 26, 1972) at a value of 314.46 feet. This means that over four vertical feet of bank was subjected to scour for the first time. The highest recorded stage prior to the 1959 survey was 308.88 feet. During the period of time that elapsed between resurveys, almost ten vertical feet of bank was subjected to scour for the first time.

Indeed, a comparison of the two resurveys shows that the shoreline between the dam and approximately thirteen miles upstream from the dam between the elevations of 308' and 318' was severely scoured in places, and averaged at least 1/2 to 1 foot of erosion in most places.

Under severe flooding conditions it is not unreasonable to suggest that a large percentage of the eroded bank material would be subjected to strong enough currents to carry the material towards the dam and out through the sluice gates.

Figure 5.3 shows the longitudinal reservoir bottom profile as measured in each of the three surveys. The expected sedimentation profiles are evident from the upstream end of the reservoir down to the previously mentioned cross-section approximately thirteen miles from the dam. Large deltas are seen to have formed on the upper reaches of both the Roanoke River and the Dan River.

It can also be seen in Figure 5.3 that in the lower reach of the reservoir the 1976 resurvey bottom depth becomes lower than or approximately coincides with the 1959 resurvey.

The direct influence of the bottom slope on water velocity is known. The increased bottom slope near the damsite results in an increased velocity and thus increased scour capabilities of the water. During extreme flooding conditions this relationship would become even more important. Therefore, some scouring activities might have occurred during this period at the lower reach of the reservoir. During extreme flood conditions, it is conceivable that this scoured material could be transported out of the reservoir. On the other hand, during the heavy flooding period, runoff from the watershed carries with it very large amounts of sediment. The sediment load on March 21, 1975 was 81,400 tons/day. An average sediment load for Kerr Reservoir is in the neighborhood of 2500 tons/day. The storm waters would have to maintain the ability to scour and hold sediment in suspension.

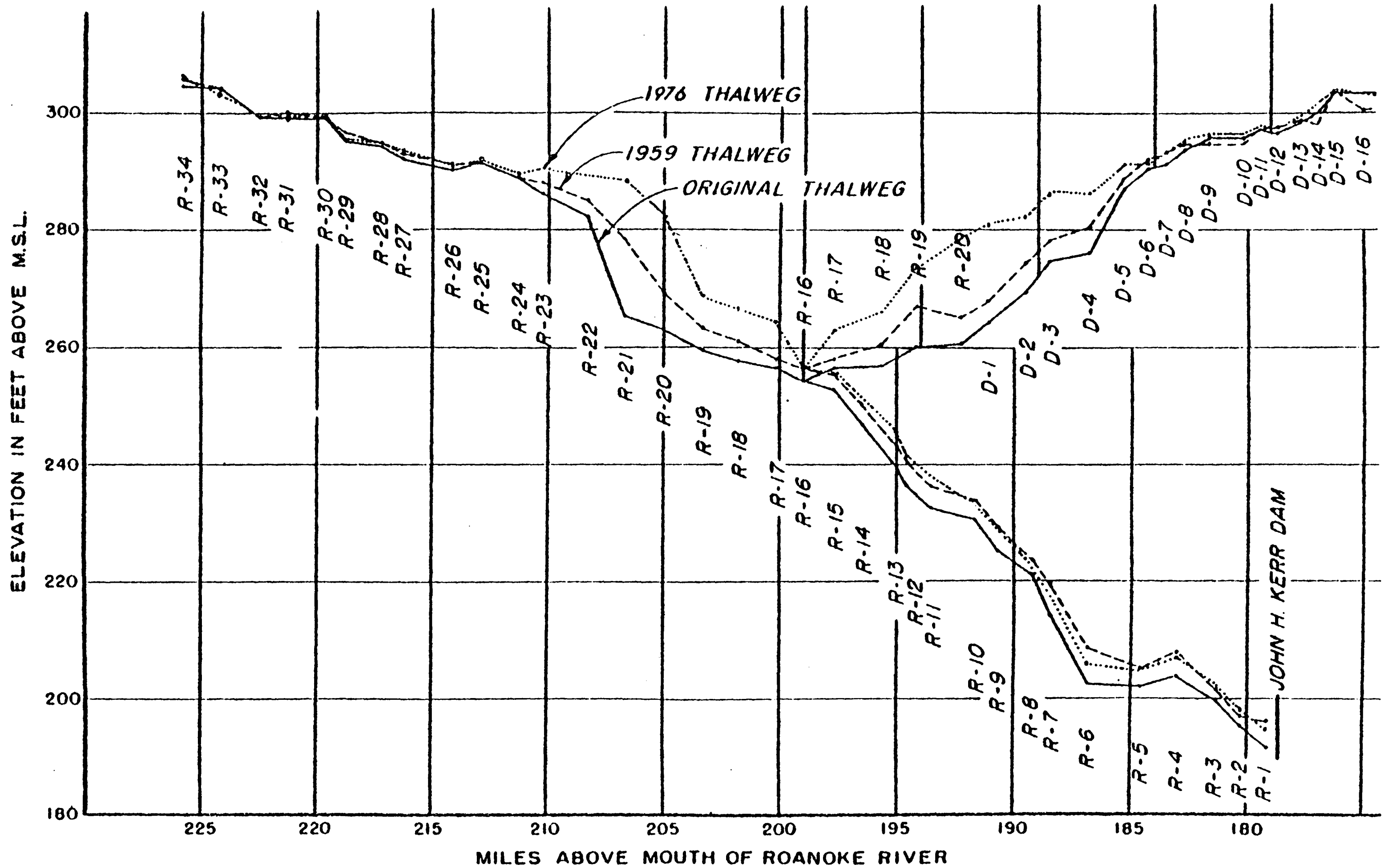

Figure 5.3 - John H. Kerr Reservoir Bottom Profile Progression with Time (10)

Coarser sediment should have been deposited in the delta area. Those fine sediment staying as suspended sediment may not have had a chance for deposition, thereby moving along with the flood water toward the dam and flushing out of the reservoir through the sluiceways. Such a process would have produced no net gain in sediment deposition in this reach. The increased scouring capacity during the flood period as previously explained could also have played a strong role in degradating the reservoir bottom and thus causing a net loss of bottom sediment deposited in the lower reach of the reservoir. However, the magnitude of the discrepancy (over 24,000 acre-ft) between the two surveys remains unexplainable by means of quantitative analysis.

The second argument of increased survey accuracy is also valid. For the 1976 resurvey, a minimum of two measurements were made in each range and were compared by computer methods. When discrepancies were found additional measurements were made. A 2.5° sound beam was used in the 1976 resurvey, while a 12.5° sound beam was used in the 1959 resurvey. A wider sound beam tends to yield a shallow measurement, especially on slopes. Thus more sediment will appear to have been deposited than is actually the case.

Because of the increased accuracy, the 1976 resurvey data will be used in this report for the analysis of sedimentation at John H. Kerr Reservoir.

5.5.2 U.S. Geological Survey Data

Since the construction of Kerr Reservoir, the U.S. Geological Survey has collected suspended sediment samples on the Roanoke River at Randolph, Virginia and the Dan River at Paces, Virginia (see Table 5.4). Samples were taken daily from January 1954 to September 1957. From October 1957 to September 1968, samples were taken at ten day intervals and during flood stages. During the intervals sediment inflow was accounted for by correlating sediment load to streamflow hydrographs developed for these rivers. From October 1968 to the present the samples were taken in one week intervals and during flood stages. Similarly, the streamflow hydrographs are used to estimate sediment load.

In the period 1957 to 1968, data for three years (Oct. 1957-Sept. 1959, Oct. 61-Sept. 62) did not include the use of streamflow hydrographs to estimate the sediment load . To account for this data deficiency, the following procedure was employed for the purpose of this analysis. All sediment inflows for each month under a value of 10,000 tons/day were summed and divided by the number of samples involved. This results in a daily average for each month. Values above 10,000 tons/day were excluded so that short, severe storms would not adversely affect the estimation of unaccounted sediment load. The average value was then multiplied by the number of days in the month with no provided sediment data. Each month was calculated separately to account for seasonal variations in sediment flow. The monthly data was then summed,

Table 5.4
SEDIMENT LOAD ENTERING JOHN H. KERR RESERVOIR

	Roanoke River (measured at Randolph, Va)	estimated	Dan River (measured at Paces, Va)	estimated
July-Sept. '52	234,901	--	233,864	--
Water Year 52-53	449,715	--	421,992	--
" " 53-54	408,700	--	586,563	--
" " 54-55	1,048,582	--	1,135,249	--
" " 55-56	193,849	--	459,654	--
" " 56-57	848,841	--	958,645	--
" " 57-58	312,357	771,301	495,210	482,195
" " 58-59	242,053	290,982	283,941	329,733
" " 59-60	837,235	--	1,214,138	--
" " 60-61	678,931	--	821,993	--
" " 61-62	355,247	411,023	335,607	512,399
" " 62-63	403,974	--	754,679	--
	6,014,385	1,473,306	7,701,535	1,324,327

Total Inflow for the period July 1952-Sep 1963 = 16,513,553 tons

Water Year 63-64	170,618	--	669,506	--
" " 64-65	247,836	--	832,150	--
" " 65-66	201,065	--	462,417	--
" " 66-67	352,683	--	227,778	--
" " 67-68	120,843	--	257,002	--
" " 68-69	166,850	--	408,850	--
" " 69-70	189,603	--	391,178	--
" " 70-71	644,617	--	576,722	--
" " 71-72	1,623,823	--	1,142,422	--
" " 72-73	926,975	--	631,862	--
" " 73-74	170,531	--	578,000	--
" " 74-75	453,087	--	985,393	--
" " 75-76	171,378	--	273,951	--
	5,440,909	--	7,437,231	--

Total inflow for the period Oct 1963-Sep 1976 - 12,878,140 tons yielding a yearly estimate. The results of the sediment measurements and estimates can be found in Table 5.4.

Prior to 1962 the watershed area above Kerr Reservoir was 7800 square miles. Of this area approximately 2.9 percent was effectively removed as a source of sediments with the initiation of filling of Philpott Dam (see Figure 5.4). This leaves approximately 7550 square miles of watershed above Kerr. As can be seen in Figure 5.4, due to the location of the sampling stations, a considerable portion of the watershed is not represented in the sediment load given in Table 5.4. The area not represented amounts to 24.7 percent of the remaining area or a total of about 1850 square miles. On Sept. 21, 1962 the combination Smith Mountain and Leesville Reservoir projects (maintained and operated by Appalachian Power Co.) was introduced. This effectively eliminated another 24 percent of the watershed area above Kerr Reservoir, leaving a total area of 3840 square miles in the Kerr Reservoir watershed. Of this area, 67.5 percent is represented by the U.S.G.S. sediment sampling station.

Assuming uniform conditions regarding such factors as rainfall, runoff, sediment composition, etc., to hold over the entire watershed, then the total amount of suspended sediment to enter Kerr Reservoir can be estimated. This is done with the following equation:

$$S_T = \frac{S_{im}}{X} \qquad (7)$$

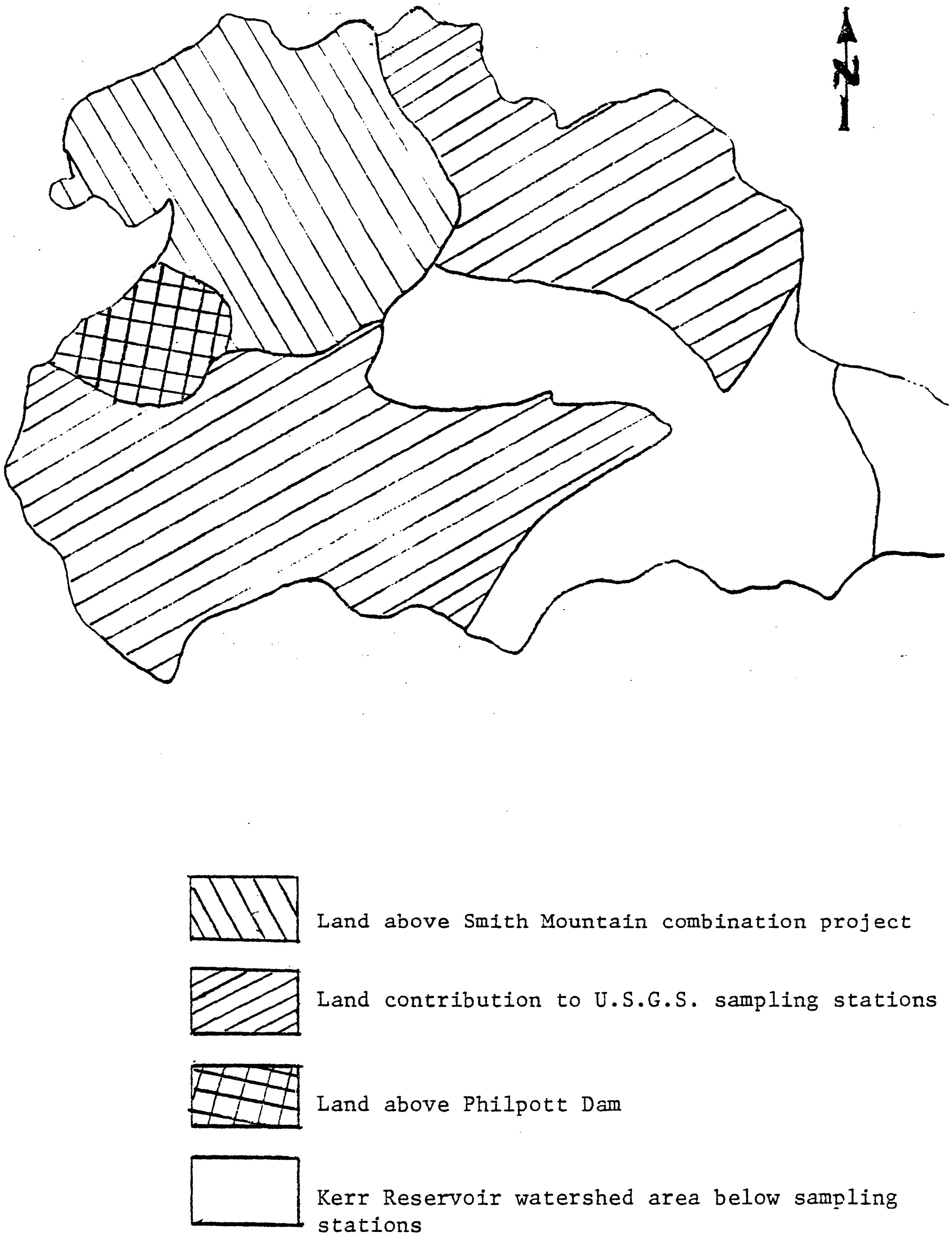

Figure 5.4 Roanoke River Basin Area Contributing to U.S.G.S. Sediment Sampling Stations

where:

S_T = total estimated sediment entering Kerr Reservoir during desired time interval.

S_{im} = measured sediment load during each individual time interval (i = 2 for this case).

X = percentage of remaining watershed area represented by the sediment sampling stations (as previously discussed).

The total estimated sediment load entering Kerr Reservoir during the period from July 1952 - September 1976 can be computed by substituting the results of Table 5.4 into Equation (7).

$$S_T = \frac{16{,}513{,}553 \text{ tons}}{0.753} + \frac{12{,}878{,}140 \text{ tons}}{0.675} = 41{,}009{,}075 \text{ tons}$$

This estimate assumes that no appreciable amount of sediment passes through either Philpott Dam or the Smith Mountain Combination project. To compare this estimated U.S.G.S. sediment inflow to the U.S. Army Corps of Engineers data a conversion parameter of the sediment unit weight is needed. For the unit weight to be determined accurately, the characteristics of Kerr Reservoir sediment need to be studied.

5.5.3 Sediment Size Distribution

During the period from January 1954 to March 1968 the U.S.G.S. performed numerous size distribution analysis on both the Roanoke and Dan rivers. These analysis were made using a combination of two or more of the following methods: bottom withdrawal tube, decantation, sieve, in both natural water and distilled water. The results can be found in Table 5.5.

It should be noted that the values in Table 5.5 are consistent, deviating by relatively small amounts from sample to sample. Consequently, it can be assumed that these values are representative of Kerr Reservoir sediment.

Table 5.6 gives soil classification as a function of particle size. It indicates a large percentage of silts and clay found in both rivers.

Substituting the results of Table 5.6 into Eq. (5) enables the calculation of Kerr Reservoir sediment unit weight by the Lane and Koelzer method.

Dan River:

$$\gamma_D = 93 \frac{\text{lb}}{\text{ft}^3} (.283) + (65 + 5.7 \log 22) (.361)$$

$$+ (30 + 16.0 \log_{10} 22) (.353)$$

$$= 70.7 \frac{\text{lb}}{\text{ft}^3}$$

Roanoke River:

$$\gamma_R = 93 \frac{\text{lb}}{\text{ft}^3} (.249) + (65 + 5.7 \log 22) (.417)$$

$$+ (30 + 16.0 \log_{10} 22) (.332)$$

$$= 70.5 \frac{\text{lb}}{\text{ft}^3}$$

Table 5.5
Particle Size Distribution for Roanoke River and Dan River

	% Finer than Indicated Size, mm									
	0.002	0.004	0.008	0.016	0.031	0.062	0.125	0.250	0.500	1.00
Dan River Sediment Size Distribution										
Avg. of 15 samples Jan-July 54		37	49.2	60.4	69.0	76.3	80.3	86.7	81.7	99.9
W.Y. 54-55 (10 Samples)		41.1	52.7	62.8	71.5	81.2	85.4	91.4	96.2	99.9
Oct 64 & Feb 65 (2 samples)	29	34.5	41.0	47.5	54.5	60.0	66.5	77.5	93.5	99.5
March 66 (2 samples)	32	34	44.5	52.5	61.0	68.0	79.0	87.0	97.5	100
Oct 66 & Aug 67 (2 samples)	23.5	30.0	44.0	57.0	69.0	72.5	85.5	91.5	95.5	98
Avg. Values for 31 samples	28.2	35.3	46.3	56.0	65.0	71.6	79.3	86.8	94.9	99.9
Roanoke River Sediment Size Distribution										
Jan-July 54 (7 samples)		35.7	50.3	64.4	77.1	87.9	93.4	97.6	98.6	99.9
WY 54-55 (11 samples)		29.2	42.1	54.2	66.9	79.6	85.6	93.8	98.3	99.9
Feb 8, 65 (1 sample)	29.0	32	46	56	64	69	81	90	98	100
Mar 1, 68 (1 sample)	28	33	46	57	67	75	84	91	99	100
Oct. 66 Mar & Aug 67 (3 samples)	25.3	34.0	45.0	56.0	64.3	70.7	82.0	94.0	99.9	100
Avg. values for 23 samples	27.4	32.8	45.9	57.5	67.9	76.4	85.2	93.3	98.8	99.9

Table 5.6

Soil Classification vs. Particle Size

Size (mm)	Class	Dan River (% of total wt)	Dan River group total	Roanoke River (% of total wt)	Roanoke River group total
0.002	medium to fine clay	28.2	35.3	27.6	33.2
.002-.004	coarse clay	7.1		5.6	
.004-.008	very fine silt	10.8	36.1	13.4	41.7
.008-.016	fine silt	9.7		11.2	
.016-.031	medium silt	9.0		8.5	
.031-.062	coarse silt	6.6		8.6	
.062-.125	very fine sand	7.7	28.3	8.9	24.9
.125-.250	fine sand	7.5		8.4	
.250-.500	medium sand	8.1		6.5	
.500-1.00	coarse sand	5.0		1.1	

thus, the Lane and Koelzer method yields an average value of 70.6 lb/ft^3.

Using Lara and Pemberton's relationship (Equation (6)) and corresponding Table 5.6, the unit weight of Kerr Reservoir sediment is calculated as follows:

Dan River:

$$\gamma_D = 97(.283) + 70(.361) + 26(.353) = 61.90 \frac{lbs}{ft^3}$$

Roanoke River:

$$\gamma_R = 97(.249) + 70(.417) + 26(.332) = 62.0 \frac{lbs}{ft^3}$$

5.5.4 Sediment Density Analysis

The U.S. Army Corps of Engineers performed twenty in situ density measurements using a radioisotope sediment densitometer. The measurements included both bulk density and dry unit weight. Dry weight densities ranged from 18.8 lbs/ft^3 to 88.5 lbs/ft^3, with an average value of 32.6 lbs/ft^3. Bulk densities varied from 74.1 lbs/ft^3 to 117.5 lbs/ft^3 with an average value of 82.7 lbs/ft^3. A plot of bulk density vs. distance from Kerr Dam is given in Figure 5.5. The measured bulk density date follows expected reservoir sedimentation patterns. The values in the upper reaches of the Roanoke and Dan Rivers indicate an almost pure sand. The unit weight then reduces to a value indicative of a more well graded sediment. Finally, the sediment nearest to

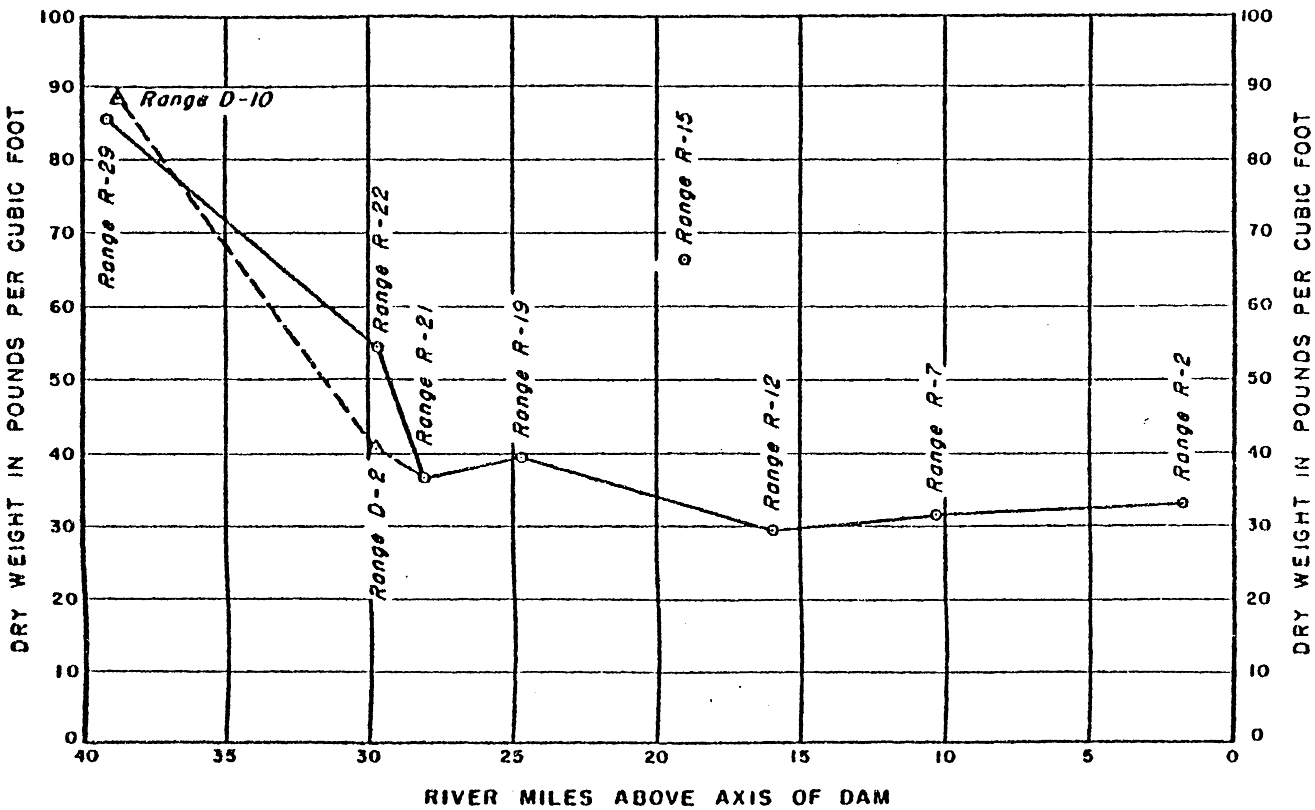

Figure 5.5 - Measured Dry Weight of Sediment vs. Distance from Dam (8)

Kerr Dam has a unit weight that reflects a large percentage of fines.

5.5.5 Water Content Calculations

From soil mechanics we know the following relationship (6):

$$\gamma_{dry} = \frac{\gamma_{sat}}{1 + w} \tag{8}$$

where:

γ_{dry} = dry unit weight of the soil

γ_{sat} = bulk density of the soil

w = water content of the soil

Rearranging Equation (8) one obtains the following:

$$\gamma_{dry}\,(1+W) = \gamma_{sat}$$

$$\gamma_{dry} + W\,\gamma_{dry} = \gamma_{sat}$$

$$W = \frac{\gamma_{sat} - \gamma_{dry}}{\gamma_{dry}} \tag{9}$$

Using the Corps of Engineers data, with known γ_{sat} and γ_{dry} values, the water content of each sample can be calculated. This was done, with the result being an average water content of 1.30.

Thus, the average theoretical value for dry unit weight can be calculated using Equation (9).

$$\underset{\text{[Lane \& Koelzer]}}{\gamma_{dry}} = \frac{70.6\ \text{lbs/ft}^3}{1 + 1.30} = 30.7\ \text{lbs/ft}^3$$

$$\gamma_{dry} = \frac{62.0}{1 + 1.30} = 27.0 \text{ lbs/ft}^3$$
[Lara & Pemberton]

Compared to the field measurements performed by the Corps of Engineers, the theoretical values for γ_{dry} varied by 5.8% and 17.1% respectively.

Assuming that the 1976 Corps resurvey was more accurate than the 1959 survey, then it can be stated that 34,508 acre-ft. have been deposited in the twenty-four years of Kerr Reservoir operation.

Using Lane and Koelzers' theoretical value converted to γ_{dry} yields the following total weight of sediment deposited in Kerr Reservoir:

$$34{,}508 \text{ acre-ft } \left(\frac{43560 \text{ ft}^2}{\text{acre}}\right) \left(30.7 \frac{\text{lbs}}{\text{ft}^3}\right) \left(\frac{1 \text{ ton}}{1000 \text{ lbs}}\right)$$

$$= 46{,}147{,}272 \text{ tons}$$

Similarly, using the Corps of Engineers measured value, the total weight of Kerr Reservoir sediment is 49,003,292 tons.

5.5.6 Trap Efficiency Calculations

For the first 18 months following the closure of Kerr Dam the Corps of Engineers monitored both sediment oputflow and release from Kerr Reservoir. Approximately 2,008,000 tons of sediment entered the reservoir and 268,000 tons were discharged, resulting in a trap efficiency of 86.7%.

For the theoretical calculation, Equation (2) was given in terms of the capacity-watershed area ratio method. The capacity of Kerr Reservoir has previously been given as 2,324,000 acre-ft, and the watershed area contributing to Kerr has been determined to be 5700 square miles. Using the mean value of K=0.10 the capacity-watershed area ratio results in the following trap efficiency.

$$E = 1 - \frac{1}{1 + 0.1\left(\frac{2,324,000}{5,700}\right)} = 97.6\%$$

To use Table 5.1 for calculating trap efficiency, the capacity must be in terms of ft^3 and the inflow in terms of ft^3/yr. Therefore, the value of C/I is 1.01×10^{11} $ft^3/2.42 \times 10^{11}$ $ft^3/yr = 0.417$. Using the value of C/I = 0.417 and interpolating Table 5.1 the trap efficiency is calculated as 95.1%. Substituting the value of C/I = 0.417 into Equation (3), the Kerr Reservoir trap efficiency is calculated as 95.4%.

Averaging the theoretical trap efficiencies results in a value of 96.5%. The estimated amount of sediment required to enter Kerr Reservoir can now be calculated by dividing the total weight of deposited Kerr sediment by the average trap efficiency. Using Lane and Koelzer's method indicates a total required sediment load of 47,800,000 tons over the time period in question. Likewise, the Corps data indicates a total of 50,775,000 tons.

5.6 DISCUSSION

Lara and Pembertons' method for estimating the unit weight of sediment resulted in a value of 62.0 lbs/ft^3. Since the unit weight of water is 62.4 lbs/ft^3, sediment weighing 62.0 lbs/ft^3 would rise to the top of the water. The result would be that the sediment would travel through the reservoir and exit through the outlets.

The Lane and Koelzer method is more representative of deposited sediment. However, the results (70.6 lbs/ft^3) still disagree with the average value as measured by the U.S. Army Corps of Engineers (82.3 lbs/ft^3) by 14.5 percent. In fact, the Corps data contained no measured sediment unit weight less than 74.5 lbs/ft. The average measured value of 82.3 lbs/ft^3 represents a more realistic value than those that the derived equations provide.

The sediment sieve analysis indicates a well graded mixture of clay, silt, and sand. This is substantiated by the diversified formations that make up the Kerr Reservoir watershed. Large amounts of clay are in evidence in the area surrounding the reservoir. Large amounts of metamorphic rocks and Quartz exist in the middle section of the watershed, and wide areas of sandstone and limestone are spread throughout the watershed.

In this study it was assumed that uniform sediment contribution exists along the entire watershed. This assumption was necessary to account for the land area below the U.S.G.S.

sediment monitoring stations. Actually, this tends to be a conservative estimate, since the probability of sediment reaching the reservoir from adjacent lands is much greater than from the end of the watershed well over one hundred miles away. Also, the average annual rainfall in the Kerr Reservoir area is several inches greater than in its headwaters. Since rainfall and the runoff that accompanies it are the major causes of the initiation of sediment movement, the assumption of uniform sediment contribution is even more conservative. It must be pointed out; however, that the slope is greater at the upper end of the watershed, which in itself increases the probability of keeping sediment in suspension for longer periods of time. The magnitude of these effects is unknown; however, the estimate is almost certainly on the conservative side.

The method used in this analysis to estimate the sediment load for the 3 years not accounted for by the U.S.G.S. has previously been discussed. This process has resulted in realistic values. Use of the monthly values represents a method which accounts for each wet and dry season. The percentage of error involved in this estimate is not likely to affect the results of the overall sediment budget.

In estimating the total weight of sediment, the 1976 survey has been used. Over the twenty four year period stretching from 1952 to 1976, the total weight of sediment entering Kerr Reservoir using the Lane and Koelzer method, together with the Corps of

Engineers volume estimate and the calculated trap efficiency, yielded a total weight of deposited sediment of 47,800,000 tons. The adjusted U.S.G.S. data equals just over 41,000,000 tons, representing a discrepancy of 6.8 tons or 14.2%. The values derived using the Corps volume and density, along with the theoretical trap efficiency, varied from the U.S.G.S. data by a total of 9,760,000 tons, or 19.2%. Both of these comparisons are within reasonable variances given the methods of sediment measurement previously discussed.

The assumption of the accuracy of the 1976 survey was essential to the calculations made in this study. The equipment was much more accurate, and the methods employed were not conducive to large error. Together with the good correlation with the U.S.G.S. data, these facts are overwhelmingly in favor of the use of the 1976 survey.

However, the most damaging evidence against the validity of the 1959 survey is that it does not correlate with the U.S.G.S. data at all. Converting the 1959 measured sediment volume of 58,051 acre-ft to dry unit weight using the conservative Lane and Koelzer value for unit weight results in a total weight of 77.6 million tons. The measured U.S.G.S. total sediment weight from 1952-1959 is 6.37 million tons. This value represents only 8.2% of the 1959 Corps of Engineers survey. It is extremely unlikely that the data from the U.S.G.S monitoring stations were so inaccurate. Therefore it would seem that the use of the 1976 data is justified.

The calculated average trap efficiency was used in finding the total weight of sediment entering Kerr Reservoir because it provided a better correlation between the U.S.G.S. data and the U.S. ARmy Corps of Engineers data. The trap efficiency of a reservoir is dependent on more than one parameter, i.e. watershed area. The use of this type of generalized equation is not recommended when other means of analysis are possible.

CHAPTER 6

CONCLUSIONS

In comparing the U.S.G.S. sediment flow data the U.S. Army Corps of Engineers measurement of the deposited volume of sediment a difference of 14.2% exists. This can be due to result of several reasons. First, the volume of the measured sediment deposited in Kerr Reservoir might be larger than actually exists. This could possibly be a factor; however, as previously discussed, the methods and equipment utilized seem to disallow this theory. Second, the unit weight of sediment used in the calculation of total weight might be too high. To match the U.S.G.S. data to the Corps volume measurements a unit weight of approximately 62.0 lbs/ft^3 would be required. This value has previously been discredited. Third, the sediment inflow measurements, could be in error. This is a much more feasible reason than the previous two, and is most likely what occurred. The apparent shortage of measured sediment inflow is probably a combination of many things, including the techniques used for measurement, the time lapse allowed between sediment samples, and the "conservative" method of accounting for land area of the Kerr Reservoir watershed not included in the U.S.G.S. data as has been previously discussed. However, to have the two final values of total weight of deposited sediment come as close to each other as they did indicates that the expense spared by measuring periodically is well worth the loss of daily data.

In the 24 year period that has been analyzed, only 1.48% of the capacity of Kerr Reservoir was lost to sedimentation. This means that Kerr Reservoir is under no threat of significant loss of capacity for the distant future. However, the extreme amount of sediment deposition in the upper reaches of the reservoir could present a problem in the future whereby dredging may be required. An example of this type of problem would be the forced meandering of the Roanoke River or Dan River due to the natural channel filling with sediment. It is recommended that this potential problem is investigated in the not too distant future.

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APPENDIX A

ANALYSIS OF FIELD DATA

INTRODUCTION

Between April 30, 1981 and March 3, 1982 ten research trips were undertaken by the VPI&SU research team. Equipment malfunctions resulted in data from one trip (Nov. 14, 1981) being excluded. The remaining research trips are analyzed for sediment distribution and temperature patterns herein.

The period during which this study was undertaken was one of severe drought in Virginia, as well as most of the continental United States. This is evidenced by the fact that seven of the nine trips analyzed here had flows under 50% of the historical average for the Roanoke River at Kerr Dam. Five of these had flows less than 30% of the historical average. However, on one occasion (Feb. 12, 1982) the reservoir had just experienced severe flooding, providing an excellent opportunity to study sedimentation patterns under these conditions.

Each research trip is analyzed individually, and a discussion of overall sedimentation patterns follows.

30 April 1981/1 May 1981 (Trip 1)

The weather conditions for this trip were very bad. The wind was extremely high on both days, with a small craft advisory issued on May 1, 1981. Air temperature varied from 61°F (15.5°C) to 74°F (22°C). The water surface elevation recorded at Kerr Dam was 300.04 ft. on both days. Average inflow for the week prior to April 30 was 4,034 cfs, or approximately 53% of the historical average inflow of the Roanoke River.

Upon entering Kerr Reservoir, the sediment load varied between 13 ppm near the surface, and 25 ppm at the bottom of the channel. As is seen in Figure A1, the sediment load is layered at the first stations, and appears to be plunging. However, at station 3 (buoy 22) the sediment distribution develops a very interesting pattern, with a "hump" in the middle, and the equal value portions opening in the direction of the dam. As Appendix D shows, the water velocity at the surface was extremely high along the entire length of the reservoir, due to the high winds previously discussed. These high surface winds are the most probable cause of the sediment upturn in the direction of the dam. The surface velocity was not as prevalent near the entrance to Kerr Reservoir since the water is much shallower in this area, allowing for much less of a velocity difference between the surface and bottom. Note the higher bottom concentration at station 6 (buoy 11). There appears to be a pocket of sediment that forms near the base of the large elevation drop that occurs at this location. High water velocities (ranging from 10 ft/min to 1.5 ft/min) were also measured at this location, the only point in the reservoir after station 2 that the measured bottom velocity exceeded 2.8 ft/min.

The temperature distribution throughout the reservoir was as expected for this time of year. The inflow was warmer than the ponded water. The surface water was warmer, with an almost linear decrease with depth. As can be seen in Figure A2, the temperature contour lines run approximately parallel to the reservoir bottom. Note that the temperature at station 9 (buoy 3) was warmer at the surface than the surrounding area. This corresponds to the location where the much smaller Nutbush Arm of the reservoir merges with the Roanoke Arm. The temperature at station 9 matches the values at station 10 (buoy D) located on the Nutbush Arm (see Appendix D).

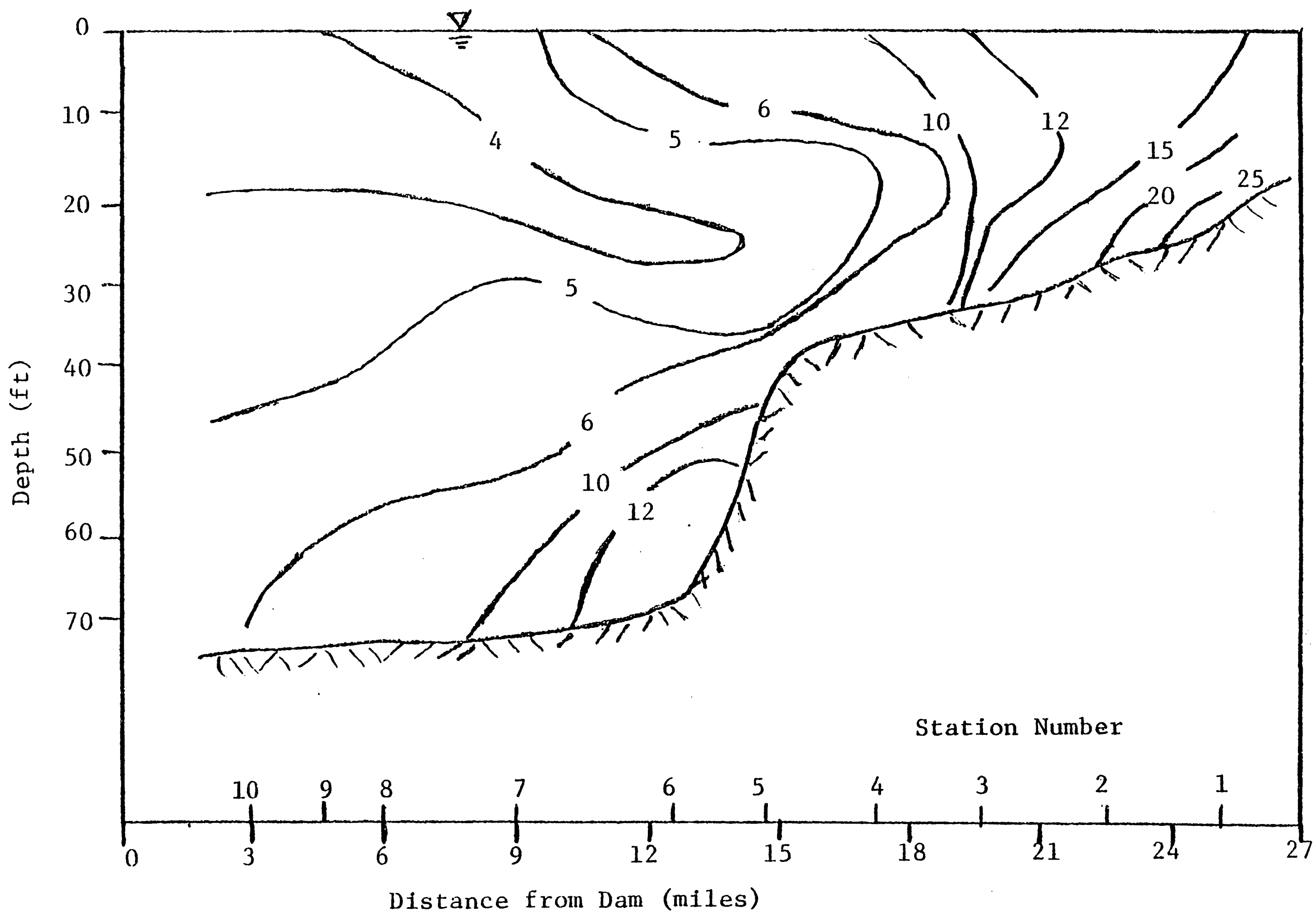


Figure A1. Distribution of Total Suspended Solids (PPM) in John H. Kerr Reservoir - 4/30/81

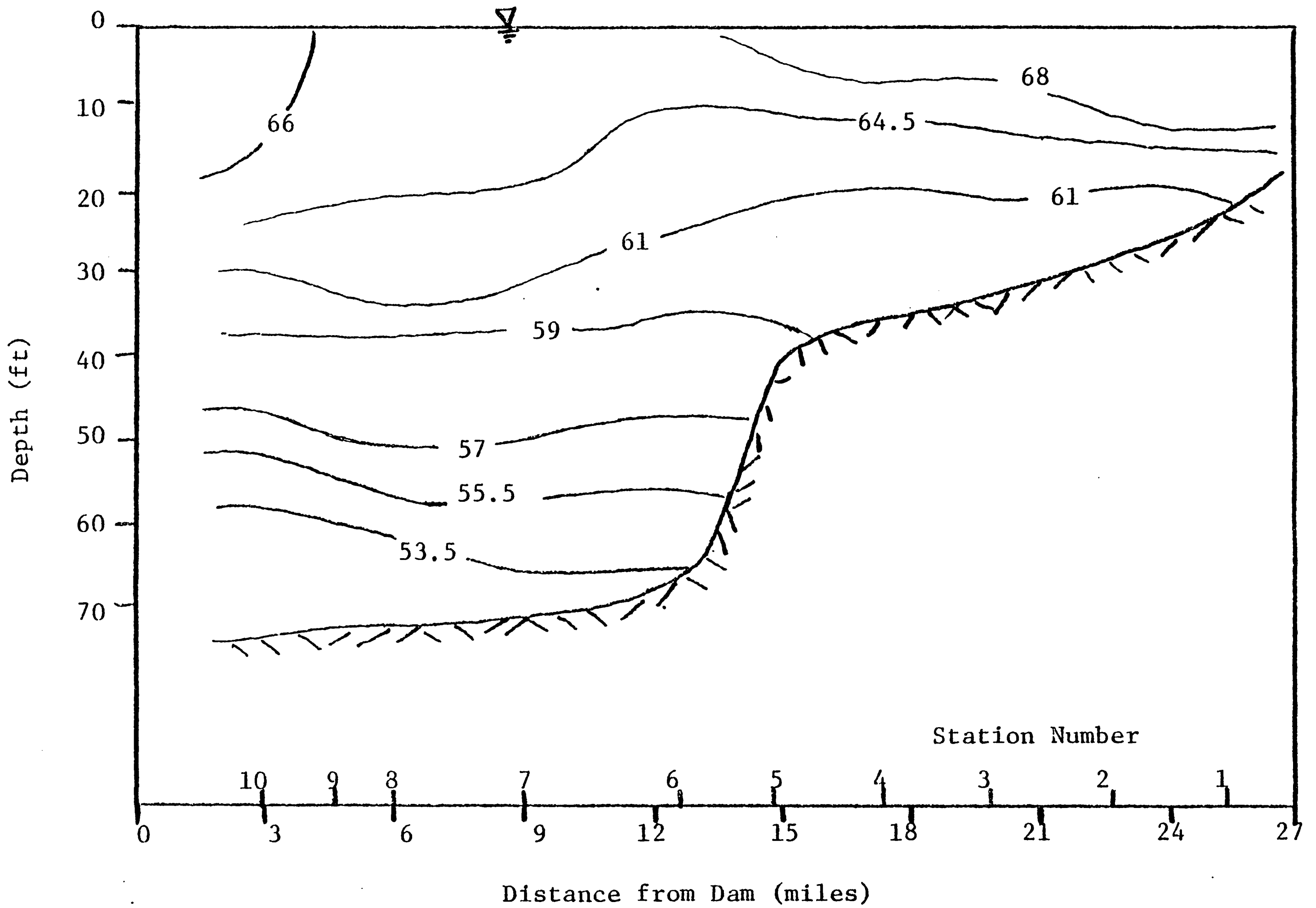


Figure A2 - Temperature Distribution in John H. Kerr Reservoir- 4/30/81

18 May 1981/19 May 1981 (Trip 2)

The average inflow for the week prior to this research trip was 3107 cfs. The sky was overcast both days, with a high air temperature of 64°F (16.8°C) on May 18, and raining with a recorded high of 60°F (15°C) on May 19. The wind was not a major inconvenience; however, on occasion it gusted enough to cause waves in the 1-1 1/2 foot range. The recorded surface water elevation at Kerr Dam was 299.05 ft. on May 18, and 298.77 ft. on May 19.

The inflow sediment distribution at station 2 (buoy 24) indicates a uniform distribution varying between 10 and 13 ppm to a bottom depth of 16 feet. Figure A3 shows that the sediment forms a bottom layer that extends the entire length of the reservoir. This bottom layer forms immediately after station 2, indicating that with extremely low flows such as experienced here, sediment will settle out of suspension very quickly after entering the reservoir. Above the bottom layer the sediment concentration is virtually uniform with values ranging from 4 to 7.5 ppm.

No velocity profile was evident from the data collected; however, as with the April 30 trip, the velocity was much higher at the base of the major vertical drop (station 6). The recorded bottom velocities in this area are twice as high as those recorded on the previous trip. The result of this is that the sediment plume develops much further downstream than on April 30 (see Figure A3).

The temperature distribution was much the same as on April 30, with a recorded high of 70°F (21°C) at the inflow surface, and a measured low of 52°F (11.2°C) at the reservoir bottom at station 9.

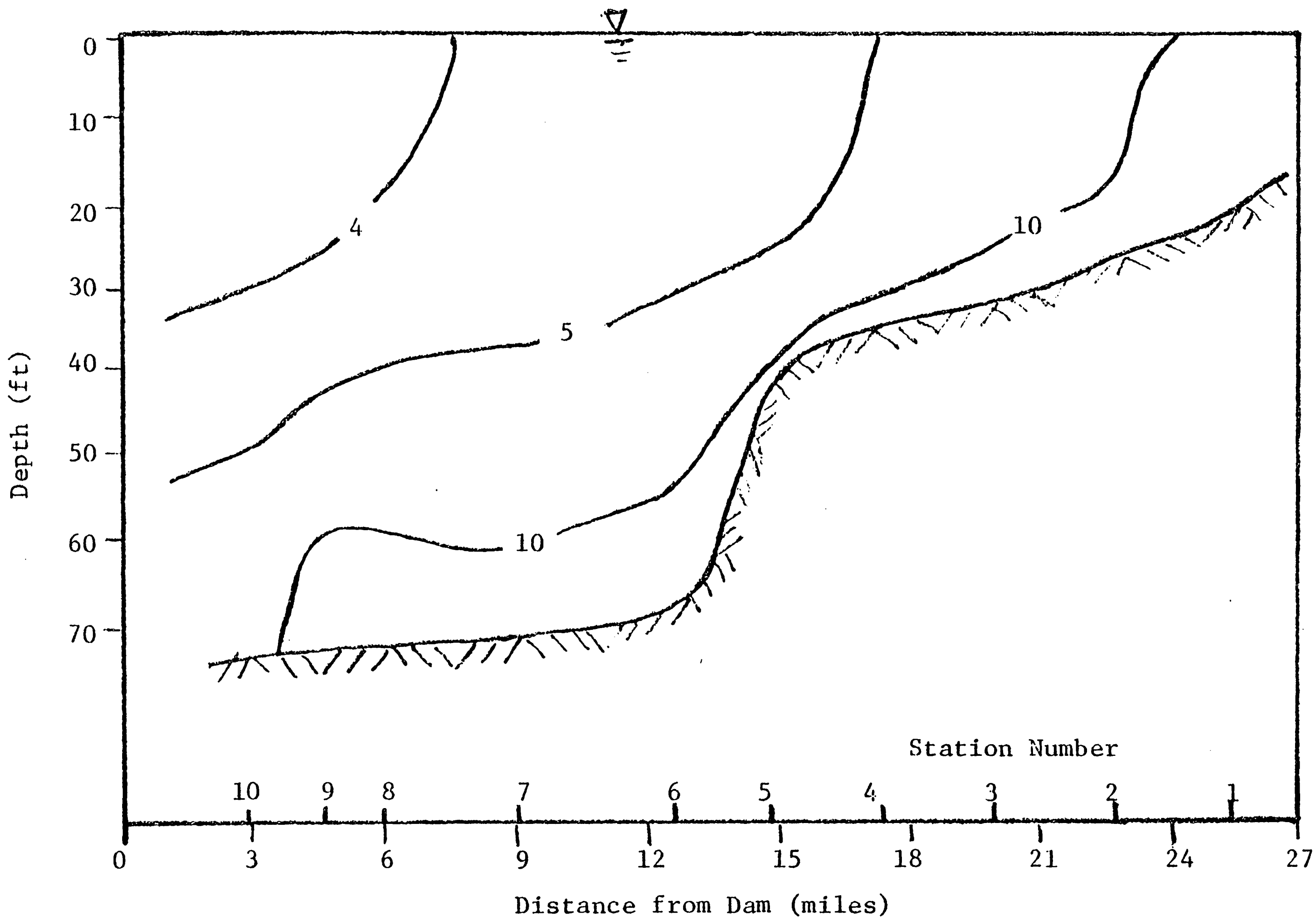


Figure A3 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) -5/18/81

24 June 1981/25 June 1981 (Trip 3)

The average inflow for the week prior to June 24th was extremely low, averaging 1477 cfs. Each of the three days preceding this research trip had an inflow of less than 1000 cfs, with a low of 220 cfs on June 23. The wind was from the Southwest with an average of 10 MPH or less. The recorded low air temperature was 75°F (23.9°C) and the recorded high was 92°F (33.3°C).

For the first time, on this research trip it was decided to locate a station closer to the point where the Dan River and Roanoke River merge. Figure 3.1 shows the location of this station, approximately 1 mile downstream from where the rivers join, referred to from here as station 1.

The sediment distribution was layered as in the previous trip; however, some differences can be noted (see Figure A4). A heavy bottom layer is obvious at stations 1 and 2, but this layer disappears quickly. Another sediment layer (20 ppm) is evident, remaining in suspension for a distance of about 14 miles. Notice that the depth of this layer slowly reduces, until it finally merges with the reservoir bottom. There is evidence of a small plume as was the case with the previous trip; however, this does not extend for too large of a distance. From station 6 downstream to the dam (a distance of approximately 11 miles) the level of suspended sediment remains almost constant, with values ranging from 3.2 ppm to 5.4 ppm.

Figure A5 shows the temperature distribution for this research trip. The temperature contour patterns are much the same as the previous two research trips, only with much higher values. The contours basically run parallel to each other, with a pocket of higher temperature around station 6 (buoy 11). The highest recorded water temperature was 86°F (30°C) and the low was 54.5°F (12.5°C) at the bottom near the dam (see Figure A5).

The measured water velocities provided no logical velocity distribution. Surface velocities ranged from very high to very low. One interesting observation was that the measured velocity near the reservoir bottom was nearly zero at station 6. It is very possible that this is the reason as to why the sediment plume did not extend further downstream towards the dam.

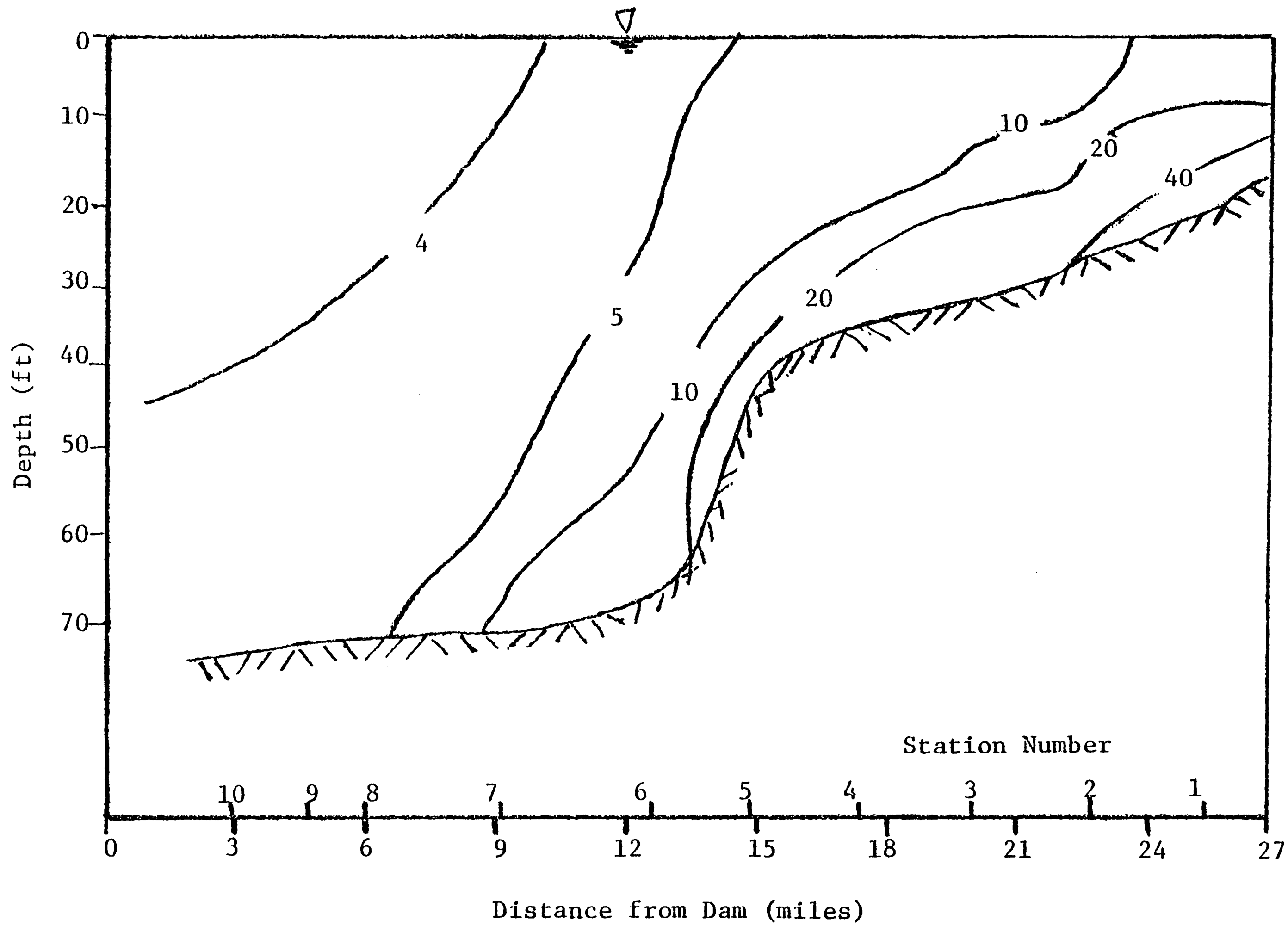


Figure A4 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 6/24/81

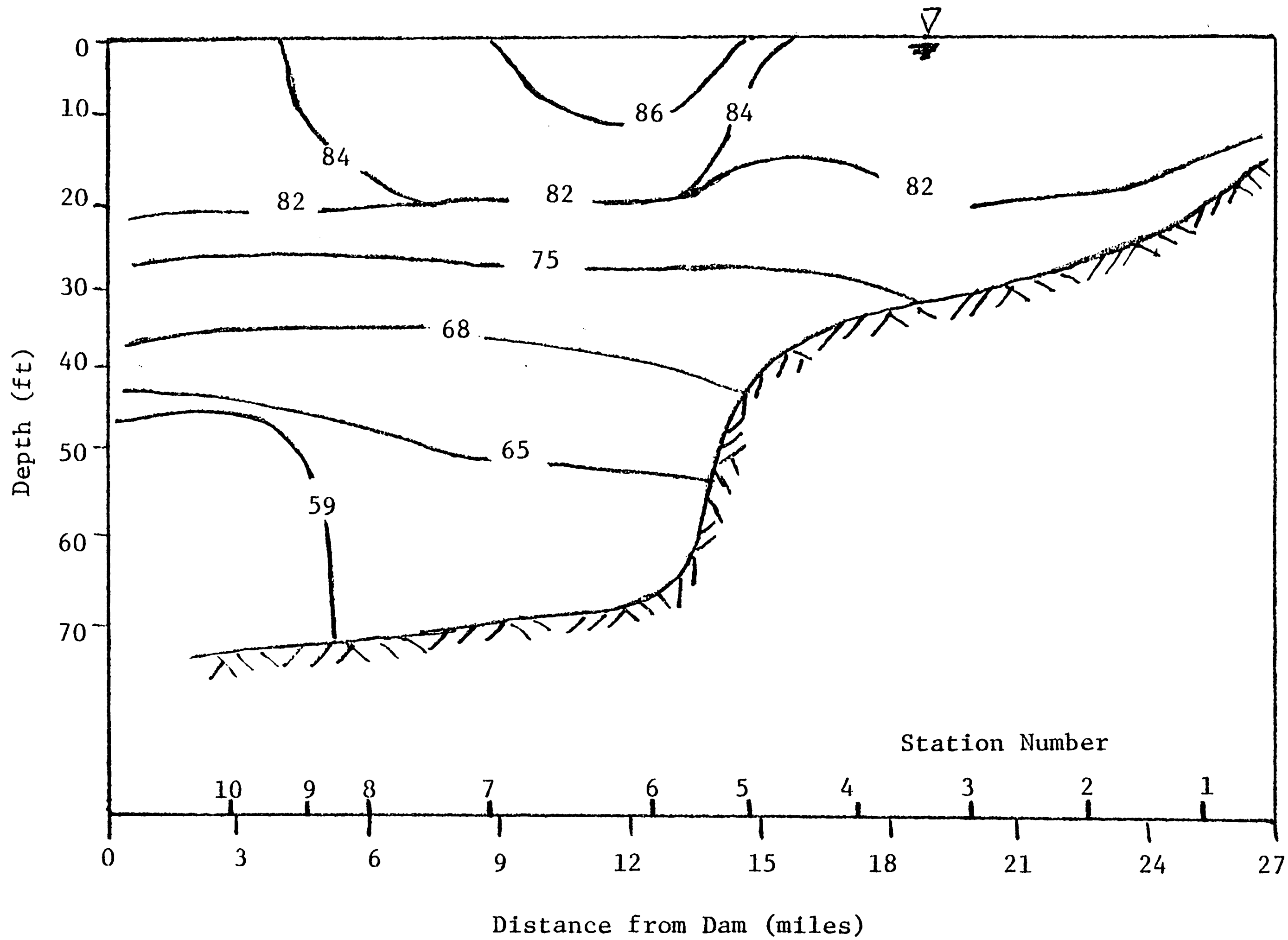


Figure A5 - Temperature Distribution for John H. Kerr Reservoir - 6/24/81

16 Aug 1981/17 Aug. 1981 (Trip 4)

The average inflow for the week prior to August 16, 1981 was 1857 cfs. The wind was nonexistent for the most part, gusting to a recorded high of 9 MPH on Aug. 16. Air temperature varied from a low of 79°F (25.9°C) to a high of 84°F (29.0°C). The recorded water surface elevations at Kerr Dam were 296.22 ft. on Aug 16 and 296.11 ft. on Aug. 17.

On this research trip bouy 18 could not be located. This buoy corresponds to station 4. An attempt was made to take readings at the approximate location of the missing bouy, but as can be seen in Appendix D, the data obtained did not seem to match the other reservoir data. The conditions in a reservoir can be vastly different from point to point, thus it was decided to neglect the station 4 data for this trip.

As with the two previous research trips, the sediment inflow is layered. Figure A6 shows that a heavy pocket of sediment was evident at the entrance to Kerr Reservoir. The sediment contour lines decrease in value rapidly in the direction of Kerr Dam. A small pocket of turbidity is evident at station 6. Notice that the highest value at this location is not on the bottom, but suspended above the bottom by several feet. This corresponds to high velocities that were measured at this location. However, at the next station very small velocity readings were taken, indicating an area of uplift around station 6. This type of uplift could easily cause turbulent conditions, raising some sediment off of the bottom.

The temperature distribution is as expected for this time of year. The surface temperature is almost uniform throughout the reservoir varying between 82°F-84°F (28.2°C-28.9°C). At each station the temperature dropped slightly in a semi-linear fashion, with a bigger drop near the bottom (see Appendix D). The lowest recorded water temperature for this trip was 64.4°F (18.0°C).

Once again there was no velocity distribution pattern evident on this research trip. Two extremely large surface velocities were recorded, 27 ft/min at station 7 and 25 ft/min at station 5.

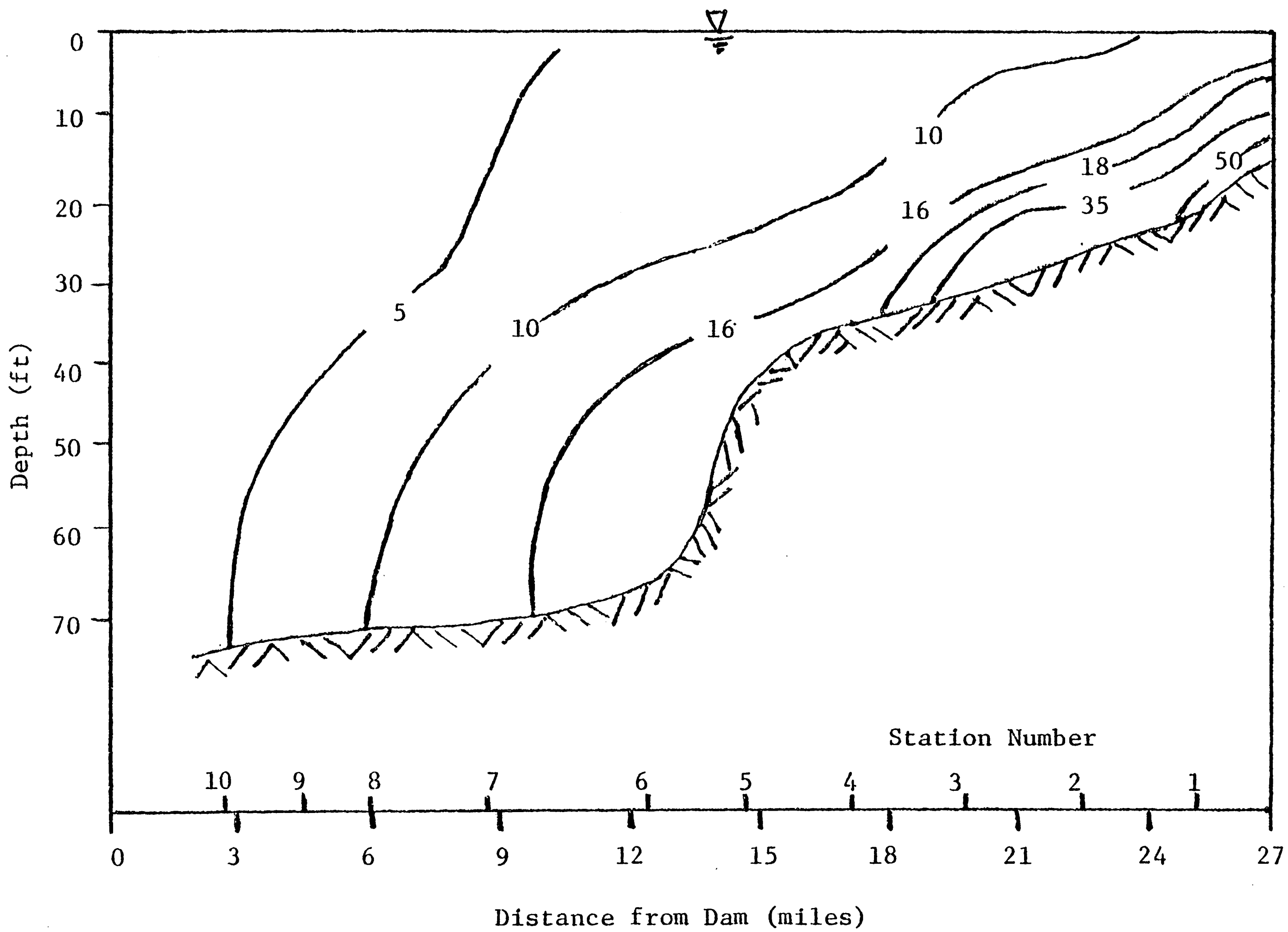


Figure A6 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 8/16/81

3 Sept. 1981/4 Sept. 1981 (Trip 5)

The inflow for the week previous to this trip was very low with an average value of 994 cfs. During the 2 day research trip the wind varied between 0 and 10 MPH. The reservoir elevation at John H. Kerr Dam was recorded as 295.04 ft. on September 3, and 294.97 ft. on Sept. 5.

Once again the sediment contour lines were very evident for this trip (see Figure A7). The sediment load at the entrance to Kerr Reservoir was uniform with depth; however, the data shows that the sediment load plunges at about station 4 (buoy 18). At this location the sediment values reduce by 50%. A sediment plume is obvious; however, there is no evidence of high bottom velocities near station 6 (buoy 11). The sediment plume was much wider for this trip than any of the previous research trips. This could be a result of the fact that the bottom ten feet of water at station 5 (buoy 15) had extremely high velocities for the location (approximately 13 ft/min).

The velocity distribution indicated high surface velocities along the entire length of Kerr Reservoir. At points these high velocities continued to a depth of 10 feet (3 m). In general (except for station 5) the velocities decreased in the direction of the reservoir bottom as would be expected under these conditions.

A nearly uniform temperature of 80.6°F (27°C) existed along the surface of the entire reservoir. A uniform temperature with depth existed for the first 5 stations (a distance of approximately 6.5 miles) to a depth of 25 feet. At this depth the temperature reduced gradually with vertical distance. The measured low was 69.4°F (20.8°C) at a depth of 56 feet near the dam.

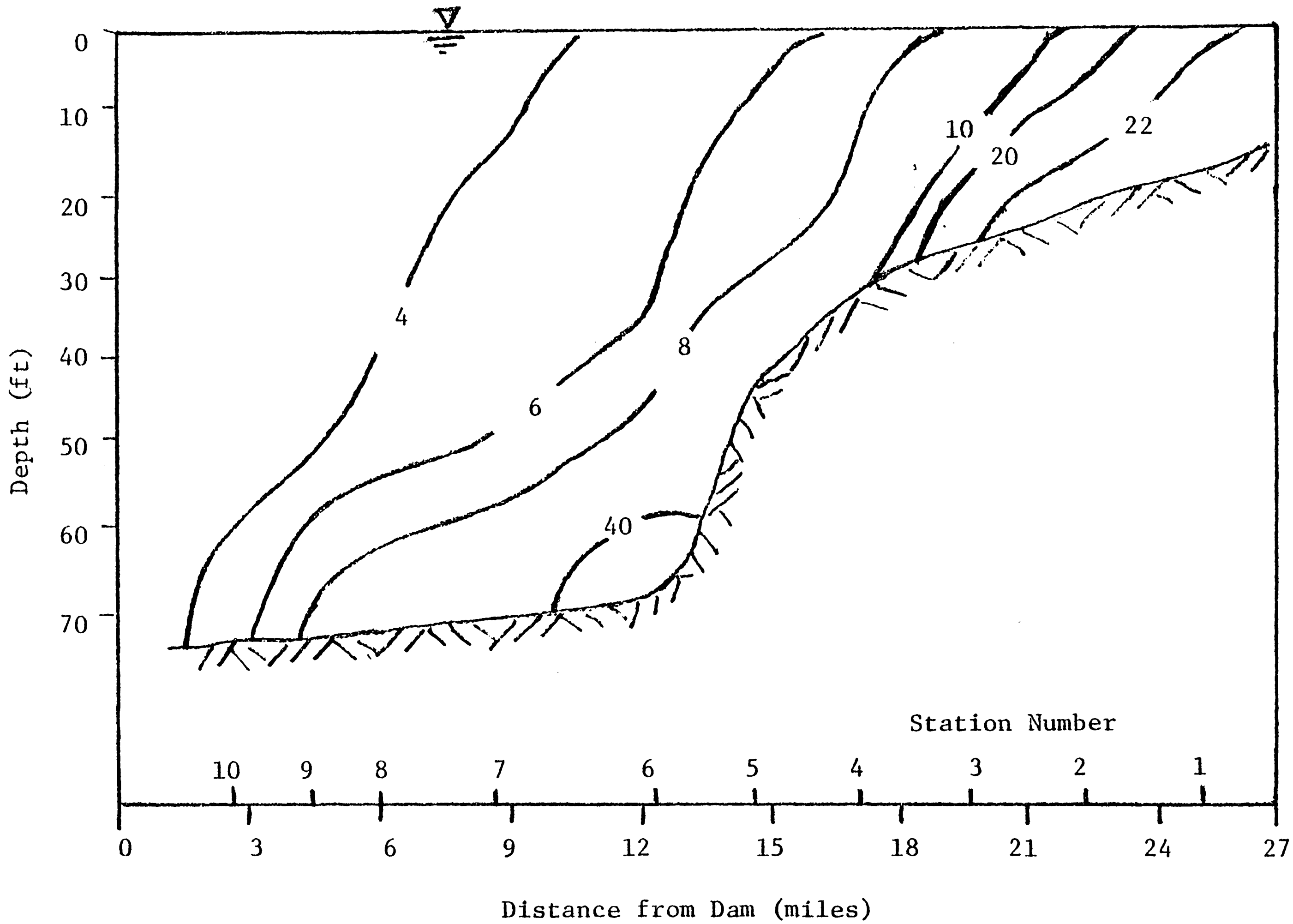


Figure A7 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 9/3/81

8 Oct 1981/9 Oct 1981 (Trip 6)

On this research trip all readings were performed at several locations perpendicular to the axis of the reservoir at each station. This procedure was performed until uniform conditions were found to exist. This procedure provided a good cross-sectional look at the way sediment acts after the major tributary enters the ponded water. The results of these efforts can be found in Appendix B.

The sky was overcast for a good portion of this trip, with some precipitation falling. Winds rose to 15 MPH and gusted at higher speeds. The air temperature hovered near 61°F (16°C). Average inflow for the week prior to October 8 was 1150 cfs. During this week on four different days total inflow was less than 1000 cfs. The recorded inflow on Oct. 8, was 850 cfs. The recorded elevation at Kerr Dam was 294,36 ft. on Oct. 8, and 294.18 ft. on Oct. 9.

The sediment distribution pattern for this trip can be seen in Figure A8. Once again the familiar contour layers are evident. However, like the very first research trip on April 30, 1981, after the original sediment plunging action, the contours no longer run parallel to the reservoir bottom, but instead turn back towards the dam near the surface. No apparent reason could be found for this type of sediment contours. The surface velocities were relatively high along the entire length of the reservoir; however, the contours alter in shape while the surface velocities remain approximately uniform.

The temperature distribution should not affect the sediment distribution in this case, because, as can be seen in Figure A9, the temperature is completely uniform for the 16 miles closest to the dam. Note the near vertical contour lines. This is indicative of the colder water inflow merging with the warmer reservoir water. It should be noted that the horizontal temperature patterns at the entrance to Kerr Reservoir disappear almost immediately, indicating a mixing process is occurring.

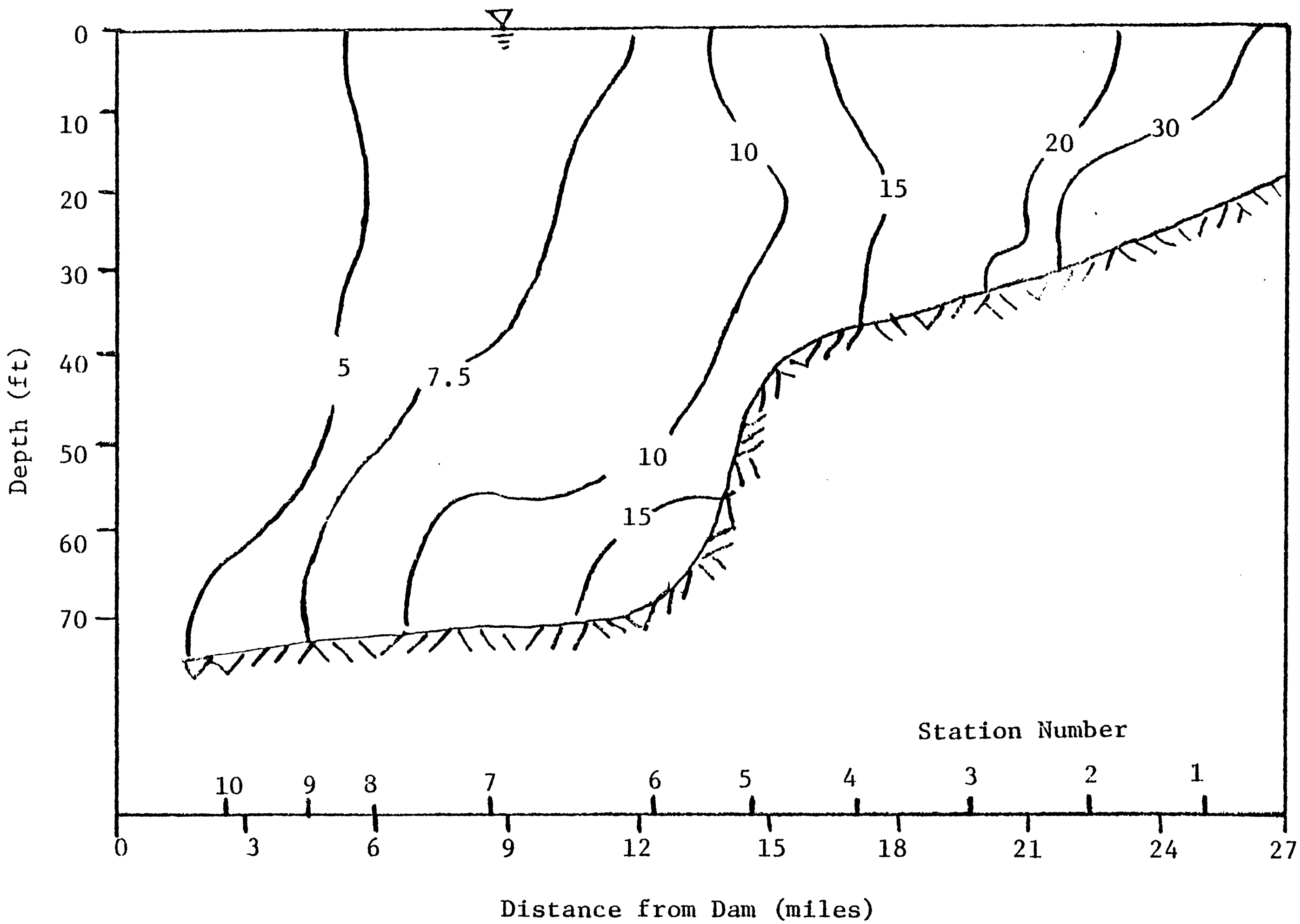


Figure A8 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 10/8/81

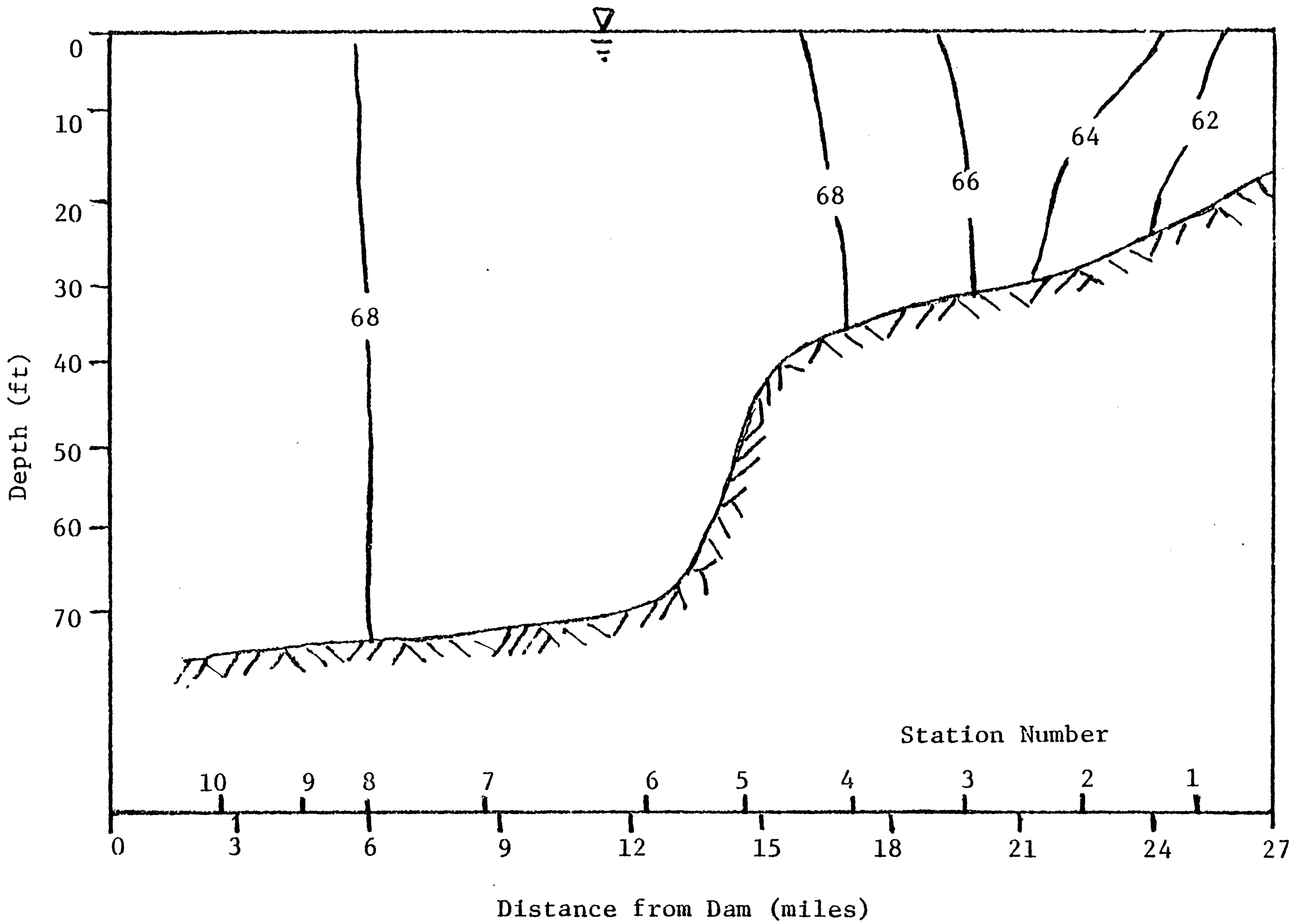


Figure A9 - Temperature Distribution in John H. Kerr Reservoir - 10/8/81

3 Dec 1981 (Trip 8)

The average inflow for the week previous to this research trip was 2042 cfs. Air temperature reached a high of 53°F (12°C), with the wind varying from 0-10 MPH. THe sky was overcast, with rainfall occurring sporadically throughout the day. Extreme conditions led to the canceling of data collection efforts on Dec. 4, 1981. Because of this, data was only obtained from station 1 through station 9 (buoy 5).

As can be seen in Figure A10 this trip provides a unique sediment distribution. The upper portion of the reservoir has the normal layered sediment distribution. However, near the middle of the reservoir there exists a large pocket of clear water. Surrounding this pocket of clear water is a heavier concentration of sediment that extended as far as the sampling was carried out. This sediment distribution is like the others in that there exists a definite density current running along the reservoir bottom.

The temperature distribution for this day is indicative of the time of year. At each station the temperature is uniform with depth (see Figure A11). The water flowing into Kerr Reservoir is the coldest, with each successive station having slightly warmer water. The highest temperature was 52°F (11.3°C) at station 9 (buoy 5).

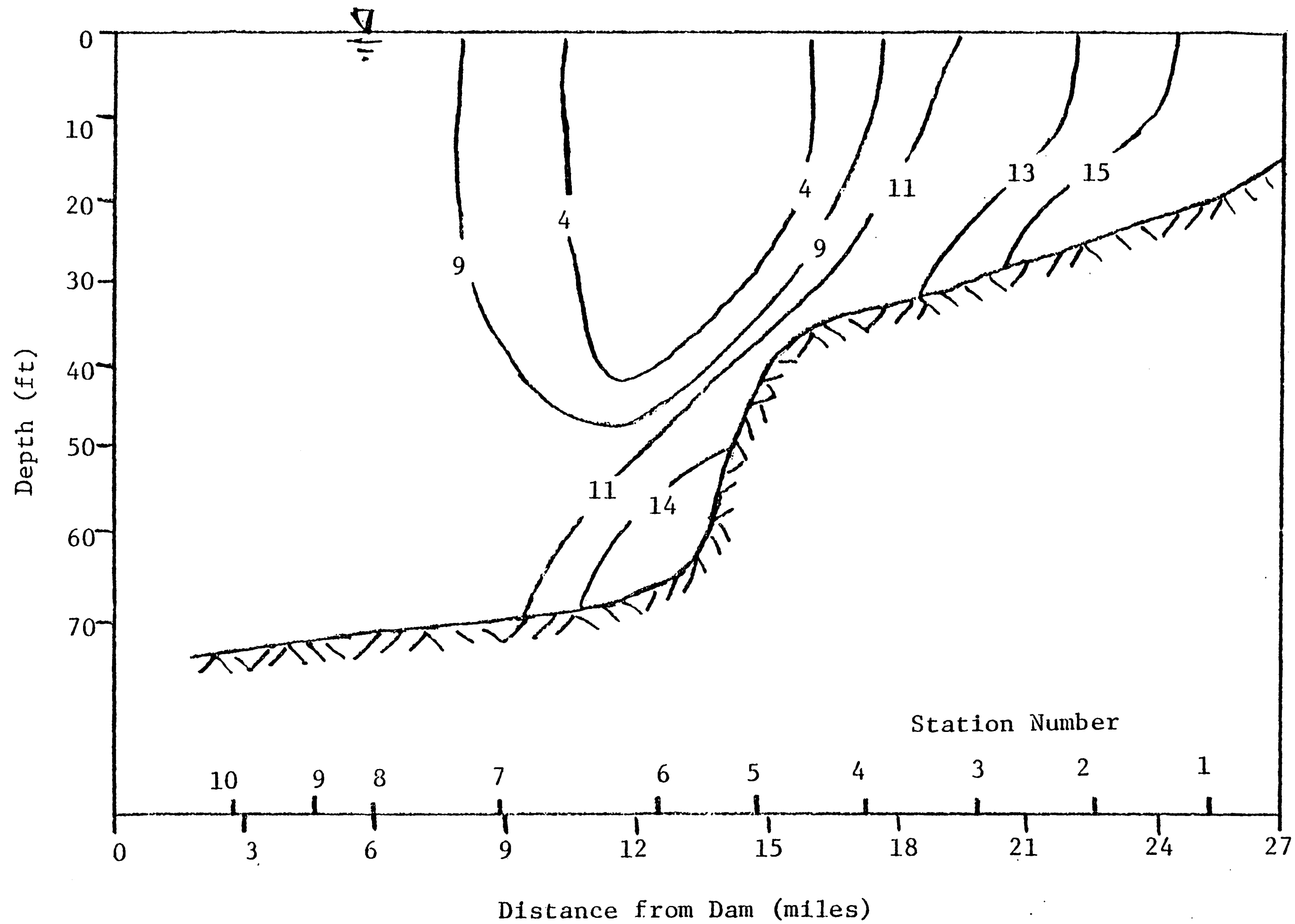


Figure A10 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 12/3/81

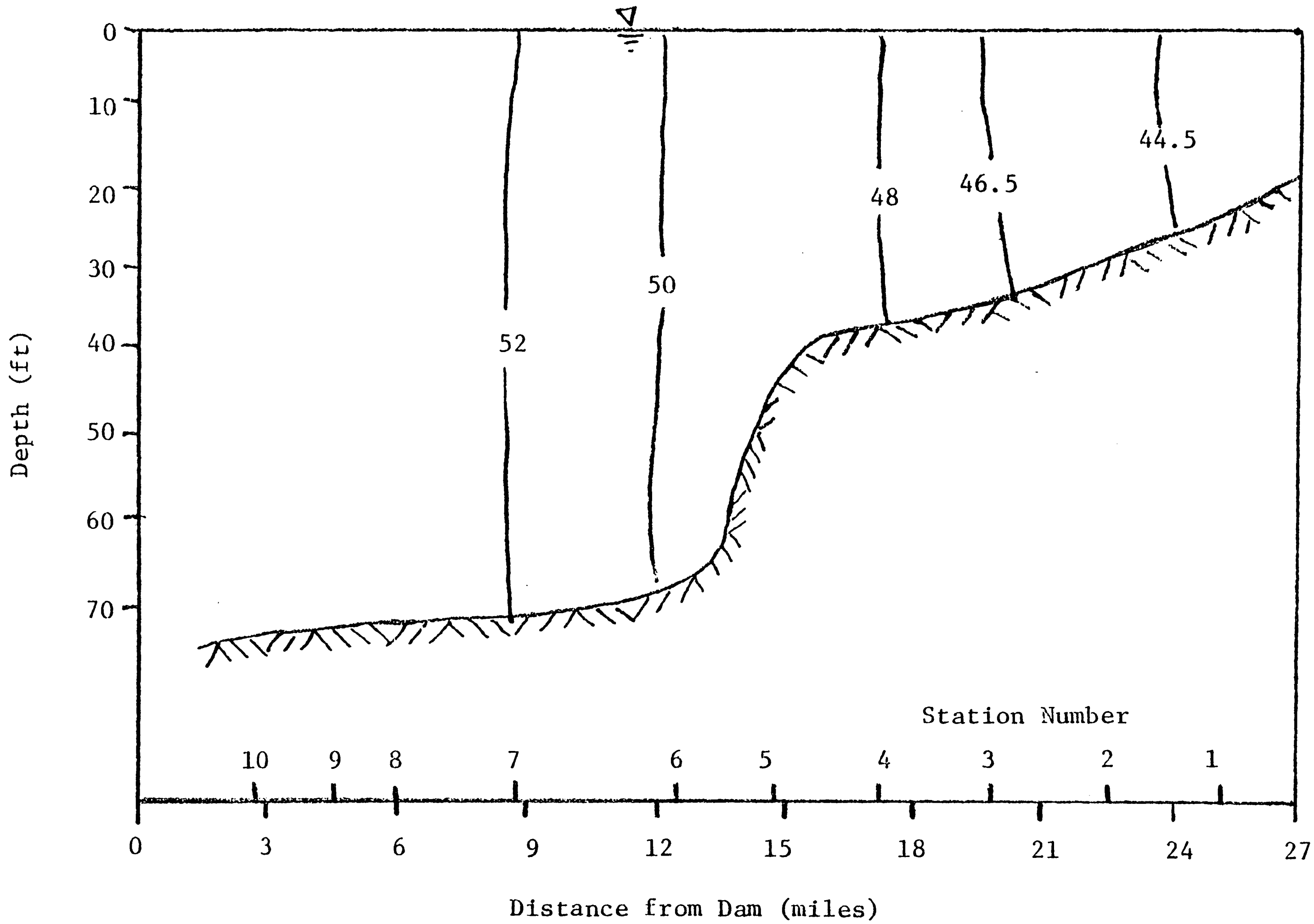


Figure A11 - Temperature Distribution in John H. Kerr Reservoir - 12/3/81

12 Feb 1982/13 Feb 1982 (Trip 9)

The average inflow for the week previous to this trip was 18,215 cfs. However, this value is due largely to a major storm that occurred during the week of Feb. 1-7. During this period average inflow was 27,100 cfs, and on Feb. 5 the recorded inflow was 51,527 cfs, approximately 50% of the highest recorded flow since the construction of Kerr Reservoir. Because of the high inflow this trip offered a good opportunity to study the sediment patterns of a reservoir under severe conditions. It must be noted that the reservoir water was extremely murky and debris was floating everywhere. Also, this trip was the only time during the duration of the research project that the transmissometer needed to use a 10 cm path length to measure turbidity.

To properly investigate the sediment distribution after severe flooding the inflow prior to the measurements must be studied in detail. The inflow for the month of February prior to this research trip is as follows:

Day	Inflow (cfs)
Feb 1	9,131
Feb 2	12,439
Feb 3	27,018
Feb 4	45,397
Feb 5	51,527
Feb 6	31,099
Feb 7	13,190
Feb 8	7,681
Feb 9	8,507
Feb 10	7,532
Feb 11	7,972
Feb 12	4,985

It is apparent that the most severe flooding took place a week prior to the turbidity values represented in Figure A12. For the four days prior to this trip the inflow approximately equaled the historical average for the Roanoke River.

Assuming that sediment flow is linearly proportional to the water flow (although it is known that this is not the case), then a flow of 31,099 cfs would carry about 6 times the sediment that 4,985 cfs would carry (the inflow for Feb. 12). Similarly, on February 5 over ten times the amount of sediment carried on Feb. 12 should flow into the reservoir. This extreme difference in values is not in evidence in Figure A12, indicating that a large percentage of the sediment settled out of suspension.

The initial lower values for the upper reaches of Kerr Reservoir represent low flow turbidity readings. Then a large pocket of extremely high concentration represents a large portion of the sediment brought in during the flood of the previous week. Closer to the dam the sediment has had a chance to settle out of suspension. The sluice gates were obviously creating a bottom current that was moving the sediment along the reservoir bottom. Most probably, as time progressed, this pocket of turbidity shrank in size, keeping the same approximate shape as is evidenced in Figure A12.

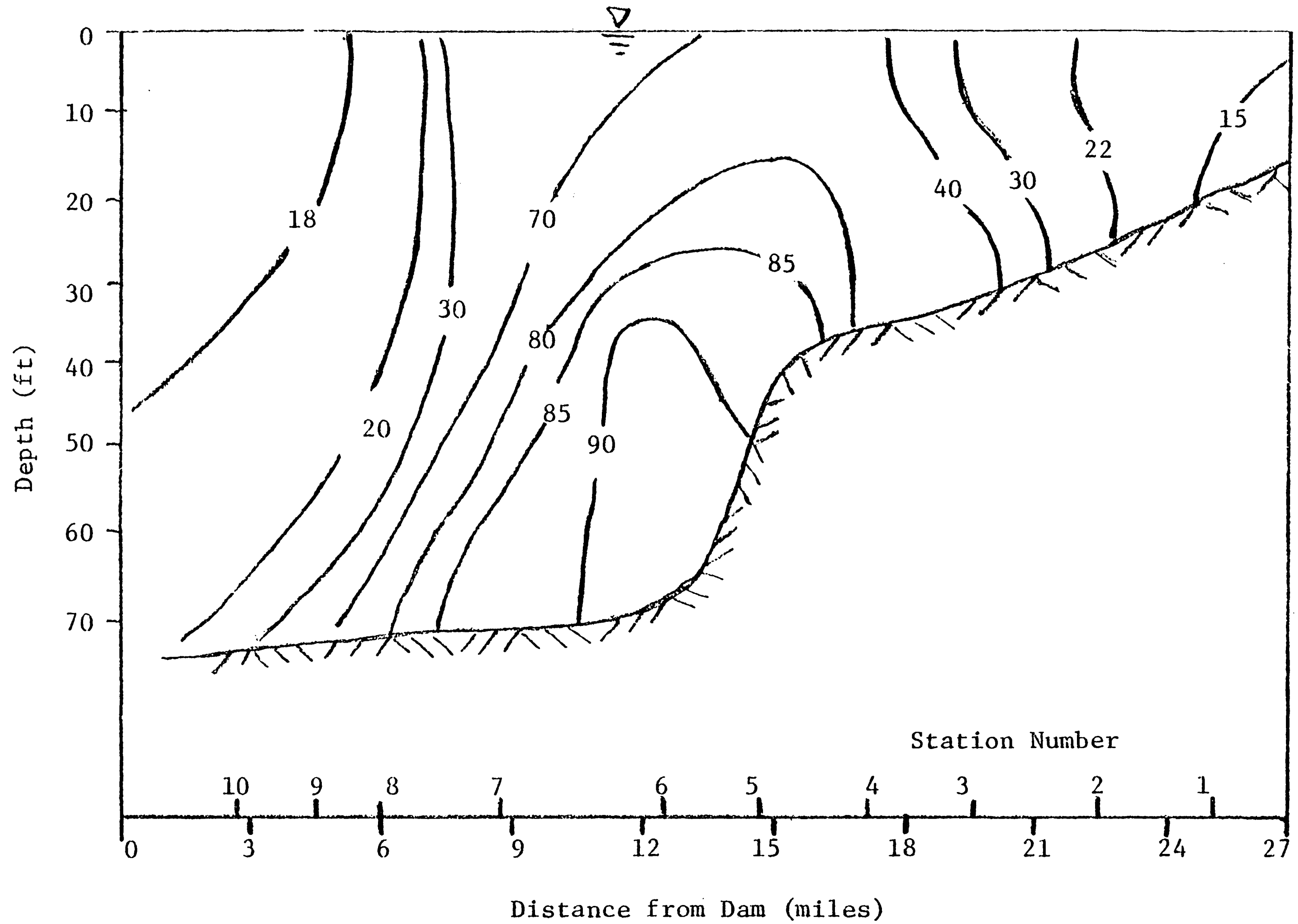


Figure A12 - Distribution of Total Suspended Sediment in John H. Kerr Reservoir (PPM) - 2/12/82

3 March 1982/4 March 1982 (Trip 10)

The weather for this trip was moderate. The inflow for the previous week was slightly below normal with an average of 6,700 cfs. The reservoir level was recorded as 299.41 ft. on March 3 and 4.

As can be seen from the data tabulated for this trip in Appendix D a uniform sediment existed over the entire length of the reservoir. Almost all of the recorded values vary between 20 and 26 ppm.

APPENDIX B

AN ANALYSIS OF THE LATERAL DISTRIBUTION OF SUSPENDED SEDIMENT IN JOHN H. KERR RESERVOIR FOR OCTOBER 8, 1981.

As discussed in Appendix A, on October 8, 1981 the VPI&SU research team collected data laterally at each station, obtaining a cross sectional distribution of suspended sediment. This was done to provide a look at how the sediment behaves once the main tributaries have entered into the pond waters of a reservoir.

Also discussed in Appendix A is the fact that extremely low flows occurred prior to this research trip. Average inflow for the week prior to October 8 was 1150 cfs. During the week on four different days the inflow fell below 1000 cfs, or approximately 12% of the historical average flow into Kerr Reservoir. On October 8 the inflow was recorded at 850 cfs, and the water surface elevation was 294.36 ft.

Figures B1 through B7 show the lateral distribution of total suspended sediment from stations 1 through 6 for this date. At station 7 the values were so uniform at each of the locations tested that it was felt there was no need to continue the lateral sampling.

It should be noted in Figure B1 that near the north shore (where the Roanoke River merges into the reservoir), 27% more suspended sediment is present. As Table 6 in the body of this text indicates, historically the Dan River has carried 27.2% more sediment.

By the time the sediment reaches station 2; however, the reservoir seems to have undergone considerable mixing action, resulting in an almost uniform lateral sediment distribution. This trend continued until the lateral testing was discontinued. It should be noted that at station 7 the total suspended sediment values were practically identical, even though the location where the samples were taken were very far apart, as well as in different valleys.

The bottom contours shown in Figures 1 through 7 are taken from the U.S. Army Corps of Engineers 1976 resurvey. It is clearly observed that at some of the cross sections the VPI&SU research teams values for bottom depths do not correspond with the values given in the Corps data. This is due to the fact that no electronic equipment was available for the VPI&SU team, thus more conventional means were utilized. This fact, together with the amount of data needed and the strict guidelines necessary in dealing with the NASA Landsat allowed little room for error in judging the bottom contours correctly. When errors were made in locating the bottom channels an attempt was made to compensate; however, on occasion there was not adequate time for complete satisfaction along these lines.

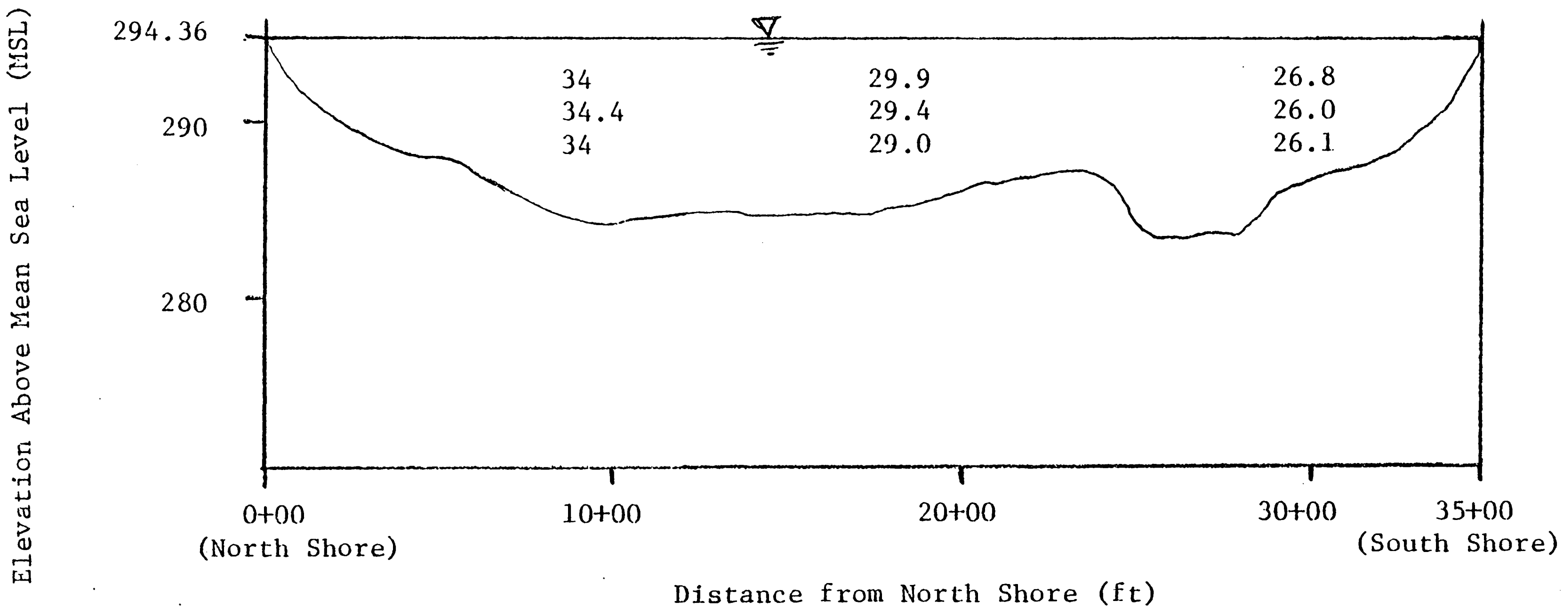


Figure B1 - Lateral Distribution of Total Suspended Sediment, Station 1 - 10/8/81

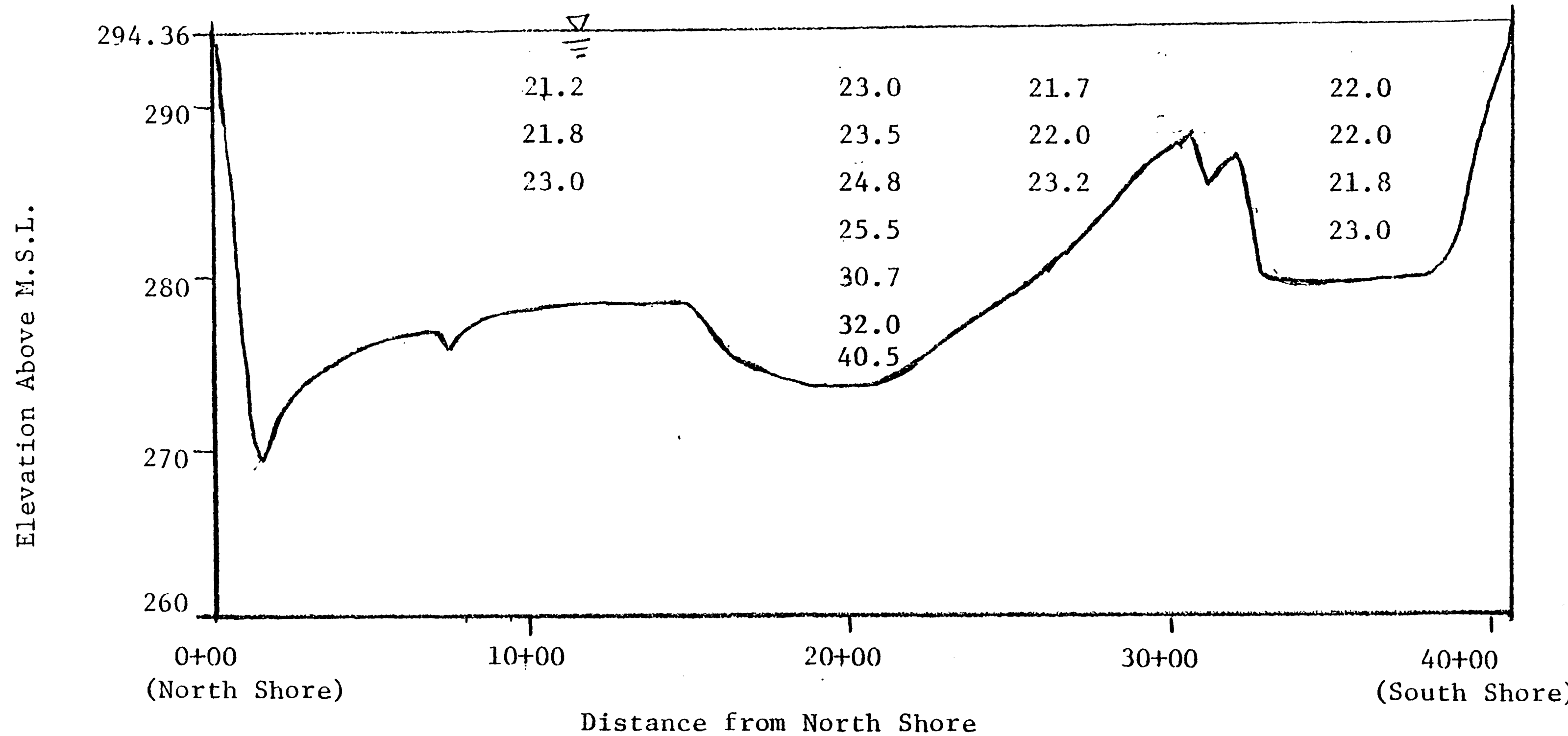


Figure B2 - Lateral Distribution of Total Suspended Sediment, Station 2 - 10/8/81

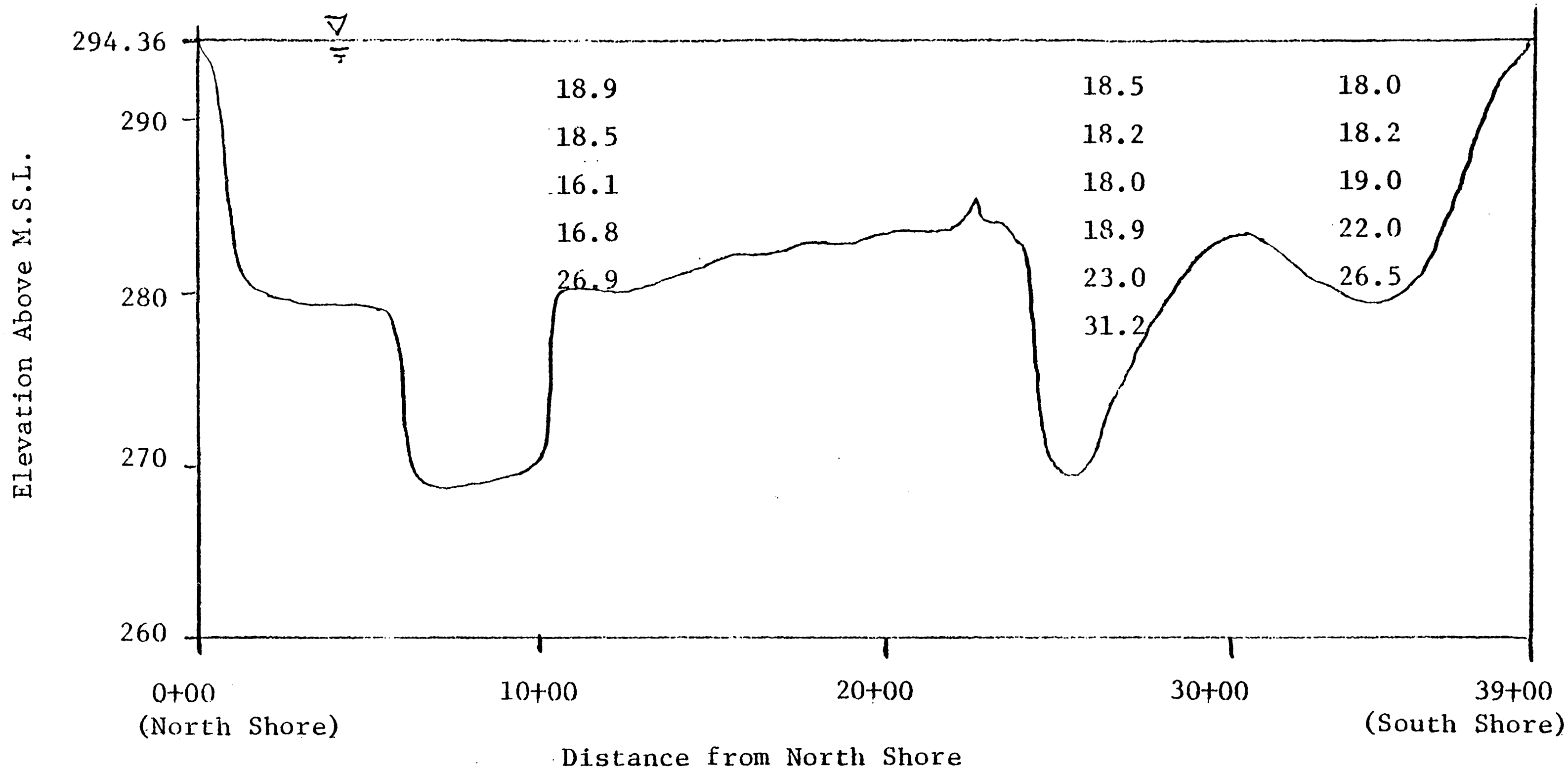


Figure B3 - Lateral Distribution of Total Suspended Sediment, Station 3 - 10/8/81

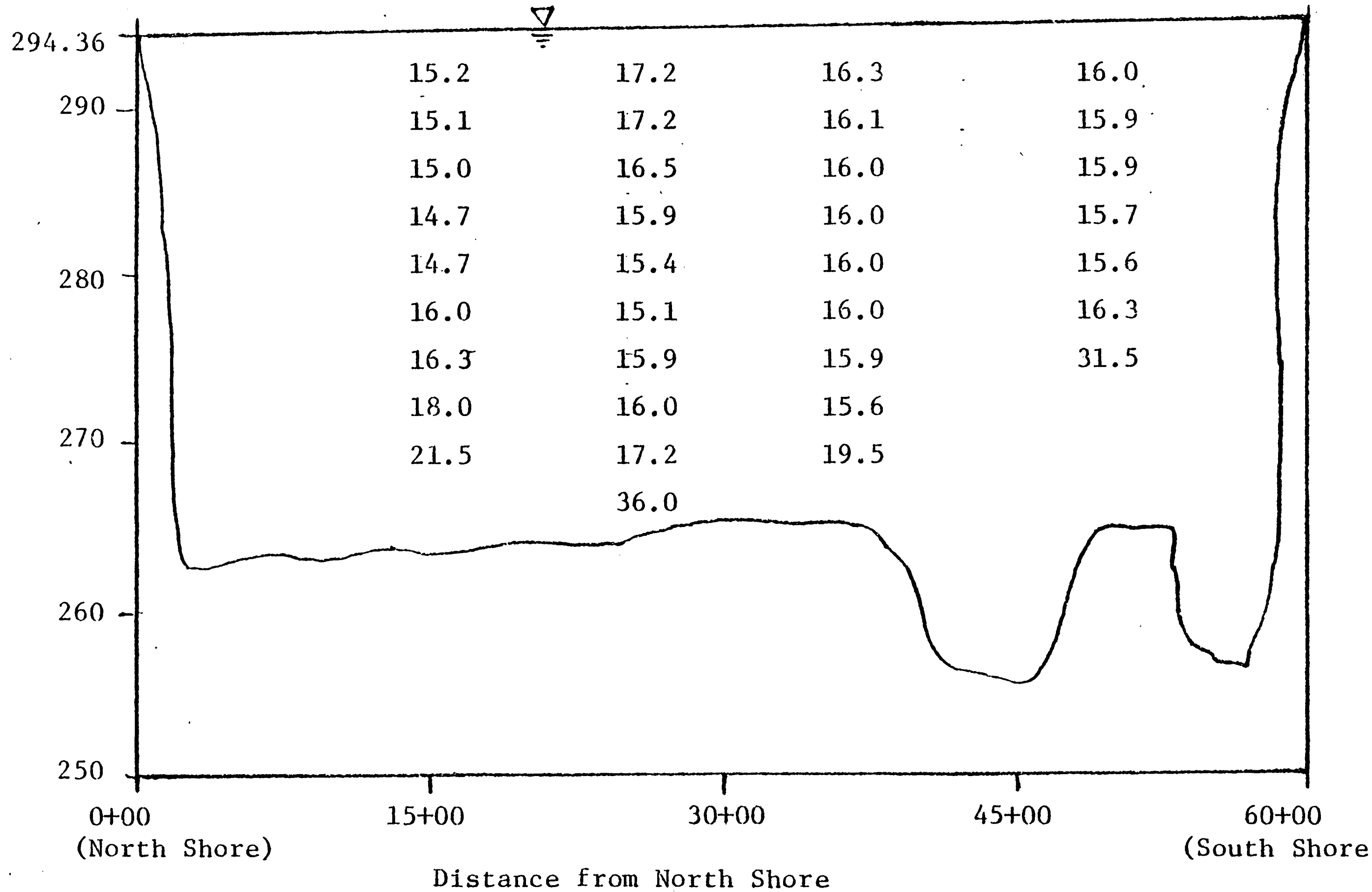


Figure B4 - Lateral Distribution of Total Suspended Sediment, Station 4 - 10/8/81

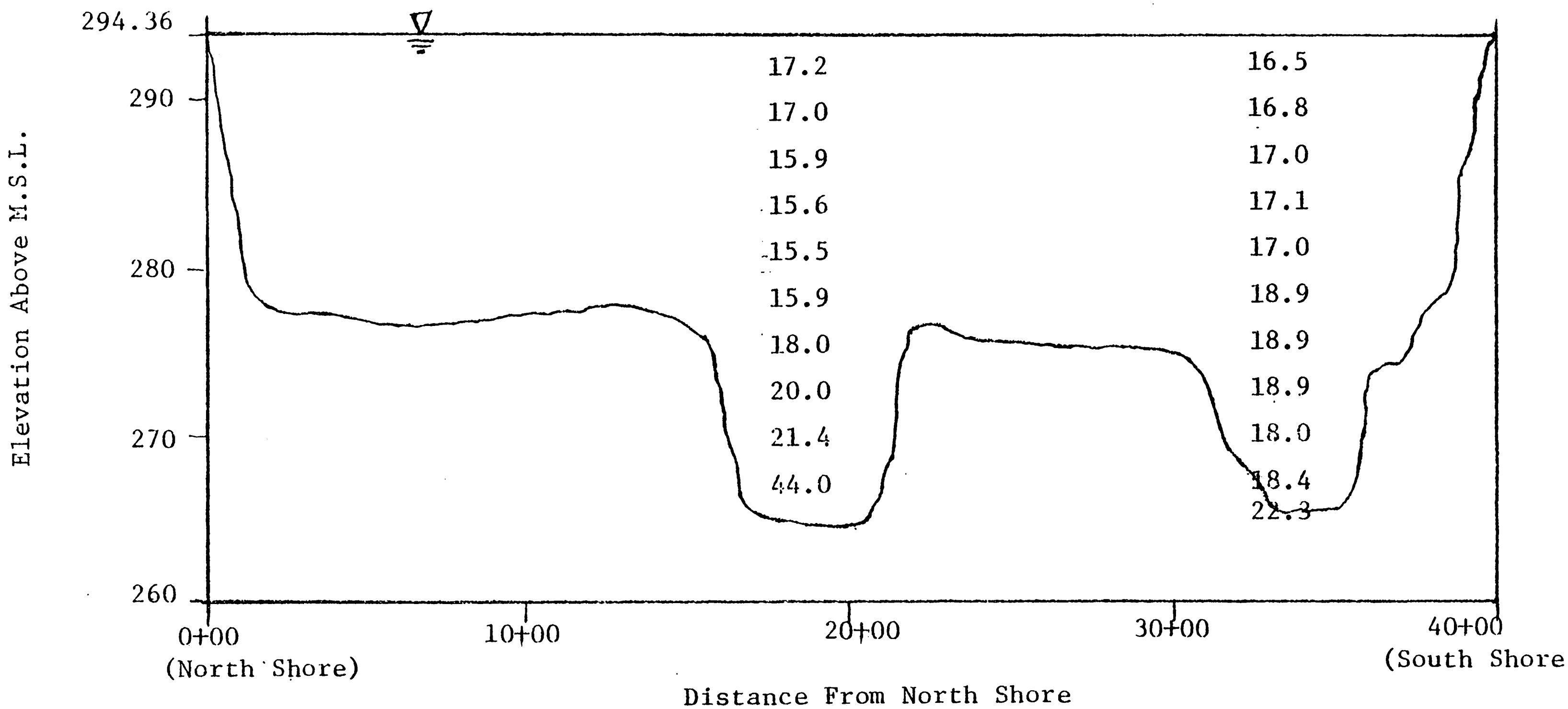


Figure B5 - Lateral Distribution of Suspended Sediment, Station 5 - 10/8/81

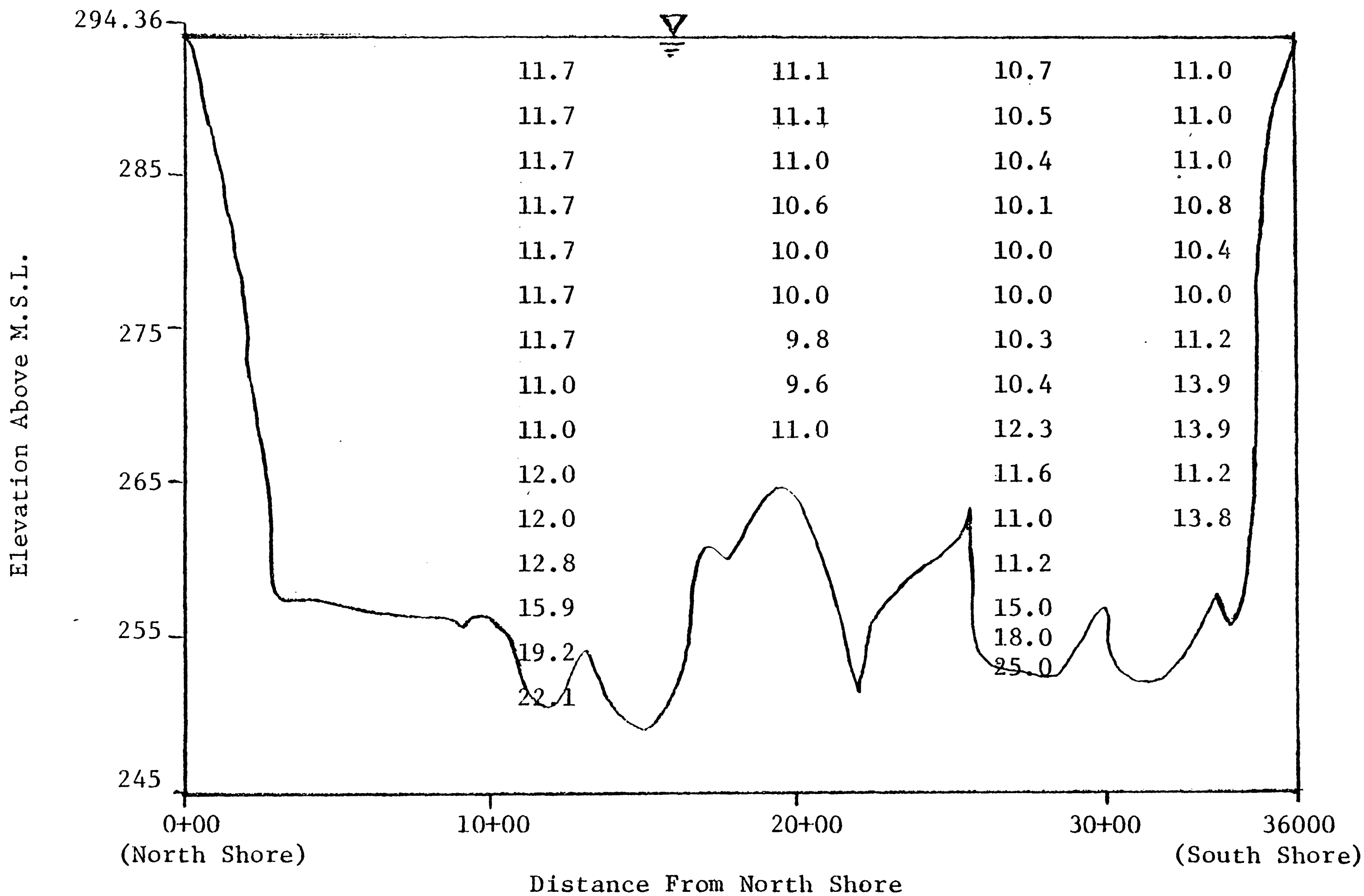


Figure B6 - Lateral Distribution of Total Suspended Sediment, Station 6 - 10/8/81

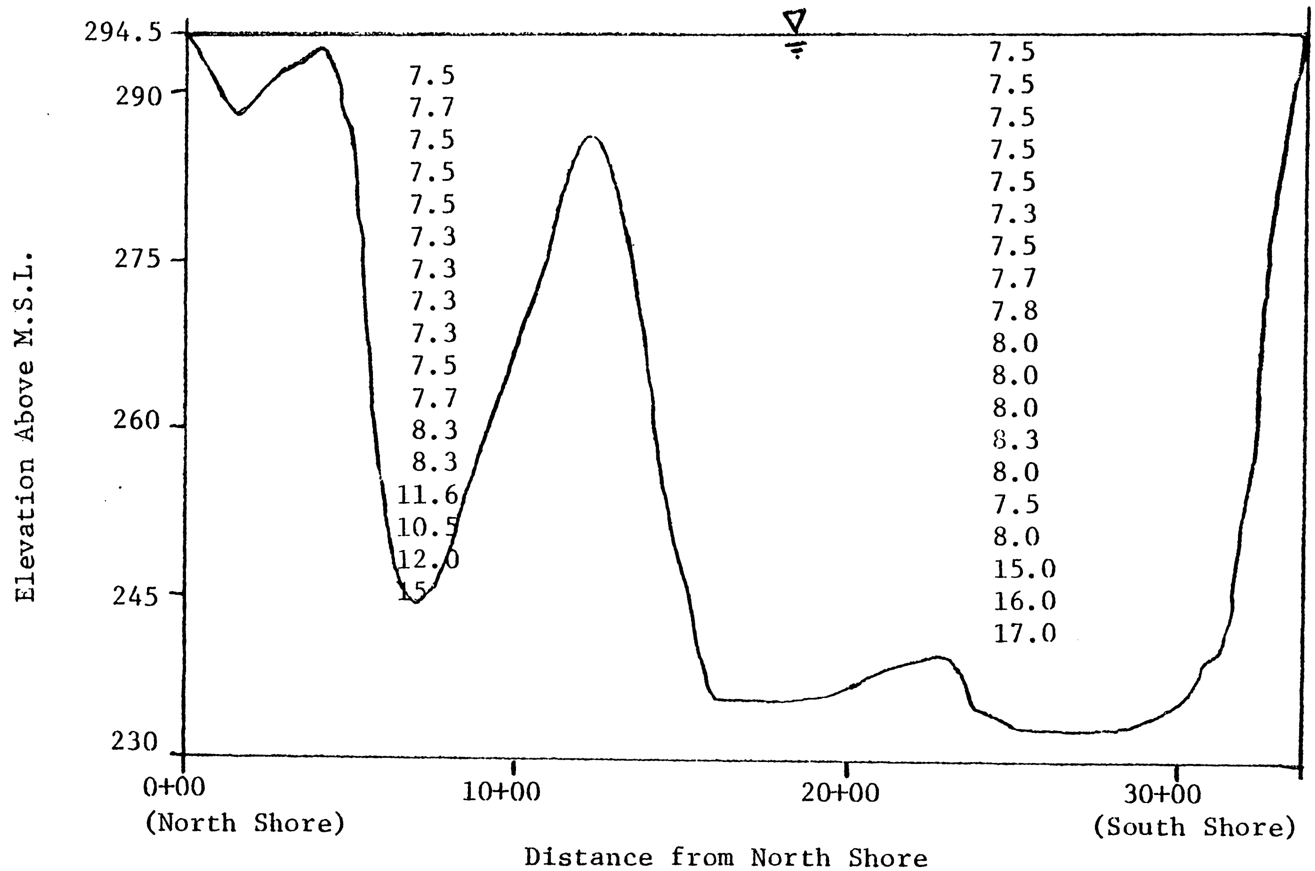


Figure B7 - Lateral Distribution of Total Suspended Sediment, Station 7 - 10/9/81

APPENDIX C

Appendix C consists of an analysis of the behavior of sediment at each station that was monitored by the VPI&SU research team. All of the data collected at each station is compared, and the similarities and differences are discussed. The accompanying figures and discussion list the trips by numbers instead of dates; therefore, the following list is included for the readers' convenience.

TRIP 1 = 30 April 1981, 1 May 1981

TRIP 2 = 18 May 1981, 19 May 1981

TRIP 3 = 24 June 1981, 25 June 1981

TRIP 4 = 16 Aug. 1981, 17 Aug. 1981

TRIP 5 = 3 Sept. 1981, 4 Sept. 1981

TRIP 6 = 8 Oct. 1981, 9 Oct. 1981

TRIP 7 - No values due to equipment malfunction.

TRIP 8 = 3 Dec. 1981

TRIP 9 = 12 Feb. 1982, 13 Feb. 1982

TRIP 10 = 3 March 1982, 4 March 1982

STATION 1 (BUOY 100)

As indicated in Appendix A, monitoring of suspended sediment concentration was not initiated until the third research trip. The remaining trips indicate mostly uniform suspended sediment concentration with depth, varying between 13 ppm (trip 8) and 30 ppm (trip 6). On two occasions (trips 3 and 5) the distribution showed extremely heavy bottom concentrations. This could be a result of the transmissometer coming in contact with the reservoir bottom. When this occurred, another reading was taken after a short period of time. However, the sediment may have still been in suspension when this second reading was taken.

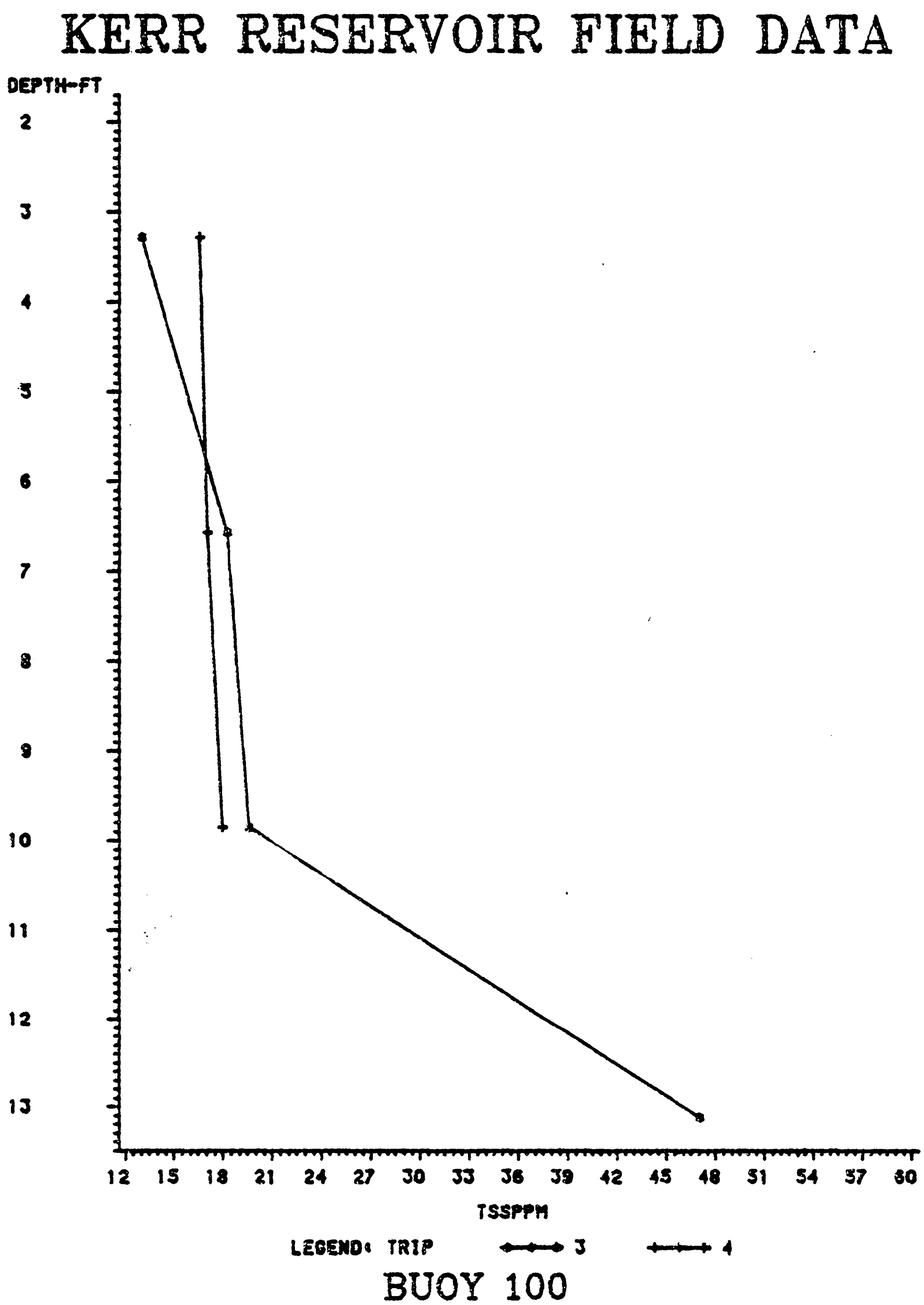


Figure C1 - Measured Values of Total Suspended Solids (PPM) for Station 1

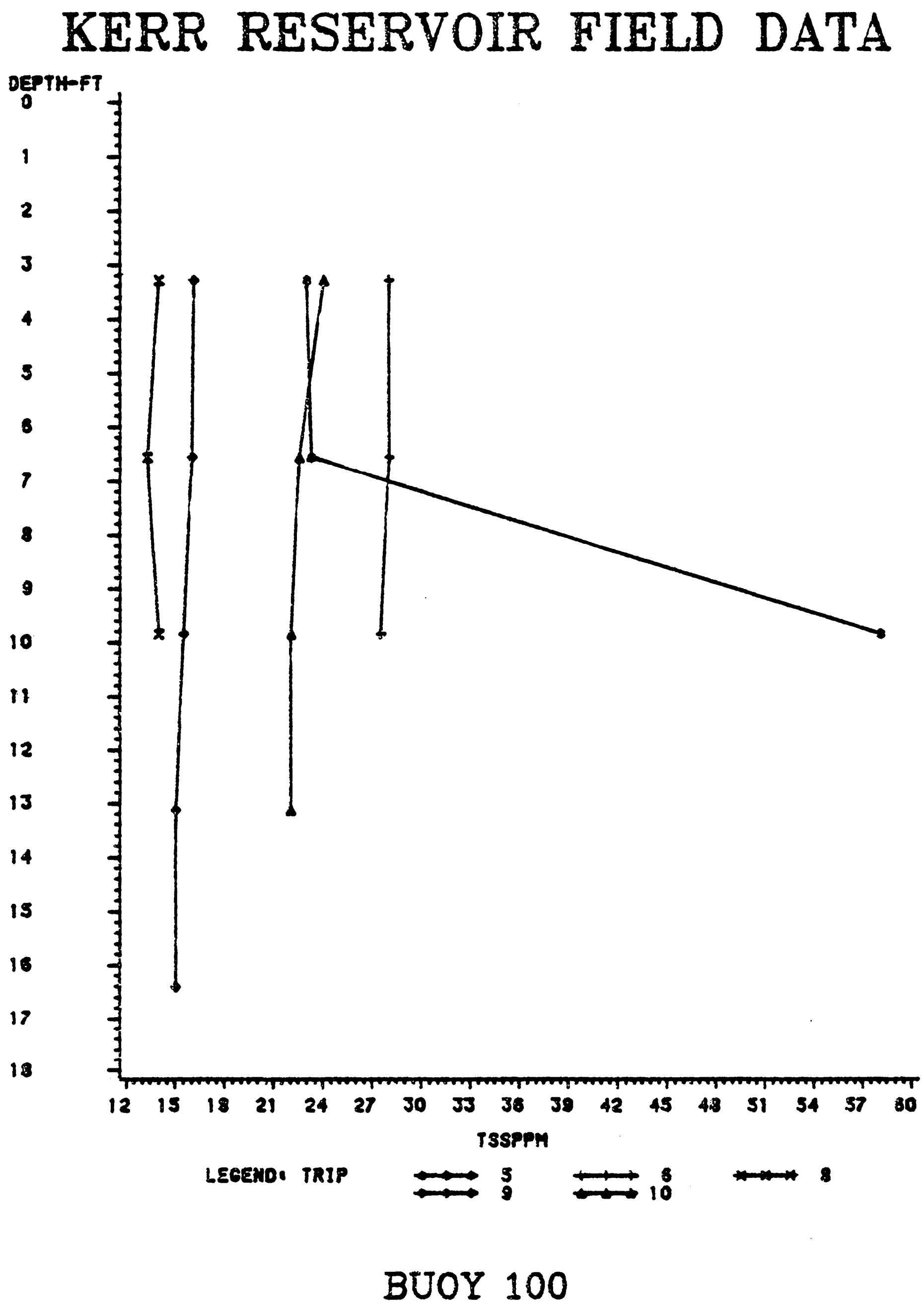


Figure C2 - Measured Values of Total Suspended Solids (PPM) for Station 1

STATION 2 (BUOY 24)

The difficulty in locating the main channel has previously been discussed. The result of these difficulties can be seen in figures C3 and C4. There exists a large difference in the located bottom depths for station 2 for the different research trips. However, the three trips with very deep bottom depths each show a much higher concentration of suspended sediment near the bottom. Each of these shows a strong increase at a depth of approximately 13 feet. The remaining trips vary from completely uniform to a slight reduction in TSS with depth to a slight increase with depth.

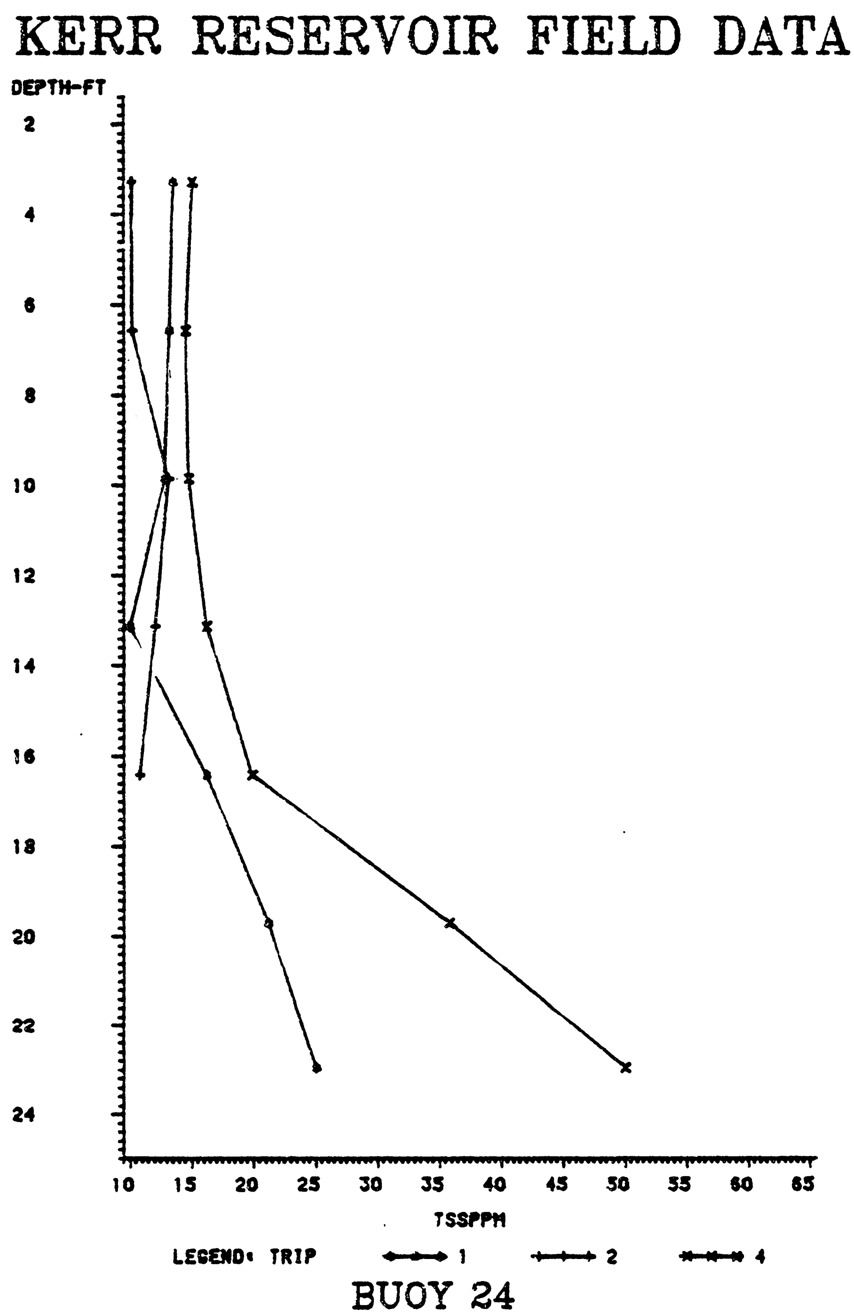


Figure C3 - Measured Values of Total Suspended Solids (PPM) for Station 2

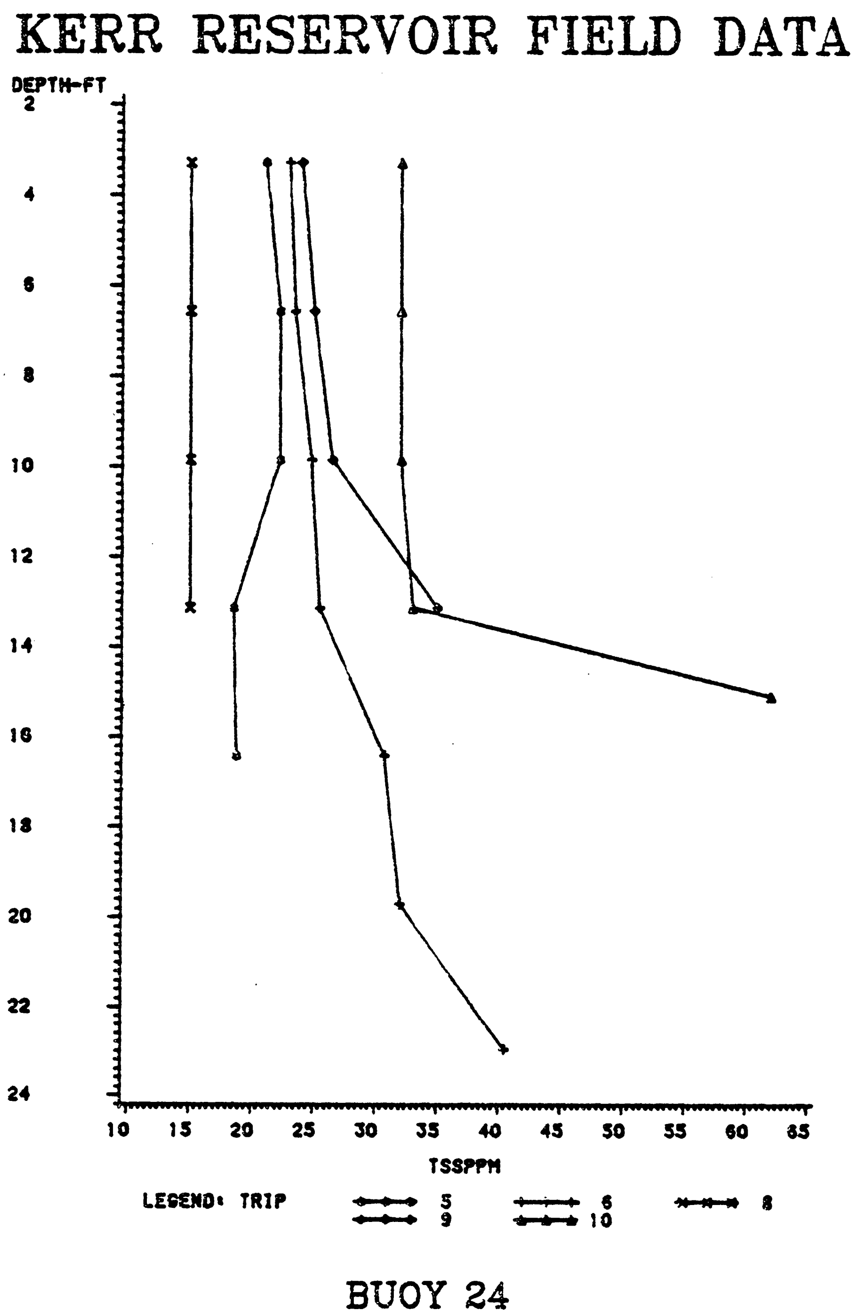


Figure C4 - Measured Values of Total Suspended Solids (PPM) for Station 2

STATION 3 (BUOY 22)

Kerr Reservoir is over 3500 feet wide at this station, with only two small channels evident (see figure B3). Thus the channel bottom was not always exactly located (see figures C5 and C6). However, the values at station 3 are consistent. Seven out of nine trips indicate increasing suspended sediment concentration with depth. Also, there usually exists a large increase near the reservoir bottom. This pattern is to be expected under normal conditions. Large amounts of sediment are still in suspension, and a definite bedload exists. The increasing TSS values with depth indicate that the water is losing its ability to keep the sediment in suspension.

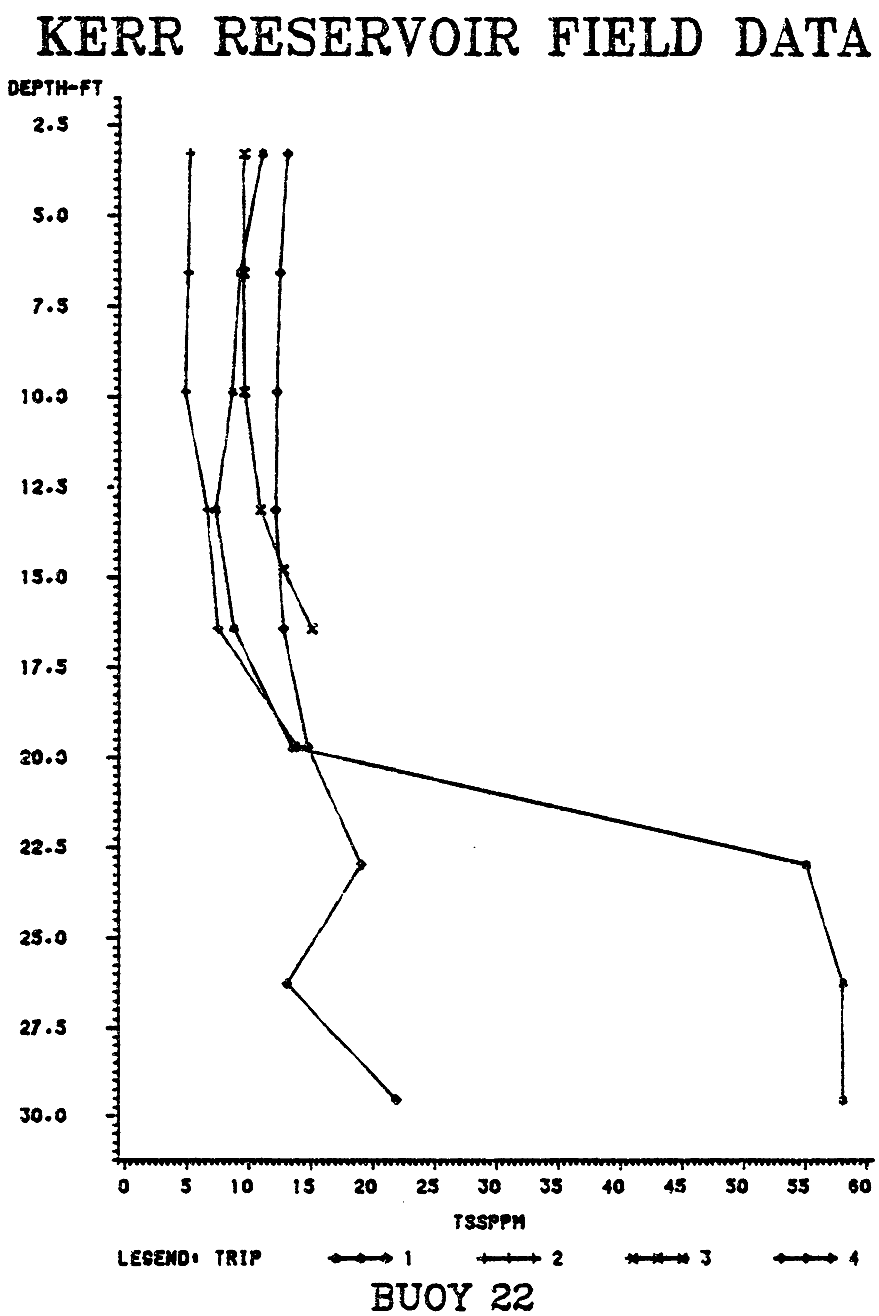


Figure C5 - Measured Values of Total Suspended Solids (PPM) for Station 3

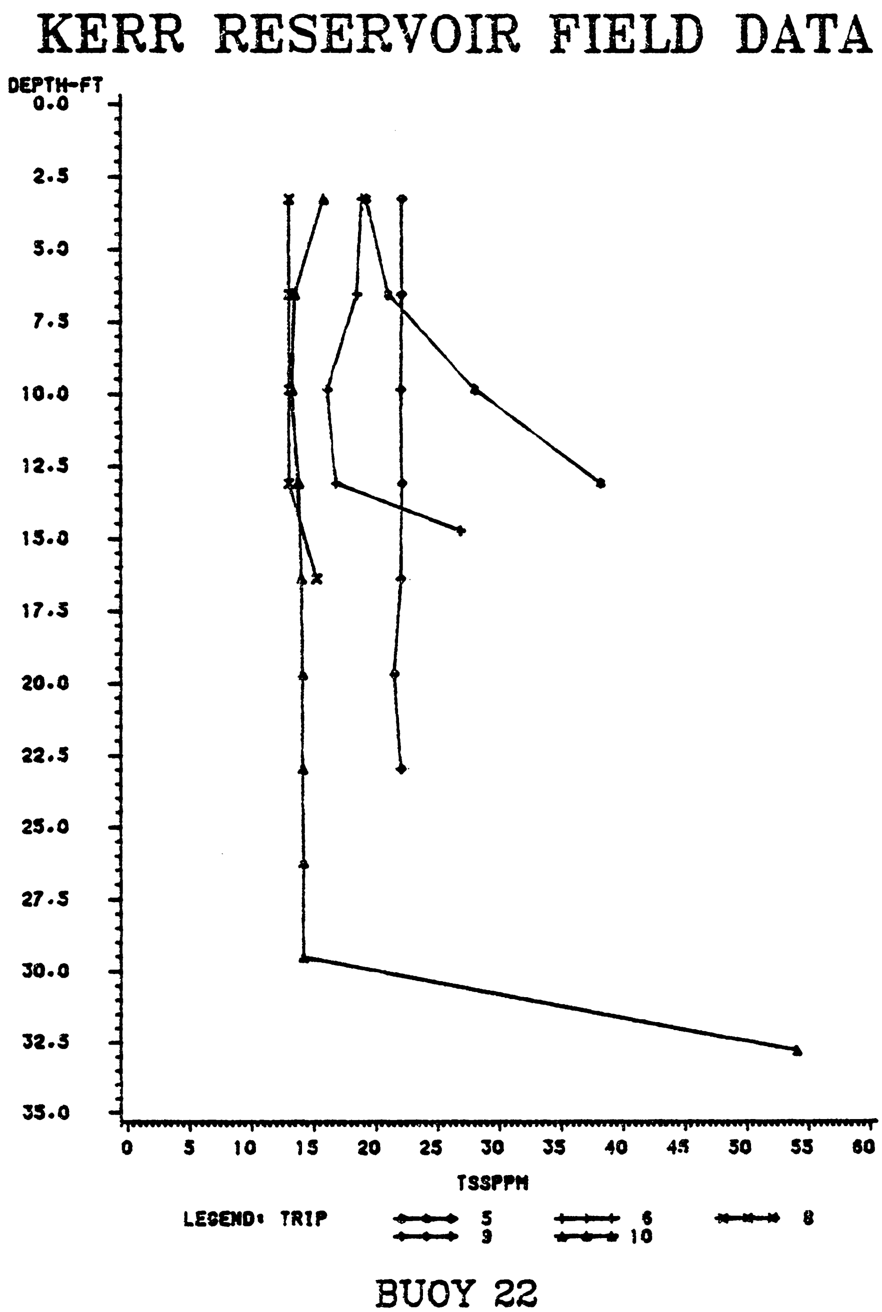


Figure C6 - Measured Values of Total Suspended Solids (PPM) for Station 3

STATION 4 (BUOY 24)

Station 4 is located at a point where the reservoir narrows considerably to pass under the only existing bridge across Kerr Reservoir. The effects this has on the sediment distribution are unknown; however, it is known that the situation presents complications. When studying figures C7 and C8, no definite pattern can be found. Three trips have large jumps in measured TSS values near the reservoir bottom but then reduce as the bottom nears. Three trips remain uniform to the bottom and two trips increase steadily towards the bottom.

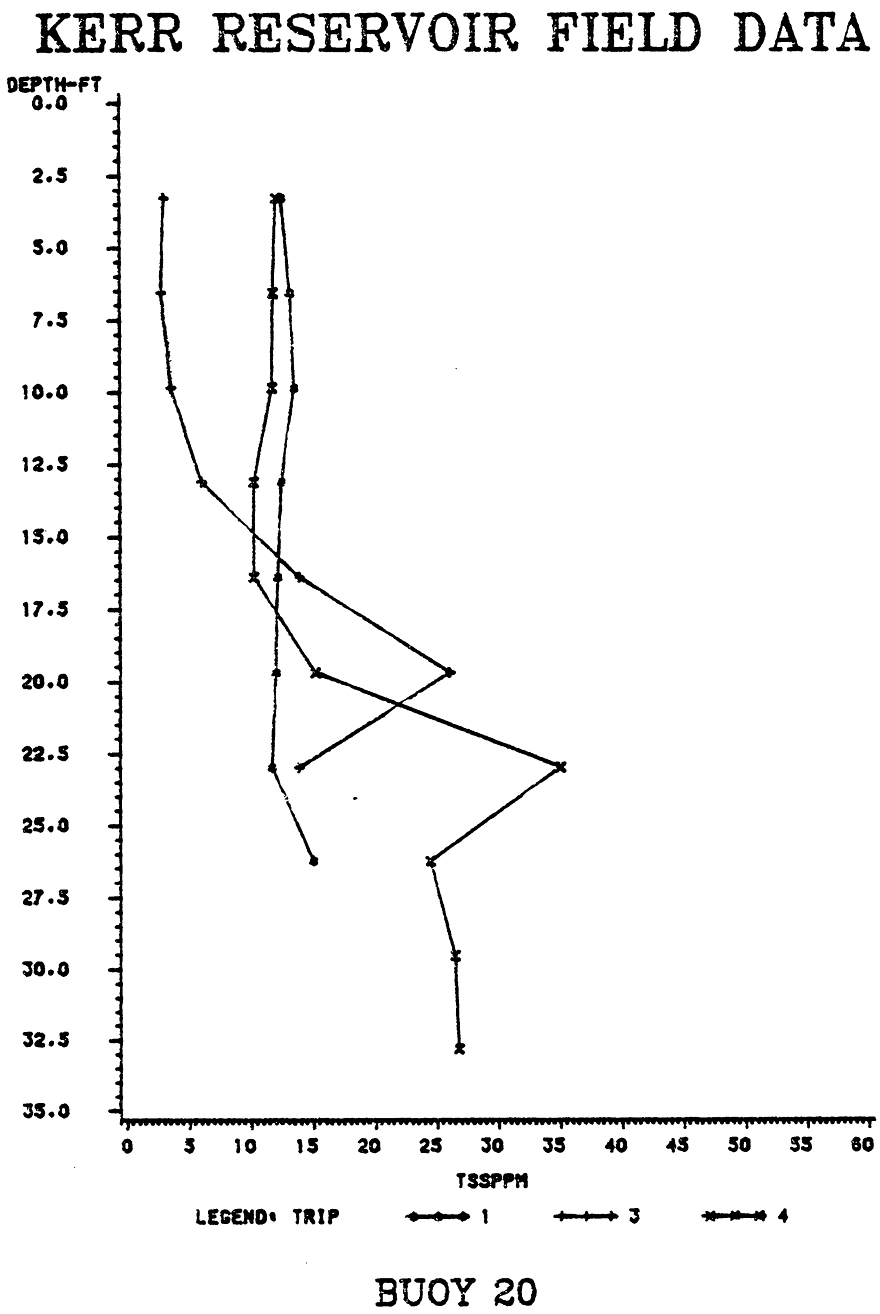


Figure C7 - Measured Values of Total Suspended Solids (PPM) for Station 4

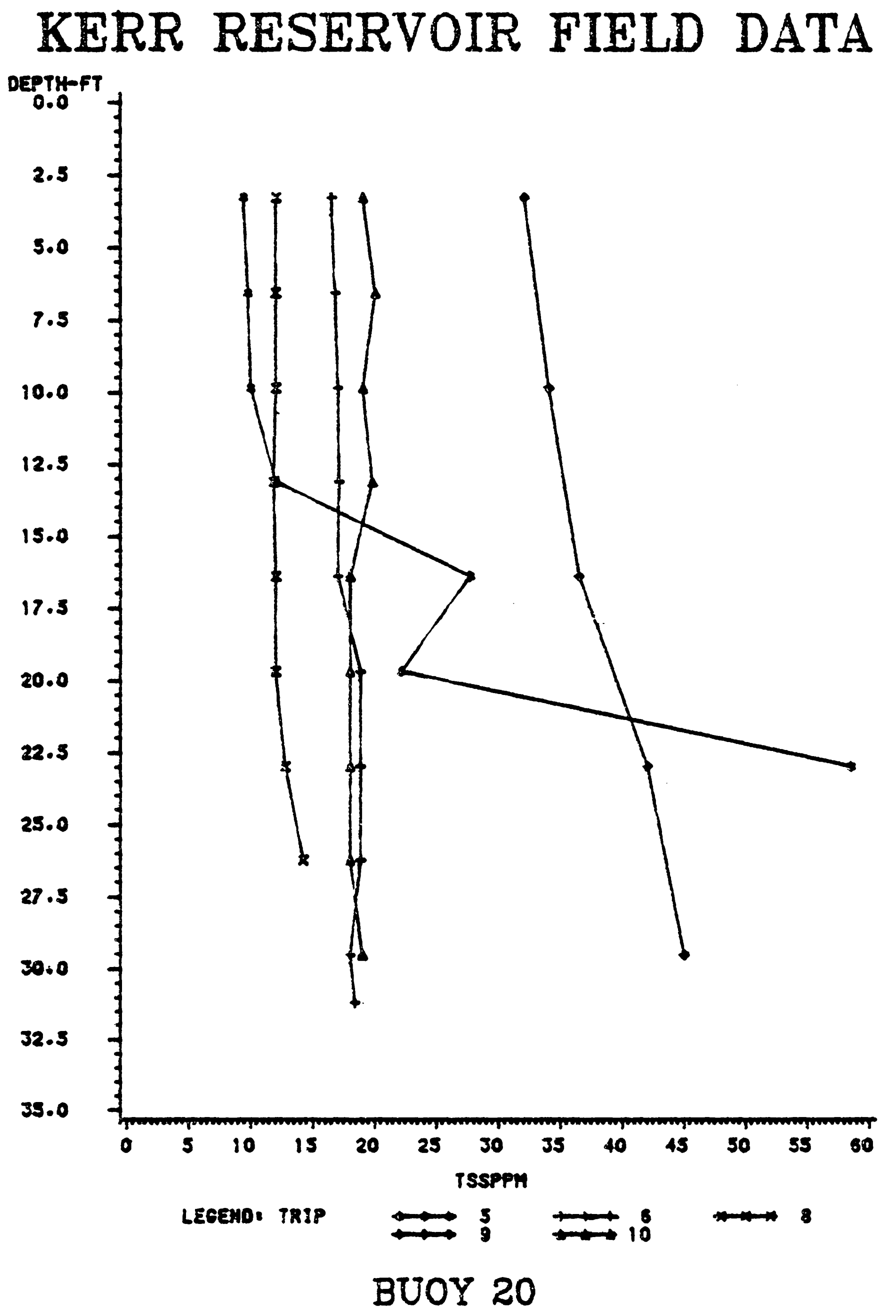


Figure C8 - Measured Values of Total Suspended Solids (PPM) for Station 4

STATION 5 (BUOY 18)

By station 5 each research trip resulted in a uniform distribution with depth until close to the bottom, where the turbidity was noticed to increase slightly. On many occasions the increase was very slight, while on three occasions (trips 2, 3, and 6) the increase was well over one hundred per cent.

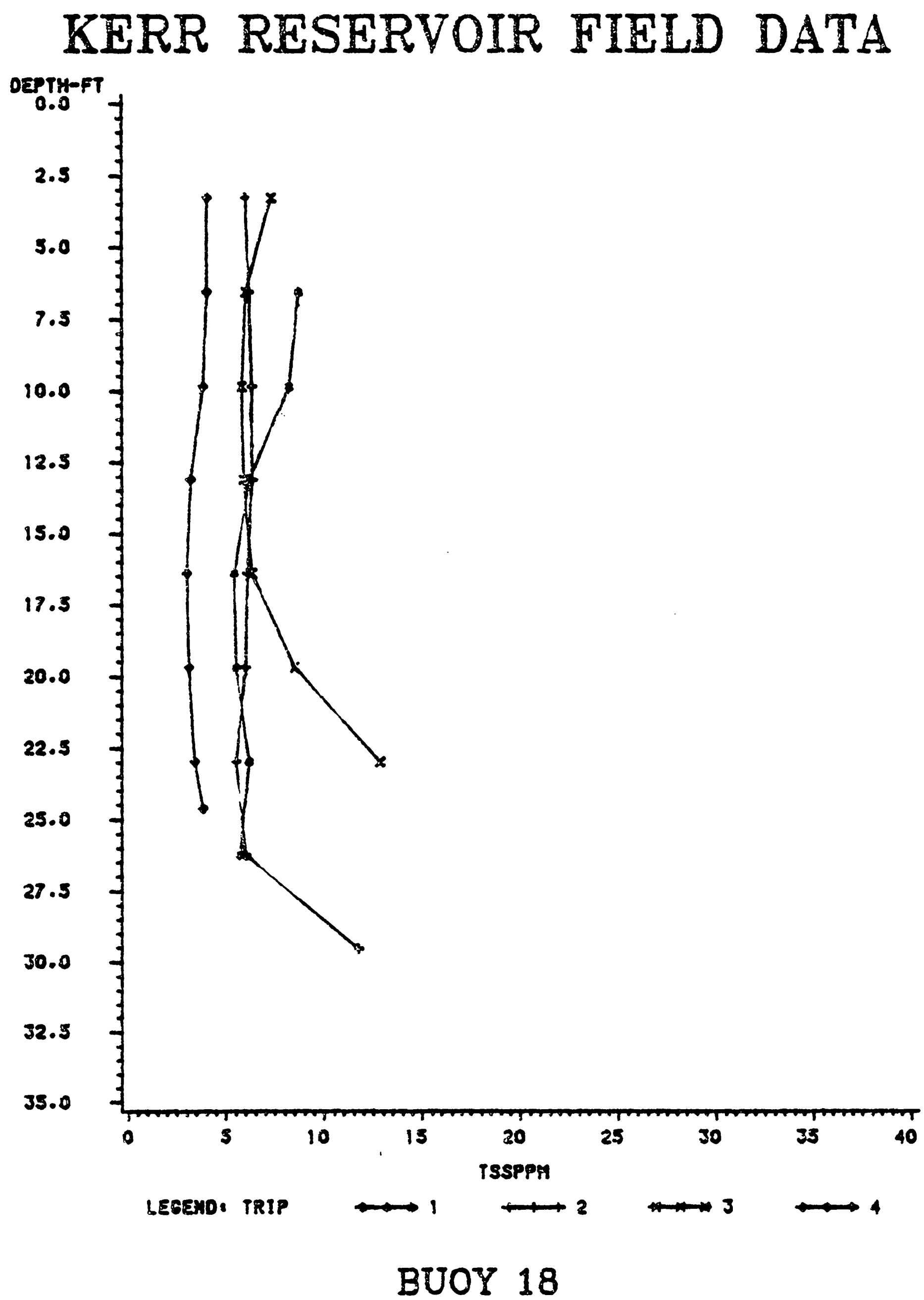
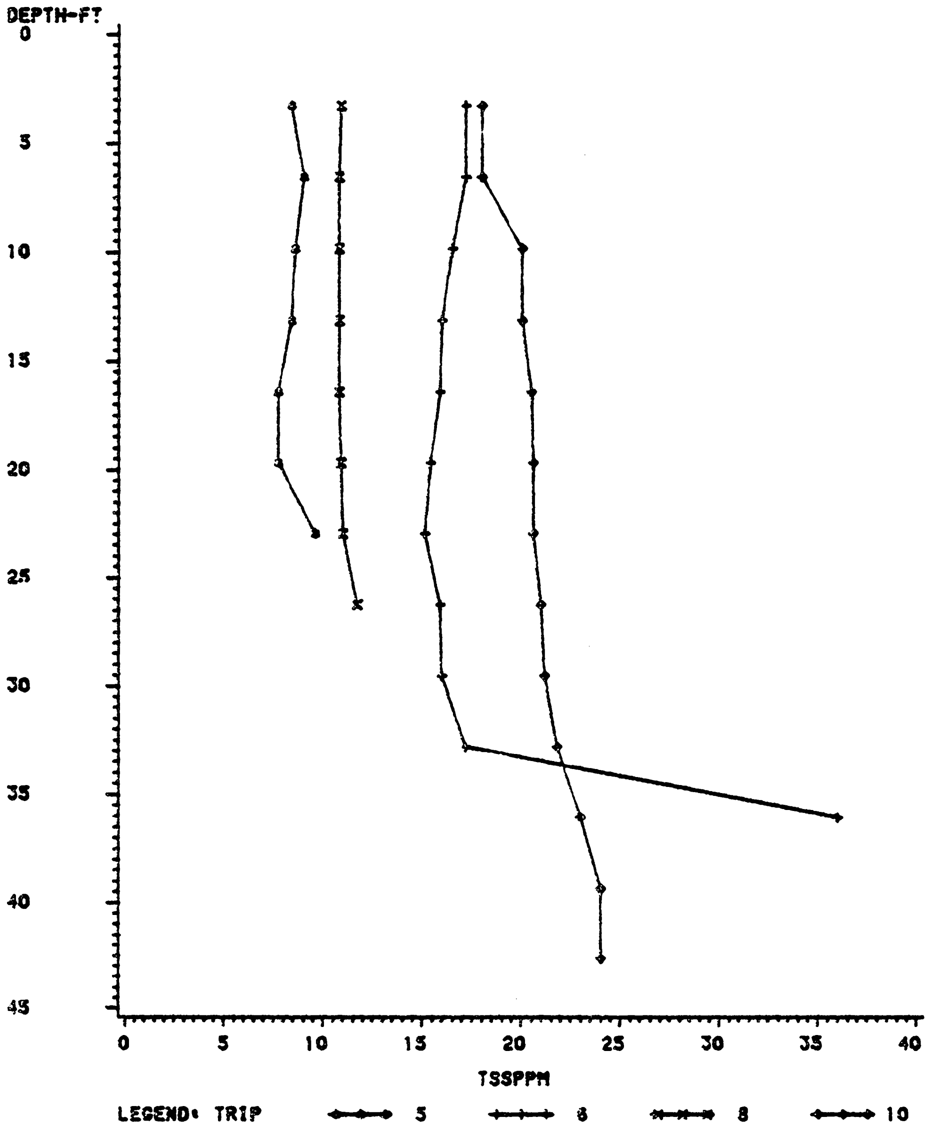


Figure C9 - Measured Values of Total Suspended Solids (PPM) for Station 5

KERR RESERVOIR FIELD DATA



BUOY 18

Figure C10 - Measured Values of Total Suspended Solids (PPM) for Station 5

STATION 6 (BUOY 15)

Six sets of research data indicate almost complete uniformity with depth by station 6. One of the remaining three sets (trip 4) shows relatively little increase in the TSS readings and this occurs near the bottom of the reservoir. Two sets of data (trips 3 and 5) indicate a rather large increase near the reservoir bottom. These two trips had the lowest measured inflow of any of the days that data was collected (220 cfs and 770 cfs respectively). This is indicative of the fact that under extremely low flow conditions very little turbulence is present, thus a good portion of the total load settles towards the bottom and travels as bedload.

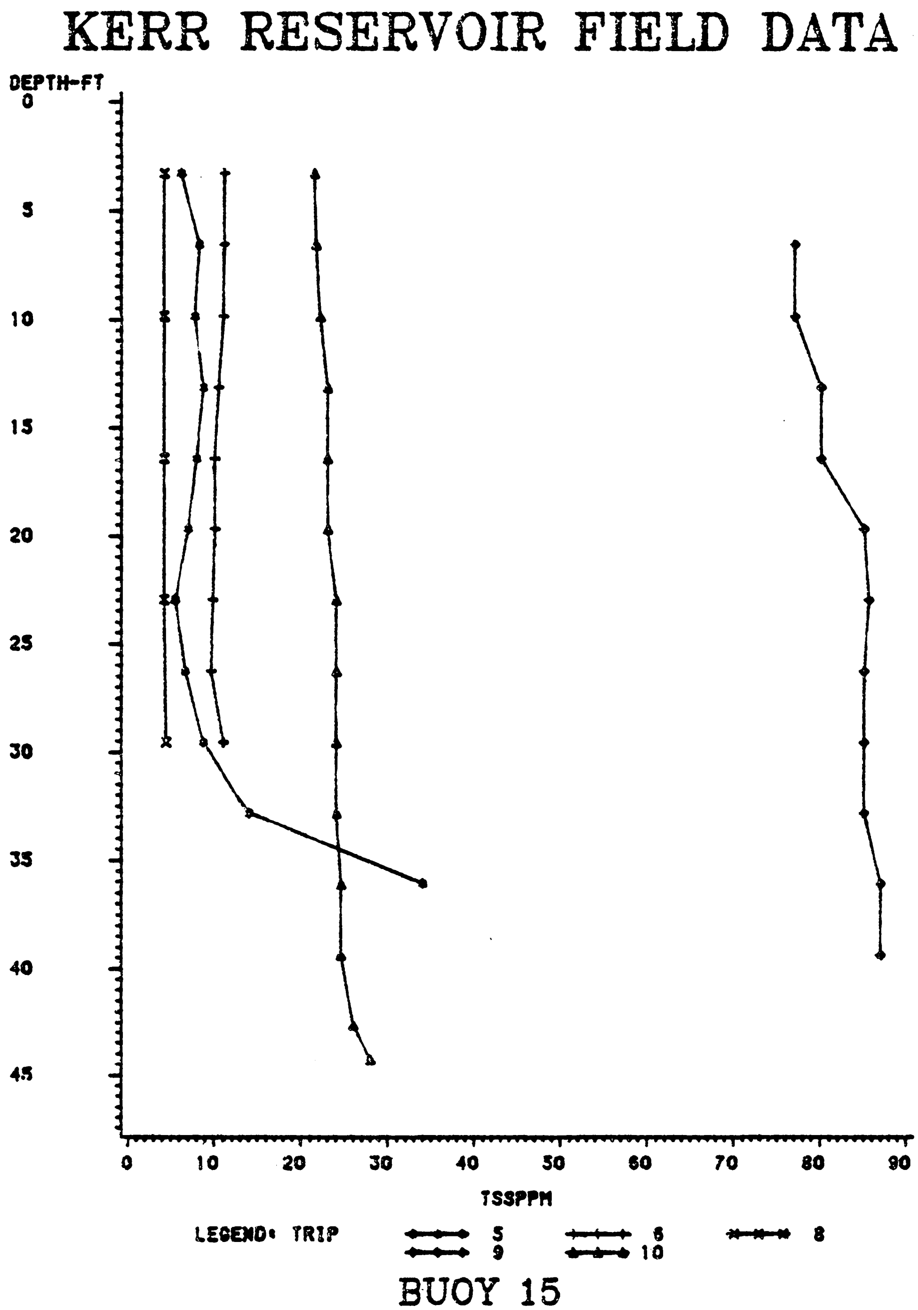


Figure C11 - Measured Values of Total Suspended Solids (PPM) for Station 6

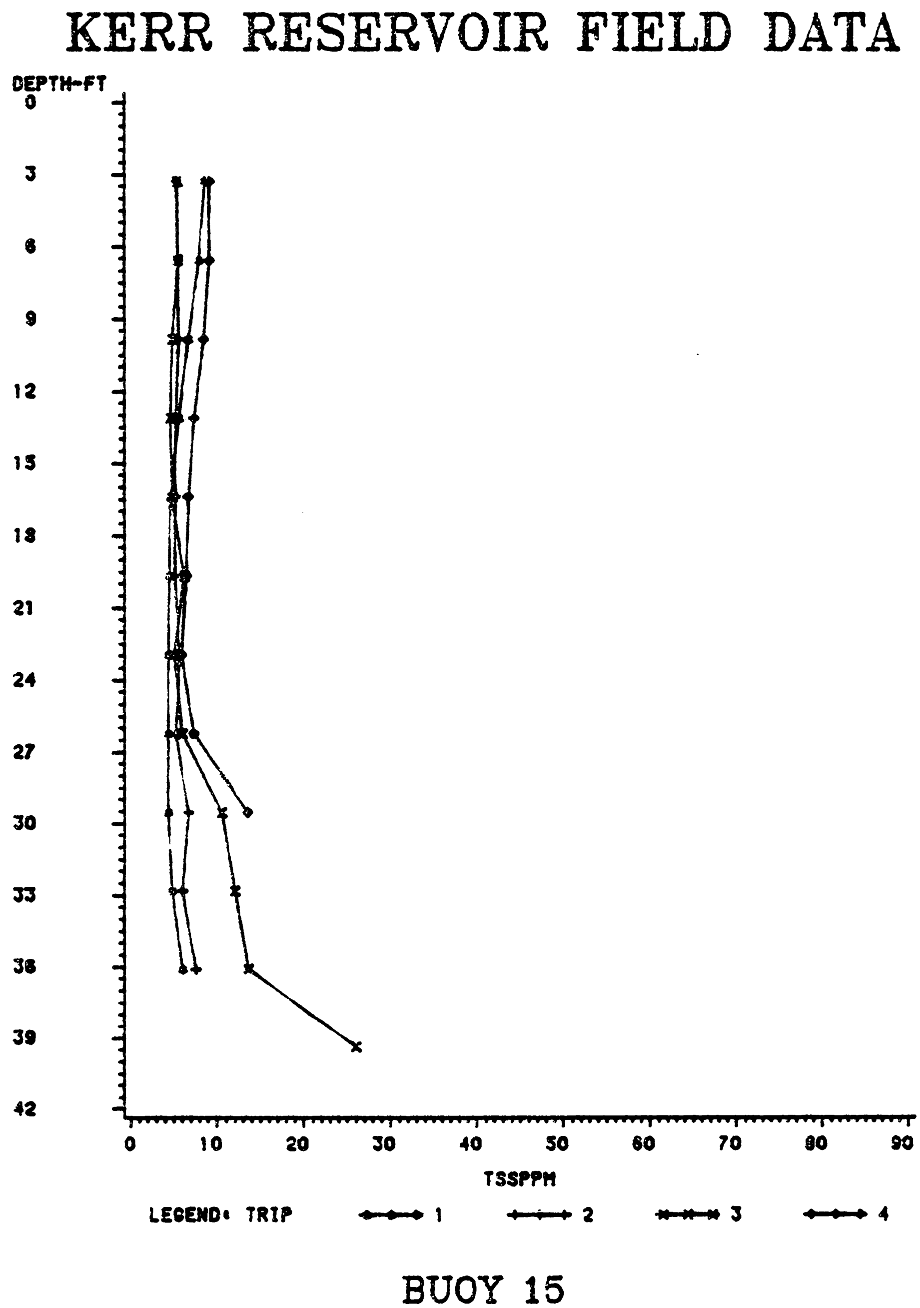


Figure C12 - Measured Values of Total Suspended Solids (PPM) for Station 6

STATION 7 (BUOY 11)

By station 7 the TSS data indicates a uniform distribution to at least 35 feet in all cases except trip 9, which as has been noted previously, immediately followed a severe flood occurrence. After a depth of 35 feet, figures C13 and C14 show no large increases until the bottom 10 feet. The one exception to this is trip 4, which shows a large increase at a depth of 33 feet.

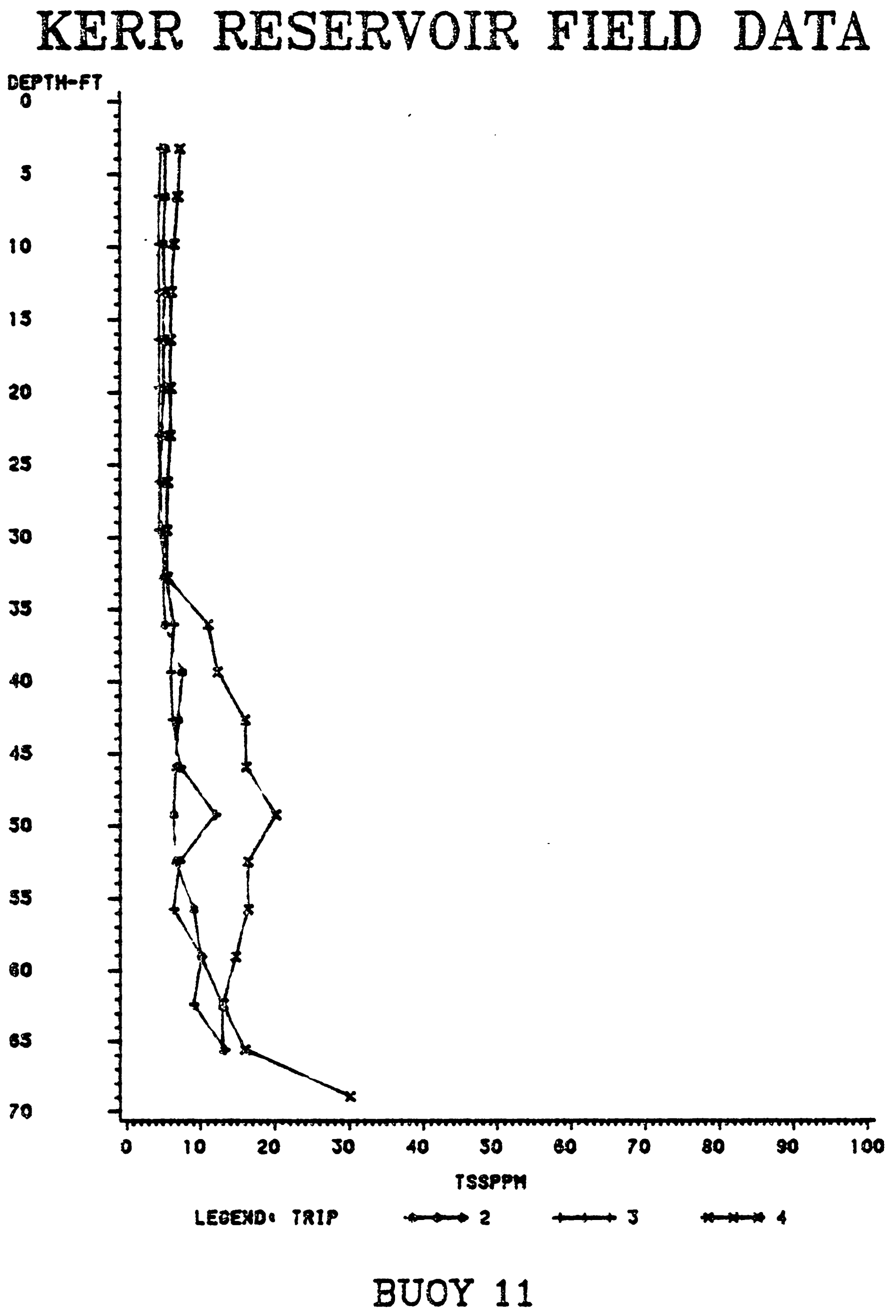


Figure C13 - Measured Values of Total Suspended Solids (PPM) for Station 7

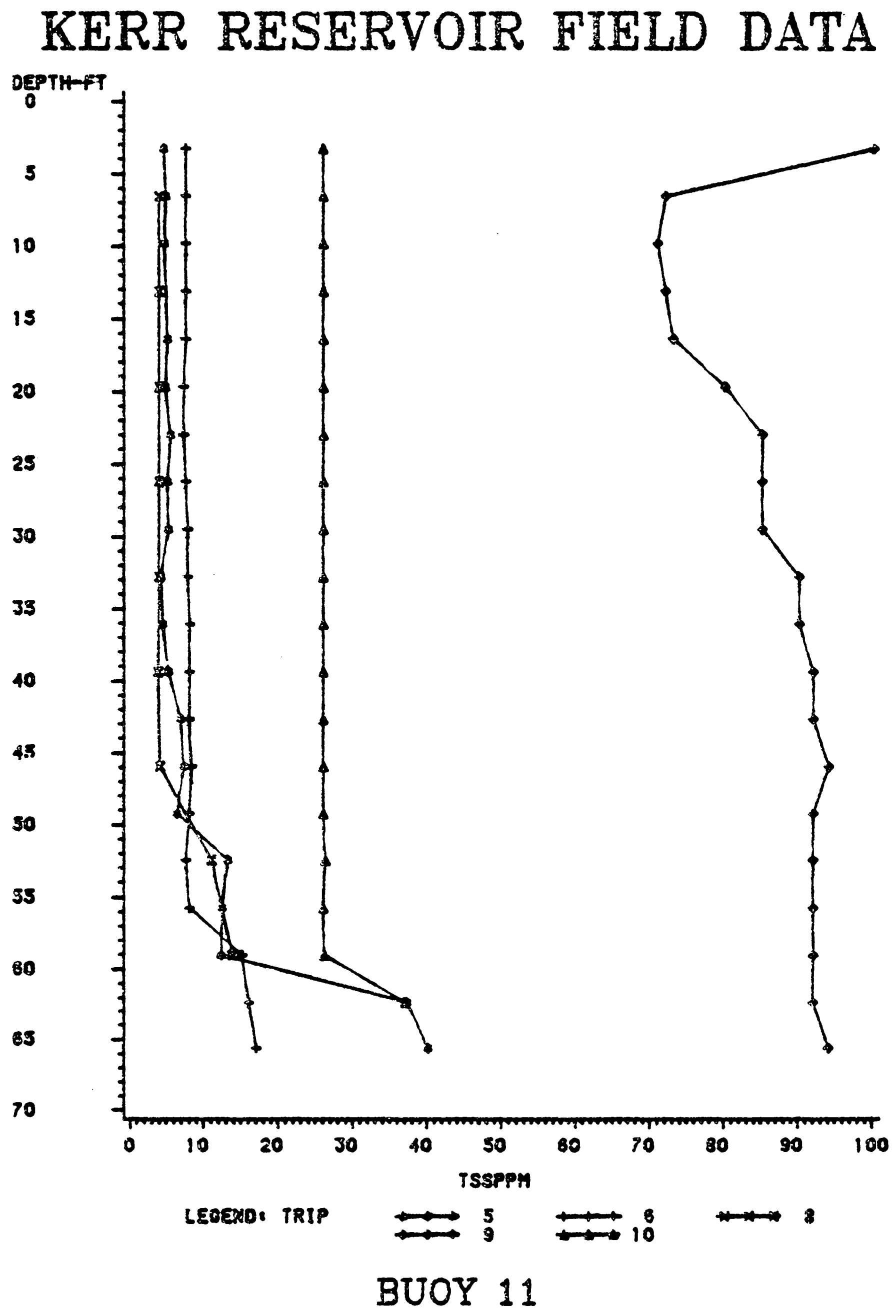


Figure C14 - Measured Values of Total Suspended Solids (PPM) for Station 7

STATION 8 (BUOY 8)

At station 8 the sediment load has become almost entirely uniform with depth. Some slight peculiarities are occasionally evident in the form of small "jumps". Even the bedload is not glaringly obvious; however, there is evidence that it still exists for many of the trips.

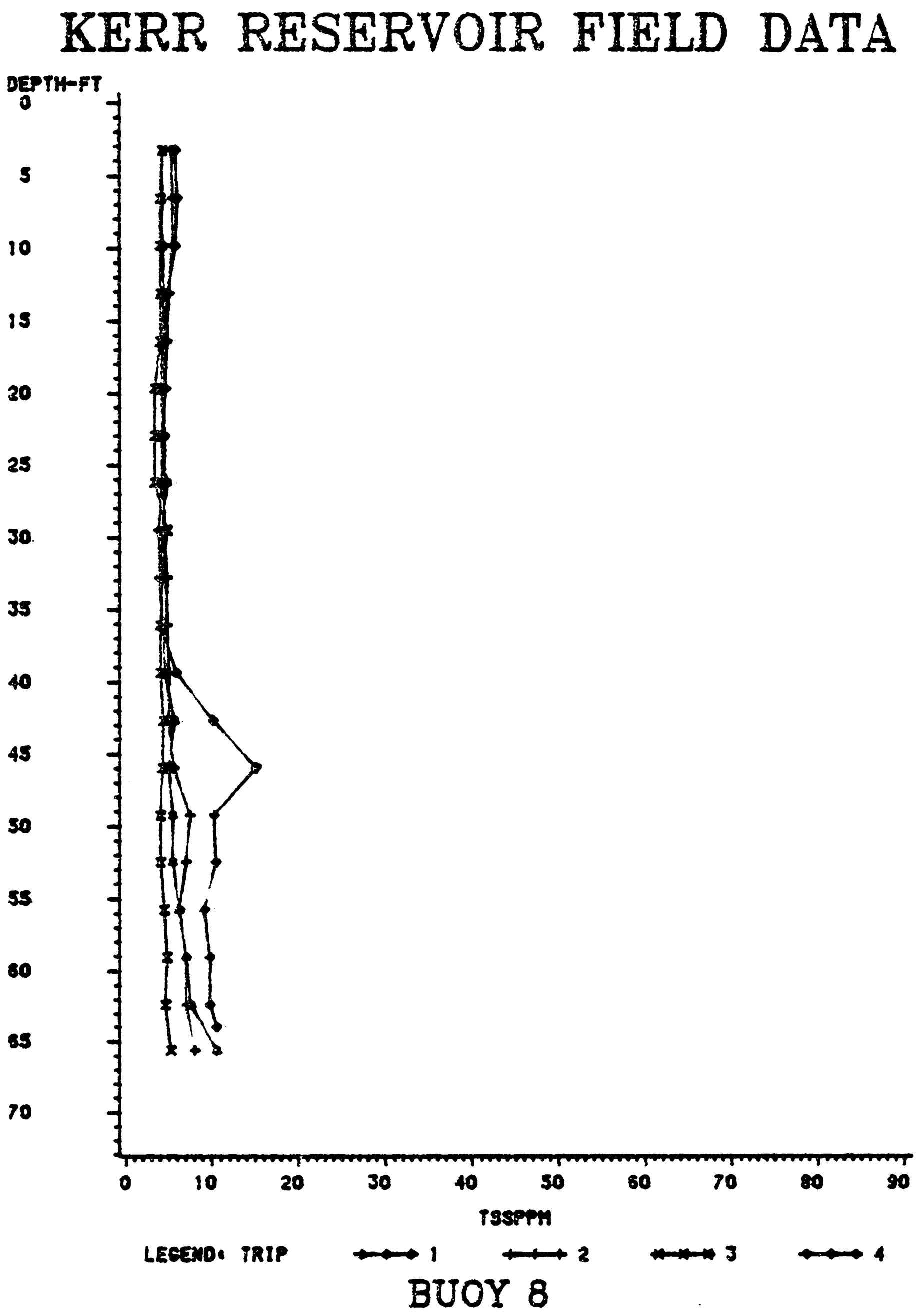


Figure C15 - Measured Values of Total Suspended Solids (PPM) for Station 8

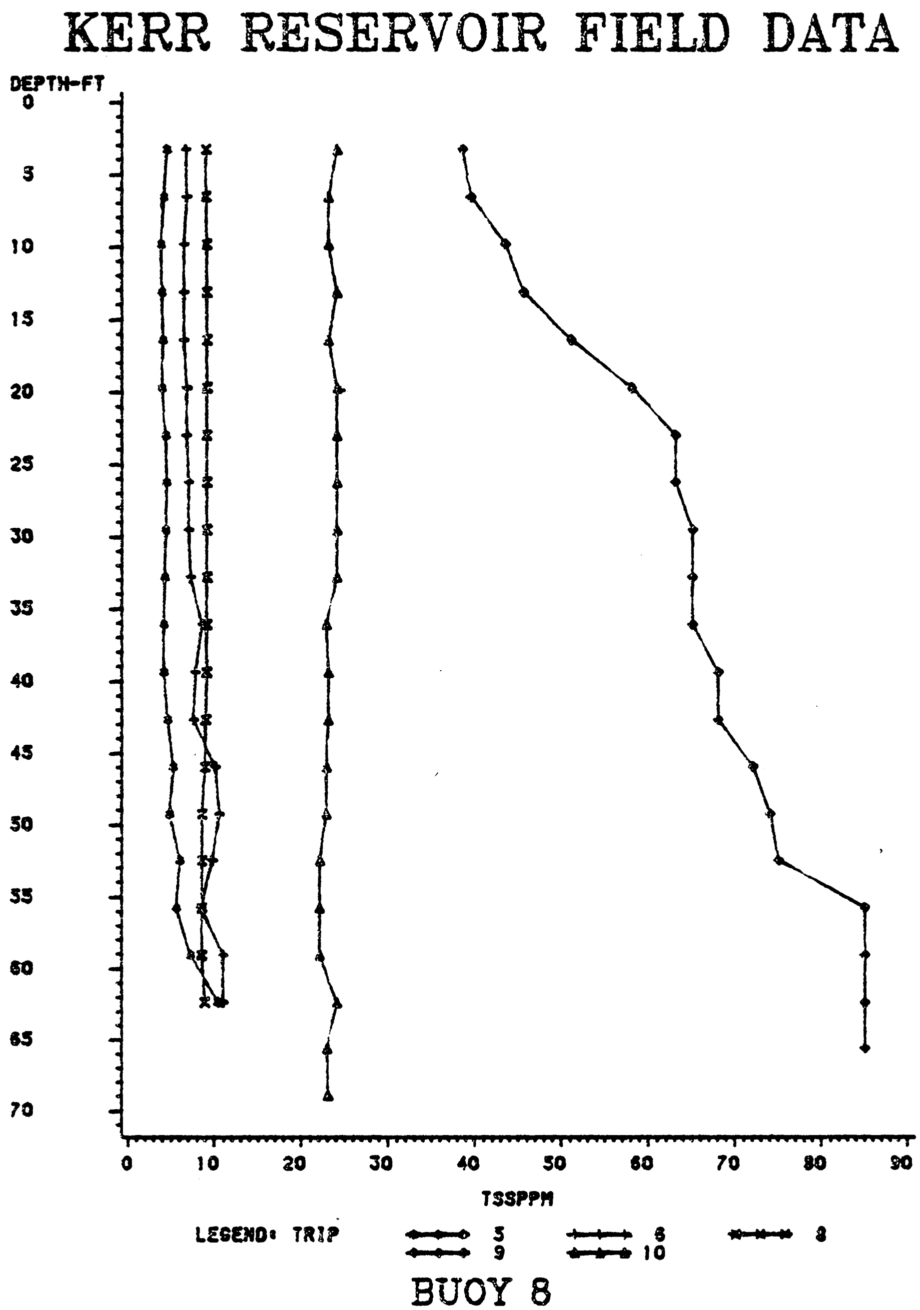


Figure C16 - Measured Values of Total Suspended Solids (PPM) for Station 8

STATION 9 (BUOY 5)

The distribution of suspended sediment is much the same at station 9 as was evidenced at station 8, only with smaller values. By this location, there is little evidence of much bedload. Station 9 is approximately 21 miles from the point where the Dan River and Roanoke River merge. It is safe to say that almost all of the sediment that will be deposited in the reservoir has already dropped out of suspension by this point. Once again, the one exception to this is trip 9.

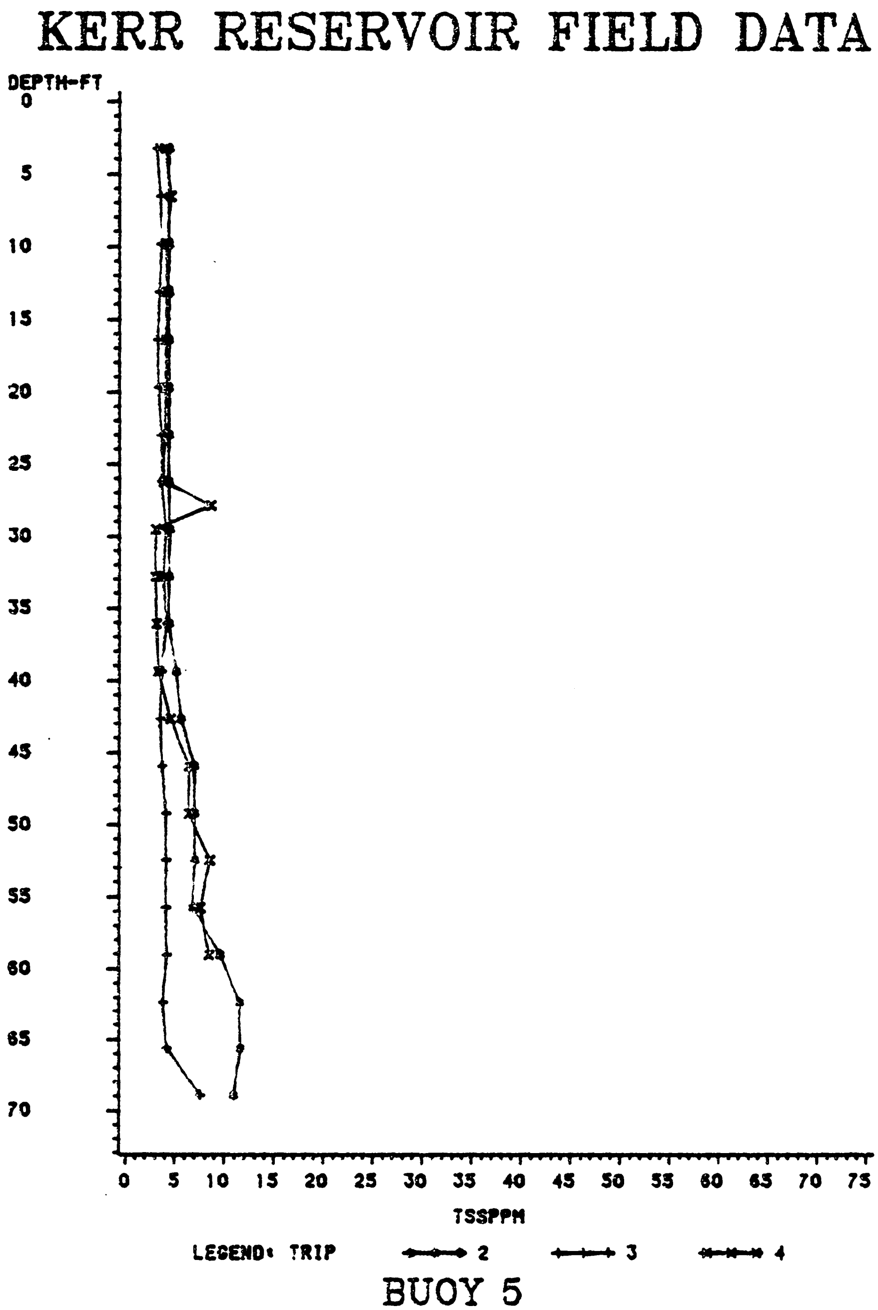


Figure C17 - Measured Values of Total Suspended Solids (PPM) for Station 9

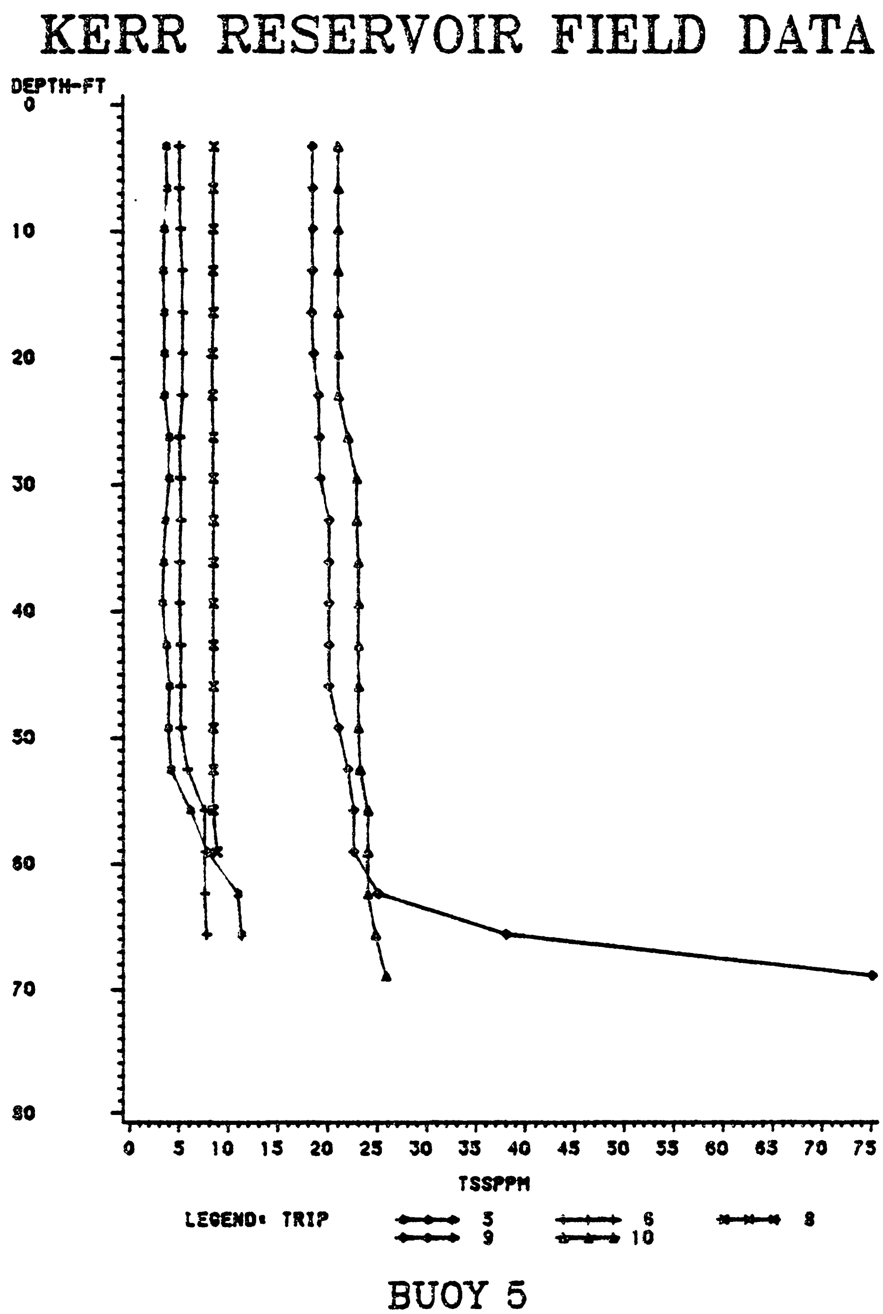
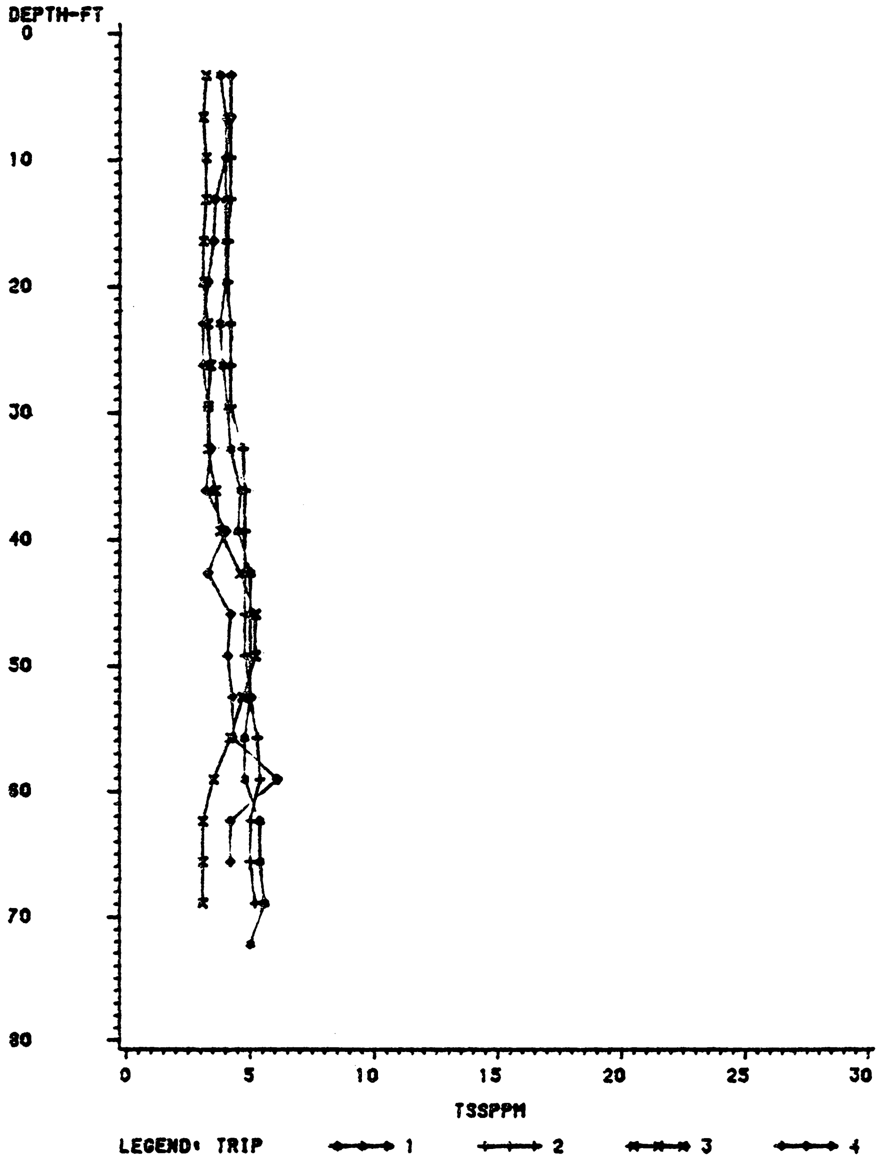


Figure C18 - Measured Values of Total Suspended Solids (PPM) for Station 9

STATION 10 (BUOY 3)

By station 10, the sediment has almost completely settled out of suspension. Relative to the readings observed at station 1, the water at station 10 is clear. In all but two cases the water maintained a constant value of 5 ppm or under. The two exceptions are trips 9 and 10 which is to be expected by now.

KERR RESERVOIR FIELD DATA



BUOY 3

Figure C19 - Measured Values of Total Suspended Solids (PPM) for Station 10

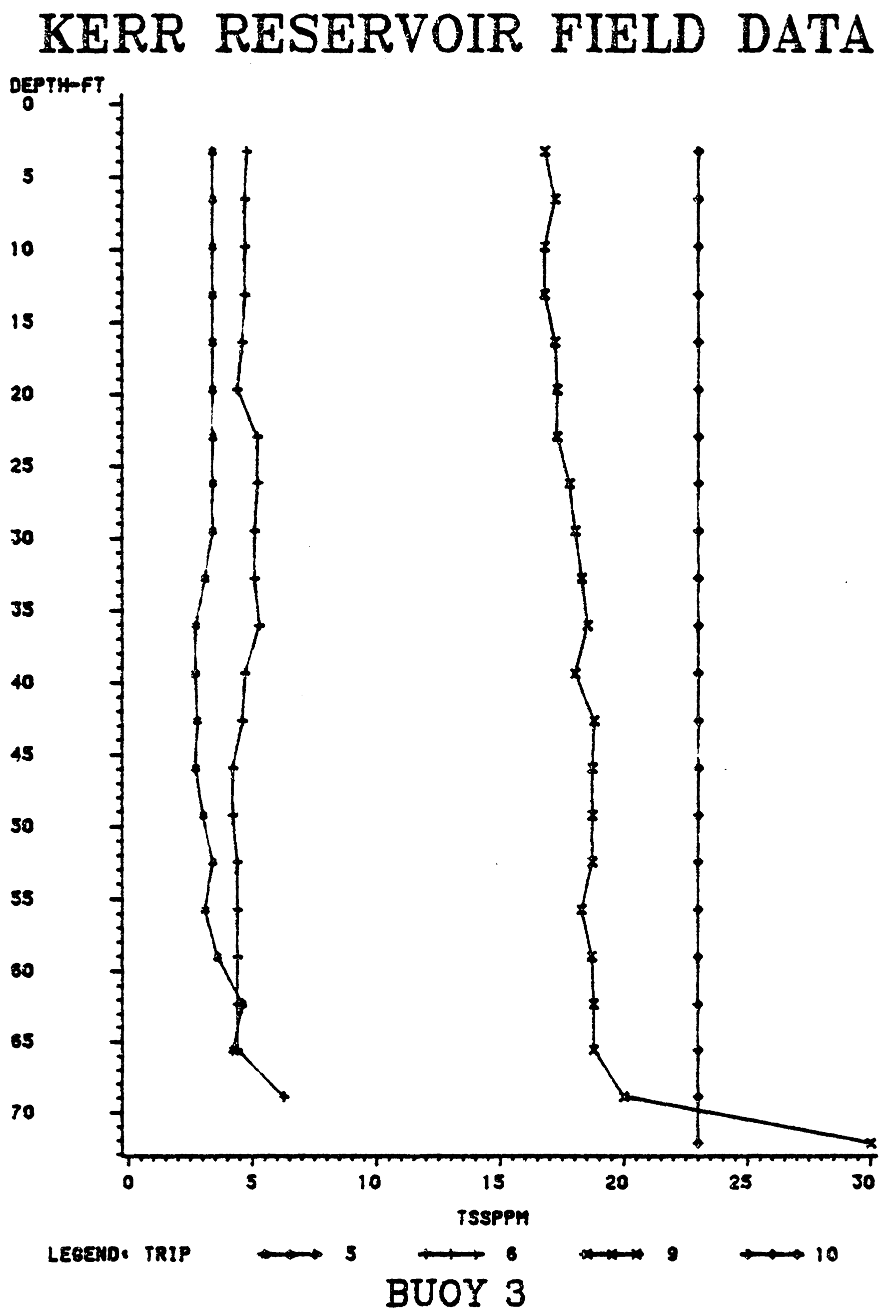
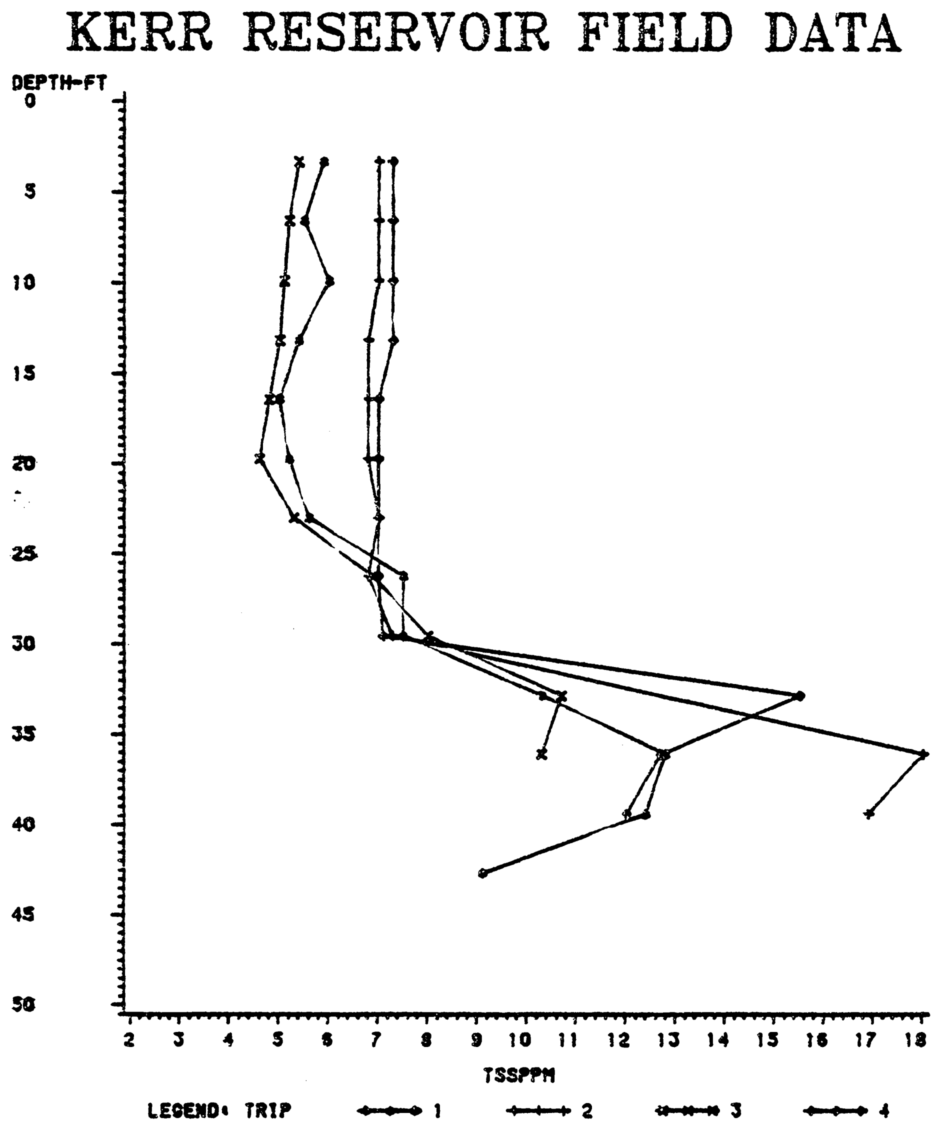


Figure C20 - Measured Values of Total Suspended Solids (PPM) for Station 10

NUTBUSH CREEK ARM

STATION 13 (BUOY K)

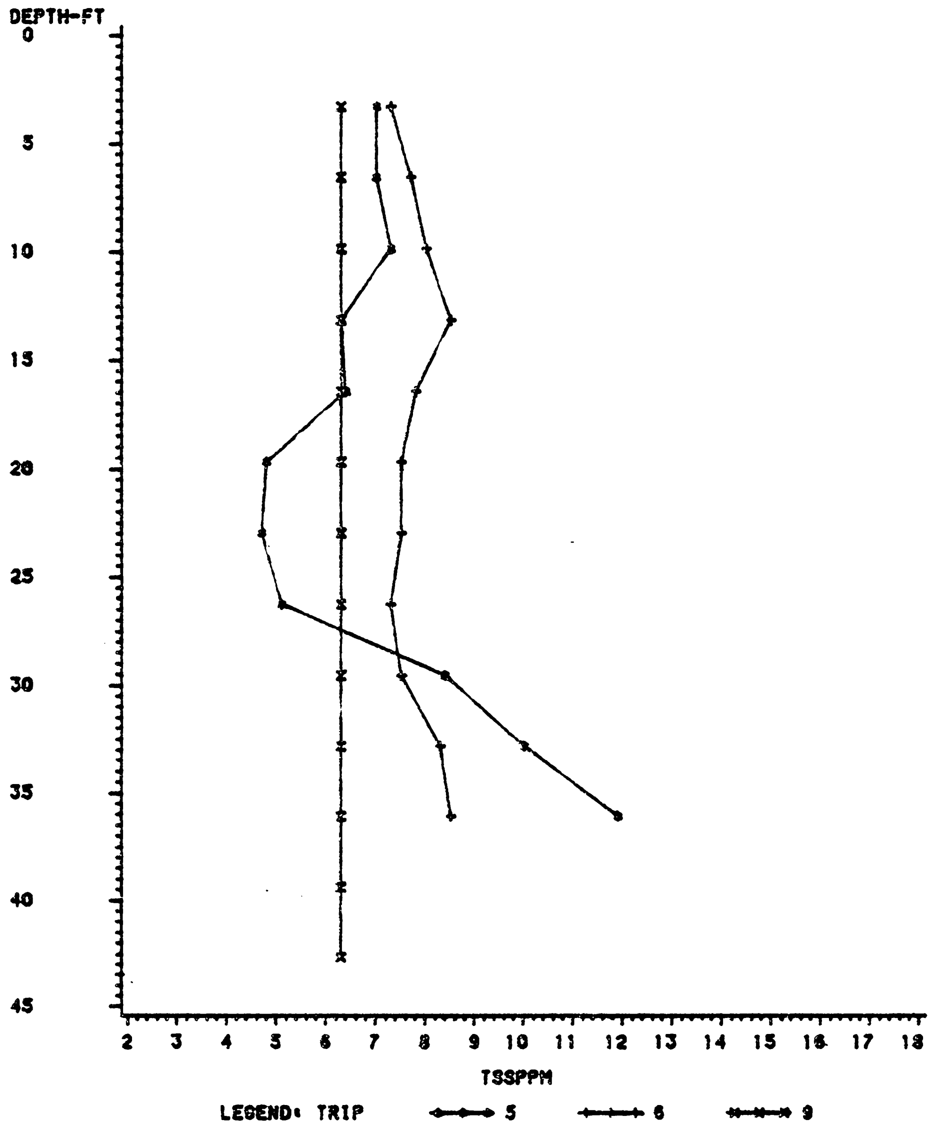
Station 13 is analyzed first because it is farthest from Kerr Dam. At this location a reasonably uniform sediment concentration is apparent to a depth of 25 feet, where the measured TSS values increase drastically. On five of the seven research trips where data was obtained at this station the increase was over one hundred percent. One trip (#9) had a completely uniform distribution to a bottom depth of 43 feet. On three occasions (trips 1, 3, and 5) a slight decrease occurred immediately before the large increase in TSS values. On four occasions (trips 1, 2, 3, and 4) a decrease also occurred near the reservoir bottom.



BUOY K (NUTBUSH)

Figure C21 - Measured Values of Total Suspended Solids (PPM) for Station 13

KERR RESERVOIR FIELD DATA

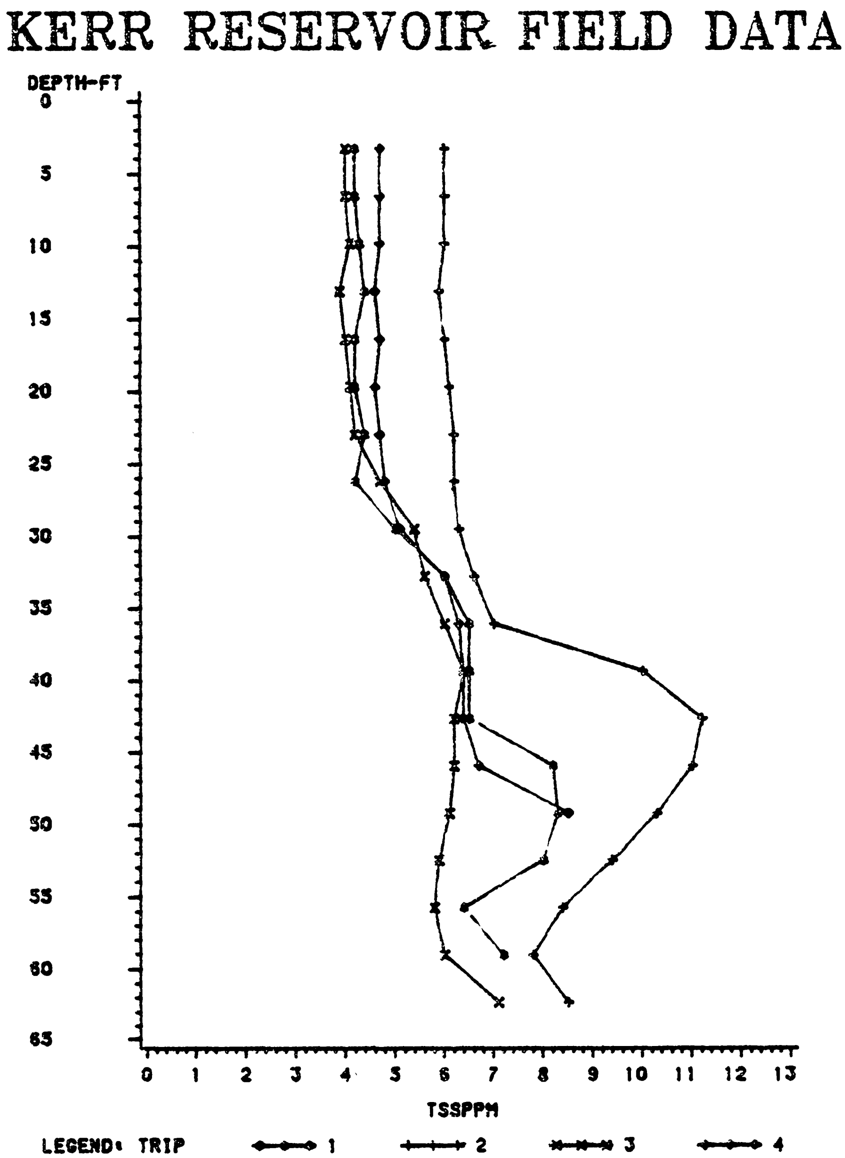


BUOY K (NUTBUSH)

Figure C22 - Measured Values of Total Suspended Solids (PPM) for Station 13

STATION 12 (BUOY G)

The same suspended sediment pattern was evidenced at station 12 as at station 13. Trips 5 and 6 show the same decrease approximately 15 feet from the surface that occurred at station 13. When an increase in suspended sediment occurs, it is at a greater depth and is less severe than was evidenced at station 13. On trip 9 the measured turbidity is almost exactly uniform with depth, as was previously discussed for station 13.



BUOY G (NUTBUSH)

Figure C23 - Measured Values of Total Suspended Solids (PPM) for Station 12

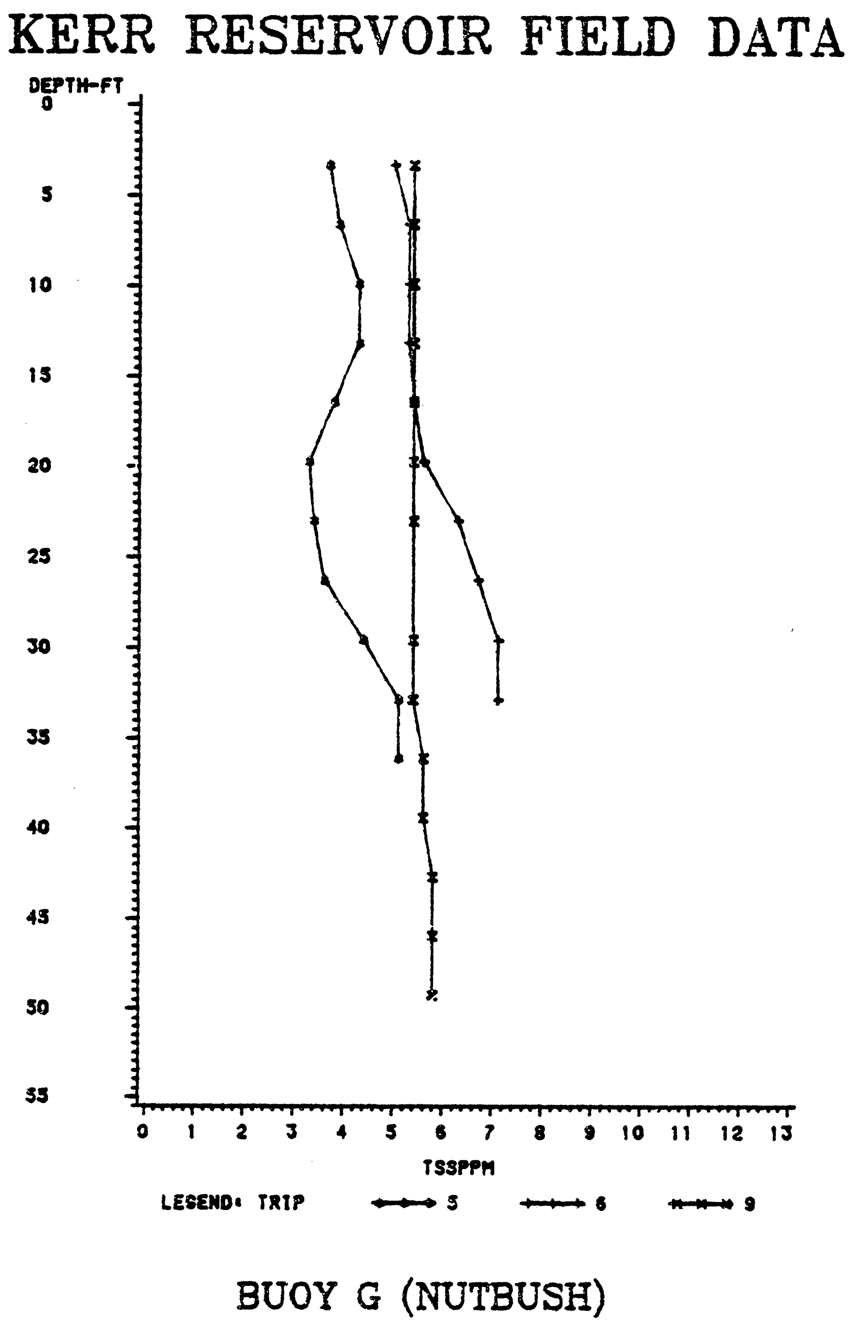


Figure C24 - Measured Values of Total Suspended Solids (PPM) for Station 12

STATION 11 (BUOY D)

The difficulty of exactly locating the deepest part of a cross-section, as was mentioned earlier, is evident at station 11 more than any other location. At this cross-section a delta extended from the north shoreline far into the reservoir, leaving a relatively small portion that reached great depth. This, together with the high winds prevalent to the Nutbush arm of Kerr Reservoir and the extreme width (over 9000 feet) at this station, made it impossible to get the correct channel everytime.

Notice, however, the uniformity indicated by figures C25 and C26. On six of the seven trips where data was obtained on the Nutbush arm, the total increase of TSS from surface to bottom was under twenty-five per cent. On the remaining trip (#5) the sediment load increased more than one hundred per cent, from 3.8 ppm to 8.4 ppm.

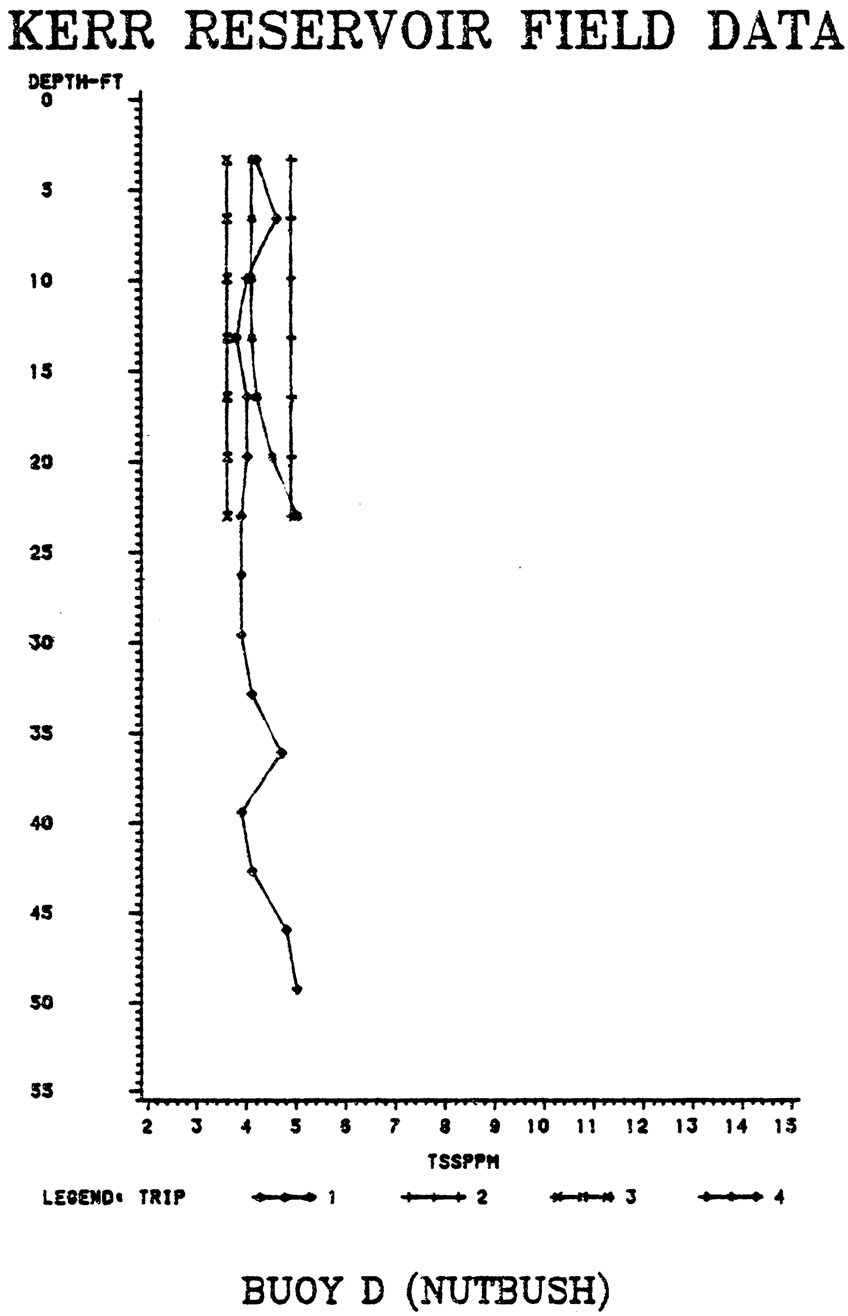


Figure C25 - Measured Values of Total Suspended Solids (PPM) for Station 11

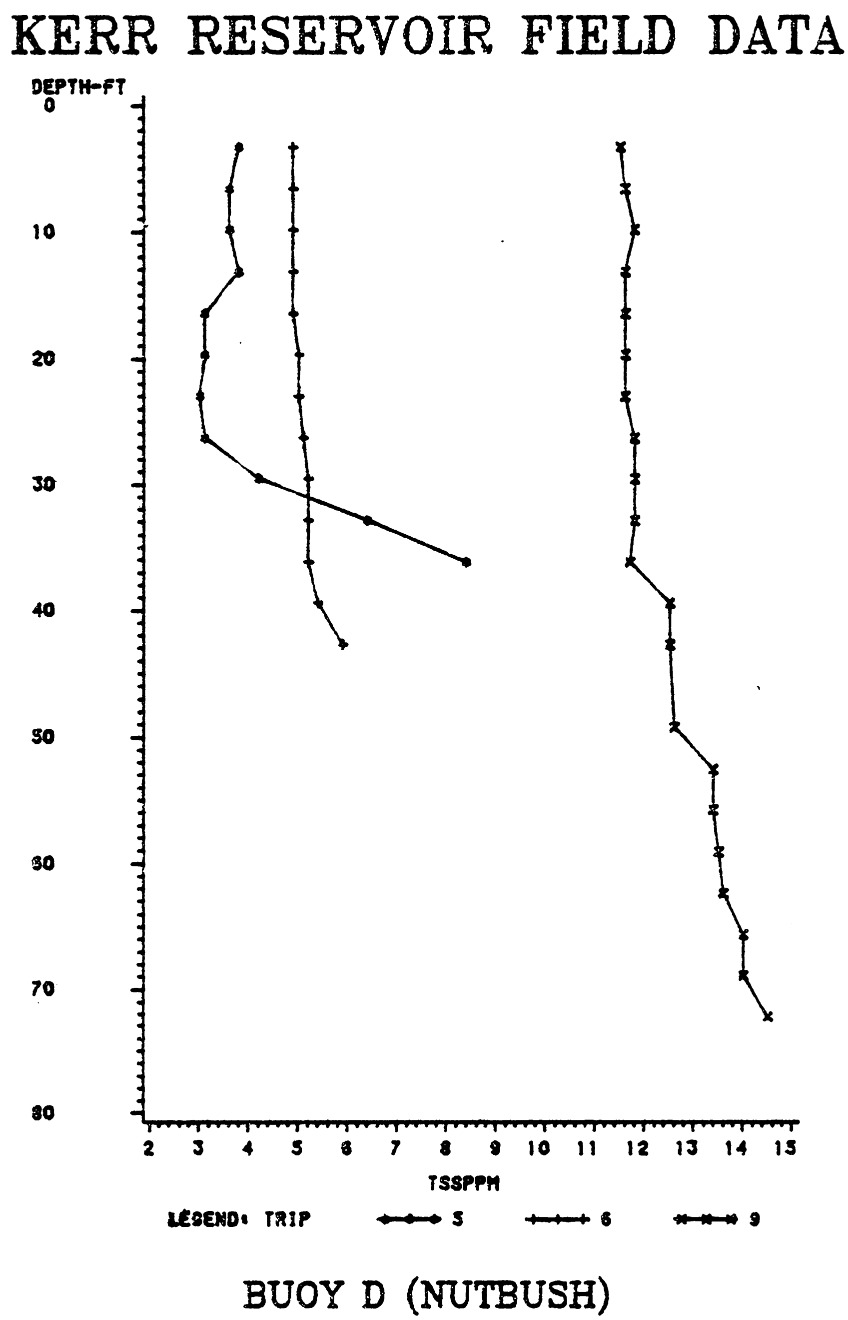


Figure C26 - Measured Values of Total Suspended Solids (PPM) for Station 11

APPENDIX D

VPI&SU FIELD DATA

Appendix D consists of the data collected by the VPI&SU research team that is relevant to this report. The data is broken into two parts. First is the data pertaining to suspended sediment. Following this is the data pertaining to water temperature and velocity. For the readers convenience explanations of the headings are given below:

PATHLNTH = pathlength of the transmissometer in cm. (100, 33, 10)

DEPTHM = depth of transmissometer reading in meters.

DEPTHFT = depth of transmissometer reading in feet.

TRANSPER = transmissometer reading in percent of light received. (see chapter 3 for further discussion)

TSSPPM = total suspended solids in parts per million corresponding to TRANSPER value.

TEMP C = water temperature in degrees celcius.

CURDIR = current direction measured from due north.

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
1	30APR81	15	100	1	3.2	1.200	8.5
1	30APR81	15	100	2	6.5	1.700	7.9
1	30APR81	15	100	3	9.8	3.650	6.7
1	30APR81	15	100	4	13.1	6.000	5.6
1	30APR81	15	100	5	16.4	8.800	4.6
1	30APR81	15	100	6	19.6	9.800	4.4
1	30APR81	15	100	7	22.9	11.150	4.3
1	30APR81	15	100	8	26.2	11.200	4.3
1	30APR81	15	100	9	29.5	11.200	4.3
1	30APR81	15	100	10	32.8	7.700	4.8
1	30APR81	15	100	11	36.0	4.000	6.0
1	30APR81	18	100	2	6.5	0.825	8.7
1	30APR81	18	100	3	9.8	1.550	8.2
1	30APR81	18	100	4	13.1	3.500	6.2
1	30APR81	18	100	5	16.4	6.150	5.4
1	30APR81	18	100	6	19.6	5.500	5.5
1	30APR81	18	100	7	22.9	4.200	6.2
1	30APR81	18	100	8	26.2	4.950	5.7
1	30APR81	18	*	9	29.5	*	*
1	30APR81	20	33	1	3.2	48.000	12.5
1	30APR81	20	33	2	6.5	39.000	13.2
1	30APR81	20	33	3	9.8	37.500	13.5
1	30APR81	20	33	4	13.1	34.200	12.5
1	30APR81	20	33	5	16.4	30.000	12.2
1	30APR81	20	33	6	19.6	30.000	12.0
1	30APR81	20	33	7	22.9	32.000	11.7
1	30APR81	20	100	8	26.2	0.120	15.0
1	30APR81	20	*	9	29.5	*	*
1	30APR81	22	100	1	3.2	0.420	11.0
1	30APR81	22	100	2	6.5	0.740	9.2
1	30APR81	22	100	3	9.8	1.150	8.6
1	30APR81	22	100	4	13.1	2.200	7.3
1	30APR81	22	100	5	16.4	1.050	8.7
1	30APR81	22	33	6	19.6	57.650	13.4
1	30APR81	22	33	7	22.9	24.000	55.0
1	30APR81	22	33	8	26.2	22.500	58.0
1	30APR81	22	33	9	29.5	21.000	58.0
1	30APR81	24	33	1	3.2	60.000	13.5
1	30APR81	24	33	2	6.5	64.000	13.2
1	30APR81	24	33	3	9.8	68.000	12.8
1	30APR81	24	33	4	13.1	100.000	10.0
1	30APR81	24	33	5	16.4	34.500	16.2
1	30APR81	24	33	6	19.6	22.000	21.2
1	30APR81	24	33	7	22.9	10.000	25.0
1	1MAY81	K	100	1	3.2	4.600	5.9
1	1MAY81	K	100	2	6.5	5.000	5.5
1	1MAY81	K	100	3	9.8	4.200	6.0
1	1MAY81	K	100	4	13.1	5.300	5.4
1	1MAY81	K	100	5	16.4	7.400	5.0
1	1MAY81	K	100	6	19.6	6.600	5.2
1	1MAY81	K	100	7	22.9	5.600	5.6
1	1MAY81	K	100	8	26.2	1.900	7.5
1	1MAY81	K	100	9	29.5	2.000	7.5
1	1MAY81	K	100	10	32.8	0.560	10.3
1	1MAY81	K	100	11	36.0	0.240	12.8
1	1MAY81	K	100	12	39.3	0.250	12.4

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
1	1MAY81	K	100	13.00	42.6	0.90	9.1
1	1MAY81	K	*	14.00	45.9	*	*
1	1MAY81	K	*	15.00	49.2	*	*
1	1MAY81	G	100	1.00	3.2	12.00	4.2
1	1MAY81	G	100	2.00	6.5	11.80	4.2
1	1MAY81	G	100	3.00	9.8	11.00	4.3
1	1MAY81	G	100	4.00	13.1	10.50	4.4
1	1MAY81	G	100	5.00	16.4	11.50	4.2
1	1MAY81	G	100	6.00	19.6	12.20	4.2
1	1MAY81	G	100	7.00	22.9	11.00	4.4
1	1MAY81	G	100	8.00	26.2	11.50	4.2
1	1MAY81	G	100	9.00	29.5	7.00	5.0
1	1MAY81	G	100	10.00	32.8	4.40	6.0
1	1MAY81	G	100	11.00	36.0	3.40	6.5
1	1MAY81	G	100	12.00	39.3	3.40	6.5
1	1MAY81	G	100	13.00	42.6	3.40	6.5
1	1MAY81	G	100	14.00	45.9	1.40	8.2
1	1MAY81	G	100	15.00	49.2	1.30	8.3
1	1MAY81	G	100	16.00	52.4	1.60	8.0
1	1MAY81	G	100	17.00	55.7	3.40	6.4
1	1MAY81	G	100	18.00	59.0	2.20	7.2
1	1MAY81	D	100	1.00	3.2	13.00	4.1
1	1MAY81	D	100	2.00	6.5	13.00	4.1
1	1MAY81	D	100	3.00	9.8	13.00	4.1
1	1MAY81	D	100	4.00	13.1	12.50	4.1
1	1MAY81	D	100	5.00	16.4	12.20	4.2
1	1MAY81	D	100	6.00	19.6	10.10	4.5
1	1MAY81	D	100	7.00	22.9	10.20	5.0
1	1MAY81	3	100	1.00	3.2	15.00	3.8
1	1MAY81	3	100	2.00	6.5	14.00	4.0
1	1MAY81	3	100	3.00	9.8	14.00	4.0
1	1MAY81	3	100	4.00	13.1	13.80	4.0
1	1MAY81	3	100	5.00	16.4	14.00	4.0
1	1MAY81	3	100	6.00	19.6	14.20	4.0
1	1MAY81	3	100	7.00	22.9	16.00	3.8
1	1MAY81	3	100	8.00	26.2	14.80	3.9
1	1MAY81	3	100	9.00	29.5	12.50	4.1
1	1MAY81	3	100	10.00	32.8	12.00	4.2
1	1MAY81	3	100	11.00	36.0	4.60	4.6
1	1MAY81	3	100	12.00	39.3	10.00	4.5
1	1MAY81	3	100	13.00	42.6	7.30	5.0
1	1MAY81	3	100	14.00	45.9	6.95	5.0
1	1MAY81	3	100	15.00	49.2	7.20	5.0
1	1MAY81	3	100	16.00	52.4	7.40	5.0
1	1MAY81	3	100	17.00	55.7	8.40	4.8
1	1MAY81	3	100	18.00	59.0	8.30	4.8
1	1MAY81	3	100	19.00	62.3	6.10	5.4
1	1MAY81	3	100	20.00	65.6	6.30	5.4
1	1MAY81	3	100	21.00	68.9	5.10	5.6
1	1MAY81	3	100	22.00	72.1	6.90	5.0
1	1MAY81	3	*	22.25	73.0	*	*
1	1MAY81	4	100	1.00	3.2	14.00	4.0
1	1MAY81	4	100	2.00	6.5	14.00	4.0
1	1MAY81	4	100	3.00	9.8	14.00	4.0
1	1MAY81	4	100	4.00	13.1	13.80	4.0
1	1MAY81	4	100	5.00	16.4	12.50	4.1

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
1	1MAY81	4	100	6.0	19.6	13.80	4.0
1	1MAY81	4	100	7.0	22.9	6.60	4.0
1	1MAY81	4	100	8.0	26.2	11.50	4.3
1	1MAY81	4	100	9.0	29.5	11.50	4.3
1	1MAY81	4	100	10.0	32.8	6.50	5.2
1	1MAY81	4	100	11.0	36.0	16.50	3.7
1	1MAY81	4	100	12.0	39.3	17.00	3.6
1	1MAY81	4	100	13.0	42.6	14.00	4.0
1	1MAY81	4	100	14.0	45.9	7.80	4.9
1	1MAY81	4	100	15.0	49.2	4.80	5.7
1	1MAY81	4	100	16.0	52.4	4.40	5.9
1	1MAY81	4	100	17.0	55.7	5.00	5.6
1	1MAY81	4	100	18.0	59.0	4.80	5.7
1	1MAY81	4	100	19.0	62.3	4.20	6.0
1	1MAY81	4	100	20.0	65.6	4.80	5.8
1	1MAY81	4	100	21.0	68.9	4.20	6.0
1	1MAY81	4	100	22.0	72.1	5.20	5.6
1	1MAY81	4	*	23.0	75.4	*	*
1	1MAY81	8	100	1.0	3.2	11.80	4.2
1	1MAY81	8	100	2.0	6.5	12.00	4.2
1	1MAY81	8	100	3.0	9.8	11.20	4.3
1	1MAY81	8	100	4.0	13.1	11.00	4.4
1	1MAY81	8	100	5.0	16.4	11.20	4.3
1	1MAY81	8	100	6.0	19.6	12.30	4.1
1	1MAY81	8	100	7.0	22.9	10.10	4.5
1	1MAY81	8	100	8.0	26.2	8.50	4.8
1	1MAY81	8	100	9.0	29.5	11.30	4.3
1	1MAY81	8	100	10.0	32.8	10.20	4.0
1	1MAY81	8	100	11.0	36.0	10.20	4.4
1	1MAY81	8	100	12.0	39.3	9.30	4.6
1	1MAY81	8	100	13.0	42.6	4.90	5.7
1	1MAY81	8	100	14.0	45.9	7.20	5.0
1	1MAY81	8	100	15.0	49.2	6.50	5.4
1	1MAY81	8	100	16.0	52.4	5.80	5.4
1	1MAY81	8	100	17.0	55.7	3.80	6.2
1	1MAY81	8	100	18.0	59.0	2.55	7.0
1	1MAY81	8	100	19.0	62.3	2.10	7.5
1	1MAY81	8	100	20.0	65.6	0.53	10.5
1	1MAY81	8	*	21.5	70.5	*	*
2	18MAY81	11	100	1.0	3.2	5.80	5.3
2	18MAY81	11	100	2.0	6.5	5.90	5.3
2	18MAY81	11	100	3.0	9.8	6.90	5.0
2	18MAY81	11	100	4.0	13.1	6.40	5.2
2	18MAY81	11	100	5.0	16.4	6.80	5.1
2	18MAY81	11	100	6.0	19.6	6.90	5.0
2	18MAY81	11	100	7.0	22.9	8.60	4.8
2	18MAY81	11	100	8.0	26.2	9.20	4.6
2	18MAY81	11	100	9.0	29.5	8.00	4.9
2	18MAY81	11	100	10.0	32.8	8.00	4.9
2	18MAY81	11	100	11.0	36.0	6.60	5.2
2	18MAY81	11	100	12.0	39.3	2.00	7.5
2	18MAY81	11	100	13.0	42.6	2.60	7.0
2	18MAY81	11	100	14.0	45.9	2.80	6.6
2	18MAY81	11	100	15.0	49.2	3.50	6.3
2	18MAY81	11	100	16.0	52.4	2.80	6.6
2	18MAY81	11	100	17.0	55.7	1.00	9.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
2	18MAY81	11	100	18	59.0	0.62	10.0
2	18MAY81	11	100	19	62.3	0.23	12.9
2	18MAY81	11	100	20	65.6	0.21	13.0
2	18MAY81	11	*	21	68.9	*	*
2	18MAY81	15	100	1	3.2	6.35	5.2
2	18MAY81	15	100	2	6.5	6.00	5.4
2	18MAY81	15	100	3	9.8	5.90	5.5
2	18MAY81	15	100	4	13.1	6.40	5.2
2	18MAY81	15	100	5	16.4	6.80	5.1
2	18MAY81	15	100	6	19.6	6.80	5.1
2	18MAY81	15	100	7	22.9	4.80	5.7
2	18MAY81	15	100	8	26.2	6.20	5.2
2	18MAY81	15	100	9	29.5	3.00	6.6
2	18MAY81	15	100	10	32.8	4.00	6.0
2	18MAY81	15	100	11	36.0	2.00	7.5
2	18MAY81	15	*	12	39.3	*	*
2	18MAY81	18	100	1	3.2	4.20	6.0
2	18MAY81	18	100	2	6.5	3.90	6.2
2	18MAY81	18	100	3	9.8	3.50	6.3
2	18MAY81	18	100	4	13.1	3.60	6.3
2	18MAY81	18	100	5	16.4	4.00	6.1
2	18MAY81	18	100	6	19.6	4.20	6.0
2	18MAY81	18	100	7	22.9	5.65	5.5
2	18MAY81	18	100	8	26.2	4.30	6.0
2	18MAY81	18	100	9	29.5	0.31	11.7
2	18MAY81	18	*	10	32.8	*	*
2	18MAY81	22	100	1	3.2	1.65	5.2
2	18MAY81	22	100	2	6.5	1.70	5.0
2	18MAY81	22	100	3	9.8	1.80	4.8
2	18MAY81	22	100	4	13.1	3.00	6.6
2	18MAY81	22	100	5	16.4	2.30	7.4
2	18MAY81	22	100	6	19.6	0.15	13.9
2	18MAY81	22	*	7	22.9	*	*
2	18MAY81	24	100	1	3.2	0.57	10.2
2	18MAY81	24	100	2	6.5	0.56	10.2
2	18MAY81	24	100	3	9.8	0.18	13.1
2	18MAY81	24	100	4	13.1	0.30	12.0
2	18MAY81	24	100	5	16.4	0.46	10.8
2	18MAY81	8	100	1	3.2	5.90	5.3
2	18MAY81	8	100	2	6.5	6.00	5.4
2	18MAY81	8	100	3	9.8	6.00	5.4
2	18MAY81	8	100	4	13.1	7.30	5.0
2	18MAY81	8	100	5	16.4	7.80	4.8
2	18MAY81	8	100	6	19.6	9.10	4.6
2	18MAY81	8	100	7	22.9	10.10	4.4
2	18MAY81	8	100	8	26.2	10.20	4.4
2	18MAY81	8	100	9	29.5	10.20	4.4
2	18MAY81	8	100	10	32.8	8.50	4.8
2	18MAY81	8	100	11	36.0	8.20	4.8
2	18MAY81	8	100	12	39.3	8.40	5.0
2	18MAY81	8	100	13	42.6	7.10	5.0
2	18MAY81	8	100	14	45.9	5.00	5.6
2	18MAY81	8	100	15	49.2	2.10	7.4
2	18MAY81	8	100	16	52.4	2.40	7.0
2	18MAY81	8	100	17	55.7	3.80	6.2
2	18MAY81	8	100	18	59.0	2.40	7.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
2	18MAY81	8	100	19.0	62.3	2.30	7.0
2	18MAY81	8	100	20.0	65.6	1.60	8.0
2	18MAY81	8	*	21.0	68.9	*	*
2	19MAY81	K	100	1.0	3.2	2.70	7.0
2	19MAY81	K	100	2.0	6.5	2.70	7.0
2	19MAY81	K	100	3.0	9.8	2.70	7.0
2	19MAY81	K	100	4.0	13.1	2.80	6.8
2	19MAY81	K	100	5.0	16.4	2.80	6.8
2	19MAY81	K	100	6.0	19.6	2.80	6.8
2	19MAY81	K	100	7.0	22.9	2.70	7.0
2	19MAY81	K	100	8.0	26.2	2.80	6.8
2	19MAY81	K	100	9.0	29.5	2.20	7.3
2	19MAY81	K	33	10.0	32.8	*	*
2	19MAY81	K	33	11.0	36.0	32.00	18.0
2	19MAY81	K	33	12.0	39.3	35.00	16.9
2	19MAY81	K	*	13.0	42.6	*	*
2	19MAY81	G	100	1.0	3.2	4.40	6.0
2	19MAY81	G	100	2.0	6.5	4.40	6.0
2	19MAY81	G	100	3.0	9.8	4.40	6.0
2	19MAY81	G	100	4.0	13.1	4.50	5.9
2	19MAY81	G	100	5.0	16.4	4.30	6.0
2	19MAY81	G	100	6.0	19.6	4.00	6.1
2	19MAY81	G	100	7.0	22.9	3.80	6.2
2	19MAY81	G	100	8.0	26.2	3.80	6.2
2	19MAY81	G	100	9.0	29.5	3.70	6.3
2	19MAY81	G	100	10.0	32.8	3.00	6.6
2	19MAY81	G	100	11.0	36.0	2.50	7.0
2	19MAY81	G	100	12.0	39.3	0.63	10.0
2	19MAY81	G	100	13.0	42.6	0.38	11.2
2	19MAY81	G	100	14.0	45.9	0.41	11.0
2	19MAY81	G	100	15.0	49.2	0.53	10.3
2	19MAY81	G	100	16.0	52.4	0.81	9.4
2	19MAY81	G	100	17.0	55.7	1.40	8.4
2	19MAY81	G	100	18.0	59.0	1.70	7.8
2	19MAY81	G	100	19.0	62.3	1.20	8.5
2	19MAY81	D	100	1.0	3.2	7.70	4.9
2	19MAY81	D	100	2.0	6.5	7.80	4.9
2	19MAY81	D	100	3.0	9.8	7.80	4.9
2	19MAY81	D	100	4.0	13.1	7.80	4.9
2	19MAY81	D	100	5.0	16.4	7.80	4.9
2	19MAY81	D	100	6.0	19.6	7.80	4.9
2	19MAY81	D	100	7.0	22.9	7.70	4.9
2	19MAY81	D	*	7.5	24.6	*	*
2	19MAY81	3	100	1.0	3.2	12.00	4.2
2	19MAY81	3	100	2.0	6.5	12.00	4.2
2	19MAY81	3	100	3.0	9.8	12.00	4.2
2	19MAY81	3	100	4.0	13.1	12.00	4.2
2	19MAY81	3	100	5.0	16.4	12.50	4.1
2	19MAY81	3	100	6.0	19.6	12.60	4.1
2	19MAY81	3	100	7.0	22.9	12.20	4.2
2	19MAY81	3	100	8.0	26.2	12.20	4.2
2	19MAY81	3	100	9.0	29.5	11.80	4.2
2	19MAY81	3	100	10.0	32.8	8.70	4.7
2	19MAY81	3	100	11.0	36.0	8.20	4.8
2	19MAY81	3	100	12.0	39.3	8.10	4.8
2	19MAY81	3	100	13.0	42.6	8.00	4.8

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
2	19MAY81	3	100	14	45.9	8.20	4.8
2	19MAY81	3	100	15	49.2	8.50	4.8
2	19MAY81	3	100	16	52.4	7.40	5.0
2	19MAY81	3	100	17	55.7	6.30	5.3
2	19MAY81	3	100	18	59.0	6.00	5.4
2	19MAY81	3	100	19	62.3	7.20	5.0
2	19MAY81	3	100	20	65.6	7.20	5.0
2	19MAY81	3	100	21	68.9	6.60	5.2
2	19MAY81	3	*	22	72.1	*	*
2	19MAY81	5	100	1	3.2	10.20	4.4
2	19MAY81	5	100	2	6.5	10.10	4.4
2	19MAY81	5	100	3	9.8	10.40	4.4
2	19MAY81	5	100	4	13.1	10.40	4.4
2	19MAY81	5	100	5	16.4	10.40	4.4
2	19MAY81	5	100	6	19.6	10.40	4.4
2	19MAY81	5	100	7	22.9	10.50	4.4
2	19MAY81	5	100	8	26.2	10.70	4.4
2	19MAY81	5	100	9	29.5	11.50	4.5
2	19MAY81	5	100	10	32.8	10.70	4.4
2	19MAY81	5	100	11	36.0	10.20	4.4
2	19MAY81	5	100	12	39.3	7.00	5.1
2	19MAY81	5	100	13	42.6	5.20	5.6
2	19MAY81	5	100	14	45.9	2.70	7.0
2	19MAY81	5	100	15	49.2	2.50	7.0
2	19MAY81	5	100	16	52.4	2.60	7.0
2	19MAY81	5	100	17	55.7	2.80	6.8
2	19MAY81	5	100	18	59.0	0.70	9.6
2	19MAY81	5	100	19	62.3	0.35	11.5
2	19MAY81	5	100	20	65.6	0.33	11.6
2	19MAY81	5	100	21	68.9	0.46	10.9
3	24JUN81	100	100	1	3.2	0.20	13.0
3	24JUN81	100	33	2	6.5	38.00	18.2
3	24JUN81	100	33	3	9.8	23.80	19.5
3	24JUN81	100	33	4	13.1	0.60	47.0
3	24JUN81	11	100	1	3.2	8.60	4.7
3	24JUN81	11	100	2	6.5	10.20	4.4
3	24JUN81	11	100	3	9.8	10.10	4.4
3	24JUN81	11	100	4	13.1	10.30	4.4
3	24JUN81	11	100	5	16.4	10.70	4.4
3	24JUN81	11	100	6	19.6	10.30	4.4
3	24JUN81	11	100	7	22.9	10.80	4.4
3	24JUN81	11	100	8	26.2	10.60	4.4
3	24JUN81	11	100	9	29.5	10.00	4.4
3	24JUN81	11	100	10	32.8	6.00	5.4
3	24JUN81	11	100	11	36.0	3.30	6.4
3	24JUN81	11	100	12	39.3	3.80	5.9
3	24JUN81	11	100	13	42.6	3.80	6.2
3	24JUN81	11	100	14	45.9	2.20	7.3
3	24JUN81	11	100	15	49.2	0.27	12.0
3	24JUN81	11	100	16	52.4	2.40	7.1
3	24JUN81	11	100	17	55.7	3.30	6.4
3	24JUN81	11	100	18	59.0	0.60	10.0
3	24JUN81	11	100	19	62.3	0.88	9.1
3	24JUN81	11	100	20	65.6	0.18	13.3
3	24JUN81	11	*	21	68.9	*	*
3	24JUN81	15	100	1	3.2	6.30	5.3

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
3	24JUN81	15	100	2.0	6.5	5.90	5.4
3	24JUN81	15	100	3.0	9.8	8.00	4.8
3	24JUN81	15	100	4.0	13.1	9.50	4.6
3	24JUN81	15	100	5.0	16.4	8.00	4.8
3	24JUN81	15	100	6.0	19.6	3.80	6.2
3	24JUN81	15	100	7.0	22.9	7.25	5.0
3	24JUN81	15	100	8.0	26.2	4.20	6.0
3	24JUN81	15	100	9.0	29.5	0.51	10.5
3	24JUN81	15	100	10.0	32.8	0.28	12.0
3	24JUN81	15	100	11.0	36.0	0.17	13.6
3	24JUN81	15	100	12.0	39.3	0.02	26.0
3	24JUN81	15	*	12.4	40.6	*	*
3	24JUN81	18	100	1.0	3.2	2.20	7.3
3	24JUN81	18	100	2.0	6.5	4.20	6.0
3	24JUN81	18	100	3.0	9.8	4.80	5.8
3	24JUN81	18	100	4.0	13.1	4.60	5.9
3	24JUN81	18	100	5.0	16.4	3.70	6.3
3	24JUN81	18	100	6.0	19.6	1.20	8.5
3	24JUN81	18	100	7.0	22.9	0.22	12.8
3	24JUN81	18	*	8.6	28.2	*	*
3	24JUN81	20	100	1.0	3.2	25.80	3.0
3	24JUN81	20	100	2.0	6.5	30.20	2.8
3	24JUN81	20	100	3.0	9.8	18.20	3.6
3	24JUN81	20	100	4.0	13.1	14.10	6.0
3	24JUN81	20	100	5.0	16.4	0.16	13.9
3	24JUN81	20	100	6.0	19.6	0.02	26.0
3	24JUN81	20	100	7.0	22.9	0.15	13.9
3	24JUN81	20	*	8.3	27.2	*	*
3	24JUN81	22	100	1.0	3.2	0.76	9.5
3	24JUN81	22	100	2.0	6.5	0.78	9.5
3	24JUN81	22	100	3.0	9.8	0.70	9.6
3	24JUN81	22	100	4.0	13.1	0.44	10.9
3	24JUN81	22	100	4.5	14.7	0.24	12.7
3	24JUN81	22	100	5.0	16.4	0.10	15.0
3	24JUN81	22	*	6.0	19.6	*	*
3	24JUN81	22	*	7.0	22.9	*	*
3	24JUN81	5	100	1.0	3.2	24.00	3.1
3	24JUN81	5	100	2.0	6.5	19.00	3.5
3	24JUN81	5	100	3.0	9.8	18.50	3.6
3	24JUN81	5	100	4.0	13.1	20.00	3.4
3	24JUN81	5	100	5.0	16.4	23.00	3.2
3	24JUN81	5	100	6.0	19.6	21.00	3.3
3	24JUN81	5	100	7.0	22.9	18.00	3.6
3	24JUN81	5	100	8.0	26.2	17.00	3.6
3	24JUN81	5	100	9.0	29.5	13.00	4.1
3	24JUN81	5	100	10.0	32.8	16.00	3.8
3	24JUN81	5	100	11.0	36.0	12.00	4.2
3	24JUN81	5	100	12.0	39.3	17.50	3.6
3	24JUN81	5	100	13.0	42.6	18.50	3.5
3	24JUN81	5	100	14.0	45.9	16.50	3.7
3	24JUN81	5	100	15.0	49.2	12.50	4.1
3	24JUN81	5	100	16.0	52.4	13.00	4.1
3	24JUN81	5	100	17.0	55.7	13.00	4.1
3	24JUN81	5	100	18.0	59.0	12.00	4.2
3	24JUN81	5	100	19.0	62.3	15.50	3.8
3	24JUN81	5	100	20.0	65.6	12.00	4.2

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
3	24JUN81	5	100	21.0	68.9	2.00	7.5
3	24JUN81	5	*	21.5	70.5	*	*
3	24JUN81	8	100	1.0	3.2	12.00	4.2
3	24JUN81	8	100	2.0	6.5	13.80	4.0
3	24JUN81	8	100	3.0	9.8	14.00	4.0
3	24JUN81	8	100	4.0	13.1	13.00	4.0
3	24JUN81	8	100	5.0	16.4	14.00	4.0
3	24JUN81	8	100	6.0	19.6	22.00	3.3
3	24JUN81	8	100	7.0	22.9	22.00	3.3
3	24JUN81	8	100	8.0	26.2	21.00	3.3
3	24JUN81	8	100	9.0	29.5	8.10	4.8
3	24JUN81	8	100	10.0	32.8	12.00	4.2
3	24JUN81	8	100	11.0	36.0	13.00	4.0
3	24JUN81	8	100	12.0	39.3	13.80	4.0
3	24JUN81	8	100	13.0	42.6	12.40	4.3
3	24JUN81	8	100	14.0	45.9	11.90	4.2
3	24JUN81	8	100	15.0	49.2	13.80	4.0
3	24JUN81	8	100	16.0	52.4	13.90	4.0
3	24JUN81	8	100	17.0	55.7	11.00	4.4
3	24JUN81	8	100	18.0	59.0	8.40	4.8
3	24JUN81	8	100	19.0	62.3	9.20	4.6
3	24JUN81	8	100	20.0	65.6	6.60	5.2
3	24JUN81	8	*	20.7	67.9	*	*
3	25JUN81	K	100	1.0	3.2	5.90	5.4
3	25JUN81	K	100	2.0	6.5	6.40	5.2
3	25JUN81	K	100	3.0	9.8	7.00	5.1
3	25JUN81	K	100	4.0	13.1	7.05	5.0
3	25JUN81	K	100	5.0	16.4	8.50	4.8
3	25JUN81	K	100	6.0	19.6	9.50	4.6
3	25JUN81	K	100	7.0	22.9	6.30	5.3
3	25JUN81	K	100	8.0	26.2	2.75	6.9
3	25JUN81	K	100	9.0	29.5	1.60	8.0
3	25JUN81	K	100	10.0	32.8	0.48	10.7
3	25JUN81	K	100	11.0	36.0	0.55	10.3
3	25JUN81	K	*	11.5	37.7	*	*
3	25JUN81	G	100	1.0	3.2	14.50	4.0
3	25JUN81	G	100	2.0	6.5	14.00	4.0
3	25JUN81	G	100	3.0	9.8	13.20	4.1
3	25JUN81	G	100	4.0	13.1	15.00	3.9
3	25JUN81	G	100	5.0	16.4	14.00	4.0
3	25JUN81	G	100	6.0	19.6	13.00	4.1
3	25JUN81	G	100	7.0	22.9	12.00	4.2
3	25JUN81	G	100	8.0	26.2	8.90	4.7
3	25JUN81	G	100	9.0	29.5	6.10	5.4
3	25JUN81	G	100	10.0	32.8	5.15	5.6
3	25JUN81	G	100	11.0	36.0	4.40	6.0
3	25JUN81	G	100	12.0	39.3	3.25	6.4
3	25JUN81	G	100	13.0	42.6	3.80	6.2
3	25JUN81	G	100	14.0	45.9	3.55	6.2
3	25JUN81	G	100	15.0	49.2	4.00	6.1
3	25JUN81	G	100	16.0	52.4	4.60	5.9
3	25JUN81	G	100	17.0	55.7	4.80	5.8
3	25JUN81	G	100	18.0	59.0	4.15	6.0
3	25JUN81	G	100	19.0	62.3	2.40	7.1
3	25JUN81	G	*	19.6	64.3	*	*
3	25JUN81	D	100	1.0	3.2	17.50	3.6

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
3	25JUN81	D	100	2.0	6.5	17.50	3.6
3	25JUN81	D	100	3.0	9.8	17.50	3.6
3	25JUN81	D	100	4.0	13.1	17.50	3.6
3	25JUN81	D	100	5.0	16.4	17.50	3.6
3	25JUN81	D	100	6.0	19.6	17.50	3.6
3	25JUN81	D	100	7.0	22.9	17.90	3.6
3	25JUN81	3	100	1.0	3.2	23.00	3.2
3	25JUN81	3	100	2.0	6.5	23.50	3.1
3	25JUN81	3	100	3.0	9.8	23.00	3.2
3	25JUN81	3	100	4.0	13.1	23.00	3.2
3	25JUN81	3	100	5.0	16.4	23.50	3.1
3	25JUN81	3	100	6.0	19.6	24.00	3.1
3	25JUN81	3	100	7.0	22.9	22.50	3.3
3	25JUN81	3	100	8.0	26.2	21.00	3.4
3	25JUN81	3	100	9.0	29.5	20.50	3.3
3	25JUN81	3	100	10.0	32.8	20.00	3.3
3	25JUN81	3	100	11.0	36.0	17.50	3.6
3	25JUN81	3	100	12.0	39.3	15.50	3.8
3	25JUN81	3	100	13.0	42.6	9.50	4.6
3	25JUN81	3	100	14.0	45.9	6.50	5.2
3	25JUN81	3	100	15.0	49.2	6.70	5.2
3	25JUN81	3	100	16.0	52.4	8.90	4.7
3	25JUN81	3	100	17.0	55.7	12.00	4.2
3	25JUN81	3	100	18.0	59.0	19.00	3.5
3	25JUN81	3	100	19.0	62.3	24.00	3.1
3	25JUN81	3	100	20.0	65.6	26.50	3.1
3	25JUN81	3	100	21.0	68.9	26.50	3.1
3	25JUN81	3	*	21.6	70.8	*	*
4	16AUG81	K	100	1.0	3.2	2.15	7.3
4	16AUG81	K	100	2.0	6.5	2.15	7.3
4	16AUG81	K	100	3.0	9.8	2.10	7.3
4	16AUG81	K	100	4.0	13.1	2.20	7.3
4	16AUG81	K	100	5.0	16.4	2.60	7.0
4	16AUG81	K	100	6.0	19.6	2.70	7.0
4	16AUG81	K	100	7.0	22.9	2.60	7.0
4	16AUG81	K	100	8.0	26.2	2.65	7.0
4	16AUG81	K	100	9.0	29.5	2.40	7.1
4	16AUG81	K	100	10.0	32.8	0.09	15.5
4	16AUG81	K	100	11.0	36.0	0.24	12.7
4	16AUG81	K	100	12.0	39.3	0.28	12.0
4	16AUG81	K	*	12.3	40.3	*	*
4	16AUG81	G	100	1.0	3.2	8.90	4.7
4	16AUG81	G	100	2.0	6.5	9.00	4.7
4	16AUG81	G	100	3.0	9.8	9.10	4.7
4	16AUG81	G	100	4.0	13.1	9.15	4.6
4	16AUG81	G	100	5.0	16.4	9.00	4.7
4	16AUG81	G	100	6.0	19.6	9.20	4.6
4	16AUG81	G	100	7.0	22.9	9.10	4.7
4	16AUG81	G	100	8.0	26.2	8.40	4.8
4	16AUG81	G	100	9.0	29.5	6.80	5.1
4	16AUG81	G	100	10.0	32.8	4.30	6.0
4	16AUG81	G	100	11.0	36.0	3.60	6.3
4	16AUG81	G	100	12.0	39.3	3.40	6.4
4	16AUG81	G	100	13.0	42.6	3.15	6.4
4	16AUG81	G	100	14.0	45.9	2.85	6.7
4	16AUG81	G	100	15.0	49.2	1.20	8.5

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
4	16AUG81	G	*	15.3	50.1	*	*
4	16AUG81	100	33	1.0	3.2	37.80	16.5
4	16AUG81	100	33	2.0	6.5	35.00	17.0
4	16AUG81	100	33	3.0	9.8	30.00	17.9
4	16AUG81	100	*	3.5	11.4	*	*
4	16AUG81	11	100	1.0	3.2	2.30	7.2
4	16AUG81	11	100	2.0	6.5	2.60	7.0
4	16AUG81	11	100	3.0	9.8	3.10	6.5
4	16AUG81	11	100	4.0	13.1	4.10	6.1
4	16AUG81	11	100	5.0	16.4	4.20	6.0
4	16AUG81	11	100	6.0	19.6	4.40	6.0
4	16AUG81	11	100	7.0	22.9	4.70	5.9
4	16AUG81	11	100	8.0	26.2	5.00	5.6
4	16AUG81	11	100	9.0	29.5	6.00	5.4
4	16AUG81	11	100	10.0	32.8	5.40	5.5
4	16AUG81	11	100	11.0	36.0	0.45	10.9
4	16AUG81	11	100	12.0	39.3	0.25	12.3
4	16AUG81	11	33	13.0	42.6	42.00	15.9
4	16AUG81	11	33	14.0	45.9	39.50	16.1
4	16AUG81	11	33	15.0	49.2	23.00	20.0
4	16AUG81	11	33	16.0	52.4	38.00	16.3
4	16AUG81	11	33	17.0	55.7	38.50	16.3
4	16AUG81	11	33	18.0	59.0	50.50	14.7
4	16AUG81	11	33	19.0	62.3	67.50	13.0
4	16AUG81	11	33	20.0	65.6	40.00	16.0
4	16AUG81	11	33	21.0	68.9	5.00	30.0
4	16AUG81	11	*	21.2	69.5	*	*
4	16AUG81	15	100	1.0	3.2	0.88	9.1
4	16AUG81	15	100	2.0	6.5	0.92	9.1
4	16AUG81	15	100	3.0	9.8	1.40	8.4
4	16AUG81	15	100	4.0	13.1	2.10	7.3
4	16AUG81	15	100	5.0	16.4	3.00	6.6
4	16AUG81	15	100	6.0	19.6	3.40	6.4
4	16AUG81	15	100	7.0	22.9	4.60	5.9
4	16AUG81	15	100	8.0	26.2	2.20	7.3
4	16AUG81	15	100	9.0	29.5	0.17	13.5
4	16AUG81	15	*	11.5	37.7	*	*
4	16AUG81	18	100	1.0	3.2	14.00	4.0
4	16AUG81	18	100	2.0	6.5	14.00	4.0
4	16AUG81	18	100	3.0	9.8	16.20	3.8
4	16AUG81	18	100	4.0	13.1	23.00	3.2
4	16AUG81	18	100	5.0	16.4	28.00	3.0
4	16AUG81	18	100	6.0	19.6	24.00	3.1
4	16AUG81	18	100	7.0	22.9	21.00	3.4
4	16AUG81	18	100	7.5	24.6	15.80	3.8
4	16AUG81	18	*	8.0	26.2	*	*
4	16AUG81	D	100	1.0	3.2	12.20	4.2
4	16AUG81	D	100	2.0	6.5	9.80	4.6
4	16AUG81	D	100	3.0	9.8	14.00	4.0
4	16AUG81	D	100	4.0	13.1	15.50	3.8
4	16AUG81	D	100	5.0	16.4	14.00	4.0
4	16AUG81	D	100	6.0	19.6	14.20	4.0
4	16AUG81	D	100	7.0	22.9	15.00	3.9
4	16AUG81	D	100	8.0	26.2	15.00	3.9
4	16AUG81	D	100	9.0	29.5	14.50	3.9
4	16AUG81	D	100	10.0	32.8	13.00	4.1

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
4	16AUG81	D	100	11.0	36.0	8.60	4.7
4	16AUG81	D	100	12.0	39.3	15.00	3.9
4	16AUG81	D	100	13.0	42.6	13.50	4.1
4	16AUG81	D	100	14.0	45.9	8.10	4.8
4	16AUG81	D	100	15.0	49.2	7.10	5.0
4	16AUG81	D	*	15.5	50.8	*	*
4	16AUG81	20	33	1.0	3.2	79.00	12.0
4	16AUG81	20	33	2.0	6.5	81.80	11.8
4	16AUG81	20	33	3.0	9.8	86.00	11.7
4	16AUG81	20	100	4.0	13.1	0.55	10.3
4	16AUG81	20	100	5.0	16.4	0.56	10.3
4	16AUG81	20	100	6.0	19.6	0.08	15.2
4	16AUG81	20	33	7.0	22.9	26.20	35.0
4	16AUG81	20	33	8.0	26.2	10.50	24.5
4	16AUG81	20	33	9.0	29.5	6.40	26.5
4	16AUG81	20	33	10.0	32.8	7.80	26.8
4	16AUG81	20	*	10.5	34.4	*	*
4	16AUG81	22	33	1.0	3.2	70.00	13.0
4	16AUG81	22	33	2.0	6.5	74.50	12.4
4	16AUG81	22	33	3.0	9.8	76.00	12.2
4	16AUG81	22	33	4.0	13.1	76.50	12.1
4	16AUG81	22	33	5.0	16.4	71.50	12.7
4	16AUG81	22	33	6.0	19.6	50.00	14.7
4	16AUG81	22	33	7.0	22.9	25.00	19.0
4	16AUG81	22	33	8.0	26.2	69.00	13.0
4	16AUG81	22	33	9.0	29.5	16.50	21.9
4	16AUG81	22	*	9.3	30.5	*	*
4	16AUG81	24	33	1.0	3.2	45.80	15.0
4	16AUG81	24	33	2.0	6.5	51.50	14.5
4	16AUG81	24	33	3.0	9.8	50.00	14.7
4	16AUG81	24	33	4.0	13.1	37.80	16.2
4	16AUG81	24	33	5.0	16.4	24.20	19.9
4	16AUG81	24	33	6.0	19.6	2.50	35.8
4	16AUG81	24	33	7.0	22.9	0.44	50.0
4	16AUG81	24	*	7.5	24.6	*	*
4	16AUG81	3	100	1.0	3.2	12.00	4.2
4	16AUG81	3	100	2.0	6.5	12.00	4.2
4	16AUG81	3	100	3.0	9.8	14.00	4.0
4	16AUG81	3	100	4.0	13.1	18.00	3.6
4	16AUG81	3	100	5.0	16.4	19.00	3.5
4	16AUG81	3	100	6.0	19.6	22.00	3.3
4	16AUG81	3	100	7.0	22.9	23.90	3.1
4	16AUG81	3	100	8.0	26.2	24.20	3.1
4	16AUG81	3	100	9.0	29.5	22.00	3.3
4	16AUG81	3	100	10.0	32.8	19.90	3.4
4	16AUG81	3	100	11.0	36.0	23.60	3.2
4	16AUG81	3	100	12.0	39.3	14.00	4.0
4	16AUG81	3	100	13.0	42.6	21.80	3.3
4	16AUG81	3	100	14.0	45.9	11.80	4.2
4	16AUG81	3	100	15.0	49.2	12.30	4.1
4	16AUG81	3	100	16.0	52.4	11.50	4.3
4	16AUG81	3	100	17.0	55.7	11.50	4.3
4	16AUG81	3	100	18.0	59.0	4.10	6.1
4	16AUG81	3	100	19.0	62.3	12.00	4.2
4	16AUG81	3	100	20.0	65.6	11.50	4.2
4	16AUG81	3	*	20.5	67.2	*	*

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
4	16AUG81	5	100	1.0	3.2	13.80	4.0
4	16AUG81	5	100	2.0	6.5	9.60	4.6
4	16AUG81	5	100	3.0	9.8	11.80	4.2
4	16AUG81	5	100	4.0	13.1	12.10	4.2
4	16AUG81	5	100	5.0	16.4	13.50	4.1
4	16AUG81	5	100	6.0	19.6	13.00	4.1
4	16AUG81	5	100	7.0	22.9	14.00	4.0
4	16AUG81	5	100	8.0	26.2	15.80	3.8
4	16AUG81	5	100	8.5	27.8	1.10	8.6
4	16AUG81	5	100	9.0	29.5	28.00	3.0
4	16AUG81	5	100	10.0	32.8	27.80	3.0
4	16AUG81	5	100	11.0	36.0	24.00	3.1
4	16AUG81	5	100	12.0	39.3	21.50	3.3
4	16AUG81	5	100	13.0	42.6	9.40	4.6
4	16AUG81	5	100	14.0	45.9	3.40	6.4
4	16AUG81	5	100	15.0	49.2	3.30	6.4
4	16AUG81	5	100	16.0	52.4	1.20	8.5
4	16AUG81	5	100	17.0	55.7	2.00	7.5
4	16AUG81	5	100	18.0	59.0	1.40	8.4
4	16AUG81	8	100	1.0	3.2	4.85	5.8
4	16AUG81	8	100	2.0	6.5	4.40	6.0
4	16AUG81	8	100	3.0	9.8	4.80	5.8
4	16AUG81	8	100	4.0	13.1	7.90	4.9
4	16AUG81	8	100	5.0	16.4	9.10	4.7
4	16AUG81	8	100	6.0	19.6	9.15	4.6
4	16AUG81	8	100	7.0	22.9	12.20	4.2
4	16AUG81	8	100	8.0	26.2	12.20	4.2
4	16AUG81	8	100	9.0	29.5	16.00	3.8
4	16AUG81	8	100	10.0	32.8	15.00	3.9
4	16AUG81	8	100	11.0	36.0	12.10	4.2
4	16AUG81	8	100	12.0	39.3	4.60	5.9
4	16AUG81	8	100	13.0	42.6	0.60	10.0
4	16AUG81	8	100	14.0	45.9	0.11	15.0
4	16AUG81	8	100	15.0	49.2	0.57	10.2
4	16AUG81	8	100	16.0	52.4	0.53	10.4
4	16AUG81	8	100	17.0	55.7	0.90	9.1
4	16AUG81	8	100	18.0	59.0	0.68	9.7
4	16AUG81	8	100	19.0	62.3	0.68	9.7
4	16AUG81	8	100	19.5	63.9	0.50	10.5
5	3SEP81	100	33	1.0	3.2	14.00	23.0
5	3SEP81	100	33	2.0	6.5	13.00	23.3
5	3SEP81	100	33	3.0	9.8	0.20	58.0
5	3SEP81	11	100	1.0	3.2	9.40	4.6
5	3SEP81	11	100	2.0	6.5	8.40	4.8
5	3SEP81	11	100	3.0	9.8	8.90	4.7
5	3SEP81	11	100	5.0	16.4	6.80	5.1
5	3SEP81	11	100	6.0	19.6	8.00	4.8
5	3SEP81	11	100	7.0	22.9	6.00	5.4
5	3SEP81	11	100	8.0	26.2	6.90	5.1
5	3SEP81	11	100	9.0	29.5	6.50	5.2
5	3SEP81	11	100	10.0	32.8	12.00	4.2
5	3SEP81	11	100	11.0	36.0	11.00	4.4
5	3SEP81	11	100	12.0	39.3	6.70	5.2
5	3SEP81	11	100	13.0	42.6	2.80	6.8
5	3SEP81	11	100	14.0	45.9	2.10	7.3
5	3SEP81	11	100	15.0	49.2	3.50	6.3

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
5	3SEP81	11	33	16.0	52.4	65.00	13.1
5	3SEP81	11	33	17.0	55.7	88.00	12.4
5	3SEP81	11	33	18.0	59.0	78.00	12.2
5	3SEP81	11	33	19.0	62.3	21.00	37.3
5	3SEP81	11	33	20.0	65.6	13.50	40.0
5	3SEP81	11	*	20.5	67.2	*	*
5	3SEP81	15	100	1.0	3.2	3.80	6.2
5	3SEP81	15	100	2.0	6.5	1.50	8.3
5	3SEP81	15	100	3.0	9.8	1.75	7.7
5	3SEP81	15	100	4.0	13.1	1.10	8.7
5	3SEP81	15	100	5.0	16.4	1.60	8.0
5	3SEP81	15	100	6.0	19.6	2.50	7.0
5	3SEP81	15	100	7.0	22.9	5.50	5.5
5	3SEP81	15	100	8.0	26.2	3.00	6.6
5	3SEP81	15	100	9.0	29.5	1.10	8.7
5	3SEP81	15	33	10.0	32.8	5.60	14.0
5	3SEP81	15	33	11.0	36.0	3.00	34.0
5	3SEP81	15	*	11.5	37.7	*	*
5	3SEP81	18	100	1.0	3.2	1.40	8.4
5	3SEP81	18	100	2.0	6.5	0.95	9.0
5	3SEP81	18	100	3.0	9.8	1.10	8.6
5	3SEP81	18	100	4.0	13.1	1.40	8.4
5	3SEP81	18	100	5.0	16.4	1.80	7.7
5	3SEP81	18	100	6.0	19.6	1.80	7.7
5	3SEP81	18	100	7.0	22.9	0.70	9.6
5	3SEP81	D	100	1.0	3.2	16.00	3.8
5	3SEP81	D	100	2.0	6.5	17.50	3.6
5	3SEP81	D	100	3.0	9.8	17.50	3.6
5	3SEP81	D	100	4.0	13.1	16.00	3.8
5	3SEP81	D	100	5.0	16.4	24.00	3.1
5	3SEP81	D	100	6.0	19.6	24.00	3.1
5	3SEP81	D	100	7.0	22.9	27.50	3.0
5	3SEP81	D	100	8.0	26.2	24.00	3.1
5	3SEP81	D	100	9.0	29.5	12.00	4.2
5	3SEP81	D	100	10.0	32.8	3.25	6.4
5	3SEP81	D	100	11.0	36.0	1.40	8.4
5	3SEP81	D	*	12.1	39.7	*	*
5	3SEP81	20	100	1.0	3.2	0.80	9.4
5	3SEP81	20	100	2.0	6.5	0.68	9.8
5	3SEP81	20	100	3.0	9.8	0.65	10.0
5	3SEP81	20	33	4.0	13.1	9.20	12.0
5	3SEP81	20	33	5.0	16.4	6.80	27.7
5	3SEP81	20	33	6.0	19.6	7.60	22.2
5	3SEP81	20	33	7.0	22.9	2.00	58.5
5	3SEP81	22	33	1.0	3.2	24.00	19.3
5	3SEP81	22	33	2.0	6.5	19.00	21.0
5	3SEP81	22	33	3.0	9.8	6.50	28.0
5	3SEP81	22	33	4.0	13.1	3.30	38.2
5	3SEP81	22	*	4.5	14.7	*	*
5	3SEP81	24	33	1.0	3.2	18.00	21.1
5	3SEP81	24	33	2.0	6.5	15.00	22.3
5	3SEP81	24	33	3.0	9.8	15.00	22.3
5	3SEP81	24	33	4.0	13.1	16.70	18.6
5	3SEP81	24	33	5.0	16.4	16.50	18.8
5	3SEP81	3	100	1.0	3.2	21.00	3.4
5	3SEP81	3	100	2.0	6.5	20.00	3.4

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
5	3SEP81	3	100	3.0	9.8	20.50	3.4
5	3SEP81	3	100	4.0	13.1	21.50	3.4
5	3SEP81	3	100	5.0	16.4	20.50	3.4
5	3SEP81	3	100	6.0	19.6	21.00	3.4
5	3SEP81	3	100	7.0	22.9	19.90	3.4
5	3SEP81	3	100	8.0	26.2	19.50	3.4
5	3SEP81	3	100	9.0	29.5	20.50	3.4
5	3SEP81	3	100	10.0	32.8	24.40	3.1
5	3SEP81	3	100	11.0	36.0	36.00	2.7
5	3SEP81	3	100	12.0	39.3	34.00	2.7
5	3SEP81	3	100	13.0	42.6	33.50	2.8
5	3SEP81	3	100	14.0	45.9	36.50	2.7
5	3SEP81	3	100	15.0	49.2	30.50	3.0
5	3SEP81	3	100	16.0	52.4	22.50	3.4
5	3SEP81	3	100	17.0	55.7	25.00	3.1
5	3SEP81	3	100	18.0	59.0	17.00	3.6
5	3SEP81	3	100	19.0	62.3	9.80	4.6
5	3SEP81	3	100	20.0	65.6	12.00	4.2
5	3SEP81	3	*	20.7	67.9	*	*
5	3SEP81	5	100	1.0	3.2	16.50	3.7
5	3SEP81	5	100	2.0	6.5	16.00	3.8
5	3SEP81	5	100	3.0	9.8	19.00	3.5
5	3SEP81	5	100	4.0	13.1	19.50	3.4
5	3SEP81	5	100	5.0	16.4	18.50	3.5
5	3SEP81	5	100	6.0	19.6	18.50	3.5
5	3SEP81	5	100	7.0	22.9	19.00	3.5
5	3SEP81	5	100	8.0	26.2	14.20	4.0
5	3SEP81	5	100	9.0	29.5	14.20	4.0
5	3SEP81	5	100	10.0	32.8	18.00	3.6
5	3SEP81	5	100	11.0	36.0	19.50	3.4
5	3SEP81	5	100	12.0	39.3	22.50	3.3
5	3SEP81	5	100	13.0	42.6	16.50	3.7
5	3SEP81	5	100	14.0	45.9	13.70	4.0
5	3SEP81	5	100	15.0	49.2	15.00	3.9
5	3SEP81	5	100	16.0	52.4	12.00	4.2
5	3SEP81	5	100	17.0	55.7	4.00	6.1
5	3SEP81	5	100	18.0	59.0	1.70	7.8
5	3SEP81	5	100	19.0	62.3	1.45	10.9
5	3SEP81	5	100	20.0	65.6	1.15	11.3
5	3SEP81	5	*	20.5	67.2	*	*
5	3SEP81	8	100	1.0	3.2	10.50	4.4
5	3SEP81	8	100	2.0	6.5	13.00	4.1
5	3SEP81	8	100	3.0	9.8	16.00	3.8
5	3SEP81	8	100	4.0	13.1	15.00	3.9
5	3SEP81	8	100	5.0	16.4	14.80	4.0
5	3SEP81	8	100	6.0	19.6	15.00	3.9
5	3SEP81	8	100	7.0	22.9	11.50	4.3
5	3SEP81	8	100	8.0	26.2	10.50	4.4
5	3SEP81	8	100	9.0	29.5	11.50	4.3
5	3SEP81	8	100	10.0	32.8	12.00	4.2
5	3SEP81	8	100	11.0	36.0	13.00	4.1
5	3SEP81	8	100	12.0	39.3	8.30	4.1
5	3SEP81	8	100	13.0	42.6	9.20	4.6
5	3SEP81	8	100	14.0	45.9	6.60	5.2
5	3SEP81	8	100	15.0	49.2	8.20	4.8
5	3SEP81	8	100	16.0	52.4	4.40	6.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
5	3SEP81	8	100	17.0	55.7	5.70	5.5
5	3SEP81	8	100	18.0	59.0	2.30	7.2
5	3SEP81	8	100	19.0	62.3	0.52	10.4
5	4SEP81	K	100	1.0	3.2	2.60	7.0
5	4SEP81	K	100	2.0	6.5	2.55	7.0
5	4SEP81	K	100	3.0	9.8	2.25	7.3
5	4SEP81	K	100	4.0	13.1	3.65	6.3
5	4SEP81	K	100	5.0	16.4	3.40	6.4
5	4SEP81	K	100	6.0	19.6	8.40	4.8
5	4SEP81	K	100	7.0	22.9	8.65	4.7
5	4SEP81	K	100	8.0	26.2	6.80	5.1
5	4SEP81	K	100	9.0	29.5	1.40	8.4
5	4SEP81	K	100	10.0	32.8	0.60	10.0
5	4SEP81	K	100	11.0	36.0	0.30	11.9
5	4SEP81	K	*	12.0	39.3	*	*
5	4SEP81	G	100	1.0	3.2	16.50	3.7
5	4SEP81	G	100	2.0	6.5	14.50	3.9
5	4SEP81	G	100	3.0	9.8	11.50	4.3
5	4SEP81	G	100	4.0	13.1	11.00	4.3
5	4SEP81	G	100	5.0	16.4	15.50	3.8
5	4SEP81	G	100	6.0	19.6	22.50	3.3
5	4SEP81	G	100	7.0	22.9	20.00	3.4
5	4SEP81	G	100	8.0	26.2	18.00	3.6
5	4SEP81	G	100	9.0	29.5	10.50	4.4
5	4SEP81	G	100	10.0	32.8	6.80	5.1
5	4SEP81	G	100	11.0	36.0	3.50	5.1
5	4SEP81	G	*	12.0	39.3	*	*
6	8OCT81	100	33	1.0	3.2	5.40	28.0
6	8OCT81	100	33	2.0	6.5	5.50	28.0
6	8OCT81	100	33	3.0	9.8	5.60	27.5
6	8OCT81	100	*	3.5	11.4	*	*
6	8OCT81	15	33	1.0	3.2	93.00	11.1
6	8OCT81	15	33	2.0	6.5	94.00	11.1
6	8OCT81	15	33	3.0	9.8	95.00	11.0
6	8OCT81	15	33	4.0	13.1	98.00	10.5
6	8OCT81	15	100	5.0	16.4	0.59	10.0
6	8OCT81	15	100	6.0	19.6	0.62	10.0
6	8OCT81	15	100	7.0	22.9	0.67	9.8
6	8OCT81	15	100	8.0	26.2	0.70	9.6
6	8OCT81	15	100	9.0	29.5	0.38	11.0
6	8OCT81	15	*	10.0	32.8	*	*
6	8OCT81	18	33	1.0	3.2	33.00	17.2
6	8OCT81	18	33	2.0	6.5	33.00	17.2
6	8OCT81	18	33	3.0	9.8	37.00	16.5
6	8OCT81	18	33	4.0	13.1	40.00	16.0
6	8OCT81	18	33	5.0	16.4	42.00	15.9
6	8OCT81	18	33	6.0	19.6	44.00	15.4
6	8OCT81	18	33	7.0	22.9	46.00	15.1
6	8OCT81	18	33	8.0	26.2	42.00	15.9
6	8OCT81	18	33	9.0	29.5	40.00	16.0
6	8OCT81	18	33	10.0	32.8	33.00	17.2
6	8OCT81	18	33	11.0	36.0	2.20	36.0
6	8OCT81	18	*	12.0	39.3	*	*
6	8OCT81	20	33	1.0	3.2	37.00	16.5
6	8OCT81	20	33	2.0	6.5	36.00	16.8
6	8OCT81	20	33	3.0	9.8	35.00	17.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
6	80CT81	20	33	4.0	13.1	33.50	17.1
6	80CT81	20	33	5.0	16.4	34.00	17.0
6	80CT81	20	33	6.0	19.6	26.00	18.9
6	80CT81	20	33	7.0	22.9	24.00	18.9
6	80CT81	20	33	8.0	26.2	20.00	18.9
6	80CT81	20	33	9.0	29.5	27.50	18.0
6	80CT81	20	33	9.5	31.1	15.00	18.4
6	80CT81	20	*	10.0	32.8	*	*
6	80CT81	22	33	1.0	3.2	26.00	18.9
6	80CT81	22	33	2.0	6.5	27.00	18.5
6	80CT81	22	33	3.0	9.8	38.50	16.1
6	80CT81	22	33	4.0	13.1	36.00	16.8
6	80CT81	22	33	4.5	14.7	8.00	26.9
6	80CT81	22	*	4.8	15.7	*	*
6	80CT81	24	33	1.0	3.2	14.00	23.0
6	80CT81	24	33	2.0	6.5	12.80	23.5
6	80CT81	24	33	3.0	9.8	11.00	24.8
6	80CT81	24	33	4.0	13.1	9.70	25.5
6	80CT81	24	33	5.0	16.4	4.60	30.7
6	80CT81	24	33	6.0	19.6	3.90	32.0
6	80CT81	24	33	7.0	22.9	1.30	40.5
6	80CT81	24	*	7.1	23.2	*	*
6	90CT81	K	100	1.0	3.2	2.20	7.3
6	90CT81	K	100	2.0	6.5	1.80	7.7
6	90CT81	K	100	3.0	9.8	1.60	8.0
6	90CT81	K	100	4.0	13.1	1.20	8.5
6	90CT81	K	100	5.0	16.4	1.70	7.8
6	90CT81	K	100	6.0	19.6	2.00	7.5
6	90CT81	K	100	7.0	22.9	2.00	7.5
6	90CT81	K	100	8.0	26.2	2.10	7.3
6	90CT81	K	100	9.0	29.5	2.00	7.5
6	90CT81	K	100	10.0	32.8	1.50	8.3
6	90CT81	K	100	11.0	36.0	1.20	8.5
6	90CT81	K	*	12.1	39.7	*	*
6	90CT81	G	100	1.0	3.2	7.40	5.0
6	90CT81	G	100	2.0	6.5	6.20	5.3
6	90CT81	G	100	3.0	9.8	6.20	5.3
6	90CT81	G	100	4.0	13.1	6.20	5.3
6	90CT81	G	100	5.0	16.4	6.00	5.4
6	90CT81	G	100	6.0	19.6	5.10	5.6
6	90CT81	G	100	7.0	22.9	3.50	6.3
6	90CT81	G	100	8.0	26.2	2.90	6.7
6	90CT81	G	100	9.0	29.5	2.40	7.1
6	90CT81	G	100	10.0	32.8	2.40	7.1
6	90CT81	G	100	10.5	34.4	0.18	13.2
6	90CT81	G	*	10.9	35.7	*	*
6	90CT81	11	100	1.0	3.2	1.90	7.5
6	90CT81	11	100	2.0	6.5	1.90	7.5
6	90CT81	11	100	3.0	9.8	1.90	7.5
6	90CT81	11	100	4.0	13.1	2.00	7.5
6	90CT81	11	100	5.0	16.4	2.00	7.5
6	90CT81	11	100	6.0	19.6	2.10	7.3
6	90CT81	11	100	7.0	22.9	2.10	7.3
6	90CT81	11	100	8.0	26.2	1.90	7.5
6	90CT81	11	100	9.0	29.5	1.80	7.7
6	90CT81	11	100	10.0	32.8	1.70	7.8

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
6	9OCT81	11	100	11.0	36.0	1.60	8.0
6	9OCT81	11	100	12.0	39.3	1.60	8.0
6	9OCT81	11	100	13.0	42.6	1.60	8.0
6	9OCT81	11	100	14.0	45.9	1.50	8.3
6	9OCT81	11	100	15.0	49.2	1.60	8.0
6	9OCT81	11	100	16.0	52.4	1.90	7.5
6	9OCT81	11	100	17.0	55.7	1.60	8.0
6	9OCT81	11	100	18.0	59.0	0.11	15.0
6	9OCT81	11	100	19.0	62.3	0.06	16.0
6	9OCT81	11	100	20.0	65.6	0.04	17.0
6	9OCT81	11	*	20.8	68.2	*	*
6	9OCT81	D	100	1.0	3.2	7.60	4.9
6	9OCT81	D	100	2.0	6.5	7.70	4.9
6	9OCT81	D	100	3.0	9.8	7.90	4.9
6	9OCT81	D	100	4.0	13.1	7.90	4.9
6	9OCT81	D	100	5.0	16.4	7.70	4.9
6	9OCT81	D	100	6.0	19.6	7.50	5.0
6	9OCT81	D	100	7.0	22.9	7.10	5.0
6	9OCT81	D	100	8.0	26.2	6.90	5.1
6	9OCT81	D	100	9.0	29.5	6.70	5.2
6	9OCT81	D	100	10.0	32.8	6.50	5.2
6	9OCT81	D	100	11.0	36.0	6.40	5.2
6	9OCT81	D	100	12.0	39.3	5.90	5.4
6	9OCT81	D	100	13.0	42.6	4.60	5.9
6	9OCT81	D	*	13.6	44.6	*	*
6	9OCT81	3	100	1.0	3.2	8.40	4.8
6	9OCT81	3	100	2.0	6.5	9.10	4.7
6	9OCT81	3	100	3.0	9.8	8.90	4.7
6	9OCT81	3	100	4.0	13.1	8.80	4.7
6	9OCT81	3	100	5.0	16.4	9.70	4.6
6	9OCT81	3	100	6.0	19.6	10.30	4.4
6	9OCT81	3	100	7.0	22.9	8.80	5.2
6	9OCT81	3	100	8.0	26.2	6.60	5.2
6	9OCT81	3	100	9.0	29.5	7.00	5.1
6	9OCT81	3	100	10.0	32.8	6.80	5.1
6	9OCT81	3	100	11.0	36.0	6.30	5.3
6	9OCT81	3	100	12.0	39.3	9.10	4.7
6	9OCT81	3	100	13.0	42.6	9.80	4.6
6	9OCT81	3	100	14.0	45.9	11.80	4.2
6	9OCT81	3	100	15.0	49.2	11.80	4.2
6	9OCT81	3	100	16.0	52.4	11.00	4.4
6	9OCT81	3	100	17.0	55.7	11.00	4.4
6	9OCT81	3	100	18.0	59.0	11.00	4.4
6	9OCT81	3	100	19.0	62.3	11.00	4.4
6	9OCT81	3	100	20.0	65.6	11.00	4.4
6	9OCT81	3	100	21.0	68.9	3.50	6.3
6	9OCT81	3	*	21.6	70.8	*	*
6	9OCT81	5	100	1.0	3.2	7.20	5.0
6	9OCT81	5	100	2.0	6.5	7.20	5.0
6	9OCT81	5	100	3.0	9.8	7.00	5.1
6	9OCT81	5	100	4.0	13.1	6.20	5.3
6	9OCT81	5	100	5.0	16.4	6.20	5.3
6	9OCT81	5	100	6.0	19.6	6.20	5.3
6	9OCT81	5	100	7.0	22.9	6.20	5.3
6	9OCT81	5	100	8.0	26.2	7.30	5.0
6	9OCT81	5	100	9.0	29.5	6.90	5.1

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
6	9OCT81	5	100	10.0	32.8	6.80	5.1
6	9OCT81	5	100	11.0	36.0	7.30	5.0
6	9OCT81	5	100	12.0	39.3	7.20	5.0
6	9OCT81	5	100	13.0	42.6	6.90	5.1
6	9OCT81	5	100	14.0	45.9	6.80	5.1
6	9OCT81	5	100	15.0	49.2	6.90	5.1
6	9OCT81	5	100	16.0	52.4	4.90	5.8
6	9OCT81	5	100	17.0	55.7	2.00	7.5
6	9OCT81	5	100	18.0	59.0	1.90	7.5
6	9OCT81	5	100	19.0	62.3	1.90	7.5
6	9OCT81	5	100	20.0	65.6	1.80	7.7
6	9OCT81	5	*	20.8	68.2	*	*
6	9OCT81	8	100	1.0	3.2	3.00	6.6
6	9OCT81	8	100	2.0	6.5	2.80	6.8
6	9OCT81	8	100	3.0	9.8	3.30	6.4
6	9OCT81	8	100	4.0	13.1	3.30	6.4
6	9OCT81	8	100	5.0	16.4	3.20	6.4
6	9OCT81	8	100	6.0	19.6	2.80	6.8
6	9OCT81	8	100	7.0	22.9	2.80	6.8
6	9OCT81	8	100	8.0	26.2	2.70	7.0
6	9OCT81	8	100	9.0	29.5	2.60	7.0
6	9OCT81	8	100	10.0	32.8	2.30	7.2
6	9OCT81	8	100	11.0	36.0	1.20	8.5
6	9OCT81	8	100	12.0	39.3	1.70	7.8
6	9OCT81	8	100	13.0	42.6	2.00	7.5
6	9OCT81	8	100	14.0	45.9	0.65	10.0
6	9OCT81	8	100	15.0	49.2	0.50	10.5
6	9OCT81	8	100	16.0	52.4	0.69	9.7
6	9OCT81	8	100	17.0	55.7	1.30	8.4
6	9OCT81	8	100	18.0	59.0	0.45	10.9
6	9OCT81	8	100	19.0	62.3	0.34	10.9
6	9OCT81	8	*	20.2	66.2	*	*
8	3DEC81	100	33	1.0	3.2	59.00	14.0
8	3DEC81	100	33	2.0	6.5	60.00	13.3
8	3DEC81	100	33	3.0	9.8	58.50	14.0
8	3DEC81	100	*	3.5	11.4	*	*
8	3DEC81	11	100	2.0	6.5	15.00	3.9
8	3DEC81	11	100	4.0	13.1	15.00	3.9
8	3DEC81	11	100	6.0	19.6	15.00	3.9
8	3DEC81	11	100	8.0	26.2	15.00	3.9
8	3DEC81	11	100	10.0	32.8	15.00	3.9
8	3DEC81	11	100	12.0	39.3	16.00	3.8
8	3DEC81	11	100	14.0	45.9	13.80	4.0
8	3DEC81	11	100	16.0	52.4	0.39	11.0
8	3DEC81	11	100	18.0	59.0	0.17	13.8
8	3DEC81	15	100	1.0	3.2	12.00	4.2
8	3DEC81	15	100	3.0	9.8	12.00	4.2
8	3DEC81	15	100	5.0	16.4	11.80	4.2
8	3DEC81	15	100	7.0	22.9	11.80	4.2
8	3DEC81	15	100	9.0	29.5	10.00	4.4
8	3DEC81	15	*	11.1	36.4	*	*
8	3DEC81	18	100	1.0	3.2	0.46	10.9
8	3DEC81	18	100	2.0	6.5	0.47	10.8
8	3DEC81	18	100	3.0	9.8	0.47	10.8
8	3DEC81	18	100	4.0	13.1	0.47	10.8
8	3DEC81	18	100	5.0	16.4	0.47	10.8

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
8	3DEC81	18	100	6.0	19.6	0.450	10.9
8	3DEC81	18	100	7.0	22.9	0.425	11.0
8	3DEC81	18	100	8.0	26.2	0.325	11.7
8	3DEC81	18	*	8.5	27.8	*	*
8	3DEC81	20	33	1.0	3.2	77.000	12.0
8	3DEC81	20	33	2.0	6.5	78.000	12.0
8	3DEC81	20	33	3.0	9.8	78.000	12.0
8	3DEC81	20	33	4.0	13.1	78.500	11.9
8	3DEC81	20	33	5.0	16.4	79.000	12.0
8	3DEC81	20	33	6.0	19.6	78.000	12.0
8	3DEC81	20	33	7.0	22.9	70.000	12.8
8	3DEC81	20	33	8.0	26.2	52.000	14.3
8	3DEC81	20	*	8.8	28.8	*	*
8	3DEC81	22	33	1.0	3.2	63.000	13.0
8	3DEC81	22	33	2.0	6.5	63.000	13.0
8	3DEC81	22	33	3.0	9.8	63.000	13.0
8	3DEC81	22	33	4.0	13.1	62.000	13.0
8	3DEC81	22	33	5.0	16.4	44.000	15.3
8	3DEC81	22	*	5.2	17.0	*	*
8	3DEC81	24	33	1.0	3.2	45.000	15.0
8	3DEC81	24	33	2.0	6.5	45.500	15.0
8	3DEC81	24	33	3.0	9.8	45.000	15.0
8	3DEC81	24	33	4.0	13.1	44.000	15.0
8	3DEC81	24	*	4.1	13.4	*	*
8	3DEC81	5	100	1.0	3.2	1.200	8.5
8	3DEC81	5	100	2.0	6.5	1.400	8.4
8	3DEC81	5	100	3.0	9.8	1.400	8.4
8	3DEC81	5	100	4.0	13.1	1.400	8.4
8	3DEC81	5	100	5.0	16.4	1.400	8.4
8	3DEC81	5	100	6.0	19.6	1.500	8.3
8	3DEC81	5	100	7.0	22.9	1.500	8.3
8	3DEC81	5	100	8.0	26.2	1.400	8.4
8	3DEC81	5	100	9.0	29.5	1.400	8.4
8	3DEC81	5	100	10.0	32.8	1.300	8.4
8	3DEC81	5	100	11.0	36.0	1.400	8.4
8	3DEC81	5	100	12.0	39.3	1.400	8.4
8	3DEC81	5	100	13.0	42.6	1.400	8.4
8	3DEC81	5	100	14.0	45.9	1.300	8.4
8	3DEC81	5	100	15.0	49.2	1.300	8.4
8	3DEC81	5	100	16.0	52.4	1.300	8.4
8	3DEC81	5	100	17.0	55.7	1.200	8.4
8	3DEC81	5	100	18.0	59.0	1.000	8.8
8	3DEC81	5	*	19.2	62.9	*	*
8	3DEC81	8	100	1.0	3.2	1.000	9.0
8	3DEC81	8	100	2.0	6.5	1.000	9.0
8	3DEC81	8	100	3.0	9.8	0.940	9.1
8	3DEC81	8	100	4.0	13.1	0.920	9.1
8	3DEC81	8	100	5.0	16.4	0.900	9.1
8	3DEC81	8	100	6.0	19.6	0.890	9.1
8	3DEC81	8	100	7.0	22.9	0.880	9.1
8	3DEC81	8	100	8.0	26.2	0.880	9.1
8	3DEC81	8	100	9.0	29.5	0.900	9.1
8	3DEC81	8	100	10.0	32.8	0.920	9.1
8	3DEC81	8	100	11.0	36.0	0.920	9.1
8	3DEC81	8	100	12.0	39.3	0.930	9.1
8	3DEC81	8	100	13.0	42.6	0.970	9.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
8	3DEC81	8	100	14.0	45.9	1.0	8.8
8	3DEC81	8	100	15.0	49.2	1.2	8.5
8	3DEC81	8	100	16.0	52.4	1.2	8.5
8	3DEC81	8	100	17.0	55.7	1.2	8.5
8	3DEC81	8	100	18.0	59.0	1.2	8.5
8	3DEC81	8	100	19.0	62.3	1.0	8.8
8	3DEC81	8	*	19.5	63.9	*	*
9	12FEB82	100	33	1.0	3.2	39.0	16.1
9	12FEB82	100	33	2.0	6.5	40.0	16.0
9	12FEB82	100	33	3.0	9.8	44.0	15.5
9	12FEB82	100	33	4.0	13.1	48.0	15.0
9	12FEB82	100	33	5.0	16.4	47.0	15.0
9	12FEB82	100	*	5.3	17.3	*	*
9	12FEB82	11	10	1.0	3.2	14.0	100.0
9	12FEB82	11	10	2.0	6.5	37.0	72.0
9	12FEB82	11	10	3.0	9.8	38.0	71.0
9	12FEB82	11	10	4.0	13.1	37.0	72.0
9	12FEB82	11	10	5.0	16.4	35.0	73.0
9	12FEB82	11	10	6.0	19.6	26.0	80.0
9	12FEB82	11	10	7.0	22.9	23.0	85.0
9	12FEB82	11	10	8.0	26.2	23.0	85.0
9	12FEB82	11	10	9.0	29.5	22.0	85.0
9	12FEB82	11	10	10.0	32.8	20.0	90.0
9	12FEB82	11	10	11.0	36.0	19.0	90.0
9	12FEB82	11	10	12.0	39.3	18.0	92.0
9	12FEB82	11	10	13.0	42.6	18.0	92.0
9	12FEB82	11	10	14.0	45.9	17.0	94.0
9	12FEB82	11	10	15.0	49.2	18.0	92.0
9	12FEB82	11	10	16.0	52.4	18.0	92.0
9	12FEB82	11	10	17.0	55.7	18.0	92.0
9	12FEB82	11	10	18.0	59.0	18.0	92.0
9	12FEB82	11	10	19.0	62.3	18.0	92.0
9	12FEB82	11	10	20.0	65.6	17.0	94.0
9	12FEB82	15	10	2.0	6.5	29.0	77.0
9	12FEB82	15	10	3.0	9.8	29.0	77.0
9	12FEB82	15	10	4.0	13.1	27.0	80.0
9	12FEB82	15	10	5.0	16.4	27.0	80.0
9	12FEB82	15	10	6.0	19.6	23.0	85.0
9	12FEB82	15	10	7.0	22.9	22.0	85.5
9	12FEB82	15	10	8.0	26.2	23.0	85.0
9	12FEB82	15	10	9.0	29.5	23.0	85.0
9	12FEB82	15	10	10.0	32.8	23.0	85.0
9	12FEB82	15	10	11.0	36.0	21.0	87.0
9	12FEB82	15	10	12.0	39.3	21.0	87.0
9	12FEB82	15	*	12.2	40.0	*	*
9	12FEB82	D	33	1.0	3.2	86.0	11.5
9	12FEB82	D	33	2.0	6.5	85.0	11.6
9	12FEB82	D	33	3.0	9.8	82.0	11.8
9	12FEB82	D	33	4.0	13.1	84.0	11.6
9	12FEB82	D	33	5.0	16.4	84.0	11.6
9	12FEB82	D	33	6.0	19.6	84.0	11.6
9	12FEB82	D	33	7.0	22.9	83.0	11.6
9	12FEB82	D	33	8.0	26.2	82.0	11.8
9	12FEB82	D	33	9.0	29.5	82.0	11.8
9	12FEB82	D	33	10.0	32.8	83.0	11.8
9	12FEB82	D	33	11.0	36.0	78.0	11.7

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
9	12FEB82	D	33	12.0	39.3	75.0	12.5
9	12FEB82	D	33	13.0	42.6	74.0	12.5
9	12FEB82	D	*	14.0	45.9	*	*
9	12FEB82	D	33	15.0	49.2	71.0	12.6
9	12FEB82	D	33	16.0	52.4	63.0	13.4
9	12FEB82	D	33	17.0	55.7	63.0	13.4
9	12FEB82	D	33	18.0	59.0	62.0	13.5
9	12FEB82	D	33	19.0	62.3	60.0	13.6
9	12FEB82	D	33	20.0	65.6	57.0	14.0
9	12FEB82	D	33	21.0	68.9	57.0	14.0
9	12FEB82	D	33	22.0	72.1	52.0	14.5
9	12FEB82	D	*	22.5	73.8	*	*
9	12FEB82	20	33	1.0	3.2	4.0	32.0
9	12FEB82	20	33	3.0	9.8	3.3	34.0
9	12FEB82	20	33	5.0	16.4	2.1	36.5
9	12FEB82	20	33	7.0	22.9	1.2	42.0
9	12FEB82	20	33	9.0	29.5	0.8	45.0
9	12FEB82	20	*	10.2	33.4	*	*
9	12FEB82	22	33	1.0	3.2	15.0	22.1
9	12FEB82	22	33	2.0	6.5	15.0	22.1
9	12FEB82	22	33	3.0	9.8	16.0	22.0
9	12FEB82	22	33	4.0	13.1	15.0	22.1
9	12FEB82	22	33	5.0	16.4	16.0	22.0
9	12FEB82	22	33	6.0	19.6	17.0	21.5
9	12FEB82	22	33	7.0	22.9	16.0	22.0
9	12FEB82	22	*	7.8	25.5	*	*
9	12FEB82	24	33	1.0	3.2	12.0	24.0
9	12FEB82	24	33	2.0	6.5	10.0	25.0
9	12FEB82	24	33	3.0	9.8	8.3	26.5
9	12FEB82	24	33	4.0	13.1	3.0	35.0
9	12FEB82	3	33	1.0	3.2	36.0	16.8
9	12FEB82	3	33	2.0	6.5	34.0	17.2
9	12FEB82	3	33	3.0	9.8	36.0	16.8
9	12FEB82	3	33	4.0	13.1	36.0	16.8
9	12FEB82	3	33	5.0	16.4	34.0	17.2
9	12FEB82	3	33	6.0	19.6	33.0	17.3
9	12FEB82	3	33	7.0	22.9	33.0	17.3
9	12FEB82	3	33	8.0	26.2	31.0	17.8
9	12FEB82	3	33	9.0	29.5	30.0	18.0
9	12FEB82	3	33	10.0	32.8	28.0	18.3
9	12FEB82	3	33	11.0	36.0	27.0	18.5
9	12FEB82	3	33	12.0	39.3	29.0	18.0
9	12FEB82	3	33	13.0	42.6	26.0	18.8
9	12FEB82	3	33	14.0	45.9	25.0	18.7
9	12FEB82	3	33	15.0	49.2	25.0	18.7
9	12FEB82	3	33	16.0	52.4	26.0	18.7
9	12FEB82	3	33	17.0	55.7	28.0	18.3
9	12FEB82	3	33	18.0	59.0	26.0	18.7
9	12FEB82	3	33	19.0	62.3	24.0	18.8
9	12FEB82	3	33	20.0	65.6	24.0	18.8
9	12FEB82	3	33	21.0	68.9	21.0	20.0
9	12FEB82	3	33	22.0	72.1	10.0	30.0
9	12FEB82	5	33	1.0	3.2	28.0	18.4
9	12FEB82	5	33	2.0	6.5	28.0	18.4
9	12FEB82	5	33	3.0	9.8	28.0	18.4
9	12FEB82	5	33	4.0	13.1	28.0	18.4

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
9	12FEB82	5	33	5.0	16.4	29.00	18.3
9	12FEB82	5	33	6.0	19.6	27.00	18.5
9	12FEB82	5	33	7.0	22.9	26.00	19.0
9	12FEB82	5	33	8.0	26.2	25.00	19.1
9	12FEB82	5	33	9.0	29.5	24.00	19.2
9	12FEB82	5	33	10.0	32.8	22.00	20.0
9	12FEB82	5	33	11.0	36.0	21.00	20.0
9	12FEB82	5	33	12.0	39.3	21.00	20.0
9	12FEB82	5	33	13.0	42.6	22.00	20.0
9	12FEB82	5	33	14.0	45.9	22.00	20.0
9	12FEB82	5	33	15.0	49.2	18.00	21.0
9	12FEB82	5	33	16.0	52.4	16.00	22.0
9	12FEB82	5	33	17.0	55.7	15.00	22.5
9	12FEB82	5	33	18.0	59.0	15.00	22.5
9	12FEB82	5	33	19.0	62.3	11.00	25.0
9	12FEB82	5	33	20.0	65.6	1.80	38.0
9	12FEB82	5	33	21.0	68.9	0.84	75.0
9	12FEB82	5	*	22.0	72.1	*	*
9	12FEB82	8	33	1.0	3.2	1.60	38.5
9	12FEB82	8	33	2.0	6.5	1.40	39.5
9	12FEB82	8	33	3.0	9.8	0.98	43.5
9	12FEB82	8	33	4.0	13.1	0.75	45.5
9	12FEB82	8	33	5.0	16.4	0.39	51.0
9	12FEB82	8	33	6.0	19.6	0.18	58.0
9	12FEB82	8	33	7.0	22.9	0.12	63.0
9	12FEB82	8	33	8.0	26.2	0.12	63.0
9	12FEB82	8	33	9.0	29.5	0.08	65.0
9	12FEB82	8	33	10.0	32.8	0.08	65.0
9	12FEB82	8	33	11.0	36.0	0.08	65.0
9	12FEB82	8	33	12.0	39.3	0.07	68.0
9	12FEB82	8	33	13.0	42.6	0.07	68.0
9	12FEB82	8	33	14.0	45.9	0.05	72.0
9	12FEB82	8	33	15.0	49.2	0.04	74.0
9	12FEB82	8	33	16.0	52.4	0.04	75.0
9	12FEB82	8	33	17.0	55.7	0.02	85.0
9	12FEB82	8	33	18.0	59.0	0.02	85.0
9	12FEB82	8	33	19.0	62.3	0.02	85.0
9	12FEB82	8	33	20.0	65.6	0.02	85.0
9	13FEB82	K	100	1.0	3.2	3.50	6.3
9	13FEB82	K	100	2.0	6.5	3.50	6.3
9	13FEB82	K	100	3.0	9.8	3.50	6.3
9	13FEB82	K	100	4.0	13.1	3.50	6.3
9	13FEB82	K	100	5.0	16.4	3.60	6.3
9	13FEB82	K	100	6.0	19.6	3.60	6.3
9	13FEB82	K	100	7.0	22.9	3.50	6.3
9	13FEB82	K	100	8.0	26.2	3.50	6.3
9	13FEB82	K	100	9.0	29.5	3.60	6.3
9	13FEB82	K	100	10.0	32.8	3.60	6.3
9	13FEB82	K	100	11.0	36.0	3.50	6.3
9	13FEB82	K	100	12.0	39.3	3.50	6.3
9	13FEB82	K	100	13.0	42.6	3.50	6.3
9	13FEB82	K	*	13.5	44.2	*	*
9	13FEB82	G	100	1.0	3.2	5.90	5.4
9	13FEB82	G	100	2.0	6.5	5.90	5.4
9	13FEB82	G	100	3.0	9.8	6.00	5.4
9	13FEB82	G	100	4.0	13.1	6.00	5.4

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
9	13FEB82	G	100	5.0	16.4	6.00	5.4
9	13FEB82	G	100	6.0	19.6	5.90	5.4
9	13FEB82	G	100	7.0	22.9	5.80	5.4
9	13FEB82	G	100	9.0	29.5	5.80	5.4
9	13FEB82	G	100	10.0	32.8	5.70	5.4
9	13FEB82	G	100	11.0	36.0	5.20	5.6
9	13FEB82	G	100	12.0	39.3	5.00	5.6
9	13FEB82	G	100	13.0	42.6	4.80	5.8
9	13FEB82	G	100	14.0	45.9	4.80	5.8
9	13FEB82	G	100	15.0	49.2	4.80	5.8
9	13FEB82	G	*	16.0	52.4	*	*
10	2MAR82	100	33	1.0	3.2	14.50	24.0
10	2MAR82	100	33	2.0	6.5	15.00	22.5
10	2MAR82	100	33	3.0	9.8	16.00	22.0
10	2MAR82	100	33	4.0	13.1	16.00	22.0
10	2MAR82	100	*	4.3	14.1	*	*
10	2MAR82	11	33	1.0	3.2	9.00	26.0
10	2MAR82	11	33	2.0	6.5	8.90	26.0
10	2MAR82	11	33	3.0	9.8	8.90	26.0
10	2MAR82	11	33	4.0	13.1	8.90	26.0
10	2MAR82	11	33	5.0	16.4	8.90	26.0
10	2MAR82	11	33	6.0	19.6	8.80	26.0
10	2MAR82	11	33	7.0	22.9	8.70	26.0
10	2MAR82	11	33	8.0	26.2	8.80	26.0
10	2MAR82	11	33	9.0	29.5	8.65	26.0
10	2MAR82	11	33	10.0	32.8	8.70	26.0
10	2MAR82	11	33	11.0	36.0	8.60	25.9
10	2MAR82	11	33	12.0	39.3	8.60	25.9
10	2MAR82	11	33	13.0	42.6	8.60	25.9
10	2MAR82	11	33	14.0	45.9	8.80	26.0
10	2MAR82	11	33	15.0	49.2	8.50	26.0
10	2MAR82	11	33	16.0	52.4	8.40	26.2
10	2MAR82	11	33	17.0	55.7	8.60	25.9
10	2MAR82	11	33	18.0	59.0	8.40	26.1
10	2MAR82	11	33	19.0	62.3	2.20	37.0
10	2MAR82	11	*	19.3	63.3	*	*
10	2MAR82	15	33	1.0	3.2	17.50	21.5
10	2MAR82	15	33	2.0	6.5	17.00	21.7
10	2MAR82	15	33	3.0	9.8	15.50	22.1
10	2MAR82	15	33	4.0	13.1	13.50	23.0
10	2MAR82	15	33	5.0	16.4	12.50	23.0
10	2MAR82	15	33	6.0	19.6	12.50	23.0
10	2MAR82	15	33	7.0	22.9	12.00	24.0
10	2MAR82	15	33	8.0	26.2	12.00	24.0
10	2MAR82	15	33	9.0	29.5	12.00	24.0
10	2MAR82	15	33	10.0	32.8	12.00	24.0
10	2MAR82	15	33	11.0	36.0	11.00	24.6
10	2MAR82	15	33	12.0	39.3	11.00	24.6
10	2MAR82	15	33	13.0	42.6	8.90	26.0
10	2MAR82	15	33	13.5	44.2	6.60	28.0
10	2MAR82	15	*	13.8	45.2	*	*
10	2MAR82	18	33	1.0	3.2	22.00	18.0
10	2MAR82	18	33	2.0	6.5	22.00	18.0
10	2MAR82	18	33	3.0	9.8	21.50	20.0
10	2MAR82	18	33	4.0	13.1	21.00	20.0
10	2MAR82	18	33	5.0	16.4	20.00	20.5

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
10	2MAR82	18	33	6.0	19.6	19.8	20.6
10	2MAR82	18	33	7.0	22.9	19.5	20.6
10	2MAR82	18	33	8.0	26.2	19.0	21.0
10	2MAR82	18	33	9.0	29.5	18.0	21.2
10	2MAR82	18	33	10.0	32.8	16.5	21.8
10	2MAR82	18	33	11.0	36.0	13.8	23.0
10	2MAR82	18	33	12.0	39.3	12.5	24.0
10	2MAR82	18	33	13.0	42.6	12.0	24.0
10	2MAR82	18	*	13.5	44.2	*	*
10	2MAR82	20	33	1.0	3.2	22.0	19.0
10	2MAR82	20	33	2.0	6.5	21.5	20.0
10	2MAR82	20	33	3.0	9.8	22.0	19.0
10	2MAR82	20	33	4.0	13.1	24.0	19.8
10	2MAR82	20	33	5.0	16.4	29.0	18.0
10	2MAR82	20	33	6.0	19.6	29.5	18.0
10	2MAR82	20	33	7.0	22.9	29.5	18.0
10	2MAR82	20	33	8.0	26.2	29.5	18.0
10	2MAR82	20	33	9.0	29.5	22.0	19.0
10	2MAR82	20	*	9.5	31.1	*	*
10	2MAR82	22	33	1.0	3.2	43.5	15.8
10	2MAR82	22	33	2.0	6.5	62.5	13.5
10	2MAR82	22	33	3.0	9.8	63.0	13.3
10	2MAR82	22	33	4.0	13.1	61.5	13.8
10	2MAR82	22	33	5.0	16.4	61.0	14.0
10	2MAR82	22	33	6.0	19.6	59.5	14.1
10	2MAR82	22	33	7.0	22.9	59.0	14.1
10	2MAR82	22	33	8.0	26.2	58.2	14.2
10	2MAR82	22	33	9.0	29.5	57.8	14.2
10	2MAR82	22	33	10.0	32.8	3.0	54.0
10	2MAR82	22	*	10.2	33.4	*	*
10	2MAR82	24	33	1.0	3.2	37.0	32.0
10	2MAR82	24	33	2.0	6.5	37.0	32.0
10	2MAR82	24	33	3.0	9.8	37.0	32.0
10	2MAR82	24	33	4.0	13.1	36.0	33.0
10	2MAR82	24	33	4.6	15.0	1.4	62.0
10	2MAR82	3	33	1.0	3.2	12.5	23.0
10	2MAR82	3	33	2.0	6.5	12.5	23.0
10	2MAR82	3	33	3.0	9.8	12.5	23.0
10	2MAR82	3	33	4.0	13.1	13.0	23.0
10	2MAR82	3	33	5.0	16.4	13.0	23.0
10	2MAR82	3	33	6.0	19.6	13.0	23.0
10	2MAR82	3	33	7.0	22.9	13.5	23.0
10	2MAR82	3	33	8.0	26.2	13.5	23.0
10	2MAR82	3	33	9.0	29.5	13.5	23.0
10	2MAR82	3	33	10.0	32.8	13.0	23.0
10	2MAR82	3	33	11.0	36.0	13.5	23.0
10	2MAR82	3	33	12.0	39.3	13.5	23.0
10	2MAR82	3	33	13.0	42.6	13.5	23.0
10	2MAR82	3	33	14.0	45.9	13.5	23.0
10	2MAR82	3	33	15.0	49.2	13.5	23.0
10	2MAR82	3	33	16.0	52.4	13.0	23.0
10	2MAR82	3	33	17.0	55.7	13.0	23.0
10	2MAR82	3	33	18.0	59.0	13.0	23.0
10	2MAR82	3	33	19.0	62.3	13.0	23.0
10	2MAR82	3	33	20.0	65.6	13.5	23.0
10	2MAR82	3	33	21.0	68.9	13.5	23.0

JOHN H. KERR RESEVERVOIR FIELD DATA

TRIP	DATE	BUOY	PATHLNTH	DEPTHM	DEPTHFT	TRANSPER	TSSPPM
10	2MAR82	3	33	22.0	72.1	14.0	23.0
10	2MAR82	5	33	1.0	3.2	18.0	21.0
10	2MAR82	5	33	2.0	6.5	18.5	21.0
10	2MAR82	5	33	3.0	9.8	18.0	21.0
10	2MAR82	5	33	4.0	13.1	18.0	21.0
10	2MAR82	5	33	5.0	16.4	18.0	21.0
10	2MAR82	5	33	6.0	19.6	18.0	21.0
10	2MAR82	5	33	7.0	22.9	17.5	21.0
10	2MAR82	5	33	8.0	26.2	16.0	22.0
10	2MAR82	5	33	9.0	29.5	14.5	22.8
10	2MAR82	5	33	10.0	32.8	14.5	22.8
10	2MAR82	5	33	11.0	36.0	14.0	23.0
10	2MAR82	5	33	12.0	39.3	14.0	23.0
10	2MAR82	5	33	13.0	42.6	14.0	23.0
10	2MAR82	5	33	14.0	45.9	13.5	23.0
10	2MAR82	5	33	15.0	49.2	13.5	23.0
10	2MAR82	5	33	16.0	52.4	13.0	23.2
10	2MAR82	5	33	17.0	55.7	12.5	24.0
10	2MAR82	5	33	18.0	59.0	12.5	24.0
10	2MAR82	5	33	19.0	62.3	12.0	24.0
10	2MAR82	5	33	20.0	65.6	11.0	24.8
10	2MAR82	5	33	21.0	68.9	9.3	25.8
10	2MAR82	5	*	22.0	72.1	*	*
10	2MAR82	8	33	1.0	3.2	12.0	24.0
10	2MAR82	8	33	2.0	6.5	12.5	23.0
10	2MAR82	8	33	3.0	9.8	12.5	23.0
10	2MAR82	8	33	4.0	13.1	12.0	24.0
10	2MAR82	8	33	5.0	16.4	12.5	23.0
10	2MAR82	8	33	6.0	19.6	12.0	24.0
10	2MAR82	8	33	7.0	22.9	11.8	24.0
10	2MAR82	8	33	8.0	26.2	12.0	24.0
10	2MAR82	8	33	9.0	29.5	11.8	24.0
10	2MAR82	8	33	10.0	32.8	12.0	24.0
10	2MAR82	8	33	11.0	36.0	13.0	22.8
10	2MAR82	8	33	12.0	39.3	13.5	23.0
10	2MAR82	8	33	13.0	42.6	13.5	23.0
10	2MAR82	8	33	14.0	45.9	14.0	22.8
10	2MAR82	8	33	15.0	49.2	14.0	22.8
10	2MAR82	8	33	16.0	52.4	14.5	22.0
10	2MAR82	8	33	17.0	55.7	14.5	22.0
10	2MAR82	8	33	18.0	59.0	15.0	22.0
10	2MAR82	8	33	19.0	62.3	11.5	24.0
10	2MAR82	8	33	20.0	65.6	14.5	22.9
10	2MAR82	8	33	21.0	68.9	13.5	23.0
10	2MAR82	8	*	21.5	70.5	*	*

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
30APR81	100	.	.	.	.
30APR81	24	1.5	20.50	112	10.439
30APR81	24	5.0	20.50	110	9.490
30APR81	24	10.0	20.00	90	9.490
30APR81	24	15.0	17.75	350	8.541
30APR81	22	2.0	20.50	140	15.184
30APR81	22	5.0	20.00	15	6.643
30APR81	22	10.0	19.00	255	4.745
30APR81	22	15.0	17.00	205	3.796
30APR81	22	20.0	15.70	235	5.694
30APR81	22	25.0	15.20	305	2.847
30APR81	20	1.0	20.00	0	0.000
30APR81	20	10.0	19.75	0	9.490
30APR81	20	20.0	16.50	30	0.000
30APR81	18	5.0	20.00	140	18.031
30APR81	18	10.0	19.50	105	8.541
30APR81	18	15.0	17.20	50	1.898
30APR81	18	20.0	16.00	325	4.745
30APR81	18	25.0	15.90	.	.
30APR81	15	5.0	20.10	170	13.286
30APR81	15	10.0	19.20	188	2.847
30APR81	15	15.0	17.20	225	0.949
30APR81	15	20.0	16.50	260	0.000
30APR81	15	25.0	16.00	278	0.949
30APR81	15	30.0	15.80	292	0.949
30APR81	11	5.0	18.20	60	15.184
30APR81	11	10.0	17.80	65	11.388
30APR81	11	15.0	16.50	90	3.796
30APR81	11	20.0	16.20	142	0.000
30APR81	11	25.0	15.60	205	5.694
30APR81	11	30.0	15.20	195	7.592
30APR81	11	35.0	14.90	205	0.000
30APR81	11	40.0	14.50	155	3.796
30APR81	11	45.0	14.00	150	0.000
30APR81	11	50.0	13.20	105	1.898
30APR81	11	55.0	12.20	60	10.439
30APR81	11	60.0	11.80	45	11.388
30APR81	11	66.0	11.60	.	.
01MAY81	8	5.0	18.20	248	17.082
01MAY81	8	10.0	18.00	265	8.541
01MAY81	8	15.0	18.00	245	4.745
01MAY81	8	20.0	17.70	235	0.949
01MAY81	8	30.0	15.60	205	4.745
01MAY81	8	40.0	15.00	130	3.796
01MAY81	8	50.0	13.90	97	3.796
01MAY81	8	60.0	12.80	75	0.949
01MAY81	5	5.0	18.10	260	10.439
01MAY81	5	10.0	18.00	265	9.490
01MAY81	5	15.0	18.10	270	7.592
01MAY81	5	20.0	17.90	295	3.796
01MAY81	5	30.0	16.40	150	6.643
01MAY81	5	40.0	15.20	97	9.490
01MAY81	5	50.0	13.20	55	4.745
01MAY81	5	60.0	11.80	260	2.847
01MAY81	3	5.0	19.50	290	8.541
01MAY81	3	10.0	19.10	245	6.643
01MAY81	3	15.0	18.80	200	2.847
01MAY81	3	20.0	17.50	110	13.286
01MAY81	3	30.0	15.90	125	2.847
01MAY81	3	40.0	15.20	180	0.949
01MAY81	3	50.0	13.00	283	0.949

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
01MAY81	3	60	11.8	80	0.000
01MAY81	D	5	18.7	262	2.847
01MAY81	D	10	18.7	200	9.490
01MAY81	D	15	18.1	180	6.643
01MAY81	D	20	17.4	.	.
01MAY81	G	5	18.2	.	.
01MAY81	G	10	17.1	.	.
01MAY81	G	15	17.0	.	.
01MAY81	G	20	16.5	.	.
01MAY81	G	30	15.5	.	.
01MAY81	G	40	14.6	.	.
01MAY81	G	50	13.5	.	.
01MAY81	K	5	18.4	215	9.490
01MAY81	K	10	17.6	270	3.796
01MAY81	K	15	16.3	325	11.388
01MAY81	K	20	16.0	308	9.490
01MAY81	K	30	15.1	300	21.827
01MAY81	K	40	14.2	.	.
18MAY81	100	.	.	.	.
18MAY81	24	5	21.0	305	6.643
18MAY81	24	10	20.2	263	0.000
18MAY81	24	15	19.8	173	3.796
18MAY81	24	17	19.3	.	.
18MAY81	22	5	20.5	270	5.694
18MAY81	22	10	20.0	30	1.898
18MAY81	22	15	19.0	.	.
18MAY81	20	5	20.0	240	1.898
18MAY81	20	10	19.8	165	0.949
18MAY81	20	15	19.5	250	1.898
18MAY81	20	20	18.5	135	0.000
18MAY81	20	21	18.3	.	.
18MAY81	18	5	19.8	175	2.847
18MAY81	18	10	19.6	140	3.796
18MAY81	18	15	19.0	125	5.694
18MAY81	18	20	18.5	65	4.745
18MAY81	18	25	17.8	.	.
18MAY81	15	5	19.2	60	4.745
18MAY81	15	10	19.0	130	2.847
18MAY81	15	15	18.8	165	0.949
18MAY81	15	20	18.2	145	3.796
18MAY81	15	25	17.5	105	4.745
18MAY81	15	30	16.0	.	.
18MAY81	11	5	19.5	45	1.898
18MAY81	11	10	19.0	60	4.745
18MAY81	11	15	18.6	130	3.796
18MAY81	11	20	18.1	195	6.643
18MAY81	11	30	16.9	195	4.745
18MAY81	11	40	15.0	60	13.286
18MAY81	11	50	14.0	45	20.878
18MAY81	11	60	13.1	45	20.878
18MAY81	11	62	12.9	.	.
18MAY81	8	5	19.2	55	0.000
18MAY81	8	10	19.0	110	1.898
18MAY81	8	15	18.8	30	1.898
18MAY81	8	20	18.1	100	1.898
18MAY81	8	30	17.5	45	0.949
18MAY81	8	40	15.5	60	7.592
18MAY81	8	50	14.1	65	7.592
18MAY81	8	56	13.8	.	.
18MAY81	5	5	18.9	315	1.898
18MAY81	5	10	19.0	80	3.796

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
18MAY81	5	15	19.0	40	4.745
18MAY81	5	20	19.0	305	9.490
18MAY81	5	30	18.1	15	14.235
18MAY81	5	34	17.0	120	21.827
18MAY81	5	40	15.5	105	15.184
18MAY81	5	50	13.6	120	1.898
18MAY81	5	60	12.2	45	0.000
19MAY81	3	5	17.7	105	5.694
19MAY81	3	10	17.8	120	10.439
19MAY81	3	15	17.8	110	8.541
19MAY81	3	20	17.8	75	12.337
19MAY81	3	30	14.8	90	7.592
19MAY81	3	40	14.0	35	5.694
19MAY81	3	50	12.2	90	7.592
19MAY81	3	56	11.2	.	.
19MAY81	D	5	17.2	175	7.592
19MAY81	D	10	17.3	275	13.286
19MAY81	D	15	17.5	195	6.643
19MAY81	D	18	17.3	.	.
19MAY81	G	5	18.2	290	7.592
19MAY81	G	10	18.1	320	9.490
19MAY81	G	15	18.1	315	10.439
19MAY81	G	20	18.0	295	13.286
19MAY81	G	30	18.0	315	12.337
19MAY81	G	36	16.8	15	15.184
19MAY81	G	40	15.8	345	13.286
19MAY81	G	50	15.5	.	.
19MAY81	K	5	18.9	180	16.133
19MAY81	K	10	19.0	150	14.235
19MAY81	K	15	19.0	135	7.592
19MAY81	K	20	19.0	90	7.592
19MAY81	K	30	18.2	15	7.592
19MAY81	K	40	17.2	.	.
24JUN81	100	5	28.8	165	23.725
24JUN81	24	5	28.4	310	10.439
24JUN81	24	10	28.2	335	0.949
24JUN81	24	15	28.0	235	2.847
24JUN81	22	5	28.4	345	2.847
24JUN81	22	10	28.2	290	1.898
24JUN81	22	15	28.0	260	10.439
24JUN81	20	5	28.8	15	14.235
24JUN81	20	10	28.6	30	6.643
24JUN81	20	15	28.2	160	7.592
24JUN81	20	20	26.5	175	18.980
24JUN81	18	5	29.7	285	5.694
24JUN81	18	10	29.0	20	10.439
24JUN81	18	15	28.6	180	5.694
24JUN81	18	20	28.0	.	.
24JUN81	15	5	28.9	25	16.133
24JUN81	15	10	28.6	330	11.388
24JUN81	15	15	27.9	45	10.439
24JUN81	15	20	26.0	100	8.541
24JUN81	15	30	22.8	195	7.592
24JUN81	15	33	22.0	155	3.796
24JUN81	11	5	30.0	210	11.388
24JUN81	11	10	29.8	270	13.286
24JUN81	11	15	29.0	210	19.929
24JUN81	11	20	26.8	240	0.949
24JUN81	11	30	22.0	45	17.082
24JUN81	11	40	19.7	40	11.388
24JUN81	11	50	18.2	60	0.000

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
24JUN81	11	58	17.5	.	.
24JUN81	8	5	29.7	280	10.439
24JUN81	8	10	29.2	10	0.000
24JUN81	8	15	29.1	30	0.949
24JUN81	8	20	25.6	90	3.796
24JUN81	8	30	21.2	330	0.000
24JUN81	8	40	18.9	20	3.796
24JUN81	8	50	18.0	125	1.898
24JUN81	8	56	17.0	.	.
24JUN81	5	5	29.5	90	2.847
24JUN81	5	10	29.1	135	10.439
24JUN81	5	15	29.0	105	6.643
24JUN81	5	20	25.8	165	21.827
24JUN81	5	30	20.8	145	16.133
24JUN81	5	40	18.5	245	1.898
24JUN81	5	50	17.7	55	4.745
24JUN81	5	57	16.9	.	.
25JUN81	3	5	28.8	45	11.388
25JUN81	3	10	28.7	0	10.439
25JUN81	3	15	28.7	52	8.541
25JUN81	3	20	28.4	305	2.847
25JUN81	3	22	24.5	.	.
25JUN81	3	27	23.0	.	.
25JUN81	3	30	20.5	215	8.541
25JUN81	3	40	18.5	170	4.745
25JUN81	3	50	14.5	180	1.898
25JUN81	3	60	12.5	215	5.694
25JUN81	D	5	28.5	35	31.317
25JUN81	D	10	28.3	35	22.776
25JUN81	D	15	28.2	20	13.286
25JUN81	D	16	28.1	.	.
25JUN81	G	5	28.5	27	21.827
25JUN81	G	10	28.3	15	18.980
25JUN81	G	15	28.2	15	23.725
25JUN81	G	20	23.9	75	7.592
25JUN81	G	30	19.5	150	1.898
25JUN81	G	40	18.0	130	12.337
25JUN81	G	50	17.0	140	9.490
25JUN81	G	53	16.5	.	.
25JUN81	K	5	28.6	10	14.235
25JUN81	K	10	28.3	20	25.623
25JUN81	K	15	26.0	195	18.031
25JUN81	K	20	24.7	240	6.643
25JUN81	K	21	22.5	.	.
25JUN81	K	22	22.2	.	.
25JUN81	K	23	22.0	.	.
25JUN81	K	24	20.5	.	.
25JUN81	K	25	20.3	210	10.439
25JUN81	K	30	19.0	195	19.929
25JUN81	K	35	18.3	.	.
16AUG81	100	2	28.2	.	.
16AUG81	100	5	28.2	200	6.643
16AUG81	24	2	28.2	55	5.694
16AUG81	24	5	28.1	135	0.000
16AUG81	24	10	28.1	340	3.796
16AUG81	24	15	28.0	345	0.949
16AUG81	24	17	27.4	.	.
16AUG81	22	2	28.2	210	12.337
16AUG81	22	5	28.1	105	8.541
16AUG81	22	10	28.1	120	1.898
16AUG81	22	15	28.1	40	2.847

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
16AUG81	22	20.0	28.1	345	0.949
16AUG81	22	22.5	27.7	130	11.388
16AUG81	20	2.0	28.5	110	6.643
16AUG81	20	5.0	28.4	85	6.643
16AUG81	20	10.0	28.3	295	5.694
16AUG81	20	15.0	28.2	310	4.745
16AUG81	20	20.0	28.0	210	2.847
16AUG81	20	25.0	27.5	200	12.337
16AUG81	20	29.0	27.2	160	9.490
16AUG81	18	2.0	28.5	350	10.439
16AUG81	18	5.0	28.3	350	4.745
16AUG81	18	10.0	28.2	330	11.388
16AUG81	18	15.0	28.1	305	7.592
16AUG81	18	18.0	28.1	320	3.796
16AUG81	15	2.0	28.9	170	26.572
16AUG81	15	5.0	28.6	180	8.541
16AUG81	15	10.0	28.5	345	0.949
16AUG81	15	15.0	28.3	40	5.694
16AUG81	15	20.0	28.2	60	8.541
16AUG81	15	25.0	27.5	150	1.898
16AUG81	15	30.0	27.1	170	1.898
16AUG81	15	30.5	.	.	.
16AUG81	11	2.0	28.5	85	13.286
16AUG81	11	5.0	28.5	130	8.541
16AUG81	11	10.0	27.4	125	2.847
16AUG81	11	15.0	27.2	270	4.745
16AUG81	11	20.0	27.1	335	7.592
16AUG81	11	25.0	27.0	300	5.694
16AUG81	11	30.0	25.8	225	25.623
16AUG81	11	35.0	24.8	225	6.643
16AUG81	11	40.0	23.7	250	14.235
16AUG81	11	45.0	21.8	325	6.643
16AUG81	11	50.0	20.2	65	17.082
16AUG81	11	55.0	19.3	55	0.000
16AUG81	11	60.0	18.0	35	14.235
16AUG81	8	2.0	28.2	120	24.674
16AUG81	8	5.0	28.2	130	21.827
16AUG81	8	10.0	27.8	15	1.898
16AUG81	8	15.0	27.4	20	6.643
16AUG81	8	20.0	27.4	55	13.286
16AUG81	8	30.0	27.0	250	6.643
16AUG81	8	40.0	24.8	255	7.592
16AUG81	8	50.0	21.0	225	5.694
16AUG81	8	57.5	18.9	210	0.000
16AUG81	5	2.0	28.4	30	3.796
16AUG81	5	5.0	28.0	195	9.490
16AUG81	5	10.0	27.6	80	5.694
16AUG81	5	15.0	27.5	140	2.847
16AUG81	5	20.0	27.3	345	0.949
16AUG81	5	25.0	27.3	240	6.643
16AUG81	5	30.0	26.9	290	14.235
16AUG81	5	40.0	25.6	330	13.286
16AUG81	5	50.0	20.3	315	7.592
16AUG81	5	60.0	18.3	260	1.898
16AUG81	3	2.0	28.1	115	9.490
16AUG81	3	5.0	28.1	110	5.694
16AUG81	3	10.0	27.9	250	12.337
16AUG81	3	15.0	27.5	175	5.694
16AUG81	3	20.0	27.4	320	4.745
16AUG81	3	25.0	27.3	305	3.796
16AUG81	3	30.0	27.3	295	0.949

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
16AUG81	3	40.0	25.0	85	4.745
16AUG81	3	50.0	21.1	100	7.592
16AUG81	3	60.0	18.4	305	2.847
16AUG81	D	2.0	28.6	45	18.031
16AUG81	D	5.0	28.0	55	9.490
16AUG81	D	10.0	27.6	265	8.541
16AUG81	D	15.0	27.3	245	27.521
16AUG81	D	20.0	27.2	230	28.470
16AUG81	D	25.0	27.2	230	26.572
16AUG81	D	30.0	26.6	250	25.623
16AUG81	D	40.0	24.5	235	10.439
17AUG81	G	2.0	27.0	215	19.929
17AUG81	G	5.0	27.0	245	19.929
17AUG81	G	10.0	27.0	185	17.082
17AUG81	G	15.0	27.0	160	8.541
17AUG81	G	20.0	27.0	250	17.082
17AUG81	G	30.0	25.5	30	8.541
17AUG81	G	40.0	23.5	45	9.490
17AUG81	K	2.0	27.0	225	21.827
17AUG81	K	5.0	26.8	210	18.031
17AUG81	K	10.0	26.8	215	16.133
17AUG81	K	15.0	26.8	205	13.286
17AUG81	K	20.0	26.8	290	14.235
17AUG81	K	30.0	26.6	35	18.980
17AUG81	K	32.5	25.5	.	.
03SEP81	100	2.0	26.8	325	2.847
03SEP81	24	2.0	26.8	290	20.878
03SEP81	24	5.0	26.5	280	4.745
03SEP81	24	10.0	26.1	305	2.847
03SEP81	22	2.0	26.9	165	1.898
03SEP81	22	5.0	26.8	135	8.541
03SEP81	22	8.0	26.8	140	6.643
03SEP81	20	2.0	26.9	360	21.827
03SEP81	20	5.0	26.8	355	10.439
03SEP81	20	10.0	26.5	320	4.745
03SEP81	20	15.0	26.3	195	3.796
03SEP81	20	18.2	26.1	210	10.439
03SEP81	18	2.0	26.8	300	22.776
03SEP81	18	5.0	26.8	290	17.082
03SEP81	18	10.0	26.3	255	8.541
03SEP81	18	15.0	26.0	275	5.694
03SEP81	18	20.0	25.9	22	7.592
03SEP81	15	2.0	27.0	355	16.133
03SEP81	15	5.0	26.4	45	10.439
03SEP81	15	10.0	25.2	45	6.643
03SEP81	15	15.0	25.1	225	3.796
03SEP81	15	20.0	25.1	197	13.286
03SEP81	15	30.0	24.9	195	13.286
03SEP81	11	2.0	27.1	240	18.980
03SEP81	11	5.0	26.8	210	22.776
03SEP81	11	10.0	25.9	255	18.031
03SEP81	11	15.0	25.7	303	7.592
03SEP81	11	20.0	25.2	60	11.388
03SEP81	11	30.0	24.9	45	14.235
03SEP81	11	40.0	24.1	55	2.847
03SEP81	11	50.0	23.2	45	6.643
03SEP81	11	59.0	21.0	50	2.847
03SEP81	8	2.0	27.0	315	8.541
03SEP81	8	5.0	26.5	68	13.286
03SEP81	8	10.0	25.8	250	15.184
03SEP81	8	15.0	25.4	230	6.643

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
03SEP81	8	20.0	25.3	205	4.745
03SEP81	8	30.0	24.9	105	0.949
03SEP81	8	40.0	24.1	290	8.541
03SEP81	8	50.0	23.4	210	2.847
03SEP81	8	56.0	22.5	.	.
03SEP81	5	2.0	26.9	305	22.776
03SEP81	5	5.0	26.5	310	17.082
03SEP81	5	10.0	26.0	63	2.847
03SEP81	5	15.0	25.8	34	4.745
03SEP81	5	20.0	25.5	175	8.541
03SEP81	5	30.0	24.5	160	16.133
03SEP81	5	40.0	24.0	80	10.439
03SEP81	5	50.0	23.1	150	6.643
03SEP81	5	52.0	22.2	.	.
03SEP81	5	56.0	21.2	.	.
03SEP81	5	59.0	20.0	135	1.898
03SEP81	3	2.0	26.3	305	18.980
03SEP81	3	5.0	26.3	300	13.286
03SEP81	3	10.0	25.6	220	4.745
03SEP81	3	15.0	25.2	165	6.643
03SEP81	3	20.0	24.5	90	16.133
03SEP81	3	30.0	24.0	135	10.439
03SEP81	3	40.0	23.9	100	6.643
03SEP81	3	50.0	22.9	64	3.796
03SEP81	3	53.5	21.8	.	.
03SEP81	3	59.0	20.8	32	1.898
03SEP81	D	2.0	26.7	285	9.490
03SEP81	D	5.0	26.8	310	6.643
03SEP81	D	10.0	26.0	320	3.796
03SEP81	D	15.0	24.9	180	5.694
03SEP81	D	20.0	24.5	195	1.898
03SEP81	D	30.0	24.1	105	2.847
04SEP81	G	2.0	26.1	285	4.745
04SEP81	G	5.0	26.0	300	8.541
04SEP81	G	10.0	25.8	110	14.235
04SEP81	G	15.0	25.2	45	10.439
04SEP81	G	20.0	25.2	110	6.643
04SEP81	G	25.0	24.0	.	.
04SEP81	G	30.0	24.0	10	9.490
04SEP81	K	2.0	26.7	295	2.847
04SEP81	K	5.0	26.5	240	4.745
04SEP81	K	10.0	26.0	195	5.694
04SEP81	K	15.0	24.8	300	1.898
04SEP81	K	20.0	24.1	300	3.796
04SEP81	K	30.0	23.9	255	3.796
08OCT81	100	2.0	15.9	130	11.388
08OCT81	100	5.0	17.1	150	11.388
08OCT81	24	2.0	17.8	180	9.490
08OCT81	24	5.0	17.8	180	9.490
08OCT81	24	10.0	17.8	315	7.592
08OCT81	24	12.0	.	.	7.592
08OCT81	24	15.0	17.4	350	14.235
08OCT81	24	18.0	17.4	255	4.745
08OCT81	22	2.0	20.8	200	7.592
08OCT81	22	5.0	20.7	325	7.592
08OCT81	22	9.0	20.1	285	9.490
08OCT81	20	2.0	18.7	140	12.337
08OCT81	20	5.0	18.7	95	7.592
08OCT81	20	10.0	18.4	345	9.490
08OCT81	20	15.0	18.2	355	13.286
08OCT81	20	20.0	18.2	315	8.541

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
08OCT81	20	25	18.1	210	10.439
08OCT81	18	2	19.5	160	13.286
08OCT81	18	5	19.4	170	11.388
08OCT81	18	10	19.3	225	1.898
08OCT81	18	15	19.2	255	4.745
08OCT81	18	20	19.1	15	1.898
08OCT81	18	25	19.1	240	10.439
08OCT81	18	30	19.1	230	3.796
08OCT81	15	2	20.1	100	9.490
08OCT81	15	5	20.1	145	11.388
08OCT81	15	10	20.1	30	0.949
08OCT81	15	15	20.1	60	4.745
08OCT81	15	20	20.0	290	3.796
08OCT81	15	24	20.0	300	6.643
09OCT81	11	2	20.1	230	13.286
09OCT81	11	5	20.0	230	10.439
09OCT81	11	10	20.0	215	6.643
09OCT81	11	15	20.0	275	15.184
09OCT81	11	20	19.9	180	14.235
09OCT81	11	30	19.9	225	3.796
09OCT81	11	40	19.9	145	8.541
09OCT81	11	50	19.9	85	4.745
09OCT81	11	58	19.9	50	8.541
09OCT81	8	2	20.3	120	14.235
09OCT81	8	5	20.2	135	9.490
09OCT81	8	10	20.1	180	0.949
09OCT81	8	15	20.1	30	3.796
09OCT81	8	20	20.1	35	14.235
09OCT81	8	30	20.1	30	0.949
09OCT81	8	40	20.1	320	3.796
09OCT81	8	50	20.1	355	6.643
09OCT81	8	56	20.1	345	4.745
09OCT81	5	2	20.2	120	0.949
09OCT81	5	5	20.2	70	2.847
09OCT81	5	10	20.2	165	9.490
09OCT81	5	15	20.2	250	6.643
09OCT81	5	20	20.1	10	10.439
09OCT81	5	30	20.1	10	2.847
09OCT81	5	40	20.2	250	11.388
09OCT81	5	50	20.1	260	3.796
09OCT81	5	58	20.1	330	0.949
09OCT81	3	2	20.3	345	1.898
09OCT81	3	5	20.3	30	4.745
09OCT81	3	10	20.2	140	5.694
09OCT81	3	15	20.2	150	10.439
09OCT81	3	20	20.2	225	5.694
09OCT81	3	30	20.2	170	0.949
09OCT81	3	40	20.2	95	7.592
09OCT81	3	50	20.2	75	10.439
09OCT81	3	60	20.2	60	6.643
09OCT81	D	2	20.1	80	3.796
09OCT81	D	5	20.1	35	1.898
09OCT81	D	10	19.9	120	4.745
09OCT81	D	15	19.9	120	4.745
09OCT81	D	20	19.9	100	5.694
09OCT81	D	25	19.9	70	5.694
09OCT81	D	30	19.9	135	7.592
09OCT81	D	35	19.9	15	4.745
09OCT81	G	2	20.1	325	4.745
09OCT81	G	5	20.0	320	6.643
09OCT81	G	10	19.9	10	5.694

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
09OCT81	G	15	19.9	70	8.541
09OCT81	G	20	19.9	30	5.694
09OCT81	G	25	19.9	295	6.643
09OCT81	K	2	20.2	270	17.082
09OCT81	K	5	19.9	230	6.643
09OCT81	K	10	19.7	20	12.337
09OCT81	K	15	19.7	215	5.694
09OCT81	K	20	19.6	260	2.847
09OCT81	K	30	19.4	.	9.490
15NOV81	100	3	10.1	250	4.745
15NOV81	100	5	10.0	240	8.541
15NOV81	24	2	10.0	345	7.592
15NOV81	24	5	10.0	340	12.337
15NOV81	22	2	12.0	265	14.235
15NOV81	22	5	11.5	345	7.592
15NOV81	22	10	11.5	330	8.541
15NOV81	22	12	11.0	.	.
15NOV81	20	2	11.5	10	11.388
15NOV81	20	5	11.5	25	14.235
15NOV81	20	10	11.5	330	4.745
15NOV81	20	15	11.5	0	.
15NOV81	20	20	11.5	360	.
15NOV81	20	24	11.5	15	.
15NOV81	18	2	12.5	210	9.490
15NOV81	18	5	12.5	235	16.133
15NOV81	18	10	12.5	225	8.541
15NOV81	18	15	12.5	90	18.031
15NOV81	15	2	13.2	180	18.980
15NOV81	15	5	13.2	195	16.133
15NOV81	15	10	13.2	270	9.490
15NOV81	15	15	13.2	210	8.541
15NOV81	15	20	13.2	120	10.439
15NOV81	15	25	13.2	180	9.490
15NOV81	11	2	13.5	25	10.439
15NOV81	11	5	13.8	20	4.745
15NOV81	11	10	13.8	290	14.235
15NOV81	11	15	13.8	200	13.286
15NOV81	11	20	13.8	225	11.388
15NOV81	11	30	13.8	45	9.490
15NOV81	11	40	13.8	33	4.745
15NOV81	11	50	13.5	350	9.490
15NOV81	11	55	13.5	.	.
15NOV81	8	.	.	.	.
15NOV81	5	2	14.0	120	16.133
15NOV81	5	5	14.0	135	11.388
15NOV81	5	10	14.0	105	8.541
15NOV81	5	15	14.0	50	7.592
15NOV81	5	20	14.0	290	7.592
15NOV81	5	30	14.0	295	5.694
15NOV81	5	40	13.8	235	5.694
15NOV81	5	50	13.8	40	8.541
15NOV81	5	59	13.8	.	.
15NOV81	3	2	14.0	215	12.337
15NOV81	3	5	14.2	125	11.388
15NOV81	3	10	14.2	110	12.337
15NOV81	3	15	14.2	270	15.184
15NOV81	3	20	14.2	255	21.827
15NOV81	3	30	14.2	225	7.592
15NOV81	3	40	13.9	240	14.235
15NOV81	3	50	13.9	300	17.082
15NOV81	3	60	13.8	290	7.592

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
15NOV81	D	.	.	.	.
15NOV81	G	2.0	13.0	160	16.133
15NOV81	G	5.0	13.0	125	10.439
15NOV81	G	10.0	13.0	80	6.643
15NOV81	G	15.0	13.0	345	9.490
15NOV81	G	20.0	13.0	200	4.745
15NOV81	G	30.0	12.8	315	10.439
15NOV81	G	37.5	12.5	.	.
15NOV81	K	2.0	13.5	170	14.235
15NOV81	K	5.0	12.5	195	16.133
15NOV81	K	10.0	12.5	60	8.541
03DEC81	100	2.0	7.0	.	.
03DEC81	100	4.0	7.0	190	12.337
03DEC81	24	3.0	7.0	170	7.592
03DEC81	24	5.0	7.0	210	2.847
03DEC81	24	9.0	7.0	160	3.796
03DEC81	22	3.0	7.2	300	3.796
03DEC81	22	5.0	7.5	285	7.592
03DEC81	22	10.0	7.5	315	8.541
03DEC81	20	3.0	7.8	200	10.439
03DEC81	20	5.0	7.8	210	5.694
03DEC81	20	10.0	7.8	225	7.592
03DEC81	20	15.0	7.8	330	20.878
03DEC81	20	20.0	7.8	335	20.878
03DEC81	20	22.0	.	.	.
03DEC81	18	2.0	9.0	105	17.082
03DEC81	18	5.0	9.0	120	18.031
03DEC81	18	10.0	9.0	180	18.980
03DEC81	18	15.0	9.0	55	10.439
03DEC81	18	20.0	9.0	135	7.592
03DEC81	18	24.0	.	.	.
03DEC81	15	2.0	9.8	145	15.184
03DEC81	15	5.0	9.8	135	14.235
03DEC81	15	10.0	9.8	135	7.592
03DEC81	15	15.0	9.8	175	8.541
03DEC81	15	20.0	9.8	170	0.949
03DEC81	15	25.0	9.8	200	14.235
03DEC81	11	2.0	10.2	80	8.541
03DEC81	11	5.0	10.3	45	8.541
03DEC81	11	10.0	10.3	50	4.745
03DEC81	11	15.0	10.2	90	7.592
03DEC81	11	20.0	10.6	95	8.541
03DEC81	11	30.0	10.9	355	12.337
03DEC81	11	40.0	10.7	135	2.847
03DEC81	11	50.0	10.2	50	2.847
03DEC81	8	2.0	11.0	155	8.541
03DEC81	8	5.0	11.1	160	12.337
03DEC81	8	10.0	11.1	165	17.082
03DEC81	8	15.0	11.1	180	12.337
03DEC81	8	20.0	11.1	180	12.337
03DEC81	8	30.0	11.1	185	3.796
03DEC81	8	40.0	11.1	135	1.898
03DEC81	8	50.0	11.1	355	3.796
03DEC81	5	2.0	11.3	220	13.286
03DEC81	5	5.0	11.3	210	6.643
03DEC81	5	10.0	11.3	170	7.592
03DEC81	5	15.0	11.3	95	6.643
03DEC81	5	20.0	11.5	135	8.541
03DEC81	5	30.0	11.5	110	5.694
03DEC81	5	4.0	11.4	5	6.643
03DEC81	5	50.0	11.3	290	0.949

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
03DEC81	3	.	.	.	.
03DEC81	D	.	.	.	.
03DEC81	G	.	.	.	.
03DEC81	K	.	.	.	.
12FEB82	100	2	5.5	130	7.592
12FEB82	100	5	4.5	120	5.694
12FEB82	100	10	4.5	115	5.694
12FEB82	24	2	5.3	140	11.388
12FEB82	24	5	5.0	125	12.337
12FEB82	22	2	5.3	285	0.949
12FEB82	22	5	5.2	230	5.694
12FEB82	22	10	5.0	115	4.745
12FEB82	22	15	4.5	90	10.439
12FEB82	22	20	4.3	100	6.643
12FEB82	20	2	5.0	245	4.745
12FEB82	20	5	5.0	160	6.643
12FEB82	20	10	4.8	155	5.694
12FEB82	20	15	4.8	85	13.286
12FEB82	20	20	4.9	155	11.388
12FEB82	20	25	4.9	150	12.337
12FEB82	18	.	.	.	.
12FEB82	15	2	4.6	310	10.439
12FEB82	15	5	4.8	225	2.847
12FEB82	15	10	4.8	225	5.694
12FEB82	15	15	4.8	345	9.490
12FEB82	15	20	4.4	150	4.745
12FEB82	15	25	4.4	55	4.745
12FEB82	15	30	4.4	340	3.796
12FEB82	15	40	4.4	350	1.898
12FEB82	11	2	4.9	315	1.898
12FEB82	11	5	4.8	10	0.949
12FEB82	11	10	4.8	75	0.949
12FEB82	11	15	4.7	65	3.796
12FEB82	11	20	4.6	65	6.643
12FEB82	11	30	4.6	62	7.592
12FEB82	11	40	4.6	85	8.541
12FEB82	11	50	4.6	60	1.898
12FEB82	11	60	4.6	40	6.643
12FEB82	8	2	4.2	130	2.847
12FEB82	8	5	4.1	55	4.745
12FEB82	8	10	4.1	70	5.694
12FEB82	8	15	4.0	155	5.694
12FEB82	8	20	4.0	145	0.000
12FEB82	8	30	4.1	200	1.898
12FEB82	8	40	4.1	210	0.949
12FEB82	8	50	4.1	185	1.898
12FEB82	8	60	4.2	115	5.694
12FEB82	5	2	3.8	225	3.796
12FEB82	5	5	3.7	190	0.949
12FEB82	5	10	3.7	165	1.898
12FEB82	5	15	3.7	170	0.949
12FEB82	5	20	3.6	155	0.949
12FEB82	5	30	3.6	185	7.592
12FEB82	5	40	3.6	170	4.745
12FEB82	5	50	3.7	130	6.643
12FEB82	5	60	3.7	135	7.592
12FEB82	3	2	3.8	205	2.847
12FEB82	3	5	3.7	180	1.898
12FEB82	3	10	3.7	170	1.898
12FEB82	3	15	3.7	190	0.949
12FEB82	3	20	3.7	225	0.949

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
12FEB82	3	30	3.7	240	0.949
12FEB82	3	40	3.7	160	2.847
12FEB82	3	50	3.7	130	1.898
12FEB82	3	60	3.7	135	0.949
12FEB82	D	2	3.5	290	6.643
12FEB82	D	5	3.5	280	3.796
12FEB82	D	10	3.5	310	4.745
12FEB82	D	15	3.5	205	4.745
12FEB82	D	20	3.4	115	5.694
12FEB82	D	30	3.5	45	2.847
12FEB82	D	40	3.5	35	4.745
12FEB82	D	50	3.4	80	4.745
12FEB82	D	60	3.4	50	0.949
13FEB82	G	2	4.1	165	11.388
13FEB82	G	5	4.1	90	2.847
13FEB82	G	10	4.1	60	10.439
13FEB82	G	15	4.1	295	8.541
13FEB82	G	20	4.1	300	3.796
13FEB82	G	30	4.1	240	4.745
13FEB82	G	40	4.1	5	7.592
13FEB82	K	2	4.6	225	17.082
13FEB82	K	5	4.6	135	6.643
13FEB82	K	10	4.6	205	8.541
13FEB82	K	15	4.6	255	10.439
13FEB82	K	20	4.5	95	10.439
13FEB82	K	30	4.4	305	1.898
13FEB82	K	36	4.4	280	5.694
02MAR82	100	2	5.4	150	19.929
02MAR82	100	5	5.1	175	21.827
02MAR82	100	10	5.0	185	13.286
02MAR82	24	2	5.6	110	11.388
02MAR82	24	5	5.5	135	14.235
02MAR82	24	9	5.0	140	16.133
02MAR82	22	2	6.3	125	19.929
02MAR82	22	5	6.1	115	5.694
02MAR82	22	10	5.0	130	7.592
02MAR82	22	15	4.9	127	6.643
02MAR82	22	20	4.9	120	4.745
02MAR82	22	25	4.9	150	9.490
02MAR82	20	2	7.1	120	11.388
02MAR82	20	5	7.0	120	9.490
02MAR82	20	10	6.8	145	14.235
02MAR82	20	15	6.4	175	3.796
02MAR82	20	20	6.2	190	8.541
02MAR82	18	2	7.2	105	32.266
02MAR82	18	5	7.0	120	18.980
02MAR82	18	10	7.0	230	18.031
02MAR82	18	15	6.7	325	10.439
02MAR82	18	20	6.6	195	8.541
02MAR82	18	25	6.4	235	4.745
02MAR82	18	30	6.3	305	5.694
02MAR82	18	35	6.2	330	5.694
02MAR82	15	2	7.0	100	26.572
02MAR82	15	5	6.9	70	13.286
02MAR82	15	10	6.8	150	15.184
02MAR82	15	15	6.4	205	12.337
02MAR82	15	20	6.0	205	5.694
02MAR82	15	25	6.0	230	7.592
02MAR82	15	30	6.0	295	7.592
02MAR82	15	35	6.0	330	12.337
02MAR82	11	2	6.9	60	19.929

DATE	BUOY	DEPTH_FT	TEMP_C	CURDIR	VELOCITY
02MAR82	11	5	6.9	60	23.725
02MAR82	11	10	6.8	80	16.133
02MAR82	11	15	6.5	60	16.133
02MAR82	11	20	6.4	110	10.439
02MAR82	11	30	6.3	140	11.388
02MAR82	11	40	6.3	20	13.286
02MAR82	11	50	6.3	60	4.745
02MAR82	8	2	6.9	120	22.776
02MAR82	8	5	7.0	115	25.623
02MAR82	8	10	6.9	90	17.082
02MAR82	8	15	6.8	125	9.490
02MAR82	8	20	6.6	180	12.337
02MAR82	8	30	6.2	170	13.286
02MAR82	8	40	6.2	105	14.235
02MAR82	8	50	6.2	340	14.235
02MAR82	8	60	6.1	170	20.878
02MAR82	5	2	6.4	135	18.980
02MAR82	5	5	6.4	95	23.725
02MAR82	5	10	6.4	155	32.266
02MAR82	5	15	6.3	110	7.592
02MAR82	5	20	6.2	160	19.929
02MAR82	5	30	5.9	109	7.592
02MAR82	5	40	5.7	90	5.694
02MAR82	5	50	5.6	285	5.694
02MAR82	5	60	5.5	160	19.929
02MAR82	3	2	5.5	185	17.082
02MAR82	3	5	5.3	210	.
02MAR82	3	10	5.4	220	.
02MAR82	3	20	5.3	225	.
02MAR82	3	30	5.4	230	.
02MAR82	3	40	5.1	250	.
02MAR82	3	50	5.0	230	.
02MAR82	3	60	5.0	230	.
02MAR82	D	.	.	.	.
02MAR82	G	.	.	.	.
02MAR82	K	.	.	.	.

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AN ANALYSIS OF SEDIMENTATION IN

JOHN H. KERR RESERVOIR

by

Daniel M. Goodwin

(ABSTRACT)

The report herein consists of a two phase study of sedimentation in John H. Kerr Reservoir. First is a comparison of suspended sediment data, which was collected by a VPI&SU team, to theoretical sedimentation patterns. A fairly good agreement was found. The field monitoring trips were performed a total of ten times between March 30,1981 and March 3, 1982. The VPI&SUdata is presented in graphical form, in terms of the suspended sediment distribution in evidence each research trip, as well as the patterns that were evident at each station during the period of monitoring.

The second phase compares historical sediment inflow data provided by the U.S.G.S. to three Kerr Reservoir sedimentation studies performed by the U.S. Army Corps of Engineers. The period involved is from Jan. 1952-Oct. 1976. The discrepency involved is calculated, and possibl causes are discussed

In the 24-year period analyzed, only 1.48 percent of the total storage volume of Kerr Reservoir was lost due to sediment accumulation, indicating that the long term operation of the reservoir is not significantly affected by sedimentation.