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Station

Limnological Assessment of West Point Lake, Georgia

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Prepared for U.S. Army Engineer District, Mobile

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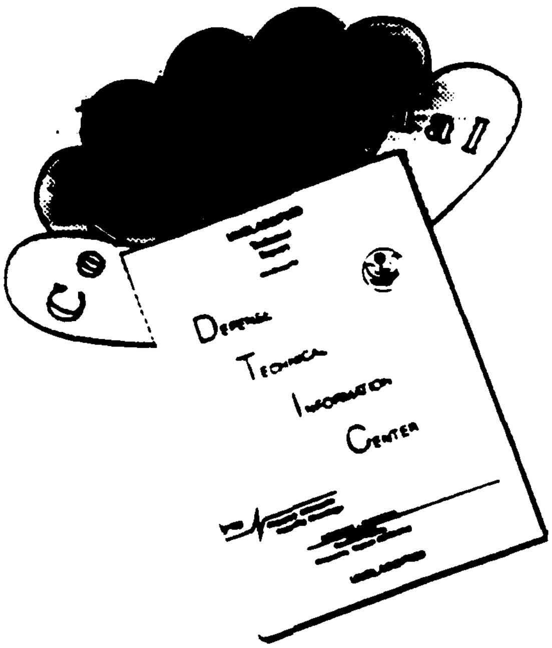

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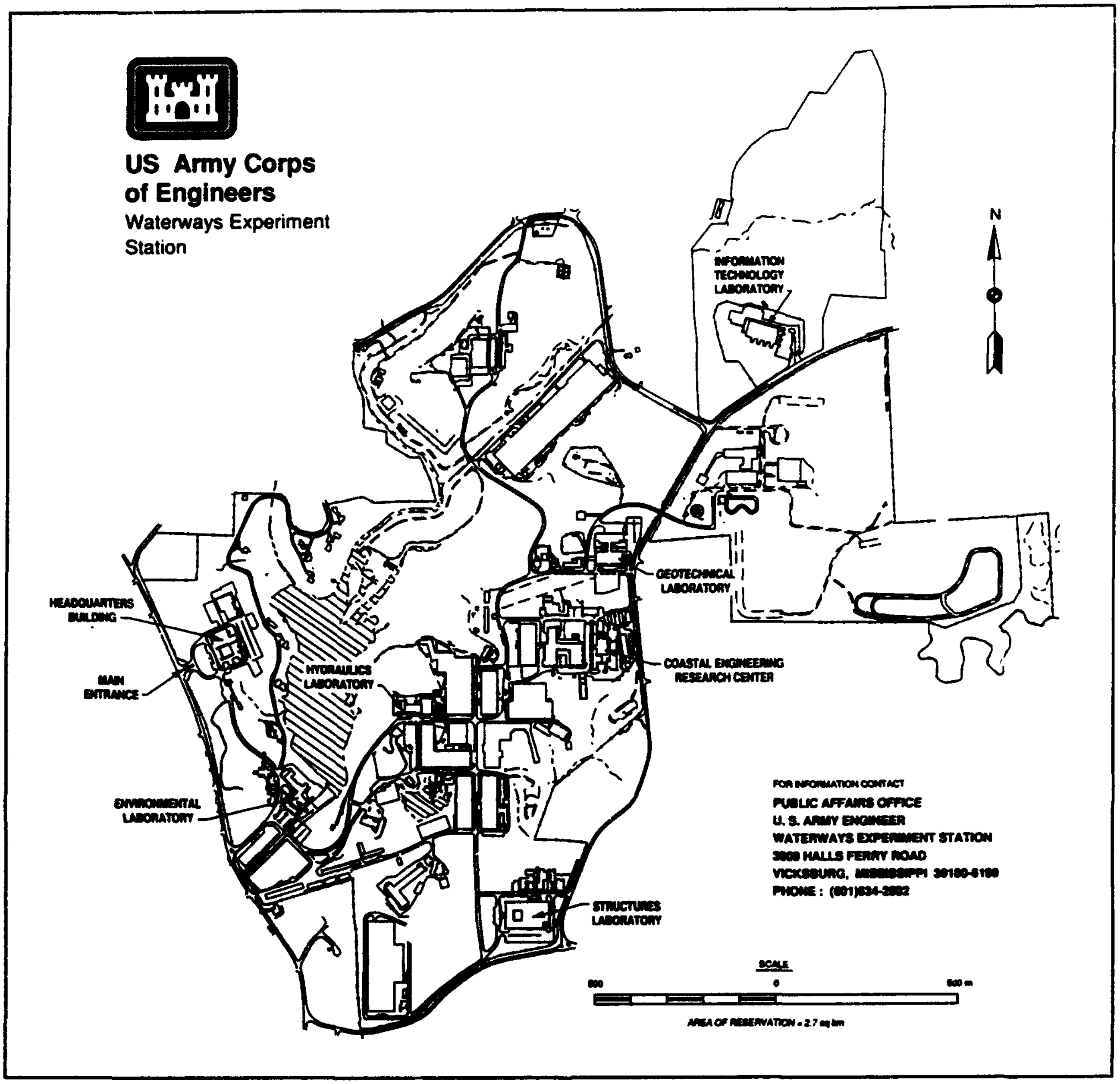

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Contents

Preface

The work described herein was conducted under a Military Interdepartmental Purchase Request by the U.S. Army Engineer Waterways Experimental Station (WES), Vicksburg, MS, for the U.S. Army Engineer District, Mobile.

This report was prepared by Drs. Robert H. Kennedy and John J. Hains, and Messrs. Steven L. Ashby and William Jabour of the Environmental Processes and Effects Division (EPED), Environmental Laboratory (EL), WES; Dr. Burl Naugle, Mid America Remote Sensing Center, Murray State University, Murray, KY; and Barbara Speziale, Department of Biological Sciences, Clemson University, Clemson, SC. The authors gratefully acknowledge the support and assistance of personnel associated with the WES's Trotter's Shoals Limnological Research Facility, Calhoun Falls, SC.

The work was performed under the general supervision of Dr. Richard E. Price, Acting Chief, Ecosystem Processes and Effects Branch, EPED; Mr. Donald L. Robey, Chief, EPED; and Dr. John W. Keeley, Director, EL.

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1 Introduction

Background

Reservoirs are, by design, located on major rivers or streams draining relatively large watersheds, and because of this, receive high water and material loads (Kennedy et al. 1985, Thornton et al. 1981). High material loads, including plant nutrients, suspended sediment and organic matter, lead to excessive algal production, reduced water clarity, and depleted oxygen reserves in bottom waters. Poor reservoir water quality conditions, particularly low dissolved oxygen and elevated concentrations of reduced substances, can, in turn, adversely impact tailwater conditions.

Differences in hydrology, lake morphometry, and the design and operation of the impounding structure are important considerations when assessing water quality responses in reservoirs (Kennedy et al. 1985). For reservoirs located in large watersheds, a single, large inflowing tributary may contribute a majority of the water and material loads, residence times may be short, and the influences of local inputs may be minor. However, the water quality of reservoirs located in smaller watersheds, receiving water and material loads from multiple tributaries, and having longer residence times, may be greatly influenced by local conditions.

Reservoirs having large embayments or a complex morphology may be differentially influenced by the major tributary(ies) and by local inputs. Embayments, which may lack tributary inflows or receive inputs from one or more secondary tributaries, often have limited hydraulic exchange with the main portion of the pool. Residence times can be long and loadings from tributaries and/or from direct inputs from point and nonpoint sources often are the principal source of nutrients. Because of this, changes in the quantity or quality of water entering via the primary tributary would have a proportionaly lower impact on conditions in embayments. Since commonly applied estimation methods assume homogeniety, these potential differences in response are important to consider when estimating the probable impact of ameliorative actions involving reduced loadings.

Proposed efforts to reduce nutrient discharges to the Chattahoochee River from point sources in and around the Altanta metropolitan area are designed to improve riverine quality and, thus, beneficially influence water quality conditions in West Point Lake and in the tailwater area below West Point Dam. While the reduction in material and nutrient loads will clearly have a beneficial impact on the lake, the degree to which local loading and lake processes will continue to influence water quality conditions is less clear.

Objectives

Objectives of this study were to (1) describe current eutrophication-related water quality conditions in West Point Lake as a basis for assessing future change, (2) assess spatial patterns in these conditions as they may relate to loading and lake characteristics, and (3) describe selected water quality processes in the tailwater below West Point Dam.

2 Site Description

Lake and Watershed

West Point Dam is located on the Chattahoochee River, 324 km above it's mouth, approximately 5 km north of West Point, Georgia, and 44.8 km downstream from Buford Dam (Figure 1). The reservoir impounded by the dam, West Point Lake, lies primarily in Troup County, GA and Chambers County, AL. The drainage area controlled by the reservoir (8754 sq km) represents about 40 percent of the Chattahoochee River basin and about 18 percent of the Apalachicola River basin. Major tributaries to the reservoir include Yellowjacket and Wehadkee Creeks,and New River. The reservoir has a shoreline of 845 km, is nearly 56 km long, and has a surface area of 10,482 hectares (25,900 acres) at an elevation of 193.5 m NGVD (National Geodetic Vertical Datum). Total volume of the reservoir is 45.7 million cubic meters; estimated retention time is 55 days.

Geologic features of the area are dominated by mica schist, gneiss, and granite derived from sedimentary and igneous rocks. The prevalent soils in the area are well-drained, often strongly acid, shallow, and highly weathered. Major land uses in the watershed include forest lands for pulpwood and timber and pasture land for livestock. Approximately 20% of the land in the project area is suitable for crops such as cotton, peanuts, corn, and hay.

Structure and Operation

West Point Dam and Lake were authorized by the Flood Control Act of October 23, 1962, for flood control, power, and fish and wildlife, and recreation. Other purposes include water supply and stream flow regulation. Construction was started in 1965 and the west earth embankment and an access road to the powerhouse area were completed in 1966. Closure of the main channel was accomplished in May 1967 and the flow of the river was diverted through a channel that had been cut on the east bank of the river. Construction of the concrete portion of the dam was started in May 1968 and completed in August 1970. The second stage closure was made June 21,1973 and the flow of the river was passed through the waterway opening which had been provided in the powerhouse intake structure for the addition of a future main generating unit. Reservoir filling was started October 16,1974 and a surface elevation of 188.06 m (617 ft) NGVD was reached November 15, 1974. This eleveation was held until April 30,1975, due to construction restrictions. Commercial operation of the main hydropower units began between March 10 (unit 3) and April 10, 1975 (unit 2 and unit 1, a smaller unit).

The dam is a concrete gravity structure with rolled, earth-fill embankments. The elevation of the top of the dam is 198.73 m (652 ft NGVD), 29.6 m above the existing stream bed. The total length of the concrete dam and earth embankments is 2210 m. The principle structures that make up the concrete dam are an intake-powerhouse structure, a non-overflow section, a gated spillway located in the main river channel, and a left embankment retaining wall which supports the earth embankment on the east abutment. The intake structure provides waterway openings for two main generating units and one small generating unit. Intakes for the two main units are between 183.5 and 170.1 m (602 and 558 ft) NGVD and the intake for the small unit is between 193.5 and 184.4 m (635 and 605 ft) NGVD. The small unit has an adjustable water intake gate designed to take water from the upper 4-5 meters of the lake and maintain a minimum flow with improved oxygen content when the two main units are not in use.

Normal operations include maintaining a minimum pool elevation of 190.5 m NGVD during December through mid-April for flood control and a recreation pool near 193.5 m NGVD the remainder of the year (except during drought periods). Hydroelectric power production at these elevations is via two main generators, each with a capacity of 35,000 kw, and a small house unit with a capacity of 3,375 kw. The small unit runs continuously and provides electricity for project operation and a minimum release. The two main units are operated to meet peak energy requirements. Discharge rates for the house unit and both main units average approximately 18 and 450 cubic meters per second, respectively.

The tailwater region extends 15.2 km from West Point Dam downstream to a low-head dam located at Langdale, GA. The tailwater provides water to downstream industry and is a source of recreation. During low-flow generation the tailwater region is a series of pools and riffles which are inundated during peaking generation. In addition to reservoir releases, two secondary tributaries, Oseligee and Long Cane Creeks, contribute inflow to the tailwater.

3 Water Quality Assessment

Introduction

Limnological surveys were conducted coincident with six LANDSAT overflights during the period April 20 to October 14, 1991. Successive sampling dates are identified as sampling round 1-6 in subsequent discussions. Single sampling efforts that extended over two to three consecutive days were considered a single sample round. LANDSAT image acquisition dates and associated sampling dates are identified in Table 1.

Two sampling strategies were followed. The first involved collection of in-situ measurements and samples of surface water (0.1 m) at approximately 60 stations (see Figure 2) within 2 to 3 hours of each satellite overflight for ground-truth evaluations. Overflights occurred at approximately 0930 hr on each date. In-situ variables included Secchi disk transparency, temperature and dissolved oxygen concentration. Analyses of water samples included turbidity, algal pigments, and on selected dates, total phosphorus and nitrogen concentrations.

The second sampling strategy involved collection of supplemental data at approximately 20 of the above stations. These data included in-situ profile measurements at depth intervals sufficient to describe vertical gradients, and results of chemical analyses of water samples collected at selected depths. Depths for collection of water samples were determined in the field based on in-situ profile information. In addition to surface, samples were collected at mid-depth at shallow stations, and in surface, bottom and mid-thermocline strata at deeper, stratified stations. Chemical analyses were performed for total and dissolved forms of carbon, phosphorus, nitrogen, iron and manganese.

Analytical Methods

Water samples were collected using a hose and pump system. Subsamples for determination of dissolved constituents were filtered in-line using a 0.45-μ glass fiber filter. Raw and filtered subsamples were stored in the dark at 4 °C prior to analysis. Standard methods (US Environmental Protection Agency 1979, American Public Health Association 1989) were used for chemical analyses of water samples. Algal pigment concentrations were determined colorimetrically following extraction from material retained on glass filters (Hains 1985).

Sampling stations, which often coincided with the locations of navigation or channel buoys, were established so as to provide nearly uniform distribution of sampling effort. The location of each station, once established, was determined initially using global positioning system (GPS) techniques (Trimble Navigation Limited, Sunnyvale, CA). GPS locations were then compared to map locations based on field observations. The locations of stations at which GPS information and field observation varied markedly were reevaluated during the next sampling round. All station locations were geographically referenced to allow comparison with LANDSAT image information (see Part 4).

Cluster analyses (SAS 1981) were performed using selected variables for surface waters on dates for which LANDSAT image analyses were performed (see Part 4). For initial analyses, variables included temperature, turbidity, and total pigment concentration. The latter was calculated as the sum of chlorophyll a, b, and c prior to acid correction. It was assumed that these variables provide information corresponding to that estimated from image analyses. Subsequent cluster analyses included chemical variables. In both cases, observations were normalized prior to analysis as the deviation from the mean divided by the standard deviation (Gaugush 1986).

Results and Discussion

In-situ conditions at selected deep-water stations in the main pool and major tributary embayments on July 25-26 indicated weak thermal stratification with an upper, mixed layer extending to a depth of 4-6 m and pronounced heat gain in bottom waters (Figure 3). At station WES1, located immediately upstream of the dam, temperatures declined only 6 °C from below the surface layer to near bottom; minimum temperature was 22.5 °C. Withdrawals of bottom water during hydropower operation would reduce the volume of cool, dense water and result in the observed increase in heat storage. Assuming no replacement of cool water by tributary inflows and an average daily hydropower discharge of 12.8 hm^3/day (based on flows for January through September, 1991), a volume equal to the volume of the lake below the surface mixed layer would be displaced in approximately 28 days. Similar operational impacts on thermal conditions have been observed for other hypolimnetic-release reservoirs (Martin and Arneson 1978).

Dissolved oxygen profiles at selected deep-water stations were clinograde with anoxic or near-anoxic conditions in bottom waters (Figure 3). Differences in the depth at which anoxia was reached may have been influenced by differences in local mixing regime, hydrology and/or proximity and quality of bottom sediments.

The vertical and longitudinal distribution of dissolved oxygen concentrations along the Chattahoochee River reach of the lake, as observed on July 26 (Figure 4), was potentially influenced by interactions between operation, hydrodynamics, morphometry and limnological processes. Concentrations in the surface layer (0-4m) were near saturation in upstream and downstream portions of the reach, but well above saturation (105-130%) at midpool. This observation may be related to longitudinal differences in algal productivity. Kennedy et al. (1982) and Cherry et al. (1980) reported increased algal abundance and growth potential at midpool locations during summer months due to relatively high nutrient concentrations from the Chattahoochee River and increased transparency resulting from sedimentation of suspended material. Algal production upstream and downstream may have been reduced by nonalgal turbidity and nutrient availability, respectively (Kennedy et al. 1982). This suggestion is further discussed below.

Sampling effort, which averaged approximately 57 surface samples per sample round, was relatively uniformly distributed across sampling rounds (see Figure 5). Exceptions were round 1 and 3 for which water quality samples were limited by logistical problems, and round 3 for which water samples were not collected.

Total phosphorus and nitrogen concentrations, chlorophyll concentrations, and Secchi disk transparency values for each round provide a seasonal assessment of reservoir trophic state (Figure 5). Nutrient concentrations where high across all sampled rounds and indicative of mesotrophic to eutrophic conditions. Total phosphorus concentrations ranged from 20 to 130 ugP/L; median concentrations ranged from 25 to 40 ugP/L. Total nitrogen concentrations ranged from < 20 to 1600 ugN/L with median concentrations between 700 and 90 ugN/L.

Spatial differences in nutrient concentrations in surface waters reflected differences in hydrology and loading. In general, concentrations were highest in the upper and middle reaches of the Chattahoochee River arm and the extreme upstream reach of major tributary embayments due to nutrient-rich riverine inflows. In downstream reaches of the lake, nutrient concentrations are markedly reduced. The downstream movement of cool, nutrient-rich riverine inflows as interflowing density currents and loses due to sedimentation would account, in part, for the existence of such spatial distributions in surface nutrient concentrations (Kennedy and Walker 1990, Kennedy et al. 1985, Soballe et al. 1992).

Chlorophyll α concentrations, which ranged from < 2 to 27 ug/L, varied between (seasonally) and within (spatially) sample rounds (Figure 5). Concentrations were relatively low in late April and early June (sample round 1 and 2, respectively), and moderate to high from July through mid October (sample rounds 3 through 6). Within-round differences were most pronounced in late summer (sample round 5). This latter observation may have been related to the combined influences of increased algal biomass in clearer middle and downstream reaches of the lake and continued presence of suspended solids in tributary inflows during seasonally lower flows.

Average Secchi disk transparency values were relatively constant (1.0 to 1.35 m) across sampling rounds (Figure 5). Within-round differences were greatest during sample rounds 2 and 6. In general, minimum transparency values were recorded for stations located in the upstream portion of the Chattahoochee River arm; greatest values were associated with stations located in downstream areas of the lake and major embayments.

Cluster analyses of variables providing information corresponding to that provided by satellite image data (temperature, turbidity, and total pigments; see Part 4) allowed identification of four groups of stations with similar responses across all sample rounds (Figure 6). Cluster 1 was composed of stations having warmer surface temperatures, low turbidity, and relatively low or moderate pigment concentrations. While also having warm temperatures and low turbidity, stations comprising cluster 2 exhibited relatively high total pigment concentrations. Cluster 3 included stations with moderate surface temperatures and moderate to high turbidity. Total pigment concentrations, which ranged from high to relatively low levels, exhibited great within- and between-station variability. Stations in cluster 4 exhibited highest turbidity values and lowest median total pigment concentrations. Temperatures were also relatively low.

The geographic distribution of stations in each cluster reflected the influences of riverine loading, lake morphology, sedimentation, and advective transport. Stations with high inorganic (non-algal) turbidity, cooler temperatures, and low total pigment concentrations (i.e., cluster 4) were located at the distal end of tributary embayments and in the upstream reaches of the Chattahoochee River arm where riverine influences would be most pronounced. High nonalgal suspended solid concentrations would account for the low total pigment concentrations, despite the potential for ample nutrient supplies throughout the growing season (see discussion below).

Stations associated in cluster 1 were most lake-like and were, in general, located in downstream areas of the reservoir and major embayments. These station locations would be least influenced by riverine inflows and the material loads they transport.

Stations associated in clusters 2 and 3, which exhibited intermediate temperature, turbidity and total pigment concentrations, were located in reaches having transitional physical characteristics. All stations assigned to cluster 3 were located in the Chattahoochee River arm downstream from the highly advective inflow area but upstream of the region in which river water plunges below warmer lake water. Cluster 2 contained stations located immediately downstream from the region of plunging flows and in

Whitewater Creek embayment.

Comparisons of eutrophication-related variables measured at stations associated with each cluster provided additional information concerning the interactions between limnological condition and loading, material transport, sedimentation, and lake morphology. Total phosphorus and total nitrogen concentrations (Figure 7) decreased significantly ($p<0.05$) from cluster 4 (upstream) through cluster 1 (downstream). In addition, N/P molar ratios displayed significant between-cluster differences. Stations associated with clusters 1 and 2 exhibited ratios at or near the point (approximately 25) at which either nitrogen or phosphorus could limit algal growth; nitrogen-limited algal growth would be expected at low N/P ratios. Ratios for stations associated with clusters 3 and 4 indicated the potential for phosphorus-limited algal growth (i.e., high N/P ratios).

Composite nutrient concentration (Walker 1985) is a predictor of algal production which is independent of whether phosphorus or nitrogen is limiting. Composite nutrient concentrations are calculated from an empirical relation describing nutrient-chlorophyll responses for selected (low turbidity) CE reservoirs. At high N/P ratios, composite nutrient concentration approaches phosphorus concentration and is relatively independent of nitrogen concentration; the opposite is true at low N/P ratios. Composite nutrient concentrations for West Point Lake station clusters (Figure 7), therefore, describe spatial patterns in algal growth potential. In general, composite nutrient concentrations were highest in upstream reaches of the lake (cluster 4) and lowest in downstream, lacustrine reaches. However, it should be noted that this assessment does not account for the presence of non-algal turbidity and light-limited effects on algal growth (see discussion below).

Patterns in the distribution of chlorophyll α, Secchi disk transparency, and nonalgal turbidity (see below) across clusters indicate the importance of light regime in West Point Lake (Figure 8). Chlorophyll α concentrations were, on average, lowest for cluster 4 and highest for cluster 2. Significant differences between cluster 1 and 3, which exhibited intermediate average concentrations, were not found ($p>0.05$). Secchi disk transparency increased from a minimum average value determined for cluster 4 to a maximum determined for stations associated with cluster 1.

Nonalgal turbidity (NAT) describes the effect of non-chlorophyll-related materials on light extinction (Walker 1982), and is determined from the relation:

$$NAT = 1/Secchi + b(Chlorophyll)$$

In a review of chlorophyll and Secchi disk data for Corps of Engineer reservoirs, Walker (1982) determined that a slope parameter (b) of 0.025 m^2/mg best described the observed relationship between Secchi disk transparency, chlorophyll concentration and NAT. Applying this relation to West Point Lake, there is a clear trend of decreasing NAT from upstream areas (cluster 4) to downstream areas (Figure 8). While color or the presence of dissolved material would also increase light extinction, observations at West Point Lake would suggest that inorganic suspended material is the primary source of nonalgal light extinction. Settling of this material would, in part, account for observed declines in NAT at stations distant from inflows.

Differences in NAT and nutrient availability may account for observed differences in chlorophyll α concentrations across clusters (see Figures 7 and 8). Stations associated with clusters 2 and 3 had moderate to high chlorophyll α concentrations but marked differences in NAT. Stations associated with cluster 3, all of which exhibited high nutrients and NAT concentrations, were located in the upstream-third of the Chattahoochee River arm, but downstream of the area strongly influenced by riverine conditions. Stations associated with cluster 2 were located in the Chattahoochee River arm near the confluence with the Yellowjacket Creek arm, in White Water Creek embayment and in the downstream portion of the Yellowjacket Creek arm. Nutrient concentrations at these sites were relatively high (Figure 7), but nonalgal turbidity (Figure 8) was markedly reduced. As discussed below, these clusters represent a transition from turbidity-dominated to nutrient-dominated algal responses. Responses at stations associated with cluster 1 appeared to be less affected by NAT.

Relationships between algal response, as indicated by chlorophyll α, and nutrient conditions are presented in Figure 9. Ratios of chlorophyll α concentration to total phosphorus and total nitrogen concentrations were unexpectedly low, particularly for clusters with moderate to high NAT (cluster 3 and 4). In general, changes in pigment to nutrient ratios from upstream to downstream suggest a trend of increased control of algal response by nutrient conditions.

The chlorophyll-Secchi product (mg/m^2) discrimnates between algal-dominated and turbidity-dominated light regimes, while composite nutrient provides a indication of nutrient availability without regard to whether nitrogen or phosphorus is limiting algal response. As presented in Figure 10, stations associated in cluster 1 exhibit moderate to low nutrient concentrations and an algal response indicative of an algal-dominated light regime (i.e., high chlorophyll-Secchi product). Because of this, changes in nutrient concentrations would be expected to have a direct proportional effect on algal response. Stations in cluster 4 are high in nutrients and algal response clearly indicates a turbidity-dominated light regime (i.e., low chlorophyll-Secchi product). Stations in this cluster would be relatively insensitive to changes in nutrient availability. Clusters 2 and 3 contain transitional stations. Since nutrient concentrations are relatively high and light regime becomes more turbidity-dominated, these stations may be sensitive to changes in either nutrients or turbidity.

4 LANDSAT Image Evaluation

Introduction

LANDSAT satellites, the first of which was launch in 1972, ushered in the era of satellite remote sensing for observation of the earth's land and water areas. It provided, for the first time, systematic, repetitive, relatively high resolution observation of the earth's landcover. The multispectral scanner (MSS) on board LANDSATs 1,2, and 3 proved to be extremely valuable for deriving landcover information. The recent availability of high resolution satellite imagery has provided the potential for updating map information relating to many environmental concerns in a timely, accurate manner. The LANDSAT Thematic Mapper (TM) on board LANDSATs 4 and 5 provided increased spectral, spatial, and radiometric resolution. It offered seven spectral bands, 30-m resolution, and a full 8-bit data range as compared to four bands, 80-m resolution, and 6-bit data range for the MSS. The French remote sensing satellite, SPOT, provided a multispectral resolution of 20 m in three bands. It also included the capability of providing a panchromatic (wide, single band) image at 10-m resolution and stereo coverage because of its pointable sensors. The potential for environmental land and water mapping provided by these satellites has been and continues to be significant. The wavelengths recorded by the TM sensor on LANDSATs 4 and 5 are presented below (Campbell 1987, Verdin 1984).

BAND	WAVE-LENGTHS(μ)	SPECTRAL REGION	USE
1	0.45-0.52	blue-green	soil/veg. separation, coastal water mapping
2	0.52-0.60	green	vegetation
3	0.63-0.69	red	chlorophyll absorption
4	0.76-0.90	near-infrared	water body delineation, vegetation vigor
5	1.55-1.75	mid-infrared	vegetative moisture
6	10.4-12.5	thermal-infrared	hydrothermal mapping
7	2.08-2.35	mid infrared	plant heat stress, geology

Additional information on the satellite sensors mentioned above, including the wavelengths sensed in each band, and other sensors is available in any recent remote sensing textbook such as Campbell (1987).

Research reported by Lathrop and Lillesand (1986), Ritchie and Cooper (1988), Lira et al. (1992) and others validate the fact that water surface temperature, chlorophyll α, Secchi depth, and especially turbidity can be successfully mapped from LANDSAT TM data using ground truth monitoring on the same day as the satellite overpass. Feeney (1992), using data for two southeastern reservoirs, demonstrated that it may be possible to develop a single model for turbidity from TM data which can be used on multiple dates, as long as a method for normalizing the data for different atmospheric conditions can be developed. Surface water temperatures can be mapped relative to each other without requiring monitoring data (Bartolucci and Chang, 1988) but to map actual temperatures requires at least an average temperature over some monitored locations on the date of the overpass is required.

Chlorophyll α appears to be considerably more difficult to map, with or without ground truth monitoring, than are turbidity and temperature. Changes in the composition of suspended matter and biota during different seasons, and possibly at different locations in the reservoir during the same season, are primary reasons for this difficulty (Verdin 1984). Also, the best relationship between surface reflectance data and chlorophyll is often non-linear, as opposed to the simple linear relationships generally found with the other parameters discussed here. These and other considerations associated with the use of satellite and airborne sensor data are discussed in Verdin (1984).

Analytical Methods

TM imagery data were acquired for June 8, 1991, and September 28, 1991. Date selection was based on a review of information describing scene availability, cloud cover, and data quality. In-situ and water chemistry data were collected coincident with these dates. As discussed in Part 3, geographic references for these sampling locations were determined by GPS and topographic maps.

Digital line graph (DLG) data were acquired for transportation, hydrology, and hypsography (contour elevation data) for the eight USGS 1:100,000 quadrangle maps required to cover the West Point Lake area. The hypsography DLG was used to derive the watershed boundaries for compiling landcover information. Elevation contours were digitized from the pre-impoundment 1:24,000 quadrangle maps for the reservoir area in order to derive bathymetry information.

LANDSAT TM data are planimetrically true (i.e., geometric distortion removed) and, therefore, not in a projection commonly used for mapping. In order to match the LANDSAT data with the monitoring data and the DLG hydrography and hypsography layers, the TM data were geographically referenced in the Universal Transverse Mercator (UTM) projection. This procedure was accomplished through the Earth Resources

Data Analysis System (ERDAS) software package (ERDAS 1991). Several "control points," or points which could be identified on both the TM data and 1:24,000 topographic quadrangles, were chosen and a bilinear equation was generated to resample the TM data to the UTM projection. Root mean square errors (RMSE) were generated for every point and some points were deleted in order to bring the overall RMSE error to below one pixel width (30m). About 20 control points were used for each scene. A nearest neighbor resampling algorithm was used in the georeferencing process (ERDAS, 1991). This involved assigning each pixel in the output grid the value of the nearest pixel in the raw TM data.

Water quality maps for turbidity, Secchi depth, chlorophyll α, and temperature were developed based on comparisons of LANDSAT TM data and measured surface water values at each sampling station. The average values in TM bands 1, 2, 3, 4, and 6 for a 3- by 3-pixel window centered on the sample point were derived as a method of reducing sensor noise (Whitlock et al. 1982) and allowing for some error in sample site location. Relationships between water quality and image data were evaluated using regression analysis.

Landcover classes were generated for that portion of the drainage basin contiguous with West Point Lake using a multi-temporal, multi-spectral landcover classification of the June and September TM data. An unsupervised classification technique was used where the software attempts to find natural spectral clusters in the data and the analyst assigns an information class to each of the spectral classes (Campbell 1987). An iterative clustering algorithm (ISODATA) was applied to the twelve 30-m resolution bands from both dates using 80 for the number of clusters and sampling every other row and column (ERDAS 1991). After the clustering was performed using the ERDAS software, a minimum distance classifier was applied to the entire data set. Using two-space plots of the means of the clusters, spectral signatures (where the means are plotted for each band), and stepping through the classes of the classified file using Earth Resources Laboratory Software (ELAS), information classes or final landcover classes were assigned to each of the 80 spectral classes. Aerial photographs of the LaGrange 1:24,000 quad were used to aid in assigning the actual landcover class.

Geographic information system (GIS) functions were used to delineate subwatershed boundaries and to tabulate the landcover distributions for each. GIS functions involving spatial relationships were also employed to derive spectral/spatial regression analysis for the chlorophyll α relationships.

Results and Discussion

Methodology and Water Quality Assessment

The TM data were of good quality. However, light haze, mostly over land and near the dam was present, in the June scene. Infrared color composites of the raw data using TM bands 4, 3, and 2 in red, green, and blue, respectively, are shown in Figures 11 and 12. Maps describing topography, hydrography, and transportation features for subbasins are presented in Figures 13, 14, and 15, respectively.

Principal component (PC) transformation of the raw TM values was propitious for water quality parameter regression purposes, particularly because of the often significant correlations among turbidity, Secchi depth, and chlorophyll α values (Lira et al. 1992). No advantages were found in attempting to apply the generated PCs to regression analyses for the West Point Lake data, so raw TM data values were used in the regressions. Reasons for the lack of improvement in the relationships for the PCs are not well understood. For the September data, TM band 3 data alone were very highly correlated with turbidity and highly and inversely correlated with chlorophyll. Thus, a linear combination of bands was unnecessary for regression purposes. For the June data, no combination of raw bands, PCs, band ratios, or logarithmic transformations (Lathrop 1992) provided significant correlations with chlorophyll α values while a two- band combination generated a very good regression equation for turbidity (see below). Spectral/spatial regressions, where TM band values in combination with Easting and Northing (UTM coordinates) were used, provided greatly improved mapping results for chlorophyll for both dates, both from a statistical and visual standpoint.

As discussed above, regression results were very good for all parameters for both dates except for the June chlorophyll α data. Regression equations along with their associated number of sample points (n), r^2 value, and root mean square error (RMSE) are listed below. Independent variables B1 through B7 refer to TM bands 1 through 7, respectively.

June 8, 1991:

Turbidity (NTU) = -19.549-0.38057*B1+1.82908*B2
$n=48$ $r^2=0.934$ RMSE=1.284

Secchi disk (m) = -1.989+0.12189*B1-0.18290*B2-0.06963*B4
$n=47$ $r^2=0.860$ RMSE=0.188

Chlorophyll α (mg/m^3) = 19.391-0.27049*B3
$n=50$ $r^2=0.257$ RMSE=2.834

Temperature (°C)= -51.406+0.57907*B6
$n=48 \quad r^2=0.596 \quad RMSE=0.508$

September 28, 1991:

Turbidity (NTU) = -15.622+1.34174*B3
$n=43 \quad r^2=0.989 \quad RMSE=0.903$

Secchi disk (m) = 1.791-0.04395*B3
$n=42 \quad r^2=0.740 \quad RMSE=0.192$

Chlorophyll α (mg/m³) = 31.336-0.89312*B3
$n=41 \quad r^2=0.746 \quad RMSE=3.660$

Temperature (°C) = -63.097+0.68241*B6
$n=39 \quad r^2=0.924 \quad RMSE=0.610$

Temperatures derived from the TM thermal band (6) for both dates are shown in Figure 16. The September image is obviously cooler than the June image and shows less variation in temperature. The lower r^2 for June (0.596) is due in part to banding in the TM thermal band. The TM sensor collects data in both the forward and backward sweep of a rotating mirror. Very often the brightness is quite different for pixels acquired during the forward sweep than those acquired in the backward sweep resulting in banding approximately every 16 rows. The striping and banding are usually most pronounced over water because the sensor is optimized for land reconnaissance.

Based on work by Lira et al. (1992), it was expected that it would be necessary to remove striping and banding from the TM data prior to data analysis, but when the algorithm that had been used advantageously for Kentucky Lake (Jones and Naugle 1990) was applied to the data no improvement was provided. In fact, some additional striping had been added to the data. This effect had been encountered previously for some Kentucky Lake scenes where the variations in values caused by the striping and banding were so small that the algorithm proved ineffective. The derived maps of water parameters showed very little striping and banding problems except for the temperature maps derived from the thermal IR band which has very different characteristics from the other bands.

Figures 17, 18, and 19 display predicted turbidity, Secchi disk depths, and chlorophyll α concentrations for both dates. Turbidity and Secchi depth were, as expected, inversely related in both scenes. The September chlorophyll regression, though statistically adequate, did not show some of the spatial patterns obvious in the monitoring data(i.e. a chlorophyll peak can be observed near the middle of the length of the mainstem but cannot be seen in the derived map). As mentioned above, the June chlorophyll results were unacceptable using standard regression techniques. Observation of the monitoring data for that date shows very little variation and does not show the spatial relationship often seen on other dates.

A spectral/spatial regression approach for chlorophyll was applied in an attempt to improve the results from simple linear regression of the TM data. Eastings and Northings of sample site locations (spatial data) and combinations of the band values and the spatial data were added to the regression analysis along with the raw band values. The results are shown below and in Figure 20. The independent variables NOR and EAS refer to Northing and Easting distances, respectively.

June 8, 1991:

$$\text{Chlorophyll } \alpha\,(\text{mg/m}^3) = -4955.5+161.279*B3+4952.75*NOR -161.808*NOR*B3+0.986344*NOR*EAS*B2$$

$n=48$, $RMSE=2.09$, $r^2=0.684$

September 28, 1991:

$$\text{Chlorophyll } \alpha\,(\text{mg/m}^3) = -4636.37-455.28*B3+4631.309*NOR*EAS +611.323*NOR*B2-608.581*NOR*EAS*B2 +681.561*EAS*B3-228.814*NOR*EAS*B3 +0.940961*NOR*B4$$

$n=39$, $RMSE=2.54$, $r^2=0.895$

In addition to the improved r^2 value and lower RMSE, chlorophyll α concentrations estimated using the spectral/spatial approach exhibit a spatial distribution more similar to the distribution in observed data. Noteable features of the distribution displayed in Figure 20 are the decline in concentration at near-dam locations and a concentration maxima downstream from the confluence of Yellowjacket Creek embayment, both of which were apparent in the observed data.

Basin Definitions and Landcover Distributions

Basin boundaries are depicted in Figure 21. These basins were delineated using the hydrography and hypsography DLGs. Landcover distributions were derived from the multi-temporal, multi-spectral TM classifications.

Forested areas represented over 50% of the watershed area evaluated. Grass lands and crop areas together accounted for another 32%; areas dominated by urban landuses represented less than 5% of the watershed. Landcover categories for the contiguous watershed are given in

Table 2 and Figure 22.

Few differences in landcover distributions between sub-basins were identified (Table 3). Differences included a higher urban use estimate for the Yellowjacket Creek watershed and slightly higher grass land and forest percentages for the Wehadkee Creek and White Water Creek watersheds, respectively. The Yellowjacket Creek watershed includes portions of the City of LaGrange, GA; however, it should be noted that much of this urban area is located in the watershed of Long Cane Creek, which is confluent with the Chattahoochee River downstream from West Point Dam. Casual observation during this study confirms the predominance of forested areas in White Water Creek watershed. Inactive farming accounts, in part, for the increased percentage of grass land areas in the Wehadkee Creek watershed.

5 Nutrient Loading Characteristics of Selected Tributary Streams

Introduction

Lakes and reservoirs receive water and material loads from the surrounding watershed and these loads play a key role in determining water quality. Large reservoirs frequently receive the majority such loads via a single large tributary. Because of this, the potential inportance of loads from smaller, secondary tributaries are often overlooked in water quality assessments. In the case of reservoirs with complex morphology, inputs from such secondary sources may have significant local influences on water quality. For instance, waters impounded in embayments and isolated coves would experience limited exchange with the main portion of the reservoir and would thus be expected to be strongly impacted by inputs from the local watershed.

Selected secondary tributaries to West Point Lake were sampled during 1991 as a means for assessing loading from sources other than the Chattahoochee River. Tributaries included Whitewater and Thompson Creeks, which drain predominantly forested areas and are confluent with the lake through a small embayment located approximately midway between the headwater and the dam. Also included were three tributaries to the Yellowjacket Creek embayment; Yellowjacket Creek, Beech Creek and Shoal Creek. Drainages for the streams exhibit a mix of landuse types including forest, abandoned pasture, agriculture, and small urban development.

Analytical Methods

Staff gauges were installed by the US Geological Survey, Georgia District Office (USGS), at selected sites on Yellowjacket, Beech and Shoals Creeks. For each creek, staff gauge panels were afixed to the downstream side of concrete box culverts, all of which were located on Hammett Road within 0.5 to 1.0 km of the lake's backwater in each tributary channel. Stage-discharge relationships were established by the USGS based on evaluations of observed stage elevations and periodic measurements of stream flow and channel cross section. Stage elevations recorded bimonthly on water quality sampling dates were converted to discharge using this relationship.

Staff gauges were not installed on Whitewater and Thompson Creeks since suitable sites were not available. Discharges for these tributaries were measured using a small rotating bucket meter. Multiple measurements were area-averaged using cross section geometry. Discharge measurements were made bimonthly coincident with water quality sample collection. Measurements for Thompson Creek were limited due to difficulties in gaining access to private property.

Daily flows for each selected tributary were estimated by comparison with daily flow values for New River recorded at the USGS continuous monitor located on Georgia State Highway 100. Evaluations of coincident historic data for the period 1978 to 1984 for USGS gauges were performed as a means for predicting flows in Yellowjacket Creek based on flows in New River. The resulting quadratic equation accounted for 89% of the variability in observed flows for Yellowjacket Creek. This relationship was used to generate daily flows for 1991 for Yellowjacket Creek based on recorded flows for New River for 1991 (Figure 23).

Since historical gauge records were not available to Shoal, Beech and Whitewater Creeks, flow relationships between New River and these tributaries were assessed based on instantaneous flow measurements collected in 1991 and coincident daily flow values recorded at the New River gauge. Linear relationships accounted for greater than 80% of the variability in flows in Shoal and Beech Creeks, but only 65% of the variability in flows for Whitewater Creek. Limited data availability precluded a similar assessment for Thompson Creek.

Water quality samples were collected bimonthly at mid-channel in each tributary stream. Filtered and unfiltered (0.45-μ glass fiber filter) samples were preserved with sulfuric acid and shipped to the laboratory for analysis. Analyses included major nutrients (nitrogen, phosphorus and carbon), selected metals (iron and manganese) and total suspended solids. Analytical procedures for nutrients and metals followed those described in Part III. Total suspended solids was determined gravimetrically as the dry weight of material retained by a 0.45-μ glass fiber filter.

Nutrient loads for each tributary were estimated using the data reduction program FLUX (Walker 1985). Flux combines information regarding discrete measurements of water chemistry and instantaneous flow, and continuous daily flow to estimate the mass flux of material throughout seasonal or annual periods.

Results and Discussion

Similar patterns of the change in the concentrations of total phosphorus , total nitrogen and total organic carbon were observed for all tributary streams (Figure 24-27). In general, total phosphorus concentrations decreased from spring to late summer while total organic carbon concentrations were relatively unchanged. Total nitrogen concentrations exhibited marked seasonal differences. Concentrations were low in spring and late summer, but high during late spring and early summer.

Changes in total phosphorus concentrations appeared to be flow dependent while those for total nitrogen concentrations were clearly related to seasonal events and not flow. Total phosphorus concentrations increased with flow in Yellowjacket, Beech and Shoal Creeks. Similar flow-related increases were not observed for Whitewater Creek. Flow-related changes in total nitrogen concentration were not apparent for any of the tributaries and only Beech Creek exhibited changes in total organic carbon with increases in flow.

Mass loadings and watershed nutrient export rates differed markedly between drainages (Table 4). Water and mass loadings were highest for Yellowjacket Creek. as were average concentrations of both total phosphorus and nitrogen. While the total phosphorus concentrations for Beech, Shoal and Yellowjacket Creeks were similar, that for Whitewater Creeks was markedly lower. Total nitrogen concentrations for Beech, Shoal and Whitewater Creeks were similar and markedly lower than that for Yellowjacket Creek. These differences may reflect differences in landuse.

While mass loadings reflect both nutrient concentration and flow, nutrient export rates (Table 4) reflect watershed characteristics, including landuse. Beaulac and Reckhow (1982) examined nutrient export relationships for a wide variety of landuses and provided a summary of data distributions for selected landuse types. Export values for phosphorus and nitrogen for West Point Lake tributaries were unexpectedly low by comparison. Export values for all four tributary watersheds approached minimum reported values for urban and agricultural landuses. However, relative differences between tributaries seemed reasonable based on observed differences in landuse. Export rates were highest for Yellowjacket Creek, the watershed expected to be influenced by urban development, and lowest for Whitewater Creek, which drains a relatively undisturbed watershed. Export rates for Shoal and Beech Creeks were intermediate.

Unexpectedly low export values may have been related to sample design or hydrology. Sampling effort was limited to the period April through early November when flows would have been seasonally low. During such a period, runoff would be minimal as would storm-related material transport. Also, contributing area would decrease with reduced flow. Since the export rates reported in Table 4 were computed as mass load divided by total watershed area, decreases in contributing area would result in underestimation of export rates.

6 Evaluation of Response Areas

Introduction

West Point Lake is composed of several morphometrically destinct areas, many of which are easily identified in Figure 1. The main body of the lake is the largest of these and consists of the Chattahoochee River portion of the lake, including the thalweg and impounded waters closely associated with it. Constrictions of the channel at bridge crossings further define subdivisions of the main body. The flooding of numerous tributary flood plains created a system of embayments, several of which have expansive surface areas and large volumes. The degree to which these latter features influence or are influenced by the main body of the lake are unclear.

The existence of morphologically and hydrologically distinct areas in the lake, many of which receive local inputs from tributaries and shoreline areas, suggests that water quality conditions may vary spacially and temporally. Analyses of satellite imagery (Part 4) and limnological surveys of surface waters (Part 3) provided initial clues to the scope and nature of variability within and between various areas of the lake.

This variability and its potential importance in understanding lake conditions was assessed using three methods, each of which addressed variablity on different time scales. First, sediment samples were collected to examine the material accumulation history through the life of the lake and to compare histories at different sites. Second, biological accumulations on artifical substrates and sediments were studied in order to compare contemporary differences cumulative over periods of months. Lastly, depth profile surveys of these sites were made to examine the internal distributions of suspended materials and how these distributions compare throughout the lake.

Four sites were chosen from areas assumed a priori to be representative of regions of the lake having differing water quality responses. Included were three embayment areas and one area in the main portion of the lake. As was done for limnological surveys, stations were established at or near buoys. Locations for these studies included buoy WWC2TC at the confluence of Whitewater Creek and Thompson Creek, buoy YC13JC at the confluence of Yellowjacket Creek and Jackson Creek, buoy 71 in the mainstem and WES3, a location in the embayment immediately east of buoy 71 (Figure 28). These sites were chosen in order to include a small embayment without significant inflows (WES3), a large embayment with few anthropogenic influences in the watershed (WWC2TC), the mainstem (71), and a large embayment with potential urban influences (YC13JC).

Analytical Methods

Collection and Preparation of Sediment Samples and Benthos.

Surface sediments were collected and analyzed for the biological community content on the assumption that those communities would integrate water quality responses over periods of weeks to months. In addition, quantitative sediment cores were collected for physical and chemical characterization of sediments at each location.

Three surface sediments were collected at each station using a 15-cm Ekman dredge lowered from a boat. Samples were passed through a series of sieves to remove materials finer than 200 μ. All retained organisms were preserved in 70% alcohol for later identification and enumeration using microscopic techniques (American Public Health Association 1989).

Sediment cores were collected using a single-barrel Wildco Core Sampler (Wildco Supply Co., Saginaw, Michigan) fitted with polyethylene liners and plastic core retainers. The corer was equipped with a stabilizer fin that maintained the barrel in a vertical position as it descended through the water column. Fifteen cores were collected randomly at each station. Of these, the five which appear to retain the greatest core integrity following collection, transportation and storage were selected for analysis.

Cores were maintained in a vertical position, in the dark at 4 °C, with overlying lake water within the core liner during transport and storage. Cores were stored under refrigeration until processed in the laboratory. Five cores from each of the four response areas were sectioned. Methods for sectioning and analysis of sediment cores followed, whenever possible, those of Gunkel et al. (1984) and Ashby (1987), to facilitate comparison with previous West Point Lake sediment analyses, and for analytical uniformity. Immediately prior to sectioning, the surface water overlying each core was removed by vacuum aspiration without disturbing the surficial sediments. Sediment was extruded from each core in 5-cm segments. The volume of each 5-cm section was approximately 79.5 cm^3.

Each section was placed in a pre-weighed, acid-washed weighing boat and the wet weight determined. Samples were then sealed into a Whirl-Pak and manually homogenized. Eighty grams of homogenized wet sediment were then removed to a 250-ml polycarbonate tube and centrifuged in a Sorvall SS-3 Automatic Centrifuge (Dupont Instruments, Wilmington, DE) equipped with a Sorvall GSA rotor for 10 minutes at 10,000 rpm to remove interstitial water (Gunkel et al. 1984). The supernatant was removed and retained for analysis. The interstitial water supernatant was removed and quantified using an acid-washed 50-ml polypropylene syringe. The supernatant was extruded from the syringe through a 0.4-μ polycarbonate filter (Nucleopore Corp., Saginaw, Michigan) fitted into a filter holder. These interstitial water samples were digested and stored for later analysis. After recording it's volume, the centrifugate (sediment remaining after decantation of the supernatant) was packaged, recorded in Whirl-Paks and homogenized. Eight to twenty-five grams of this wet sediment (after centrifugation) were dried (24 hours, 108 °C), ground to a powder and repackaged in new Whirl-Paks.

Collection and Analysis Biota Attached to Artificial Substrates

Because suspended and swimming organisms are mobile, organisms colonizing surfaces are more likely to integrate the effects of changing limnological characteristics into their life histories and to indicate the effects of integrated limnological characteristics in their communities. However, surface colonizers are strongly affected by the nature of the surface they are colonizing, its chemical composition, color and texture. Therefore, the use of standard artificial substrates minimizes the differential effect of substrate type.

Hester-Dendy artificial substrate assemblies (American Public Health Association 1989) were deployed at each response area in order to accumulate colonizing organisms over intervals of approximately one month. Replicate assemblies were deployed from buoys at a depth of approximately 1 meter. A depth of 1 meter was selected because the processes in the epilimnion were the ones of primary interest for this study. Most of the productivity of the lake occurs in the photic zone which is approximately the same depth as the epilimion. Two deployments were completed in 1991 (July and September) and four in 1992 (May, June, July, August).

At the end of each colonization period, substrates were removed from the field, placed in plastic sample bags and refrigerated until processed in the laboratory. Each Hester Dendy assembly was removed from the bag and disassembled into component plate surfaces. The surface of each plate was cleaned using a brush and rinsed with water in order to remove colonizing organisms. Where sediments became incorporated into the accumulations, the sample was washed through a 200-μ screen which retained colonizing invertebrate organisms. The organisms collected in this way were placed in labeled bottles and preserved with 70% alcohol for later identification and enumeration.

Enumeration was accomplished microscopically in the laboratory.

Major taxonomic groups were identified and the number of individuals in each category counted. Results were reported as totals for each sample and viewed in terms of relative abundance.

Analysis of Sediment Cores

Four aliquots (1-2 g each) of the homogenized wet sediment (after centrifgation) were placed in pre-weighed, acid-washed crucibles and weighed before and after drying for 24 hours at 108 °C (Wetzel & Likens 1991). Samples were then ashed at 550 °C for 1 hour (Hakanson & Janson 1983) and reweighed.

Loss on ignition was calculated using the equation (Håkanson and Janson 1983):

$$\%IG = ((gDW-gIR)/gDW) \times 100$$

where:

%IG = percent loss on ignition
gDW = dry weight of sediment (gm)
gIR = inorganic residue after ashing (gm)

Loss on ignition can serve as an estimate of sediment organic carbon content if %IG is greater than 10% (Ryding and Borg 1973 in Håkanson and Janson 1983).

Bulk density was calculated using the equation (Håkanson and Janson 1983):

$$\rho = (100 \times \rho_m)/(100+(W+IG^0)(\rho_m-1))$$

where:

ρ = bulk density (gm/cm^3)
IG^0 = the loss on ignition as percent of total wet weight
ρ_m = the density of the solid particles (g/cm^3)
W = percent water content (see below)

Water content was calculated using the equation:

$$W = ((Wt - Ws)/Wt)100$$

where:

W = percent water content
Wt = total wet weight of sediment (gm)
Ws = dry weight of sediment solids (gm)

Total phosphorus and total nitrogen of the sediments were determined by colorimetric analyses after a persulfate oxidation digestion modified from Raveh and Avnimelech (1979). The surface and bottom sections of each core were digested, in order to gain information as to historical changes in the sediments. Four replicate samples were digested from each core section. Dry sediment (0.1 gm) was placed in an acid-washed 125-ml Erlenmeyer flask containing 50 ml of glass-distilled water and 4.0 gm of $K_2H_2SO_8$. Flasks were capped with glass refluxer caps and digested in an autoclave (15 psi, 121 °C) for 2 hours. The digested samples were then cooled and allowed to settle overnight. At least four 10-ml samples of the supernatant were pipetted from each flask into scintillation vials for analysis.

Total phosphorus was assayed using the ascorbic acid reduction method (American Public Health Association 1989), after neutralization of the supernatant from each digested subsample with 10M NaOH. Total nitrogen analysis of the persulfate-digested supernatant followed a 24-hour reduction to ammonium with approximately 0.4 gm DeVarda's Alloy (50% Cu, 45% Al, 5% Zn). Total nitrogen was determined using the phenate method (American Public Health Association 1989). Colorimetric determination of total nitrogen was accomplished using a Technicon AAII system (Technicon Industrial Systems, Tarrytown, NY).

Total phosphorus content of interstitial water samples was determined using the ascorbic acid reduction method (American Public Health Association 1989), following digestion of each 10-ml sample with 0.2 gm $K2H_2SO_8$ in the autoclave for 1 hour and neutralization of each subsample with 10M NaOH.

Sediment samples for analyses of total iron and total manganese were digested using hot acid (American Public Health Association 1989). Approximately 0.1 g of dried sediment was placed in a 100-ml beaker containing 50 ml of aqua-regia acid (1:3 HNO_3:HCl) and heated, uncovered, to near dryness. After cooling, samples were subjected to two treatments, each of which involved adding 3 ml of aqua-regia, covering the beaker with a watch glass to capture condensate, and heating to near dryness. After cooling, samples were diluted to 50 ml for subsequent analysis. Analyses were conducted on an atomic absoprtion spectrophotometer using an air-acetylene flame (Model 4000, Bodenseewerk Perkin-Elmer and Company, Uberlingen, Germany).

In-situ Transmissometry

The quantity, nature and distribution of suspended material was evaluated using transmissometry. The instrument, a prototype described in detail by Robertson (1992), differs from previous transmissometers in that it employs three wavelengths of light and has the capability of directly measuring scatterance as well as transmittance in three wavelengths; red, green and amber. The implications of this capability are discussed in

Robertson (1992), as well as Schreiner (1983).

Measurements were made throught the water column at each of the response areas as well as longitudinally through much of the Chattahoochee River portion of the lake. Stations were selected to attain maximum depth, with freedom from fouling objects (e.g., submerged vegetation). Measurements were made at approximately 1-m depth intervals and the data collected were used to develop a two dimensional view of the distribution of light-modifying materials.

Because of the time necessary for such surveys and the liklihood that nephelometric conditions in the water column are slow to change except in headwater areas, only one complete survey was performed on 28-29 July 1992, and was considered as typical for summer conditions for West Point Lake.

Results

Sediment characteristics

Although five replicate cores were analyzed from each station in West Point Lake, samples are not strictly comparable by depth between cores (depth, in this sense, relates to the linear position down the length of the core.) Because the rate of sedimentation varies both spatially and temporally in any lacustrine system, sediment characteristics and nutrient content at depth in any core vary, and a simple combination of all replicate samples for a sampling station, at a given core depth, would produce erroneous trends, if any. Hence, data in this report were examined in several combinations, to discover real historical trends, where present, at each sampling station.

The depth of sediment in the collected cores (Table 5) from all stations ranged from 3 - 50 cm. The mean depth of sediment cores was approximately 23-29 cm at all stations except YC13JC which was markedly less (mean of approximately 15 cm). Although YC13JC was located at the confluence of Yellowjacket and Jackson Creek, sediment accumulation at that location was less than at other study areas over the present history of West Point Lake.

The depth of the water column at each core site (Table 6) was similar for all locations except WES3 which was significantly shallower than other sites. WES3 was a small embayment which had no significant tributary although sediment core lengths at WES3 were among the greatest collected. Either the accumulated sediments at WES3 originated in the adjacent mainstem area of West Point Lake, or they originated as eroded soils from the adjacent banks of the embayment. The depth of collected sediment in each core was not strongly related to water depth at the collection site, when compared using regression analysis.

Bulk density, water content, and loss on ignition (organic content) are measured gravimetrically and are strongly related numerically and physically. Therefore, any one of these measures of sediment character should show the same or similar trend with regard to some independent variable. As such, bulk density, water content, and loss on ignition should be judged as a group (Tables 7-10; Hakanson and Jansson 1983).

Bulk density assays for all cores from all stations ranged from 1.5 to 4.8 (Figure 29). Minimum bulk densities (1.7 - 2.17) were observed in the organic surface sediments of four cores from Station WWC2TC and values in that range were observed at surface depths for other stations as well. Maximum bulk densities (>3.5) were observed at a depth of 15-20 cm in cores at Station WES3, and throughout core depths at Station YC13JC. Most of the samples from cores taken at YC13JC had bulk densities >2.8.

These results indicate that except for station YC13JC, surface sediments have greater organic content than deeper sediments, especially at 71 and WES3. Humus has a bulk density of 1.3 - 1.5 and must compose a major proportion of sediments with bulk densities less than 2.2. Clays have a bulk density of 2.2 - 2.6, clays and silts have a bulk density of 2.6 - 2.85 and sand (quartz) has a bulk density of 2.5 - 2.8 (Hakanson and Janson 1983). Bulk density values for the cores of stations 71, WES3, and YC13JC indicate that for most locations on West Point Lake, sediments are dominated by clays and silts. Decreasing organic content with depth into the sediments could be the result of increased deposition of organic material over time or the result of decomposition of organic materials in the deeper sediments.

The water content of all cores for all stations ranged from 16.6% to 59.5% (Figure 30). The greatest water content (>35%) was measured from depths 0 - 25 cm at station WWC2TC, the upper 10 cm of four cores from station WES3 and throughout the 50 cm depth of the remaining core from that station, and the upper 10 cm in two cores and throughout the remaining three cores of Station 71. Station YC13JC consistently had the least water content (< 30%). The water content of most of the surficial sediments was 35%, with the exception of those from YC13JC.

The water content of sediments is generally low in shallow, high-energy areas and high in deeper areas of lakes where sediments often exhibit a greater proportion of organic material. Also, water content usually decreases with depth in sediment cores due to compaction (Hakanson and Janson 1983). Each of these trends were found in West Point Lake. Except for one very deep core, water content of sediments at WES3 consistently decreased with depth into the sediments. That trend was also visible at station WWC2TC but not as clear at station 71 which contained sediments dominated by organics, clays and silts.

Moisture content is strongly related numerically to water content (r^2 > 0.9 in all cases) and is not considered further in this report because of that redundancy.

Loss on ignition is a strong indicator of sediment organic content (Hakanson and Jansson 1983), which is important as a substrate for organismal growth as well as for determining the physical characteristics of sediments. Its presence can be estimated from the loss of mass following combustion of dried sediments in a furnace.

Loss on ignition (Figure 31) compared to the total dry mass was approximately 10% in most surficial sediment samples, except at station YC13JC where values were usually less than 10% and station WES3, which was 10% or less except for one long core. Loss on ignition decreased slightly at deeper levels of most cores. Hakanson and Jansson (1983) clearly demonstrated that where loss on ignition values were 10% or greater, the carbon content of sediments could be reliably estimated as one-half of the loss on ignition. At values less than 10%, the proportion of carbon was greatly diminished and difficult to estimate using this method. Such small amounts of carbon are likely to occur in several cores at station YC13JC and in one core each at stations 71 and WWC2TC. If the maximum values at each station are considered to be the maximum deposition and typical of that condition, then several cores at station WWC2TC, one at station WES3 and most cores at station 71 had large depositions of carbon throughout much of the lake history. Only the most surficial sediments at station YC13JC had such significant carbon content.

Statistical relationships between water content, bulk density, moisture content and loss on ignition are listed in Table 11. These analyses employed only those cores for which the data did not contain obvious outliers resulting from known problems with laboratory analyses or core storage. These analyses considered the sediments with interstitial pore water extracted. The variation among these results indicates that sediments at most sites in West Point Lake are far from uniform with respect to depth. An exception was station WES3, located adjacent to mainstem station 71, which showed a strong correlation with depth for all four gross sediment parameters if the one obvious outlier was excluded from the analyses. Station WWC2TC showed the next strongest relationship with one outlier removed.

Hakanson and Jansson (1983) also presented several examples of the well-established positive relationships between sediment nitrogen content and organic content estimated by loss on ignition. This would similarly indicate deposition of nitrogen throughout the lake'sistory at stations 71, WES3, and WWC2TC but not at station YC13JC.

The phosphorus content of lake sediments is related to shoreline erosion, allochthonous inputs from streams draining the watershed, autochthonous processes removing dissolved phosphorus from the water and depositing it as sedimenting particulates, and aeolian sources. This latter source is often neglected. In West Point Lake, the most likely sources included allochthonous inflows (Chattahoocheee River and tributary streams) and autochthonous fixation of dissolved phosphorus by plankton communities.

As was discussed in Part III, there were observable trends in phosphorus concentrations in which greatest concentrations were observed upstream and at greater depth in deep water. This trend was true for both total phosphorus and dissolved phosphorus measured as soluble reactive phosphorus. Because there was also a trend for greatest surface turbidity at upstream stations, phosphorus was likely removed from lake waters by sedimentation of both allochthonous particulates that contributed to turbidity as well as by sedimentation of autochthonous particles which contained previously dissolved phosphorus. Both of these processes would impact the water quality of West Point Lake and would be reflected by accumulation and distribution of phosphorus in the sediment cores.

Sediment total phosphorus (Table 12 and Figure 32) ranged from less than 1.0 to greater than 3 mg/gm dry weight. Greatest values were observed in samples from the surface of cores from stations WW2TC, 71 and WES3; lowest values were at station YC13JC. Gunkel et al. (1984) determined that the total phosphorus content of West Point Lake sediments ranged from 1.7 - 1.01 mgP/gm when surveyed in 1983. Concentrations determined here were comparable, but only at the bottom of each core and throughout the core for station YC13JC.

Nitrogen in sediments is unlikely to have a geologic origin. Therefore, nitrogen must either originate as allochthonous organic material input with stream inflows or as material fixed autochthonously from dissolved nitrogen in the lake. Sediment total nitrogen (Table 12) ranged from less than 4.3 to greater than 8 mgN/gm. Greatest values were in samples from the surface of cores from stations WW2TC, 71 and WES3; minimum values were at station YC13JC.

Comparison of the nitrogen content of surface sediments with that at greater depths showed no significant difference. Gunkel et al. (1984) reported average concentrations of between 1.18 and 1.80 mgN/gm. This study found average concentrations 2 to 4 times as great as those observed by Gunkel et al. (1984) even in deep sediments that should have been there during their study.

Interstitial water represents a potential source of error in sediment analysis. For this reason, many of the analyses were repeated with interstitial water in the sediments to discover such differences, if any. Tables 13-16 present combined values (mean $\pm$ 1 standard deviation) for all cores sampled at a station, by depth, including interstitial pore water. The observed trends for bulk density, loss on ignition, water and moisture content were similar with and without interstitial water.

Statistical relationships between water content, bulk density, moisture content and loss on ignition are listed in Table 17. These analyses considered the sediments with interstitial pore water included. As with the analyses without pore water, the variation among these results indicates that sediments at most sites in West Point Lake are far from uniform as a function of depth with the exception of Station WES3. Station WES3, adjacent to mainstem station 71, showed a strong correlation with depth for all four gross sediment parameters if the one obvious outlier was excluded from the analyses. Station WWC2TC showed the next strongest relationship with one outlier removed. Examination of the statistics showed that inclusion of pore water did aid the correlation of sediment characteristics with depth.

The results of phosphorus and nitrogen analyses of sediments inluding interstitial water are presented in Table 18. The results and trends were similar to those found for sediments from which interstitial water was removed.

Assays of the interstitial water extracted by centrifugation of the wet sediment (Table 19) were compromised by what was ultimately discovered to be leakage of particulate material through breaches in the polycarbonate filters. Thus, a number of interstitial water measurements estimate unrealistically high levels of total phosphorus.

Gunkel et al. (1984) measured 0.12 -0.16 mgP/L in the interstitial water extracted from cores removed from Wehadkee Creek and Yellowjacket Creek. If all interstitial water samples are considered, only those samples from station YC13JC approximate the values determined by Gunkel et al. (1984). The greater concentrations found in the contemporary sediments indicates a net accumulation of nutrients in the sediments over time.

Table 20 provides a comparison of phosphorus and nitrogen content of the West Point Lake sediments with and without interstitial pore water as weel as for the interstitial water alone. Concentrations of nutrients in the pore water were sufficient for the pore water to be considered an important nutrient component of the sediments except for station WWC2TC, where pore water phosphorus was a minor contituent of the sediments. Pore water was a major site for phosphorus in the sediments at other locations with the greatest proportional contribution at station WES3. This indicates that for much of West Point Lake phosphorus exists in a highly mobile form for much of the sediments and could be available to the lake water under the right conditions for such an exchange. Such conditions will occur if concentrations of nutrients in the overlying water column decrease. With the resultant concentration gradient, dissolved constituents could be transported from sediments to water. In addition, changes in sediment redox state (e.g., onset of anoxia) would convert sedimentary nutrients to dissolved forms allowing increased mobilization. Increased biological activity by borrowing insect larvae would also mediate such a mobilization as would other physical disturbances which would increase contact between sediment and overlying water.

Biotic Assemblages - Sediment

While sediments have accumulated over the life of the lake and have thereby integrated many of the limnological characteristics of West Point Lake, other components of the lake ecosystem integrate these characteristics over shorter time intervals. Macroinvertebrates, especially insects, complete life cycles over seasons or years and their communities may indicate the integrated limnological characteristics over those times. Macroinvertebrate communities in the sediments are likely to reflect by their composition and abundance the integrated characteristics of the sediment habitats they occupy. Communities of macroinvertebrates colonizing the response areas were studied and compared during the two summer seasons of 1991 and 1992. Results indicate that important ecological differences exist between response areas.

Microscopic examination of the sediment biota identified eleven major groups of organisms important to the benthic macrofauna of West Point Lake (Table 2[illegible]) and common to many freshwater environments. Of these groups, five were dominant organisms for at least one of the sample locations. Organisms which were identified but not dominant included Coelenterates (*Hydra*), the water mite (*Hydracarina*), nematodes, caddisflies (*Cyrnellus fraternus*), the Chironomidae (Diptera) and a ceratopogonid fly (Diptera).

Chaoborus is one of the most important organisms in aquatic systems and one of the numerically dominant predators on the plankton. Its life cycle includes a larval stage in which often dense populations exhibit diel vertical migrations through the water column. They may inhabit the sediments during day and prey upon the plankton at night. Because of this the quality of both sediments and the water column are important determinants of their population growth.

Relative abundance (the number of organisms in a particular group divided by the total number of organisms per sample) is useful in comparing non-quantitative population samples such as sediments collected with a dredge. Station 71 had the greatest average relative abundance of *Chaoborus* (Table 21), and although it was adjacent to station 71, station WES3 had the least relative abundance of *Chaoborus*. Throughout the survey, *Chaoborus* represented approximately 10% to 40% of the benthos.

Aquatic members of Class Oligochaeta are obligate sediment organisms and their distributions are related to sediment characteristics such as composition and texture. In West Point Lake, they composed a greater proportion of the benthos at station 71 (approximately 40-45% of all organisms) than other regions of the lake especially station YC13JC where they represented less than 5% of the benthic organisms. In general, Oligochaeta were more dominant nearer the mainstem of the lake.

The Cladocera and the Ostracoda are both members of the Crustacea and in aquatic environments, some genera of the Cladocera and many of Ostracoda seem to be adapted to benthic habitats. In West Point Lake, they had almost identical distributional trends in the sediments. They were least represented in the benthos at station YC13JC (Figure 33) and most at WES3 (Figure 34). Genera adapted for benthic life occasionally inhabit the plankton, temporarily at least, but usually remain near the sediment surface. However, the range of variation in West Point Lake (approximately 2%-15%) was insufficient for strong conclusions about sediment characteristics.

Members of Copepoda were dominant in all locations on West Point Lake except station 71. In the response areas, they composed approximately 50% to 80% numerically of all organisms but less than 10% at station 71.

Taken with the distributions of the other benthic organisms, a pattern is clear. The mainstem tends to be dominated by Oligochaeta and Chaoboridae whereas the reponse areas tend to be dominated by Copepoda. This is a strong indication that the mainstem sediments are more typical of eutrophic or polluted habitats than the response areas. Cole (1979) stated, "the profundal benthos of eutrophic lakes is distinguished by a few hardy forms that can tolerate low levels of oxygen." Among these organisms, he includes a few species of Oligochaeta and *Chaoborus*, the dominant organisms at mainstem station 71.

Biotic Assemblages - Artificial Substrates

Organisms colonizing artificial substrates in one month of exposure in West Point Lake included members of Phylum Crustacea, several representatives of Insecta (Trichoptera and Diptera), Coelenterata (*Hydra*), Nematoda and Annelida.

The Crustacea included Cladocera, Copepoda and Ostracoda. Although finer taxonomic distinctions were not made, most of the Cladocera were *Sida crystallina*, a common benthic cladoceran. Copepoda were frequently encountered but were not prevalent and probably were recruited from the plankton. Ostracoda were occasionally important. The Coelenterata were solely represented by *Hydra* a common benthic organism but infrequent in the study communities. Oligochaeta (Annelida or segmented worms) were common in these communities but rarely major components. Nematoda were occasionally important components of the colonizing assemblages. Insect larvae, especially members of Diptera and Trichoptera were always present and usually dominated the colonizing assemblages. Trichoptera were represented by *Cyrnellus fraternus* which often was as dominant as the combined Chironomidae. Occasionally the dipteran larvae of *Stenochironomus* sp. was an important component of the fauna. On those occasions it was enumerated separately.

The most abundant organism of all samples was Cladoceran, *Sida crystallina*. This benthic cladoceran is highly motile and often inhabits the plankton in lakes as well as the benthos. However, its occurence is seasonal, and at times ephemeral and little conclusion can be drawn from its presence or absence other than its commonplace nature. It seemed to be dominant when other organisms were least represented.

If this Cladoceran was neglected, then a trend of greater accumulation later in the year was displayed for all stations (Figures 35-40). Trichoptera (caddisflies) are dominant at all stations later in the year. The Chironomidae were the other dominant group at many locations and times.

Station 71, the mainstem location, was dominated early by Chironomidae and later by Trichoptera. The adjacent location, WES3, showed an early dominance by Chironomidae and a later codominance with Trichoptera. Surprisingly, station WWC2TC showed dominance trends similar to station 71. Trends at station YC13JC were obscured by the absence of data for several complete samples.

Neglecting the Cladocerans, station WES3 was consistently the most productive site for organismal accumulation. Station 71, adjacent to station WES3, was similar. With the exceptions of July 1992 and September 1991, WWC2TC was the least productive (Figures 35-40).

Dominant organisms varied in timing and location but were consistently either Trichoptera or Diptera (Chironomidae) if not Cladocera. Although sediment organisms contained both of these groups, members of Oligochaeta were not dominant at any time on the artificial substrates and unlike the sediments where Oligochaeta was often dominant.

Transmissometry

Tables 22-31 contain the light field information collected from one complete survey of the mainstem region of West Point Lake. This information included transmittance, scatterance, upwelling and downwelling irradiance, temperature, attenuance and absorbance. The optical data relating to specific light field characteristics was further discriminated into specific wavelengths of light, red (660 nm), amber (605 nm), and green (555 nm).

Upwelling and downwelling irradiance was not wavelength specific and was relative to the surface intensity of solar radiation impacting the lake at the time of the measurement. This data was collected mainly for reference while assessing the other optical characteristics.

Transmittance, scatterance, absorbance and attenuance are measured or calculated characteristics water which are independent of solar radiation. They do, however, allow examination of all of the components of the light extinction coefficient in water and as such allow prediction of the submarine light field given solar irradiance. The advantage of measuring the components independently is that they are not sensitive to changing conditions of incoming light energy.

Attenuance and absorbance were calculated from the transmittance and scatterance measures and are included here for reference. This discussion centers mainly on transmittance and scatterance as measures of water clarity at depth and turbidity at depth.

Tables 22-31 show a typical pattern that has been observed in other warm monomictic reservoirs in the Southeast. Turbid headwaters enter the reservoir and eventually submerge beneath warmer waters that have greater clarity and fewer dissolved materials. In West Point Lake, this process is well developed by station 71. The suspended materials responsible for turbidity in inflows tends to settle slowly, depending upon composition and size, and this turbid zone becomes restricted to bottom depths (Figure 41).

Results of the LANDSAT surveys show distinct distributions of turbid materials at the surface of West Point Lake that diminish from headwaters to the forebay region of the lake. This trend is typical for large reservoirs having turbid inflow. The survey of optical characteristics showed, however, that these materials continued downstream after they were no longer surficially apparent. The stations (which correspond to buoy designations except for WES1 in the middle of the forebay) show a steady progression of deepening of the lake and deepening of the turbid flow from upstream regions to downstream regions.

Eventually, these materials occupy the hypolimnetic region of the lake and enter an environment conducive to chemical transformations of these materials into such forms as reduced metals, sulfides, and dissolved nutrients.

There was evidence that nepheloid material (light-scattering particles) in the main body of the lake downstream (near stations WES1-38) was different from similarly distributed materials upstream in the main body of the lake. This was based on the tendency of the materials to absorb green and red light in a different manner. Such a result could be due to settling of clays and silt particles upstream and replaced by chemically altered particles in the hypolimnion downstream where processes existed such as chemical oxidation and reduction.

Near the bottom of the euphotic zone, a secondary nepheloid (light-scattering) structure often develops and is associated with such processes as settling plankton and chemical cycling between the hypolimnion and epilimnion. Such a structure is not observed widely in the tributary embayments of West Point Lake. This result was not expected because such structure most often develops under strong stratification and in the presence of a well-defined thermocline. Because the development of such structure requires considerable time, lessened residence of water in a lake will also decrease the intensity to which such structure can develop.

Often regions that exhibit greater productivity of plankton such as the tributary regions (See LANDSAT results) are the most likely to develop such nepheloid layers. In West Point Lake, the survey showed evidence of this phenomenon only downlake in the mainstem region. Its restriction to that area of the lake and limited development could be due to the overall short residence time of those waters, too short for intensive development of metalimnetic structure.

In West Point Lake, there was also evidence that physical morphometric features of the lake affected the distributions of these materials. Near the mouth of Whitewater Creek, the railroad bridge abutments form a constriction of the channel as does an additional bridge abutment for highway 109 just downstream. The survey indicates that the regions formed by these constrictions may contribute to isolation of settling materials originating upstream and these features therefore are important to the internal material distributions for much of the lake. The limited nature of the survey does not allow for greater interpretation.

7 Release Water Quality

Introduction

Reservoir tailwaters provide water supplies, recreational opportunities, and aquatic habitat. However, these valuable water resources are often impacted by changes in flow and physicochemical characteristics associated with hydropower operations. Discharge of hypolimnetic water impacts temperature, dissolved oxygen, turbidity, and chemical processes in the tailwater region. The fates of reduced materials in the discharge are of particular interest since associated reactions influence dissolved oxygen concentrations, turbidity levels, and a variety of chemical processes. Reaction mechanisms and rates have been described in laboratory (e.g. Stumm and Morgan 1981) and lake (e.g. Mortimer 1941, 1942, Delfino and Lee 1971) studies but studies conducted in reservoir tailwaters have been limited.

A common theme of several recent tailwater studies is disparities between field and laboratory observations of reaction rates of reduced materials (Nix 1986, 1991, and Gordon 1989). Although interactions with substrates have been suggested as sources for observed differences (Nix et al. 1991), impacts of hydropower operations on these processes may also contribute to these disparities. The objective of this portion of the study was to describe the distribution and fate of selected physicochemical variables in the discharge from West Point Dam and to assess operational impacts on tailwater quality.

Analytical Methods

Sampling of the lake at a site 0.1 km above the dam was conducted on 29 July, 4 hours prior to initiation of tailwater sampling. In-situ measurements were recorded at 1-m intervals from surface to bottom and water samples were collected at selected depths in order to describe vertical gradients. Included were depths coinciding with the centerline elevations of the penstock openings for the house (189 m NVGD) and main (176 m NVGD) generator units.

Two strategies were employed for sampling the tailwater. The first involved repeated sampling at fixed stations throughout consecutive periods of peaking and low-flow operation on 29-30 July, 1991. The five fixed stations extended 15 km from the tailrace (approximately 0.1 km below the dam) to the lowhead dam at Langdale, GA (Figure 42). Stations were sampled at intervals of 0.25 to 8 hours, depending on flow conditions. In general, sampling was most frequent during periods of rising and elevated flow. Temporary staff gauges were deployed at each station as a means for determining relative water level.

The second sampling strategy involved periodic sampling of a discrete parcel of released water. Sampling, which commenced on 30 July, 1991, 4.6 hours after initiation of peak-power operation and 1.4 hours after stable, peak flows were attained, was conducted from a drifting boat at 15- to 30-minute intervals. Releases from the dam were maximal and constant throughout the 2.4-hr sampling period. Floats released immediately below the dam were used as an independent estimate of parcel location.

Temperature, dissolved oxygen, pH, and conductivity were measured in-situ with a Hydrolab Surveyor II (Hydrolab Corporation, Austin, TX) at both tailwater and in-lake sites. Samples for metal analyses were filtered (0.45μ) immediately, placed in acid-washed bottles and preserved with acid until analyzed. In the laboratory, samples were acid-digested and analyzed using atomic adsorption spectrophotometry (APHA 1989) with an air/acetylene flame (Model 4000, Bodenseewerk Perkin-Elmer and Company, Uberlingen, Germany).

Results and Discussion

Forebay conditions

Temperature and oxygen conditions in the forebay were characteristic of reservoirs with hypolimnetic releases (Figure 43). Temperature differences between surface and bottom layers were minimal (ca. 7 °C) and a broad thermocline extended from a depth of 5 m to the bottom. Dissolved oxygen concentrations decreased rapidly below the mixed layer and were less than 1 mg/L at depths below 10 m. Total iron and manganese concentrations were near detection limit (0.05 mg/L) in the mixed surface layer but increased to maxima of 5.0 mg/L and 2.0 mg/L, respectively, near bottom (Figure 43).

Tailwater hydrology

During periods of low-flow operation, which occurred between approximately 2100 hr and 1000 hr, discharges from the dam averaged 14.2 m^3/sec (Figure 44) and water elevations in the stilling basin were low. In downstream areas, rocks and bottom materials were exposed across much of the river's width and flows were restricted to shallow meandering channels. Standing water occupied off-channel depressions creating numerous pools 0.1 to 1.0 m in depth. The temperature of water released from the dam during these periods was similar to that of the mixed, surface layer (0-10 m) of the lake and ranged from 27 to 27.5 °C.

Peaking operation occurred from 1000 hr to 2100 hr and resulted in markedly different hydrologic conditions in the tailrace and downstream areas. Discharge from the dam increased to a maximum of approximately 450 m^3/sec during a 0.5-hr start-up period (Figure 44) and tailrace surface elevations increased by 2 to 2.5 m. Discharge rates and water elevations in the tailrace were relatively constant during the remainder of the generation cycle. Following cessation of peaking operation, discharges and tailrace elevations returned to low-flow operation levels within 0.5 hr. The temperature of peak operation releases from the dam ranged from 26.5 to 28 °C.

Flooding of the river channel to depths of 1.75 to 2.0 m occurred at downstream areas with arrival of the release hydrograph. Lags in the time at which stage elevations and flow rates increased at each station reflected longitudinal changes in channel morphology and travel distances. Differences in the timing of the rise in stage elevation at stations 10, 20 and 40 (see Figure 45), located 0.1, 4 and 10 km downstream, respectively, suggest an average flow velocity of approximately 1.4 m/sec. Flooding of several tributary stream channels occurred coincident with increased depth in the river channel during peaking operation.

Tailwater quality

Temperature and dissolved oxygen concentrations immediately below the dam (station 10) were influenced by changes in operation, water withdrawal characteristics and water quality conditions in the forebay. During low-flow operation, when water would have been withdrawn primarily from surface strata, average temperature and dissolved oxygen concentration were 27.0 °C and 4.7 mg/L, respectively. During peaking operation, when water would have been withdrawn from lower in the water column, average dissolved oxygen concentration was significantly ($p \leq 0.05$) lower but temperature was relatively unchanged.

Model studies of withdrawal characteristics resulted in predicted temperature and dissolved oxygen concentrations similar to those observed during low-flow operation; however, predicted peaking operation temperatures and dissolved oxygen concentrations were lower than those observed in the field. Based on the temperature profile in the forebay prior to peaking operation (see Figure 43) and the near-bottom location of the penstock openings for the two main generator units, SELECT (Davis et al. 1987) predicted a steady-state temperature and dissolved oxygen concentration of 24.5 °C and 0.9 mg/L, respectively. Discrepancies between observed and predicted temperature and dissolved oxygen concentrations in the tailwater may be related to the presence of a partially-breached coffer dike submerged during reservoir filling. The dike is located 0.1 km upstream from the dam and spans the width of the powerhouse section of the dam at an elevation of 178.3 m NGVD, which corresponded to a depth of 15.8 m during this study. Applications of SELECT assuming the presence of a submerged weir of equal vertical extent resulted in temperatures and dissolved oxygen concentrations similar to those observed in the tailwater during this study, suggesting that the submerged coffer dam acts to limit discharges from the hypolimnion during peaking operation.

Changes in temperature and dissolved oxygen concentrations observed throughout the study reach reflected the quality of water released from the dam and the influences of hydrologic changes related to operation. While discharge temperatures were relatively constant throughout the study period, short term increases occurred coincident with the rising limb of the peaking-operation hydrograph at stations 10, 20 and 40 (Figure 45). Similar increases in dissolved oxygen concentration were observed, particularly at station 40 (Figure 45). The isolation of water in shallow, off-channel depressions during low-flow operation would have provided opportunity for warming and for reaeration due to exchange at the air-water interface and photosynthesis by phytoplankton and periphyton. Subsequent downstream displacement of this water at the initiation of peak operation could have accounted for observed changes in temperature and dissolved oxygen concentration. Turbulence associated with the advance of the release wave could also have increased reaeration opportunities.

Dissolved oxygen concentrations were markedly lower at station 40 than at stations near the dam (stations 10 and 20) during low-flow operation (Figure 45). Marked differences in concentrations were also observed between peaking and low-flow operation at upstream stations. While concentrations ranged from 4 to 6 mg/L upstream during low-flow operation, those at station 40 ranged from 2 to 3 mg/L, possibly reflecting the influence of microbial and/or algal respiration. Differences in dissolved oxygen concentrations between low-flow and peaking operation at stations 10 and 20 were clearly related to differences in withdrawal depths and vertical differences in water quality in the forebay.

Temporal and spatial patterns in the distribution of manganese and iron were clearly related to conditions in the forebay, tailwater hydrology, and processes occurring following release. Concentrations of total iron exceeded those of dissolved iron (indicating the presence of particulate iron) and both were relatively constant through time at station 10 (Figure 46). Patterns in distribution differed at station 20 were total iron concentrations, a large percentage of which was particulate, exceeded those in the discharge (station 10) during low-flow operation. The return of water pooled in Oseligee Creek during peaking generation and associated material transport may have been the source of the observed increase in particulate iron concentrations. This suggestion is supported by observations of reddish precipitates in Oseligee Creek and by the fact that total iron concentrations decreased to values similar to those in the discharge (approximately 0.5 mg/L) coincident with the arrival of peaking-operation water.

Total and particulate iron concentrations increased at station 40 with the rising limb of the peaking-operation hydrograph (Figure 46). Increased transport of resuspended material could have accounted for the increased concentrations; however, the source of this material is not easily identified from existing data. One possible source is particulate iron transported out of Oseligee Creek coincident with the return to low-flow conditions in the river channel. This material, if deposited in the channel, would be resuspended as flows increased with peaking operation. The fact that increases in particulate iron, during either low-flow or peaking operation, did not occur above Oseligee Creek (i.e., station 10) supports this suggestion.

Total and dissolved manganese concentrations were similar, suggesting a lack of particulate forms, and relatively constant throughout the study at stations 10 and 20 (Figure 47). Concentrations were more time-variable at station 40 where concentrations were elevated coincident with increases in stage. The fact that particulate manganese represented a small percentage of the total concentration suggests that processes other than those affecting changes in iron concentration may have been responsible for observed changes. Alternatively, the filtration method may not have removed fine particulates and, thus failed to define dissolved forms of manganese.

Changes in the quality of a parcel of discharge water as it travelled through the tailwater provided additional information about physicochemical processes in the discharge. Temperature and dissolved oxygen values increased from 26.5 to 27.2 °C and from 2.3 to 3.1 mg/L, respectively, during the 3.5-hour period of travel from the dam to station 50 (Figure 48). Increased dissolved oxygen concentrations suggests that some reaeration occurs during generation.

Manganese and iron concentrations decreased with time and distance downstream (Figure 48). During the 3.5-hour period required for the parcel of water to traverse the study reach, total iron concentrations decreased from approximately 0.55 to 0.40 mg/L and dissolved iron from 0.29 to 0.09 mg/L. Particulate iron concentrations were constant (0.32 mg/L) during this period. Total manganese, which equalled dissolved manganese for all but one sample, decreased from 0.37 to 0.26 mg/L.

Since the tailwater was oxic, it is reasonable to assume that declines in dissolved iron occurred through oxidation. Based on the observed data and assuming first order reaction kinetics, an oxidation rate of 0.014/min is obtained (Figure 49). This rate is similar to that expected for iron oxidation given the observed pH range (6.5-6.8; Stumm and Morgan 1981) and is comparable to those reported by Dortch et al. (1992) for other tailwaters. However, the fact the particulate iron concentrations did not increase, as might be expected following oxidation, suggests that other processes, such as sedimentation or adsorption to streambed materials, may also be involved in changes in water column iron concentrations.

A similar conclusion is reached based on declines in dissolved manganese concentrations, which were estimated to occur at a rate of 0.002/min. However, the assumption of first order reaction kinetics is probably inappropriate since the oxidation of manganese in autocatalytic (Stumm and Morgan 1981). As was noted for iron, failure to detect quantities of particulate (oxidized) manganese indicates that processes other the direct liquid phase reaction with dissolved oxygen is involved in the loss of manganese from the water column. Morgan (1967) indicates that oxidation can occur through a heterogeneous mechanism at available surfaces, such as those provided by suspended sediments or streambed materials. Losses of manganese to streambed materials have been documented by studies in the Little River below Narrows Dam (Nix 1986) and the Duck River below Normandy Dam (Gordon et al. 1984). Emerson et al. (1982) report bacterially-mediated "binding" of manganese to particulate surfaces.

8 Summary Discussion

Lake Water Quality

West Point Lake, like other southeastern impoundments, exhibits symptoms of eutrophication. These symptoms include high nutrient concentrations, excessive algal production, reduced transparency, and depletion of dissolved oxygen reserves in bottom waters during summer months. Walker (1981) reviewed data collected as part of the National Eutrophication Survey conducted by the U.S. Environmental Protection Agency and identified that 30 of 33 southeastern reservoirs sampled between 1973 and 1975 were determined to be eutrophic. The occurrance of such conditions was related to the influx of nutrients, particularly nitrogen and phosphorus, from point and nonpoint sources.

Soballe et al. (1993) compiled eutrophication-related water quality information for 45 southeastern reservoirs operated by the CE, the Tennessee Valley Authority (TVA), and private agencies. Average phosphorus and nitrogen concentrations for these reservoirs were 0.042 mgP/L and 0.594 mgN/L, respectively; chlorophyll α concentrations averaged 7.1 μg/L. Nutrient and chlorophyll α concentrations for West Point Lake surface waters observed during this study, while highly variable *spatially, were at or above these levels. Nutrient levels* observed at West Point Lake reflect the influence of material loads from the Chattahoochee River and, to some degree, loads from secondary tributaries.

Lake management and restoration efforts during the last 10 to 20 years have logically focused on the importance of linkages between watershed loading processes and lake responses (see Cooke et al. 1993). As inputs of nutrients, particularly phosphorus, increase, proportional increases in nutrient concentrations in surface waters often lead to increased chlorophyll α concentrations and decreases in transparency.

Relationships between phosphorus, chlorophyll α (an estimate of algal biomass), and transparency are well-documented, particularly for north temperate lakes. The importance of these relationships led Carlson (1977) to develop a trophic state index (TSI). The indexing system assumes phorphorus-limted algal growth and a direct relationship between chlorophyll α and Secchi disk transparency, and has been widely used as a means for quantifying eutrophication response. TSI values, which can be calculated from either total phosphorus concentration, chlorophyll α concentration or Secchi disk transparency, occur along a scale from 0 to 100, with each 10-unit change reflecting a doubling in chlorophyll α concentration.

Trophic state responses for West Point Lake were evaluated by computing TSI values for each cluster (See Part 3; Figure 50). TSI values computed for cluster 1, composed of stations located in downstream areas of the Chattahoochee River arm and in large embayments, are similar across computation method and, with the exception of values based on chlorophyll α concentration, lower than those computed for other clusters. Highest values were computed for cluster 4, which included stations located in the riverine portion of the Chattahoochee River arm of the lake. Intermediate values were computed for clusters 2 and 3. Stations associated within these clusters were located midway between the Chattahoochee River inflow and the dam, and immediately downstream from the riverine portion of the Chattahoochee River arm, respectively. Such differences reflect the proportional influence of nutrient loadings from the Chattahoochee River and other tributaries.

Carlson (1977) noted that the TSI scale can serve as an internal check on assumptions concerning trophic relationships in lake ecosystems. As such, within-cluster differences in TSI values computed from each response parameter provide valuable information concerning the nature of trophic responses in West Point Lake (Figure 50). Differences between TSI values computed from total phosphorus concentration and Secchi disk transparency and those computed from chlorophyll α concentration for stations in clusters 3 and 4 would be unexpected under the indexing assumptions. Since chlorophyll-based TSI values fell far below those computed from phosphorus concentration, algal growth at these stations was clearly limited by other factors. These could have included nitrogen and/or light availability. The fact that Secchi-based TSI values exceeded chlorophyll-based TSI values would support the suggestion of limited light availability. However, these clusters also exhibited N/P ratios near those for nitrogen limited algal growth.

Cluster characteristics (Table 32; Figure 51) provide a general framework within which to discuss limnological responses and management implicatiuons at West Point Lake. River-like reaches of the lake (cluster 4) exhibit excessively-high nutrient concentrations and, although defined as either nitrogen- or phosphorus-limited based on nutrient ratios, are light-limited throughout most or all of the year. Because of this, management initiatives to reduce nutrient loading would have minimal effectiveness in reducing algal-related problems in this portion of the lake. However, lake-like portions of the lake (cluster 1) have light regimes dominated by biogenic turbidity and algal populations limited by phosphorus availability. Changes in nutrient (phosphorus) loads to the lake would be expected to promote proportional responses in algal abundance in these areas.

Transitional reaches of the lake exhibited characteristics intermediate between lake- and river-like areas of the lake (Table 32; Figure 51). Cluster 2 and 3, while both clearly transitional in character, can be differentiated by their potential responses to nutrient-related changes. Cluster 3, the most upstream of the two (i.e., areas located above the LaGrange water intake and below the riverine portion of the lake), is high in nutrients, but strongly influenced by turbidity levels. Thus, changes in trophic response variables following changes in nutrient concentration would be expected to be controlled in part by turbidity. It would also be expected that, even in absence of changes in nutrient concentration, marked changes in response variables would follow changes in turbidity. Therefore, this region of the lake may be most sensitive to changes in turbidity.

Cluster 2, representing the other transitional area of the lake, is moderately high in nutrients, potentially phosphorus-limited and influenced by either biogenic or abiogenic turbidity. Areas of the lake associated within this cluster would be potentially sensative to changes in nutrient inputs. These responses would be magnified if concurrent changes in abiogenic turbidity occurred.

Comparisons between response areas located in the main stem and selected embayments identify differences important to a better understanding of water quality processes. Kennedy et al. (1993), reporting on the application of the eutrophication-response model BATHTUB, point out that observed gradients in water quality indicate that significant exchanges must occur between Yellowjacket Creek embayment and the main portion of the lake. Such exchanges are probably limited to the downstream portion of the embayment. The responses of areas in middle and upstream portions of the embayment clearly reflect differences in local inputs from tributaries and contiguous landuse areas. This conclusion can be extended to other embayments in which hydrologic and morphologic conditions exert a degree of control on the loading, transport and fate of materials.

Tailwater Processes and Quality

The quality of water in the tailwater below West Point Dam was influenced by chemical stratification in West Point Lake, structural and operational characteristics of the dam, and processes occurring in the tailwater following release. Thermal stratification led to anoxic conditions in bottom waters and subsequent reduction of iron and manganese to soluble forms. Low-flow operation resulted in the selective withdrawal of warmer, more oxygenated, near-surface waters low in iron and manganese concentrations. Based on declines in dissolved oxygen concentrations immediately downstream, peaking operation withdrew water from deeper in the water column; however iron and manganese concentrations were not substantially increased. The coffer dike located immediately upstream of the dam and operation of the small generator during non-peak generation periods clearly enhance the quality of water discharged to downstream reaches during peaking and low-flow generation, respectively.

Fluctuations in water level clearly affected changes in water quality in the tailwater, directly or indirectly. The advance of the release peaking operation hydrograph resuspended and transported materials accumulated across the streambed during low-flow operation. These accumulations presumably followed oxidation of iron and manganese in pools and depressions during low-flow periods. Additionally, iron particulates were transported to the channel as flooded stream channels drained following cessation of peaking operation.

Time-varying changes in water quality under near-steady conditions during peaking operation were related to increases in dissolved oxygen due to reaeration and "loss" processes involving iron and manganese. These processes may have included oxidation, sedimentation, and sorption or bacterially-mediated binding of iron and manganese oxides to substrate surfaces.

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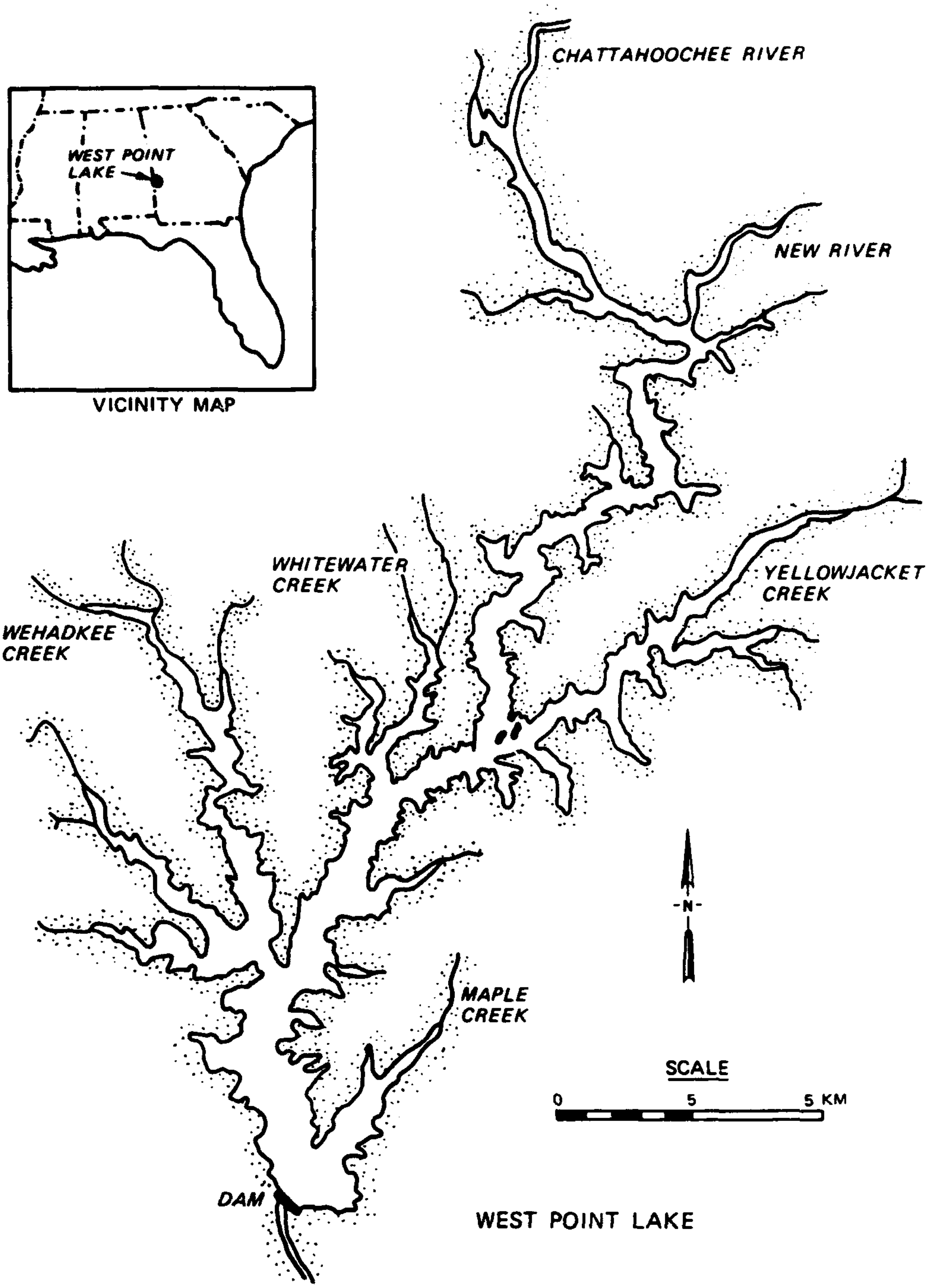


Figure 1. Location of West Point Dam and Lake, GA.

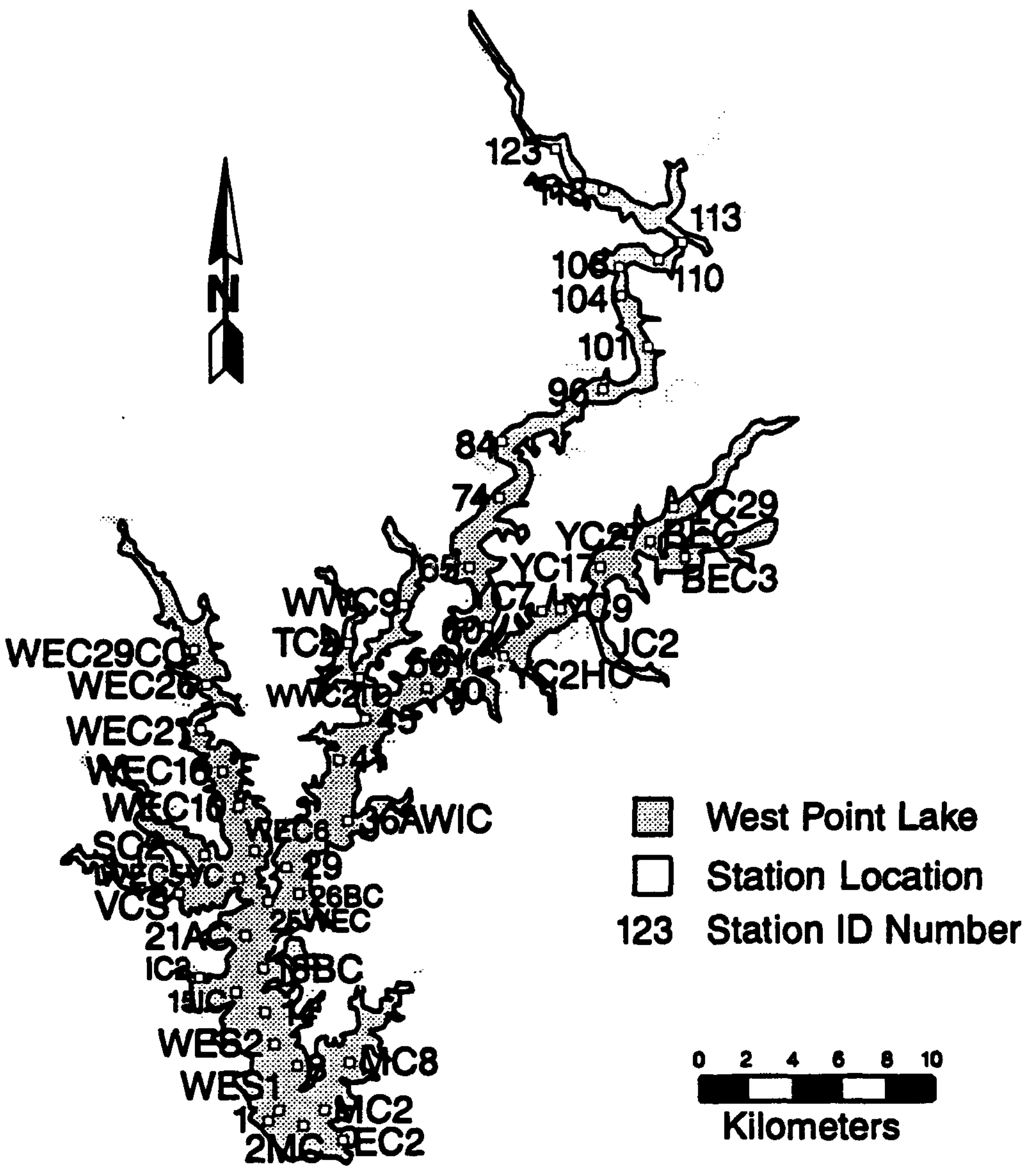


Figure 2. Sample station locations in West Point Lake.

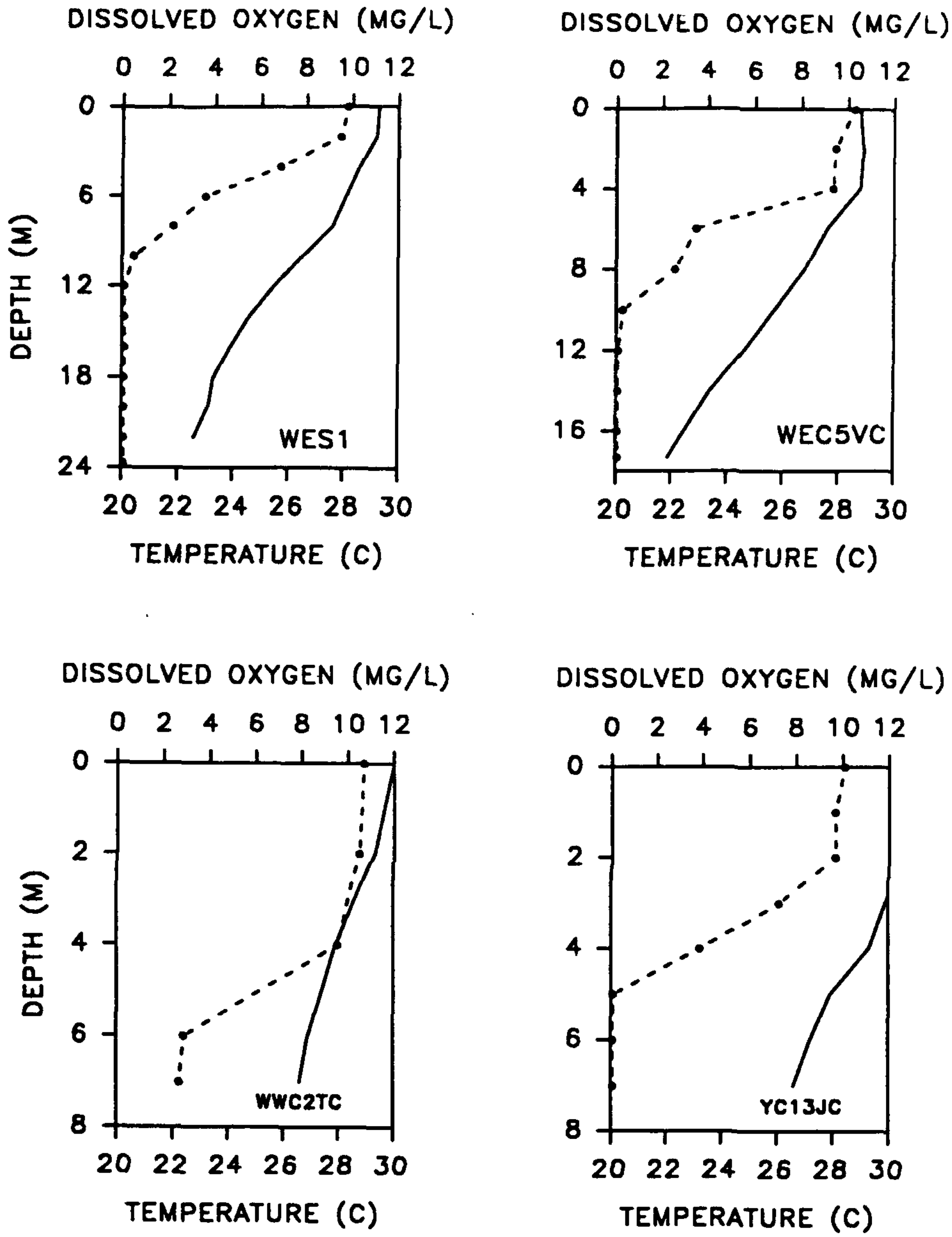


Figure 3. Vertical profiles of dissolved oxygen concentration (dashed line) and temperature (solid line) at selected stations in West Point Lake. Station WES1 was located immediately upstream from the dam; Stations WEC5VC, WWC2TC, and YC13JC were located in Wehadkee Creek, Whitewater Creek, and Yellowjacket Creek embayments, respectively. Based on data collected July 25-26.

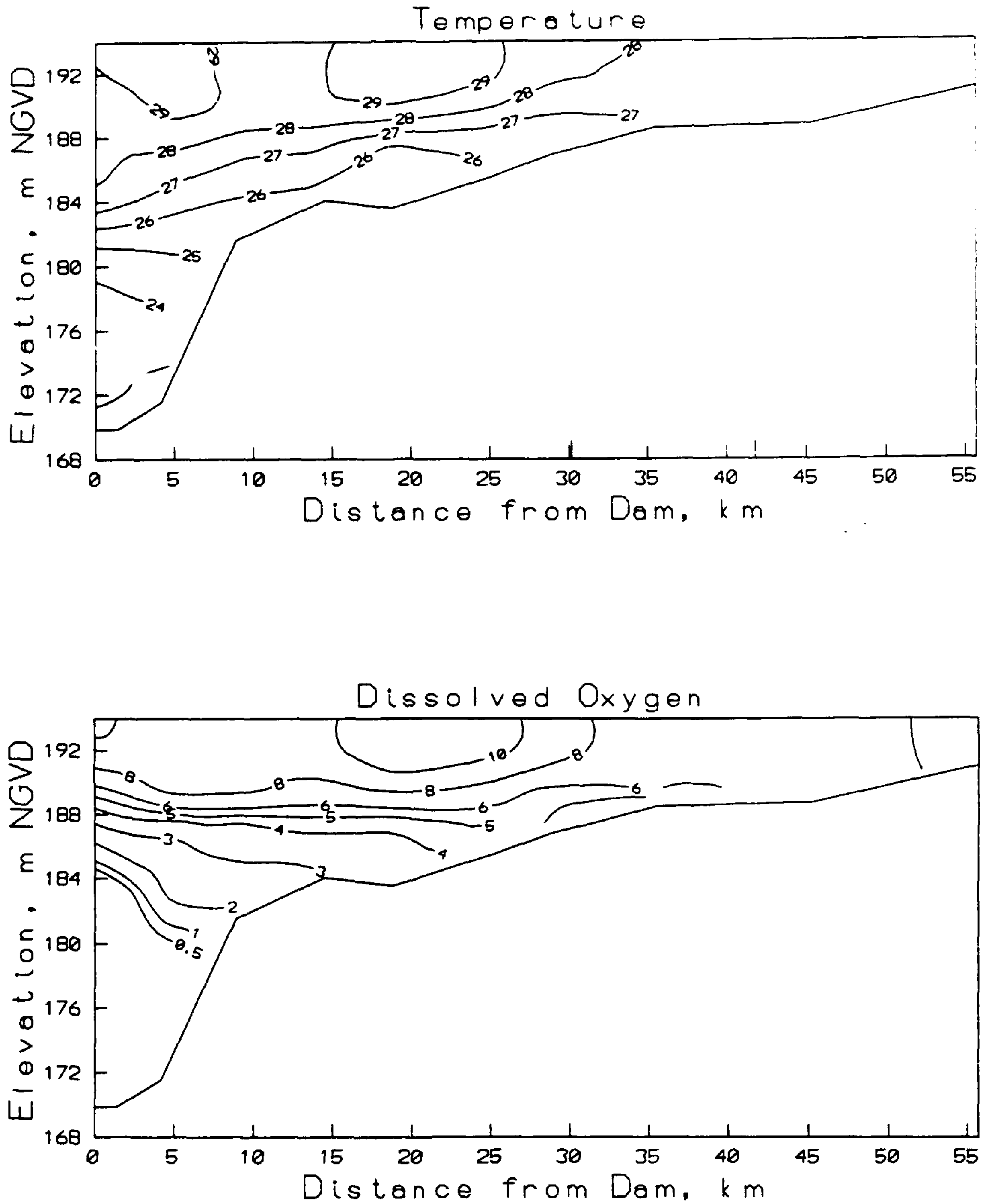


Figure 4. Vertical and longitudinal changes in temperature (upper) and dissolved oxygen concentration (lower) along the axis of the Chattahoochee River arm of West Point Lake. Based on data collected July 26, 1991.

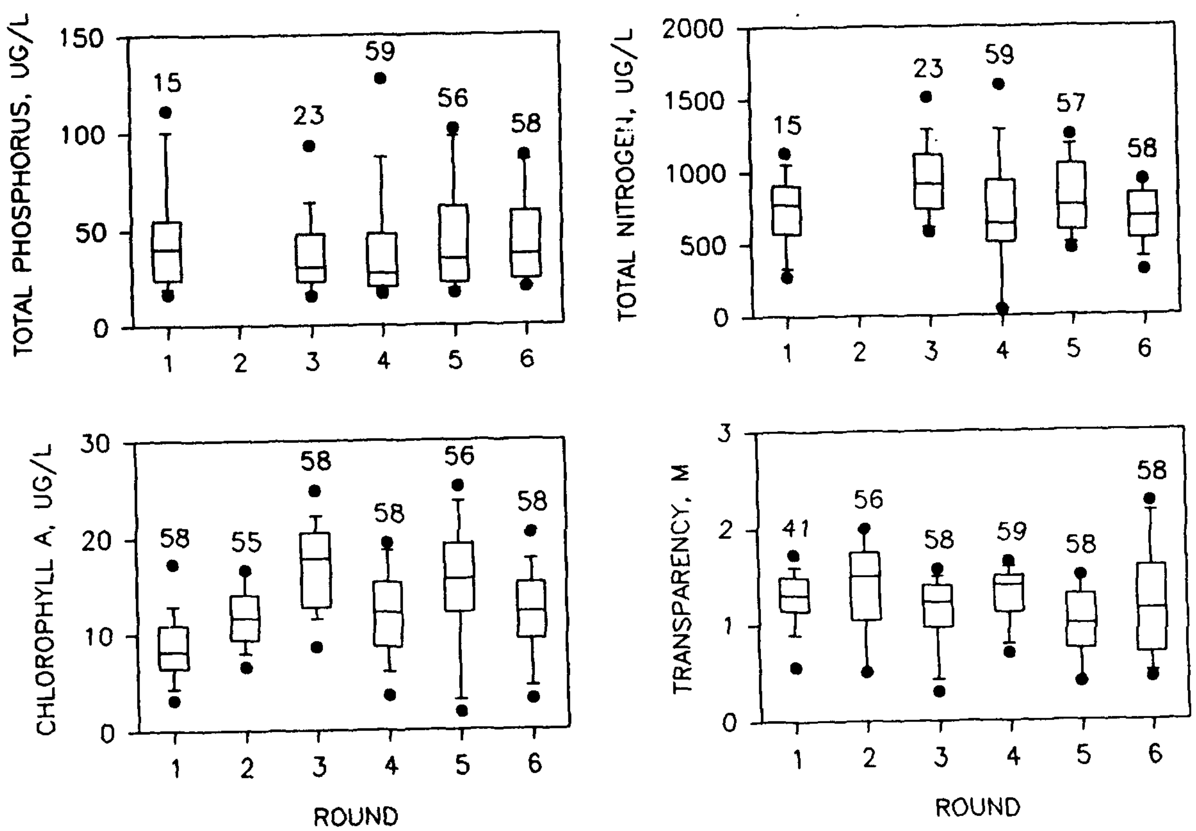


Figure 5. Variability of total phosphorus, total nitrogen, and chlorophyll a concentrations, and transparency for surface water on each of six sample rounds. Boxes and enclosed lines indicate 25th and 75th, and 50th percentiles, respectively. Capped vertical lines identify the 10th and 90 percentiles. The 5th and 95th percentiles are displayed as closed circles. Distribution of sampling effort across sample rounds is indicated as the number of stations sampled for each variable. (See Table 1 for data collection dates for each sample round.

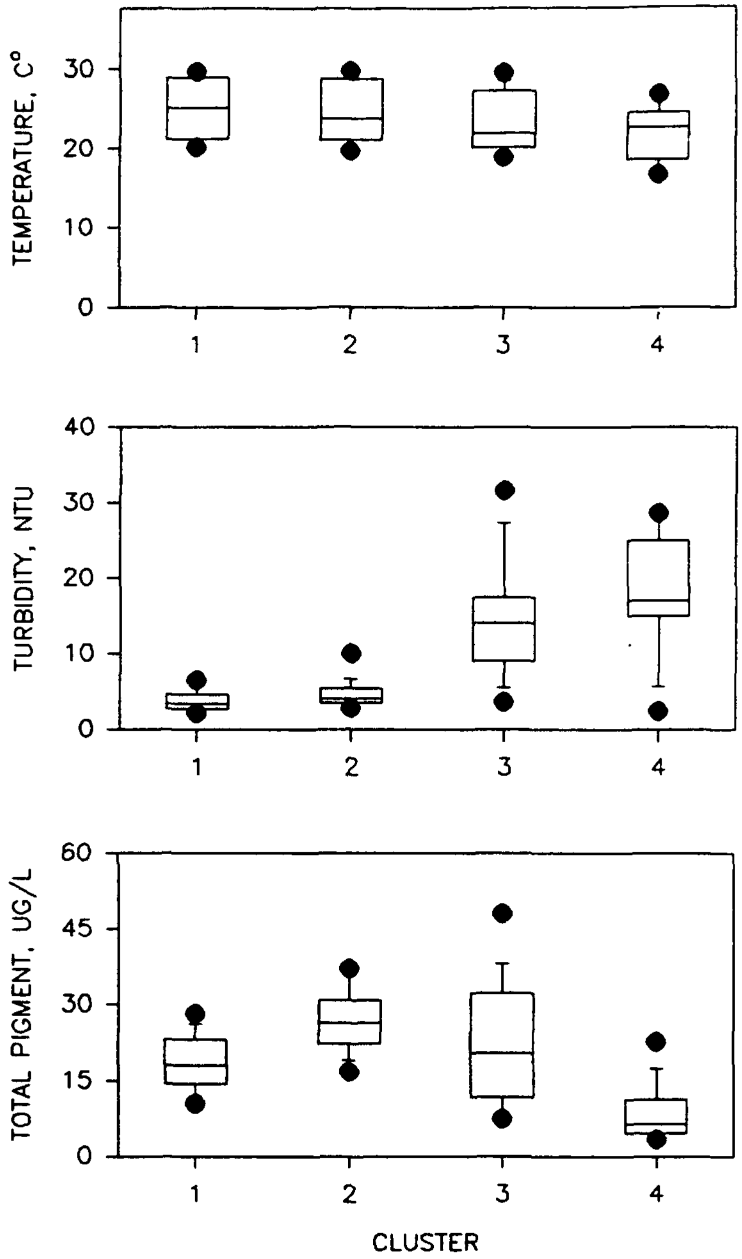


Figure 6. Variablity of temperature, turbidity and total pigment concentration for stations associated with each cluster. Boxes and enclosed lines indicate 25th and 75th, and 50th percentiles, respectively. Capped vertical lines identify the 10th and 90 percentiles. The 5th and 95th percentiles are displayed as closed circles. Numbers indicate number of stations assigned to each cluster.

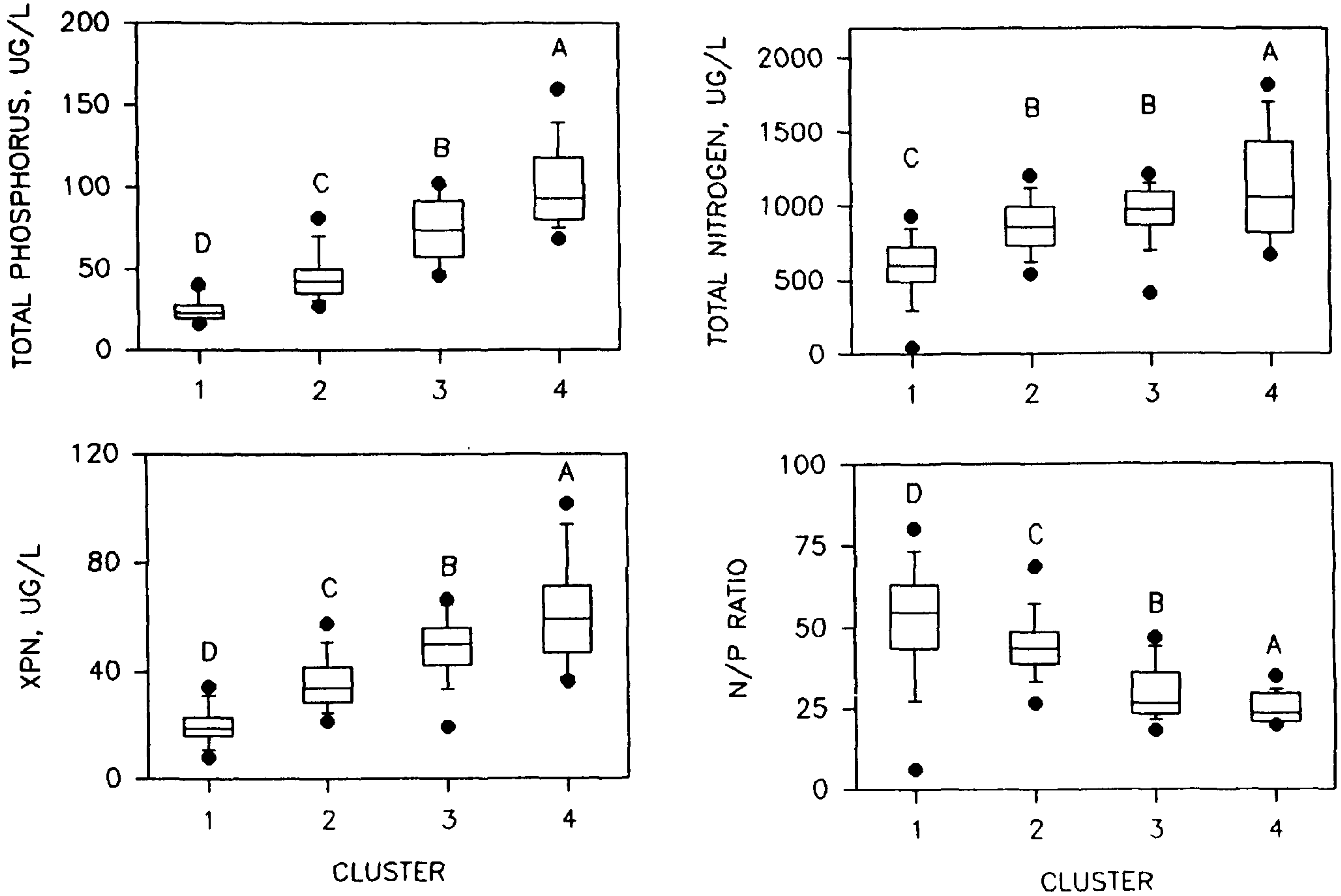


Figure 7. Distribution of total phosphorus, total nitrogen, and composite nutrient (XPN) concentrations, and N/P ratios for stations associated with each cluster. Boxes and enclosed lines indicate 25th and 75th, and 50th percentiles, respectively. Capped vertical lines identify the 10th and 90 percentiles. The 5th and 95th percentiles are displayed as closed circles. Letters indicate results of Duncan Multiple Range tests; letters denote clusters with significantly ($p<0.05$) different characteristics.

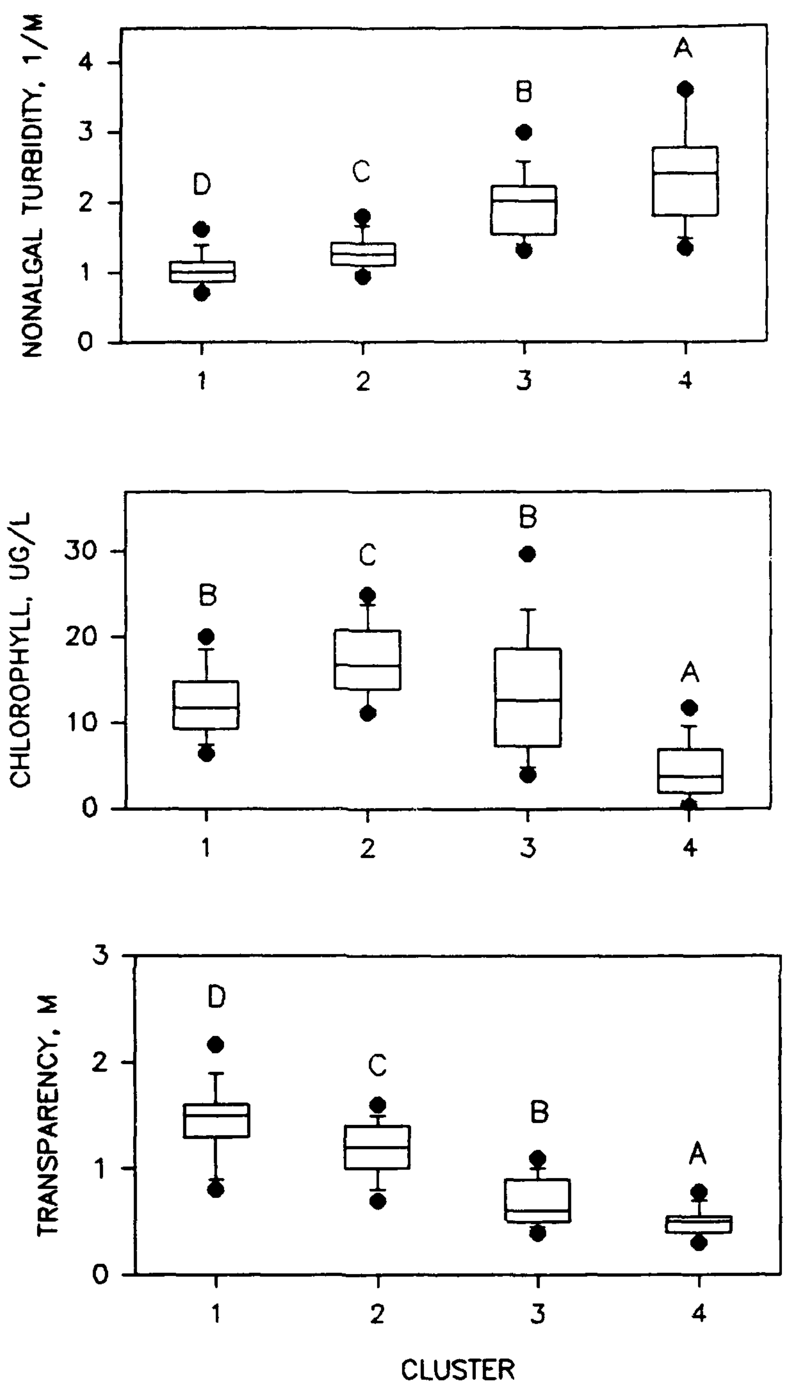


Figure 8. Distribution of nonalgal turbidity, chlorophyll a concentration, and Secchi disk transparency for stations associated with each cluster. Boxes and enclosed lines indicate 25th and 75th, and 50th percentiles, respectively. Capped vertical lines identify the 10th and 90 percentiles. The 5th and 95th percentiles are displayed as closed circles. Letters indicate results of Duncan Multiple Range tests; letters denote clusters with significantly ($p<0.05$) different characteristics.

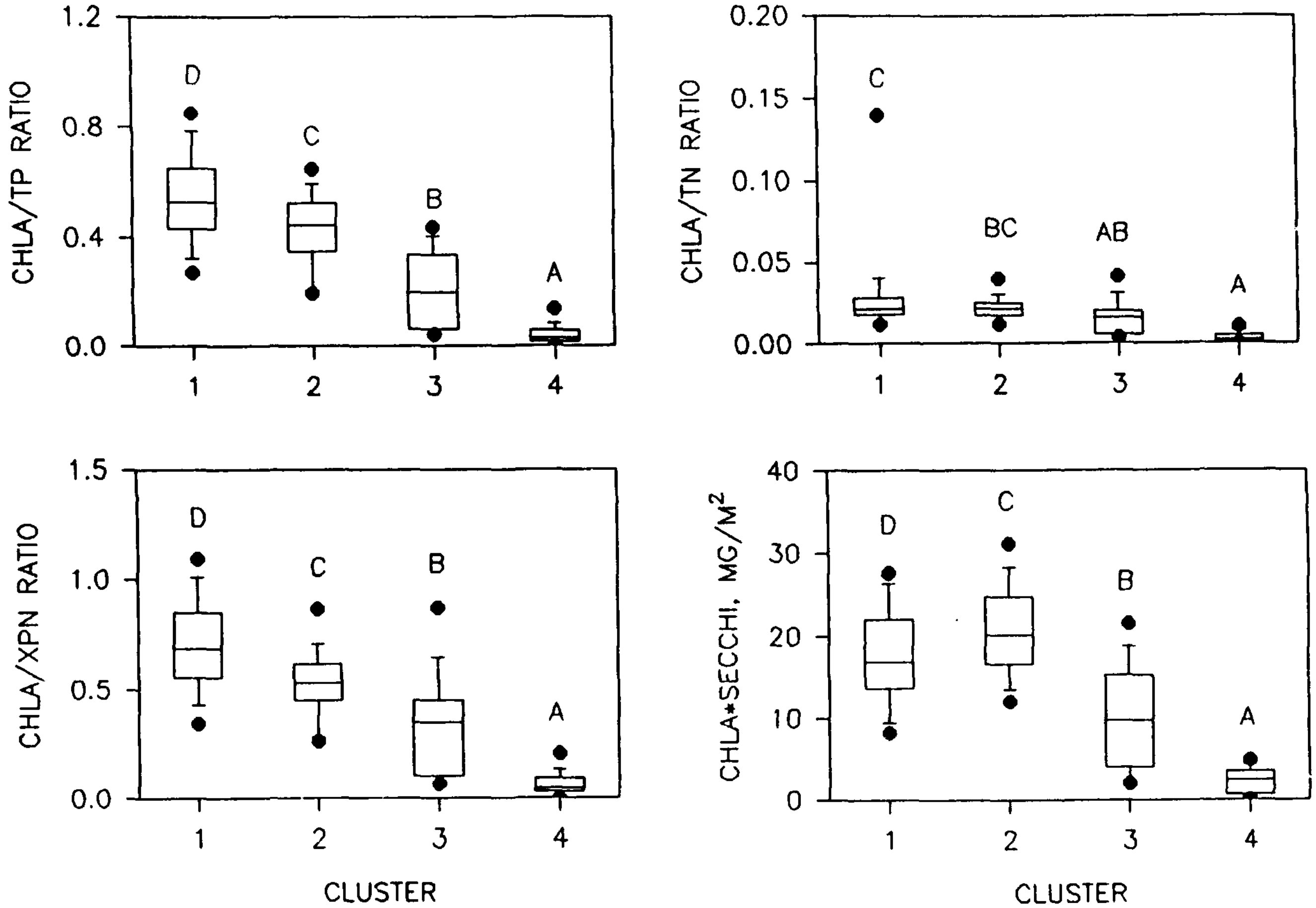


Figure 9. Distribution of chlorophyll/total phosphorus, chlorophyll/total nitrogen, chlorophyll/composite nutrient, and chlorophyll/Secchi transparency ratios for stations associated with each cluster. Boxes and enclosed lines indicate 25th and 75th, and 50th percentiles, respectively. Capped vertical lines identify the 10th and 90 percentiles. The 5th and 95th percentiles are displayed as closed circles. Letters indicate results of Duncan Multiple Range tests; letters denote clusters with significantly ($p<0.05$) different characteristics.

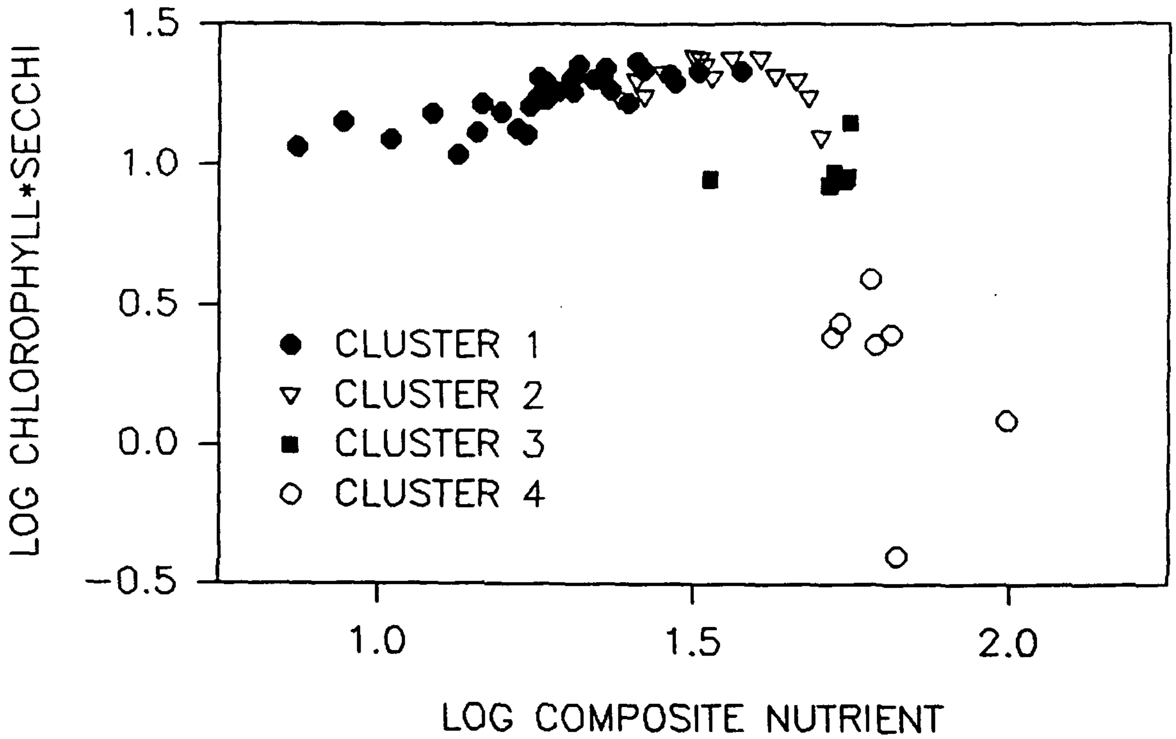


Figure 10. Relationship between chlorophyll-Secchi product and composite nutrient concentration for surface water clusters.

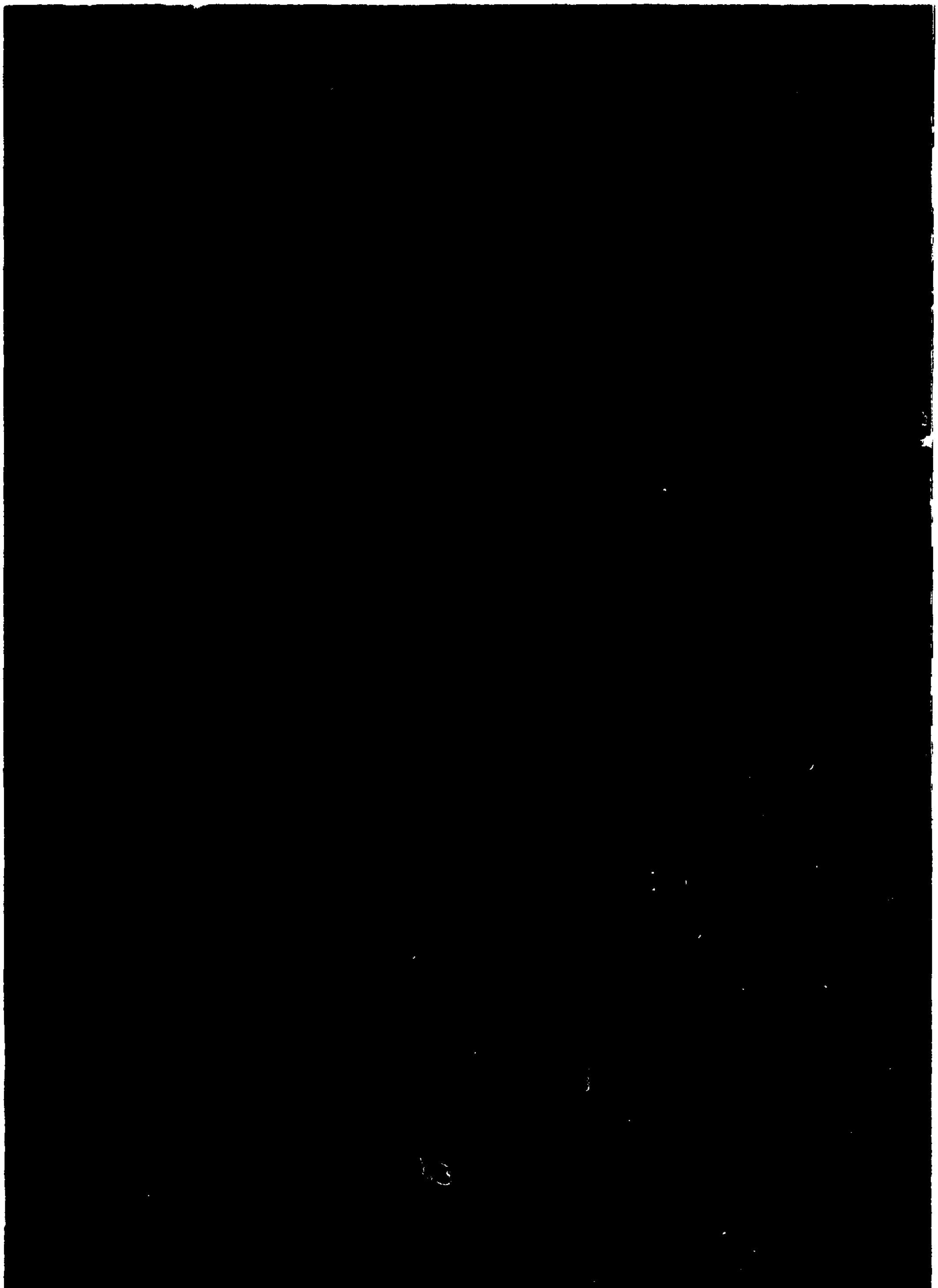


Figure 11. Infrared color composite image of West Point Lake and surrounding area. Derived from TM data collected June 8, 1991.

Figure 12. Infrared color composite image of West Point Lake and surrounding area. Derived from TM data collected September 28, 1991.

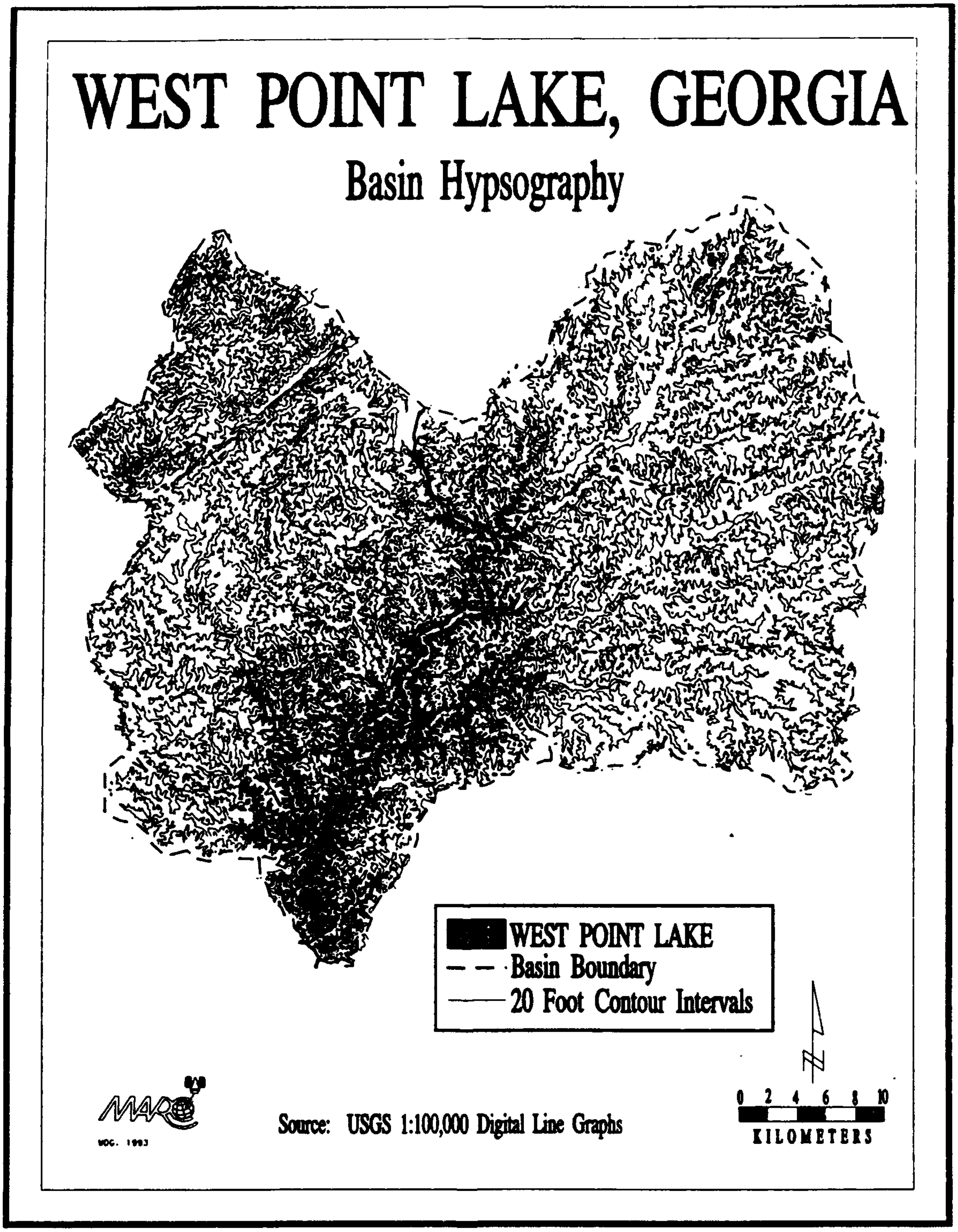


Figure 13. Digital line graph of basin hypsography.

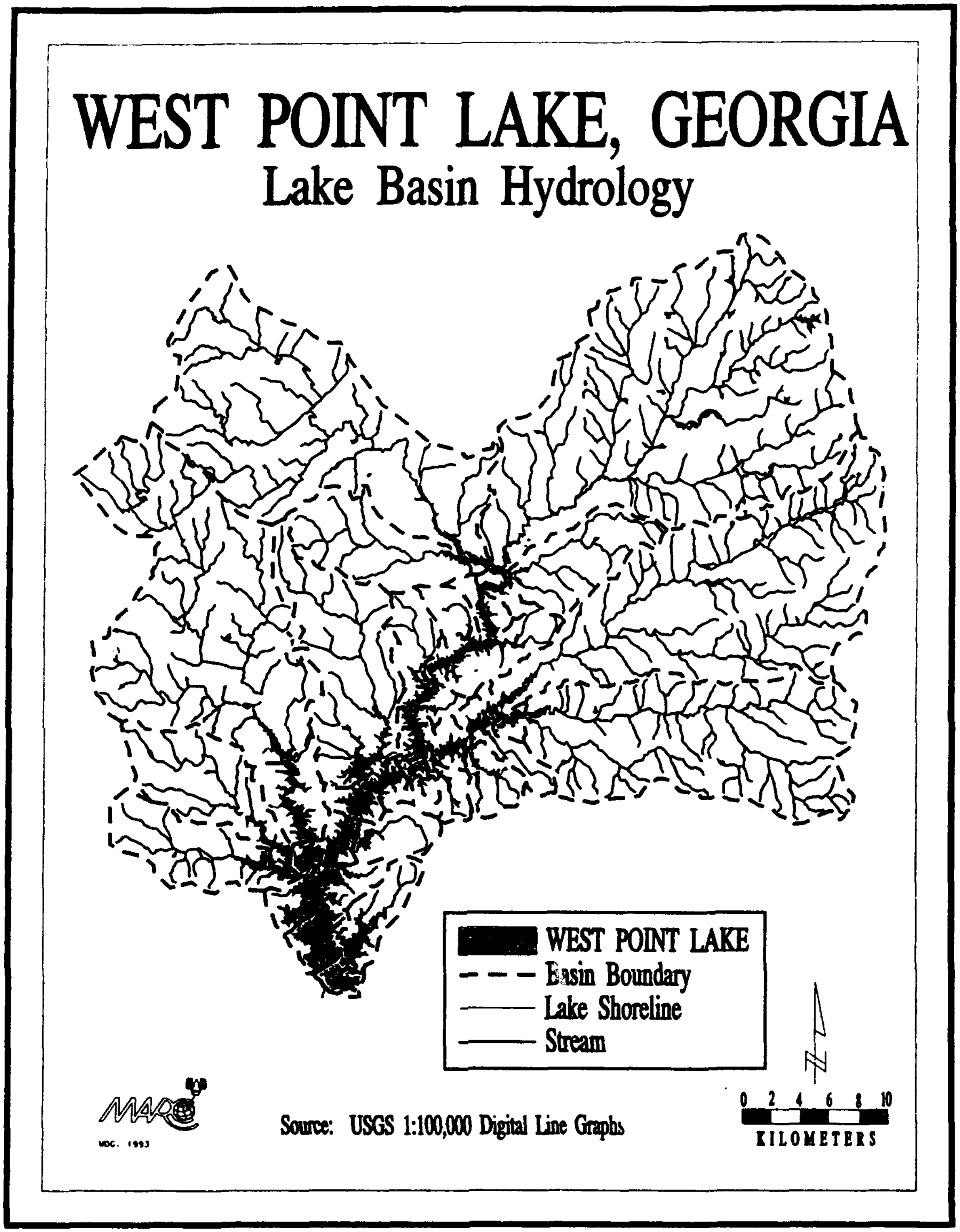


Figure 14. Digital line graph of selected basin hydrologic feature.

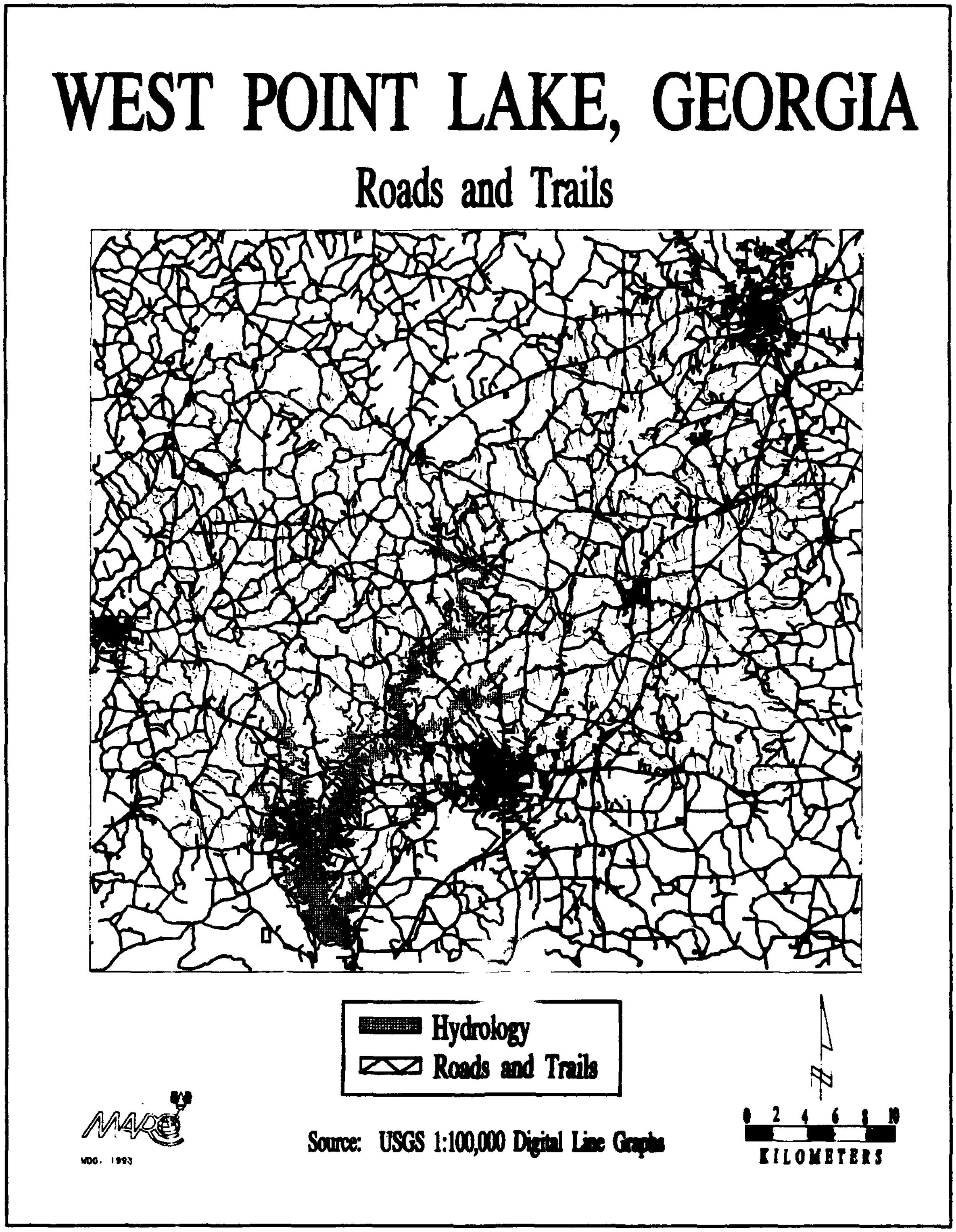


Figure 15. Digital line graph of major transportation routes and urban areas in the basin.

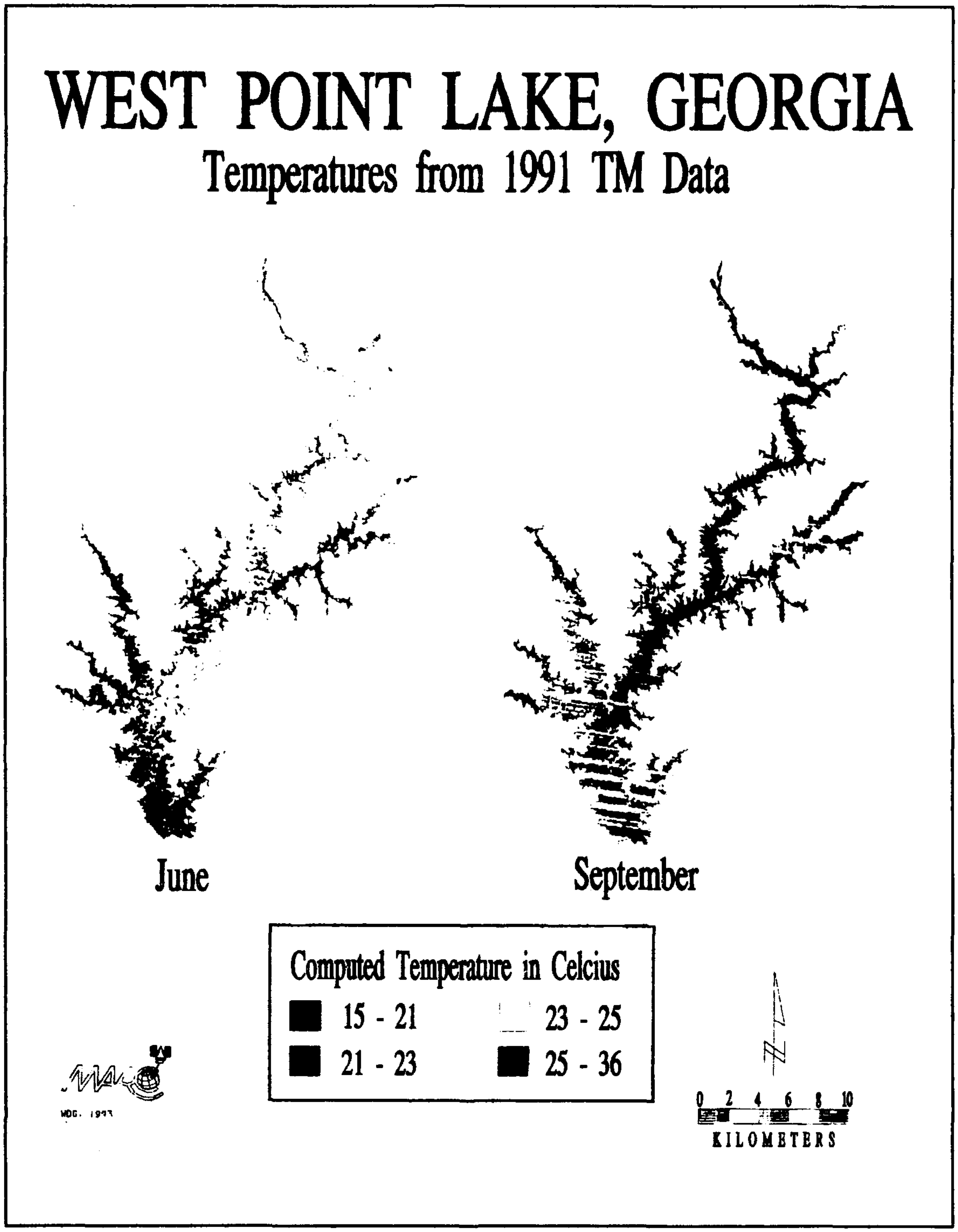


Figure 16. Distribution of computed surface water temperatures for June 8 and September 28, 1991. Based on TM data.

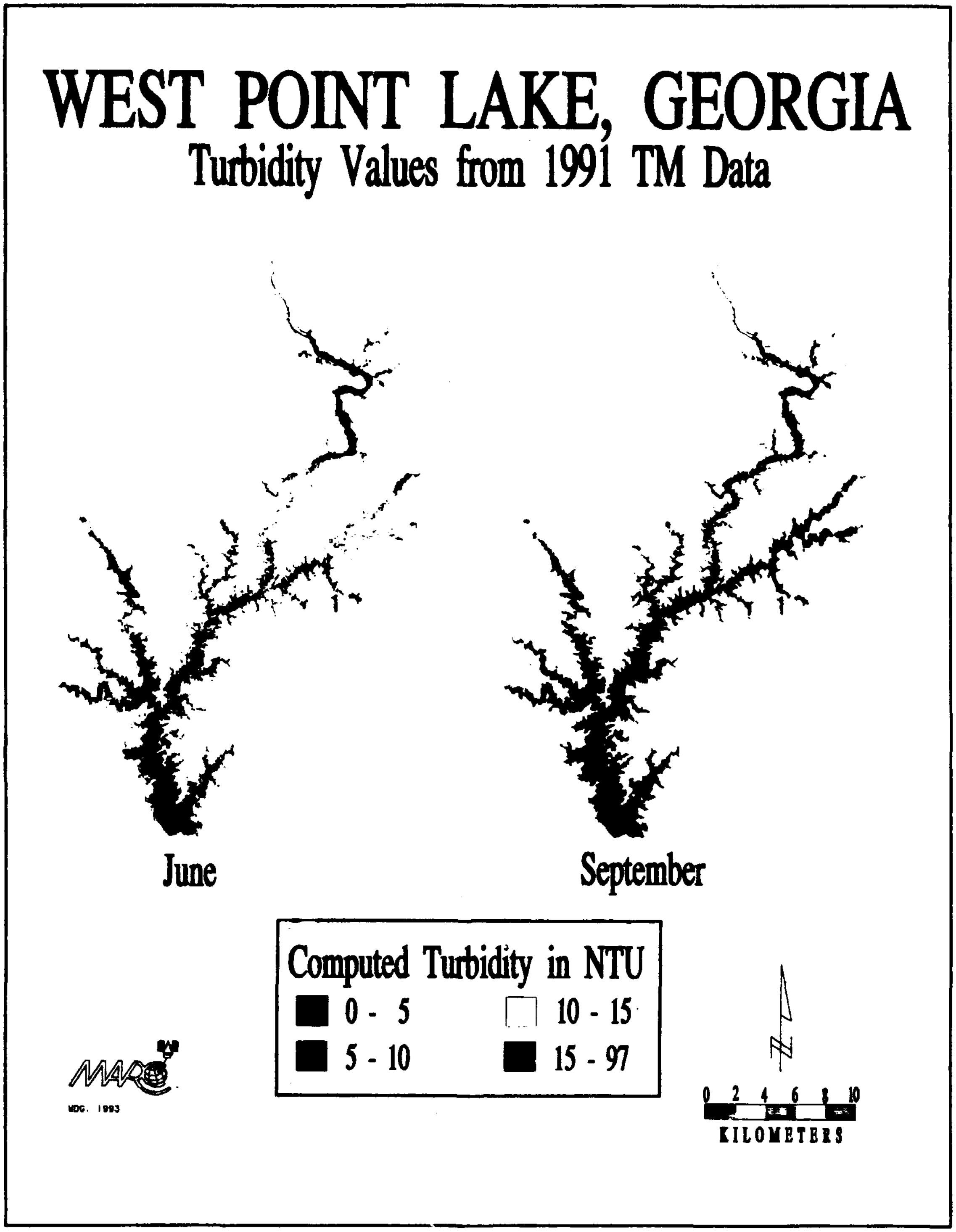


Figure 17. Distribution of computed surface water turbidity for June 8 and September 28, 1991. Based on TM data.

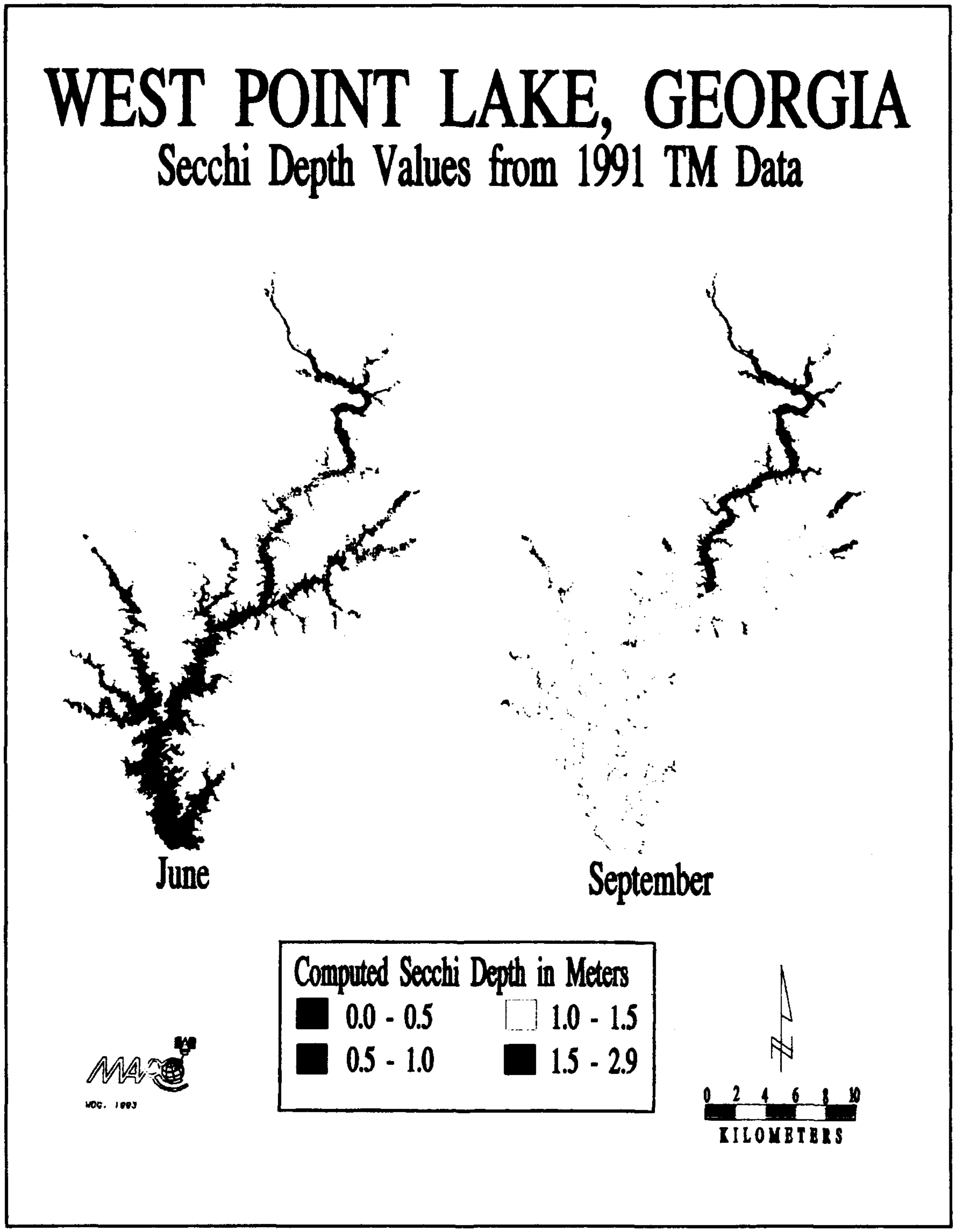


Figure 18. Distribution of computed Secchi disk transparencies for June 8 and September 28, 1991. Based on TM data.

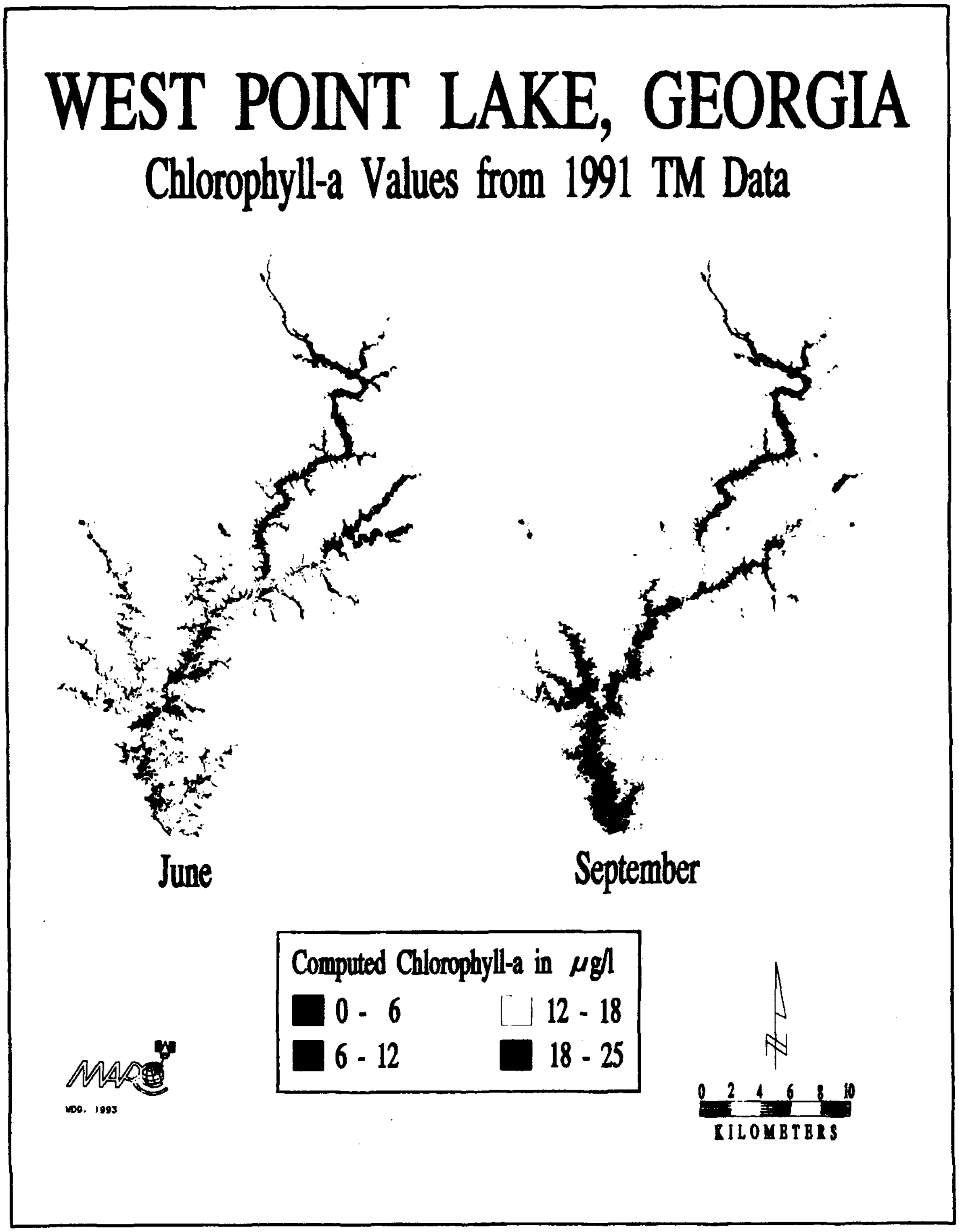


Figure 19. Distribution of computed surface chlorophyll α concentrations for June 8 and September 28, 1991. Based on TM data.

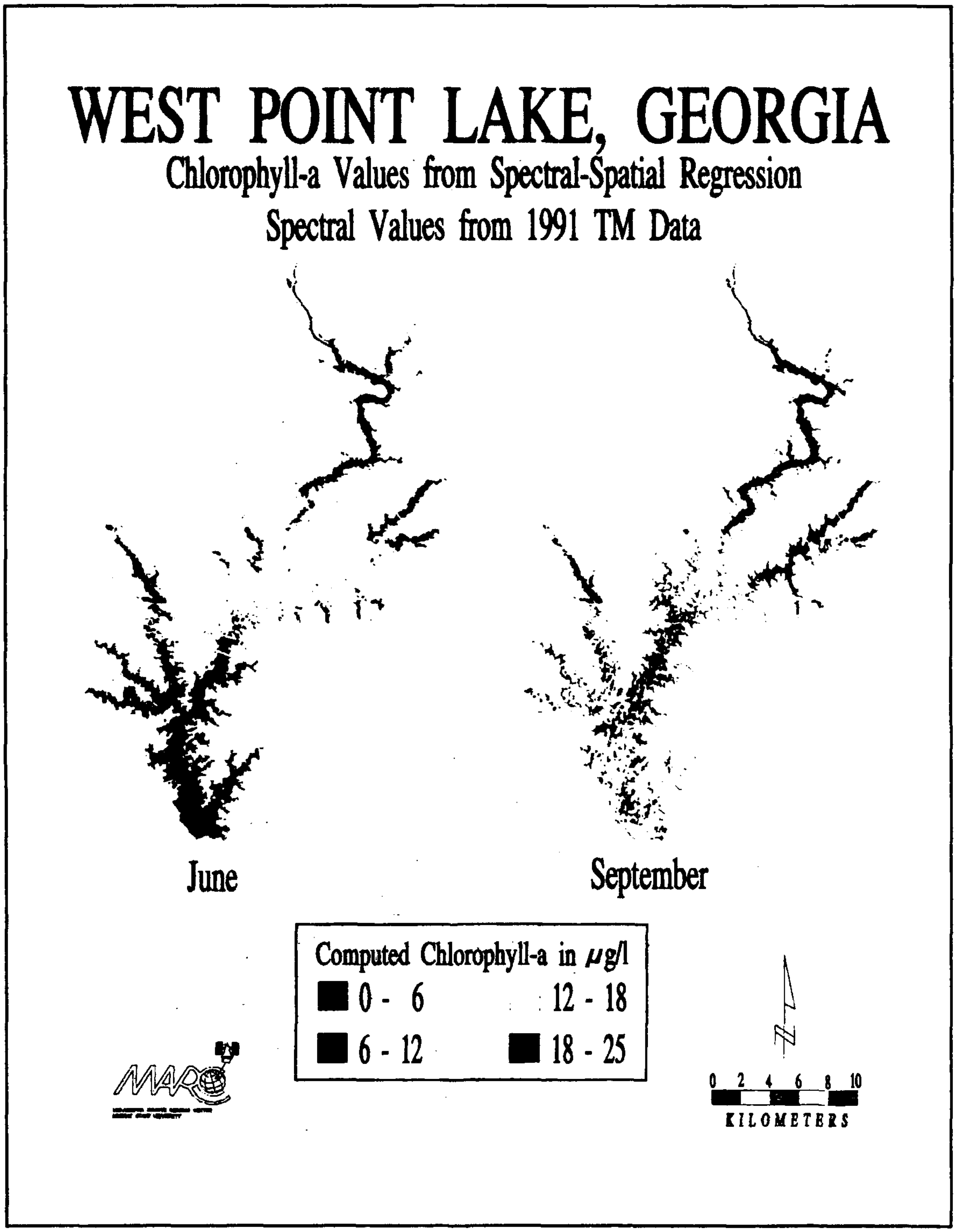


Figure 20. Distribution of surface chlorophyll α concentrations for June 8 and September 28, 1991, computed using a spectral/spatial regression approach. Based on TM data.

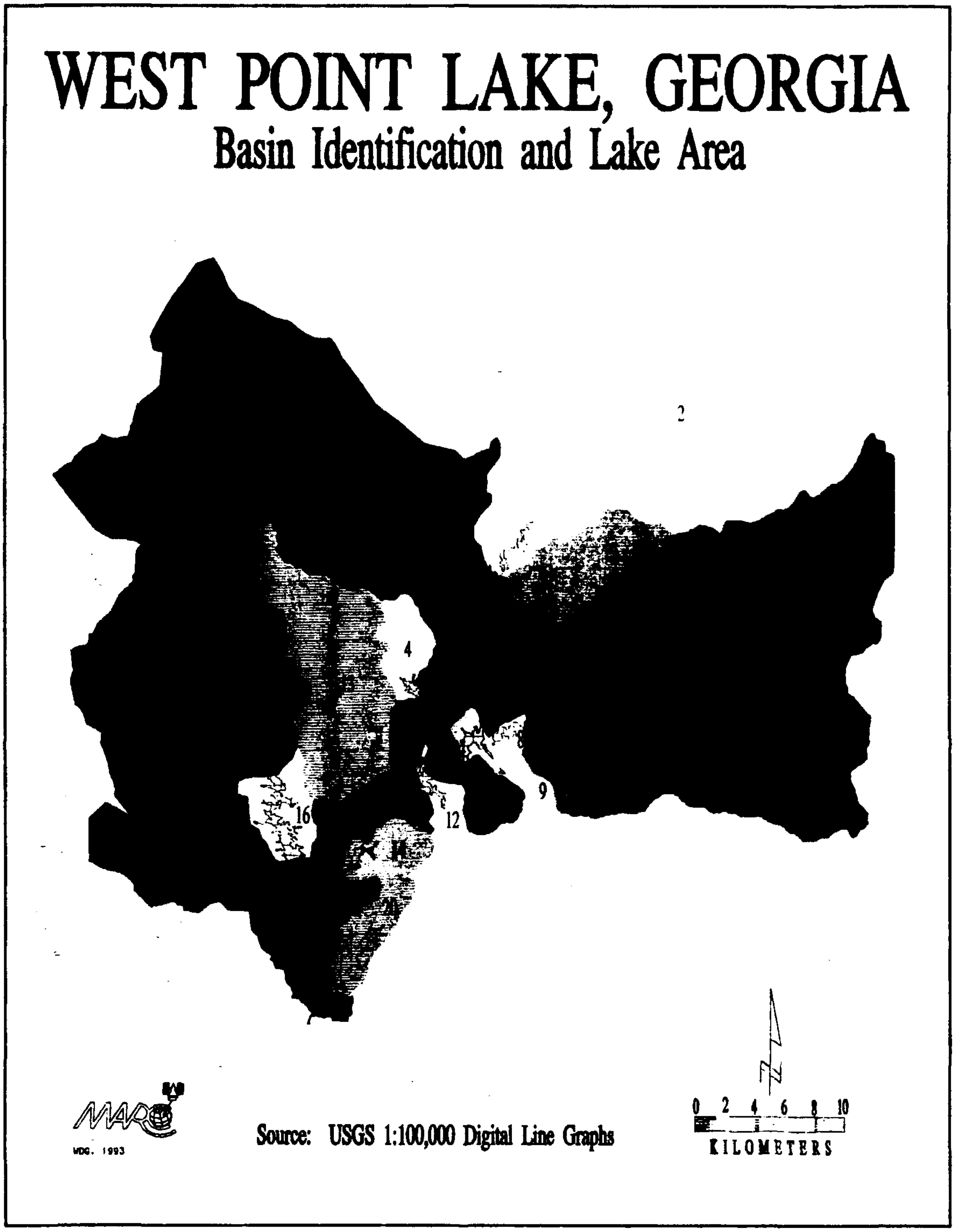


Figure 21. Map of sub-watershed basins identified from hypsographic information.

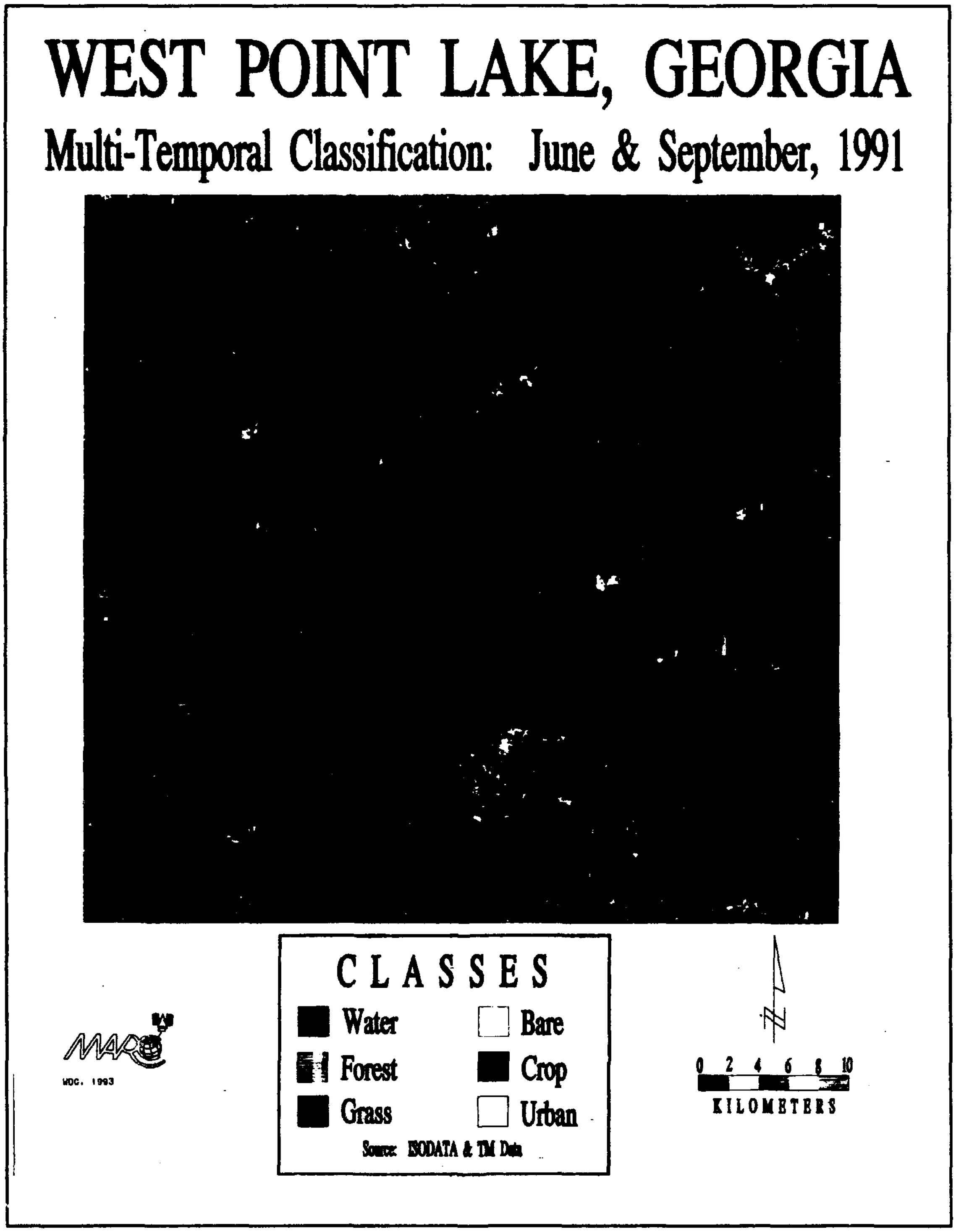


Figure 22. Land cover distributions derived from multi-temporal, multi-spectral TM data.

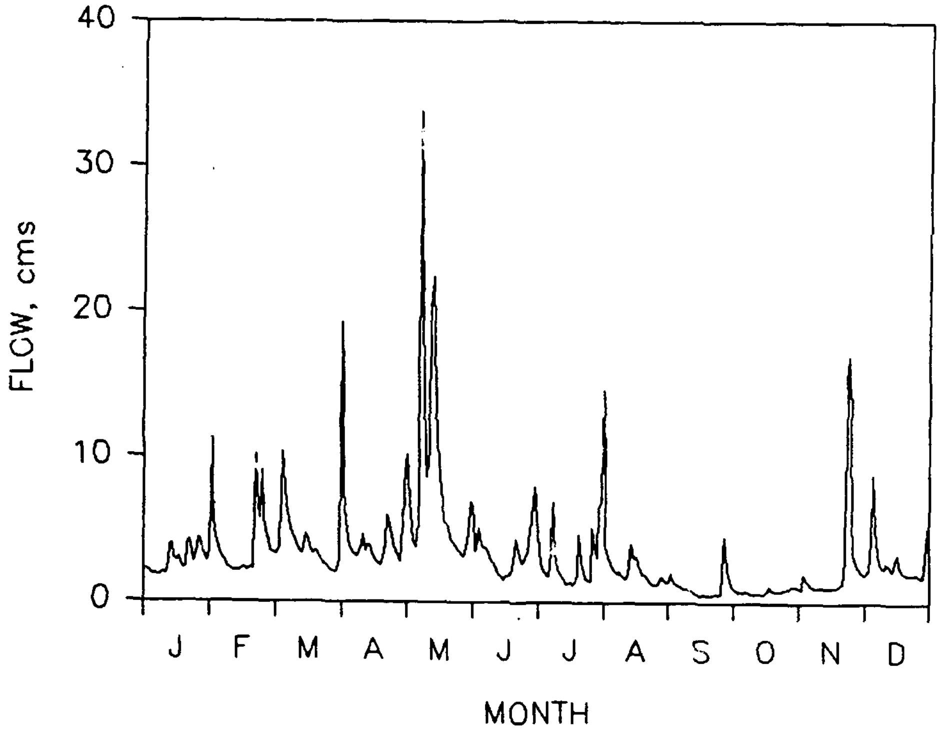


Figure 23. Computed discharge hydrograph for Yellowjacket Creek for 1991. Based on flows for New River for the same period.

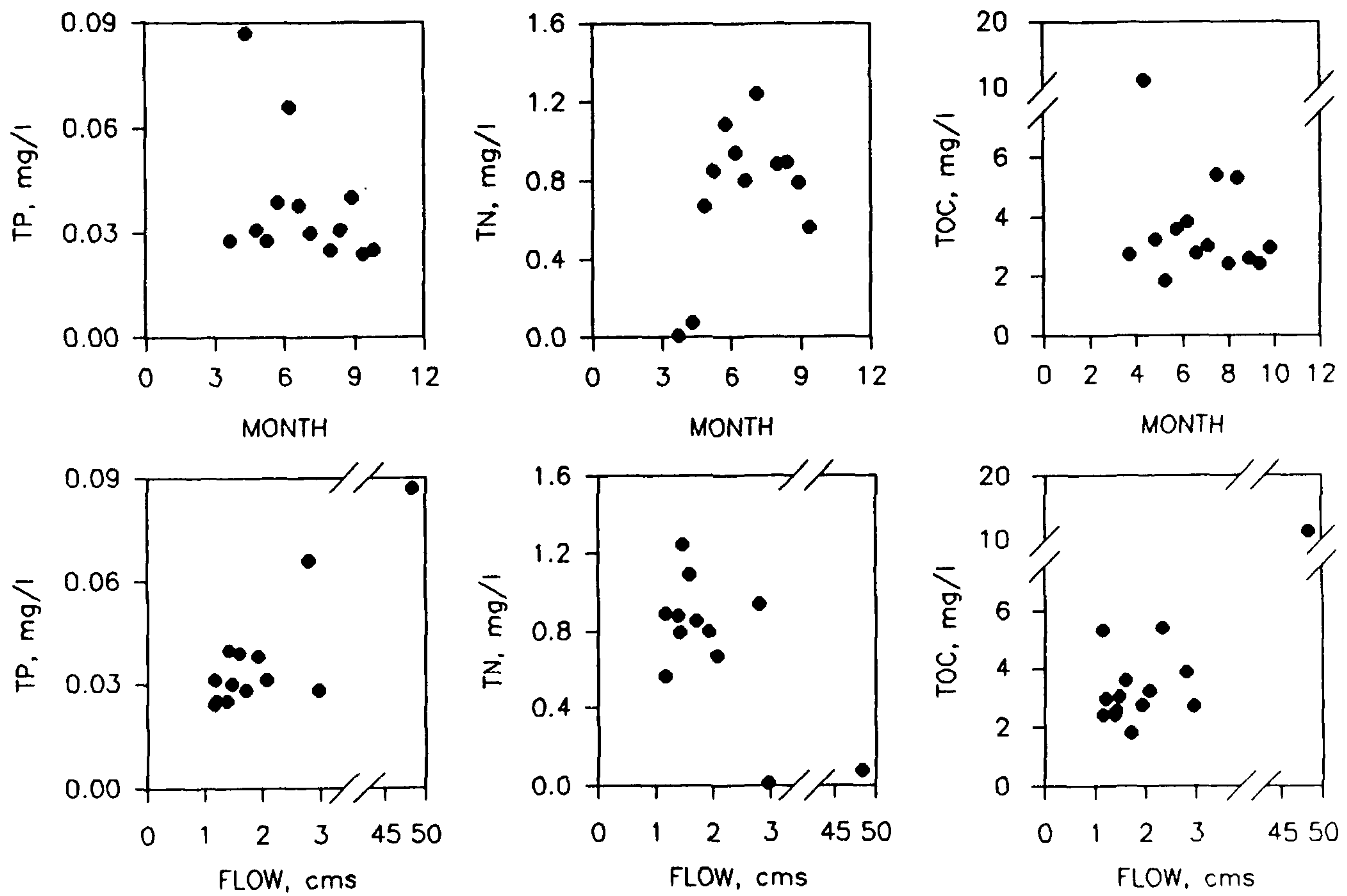


Figure 24. Seasonal (upper) and flow-related (lower) changes in total phosphorus (TP), total nitrogen TN), and total organic carbon (TOC) for Yellowjacket Creek for 1991.

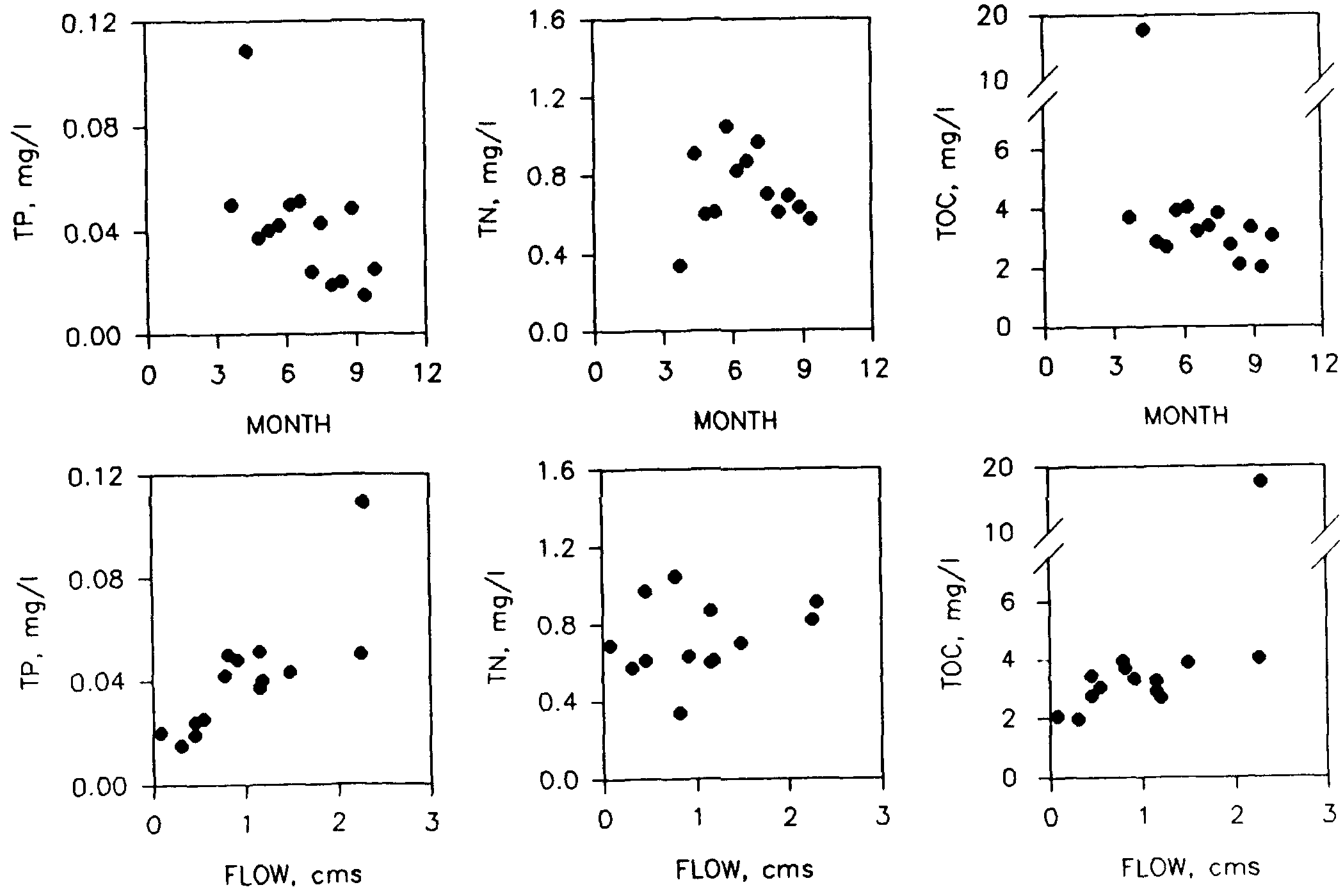


Figure 25. Seasonal (upper) and flow-related (lower) changes in total phosphorus (TP), total nitrogen TN), and total organic carbon (TOC) for Beech Creek for 1991.

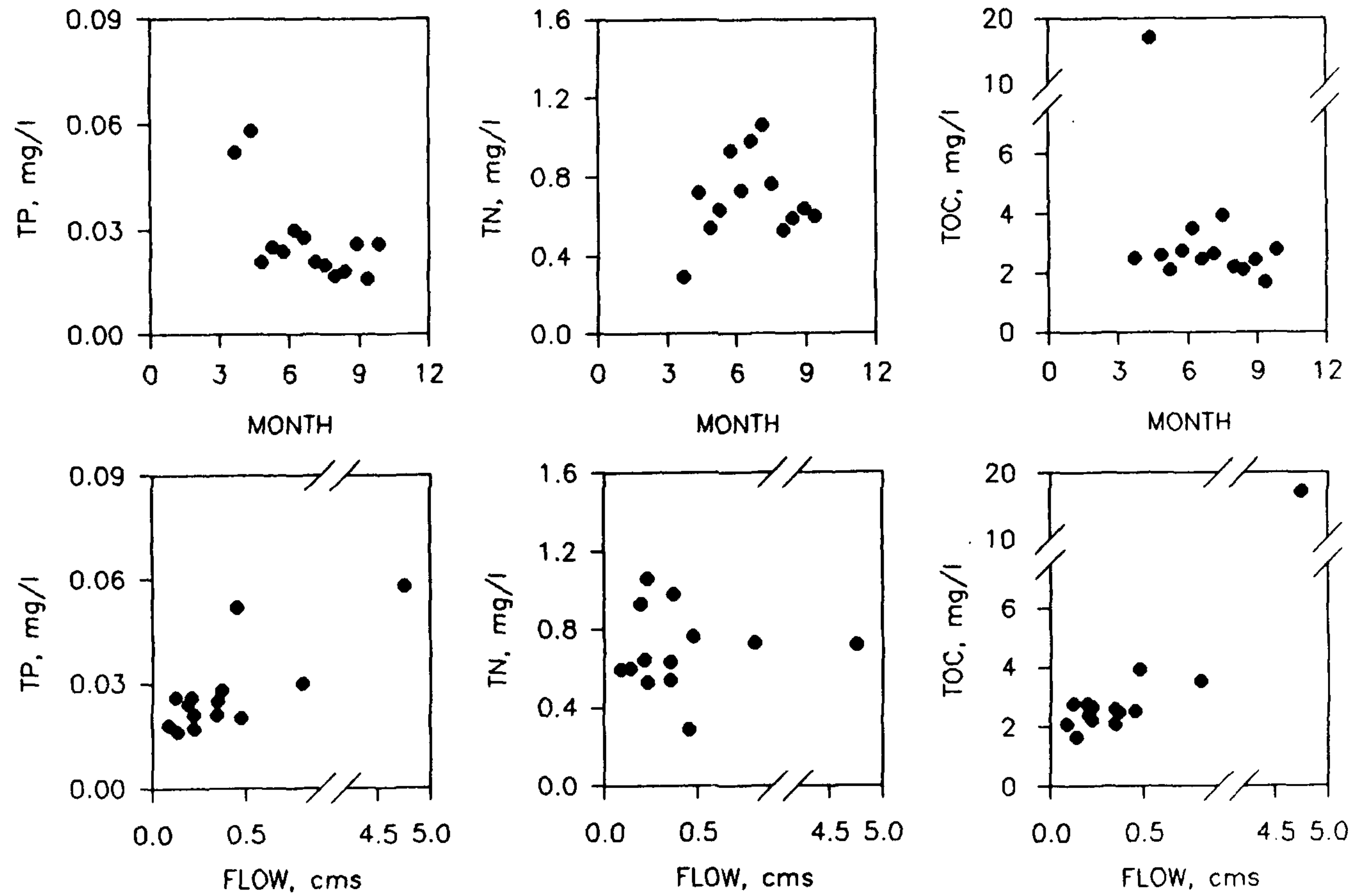


Figure 26. Seasonal (upper) and flow-related (lower) changes in total phosphorus (TP), total nitrogen TN), and total organic carbon (TOC) for Shoal Creek for 1991.

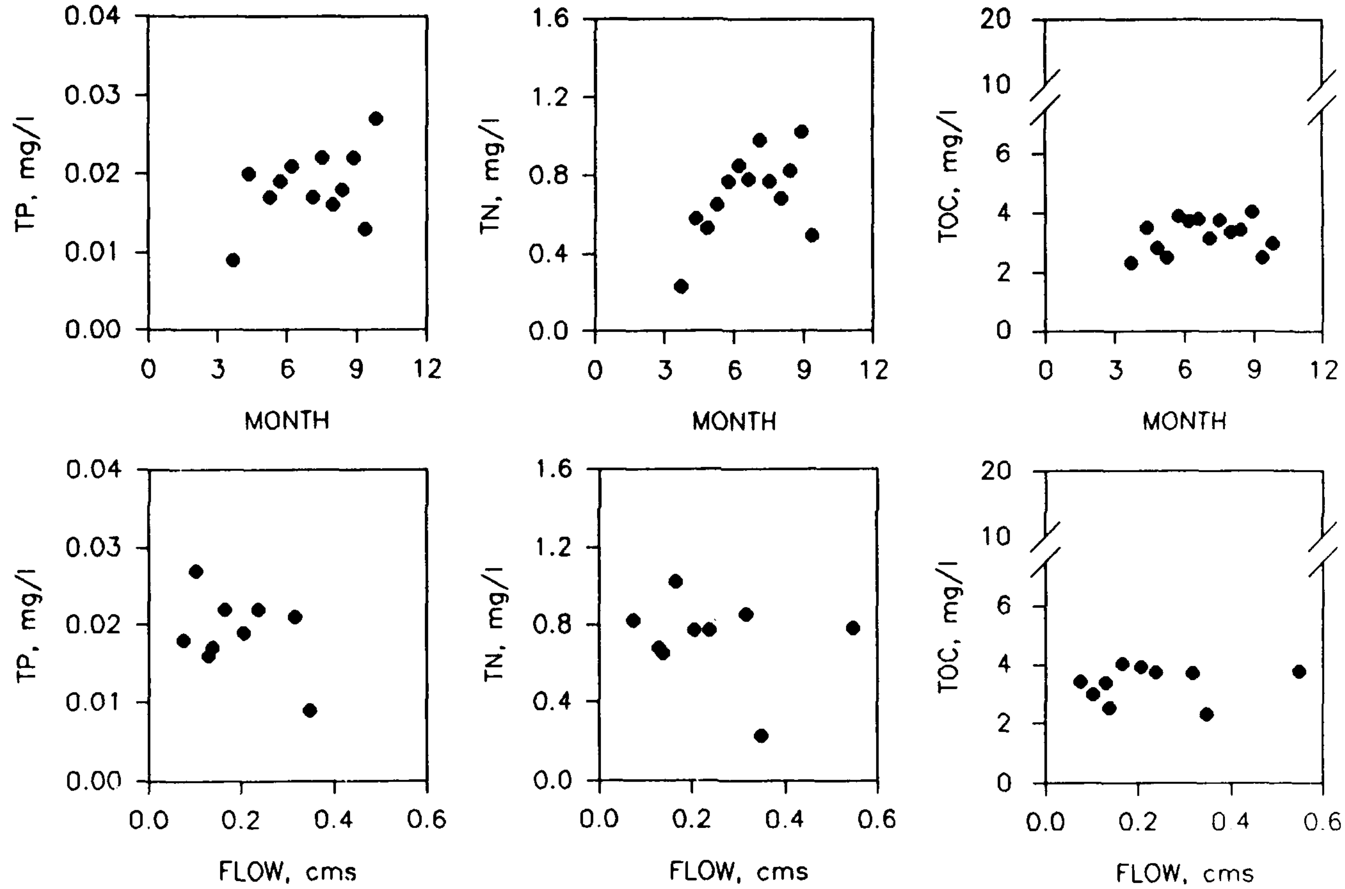


Figure 27. Seasonal (upper) and flow-related (lower) changes in total phosphorus (TP), total nitrogen TN), and total organic carbon (TOC) for Whitewater Creek for 1991.

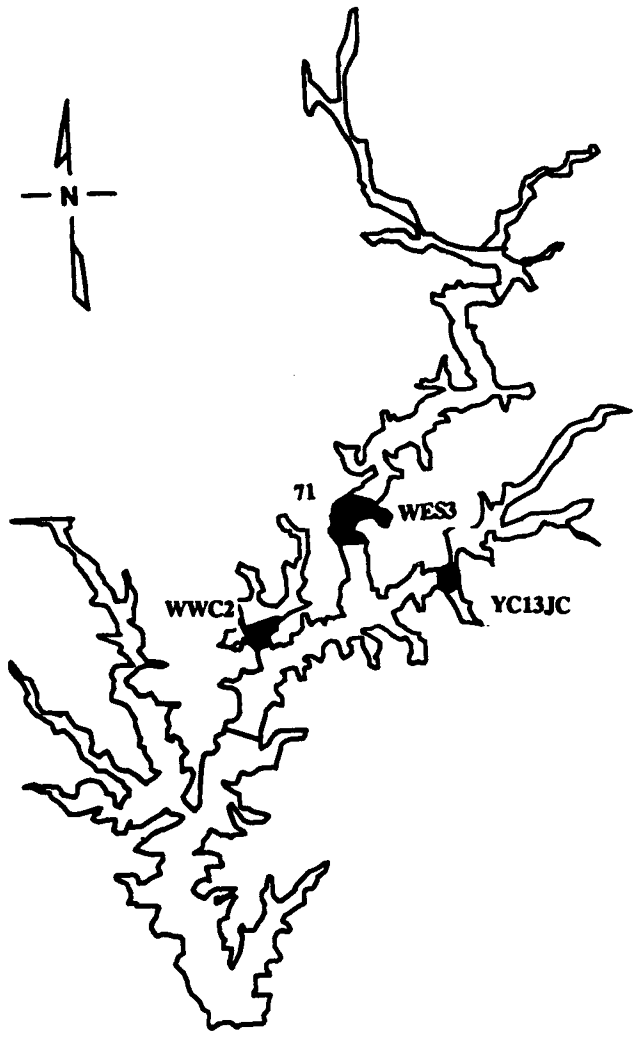


Figure 28. Map of response area sampling sites in West Point Lake.

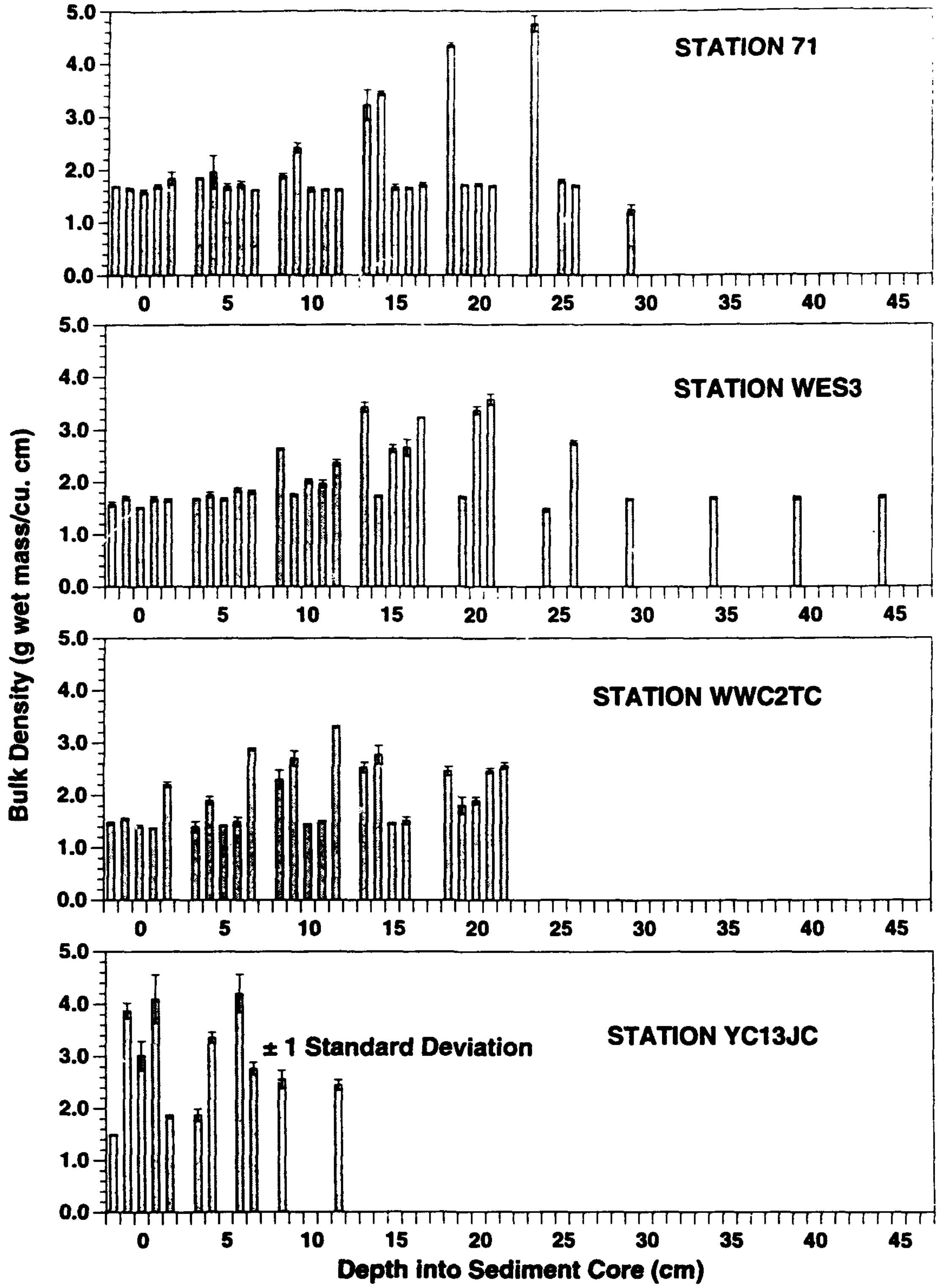


Figure 29. Depth distribution of bulk density for West Point Lake sediment cores.

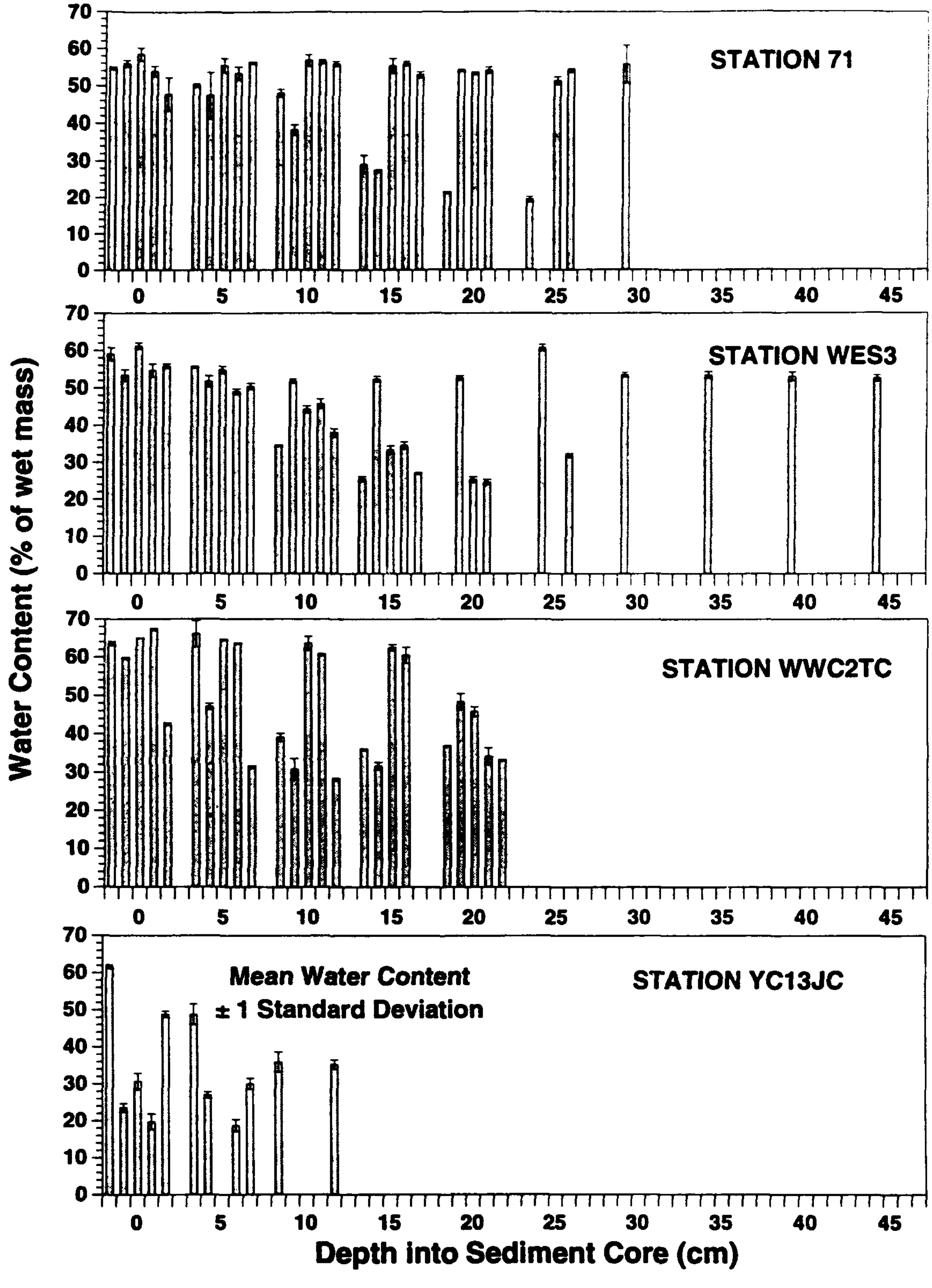


Figure 30. Depth distribution of water content for West Point Lake sediment cores.

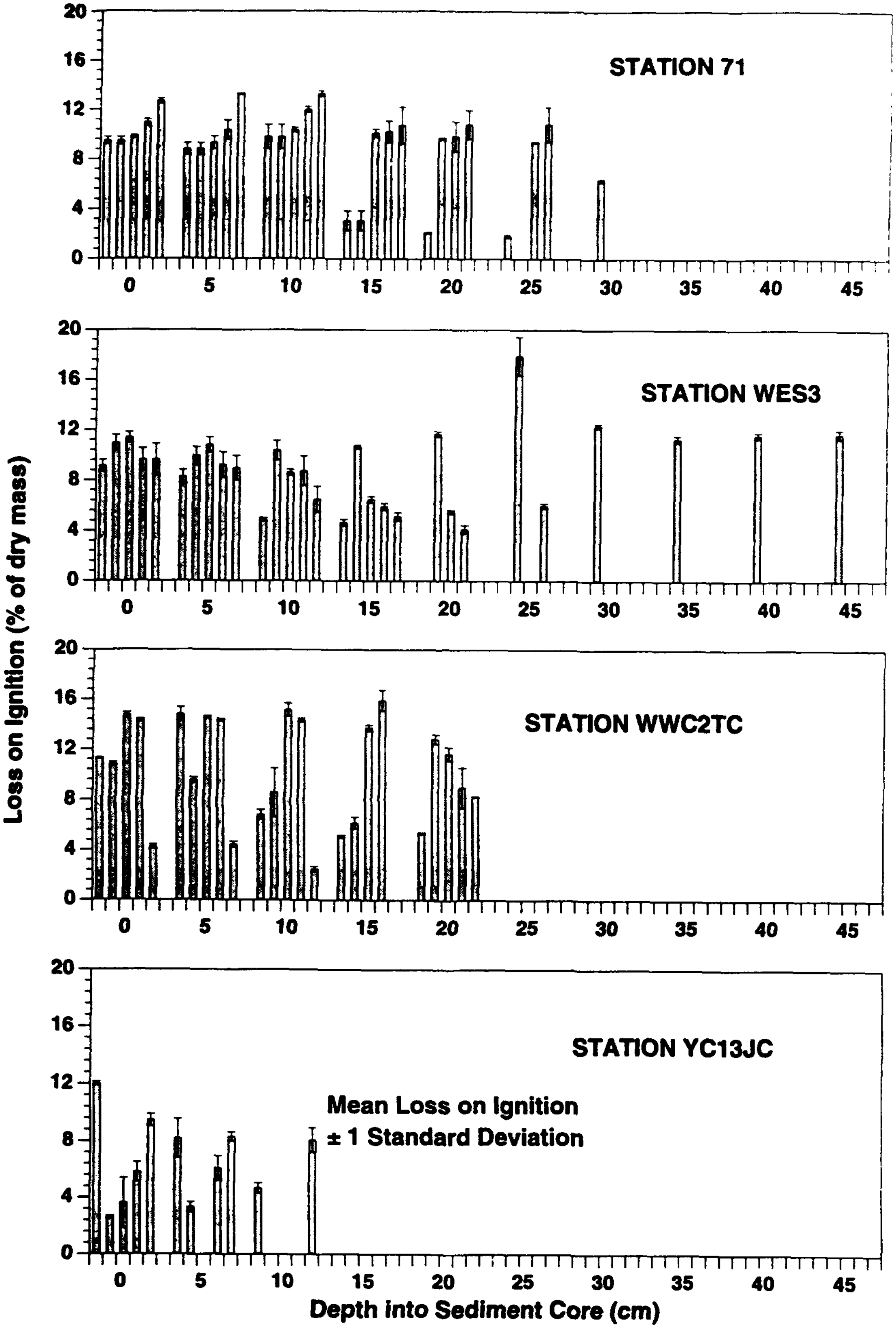


Figure 31. Depth distribution of organic content (loss on ignition) for West Point Lake sediment cores.

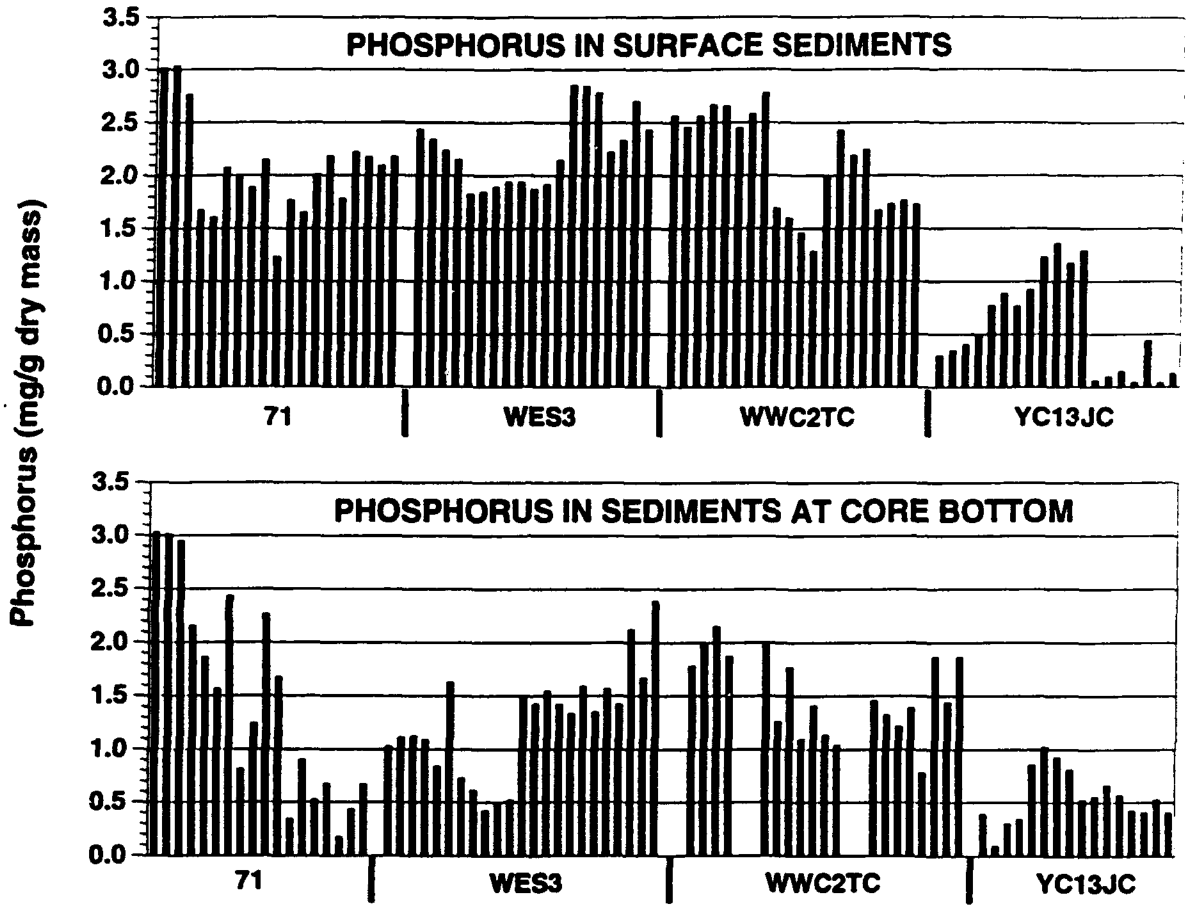


Figure 32. Phosphorus content of sediment removed from the surface (upper) and bottom (lower) of cores collected at each sampling site.

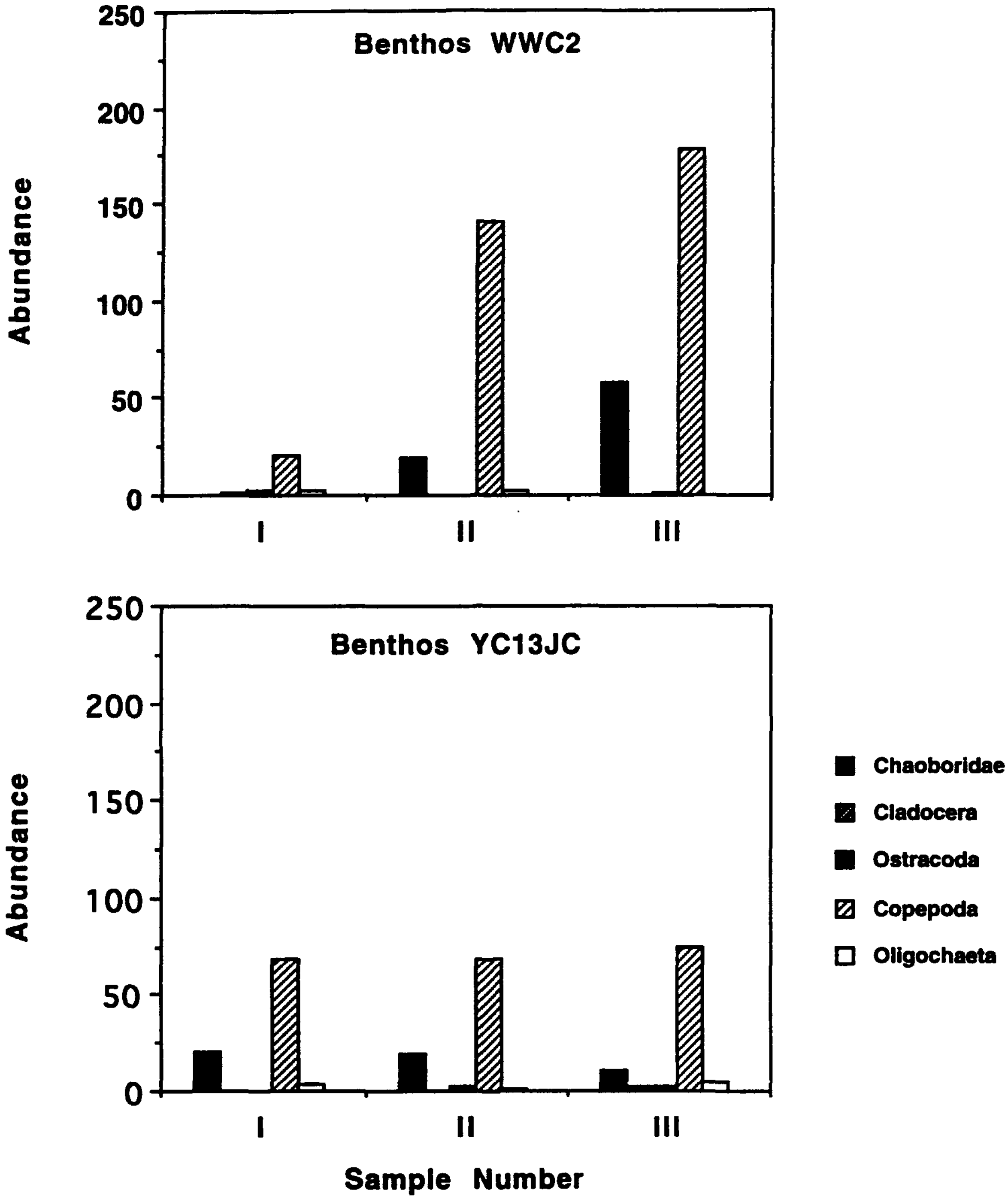


Figure 33. Abundances of major groups of benthic organisms at stations WWC2TC and YC13JC in West Point Lake. Sample number identifies results of replicate samples.

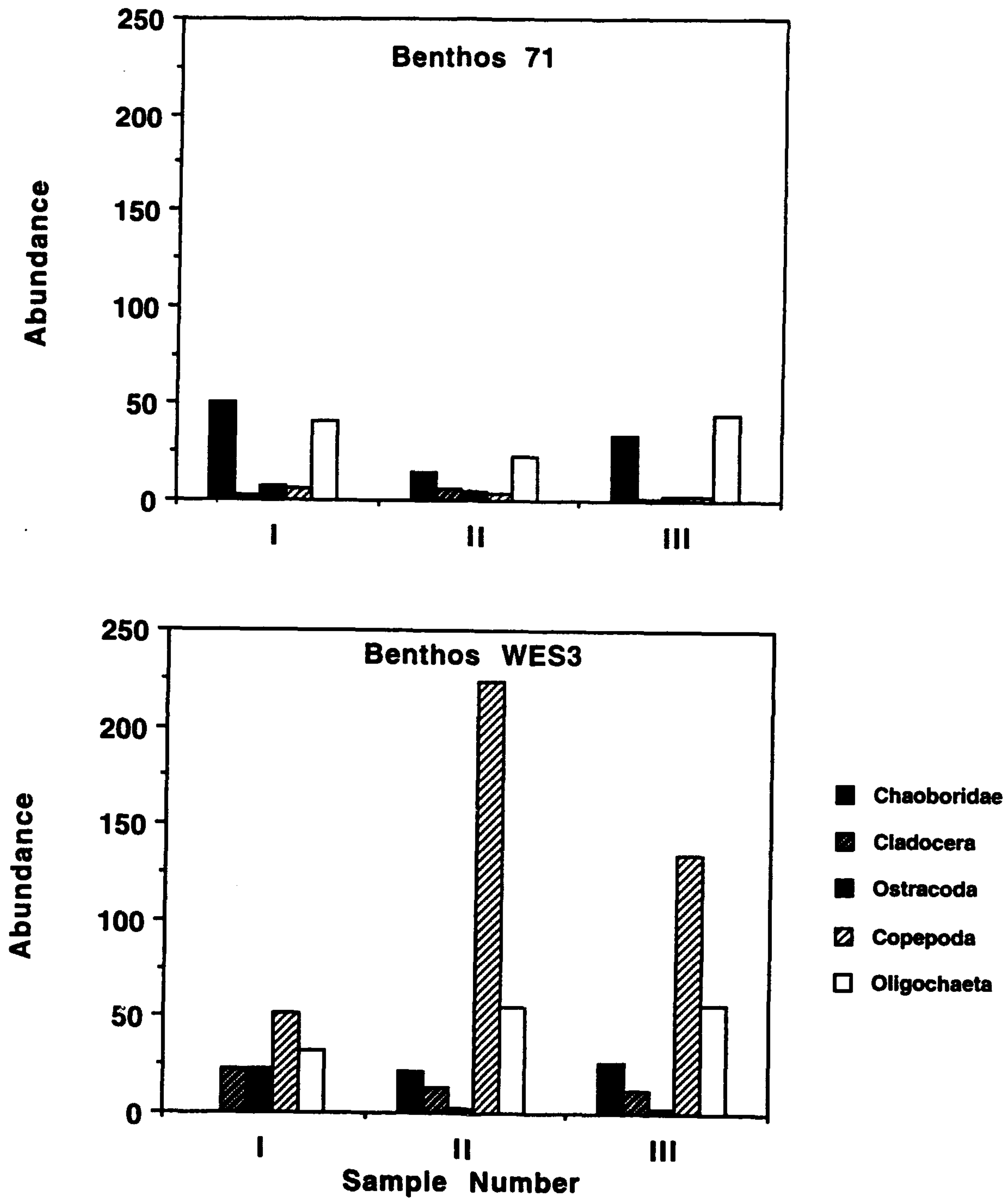


Figure 34. Abundances of major groups of benthic organisms at stations 71 and WES3 in West Point Lake. Sample number identifies results of replicate samples.

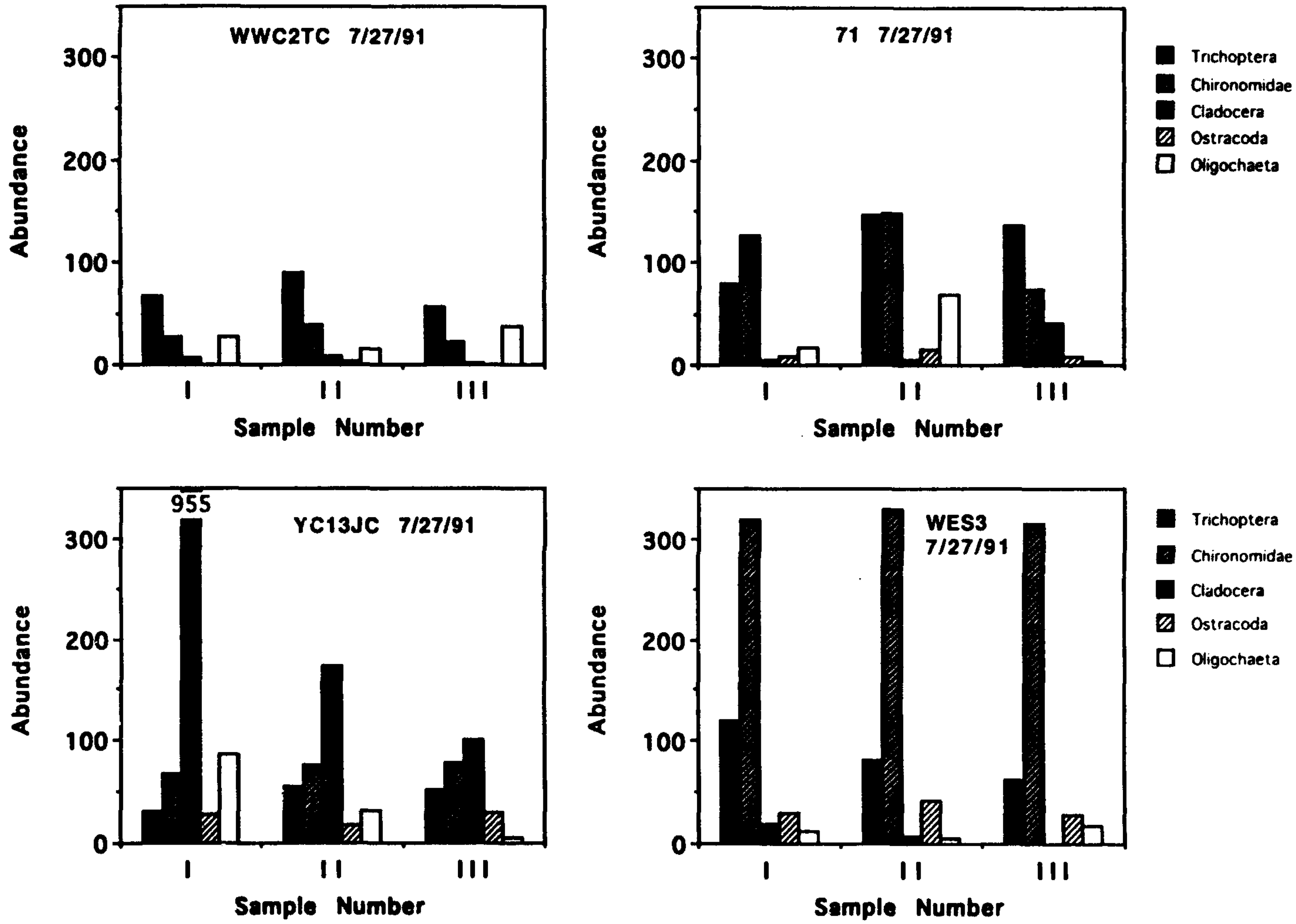


Figure 35. Abundances of selected groups of invertebrates colonizing artificial substrates deployed at stations WWC2TC, 71, YC13JC and WES3, and sampled July 27, 1991. Sample number identifies results of replicate samples.

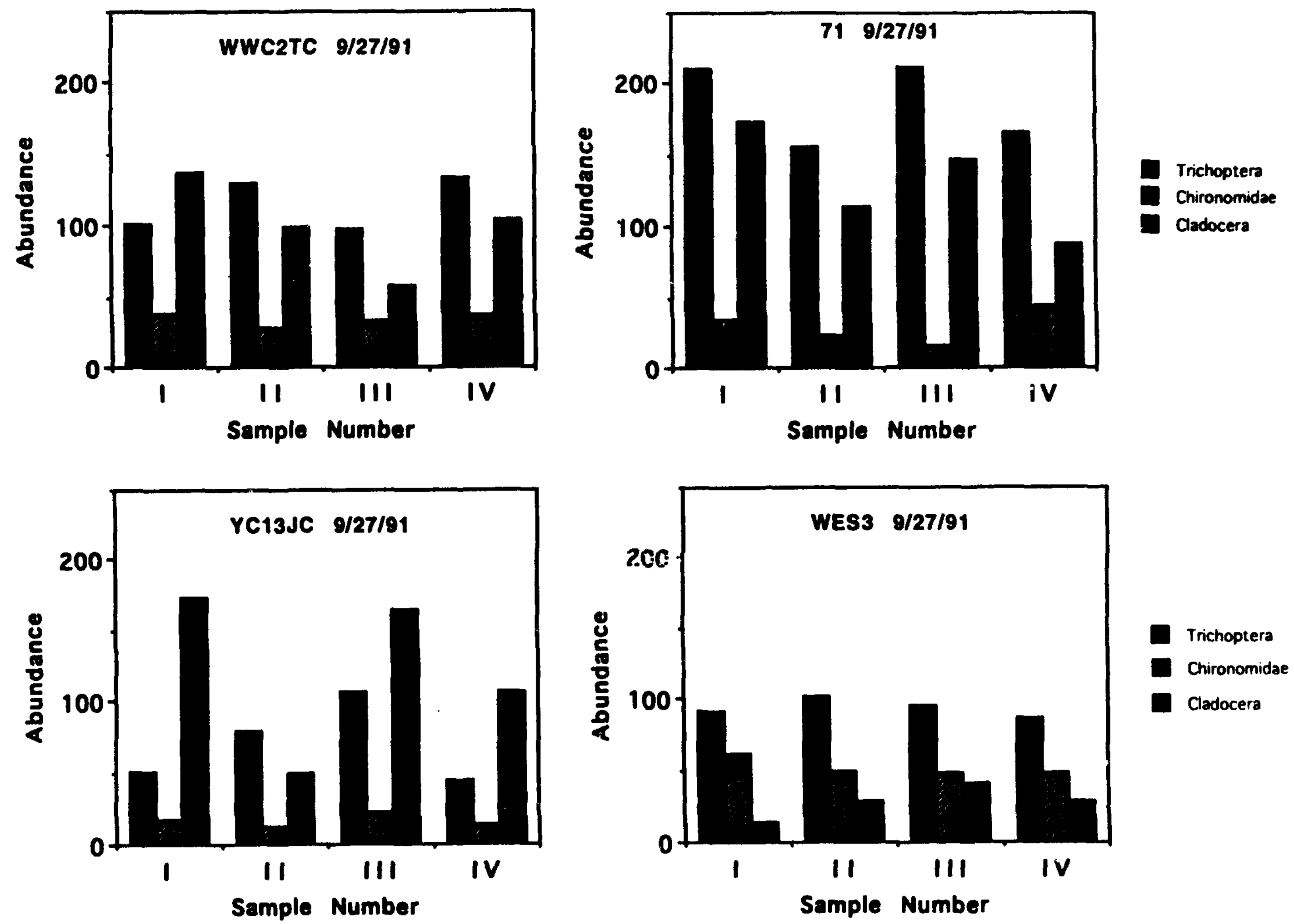


Figure 36. Abundances of selected groups of invertebrates colonizing artificial substrates deployed at stations WWC2TC, 71, YC13JC and WES3, and sampled July 27, 1991. Sample number identifies results of replicate samples.

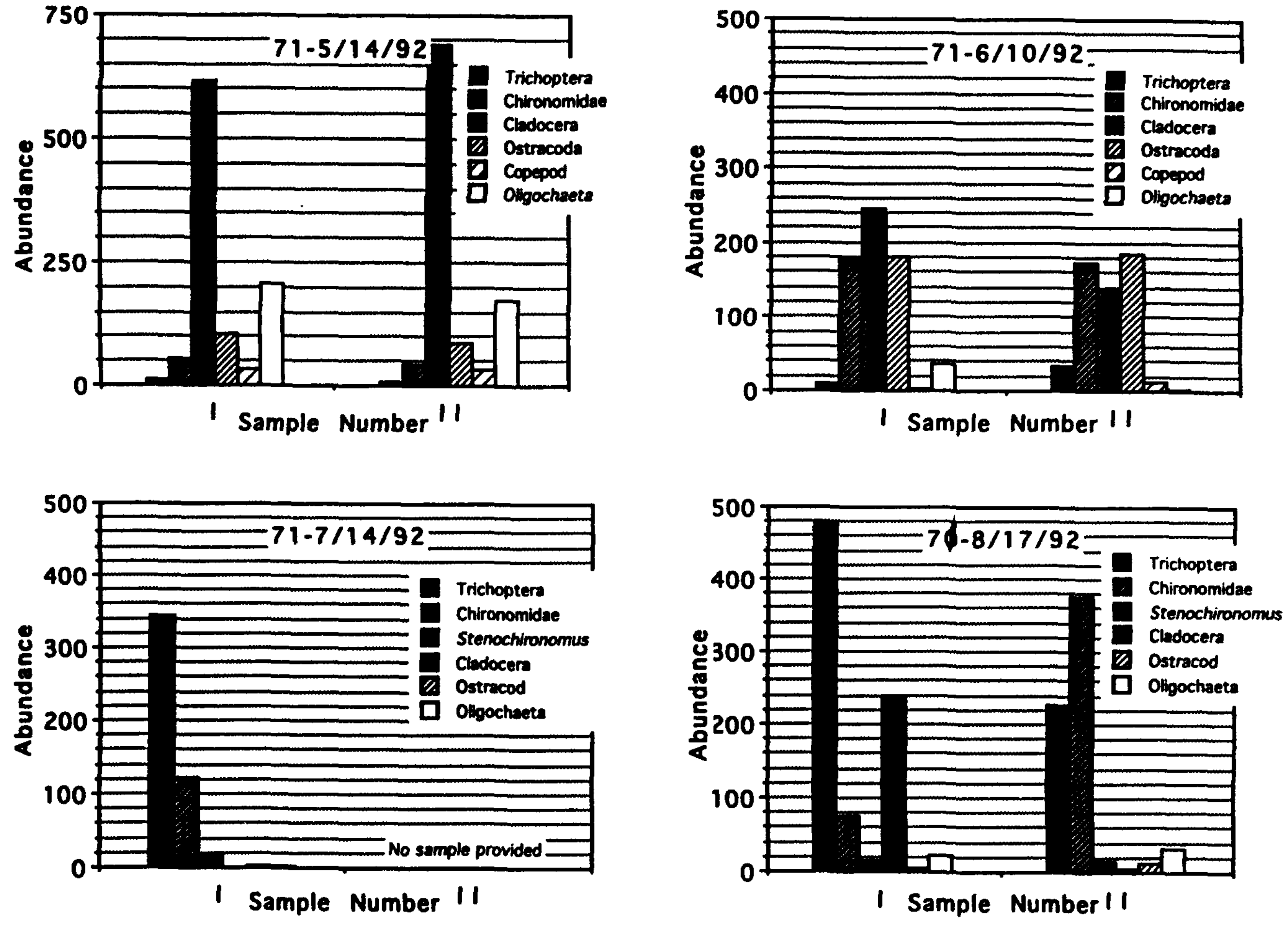


Figure 37. Abundances of major groups of invertebrates colonizing artificial substrates deployed at station 71 and sampled on selected dates in 1992. Sample number identifies results of replicate samples.

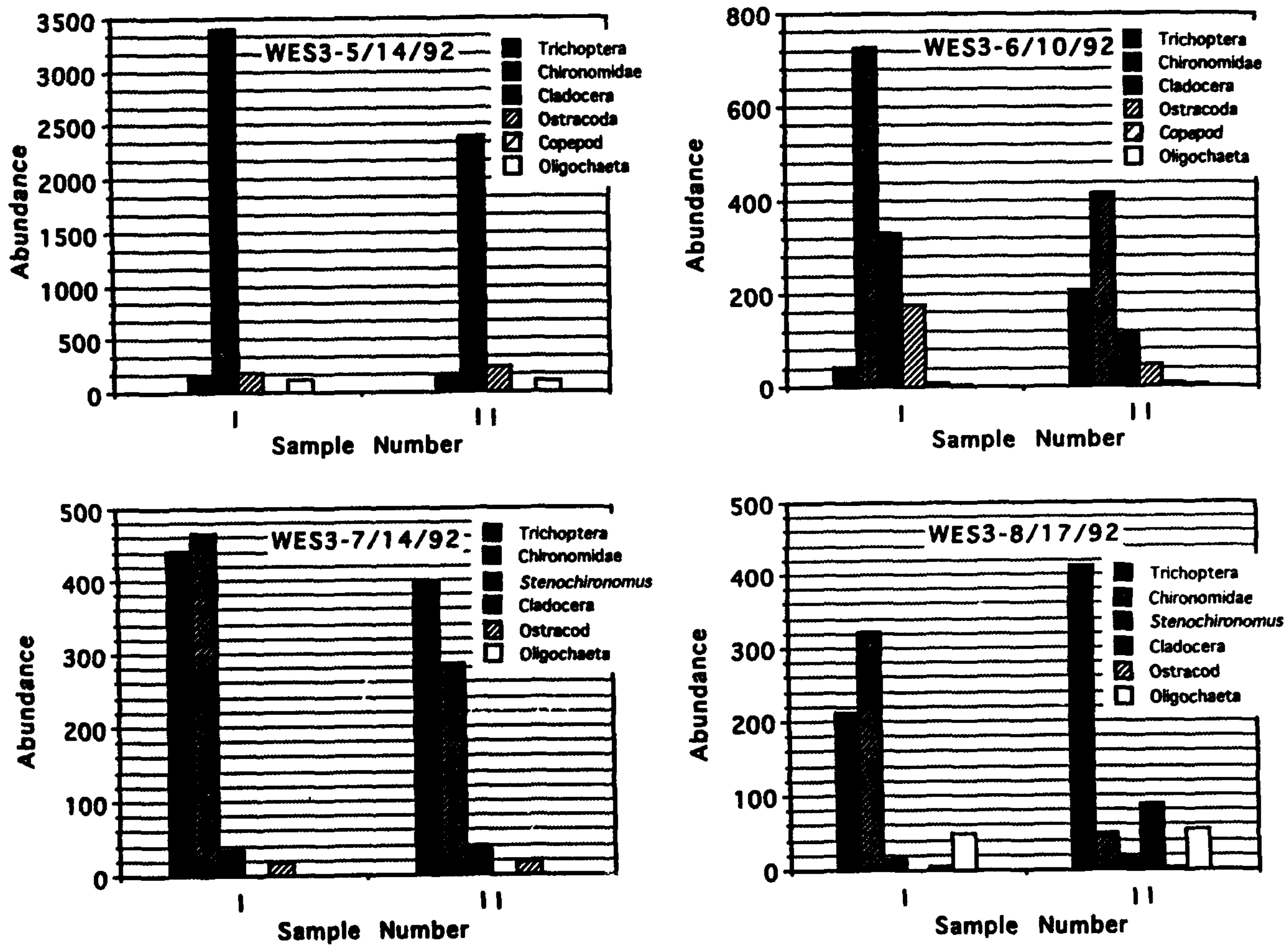


Figure 38. Abundances of major groups of invertebrates colonizing artificial substrates deployed at station WES3 and sampled on selected dates in 1992. Sample number identifies results of replicate samples.

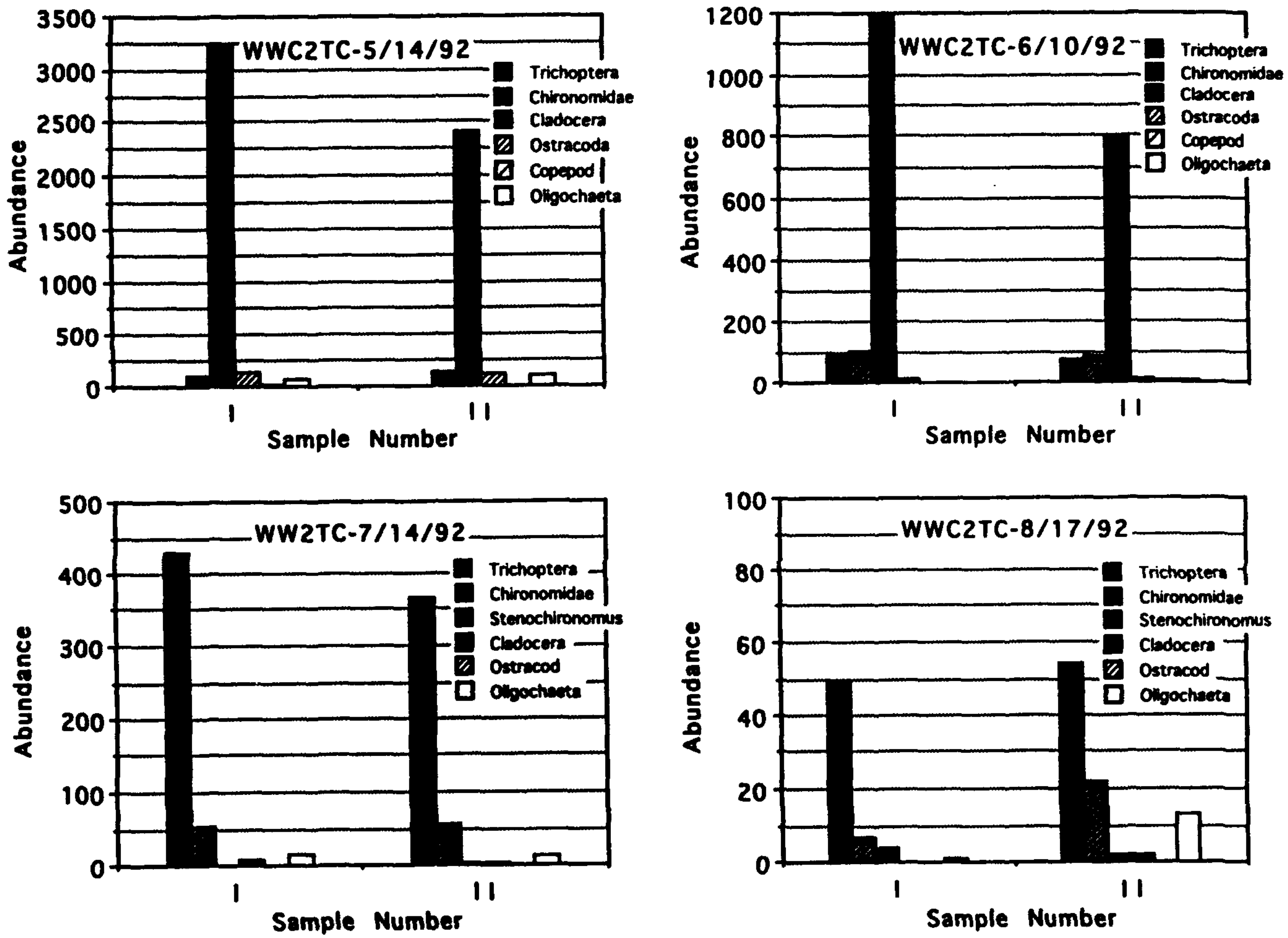
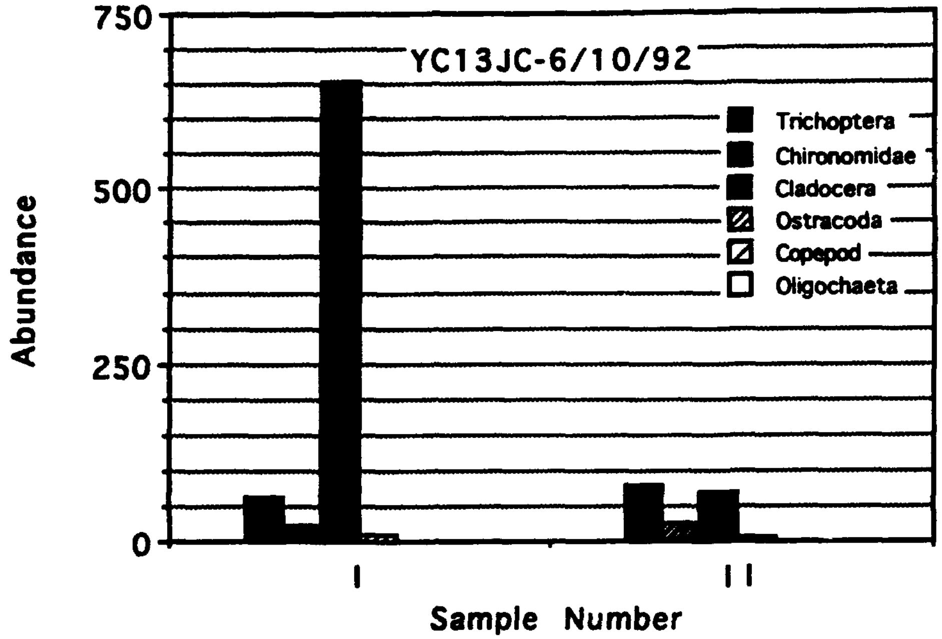


Figure 39. Abundances of major groups of invertebrates colonizing artificial substrates deployed at station WWC2TC and sampled on selected dates in 1992. Sample number identifies results of replicate samples.



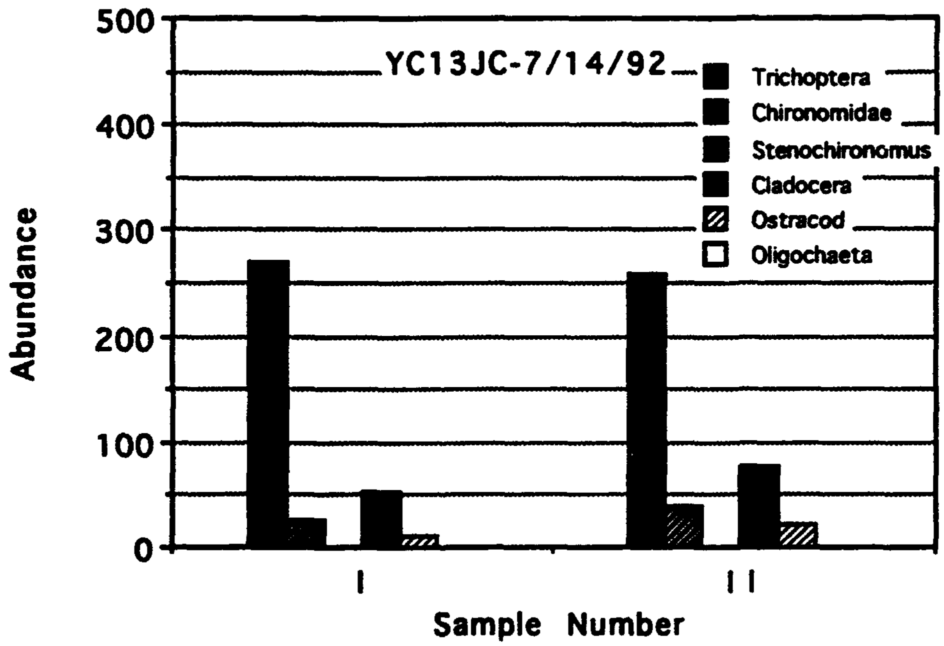


Figure 40. Abundances of major groups of invertebrates colonizing artificial substrates deployed at station YC13JC and sampled on selected dates in 1992. Sample number identifies results of replicate samples.

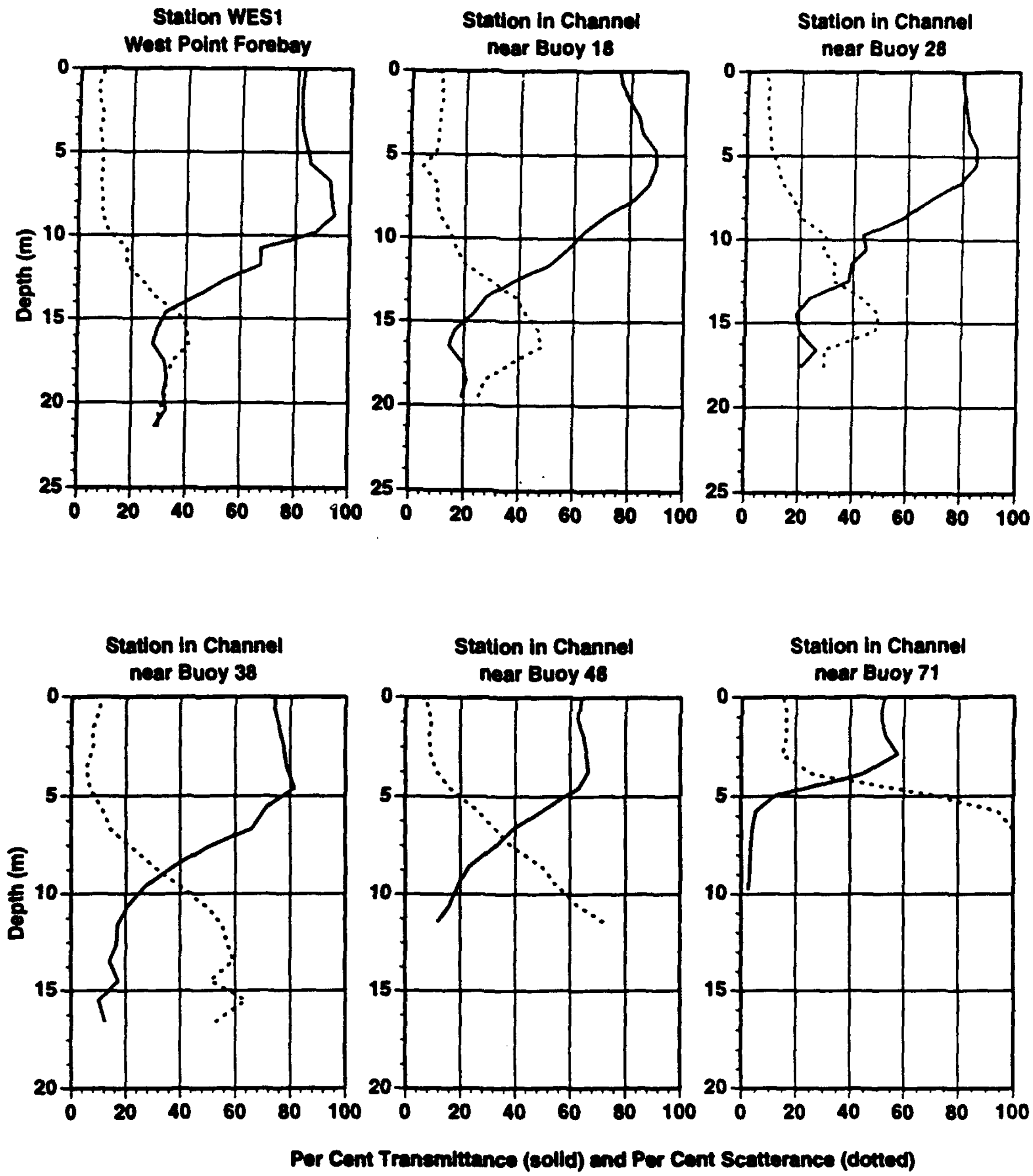


Figure 41. Depth distribution of percent transmittance and scatterance for selected stations in West point Lake. Bouy number increases with increasing distance upstream from the dam and forebay.

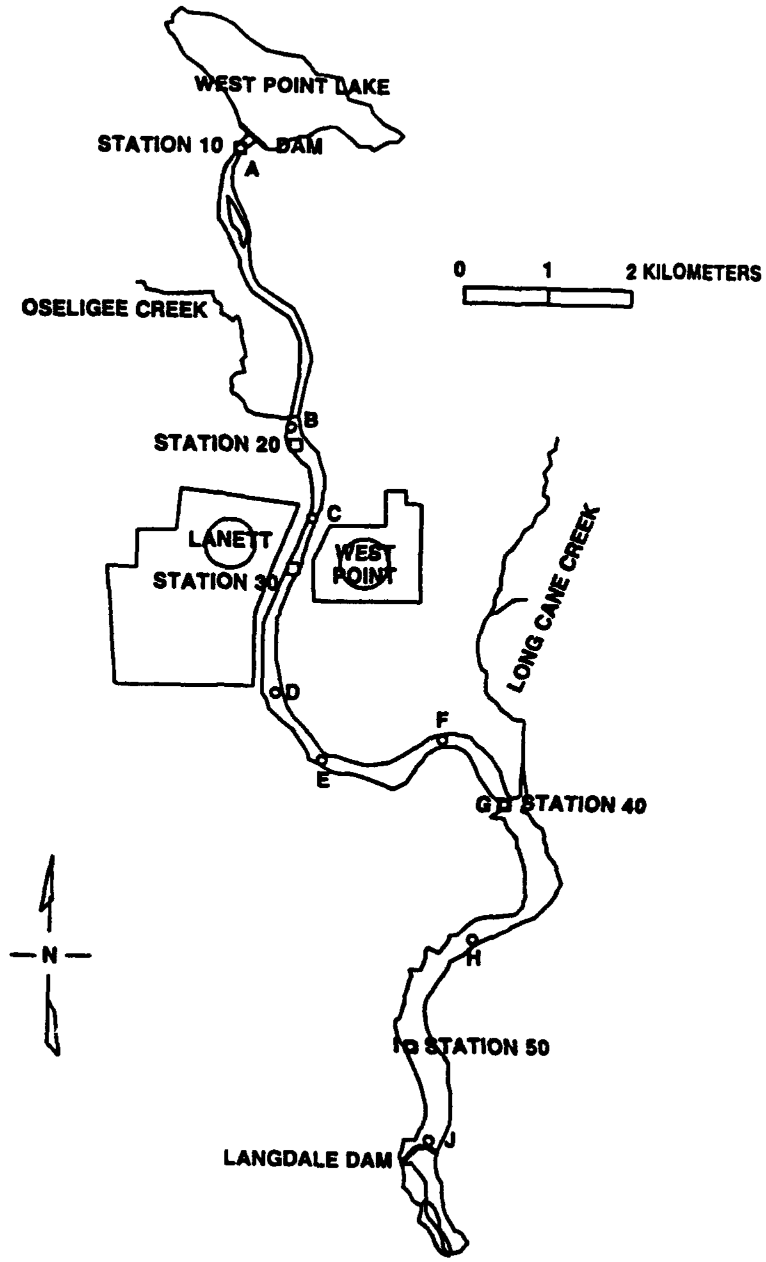


Figure 42. Location of sampling locations in the tailwater area below West Point Dam.

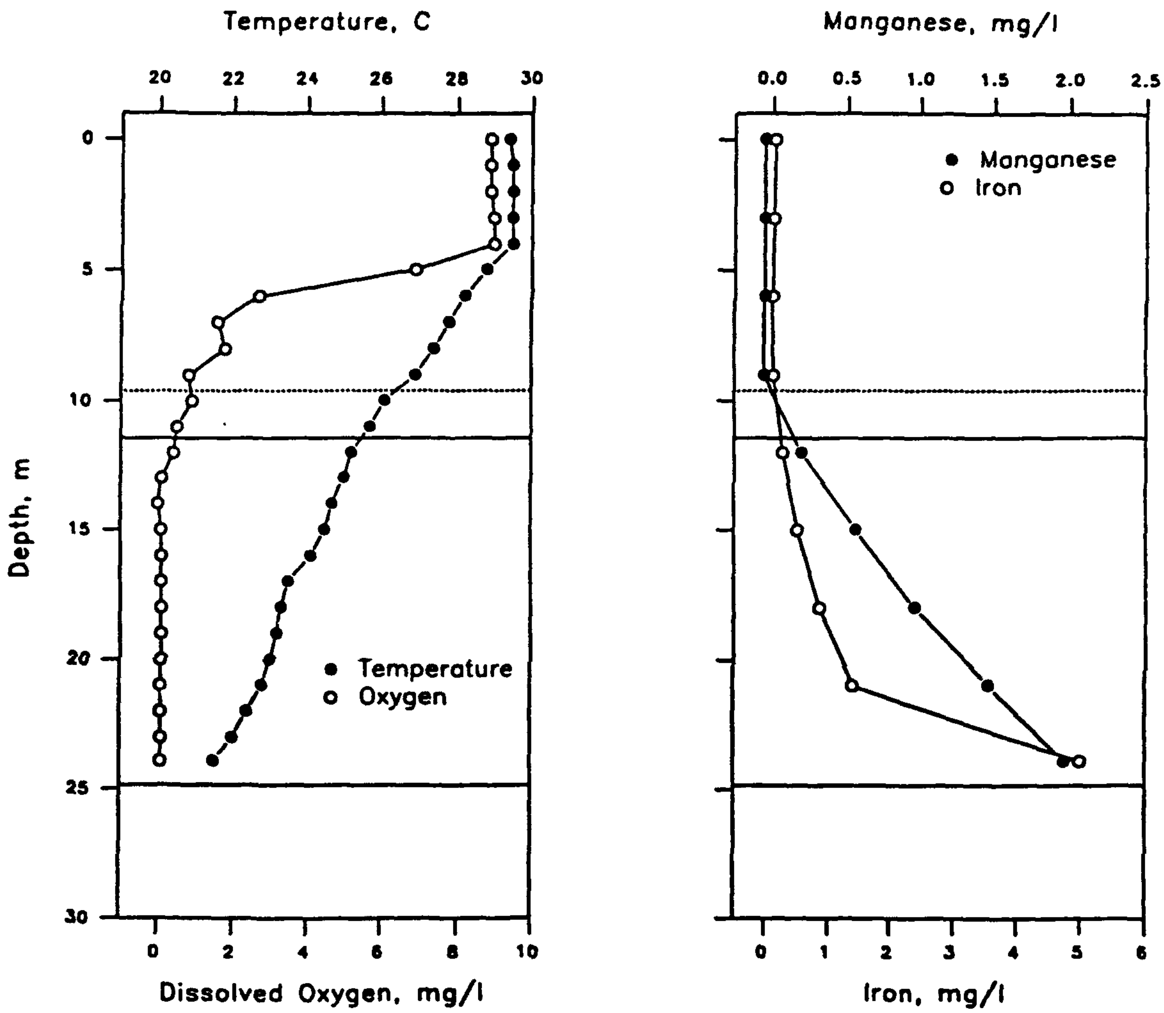


Figure 43. Vertical distribution of temperature, dissolved oxygen, iron, and manganese in the forebay of West Point Lake observed on July 29, 1991. Dashed line approximates the lower limit of withdrawal for the house unit and the upper limit of withdrawal for the main hydropower units.

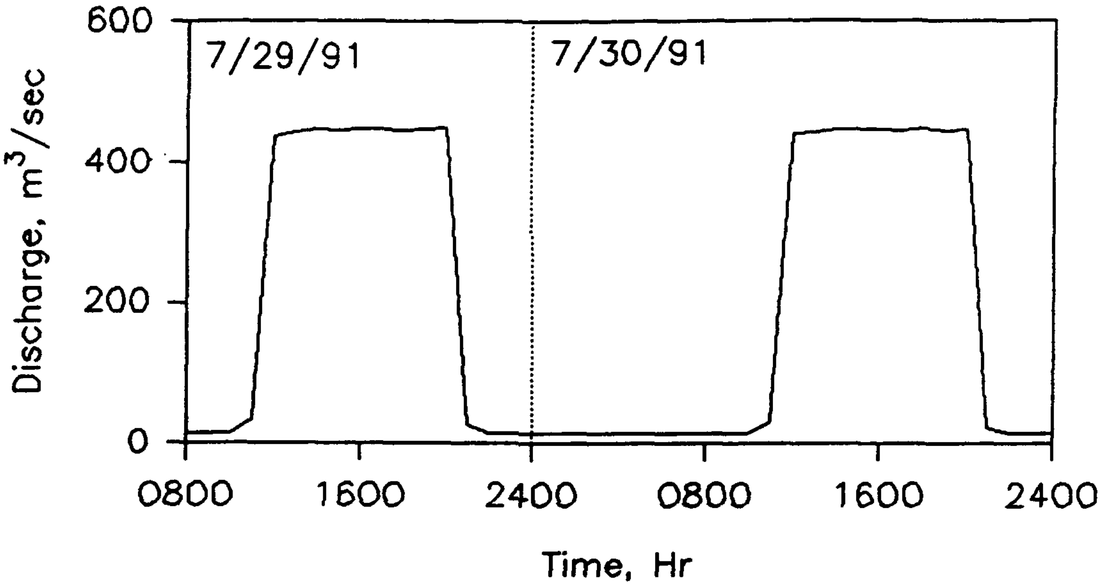


Figure 44. Discharge hydrograph for West Point Dam

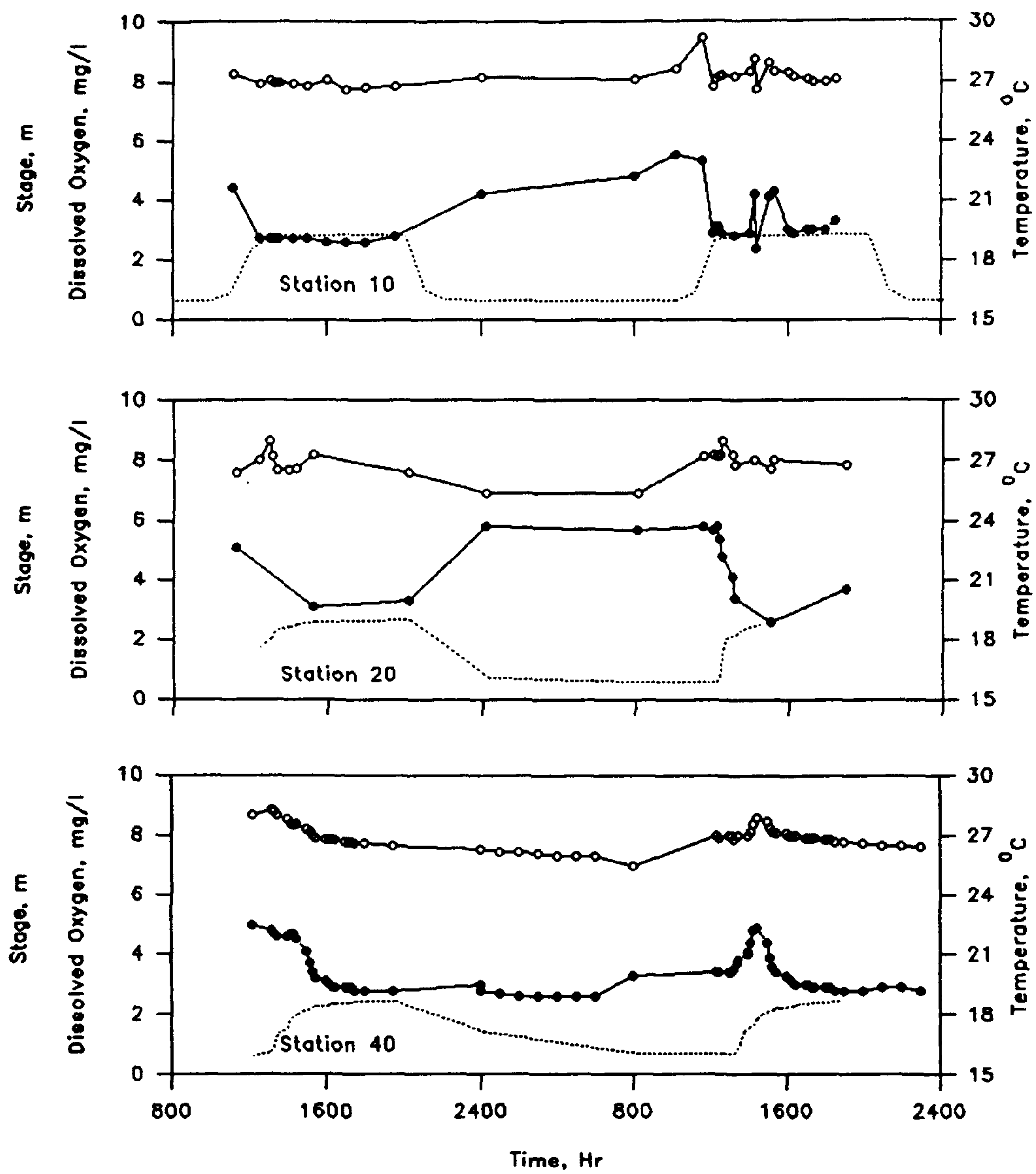


Figure 45. Changes in stage (dashed line), temperature (open circles) and dissolved oxygen (solid circles) at stations 10, 20, and 40.

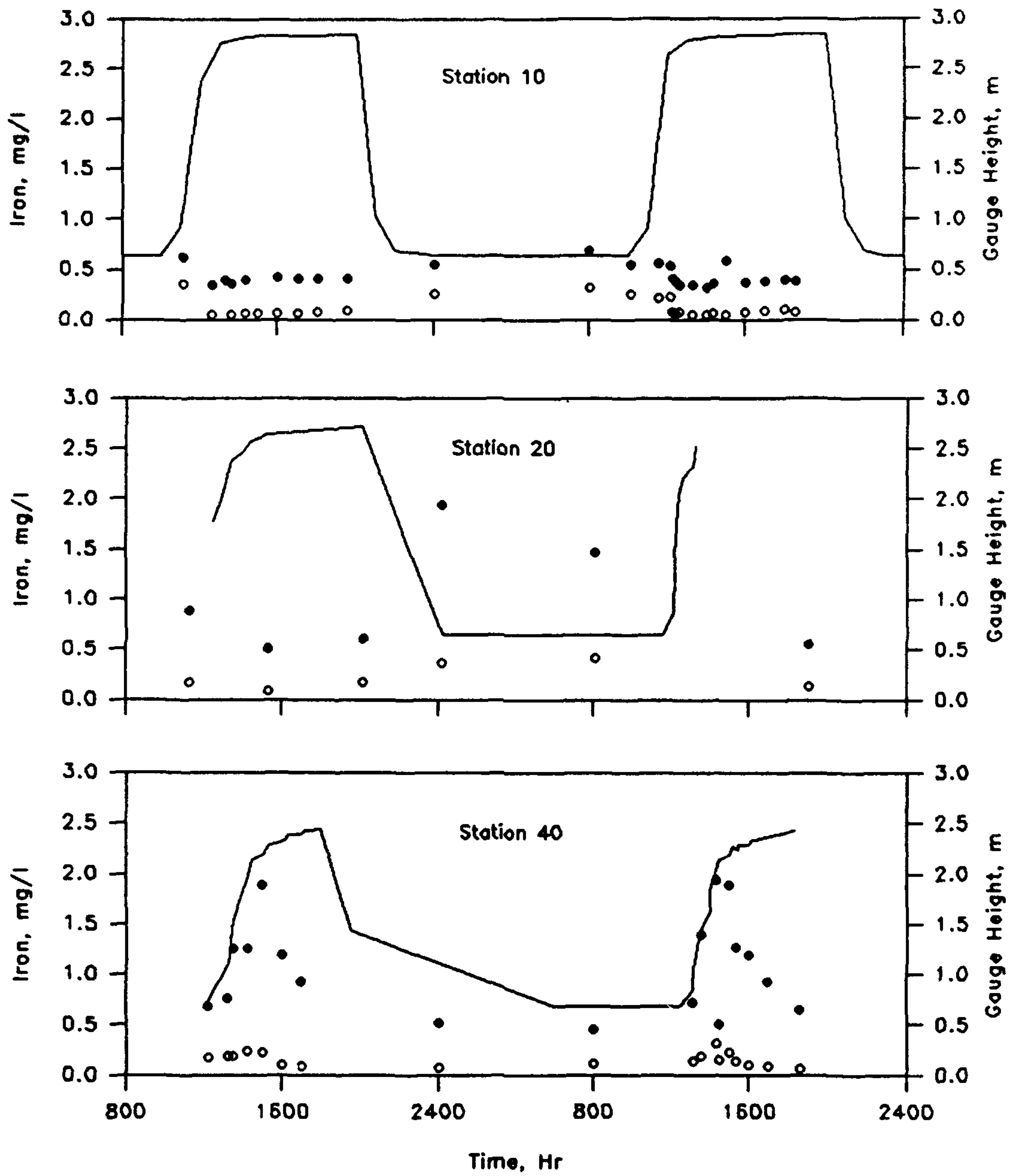


Figure 46. Changes in total (solid circles) and dissolved (open circles) iron concentrations at stations 10, 20, and 40.

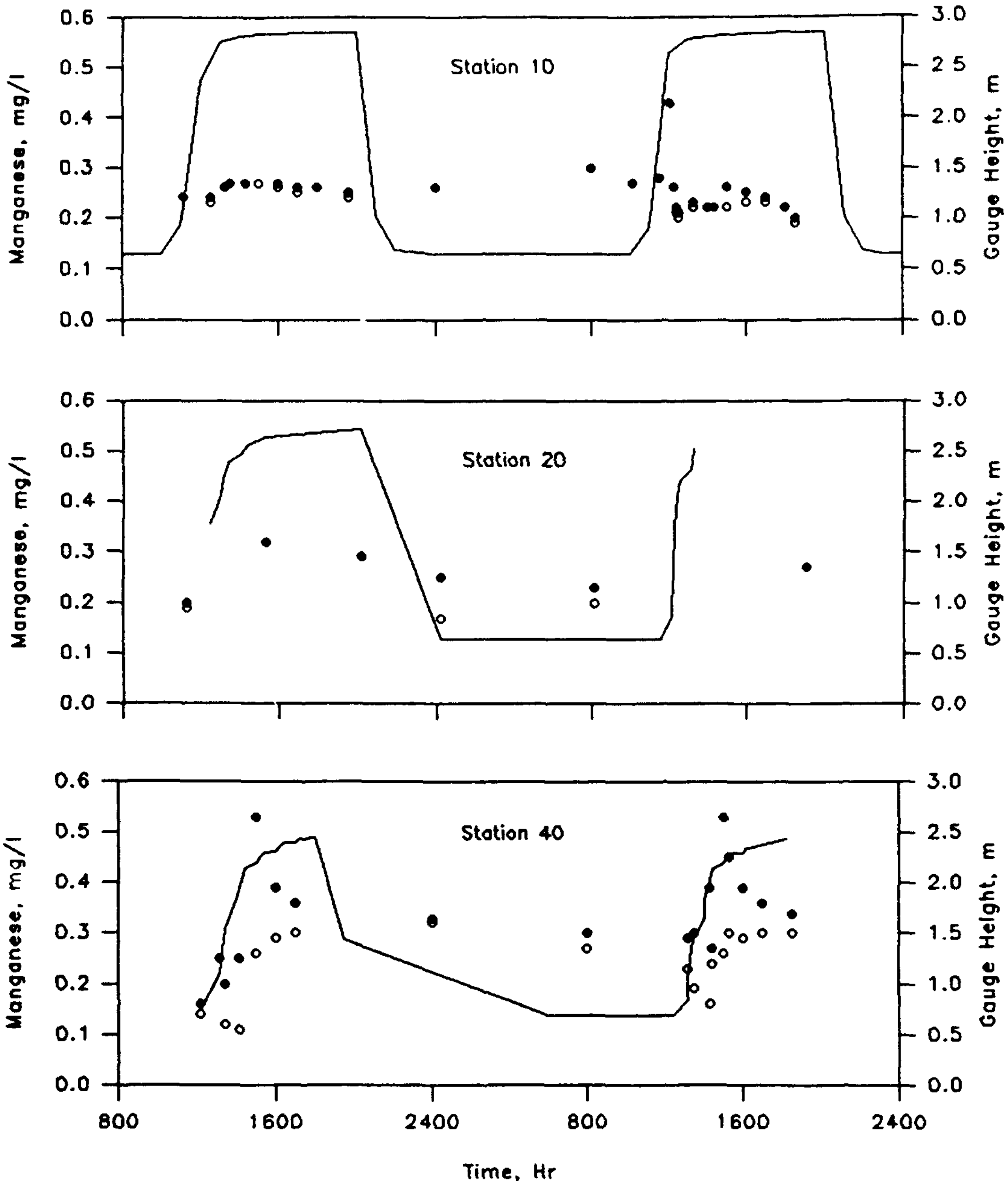


Figure 47. Changes in total (solid circles) and dissolved (open circles) manganese concentrations at stations 10, 20, and 40.

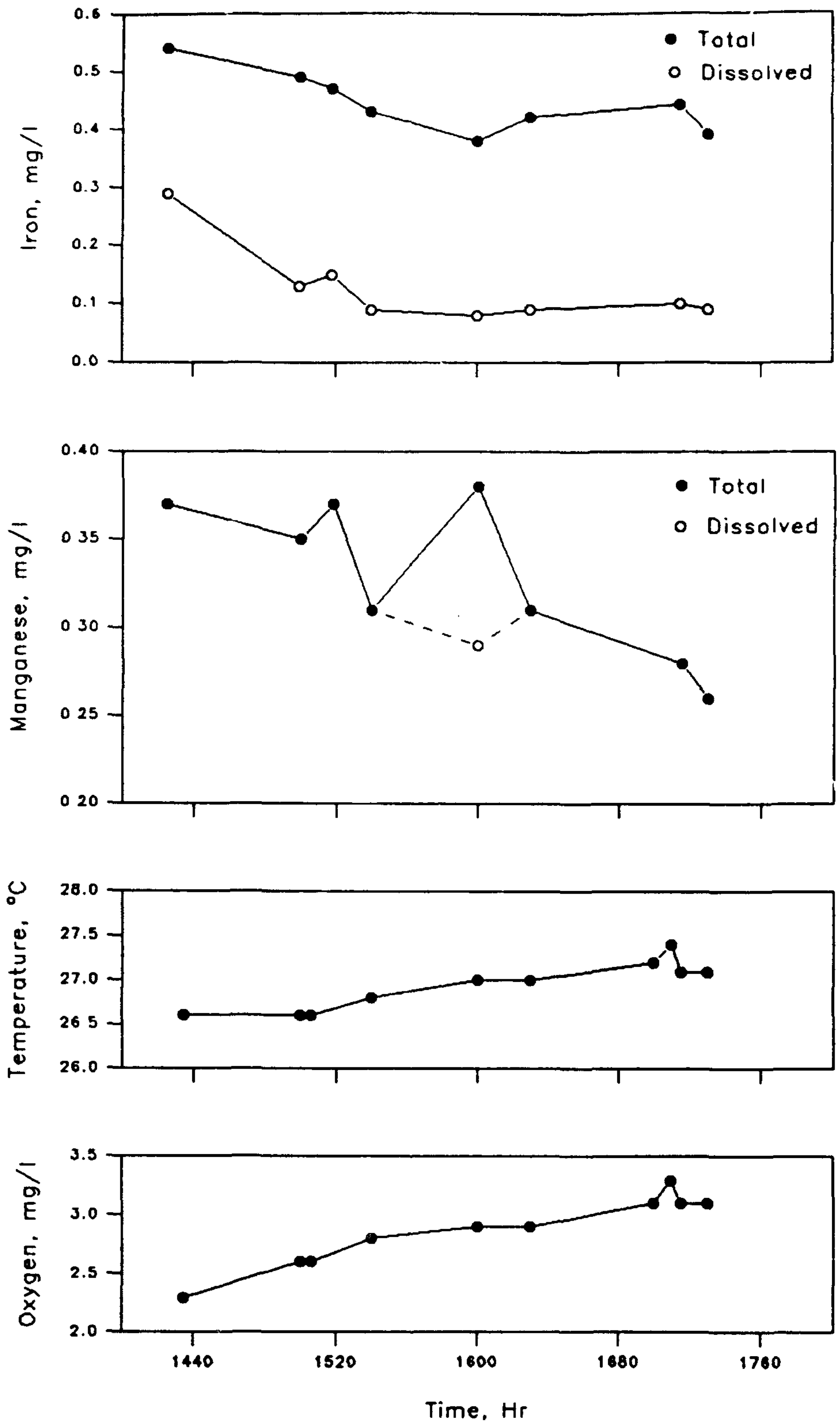


Figure 48. Changes in selected physicochemical characteristics of water released from West Point Lake during peaking operation.

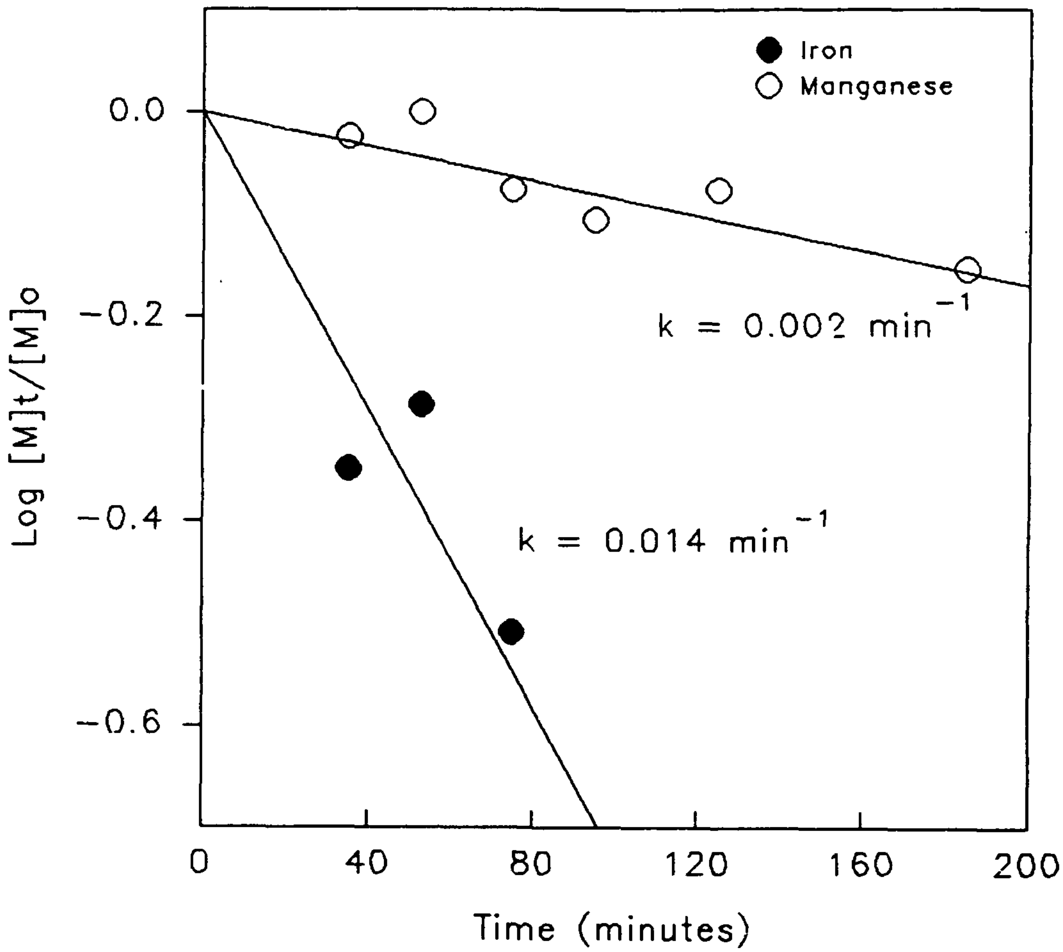


Figure 49. Time-dependent changes in iron and manganese concentrations, and associated loss rates.

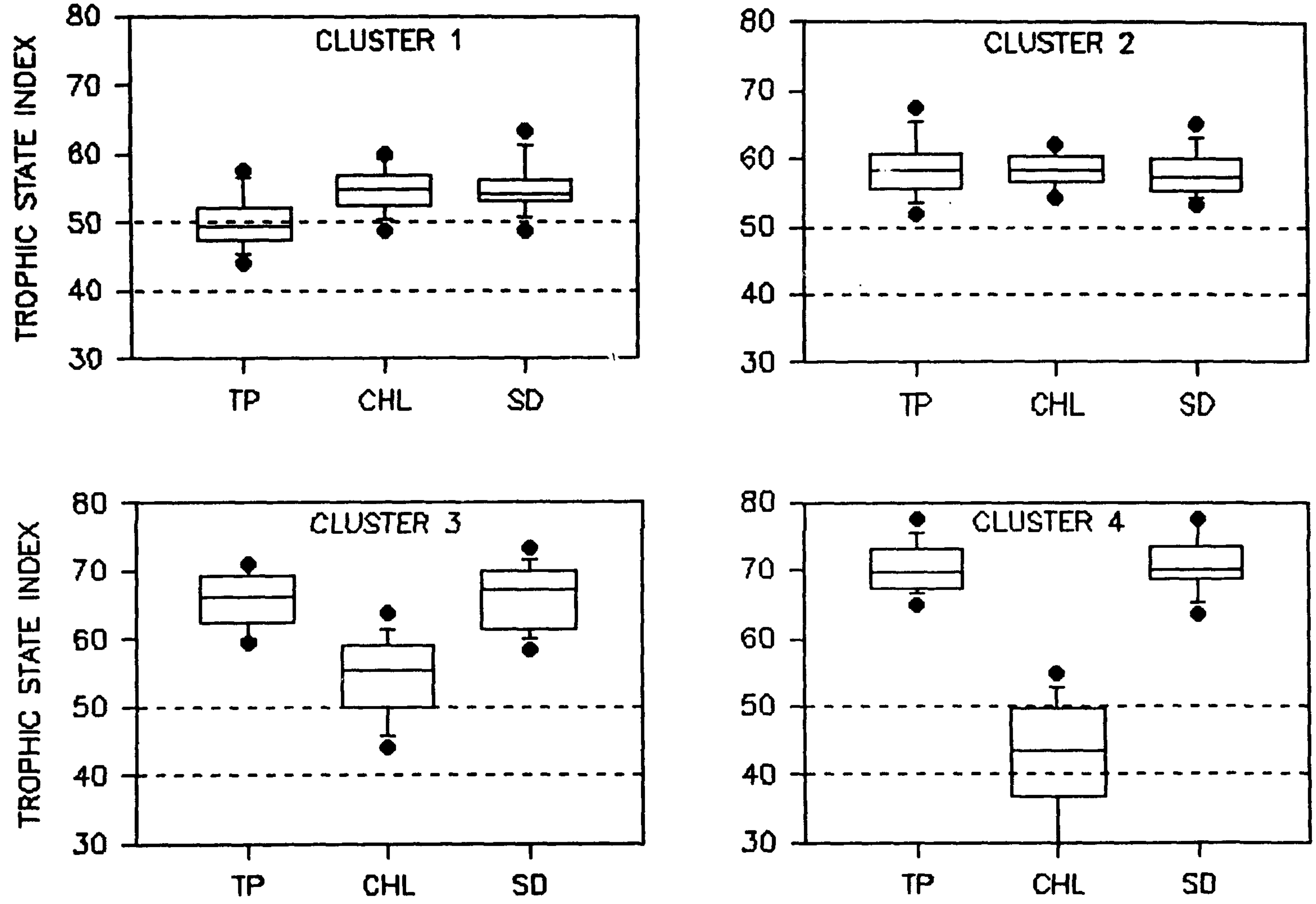


Figure 50. Spatial differences in Carlson's Trophic State Indices (TSI). TP, CHL and SD refer to TSI values computed from total phosphorus concentration, chlorophyll concentration and Secchi disk transparency, respectively.

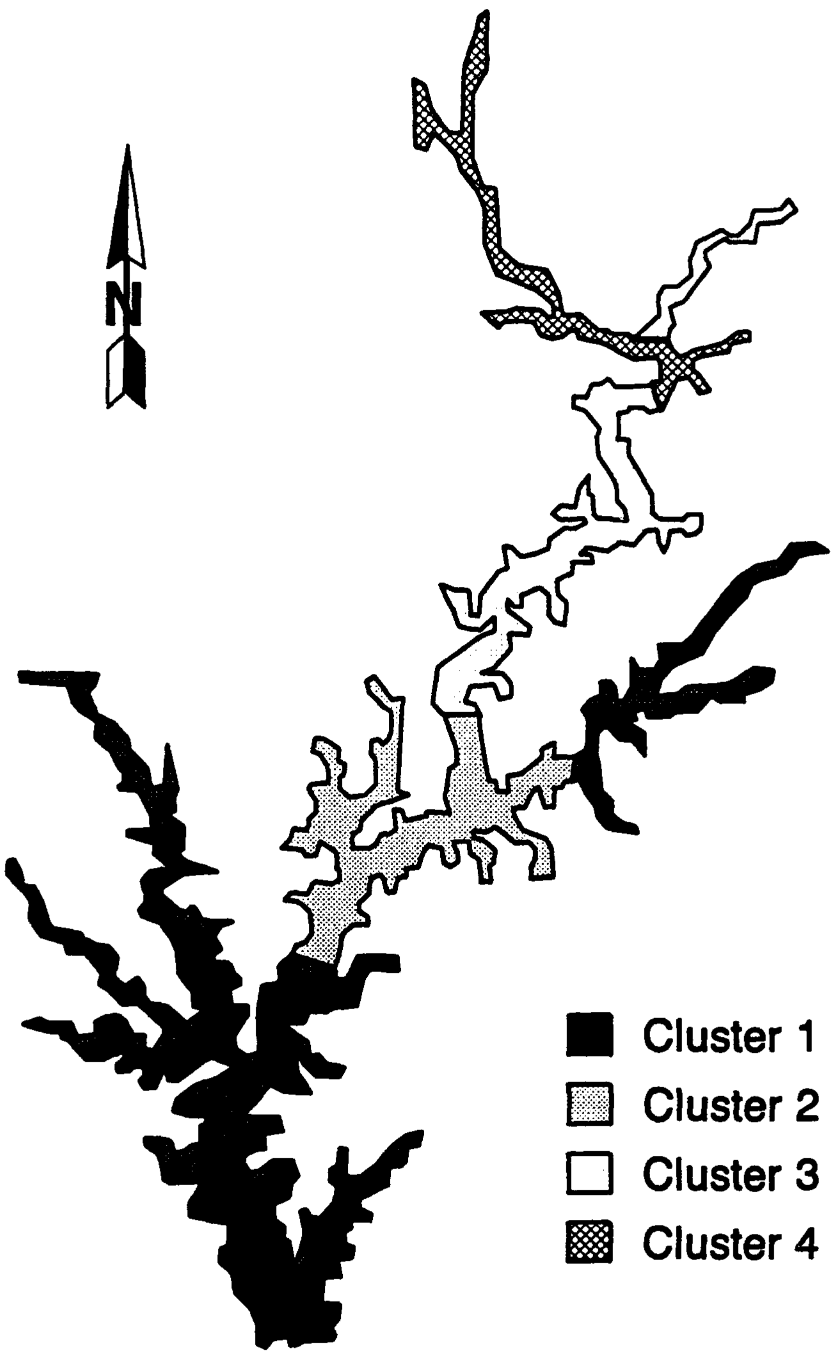


Figure 51. Location of water quality clusters, West Point Lake.

Table 1. Sampling and LANDSAT image acquisition dates

Sample Round	LANDSAT Date	Sample Dates
1	April 21	April 20-22
2	June 8	June 8
3	July 26	July 25-26
4	September 12	September 12
5	September 28	September 27-28
6	October 14	October 14

Table 2. Landcover areas and distributions for the West Point Lake watershed.

Landcover Class	Area (10^3 Hectares)	Percent Coverage
Water	10.4	5.2
Forest	106.1	53.2
Grass	34.2	17.1
Bare Ground	11.8	5.9
Crop Land	30.9	15.5
Urban	6.2	3.1
Total	199.6	100.0

Table 3. Landcover distributions for major sub-basins of the West Point Lake watershed.

Sub-basin	Water	Forest	Grass	Bare	Crop	Urban
New River	1.5	54.8	17.9	6.3	16.4	3.1
Yellowjacket Creek	2.8	57.6	14.5	6.6	13.8	4.7
Wehadkee Creek	4.0	45.6	20.8	5.4	21.6	2.6
White Water Creek	3.5	60.0	18.7	4.3	12.2	1.4
All Others	11.0	52.0	16.2	5.7	12.7	2.4

Table 4. Loading characteristics for selected tributaries to West Point Lake.

	Tributary			
	Yellow-jacket	Shoal	Beech	White-water
Drainage area (km^2)	236	63	137	87
Mean Flow (hm^3/yr)	107	12	16	5
Total Phosphorus				
Concentration (mg/l)	0.048	0.032	0.039	0.019
Mass Load (kg/yr)	5156	374	644	101
Export (kg/ha/yr)	0.218	0.059	0.047	0.012
Total Nitrogen				
Concentration (mg/l)	0.964	0.702	0.751	0.725
Mass Load (kg/yr)	103148	8424	12016	3623
Export (kg/ha/yr)	4.371	1.337	0.877	0.416

Table 5. Sediment core depths for each station. Based on 15 sample cores per station.

Station	Mean Sediment depth (cm)	Standard Deviation	Variance	Min/Max (cm)
WWC2TC	24.00	11.73	137.53	7.1/50
71	25.07	12.90	166.46	9/50
WES3	29.92	13.37	178.84	14/40
YC13JC	15.14	7.18	51.53	3/30.5

Table 6. Water column depth at locations of core samples. Based on 15 locations per sample site.

Station	Mean Water depth (m)	Standard Deviation	Variance	Min/Max (cm)
WWC2TC	7.79	1.27	1.63	4.57/9.14
71	6.93	2.48	6.16	3.96/10.98
WES3	4.04	0.64	0.40	2.74/5.18
YC13JC	6.50	2.26	5.11	1.83/9.76

Table 7. Station WW2TC sediment characteristics, by depth, after extraction of interstitial water. Combined assays (mean ± 1 standard deviation) of all cores (n=5).

Depth (cm)	Statistic	% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	40.9118	0.7234	2.2378	11.1095
0	std dev	8.7435	0.2224	0.6725	3.9666
5	mean	41.2513	0.7630	2.2991	11.3465
5	std dev	11.3598	0.3379	0.7363	4.6443
10	mean	33.8270	0.5535	2.7552	9.4861
10	std dev	10.8874	0.2715	0.8487	5.0632
15	mean	37.2881	0.6302	2.4843	9.8589
15	std dev	9.6887	0.2467	0.6851	4.8475
20	mean	35.0730	0.5450	2.4104	9.9386
20	std dev	3.5583	0.0959	0.2127	3.6534
25	mean	26.6775	0.3645	3.0025	8.6274
25	std dev	1.7623	0.0337	0.0861	1.4691

Table 8. Station 71 sediment characteristics, by depth, after extraction of interstitial water. Combined assays (mean $\pm$ 1 standard deviation) of all cores (n=5).

Depth (cm)	Statistic	% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	37.0652	0.5998	2.2854	10.5561
0	std dev	5.3000	0.1370	0.2256	1.3263
5	mean	37.9542	0.6176	2.2601	10.2231
5	std dev	3.8460	0.1007	0.2206	1.7946
10	mean	39.5219	0.6614	2.1651	11.1993
10	std dev	4.3825	0.1160	0.2306	1.4900
15	mean	32.5936	0.5138	2.9969	7.4673
15	std dev	10.0185	0.2146	1.1314	3.7878
20	mean	34.8099	0.5566	2.7702	8.5197
20	std dev	8.8881	0.1779	1.2064	3.4604
25	mean	30.1123	0.4603	3.3969	7.1690
25	std dev	10.7659	0.2101	1.5980	4.3703
30	mean	41.5339	0.7266	2.1805	9.5259
30	std dev	6.7057	0.2117	0.1528	0.1016

Table 9. Station WES3 sediment characteristics, by depth, after extraction of interstitial water. Combined assays (mean $\pm$ 1 standard deviation) of all cores (n=5).

Depth (cm)	Statistic	% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	37.9376	0.6143	2.2492	10.1556
0	std dev	2.7181	0.0701	0.1450	1.1023
5	mean	35.0943	0.5433	2.4123	9.5106
5	std dev	2.7349	0.0649	0.1686	1.1173
10	mean	29.1854	0.4174	2.9154	7.9834
10	std dev	4.4233	0.0896	0.4559	2.0268
15	mean	24.5983	0.3347	3.5433	6.5145
15	std dev	5.7981	0.1154	0.6610	2.1449
20	mean	27.3932	0.3974	3.3844	7.3376
20	std dev	9.2407	0.1841	1.0928	4.0287
25	mean	30.3645	0.4903	3.0765	9.9444
25	std dev	13.5963	0.3333	1.0427	6.1979
30	mean	38.9877	0.6392	2.1288	12.3150
30	std dev	0.7032	0.0189	0.0285	0.1628
35	mean	39.9753	0.6664	2.1200	11.2808
35	std dev	1.0539	0.0291	0.0380	0.2452
40	mean	39.3932	0.6507	2.1285	11.5662
40	std dev	1.4560	0.0401	0.0562	0.2134
45	mean	40.4814	0.6805	2.0798	11.6790
45	std dev	1.0536	0.0295	0.0458	0.3450

Table 10. Station YC13JC sediment characteristics, by depth, after extraction of interstitial water. Combined assays (mean $\pm$ 1 standard deviation) of all cores (n=5).

Depth (cm)	Statistic	% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	28.3568	0.4126	3.1182	6.9290
0	std dev	7.7334	0.1653	0.7530	3.6907
5	mean	26.1802	0.3604	3.1292	8.2550
5	std dev	5.0569	0.0967	0.4484	0.9104
10	mean	23.9878	0.3194	3.6478	4.7020
10	std dev	4.3029	0.0739	0.4935	1.2795
15	mean	28.8574	0.4059	2.8708	8.0560
15	std dev	1.2989	0.0259	0.1405	0.8647

Table 11. Pearson Product-Moment correlation of percent water content (WC), moisture content (MC), bulk density (BD) and loss on ignition (LOI) with depth. Sediments were prepared for analysis by prior extraction of interstitial water.

Station	Number of Cores	Pearson Product-Moment Correlation WC	MC	BD	LOI
71	all (5)	-0.218	-0.185	0.320	-0.358
	3	-0.012	-0.041	0.106	-0.362
	2	-0.921	-0.922	0.912	-0.871
WW2TC	all (5)	-0.343	-0.359	0.222	-0.167
	4	-0.561	-0.553	0.516	-0.412
	1	-0.781	-0.780	0.849	-0.784
YC13JC	all (5)	-0.104	-0.104	0.112	-0.122
	4	0.019	0.021	0	0.106
	1	-0.881	-0.888	0.898	-0.973
WES3	all (5)	0.021	0.061	0.042	0.141
	4	-0.960	-0.886	0.888	-0.808
	1	0.553	0.553	-0.617	0.616

Table 12. Mean sediment total phosphorus (mgP/g dry weight) and total nitrogen (mgN/g dry weight) and associated standard deviations (std dev) for surface (0-5 cm) and bottom portions of sediment cores. Based on five core samples for each station.

		Total Phosphorus		Total Nitrogen	
Station	Depth	Mean	Std Dev	Mean	Std Dev
WW2TC	Surface	2.130	0.470	6.743	2.894
	Bottom	1.171	0.164	6.229	1.538
71	Surface	2.078	0.462	6.063	1.929
	Bottom	1.500	0.620	6.284	1.010
WES3	Surface	2.248	0.343	6.831	1.589
	Bottom	0.503	0.065	6.123	3.189
YC13JC	Surface	0.605	0.474	5.962	1.472
	Bottom	0.902	0.088	5.167	0.778

Table 13. Station WWC2TC sediment characteristics, by depth. Combined assays (mean ±1 standard deviation) of all cores (n=5). Sediments include interstitial water.

Depth (cm)		% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	59.5884	1.5803	1.6010	11.1095
0	std dev	9.3971	0.4845	0.3260	3.9666
5	mean	54.9490	1.4079	1.8136	11.3465
5	std dev	14.2215	0.6409	0.5934	4.6443
10	mean	44.5044	0.9565	2.2473	9.4861
10	std dev	15.3502	0.5922	0.7408	5.0632
15	mean	47.6841	1.0584	2.0723	9.8589
15	std dev	14.4836	0.5676	0.6151	4.8475
20	mean	43.7376	0.7961	2.0612	9.9386
20	std dev	5.8888	0.1975	0.3171	3.6534
25	mean	33.7704	0.5108	2.5122	8.6274
25	std dev	1.6716	0.0394	0.0695	1.4691

Table 14. Station 71 sediment characteristics, by depth. Combined assays (mean ±1 standard deviation) of all cores (n=5). Sediments include interstitial water.

Depth (cm)		% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	53.9757	1.1883	1.6832	10.8658
0	std dev	4.1529	0.1824	0.0991	1.2069
5	mean	52.4093	1.1156	1.7465	10.1911
5	std dev	4.2813	0.1696	0.1786	2.1011
10	mean	51.2158	1.0920	1.8188	10.0995
10	std dev	7.5841	0.2876	0.3292	3.0256
15	mean	44.0792	0.8846	2.3258	7.3577
15	std dev	13.5438	0.4195	0.8402	3.9139
20	mean	47.2780	0.9859	2.2234	8.5197
20	std dev	13.5373	0.3724	1.0999	3.4604
25	mean	40.6008	0.8002	2.8263	7.1690
25	std dev	16.9988	0.4490	1.5379	4.3703
30	mean	55.6655	1.2769	1.2221	9.5259
30	std dev	5.0849	0.2792	0.8756	0.1016

Table 15. Station WES3 sediment characteristics, by depth. Combined assays of all cores (n=5). Sediments include interstitial water.

Depth (cm)		% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	56.8109	1.3277	1.6219	10.1556
0	std dev	3.1864	0.1753	0.0776	1.1310
5	mean	52.1312	1.0952	1.7515	9.5106
5	std dev	2.6616	0.1177	0.0799	1.1173
10	mean	43.3168	0.7838	2.1176	7.9834
10	std dev	6.0919	0.1935	0.3103	2.0268
15	mean	35.4342	0.5908	2.6740	6.7545
15	std dev	9.9925	0.2889	0.6225	2.3296
20	mean	32.5749	0.5463	2.9849	6.6674
20	std dev	12.9033	0.3634	0.8317	3.2569
25	mean	41.4420	0.8258	2.3210	9.9444
25	std dev	14.9085	0.5567	0.6656	6.1979
30	mean	53.5144	1.1514	1.6704	12.3150
30	std dev	0.5358	0.0249	0.0135	0.1628
35	mean	53.3788	1.1454	1.6894	11.2808
35	std dev	0.8186	0.0374	0.0188	0.2452
40	mean	52.9268	1.1253	1.6910	11.5662
40	std dev	1.1309	0.0516	0.0279	0.2134
45	mean	52.3851	1.1007	1.7015	11.6790
45	std dev	0.8429	0.0369	0.0246	0.3450

Table 16. Station YC13JC sediment characteristics, by depth. Combined assays of all cores (n=5). Sediments include interstitial water.

Depth (cm)		% Water Content	Moisture Content	Bulk Density	%Loss on Ignition
0	mean	38.3797	0.7572	2.7492	7.1721
0	std dev	16.6139	0.5373	1.0982	3.6377
5	mean	31.1475	0.4969	3.0539	6.4866
5	std dev	11.4509	0.2882	0.8972	2.2125
10	mean	35.6562	0.5555	2.5106	6.1207
10	std dev	2.0194	0.0501	0.1454	1.8960

Table 17. Pearson Product-Moment correlation of core percent water content (WC), moisture content (MC), bulk density (BD) and loss on ignition (LOI) with depth. Sediments include interstitial water.

Station	Number of Cores	WC	MC	BD	LOI
71	all (5)	-0.303	-0.275	0.313	-0.353
	3	-0.012	-0.041	0.167	-0.362
	2	-0.958	-0.943	0.952	-0.879
WWC2TC	all(5)	-0.487	-0.517	0.379	-0.167
	4	-0.670	-0.694	0.608	-0.412
	1	-0.950	-0.938	0.990	-0.784
YC13JC	all(5)	-0.142	-0.239	-0.027	-0.160
	4	-0.054	-0.119	-0.104	0.269
	1	-0.983	-0.979	0.961	-0.973
WES3	all(5)	-0.187	-0.202	0.157	0.134
	4	-0.914	-0.906	0.871	-0.804
	1	0.127	0.113	-0.246	0.314

Table 18. Mean sediment total phosphorus (mgP/g dry weight) and total nitrogen (mgN/g dry weight) and associated standard deviations (std dev) for surface (0-5 cm) and bottom portions of sediment cores. Based on five core samples for each station. Samples include interstitial water.

		Total Phosphorus		Total Nitrogen	
Station	Depth	Mean	Std Dev	Mean	Std Dev
WW2TC	Surface	2.84	1.02	4.99	0.69
	Bottom	1.74	0.73	4.07	0.52
71 Surface	4.72	0.22	5.39	0.32	
	Bottom	4.70	1.04	5.26	0.21
WES3	Surface	5.68	1.01	5.63	0.36
	Bottom	3.47	0.25	4.06	0.52
YC13JC	Surface	2.56	0.76	4.44	0.69
	Bottom	2.13	0.21	3.80	0.41

Table 19. Interstitial water total phosphorus (mgP/liter interstitialwater) for each core.

Station	Depth (cm)	mg P/liter interstitial water
WW2TC	surface (0 - 5 cm)	1.31±1.517
	bottom (10 - 20 cm)	1.17±0.49
71	surface (0 - 5 cm)	1.03±0.57
	bottom (20 - 30 cm)	0.55±0.74
WES3	surface (0 - 5 cm)	1.73±1.27
	bottom (15 -45 cm)	2.24±1.53
YC13JC	surface (0 - 5 cm)	0.26±0.25
	bottom	

Table 20. Interstitial water total phosphorus (mgP/DW) in surface (0-5 cm) and deepest section (variable depth) at each sampling station.

		SEDIMENTS INCLUDING INTERSTITIAL WATER		SEDIMENTS WITHOUT INTERSTITIAL WATER		INTERSTITIAL WATER (BY DIFFERENCE)		INTERSTITIAL WATER (EXTRACTION)
Station	Depth (cm)	mgP/g DW	mgN/g DW	mgP/g DW	mgN/gDW	mgP/g DW	mgN/gDW	mg P/gDW
WW2TC	surface (0-5 cm)	2.84	4.99	2.13	6.74	0.71	-1.36	0.00 ±.0011
WW2TC	bottom	1.74	4.07	1.53	6.23	0.21	-2.03	0.00 ±.0017
71	surface (0-5 cm)	4.72	5.38	2.08	6.06	2.64	-1.07	0.00 ±.0019
71	bottom	4.70	4.21	1.51	6.28	3.19	-2.21	0.00 ±.0001
WES3	surface (0-5 cm)	5.68	5.61	2.25	6.83	3.43	-1.22	0.00 ±.0007
WES3	bottom	4.03	3.69	1.18	6.12	2.85	-2.43	0.00 ±.0011
YC13JC	surface (0-5 cm)	3.20	5.55	0.61	5.96	2.59	-0.41	0.00
YC13JC	bottom	2.13	3.80	0.55	5.17	1.58	-1.38	0.00

Table 21. Organismal groups identified from surface sediments of West Point Lake at different locations in the lake. Numerical data include the total number of organisms counted in each of three samples from each location and calculated relative abundances.

	SAMPLING STATION AND SAMPLE NUMBER											
	YC13JC			WWC2TC			71			WES3		
ORGANISMAL GROUP	I	II	III	I	II	III	I	II	III	I	II	III
Cyrnellus fraternus (Trichoptera)	0	0	1	0	0	0	3	0	0	0	0	0
Chironomidae (Diptera)	0	1	0	0	3	6	1	2	6	1	11	12
Chaoboridae (Diptera)	20	19	11	0	19	58	51	15	34	0	22	27
Ceratopogonidae (Diptera)	0	0	0	0	0	0	0	0	0	2	1	0
Cladocera (Crustacea)	0	0	3	1	0	0	3	6	1	23	13	12
Ostracoda (Crustacea)	0	3	2	2	0	1	7	5	3	23	3	2
Copepoda (Crustacea)	69	69	74	21	141	178	6	4	2	52	224	135
Oligochaeta (Annelida)	4	1	5	3	2	0	41	23	44	32	55	56
Nematoda	0	0	0	0	0	0	0	0	1	0	5	0
Hydracarina (Arachnida)	0	0	0	0	0	0	0	0	0	0	0	1
Hydra spp.(Coelenterata)	0	0	0	0	0	0	0	1	1	1	0	0
Total	93	93	95	27	165	243	112	56	92	134	334	245
	RELATIVE ABUNDANCES											
Chaoboridae	.21	.20	.12	0	.12	.24	.46	.26	.36	0	.07	.11
Cladocera	0	0	.03	.04	0	0	.03	.11	.01	.17	.04	.05
Ostracoda	0	.03	.02	.07	0	0	.06	.09	.03	.17	.01	.01
Copepoda	.74	.74	.78	.78	.85	.73	.05	.07	.02	.39	.67	.55
Oligochaeta	.04	.01	.05	.11	.01	0	.37	.41	.48	.24	.16	.23

Table 22. Optical properties of the water column at station 71 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	52.54	15.09	45.17	15.62	48.85	12.96	376.73	99.11	11.24	29.98
0.815	51.22	16.41	43.4	19.82	47.91	12.61	141.81	37.31	6.69	29.62
1.972	53.28	16.66	44.64	13.81	49.44	10.86	32.56	8.57	2.14	29.46
2.871	57.6	14.92	48.01	16.82	52.51	10.51	12.92	3.4	1.34	29.34
3.891	44.19	26.77	33.66	26.57	40.12	19.61	2.69	0.71	0	28.87
4.932	12.8	70.7	6.64	57.06	11.45	53.59	0	0	0	26.63
5.753	5.35	94.49	1.77	78.08	4.72	71.8	0	0	0	25.89
6.703	3.79	105.1	1.77	82.28	3.54	78.81	0	0	0	25.7
7.669	3.38	109.66	0.89	83.48	2.95	83.01	0	0	0	25.65
8.703	2.93	110.98	0.89	87.09	2.36	83.01	0	0	0	25.6
9.757	2.54	113.63	0.89	86.49	2.36	84.76	0	0	0	25.58

Depth (m)	ATTENUANCE (per meter) RED	GREEN	AMBER	SCATTERANCE (per meter) RED	GREEN	AMBER	ABSORBANCE (per meter) RED	GREEN	AMBER
0	2.57	3.18	2.87	0.39	0.48	0.43	2.19	2.7	2.43
0.815	2.68	3.34	2.94	0.44	0.55	0.48	2.24	2.79	2.46
1.972	2.52	3.23	2.82	0.42	0.54	0.47	2.1	2.69	2.35
2.871	2.21	2.94	2.58	0.33	0.44	0.38	1.88	2.5	2.19
3.891	3.27	4.36	3.65	0.87	1.17	0.98	2.39	3.19	2.68
4.932	8.22	10.85	8.67	5.81	7.67	6.13	2.41	3.18	2.54
5.753	1.71	16.13	12.21	11.07	15.24	11.54	0.65	0.89	0.67
6.703	3.09	16.13	13.36	13.76	16.96	14.05	-0.67	-0.82	-0.68
7.669	3.55	18.91	14.09	14.85	20.73	15.45	-1.31	-1.83	-1.36
8.703	4.12	18.91	14.99	15.67	20.98	16.63	-1.55	-2.08	-1.65
9.757	4.7	18.91	14.99	16.7	21.48	17.03	-2	-2.58	-2.04

Table 23 (Continued). Optical properties of the water column at station 28 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	79.37	5.22	67.14	7.21	66.43	4.2	423.55	99.21	10.7	28.94
0.705	79.54	7.87	66.78	6.61	71.15	3.5	285.51	66.88	9.37	28.94
1.605	80.52	7.46	67.32	7.81	72.09	4.55	94.72	22.19	4.01	28.91
2.551	81.53	7.79	68.2	7.81	73.04	3.5	56.24	13.17	2.68	28.88
3.553	82.26	8.54	68.38	4.8	73.27	4.2	30.41	7.12	1.34	28.86
4.512	85.08	8.7	69.97	4.2	75.04	2.45	10.76	2.52	0	28.63
5.499	84.68	11.11	68.02	7.81	73.86	4.9	5.38	1.26	0	27.52
6.594	79.23	12.93	62	9.01	68.91	5.95	2.69	0.63	0	27.02
7.635	67.92	17.16	51.37	12.01	59.23	10.51	1.35	0.32	0	26.58
8.725	58.14	20.72	42.69	14.41	51.21	12.26	0	0	0	26.25
9.722	43.43	29.76	30.12	22.22	38.23	20.67	0	0	0	26.04
10.589	44.48	28.6	31	21.62	39.41	19.61	0	0	0	25.84
11.424	39.28	33.15	26.57	26.43	35.04	21.02	0	0	0	25.7
12.444	38.32	32.91	25.69	30.63	33.98	23.12	0	0	0	25.63
13.496	23.94	43.18	15.06	35.44	22.54	30.82	0	0	0	25.21
14.493	18.82	49.4	11.69	36.64	17.82	36.08	0	0	0	24.94
15.488	19.98	47.99	12.93	38.44	19.12	36.43	0	0	0	24.27
16.585	26.63	29.67	19.49	24.02	25.6	21.72	0	0	0	23.1
17.595	20.95	29.51	15.06	22.22	20.06	20.32	0	0	0	22.63

Table 23 (Concluded).

Depth (m)	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0	0.92	1.59	1.64	0.05	0.08	0.09	0.88	1.51	1.55
0.705	0.92	1.61	1.36	0.07	0.13	0.11	0.84	1.49	1.25
1.605	0.87	1.58	1.31	0.06	0.12	0.1	0.8	1.46	1.21
2.551	0.82	1.53	1.26	0.06	0.12	0.1	0.75	1.41	1.16
3.553	0.78	1.52	1.24	0.07	0.13	0.11	0.71	1.39	1.14
4.512	0.65	1.43	1.15	0.06	0.12	0.1	0.59	1.3	1.05
5.499	0.66	1.54	1.21	0.07	0.17	0.13	0.59	1.37	1.08
6.594	0.93	1.91	1.49	0.12	0.25	0.19	0.81	1.66	1.3
7.635	1.55	2.66	2.09	0.27	0.46	0.36	1.28	2.21	1.74
8.725	2.17	3.4	2.68	0.45	0.71	0.55	1.72	2.7	2.12
9.722	3.34	4.8	3.85	0.99	1.43	1.14	2.34	3.37	2.7
10.589	3.24	4.68	3.72	0.93	1.34	1.07	2.31	3.35	2.66
11.424	3.74	5.3	4.19	1.24	1.76	1.39	2.5	3.54	2.8
12.444	3.84	5.44	4.32	1.26	1.79	1.42	2.57	3.65	2.9
13.496	5.72	7.57	5.96	2.47	3.27	2.57	3.25	4.3	3.39
14.493	6.68	8.59	6.9	3.3	4.24	3.41	3.38	4.34	3.49
15.488	6.44	8.18	6.62	3.09	3.93	3.18	3.35	4.26	3.44
16.585	5.29	6.54	5.45	1.57	1.94	1.62	3.72	4.6	3.83
17.595	6.25	7.57	6.43	1.84	2.23	1.9	4.41	5.34	4.53

Table 24 (Continued). Optical properties of the water column at station 18 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (µE)	Irradiance Percent of Surface	Irradiance Upwelling (µE)	Temp. (°C)
0.00	75.73	10.11	63.95	7.81	69.03	5.25	56.51	83.50	1.34	29.42
0.686	76.47	10.94	64.13	9.61	69.62	5.95	30.95	45.73	1.34	29.41
1.729	79.43	11.19	66.61	7.21	71.98	4.55	10.76	15.90	0.00	29.26
2.665	82.96	10.53	69.26	7.21	74.45	7.01	5.38	7.95	0.00	28.90
3.728	84.65	10.28	70.15	7.21	75.40	5.25	2.69	3.98	0.00	28.53
4.699	89.16	9.45	73.34	6.01	79.06	5.25	1.35	1.99	0.00	28.00
5.703	89.37	4.50	68.44	4.80	76.11	7.36	0.81	1.19	0.00	27.62
6.751	86.73	9.70	68.38	8.41	75.52	6.66	0.00	0.00	0.00	27.41
7.652	81.53	9.45	62.18	7.21	70.97	8.76	0.00	0.00	0.00	26.95
8.629	71.68	10.86	52.44	12.61	61.95	9.81	0.00	0.00	0.00	26.42
9.578	63.76	14.34	46.06	14.41	55.58	12.96	0.00	0.00	0.00	26.04
10.639	57.75	16.83	40.57	15.01	50.03	13.31	0.00	0.00	0.00	25.69
11.592	50.61	20.39	34.72	17.42	44.37	16.46	0.00	0.00	0.00	25.41
12.533	37.95	29.34	25.33	25.23	34.22	23.47	0.00	0.00	0.00	25.18
13.521	28.18	38.95	17.89	30.63	25.96	30.12	0.00	0.00	0.00	24.58
14.492	23.59	42.35	14.70	34.23	22.06	32.92	0.00	0.00	0.00	23.94
15.483	16.52	47.00	10 10	36.64	15.93	39.58	0.00	0.00	0.00	23.42
16.480	14.66	48.57	9.03	34.23	14.40	38.88	0.00	0.00	0.00	22.64
17.453	19.61	37.13	13.46	26.43	19.23	26.97	0.00	0.00	0.00	22.38
18.521	20.98	27.68	14.35	22.22	19.94	23.82	0.00	0.00	0.00	22.09
19.491	19.09	25.28	13.11	22.22	17.70	20.32	0.00	0.00	0.00	21.84

Table 24 (Concluded).

Depth	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
(m)	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0.000	1.11	1.79	1.48	0.11	[illegible]	0.15	1.00	1.61	1.33
0.686	1.07	1.78	1.45	0.12	[illegible]	0.16	0.96	1.58	1.29
1.729	0.92	1.63	1.32	0.10	0.1	0.15	0.82	1.44	1.17
2.665	0.75	1.47	1.18	0.08	0.15	0.12	0.67	1.31	1.06
3.728	0.67	1.42	1.13	0.07	0.15	0.12	0.60	1.27	1.01
4.699	0.46	1.24	0.94	0.04	0.12	0.09	0.42	1.12	0.85
5.703	0.45	1.52	1.09	0.02	0.07	0.05	0.43	1.45	1.04
6.751	0.57	1.52	1.12	0.06	0.15	0.11	0.51	1.37	1.01
7.652	0.82	1.90	1.37	0.08	0.18	[illegible]	0.74	1.72	1.24
8.629	1.33	2.58	1.92	0.14	0.28	0.21	1.19	2.30	1.71
9.578	1.80	3.10	2.35	0.26	0.44	0.34	1.54	2.66	2.01
10.639	2.20	3.61	2.77	0.37	0.61	0.47	1.83	3.00	2.30
11.592	2.72	4.23	3.25	0.56	0.86	0.66	2.17	3.37	2.59
12.533	3.88	5.49	4.29	1.14	1.61	1.26	2.74	3.88	3.03
13.521	5.07	6.88	5.39	1.97	2.68	2.10	3.09	4.20	3.29
14.492	5.78	7.67	6.04	2.45	3.25	2.56	3.33	4.42	3.48
15.483	7.20	9.17	7.35	3.39	4.31	3.45	3.82	4.86	3.89
16.480	7.68	9.62	7.75	3.73	4.67	3.77	3.95	4.95	3.99
17.453	6.52	8.02	6.59	2.42	2.98	2.45	4.10	5.04	4.15
18.521	6.25	7.77	6.45	1.73	2.15	1.79	4.52	5.62	4.66
19.491	6.62	8.13	6.93	1.67	2.05	1.75	4.95	6.07	5.18

Table 25 (Continued). Optical properties of the water column at station WES1 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0.000	82.58	8.62	68.56	9.01	62.77	4.55	320.76	98.96	8.03	28.95
0.921	82.04	6.96	71.39	6.61	73.98	3.85	164.15	50.64	7.23	28.97
1.922	81.72	7.21	71.21	6.61	73.98	3.85	172.49	53.22	7.76	28.97
2.789	82.08	9.03	71.21	8.41	73.98	3.85	121.90	37.61	-2.48	28.96
3.719	82.58	7.71	71.39	9.61	74.22	4.20	71.58	22.08	2.68	28.95
4.671	83.91	8.62	71.92	6.61	75.16	4.55	41.98	12.95	1.34	28.91
5.667	85.23	8.87	71.74	6.61	75.63	2.80	22.87	7.06	1.34	28.81
6.733	92.56	8.16	78.83	6.01	80.71	3.15	9.42	2.91	0.00	28.27
7.762	92.88	8.70	78.30	9.01	81.06	3.50	5.92	1.83	0.00	27.66
8.768	94.50	9.03	79.01	8.41	82.12	4.90	2.69	0.83	0.00	26.97
9.807	87.20	11.19	71.21	9.61	76.11	6.30	1.35	0.42	0.00	26.27
10.759	67.46	18.23	51.55	17.42	59.47	10.86	1.35	0.42	0.00	25.81
11.744	67.31	18.07	52.61	16.82	59.94	11.21	0.00	0.00	0.00	25.34
12.700	53.40	24.12	39.50	19.22	47.79	16.75	0.00	0.00	0.00	24.80
13.683	43.62	28.93	31.53	25.23	39.88	20.67	0.00	0.00	0.00	24.39
14.606	32.59	36.97	22.32	29.43	30.09	25.22	0.00	0.00	0.00	23.80
15.549	29.78	40.45	20.02	34.23	27.61	29.07	0.00	0.00	0.00	23.47
16.524	28.07	41.36	18.60	33.63	25.84	29.42	0.00	0.00	0.00	23.12
17.502	32.12	35.39	22.50	29.43	30.09	25.22	0.00	0.00	0.00	22.64
18.494	33.21	32.91	23.56	25.83	31.03	22.77	0.00	0.00	0.00	22.48
19.416	31.80	32.66	22.50	29.43	30.09	22.77	0.00	0.00	0.00	22.28
20.447	32.69	30.50	23.56	25.23	30.91	22.07	0.00	0.00	0.00	21.98
21.424	28.74	29.84	20.73	25.23	27.26	19.97	0.00	0.00	0.00	21.48

Table 25 (Concluded).

Depth (m)	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0.000	0.77	1.51	1.86	0.07	0.13	0.16	0.70	1.38	1.70
0.921	0.79	1.35	1.21	0.06	0.09	0.08	0.74	1.25	1.12
1.922	0.81	1.36	1.21	0.06	0.10	0.09	0.75	1.26	1.12
2.789	0.79	1.36	1.21	0.07	0.12	0.11	0.72	1.24	1.10
3.719	0.77	1.35	1.19	0.06	0.10	0.09	0.71	1.24	1.10
4.671	0.70	1.32	1.14	0.06	0.11	0.10	0.64	1.20	1.04
5.667	0.64	1.33	1.12	0.06	0.12	0.10	0.58	1.21	1.02
6.733	0.31	0.95	0.86	0.03	0.08	0.07	0.28	0.87	0.79
7.762	0.30	0.98	0.84	0.03	0.09	0.07	0.27	0.89	0.77
8.768	0.23	0.94	0.79	0.02	0.09	0.07	0.21	0.86	0.72
9.807	0.55	1.36	1.09	0.06	0.15	0.12	0.49	1.21	0.97
10.759	1.57	2.65	2.08	0.29	0.48	0.38	1.29	2.17	1.70
11.744	1.58	2.57	2.05	0.29	0.46	0.37	1.30	2.10	1.68
12.700	2.51	3.72	2.95	0.61	0.90	0.71	1.90	2.82	2.24
13.683	3.32	4.62	3.68	0.96	1.34	1.06	2.36	3.28	2.61
14.606	4.48	6.00	4.80	1.66	2.22	1.78	2.83	3.78	3.03
15.549	4.84	6.43	5.15	1.96	2.60	2.08	2.89	3.83	3.07
16.524	5.08	6.73	5.41	2.10	2.78	2.24	2.98	3.95	3.17
17.502	4.54	5.97	4.80	1.61	2.11	1.70	2.94	3.86	3.10
18.494	4.41	5.78	4.68	1.45	1.90	1.54	2.96	3.88	3.14
19.416	4.58	5.97	4.80	1.50	1.95	1.57	3.09	4.02	3.24
20.447	4.47	5.78	4.70	1.36	1.76	1.43	3.11	4.02	3.26
21.424	4.99	6.30	5.20	1.49	1.88	1.55	3.50	4.42	3.65

Table 26 (Continued). Optical properties of the water column at station 38 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	73.99	10.61	55.98	6.61	62.54	8.41	232.76	88.85	6.69	29.13
0.575	74.31	10.36	55.98	10.81	63.01	6.65	92.57	35.34	4.01	29.12
1.6	76.18	7.71	56.86	8.41	63.95	8.41	34.44	13.15	1.61	29.09
2.568	77.78	7.96	58.46	12.01	65.01	7.71	18.84	7.19	1.34	28.99
3.565	78.87	5.3	57.75	7.81	65.25	7.01	9.42	3.6	0	28.95
4.58	81.31	6.46	57.75	8.41	66.19	8.41	4.04	1.54	0	27.83
5.54	71.72	10.77	49.6	9.61	58.76	11.21	2.69	1.03	0	27.3
6.669	65.9	14.26	44.46	14.41	54.04	12.26	1.35	0.51	0	27
7.586	50.04	21.88	31.89	22.82	41.06	19.61	0	0	0	26.53
8.596	37.45	30.09	21.43	23.42	30.8	27.32	0	0	0	26.22
9.642	26.93	40.28	15.06	33.01	22.65	33.98	0	0	0	25.99
10.654	20.61	49.56	10.81	39.04	17.35	41.33	0	0	0	25.85
11.612	17.04	55.2	8.5	44.44	14.28	44.48	0	0	0	25.7
12.627	16.45	57.02	8.15	45.65	13.92	47.29	0	0	0	25.68
13.502	14.28	59.35	7.26	46.85	12.39	48.34	0	0	0	25.58
14.503	17.23	50.97	9.03	38.44	14.99	42.03	0	0	0	25.11
15.526	10.03	63.82	5.31	50.45	9.44	52.19	0	0	0	23.82
16.602	12.08	52.8	7.26	37.84	11.68	43.08	0	0	0	23.02

Table 26 (Concluded).

Depth (m)	ATTENUANCE (per meter) RED	GREEN	AMBER	SCATTERANCE (per meter) RED	GREEN	AMBER	ABSORBANCE (per meter) RED	GREEN	AMBER
0	1.2	2.32	1.88	0.13	0.25	0.2	1.08	2.07	1.68
0.575	1.19	2.32	1.85	0.12	0.24	0.19	1.06	2.08	1.66
1.6	1.09	2.26	1.79	0.08	0.17	0.14	1	2.08	1.65
2.568	1.01	2.15	1.72	0.08	0.17	0.14	0.93	1.98	1.59
3.565	0.95	2.2	1.71	0.05	0.12	0.09	0.9	2.08	1.62
4.58	0.83	2.2	1.65	0.05	0.14	0.11	0.77	2.05	1.54
5.54	1.33	2.8	2.13	0.14	0.3	0.23	1.19	2.5	1.9
6.669	1.67	3.24	2.46	0.24	0.46	0.35	1.43	2.78	2.11
7.586	2.77	4.57	3.56	0.61	1	0.78	2.16	3.57	2.78
8.596	3.93	6.16	4.71	1.18	1.85	1.42	2.75	4.31	3.29
9.642	5.25	7.57	5.94	2.11	3.05	2.39	3.13	4.52	3.55
10.654	6.32	8.9	7.01	3.13	4.41	3.47	3.19	4.49	3.53
11.612	7.08	9.86	7.79	3.91	5.44	4.3	3.17	4.42	3.49
12.627	7.22	10.03	7.89	4.12	5.72	4.5	3.1	4.31	3.39
13.502	7.79	10.49	8.35	4.62	6.22	4.96	3.17	4.26	3.4
14.503	7.03	9.62	7.59	3.59	4.9	3.87	3.45	4.71	3.72
15.526	9.2	11.74	9.44	5.87	7.49	6.03	3.33	4.25	3.42
16.602	8.46	10.49	8.59	4.46	5.54	4.53	3.99	4.95	4.05

Table 27 (Continued). Optical properties of the water column at station 40 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	36.69	6.71	30.09	6.01	32.09	7.01	71.85	91.28	2.41	29.3
0.884	34.38	7.96	27.43	5.41	29.73	5.95	30.68	38.97	1.34	29.31
1.755	37.19	9.86	30.09	6.01	32.41	7.71	11.57	14.7	0.54	29.31
2.703	37	10.69	29.38	6.01	32.21	7.01	4.04	5.13	0	29.3
3.72	36.43	11.44	29.21	6.61	31.5	6.3	1.35	1.71	0	29.24
4.682	39.67	14.59	30.09	12.01	33.63	8.76	1.35	1.71	0	27.92
5.701	30.94	23.71	20.88	18.02	25.96	15.41	0	0	0	27.02
6.595	31.02	23.79	20.35	18.02	25.6	16.71	0	0	0	26.88
7.614	27.14	26.52	16.81	17.42	22.42	20.32	0	0	0	26.63
8.611	21	34.65	11.49	24.62	17.35	26.27	0	0	0	26.34
9.613	18.16	40.45	9.54	30.63	14.99	30.47	0	0	0	26.2
10.554	12.25	52.55	5.29	38.44	10.27	39.93	0	0	0	25.92
11.548	8.16	61.5	2.63	43.84	7.2	45.88	0	0	0	25.76
12.546	4.74	74.76	0.86	54.05	4.37	57.09	0	0	0	25.69
13.452	3.45	79.49	-0.02	58.26	3.19	59.54	0	0	0	25.57
14.459	4.94	72.52	0.86	54.05	4.72	55.69	0	0	0	25.31
15.395	4.97	70.87	0.86	52.85	4.48	54.29	0	0	0	24.47
16.336	3.6	75.26	-0.02	55.26	3.3	58.14	0	0	0	23.74

Table 27 (Concluded).

Depth (m)	ATTENUANCE (per meter) RED	GREEN	AMBER	SCATTERANCE (per meter) RED	GREEN	AMBER	ABSORBANCE (per meter) RED	GREEN	AMBER
0	4.01	4.8	4.55	0.27	0.32	0.31	3.74	4.48	4.24
0.884	4.27	5.17	4.85	0.34	0.41	0.39	3.93	4.76	4.47
1.755	3.96	4.8	4.51	0.39	0.47	0.44	3.57	4.33	4.06
2.703	3.98	4.9	4.53	0.43	0.52	0.48	3.55	4.38	4.05
3.72	4.04	4.92	4.62	0.46	0.56	0.53	3.58	4.36	4.09
4.682	3.7	4.8	4.36	0.54	0.7	0.64	3.16	4.1	3.72
5.701	4.69	6.27	5.39	1.11	1.49	1.28	3.58	4.78	4.12
6.595	4.68	6.37	5.45	1.11	1.51	1.3	3.57	4.85	4.15
7.614	5.22	7.13	5.98	1.38	1.89	1.59	3.83	5.24	4.39
8.611	6.24	8.65	7.01	2.16	3	2.43	4.08	5.66	4.58
9.613	6.82	9.4	7.59	2.76	3.8	3.07	4.06	5.6	4.52
10.554	8.4	11.76	9.11	4.41	6.18	4.78	3.98	5.58	4.32
11.548	10.02	14.55	10.53	6.17	8.95	6.47	3.86	5.6	4.05
12.546	12.2	19.01	12.53	9.12	14.22	9.36	3.08	4.8	3.16
13.452	13.46	.	*13.79*	*10.7*	.	*10.96*	2.76	.	2.83
14.459	12.03	19.01	12.21	8.72	13.79	8.86	3.31	5.22	3.36
15.395	12.01	19.01	12.42	8.51	13.47	8.8	3.5	5.54	3.62
16.336	13.3	.	13.64	10.01	.	10.27	3.29	.	3.37

Table 28 (Continued). Optical properties of the water column at station 45 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	[illegible]diance [illegible]nwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	70.13	11.94	57.4	4.2	62.77	7.78	1119.42	99.11	31.31	29.63
0.758	67.08	9.42	57.22	10.81	61.36	5.33	504.82	44.69	17.4	29.03
1.705	70.31	12.03	57.57	10.81	63.01	15.03	196.44	17.39	8.03	28.69
2.623	70.41	12.28	59.34	6.61	63.6	5.33	73.46	6.5	3.48	28.66
3.651	72.53	12.77	60.76	10.21	65.08	4.98	45.41	4.02	1.34	28.56
4.625	71.61	14.6	57.93	9.01	63.6	8.13	12.11	1.07	1.34	28.17
5.653	70.19	16.67	54.92	12.01	61.83	9.88	5.11	0.45	0	27.45
6.719	57.22	24.87	41.28	19.82	50.38	15.48	1.35	0.12	0	26.78
7.698	47.24	29.76	32.77	24.02	41.53	18.64	0	0	0	26.36
8.779	32.51	39.46	20.55	30.63	28.91	26.69	0	0	0	26.2
9.789	26.46	47.83	15.94	38.44	23.13	34.05	0	0	0	25.95
10.744	16.91	62.25	8.86	44.44	14.87	44.21	0	0	0	25.8
11.751	12.09	73.36	5.49	55.86	10.62	53.31	0	0	0	25.65
12.74	10.23	76.68	4.43	59.46	8.97	58.22	0	0	0	25.48
13.[illegible]	9.53	79.99	4.43	63.06	8.26	58.22	0	0	0	25.46
14.522	7.56	85.88	3.54	67.27	6.49	64.52	0	0	0	25.39
15.458	6.44	89.69	2.66	69.07	5.9	66.97	0	0	0	25.35
16.532	0	190.89	0	105.1	0	133.17	0	0	0	25.31

Table 28 (Concluded).

Depth (m)	ATTENUANCE (per meter) RED	GREEN	AMBER	SCATTERANCE (per meter) RED	GREEN	AMBER	ABSORBANCE (per meter) RED	GREEN	AMBER
0	1.42	2.22	1.86	0.17	0.27	0.22	1.25	1.96	1.64
0.758	1.6	2.23	1.95	0.15	0.21	0.18	1.45	2.02	1.77
1.705	1.41	2.21	1.85	0.17	0.27	0.22	1.24	1.94	1.63
2.623	1.4	2.09	1.81	0.17	0.26	0.22	1.23	1.83	1.59
3.651	1.28	1.99	1.72	0.16	0.25	0.22	1.12	1.74	1.5
4.625	1.34	2.18	1.81	0.19	0.32	0.26	1.14	1.87	1.55
5.653	1.42	2.4	1.92	0.24	0.4	0.32	1.18	2	1.6
6.719	2.23	3.54	2.74	0.56	0.88	0.68	1.68	2.66	2.06
7.698	3	4.46	3.51	0.89	1.33	1.05	2.11	3.13	2.47
8.779	4.49	6.33	4.96	1.77	2.5	1.96	2.72	3.83	3.01
9.789	5.32	7.34	5.86	2.54	3.51	2.8	2.77	3.83	3.06
10.744	7.11	9.7	7.62	4.43	6.04	4.75	2.68	3.66	2.88
11.751	8.45	11.61	8.97	6.2	8.52	6.58	2.25	3.09	2.39
12.74	9.12	12.47	9.65	6.99	9.56	7.4	2.13	2.91	2.25
13.541	9.4	12.47	9.98	7.52	9.97	7.98	1.88	2.49	2
14.522	10.33	13.36	10.94	8.87	11.47	9.39	1.46	1.89	1.55
15.458	10.97	14.51	11.32	9.84	13.02	10.15	1.13	1.5	1.17
16.532	0	0	0	0	0	0	0	0	0

Table 29. Optical properties of the water column at station 48 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0.000	63.90	6.71	58.46	10.84	52.80	8.76	418.71	99.20	12.04	29.28
1.070	62.75	9.53	59.17	5.43	52.09	9.11	115.44	27.35	5.35	29.22
1.867	64.80	8.79	59.17	8.43	54.10	5.60	54.89	13.01	2.68	29.18
2.739	65.70	9.03	60.05	7.23	55.04	7.71	58.93	13.96	3.48	29.15
3.699	66.48	11.27	60.05	12.04	54.93	7.71	25.03	5.93	1.34	28.90
4.558	62.95	15.67	52.79	16.24	48.67	11.91	8.61	2.04	1.34	27.63
5.522	52.49	24.62	41.10	22.85	38.41	18.91	2.15	0.51	0.00	26.87
6.616	39.47	32.57	29.05	27.65	28.02	25.92	0.00	0.00	0.00	26.42
7.495	32.90	38.71	23.38	33.66	22.01	29.07	0.00	0.00	0.00	26.28
8.589	22.92	49.81	14.88	38.46	12.68	39.23	0.00	0.00	0.00	25.96
9.520	19.28	54.87	12.22	43.87	9.14	44.47	0.00	0.00	0.00	25.85
10.553	16.12	62.66	9.57	49.28	6.19	49.04	0.00	0.00	0.00	25.74
11.435	11.81	72.03	6.91	60.69	2.06	57.79	0.00	0.00	0.00	25.57

Depth (m)	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0.000	1.79	2.15	2.55	0.12	0.14	0.17	1.67	2.00	2.38
1.070	1.86	2.10	2.61	0.18	0.20	0.25	1.69	1.90	2.36
1.867	1.74	2.10	2.46	0.15	0.18	0.22	1.58	1.91	2.24
2.739	1.68	2.04	2.39	0.15	0.18	0.22	1.53	1.86	2.17
3.699	1.63	2.04	2.40	0.18	0.23	0.27	1.45	1.81	2.13
4.558	1.85	2.56	2.88	0.29	0.40	0.45	1.56	2.16	2.43
5.522	2.58	3.56	3.83	0.63	0.88	0.94	1.94	2.68	2.89
6.616	3.72	4.94	5.09	1.21	1.61	1.66	2.51	3.33	3.43
7.495	4.45	5.81	6.06	1.72	2.25	2.34	2.73	3.56	3.71
8.589	5.89	7.62	8.26	2.93	3.80	4.11	2.96	3.82	4.15
9.520	6.58	8.41	9.57	3.61	4.61	5.25	2.97	3.79	4.32
10.553	7.30	9.39	11.13	4.57	5.88	6.97	2.73	3.51	4.15
11.435	8.54	10.69	15.52	6.15	7.70	11.18	2.39	2.99	4.34

Table 30. Optical properties of the water column at station 89 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (μE)	Irradiance Percent of Surface	Irradiance Upwelling (μE)	Temp. (°C)
0	46.48	15.17	35.61	43.84	44.25	26.62	1473.54	88	35.86	30.27
0.913	42.03	21.38	33.66	37.84	40.47	27.32	315.1	18.82	16.06	29.4
1.924	32.73	35.23	23.03	50.45	30.68	35.03	39.29	2.35	3.48	28.22
2.951	32.25	34.56	23.03	51.65	30.44	38.53	7	0.42	0	28.16
3.978	20.46	51.22	12.4	58.86	19.23	49.39	0	0	0	27.48
4.846	13.95	62.16	7.97	66.67	13.33	57.44	0	0	0	26.95
5.838	10.9	68.71	6.2	72.67	10.86	61.3	0	0	0	26.5
6.758	10.19	71.2	5.49	70.27	10.15	63.75	0	0	0	26.34
7.725	9.43	72.52	5.31	75.68	9.44	62.7	0	0	0	26.25
8.734	9.07	72.69	5.31	76.88	9.2	63.05	0	0	0	26.12
9.693	5.23	86.61	2.66	82.88	5.66	75.31	0	0	0	25.86

Depth (m)	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0	3.06	4.13	3.26	0.46	0.63	0.49	2.6	3.5	2.77
0.913	3.47	4.36	3.62	0.74	0.93	0.77	2.73	3.42	2.84
1.924	4.47	5.87	4.73	1.57	2.07	1.66	2.89	3.8	3.06
2.951	4.53	5.87	4.76	1.56	2.03	1.64	2.96	3.84	3.11
3.978	6.35	8.35	6.59	3.25	4.28	3.38	3.1	4.07	3.22
4.846	7.88	10.12	8.06	4.9	6.29	5.01	2.98	3.83	3.05
5.838	8.87	11.12	8.88	6.09	7.64	6.1	2.77	3.48	2.78
6.758	9.13	11.61	9.15	6.5	8.26	6.52	2.63	3.34	2.64
7.725	9.44	11.74	9.44	6.85	8.51	6.85	2.59	3.23	2.59
8.734	9.6	11.74	9.54	6.98	8.53	6.94	2.62	3.21	2.61
9.693	11.8	14.51	11.48	10.22	12.57	9.95	1.58	1.94	1.54

Table 31. Optical properties of the water column at station 120 on 28 July 1992.

Depth (m)	Transmit. Red %	Scatter. Red %	Transmit. Green %	Scatter. Green %	Transmit. Amber %	Scatter. Amber %	Irradiance Downwelling (µE)	Irradiance Percent of Surface	Irradiance Upwelling (µE)	Temp. (°C)
0	40.26	32.74	28.52	28.83	34.57	23.12	335.29	99.01	27.56	27
0.887	20.33	50.89	15.06	45.03	20.29	37.83	46.82	13.83	5.35	25.95
1.839	16.65	55.7	12.4	45.65	17.11	42.38	5.38	1.59	1.07	25.91
2.904	15.17	57.94	10.81	46.25	15.46	42.03	0.81	0.24	0	25.86
3.779	0.2	157.31	0	97.3	0	126.79	0	0	0	25.76

Depth (m)	ATTENUANCE (per meter)			SCATTERANCE (per meter)			ABSORBANCE (per meter)		
	RED	GREEN	AMBER	RED	GREEN	AMBER	RED	GREEN	AMBER
0	3.64	5.02	4.25	1.19	1.64	1.39	2.45	3.38	2.86
0.887	6.37	7.57	6.38	3.24	3.85	3.25	3.13	3.72	3.13
1.839	7.17	8.35	7.06	3.99	4.65	3.93	3.18	3.7	3.13
2.904	7.54	8.9	7.47	4.37	5.16	4.33	3.17	3.74	3.14
3.779	24.81	62.09	63.72	39.03	97.68	100.24	-14.22	-35.59	-36.52

Table 32. Cluster characteristics and relative sensitivity to changes in nutrients and/or turbidity.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Physical Condition	Lake-Like	Transition	Transition	River-Like
Nutrient Supply	Moderate P-Limited	Moderate P-Limited	High N/P-Limited	Very High N/P-Limited
Water Clarity	Algae-Dominated	Transition Algae	Transition Turbidity	Turbidity-Dominated
Response to Change	Moderate (Nutrients)	High (Nutrients)	High (Turbidity)	Minimal

Appendix A

Water Quality Data for Tributary Streams for 1991

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time, 24-hr Clock
stg	Stage, ft
dschg	Discharge, cfs
dep	Depth, m
tem	Temperature, °C
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
tsn	Total Soluble Nitrogen, mg/L
nh3	Ammonia Nitrogen, mg/L
no3no2	Nitrate Nitrite Nitrogen, mg/L
tfe	Total Iron, mg/L
dfe	Dissolved Iron, mg/L
tmn	Total Manganese, mg/L
dmn	Dissolved Manganese, mg/L
toc	Total Organic Carbon, mg/L
tss	Total Suspended Solids, mg/L

m	d	y	sta	time	stg	dschg	dep	tem	tp	tsp	srp	tn	tsn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	tss
4	21	91	IBC	1410	2.34	.	0.0	17.0	0.050	0.011	0.008	0.34	0.39	.	.	.	.	.	.	3.7	20.4
4	21	91	ISC	1340	1.20	.	0.0	16.5	0.052	0.010	0.006	0.29	0.28	.	.	.	.	.	.	2.5	4.0
4	21	91	ITC	1710	.	.	0.0	20.5	0.028	0.009	0.006	0.39	0.19	.	.	.	.	.	.	3.4	3.2
4	21	91	IWC	1520	.	12.31	0.0	17.0	0.009	-0.005	-0.005	0.23	0.20	.	.	.	.	.	.	2.3	14.0
4	21	91	IYC	1530	2.80	.	0.0	17.2	0.028	0.007	0.005	-0.02	0.31	.	.	.	.	.	.	2.7	14.0
4	21	91	WPDC	1755	.	.	0.0	20.0	0.025	0.018	0.011	0.77	0.67	.	.	.	.	.	.	2.6	2.4
5	11	91	IBC	835	3.12	.	0.0	20.0	0.109	0.033	0.025	0.91	0.69	0.03	0.19	.	.	.	.	17.7	100.7
5	11	91	ISC	820	3.36	.	0.0	13.8	0.058	0.015	0.013	0.72	0.90	0.03	0.40	.	.	.	.	17.1	83.3
5	11	91	ITC	1045	.	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
5	11	91	IWC	950	.	31.84	0.0	20.0	0.020	0.007	-0.005	0.58	0.54	0.05	0.11	.	.	.	.	3.5	6.0
5	11	91	IYC	902	8.20	.	0.0	20.0	0.087	0.017	0.010	0.08	0.62	-0.02	0.24	.	.	.	.	11.1	59.5
5	11	91	WPDC	1115	.	.	0.0	21.8	0.038	0.021	0.014	1.04	1.00	0.04	0.79	.	.	.	.	6.9	2.0
5	25	91	IBC	835	2.54	.	0.0	22.2	0.366	0.182	0.167	0.60	0.53	0.04	0.24	.	.	.	.	2.9	13.2
5	25	91	ISC	820	1.10	.	0.0	22.0	0.214	0.148	0.080	0.54	0.42	0.09	0.14	.	.	.	.	2.6	7.2
5	25	91	ITC	1040	.	1.31	0.0	25.0	0.544	0.281	0.118	1.57	1.29	0.08	0.11	.	.	.	.	10.0	15.2
5	25	91	IWC	940	.	.	0.0	22.2	0.228	0.141	0.089	0.53	0.42	0.09	0.12	.	.	.	.	2.8	6.8
5	25	91	IYC	854	2.30	.	0.0	22.2	0.311	0.216	0.146	0.67	0.46	0.06	0.25	.	.	.	.	3.2	24.8
5	25	91	WPDC	1130	.	12.01	0.0	21.5	0.386	0.241	0.127	0.91	0.81	0.13	0.61	.	.	.	.	2.8	3.2
6	8	91	IBC	812	2.56	.	0.0	19.0	0.040	0.017	0.010	0.61	0.53	0.07	0.20	.	.	.	.	2.7	5.0
6	8	91	ISC	755	1.10	.	0.0	18.5	0.025	0.012	0.007	0.63	0.46	0.07	0.13	.	.	.	.	2.1	0.5
6	8	91	ITC	1036	.	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
6	8	91	IWC	920	.	4.89	0.0	18.5	0.017	0.008	0.005	0.65	0.51	0.12	0.12	.	.	.	.	2.5	8.5
6	8	91	IYC	830	2.02	.	0.0	19.8	0.028	0.011	0.007	0.85	0.51	0.08	0.29	.	.	.	.	1.8	3.0
6	8	91	WPDC	1115	.	.	0.0	25.5	0.036	0.016	0.009	1.01	0.95	0.16	0.37	.	.	.	.	2.8	1.0
6	22	91	IBC	.	2.32	.	0.0	24.2	0.042	0.019	0.009	1.05	0.53	0.06	0.17	1.82	0.54	0.45	0.41	3.9	8.5
6	22	91	ISC	.	0.92	.	0.0	23.5	0.024	0.011	-0.005	0.93	0.89	0.08	0.08	1.72	0.48	0.96	0.96	2.7	6.0
6	22	91	ITC	.	.	.	0.0	30.5	0.042	0.011	-0.005	1.00	0.64	0.07	0.00	0.44	-0.05	4.46	4.00	.	.
6	22	91	IWC	.	.	7.28	0.0	24.5	0.019	0.007	-0.005	0.77	0.44	0.11	0.07	3.17	0.10	1.30	1.30	3.9	10.3
6	22	91	IYC	.	1.92	.	0.0	24.5	0.039	0.013	0.005	1.09	0.61	0.07	0.23	2.24	32.00	0.36	0.22	3.6	23.5
6	22	91	WPDC	.	.	.	0.0	27.0	0.029	0.010	0.005	0.87	0.43	0.18	7.37	0.31	0.06	0.23	0.23	2.9	3.0
7	6	91	IBC	825	3.10	.	0.0	24.5	0.050	0.016	0.010	0.82	0.69	0.28	0.18	2.77	0.46	0.71	0.58	4.0	12.5
7	6	91	ISC	808	1.48	.	0.0	23.8	0.030	0.011	0.131	0.73	0.57	0.28	0.14	2.62	0.16	0.61	0.56	3.5	14.0
7	6	91	ITC	1030	.	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	6	91	IWC	920	.	11.20	0.0	24.5	0.021	0.007	0.005	0.85	0.60	0.29	0.09	3.33	0.09	1.09	1.09	3.7	8.0
7	6	91	IYC	840	2.72	.	0.0	24.7	0.066	0.014	0.036	0.94	0.54	0.29	0.19	3.34	0.21	0.48	0.25	3.8	43.0
7	6	91	WPDC	1055	.	.	0.0	26.8	0.028	0.013	0.006	1.27	1.15	0.29	0.59	0.22	-0.05	0.17	0.17	2.7	1.5
7	19	91	IBC	1100	2.54	.	0.0	25.1	0.510	0.190	0.008	0.87	0.60	0.00	0.21	2.47	0.42	0.44	0.35	3.2	1.9
7	19	91	ISC	1045	1.12	.	0.0	25.0	0.280	0.100	0.008	0.98	0.77	0.13	0.09	1.98	0.27	0.83	0.81	2.5	0.8
7	19	91	ITC	1315	.	1.66	0.0	31.7	0.590	0.080	0.000	1.01	0.63	0.02	0.09	0.44	-0.05	0.56	-0.05	3.9	2.6
7	19	91	IWC	1150	.	19.30	0.0	27.5	0.220	0.050	0.000	0.78	0.55	0.00	0.11	2.98	-0.05	0.49	0.46	3.8	4.4
7	19	91	IYC	1118	2.20	.	0.0	26.6	0.380	0.130	0.000	0.80	0.66	0.00	0.31	2.84	0.15	0.35	0.21	2.7	1.0
7	19	91	WPDC	1400	.	.	0.0	25.8	0.230	0.040	0.102	1.08	1.07	0.20	0.57	0.22	-0.05	0.20	0.20	2.1	0.4

m	d	y	sta	time	stg	dschg	dep	tem	tp	tsp	srp	tn	tsn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	tss
8	4	91		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	4	91	IBC	1203	2.10	.	0.0	26.1	0.024	0.010	0.005	0.97	0.83	0.03	0.07	1.48	0.44	0.43	0.42	3.4	10.5
8	4	91	ISC	1220	0.96	.	0.0	26.0	0.021	0.010	-0.005	1.06	0.85	0.12	0.04	1.78	0.29	0.90	0.89	2.6	7.0
8	4	91	IWC	1305	.	.	0.0	26.8	0.017	0.010	-0.005	0.98	0.80	0.11	0.07	3.12	0.10	1.27	1.20	3.1	19.5
8	4	91	IYC	1147	1.80	.	0.0	27.7	0.030	0.010	-0.005	1.24	0.89	0.09	0.22	1.75	0.29	0.28	0.22	3.0	11.0
8	4	91	WPDC	1455	.	1.99	0.0	28.2	0.027	0.010	-0.005	1.25	1.11	0.15	0.38	0.42	0.08	0.21	0.21	3.5	4.5
8	16	91	IBC	1145	2.72	.	0.0	23.6	0.043	0.010	-0.005	0.70	0.49	0.09	0.10	2.36	0.22	0.42	0.31	3.9	13.0
8	16	91	ISC	1130	1.22	.	0.0	22.7	0.020	0.008	-0.005	0.76	0.56	0.13	0.08	1.93	0.16	0.71	0.68	3.9	4.5
8	16	91	ITC	940	.	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
8	16	91	IWC	1020	.	8.44	0.0	23.0	0.022	0.007	-0.005	0.77	0.56	0.09	0.06	2.84	0.05	0.66	0.60	3.7	6.5
8	16	91	IYC	1203	2.46	.	0.0	24.5	.	0.015	0.006	1.61	0.61	0.06	0.22	3.48	0.19	0.48	0.44	5.4	48.0
8	16	91	WPDC	910	.	.	0.0	27.2	0.026	0.008	-0.005	1.01	0.85	0.15	0.39	0.20	-0.05	0.14	0.14	2.6	3.5
8	30	91	IBC	932	2.10	.	0.0	23.8	0.019	0.011	0.007	0.61	0.49	0.10	0.15	1.70	0.58	0.52	0.49	2.8	4.5
8	30	91	ISC	917	0.96	.	0.0	23.5	0.017	0.008	0.005	0.53	0.45	0.12	0.11	1.71	0.26	0.74	0.67	2.2	4.5
8	30	91	ITC	1140	.	0.51	0.0	28.5	0.048	0.011	0.005	0.85	0.40	0.09	-0.04	0.49	-0.05	0.41	-0.05	5.3	9.5
8	30	91	IWC	1035	.	4.58	0.0	24.1	0.016	0.008	-0.005	0.68	0.62	0.17	0.14	2.96	0.05	1.05	0.98	3.4	6.0
8	30	91	IYC	955	1.70	.	0.0	24.1	0.025	0.008	0.006	0.88	0.69	0.12	0.26	1.90	0.18	0.32	0.27	2.4	10.5
8	30	91	WPDC	1227	.	.	0.0	27.8	0.029	0.010	.	2.19	0.99	0.23	0.46	0.32	-0.05	0.21	0.19	3.0	3.3
9	12	91	IBC	1617	1.82	.	0.0	25.0	0.020	0.011	-0.005	0.69	0.52	0.08	0.14	1.13	0.37	0.40	0.40	2.1	1.0
9	12	91	ISC	1630	0.76	.	0.0	24.4	0.018	0.013	-0.005	0.59	0.45	0.11	0.07	1.26	0.40	0.45	0.43	2.1	4.5
9	12	91	ITC	1425	.	.	0.0	29.7	0.071	0.015	0.007	1.33	0.66	0.11	-0.04	0.54	-0.05	0.22	-0.05	3.7	10.5
9	12	91	IWC	1500	.	2.69	0.0	25.5	0.018	0.008	-0.005	0.82	0.62	0.12	0.07	2.93	0.06	0.95	0.87	3.4	5.5
9	12	91	IYC	1600	1.38	.	0.0	27.5	0.031	0.016	0.010	0.89	0.70	0.09	0.29	1.60	0.32	0.28	0.24	5.3	3.0
9	12	91	WPDC	1330	.	.	0.0	27.0	0.036	0.012	0.005	1.25	0.94	0.11	0.55	0.34	-0.05	0.11	0.60	2.0	5.0
9	27	91	IBC	1625	2.40	.	0.0	18.3	0.048	0.020	0.014	0.63	0.55	0.06	0.07	1.92	0.26	0.25	0.14	3.3	13.0
9	27	91	ISC	1638	0.94	.	0.0	18.5	0.026	0.018	0.008	0.64	0.51	0.08	0.08	1.89	0.20	0.37	0.34	2.4	6.5
9	27	91	ITC	1420	.	1.01	0.0	25.6	0.048	0.012	0.008	0.92	0.46	0.08	-0.04	0.76	0.05	0.35	-0.05	5.1	5.0
9	27	91	IWC	1500	.	5.82	0.0	19.5	0.022	0.009	0.007	1.02	0.49	0.09	0.10	2.92	0.09	0.46	0.38	4.0	6.5
9	27	91	IYC	1604	1.74	.	0.0	21.0	0.040	0.016	0.012	0.79	0.60	0.08	0.15	2.22	0.28	0.23	0.12	2.5	15.0
9	27	91	WPDC	1340	.	.	0.0	25.0	0.036	0.012	0.007	1.05	0.70	0.08	0.32	0.23	-0.05	0.06	-0.05	1.8	1.5
10	11	91		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	11	91	IBC	1205	2.00	.	0.0	16.2	0.015	0.008	0.008	0.57	0.30	-0.02	0.09	1.02	0.36	0.37	0.37	2.0	5.0
10	11	91	ISC	1150	0.84	.	0.0	15.6	0.016	0.009	0.007	0.60	0.35	0.06	0.11	1.12	0.26	0.37	0.37	1.7	3.0
10	11	91	ITC	1010	.	.	0.0	16.7	0.047	0.013	0.009	1.01	0.46	0.02	0.02	0.57	-0.05	0.26	-0.05	5.1	3.0
10	11	91	IWC	900	.	.	0.0	14.4	0.013	0.006	0.007	0.49	0.34	0.07	0.06	2.54	0.11	0.62	0.53	2.5	5.0
10	11	91	IYC	1220	1.40	.	0.0	18.3	0.024	0.010	0.017	0.56	0.34	0.04	0.17	1.44	0.24	0.24	0.21	2.4	5.5
10	11	91	WPDC	1100	.	3.37	0.0	21.8	0.032	0.008	0.007	1.15	0.71	0.03	0.44	0.23	-0.05	-0.05	-0.05	2.3	2.5
10	25	91	IBC	1200	2.16	.	0.0	18.7	0.025	0.010	0.005	.	.	0.07	-0.02	1.31	0.29	0.27	0.23	3.1	5.0
10	25	91	ISC	1150	0.82	.	0.0	18.5	0.026	0.012	0.005	.	.	0.03	0.03	1.00	0.19	0.33	0.32	2.8	4.0
10	25	91	ITC	1020	.	.	0.0	20.5	0.052	0.013	0.005	.	.	0.05	-0.02	0.60	-0.05	0.26	-0.05	5.7	4.5
10	25	91	IWC	915	.	3.64	0.0	17.5	0.027	0.007	0.005	.	.	0.09	-0.02	2.68	0.12	0.53	0.51	3.0	9.5
10	25	91	IYC	1220	1.46	.	0.0	20.6	0.025	0.012	0.024	.	.	0.07	0.09	1.33	0.21	0.20	0.16	2.9	7.5
10	25	91	WPDC	1100	.	.	0.0	21.3	0.039	0.025	0.013	.	.	0.05	0.48	0.28	-0.05	0.07	-0.05	2.6	2.0

m	d	y	sta	time	stg	dschg	dep	tem	tp	tsp	srp	tn	tsn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	tss
11	8	91	IBC	815	2.20	.	0.0	8.5	.	.	.	.	.	.	.	.	.	.	.	.	2.5
11	8	91	ISC	800	0.86	.	0.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.
11	8	91	ITC	1015	.	.	0.0	10.5	.	.	.	.	.	.	.	.	.	.	.	5.8	2.5
11	8	91	IWC	915	.	4.41	0.0	8.0	.	.	.	.	.	.	.	.	.	.	.	.	2.3
11	8	91	IYC	833	1.58	.	0.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	2.6
11	8	91	WPDC	1100	.	.	0.0	15.3	.	.	.	.	.	.	.	.	.	.	.	2.3	4.5

Appendix B

Water Quality Data for Tributary Streams for 1992

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time, 24-hr Clock
stg	Stage, ft
dschg	Discharge, cfs
dep	Depth, m
tem	Temperature, °C
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
tsn	Total Soluble Nitrogen, mg/L
nh3	Ammonia Nitrogen, mg/L
no3no2	Nitrate Nitrite Nitrogen, mg/L
tfe	Total Iron, mg/L
dfe	Dissolved Iron, mg/L
tmn	Total Manganese, mg/L
dmn	Dissolved Manganese, mg/L
toc	Total Organic Carbon, mg/L
tss	Total Suspended Solids, mg/L

m	d	y	sta	time	stg	dschg	dep	tem	tp	tsp	srp	tn	tsn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	tss
6	5	92	IBC	1247	.	.	0.0	.	0.044	.	.	0.70	.	.	.	2.90	.	0.32	.	3.3	16.1
6	5	92	ISC	1303	1.1	.	0.0	.	0.028	.	.	0.54	.	.	.	2.62	.	0.46	.	2.9	9.7
6	5	92	IYC	1230	.	.	0.0	.	0.046	.	.	0.78	.	.	.	4.71	.	0.37	.	3.6	49.8
6	19	92	IBC	1219	.	.	0.0	.	0.072	.	.	1.18	.	.	.	2.20	.	0.47	.	2.9	7.5
6	19	92	ISC	1232	1.1	.	0.0	.	0.075	.	.	1.21	.	.	.	2.21	.	0.78	.	2.5	5.5
6	19	92	IYC	1205	.	.	0.0	.	0.082	.	.	1.29	.	.	.	2.88	.	0.28	.	2.4	17.6
7	3	92	IBC	1043	.	.	0.0	.	0.075	.	.	1.81	.	.	.	2.30	.	0.35	.	3.6	9.6
7	3	92	ISC	1053	0.9	.	0.0	.	0.062	.	.	1.38	.	.	.	2.14	.	0.62	.	2.1	5.9
7	3	92	IYC	1026	.	.	0.0	.	0.077	.	.	1.92	.	.	.	2.70	.	0.27	.	5.0	12.6
7	19	92	IBC	1707	.	.	0.0	.	0.053	.	.	1.07	.	.	.	1.83	.	0.38	.	2.3	5.5
7	19	92	ISC	1718	0.9	.	0.0	.	0.066	.	.	1.06	.	.	.	2.17	.	0.68	.	2.0	3.3
7	19	92	IYC	1652	.	.	0.0	.	0.066	.	.	1.21	.	.	.	2.39	.	0.26	.	.	11.8

Appendix C

Supplemental Water Quality Data for West Point Lake for 1991

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time
do	Dissolved Oxygen, mg/L
spc	Specific Conductivity, μmhos
ph	pH
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
dn	Dissolved Nitrogen, mg/L
tfe	Total Iron, mg/L
tmn	Total Manganese, mg/L
toc	Total Organic Carbon, mg/L
doc	Dissolved Organic Carbon, mg/L
turb	Turbidity, NTUs
fluo	Fluorescence, relative units
chla	Chlorophyll a, mg/m^3
chlb	Chlorophyll b, mg/m^3
chlc	Chlorophyll c, mg/m^3
acla	Acid-corrected Chlorophyll a, mg/m^3
pha	Phaeophytin, mg/m^3
sd	Secchi Disk Transparency, m

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
4	20	91	101	1635	0.0	21.3	7.5	85.0	7.1	.	.	.	.	.	.	.	.	.	.	0.66	10.9	0.6	1.2	9.4	2.0	0.5
4	20	91	101	1635	1.0	21.3	7.3	85.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
4	20	91	101	1635	2.0	21.2	7.1	84.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
4	20	91	101	1635	3.0	21.1	6.9	83.0	6.9	0.115	0.056	0.017	1.05	0.95	1.64	0.11	3.00	2.40	20.0	.	.	.	.	.	.	0.5
4	20	91	101	1635	4.0	21.0	6.5	82.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
4	20	91	101	1635	5.0	21.0	6.7	82.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
4	20	91	118	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.9	0.8	1.6	14.0	3.9	.
4	20	91	50	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	30.0	2.0	3.1	23.9	8.6	.
4	20	91	60	1725	0.0	22.4	9.8	82.0	7.6	0.067	0.032	0.030	1.00	0.77	0.48	0.07	3.50	2.80	6.0	1.71	23.5	1.1	2.3	18.0	8.0	1.1
4	20	91	60	1725	2.0	22.4	9.7	82.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	20	91	60	1725	4.0	22.4	9.6	82.0	7.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	20	91	60	1725	6.0	20.7	5.3	82.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	20	91	60	1725	8.0	20.1	4.8	81.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	20	91	60	1725	10.0	18.3	3.5	77.0	6.7	0.064	0.044	0.027	0.92	0.85	0.77	0.09	3.10	3.00	13.0	.	.	.	.	.	.	1.1
4	20	91	60	1725	12.0	17.2	2.9	72.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	20	91	60	1725	14.0	16.1	2.3	70.0	6.5	0.068	0.044	0.006	0.86	0.75	1.13	0.24	3.90	3.60	18.0	.	.	.	.	.	.	1.1
4	20	91	84	1700	0.0	22.0	8.6	91.0	7.2	.	.	.	.	.	.	.	.	.	.	1.04	3.6	0.2	0.6	2.7	1.4	0.9
4	20	91	84	1700	1.0	22.2	8.3	90.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
4	20	91	84	1700	2.0	22.1	7.7	90.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
4	20	91	84	1700	3.0	22.0	6.8	90.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
4	20	91	84	1700	4.0	21.6	6.7	90.0	6.8	0.100	0.043	0.034	1.16	0.94	1.20	0.16	2.60	2.70	13.0	.	.	.	.	.	.	0.9
4	20	91	84	1700	5.0	21.6	6.7	90.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
4	20	91	84	1700	6.0	21.6	6.7	90.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
4	20	91	NR3	1610	0.0	19.6	6.6	53.0	7.2	.	.	.	.	.	.	.	.	.	.	0.66	12.9	1.4	0.8	11.1	2.4	0.2
4	20	91	NR3	1610	1.0	19.4	6.3	53.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2
4	20	91	NR3	1610	2.0	19.1	5.9	51.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2
4	20	91	NR3	1610	3.0	18.9	5.9	51.0	6.8	0.057	0.021	0.006	0.33	0.41	3.26	0.32	4.70	4.40	33.0	.	.	.	.	.	.	0.2
4	20	91	NR3	1610	4.0	18.8	5.9	51.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.2
4	20	91	WWC2TC	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	18.7	0.7	2.6	14.5	5.9	.
4	20	91	YC13JC	1430	0.0	23.2	10.7	63.0	8.4	0.021	0.005	-0.005	0.48	0.29	0.23	-0.05	3.10	2.90	3.0	1.05	10.7	0.0	1.7	8.9	2.3	2.2
4	20	91	YC13JC	1430	2.0	23.0	10.6	63.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2
4	20	91	YC13JC	1430	3.0	22.8	10.1	59.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2
4	20	91	YC13JC	1430	4.0	21.2	8.9	59.0	7.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2
4	20	91	YC13JC	1430	5.0	20.5	6.8	62.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2
4	20	91	YC13JC	1430	6.0	19.9	4.8	59.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2
4	20	91	YC13JC	1430	7.0	18.6	3.6	54.0	6.9	0.011	0.009	0.005	0.38	0.31	0.53	0.07	3.20	2.50	6.4	.	.	.	.	.	.	2.2
4	20	91	YC27BEC	1400	0.0	22.8	9.5	49.0	7.5	0.016	0.011	-0.005	0.21	0.11	0.38	-0.05	2.60	2.40	3.5	0.94	7.9	0.1	1.0	6.7	1.6	1.6
4	20	91	YC27BEC	1400	2.0	22.7	9.4	49.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6
4	20	91	YC27BEC	1400	3.0	22.6	9.3	49.0	7.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6
4	20	91	YC27BEC	1400	4.0	21.0	7.7	49.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6
4	20	91	YC27BEC	1400	5.0	20.3	5.4	51.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.6
4	20	91	YC27BEC	1400	6.0	19.0	2.7	53.0	6.8	0.015	0.005	-0.005	0.29	0.22	0.55	0.16	2.80	2.40	7.0	.	.	.	.	.	.	1.6

m	J	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
4	20	91	YC2HC	1455	0.0	23.1	11.5	80.0	8.7	0.043	0.023	0.006	0.79	0.55	0.30	-0.05	3.40	3.00	4.2	1.93	27.1	2.0	2.8	21.4	8.2	1.5
4	20	91	YC2HC	1455	0.0	23.1	11.5	80.0	8.7	0.040	0.014	0.006	0.76	0.52	0.30	-0.05	3.50	3.10	4.0	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	2.0	22.7	10.4	78.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	4.0	21.2	7.0	77.0	7.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	6.0	20.2	5.4	77.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	8.0	18.9	4.3	69.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	10.0	16.7	1.4	63.0	6.9	0.043	0.020	0.012	0.56	0.68	0.89	0.09	3.70	3.60	15.0	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	10.0	16.7	1.4	63.0	6.9	0.038	0.021	0.008	0.69	0.60	0.88	0.08	3.80	3.60	15.0	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	12.0	16.3	0.8	64.0	6.8	0.038	0.024	0.012	0.66	0.67	1.25	0.48	3.60	3.70	20.0	.	.	.	.	.	.	1.5
4	20	91	YC2HC	1455	12.0	16.3	0.8	64.0	6.8	0.039	0.024	0.010	0.66	0.60	1.32	0.50	3.60	3.90	20.0	.	.	.	.	.	.	1.5
4	22	91	21AC	1150	0.0	20.0	9.0	76.0	7.3	0.040	0.015	-0.005	0.84	0.56	0.32	-0.05	4.00	3.00	4.1	.	12.0	0.0	1.3	8.9	4.5	1.1
4	22	91	21AC	1150	2.0	19.6	8.7	76.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	22	91	21AC	1150	4.0	19.5	8.4	76.0	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	22	91	21AC	1150	6.0	19.5	8.0	76.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	22	91	21AC	1150	8.0	19.1	6.7	75.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
4	22	91	21AC	1150	10.0	16.9	3.6	69.0	6.7	0.030	0.014	0.006	0.77	0.73	0.34	-0.05	3.00	2.20	6.0	.	.	.	.	.	.	1.1
4	22	91	21AC	1150	12.0	16.0	2.5	66.0	6.6	0.045	0.034	0.014	0.75	0.73	0.65	0.08	3.10	2.70	13.0	.	.	.	.	.	.	1.1
4	22	91	36AWIC	910	0.0	19.7	8.1	78.0	6.9	0.048	0.012	-0.005	0.92	0.64	0.38	-0.05	3.50	2.60	5.1	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	2.0	19.7	8.3	78.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	4.0	19.7	8.0	78.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	6.0	19.7	7.7	78.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	8.0	17.4	3.6	70.0	6.5	0.045	0.029	0.015	0.86	0.75	0.61	-0.05	3.30	2.80	10.5	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	10.0	16.4	2.7	65.0	6.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	36AWIC	910	12.0	15.9	1.8	68.0	6.3	0.058	0.040	0.027	0.78	0.71	0.90	0.19	3.40	3.20	17.0	.	.	.	.	.	.	1.4
4	22	91	41	850	0.0	19.9	8.2	79.0	7.0	0.047	0.019	0.008	0.86	0.77	0.35	-0.05	3.20	3.10	5.0	1.16	14.6	0.4	1.5	10.9	5.5	1.4
4	22	91	41	850	2.0	19.9	8.2	79.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	41	850	4.0	19.9	8.1	79.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	41	850	6.0	19.7	6.4	79.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	41	850	8.0	17.7	3.3	71.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	41	850	9.0	17.2	2.8	69.0	6.5	0.053	0.033	0.016	0.79	0.33	1.06	0.14	3.50	3.30	15.0	.	.	.	.	.	.	1.4
4	22	91	MC2	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9.8	0.0	1.2	7.6	3.2	.
4	22	91	SC2	1050	0.0	19.8	8.6	71.0	7.3	0.024	0.013	-0.005	0.74	0.44	0.28	-0.05	3.20	2.80	5.1	.	.	.	.	.	.	1.7
4	22	91	SC2	1050	2.0	19.7	8.5	71.0	7.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
4	22	91	SC2	1050	4.0	19.7	8.0	71.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
4	22	91	SC2	1050	6.0	19.5	7.5	69.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
4	22	91	SC2	1050	8.0	17.4	4.1	65.0	6.8	0.010	0.010	-0.005	0.55	0.45	0.27	0.05	2.40	2.20	4.5	.	.	.	.	.	.	1.7
4	22	91	SC2	1050	10.0	16.3	2.1	59.0	6.5	0.012	0.018	-0.005	0.55	0.47	0.38	0.19	2.70	2.60	5.2	.	.	.	.	.	.	1.7
4	22	91	VC3	1025	0.0	19.9	8.7	69.0	7.4	0.024	0.015	-0.005	0.60	0.42	0.31	-0.05	2.80	2.90	4.8	.	.	.	.	.	.	.
4	22	91	VC3	1025	2.0	20.0	8.6	69.0	7.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	22	91	VC3	1025	4.0	20.0	8.0	69.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	22	91	VC3	1025	6.0	19.3	5.1	69.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	22	91	VC3	1025	8.0	17.2	2.2	62.0	6.5	0.012	0.008	-0.005	0.48	0.43	0.28	0.09	2.40	2.10	4.5	.	.	.	.	.	.	.
4	22	91	VC3	1025	10.0	16.2	0.7	63.0	6.4	0.012	0.008	0.012	0.51	0.37	0.42	0.32	2.40	2.20	.	.	.	.	.	.	.	.
4	22	91	WEC16	1120	0.0	19.9	8.0	65.0	7.1	0.019	0.009	-0.005	0.57	0.46	0.35	-0.05	2.60	2.90	6.0	0.28	3.8	0.1	0.5	2.7	1.7	1.5
4	22	91	WEC16	1120	2.0	19.5	7.9	67.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	22	91	WEC16	1120	4.0	19.5	7.6	65.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	22	91	WEC16	1120	6.0	19.3	5.8	63.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
4	22	91	WEC16	1120	8.0	17.1	2.6	48.0	6.6	0.016	0.008	-0.005	0.44	0.34	0.57	0.09	2.70	2.40	8.0	.	.	.	.	.	.	1.5
4	22	91	WEC16	1120	10.0	16.2	1.4	50.0	6.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
4	22	91	WEC16	1120	12.0	15.5	0.1	58.0	6.3	0.018	0.009	0.100	0.44	0.33	0.74	0.83	2.70	2.20	9.0	.	.	.	.	.	.	1.5
4	22	91	WEC5VC	950	0.0	19.7	8.8	71.0	7.6	0.027	0.014	-0.005	0.67	0.57	0.37	-0.05	2.80	2.50	5.3	0.36	6.8	0.0	0.8	5.6	1.6	1.8
4	22	91	WEC5VC	950	2.0	19.8	8.5	71.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	4.0	19.7	8.2	71.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	6.0	19.7	8.1	71.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	8.0	17.1	4.0	68.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	10.0	16.1	3.1	64.0	6.6	0.035	0.025	0.016	0.66	0.65	0.54	0.08	2.90	2.70	9.0	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	12.0	15.5	2.7	63.0	6.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	14.0	14.7	1.0	67.0	6.4	0.032	0.020	0.013	0.63	0.55	0.47	0.41	2.50	2.30	7.5	.	.	.	.	.	.	1.8
4	22	91	WEC5VC	950	16.0	14.2	0.1	70.0	6.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8
4	22	91	WES1	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12.2	0.1	1.8	10.0	2.9	.
4	22	91	WES2	1220	0.0	20.5	9.1	75.0	7.5	0.030	0.016	-0.005	0.80	0.65	0.32	-0.05	2.80	2.40	7.5	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	2.0	19.9	8.5	75.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	4.0	19.8	8.1	75.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	6.0	19.8	8.0	75.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	8.0	19.6	7.8	75.0	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	10.0	18.8	4.4	75.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	12.0	16.4	3.7	70.0	6.7	0.035	0.029	0.018	0.79	0.77	0.42	0.06	2.30	2.20	7.7	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	14.0	15.9	3.2	68.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	16.0	15.1	2.0	68.0	6.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	18.0	14.8	1.6	68.0	6.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	20.0	14.6	1.4	69.0	6.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	25	91	101	930	0.0	28.0	6.6	89.0	7.4	0.083	0.031	-0.005	1.62	1.20	1.17	0.22	3.28	2.80	22.0	0.42	10.4	0.6	0.6	8.5	2.6	0.4
7	25	91	101	930	2.0	27.8	6.6	85.0	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.4
7	25	91	101	930	4.0	27.5	6.2	80.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.4
7	25	91	101	930	5.0	26.3	3.8	71.0	6.9	0.071	0.023	-0.005	1.23	1.22	1.26	0.22	3.67	2.98	.	.	.	.	.	.	.	0.4
7	25	91	101	930	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.41	10.7	0.5	0.8	9.1	2.1	0.4
7	25	91	118	830	0.0	27.6	6.9	86.0	6.9	.	.	.	.	.	.	.	.	.	.	0.12	2.6	0.1	0.3	1.9	1.0	0.4
7	25	91	118	830	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.7	0.1	0.1	1.9	1.2	0.4
7	25	91	118	830	2.0	27.6	6.9	86.0	6.9	0.123	0.085	0.064	1.66	1.49	1.40	0.09	3.19	2.26	26.0	.	.	.	.	.	.	0.4
7	25	91	118	830	4.0	27.7	6.9	86.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.4
7	25	91	118	830	4.8	27.7	6.9	86.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.4
7	25	91	50	1910	0.0	29.7	11.2	80.0	8.7	0.044	0.038	-0.005	1.10	1.05	0.13	-0.05	3.20	2.89	3.7	1.32	25.6	0.3	2.2	21.2	5.8	0.9
7	25	91	50	1910	2.0	29.7	11.2	80.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
7	25	91	50	1910	4.0	28.7	8.4	78.0	8.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
7	25	91	50	1910	6.0	26.0	4.3	69.0	7.4	0.077	0.014	-0.005	1.18	1.16	14.00	-0.05	2.94	2.50	12.0	.	.	.	.	.	.	0.9
7	25	91	50	1910	8.0	25.5	3.8	66.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
7	25	91	50	1910	9.0	.	.	.	.	0.053	0.021	-0.005	1.21	1.08	1.14	0.19	3.56	2.96	31.0	.	.	.	.	.	.	0.9
7	25	91	50	1910	10.0	25.3	3.3	64.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.9
7	25	91	50	1910	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.31	24.4	1.0	3.0	20.1	5.9	0.9
7	25	91	60	1545	0.0	31.1	11.2	77.0	8.9	0.041	0.013	-0.005	0.15	-0.02	0.12	-0.05	3.38	2.69	3.3	1.25	27.6	0.0	2.2	23.4	5.3	1.0
7	25	91	60	1545	2.0	30.1	11.5	79.0	8.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	60	1545	4.0	29.5	10.0	76.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	60	1545	6.0	26.3	5.0	67.0	7.6	0.041	0.023	-0.005	1.09	1.08	0.54	-0.05	3.29	3.08	4.4	.	.	.	.	.	.	1.0
7	25	91	60	1545	8.0	26.0	4.0	66.0	7.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
7	25	91	60	1545	10.0	25.8	3.6	64.0	7.1	0.046	0.027	-0.005	1.34	1.18	0.95	0.12	3.44	3.13	23.0	.	.	.	.	.	.	1.0
7	25	91	60	1545	12.0	25.5	3.2	64.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	60	1545	14.0	25.3	2.7	65.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	60	1545	15.5	25.1	1.6	66.0	6.8	0.049	0.030	-0.005	1.19	1.12	1.29	0.26	3.30	3.09	30.0	.	.	.	.	.	.	1.0
7	25	91	60	1545	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.22	24.5	0.6	2.9	20.1	5.9	1.0
7	25	91	71	1100	0.0	29.1	10.6	75.0	8.9	0.054	0.016	-0.005	1.17	0.79	0.25	-0.05	3.36	3.06	5.7	1.20	21.4	0.8	1.4	16.0	7.9	1.0
7	25	91	71	1100	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.0	0.5	1.7	18.2	8.4	1.0
7	25	91	71	1100	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	26.9	0.1	2.1	22.3	6.0	1.0
7	25	91	71	1100	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	0.3	2.2	23.4	7.0	1.0
7	25	91	71	1100	2.0	29.0	10.1	73.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	71	1100	4.0	27.8	7.3	69.0	7.6	0.044	0.012	-0.005	1.07	0.87	0.52	0.09	3.08	3.02	14.0	.	.	.	.	.	.	1.0
7	25	91	71	1100	6.0	26.3	5.1	67.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	71	1100	8.0	25.9	4.3	66.0	6.9	0.054	0.024	-0.005	1.20	1.09	1.25	0.17	3.78	3.27	26.0	.	.	.	.	.	.	1.0
7	25	91	71	1100	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.15	22.3	0.7	2.1	17.9	6.2	1.0
7	25	91	84	950	0.0	28.4	9.6	68.0	8.3	0.050	0.013	-0.005	1.04	0.80	0.40	0.10	3.66	2.83	12.0	0.84	24.5	0.5	1.8	19.0	7.8	0.6
7	25	91	84	950	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.3	0.8	0.8	13.5	8.7	0.6
7	25	91	84	950	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22.0	0.7	1.5	16.2	8.4	0.6
7	25	91	84	950	2.0	28.2	8.9	68.0	7.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
7	25	91	84	950	4.0	26.9	5.4	70.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
7	25	91	84	950	5.0	26.7	5.2	70.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
7	25	91	84	950	6.0	26.6	5.1	69.0	6.9	0.060	0.018	-0.005	1.15	1.02	1.21	0.18	3.24	2.72	27.0	.	.	.	.	.	.	0.6
7	25	91	84	950	6.7	26.5	4.7	69.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.6
7	25	91	84	950	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.85	26.2	0.9	1.5	20.6	7.9	0.6
7	25	91	NR3	900	0.0	28.2	9.5	71.0	8.1	0.037	0.014	-0.005	0.85	0.66	0.68	0.23	2.96	2.85	8.3	0.88	19.0	0.7	1.5	14.9	6.0	0.8
7	25	91	NR3	900	2.0	28.1	8.3	74.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.8
7	25	91	NR3	900	4.0	25.6	0.6	76.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.8
7	25	91	NR3	900	4.5	25.0	0.2	78.0	6.8	0.052	0.020	0.010	0.97	0.77	1.68	1.59	3.55	2.75	27.0	.	.	.	.	.	.	0.8
7	25	91	NR3	900	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.88	21.5	0.9	1.6	17.1	6.2	0.8
7	25	91	WES3	1230	0.0	31.3	11.2	84.0	8.9	.	.	.	.	.	.	.	.	.	.	.	23.6	0.7	2.0	19.0	6.4	1.0
7	25	91	WES3	1230	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24.0	0.7	2.1	19.3	6.5	1.0
7	25	91	WES3	1230	1.0	30.8	11.2	84.0	8.9	0.049	0.012	-0.005	1.09	0.73	0.14	-0.05	3.07	2.71	4.3	.	.	.	.	.	.	1.0
7	25	91	WES3	1230	2.0	30.1	10.0	82.0	8.7	.	.	.	.	.	.	.	3.29	2.47	4.4	.	.	.	.	.	.	1.0
7	25	91	WES3	1230	3.0	29.4	7.5	81.0	7.9	0.051	0.009	-0.005	1.14	0.96	0.17	-0.05	.	.	.	.	.	.	.	.	.	1.0
7	25	91	WES3	1230	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	27.0	0.5	2.4	22.3	6.2	1.0
7	25	91	WWC2TC	1855	0.0	30.0	10.7	75.0	8.7	0.035	0.013	0.005	0.80	0.44	0.17	0.08	3.43	2.98	2.9	1.00	20.2	0.0	1.6	17.6	3.0	1.3
7	25	91	WWC2TC	1855	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	19.8	0.1	1.9	17.6	2.4	1.3
7	25	91	WWC2TC	1855	2.0	29.3	10.5	77.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	WWC2TC	1855	4.0	27.9	9.6	81.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	WWC2TC	1855	6.0	26.9	2.9	81.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	WWC2TC	1855	7.0	26.6	2.7	78.0	7.0	0.018	0.010	-0.005	1.29	1.29	0.15	0.10	3.13	2.34	2.9	.	.	.	.	.	.	1.3
7	25	91	WWC2TC	1855	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	0.0	32.1	10.1	66.0	8.6	.	.	.	.	.	.	.	.	.	.	1.02	21.6	0.0	2.0	19.3	2.5	1.3
7	25	91	YC13JC	1700	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.58	12.7	0.0	1.1	11.6	1.2	1.3
7	25	91	YC13JC	1700	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	13.0	0.0	1.2	11.8	1.1	1.3
7	25	91	YC13JC	1700	1.0	31.9	9.7	66.0	8.6	0.022	0.008	-0.005	0.63	0.43	0.17	0.13	3.46	2.92	3.9	.	12.5	0.0	1.1	11.3	1.2	1.3
7	25	91	YC13JC	1700	2.0	30.5	9.7	67.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	3.0	29.9	7.3	65.0	8.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
7	25	91	YC13JC	1700	4.0	29.3	3.9	61.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	5.0	27.9	0.1	64.0	6.9	0.023	0.014	0.010	0.73	0.67	0.68	1.17	2.88	2.71	8.0	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	6.0	27.2	0.1	67.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	7.0	26.6	0.1	68.0	6.7	0.013	0.012	0.005	0.73	0.74	0.89	1.62	3.28	2.84	9.1	.	.	.	.	.	.	1.3
7	25	91	YC13JC	1700	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.63	14.5	0.0	1.5	13.2	1.2	1.3
7	25	91	YC27BEC	1735	0.0	32.3	9.5	60.0	8.3	.	.	.	.	.	.	.	.	.	.	0.50	13.1	0.0	1.2	12.1	0.8	1.1
7	25	91	YC27BEC	1735	1.0	31.3	9.7	60.0	8.3	0.016	0.033	-0.005	0.53	0.41	0.18	0.12	3.44	2.99	3.5	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	2.0	30.6	9.7	59.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	3.0	30.0	9.4	59.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	4.0	28.8	4.0	59.0	7.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	5.0	27.7	0.8	61.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	6.0	27.4	0.3	64.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	7.0	26.6	6.2	77.0	6.8	0.018	0.008	0.023	0.63	0.58	0.98	1.74	3.18	2.73	3.0	.	.	.	.	.	.	1.1
7	25	91	YC27BEC	1735	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.49	13.2	0.0	1.0	12.1	1.0	1.1
7	25	91	YC2HC	1620	0.0	31.2	10.8	77.0	8.9	0.033	0.011	-0.005	0.81	0.53	14.40	1.00	3.53	2.99	3.7	1.18	25.3	0.4	2.2	21.8	4.5	1.0
7	25	91	YC2HC	1620	2.0	29.8	10.7	79.0	8.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	4.0	29.1	3.0	73.0	8.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	6.0	26.8	1.3	75.0	7.0	0.031	0.010	-0.005	1.18	1.09	0.27	0.11	2.32	2.13	4.8	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	8.0	25.8	2.2	70.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	10.0	25.2	2.3	65.0	6.8	0.039	0.021	-0.005	1.12	1.09	0.86	0.20	3.53	3.12	20.0	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	12.0	24.1	0.2	78.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	14.0	23.2	0.1	96.0	6.8	0.060	0.054	0.055	1.47	1.45	4.60	3.86	4.28	3.44	23.0	.	.	.	.	.	.	1.0
7	25	91	YC2HC	1620	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.16	25.2	0.5	2.5	21.5	4.7	1.0
7	26	91	21AC	1415	0.0	29.2	9.5	81.0	8.4	0.033	0.011	-0.005	0.95	0.63	0.13	-0.05	2.89	2.64	2.4	1.01	.	.	.	.	.	1.3
7	26	91	21AC	1415	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.99	.	.	.	.	.	1.3
7	26	91	21AC	1415	2.0	29.1	9.3	81.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	4.0	28.8	8.0	81.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	6.0	27.5	3.4	85.0	7.4	0.020	0.007	-0.005	1.56	1.12	0.17	0.05	2.38	2.13	2.8	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	8.0	26.8	3.0	84.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	10.0	26.0	1.8	77.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	12.0	25.2	1.9	72.0	6.8	0.053	0.018	-0.005	1.21	1.12	1.47	0.38	2.70	2.72	21.0	.	.	.	.	.	.	1.3
7	26	91	21AC	1415	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.32	25.3	0.0	2.1	22.6	3.1	1.3
7	26	91	21AC	1415	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.30	.	.	.	.	.	1.3
7	26	91	25WEC	1030	0.0	28.5	8.9	80.0	8.3	0.028	0.009	-0.005	0.83	0.66	0.13	-0.05	2.78	2.46	2.7	0.89	.	.	.	.	.	1.5
7	26	91	25WEC	1030	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.88	.	.	.	.	.	1.5
7	26	91	25WEC	1030	2.0	28.6	8.7	80.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	4.0	28.7	8.7	79.0	8.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	6.0	27.4	4.0	83.0	7.4	0.017	0.007	-0.005	1.20	1.18	0.24	-0.05	2.34	2.31	3.5	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	8.0	26.6	3.2	80.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	10.0	25.6	2.3	78.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	12.0	25.3	1.7	74.0	6.8	0.043	0.012	-0.005	1.23	1.13	0.82	0.21	3.24	3.03	19.0	.	.	.	.	.	.	1.5
7	26	91	25WEC	1030	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.17	21.9	0.0	1.8	20.1	1.7	1.5
7	26	91	36AWIC	945	0.0	29.0	9.4	83.0	8.5	0.034	0.008	-0.005	1.00	0.63	0.13	-0.05	3.29	2.86	2.5	0.95	18.5	0.5	1.7	15.4	4.0	1.3
7	26	91	36AWIC	945	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.07	.	.	.	.	.	1.3
7	26	91	36AWIC	945	2.0	29.1	9.3	84.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	4.0	29.1	9.3	83.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	6.0	26.9	4.3	79.0	7.4	0.027	0.008	-0.005	1.21	0.94	0.23	0.29	2.65	2.56	3.0	.	.	.	.	.	.	1.3

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
7	26	91	36AWIC	945	8.0	26.2	3.5	75.0	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	10.0	25.5	1.8	77.0	7.0	0.034	0.016	-0.005	1.32	1.21	0.60	0.40	2.72	2.52	12.0	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	12.0	25.0	0.2	82.0	6.8	.	.	.	.	.	.	.	2.39	2.44	20.0	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	13.0	24.7	0.1	90.0	6.7	0.035	0.012	-0.005	1.15	1.09	0.94	0.79	2.93	2.44	.	.	.	.	.	.	.	1.3
7	26	91	36AWIC	945	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.33	25.5	0.0	1.9	23.1	2.3	1.3
7	26	91	41	845	0.0	28.7	9.4	83.0	8.2	0.037	0.012	-0.005	1.04	0.71	0.15	-0.05	.	.	2.9	.	22.5	1.0	3.6	19.3	4.2	1.1
7	26	91	41	845	2.0	28.9	9.1	83.0	8.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	26	91	41	845	4.0	28.6	7.2	82.0	7.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	26	91	41	845	6.0	27.2	4.6	78.0	7.3	0.027	0.008	-0.005	1.15	1.01	0.27	-0.05	2.93	2.51	5.9	.	.	.	.	.	.	1.1
7	26	91	41	845	8.0	26.1	3.3	74.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	26	91	41	845	9.0	.	.	.	.	0.040	0.016	-0.005	1.18	1.12	0.93	0.13	3.30	2.47	15.0	.	.	.	.	.	.	1.1
7	26	91	41	845	9.5	25.7	2.9	73.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
7	26	91	41	845	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.37	18.2	0.0	0.0	15.7	3.0	1.1
7	26	91	MC2	1700	0.0	29.5	9.9	79.0	8.8	0.029	0.010	-0.005	0.73	0.44	0.12	-0.05	3.38	2.74	2.2	0.96	.	.	.	.	.	1.4
7	26	91	MC2	1700	2.0	29.5	9.5	78.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	4.0	29.4	9.4	78.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	6.0	28.5	4.4	76.0	7.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	8.0	27.6	0.5	70.0	7.2	0.031	0.021	0.024	0.70	0.70	0.60	0.22	2.31	2.26	1.8	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	10.0	26.5	0.1	75.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	12.0	25.4	0.1	78.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	14.0	24.6	0.1	82.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	16.0	23.8	0.1	89.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	17.0	.	.	.	.	0.076	0.070	0.066	1.57	1.49	3.11	0.94	3.08	2.69	12.0	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	17.3	23.3	0.1	95.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	MC2	1700	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.49	24.1	0.0	2.5	22.0	1.9	1.4
7	26	91	SC2	1330	0.0	29.1	9.8	75.0	8.4	0.021	0.010	-0.005	0.73	0.50	0.13	-0.05	2.89	2.38	2.4	0.90	.	.	.	.	.	1.4
7	26	91	SC2	1330	2.0	28.9	9.2	75.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	4.0	28.5	6.1	78.0	7.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	6.0	27.8	2.4	80.0	7.2	0.014	0.009	-0.005	0.91	0.82	0.13	0.05	2.37	2.94	1.9	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	8.0	26.8	0.2	76.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	10.0	25.6	0.1	79.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	11.0	.	.	.	.	0.028	0.026	0.026	1.18	1.09	3.18	1.34	3.06	2.48	13.0	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	11.9	24.7	0.1	87.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	SC2	1330	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.10	12.4	0.0	0.0	9.9	3.4	1.4
7	26	91	VC3	1245	0.0	28.8	9.7	70.0	8.5	0.016	0.006	-0.005	0.57	0.39	0.13	-0.05	3.34	2.55	2.7	0.77	.	.	.	.	.	1.3
7	26	91	VC3	1245	2.0	28.6	8.9	70.0	8.4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	4.0	28.2	4.6	80.0	7.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	6.0	27.6	2.1	80.0	7.1	0.013	-0.005	-0.005	0.94	0.84	0.13	-0.05	2.22	1.96	2.1	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	8.0	26.7	0.1	74.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	10.0	25.3	0.1	82.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	11.0	24.8	0.1	91.0	6.7	0.021	0.008	-0.005	1.10	1.05	2.83	1.58	3.09	2.97	16.0	.	.	.	.	.	.	1.3
7	26	91	VC3	1245	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.91	14.6	0.4	1.3	13.5	1.0	1.3
7	26	91	WEC18	1120	0.0	29.1	9.6	72.0	8.4	0.020	0.010	-0.005	0.59	0.42	0.15	-0.05	2.90	2.77	3.2	0.84	.	.	.	.	.	.
7	26	91	WEC18	1120	2.0	29.2	9.5	73.0	8.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	26	91	WEC18	1120	4.0	29.1	9.5	72.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	26	91	WEC18	1120	6.0	27.7	2.2	68.0	6.6	0.014	0.010	-0.005	0.63	0.56	0.13	-0.05	2.49	2.23	1.8	.	.	.	.	.	.	.
7	26	91	WEC18	1120	8.0	26.6	0.1	63.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

m	d	y	sta	time	dep	tem	do	spc	pH	tp	tsp	srp	tn	dn	tfe	tmn	toc	doc	turb	fluo	chla	chlb	chlc	acla	pha	sd
7	26	91	WEC18	1120	9.0	.	.	.	.	0.016	0.006	-0.005	0.71	0.67	1.77	1.06	3.44	3.19	8.7	.	.	.	.	.	.	.
7	26	91	WEC18	1120	9.7	25.3	0.1	73.0	6.7	.	.	.	.	.	.	9.70	.	.	.	.	.	.	.	.	.	.
7	26	91	WEC5VC	.	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21.2	0.0	2.1	19.5	1.5	1.4
7	26	91	WEC5VC	1205	0.0	28.8	10.3	75.0	8.4	0.025	0.010	-0.005	0.77	0.54	0.13	0.07	2.91	2.94	3.1	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.97	17.0	0.0	1.5	15.1	2.0	1.4
7	26	91	WEC5VC	1205	2.0	28.9	9.5	76.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	4.0	28.8	9.4	76.0	8.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	6.0	27.6	3.5	85.0	7.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	8.0	26.8	2.6	86.0	7.1	0.018	0.012	0.006	1.27	1.23	0.83	0.32	2.74	2.40	2.8	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	10.0	25.7	0.3	76.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	12.0	24.6	0.1	72.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	14.0	23.4	0.1	69.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	16.0	22.5	0.1	83.0	6.6	0.050	0.044	0.041	1.55	1.52	3.65	1.38	3.81	3.50	8.7	.	.	.	.	.	.	1.4
7	26	91	WEC5VC	1205	17.3	21.9	0.1	91.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WES1	1550	0.0	29.3	9.8	80.0	8.4	0.024	0.031	-0.005	0.74	0.55	0.12	0.10	2.94	2.52	2.7	0.93	.	.	.	.	.	1.5
7	26	91	WES1	1550	2.0	29.2	9.5	79.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	4.0	28.6	6.9	79.0	8.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	6.0	28.1	3.6	84.0	7.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	8.0	27.6	2.2	83.0	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	10.0	26.5	0.5	81.0	6.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	12.0	25.5	0.1	79.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	14.0	24.6	0.1	75.0	6.6	0.031	0.013	-0.005	1.11	0.94	0.54	0.46	3.08	2.68	12.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	16.0	23.9	0.1	76.0	6.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	18.0	23.3	0.1	80.0	6.5	0.039	0.016	0.017	0.98	0.88	1.50	1.43	3.20	2.77	17.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	20.0	23.1	0.1	81.0	6.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	22.0	22.6	0.1	86.0	6.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	23.0	.	.	.	.	0.087	0.070	0.073	1.39	1.29	3.41	1.74	3.99	2.97	17.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	23.7	21.7	0.1	110.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.32	23.9	0.0	1.9	22.0	1.7	1.5
7	26	91	WES2	1740	0.0	29.6	9.8	81.0	8.8	0.029	0.010	-0.005	0.82	0.49	3.41	1.74	3.23	2.80	2.4	1.02	20.2	0.0	2.1	18.2	2.1	1.3
7	26	91	WES2	1740	2.0	29.6	9.6	80.0	8.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	4.0	29.2	8.7	77.0	8.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	6.0	28.3	3.6	85.0	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	8.0	27.3	2.7	86.0	7.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	10.0	26.3	2.4	80.0	6.8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	12.0	25.1	1.3	74.0	6.8	0.039	0.020	0.006	1.20	1.17	0.79	0.38	2.82	2.83	14.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	14.0	24.7	0.1	75.0	6.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	16.0	24.0	0.1	78.0	6.6	0.040	0.014	0.008	0.99	0.98	1.37	1.09	2.91	2.72	18.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	18.0	23.6	0.1	80.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	20.0	22.9	0.1	96.0	6.6	0.072	0.067	0.066	1.42	1.39	3.28	1.73	3.97	3.65	12.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	22.0	22.3	0.1	95.0	6.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.19	21.5	0.0	1.9	19.5	1.8	1.3

Appendix D

Water Quality Data for LANDSAT Comparisons in 1991

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time
do	Dissolved Oxygen, mg/L
spc	Specific Conductivity, μmhos
ph	pH
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
dn	Dissolved Nitrogen, mg/L
tfe	Total Iron, mg/L
tmn	Total Manganese, mg/L
toc	Total Organic Carbon, mg/L
doc	Dissolved Organic Carbon, mg/L
turb	Turbidity, NTUs
fluo	Fluorescence, relative units
chla	Chlorophyll a, mg/m^3
chlb	Chlorophyll b, mg/m^3
chlc	Chlorophyll c, mg/m^3
acla	Acid-corrected Chlorophyll a, mg/m^3
pha	Phaeophytin, mg/m^3
sd	Secchi Disk Transparency, m

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
4	21	91	1	812	0.0	20.5	.	.	.	.	.	5.0	0.61	11.1	0.0	1.3	9.6	1.8	1.4
4	21	91	101	752	0.0	20.0	.	.	.	.	.	28.0	0.50	5.4	0.3	0.9	4.5	1.3	.
4	21	91	104	757	0.0	19.5	.	.	.	.	.	28.0	0.44	5.4	0.1	1.2	4.5	1.3	.
4	21	91	106	800	0.0	19.5	.	.	.	.	.	25.0	0.42	5.5	0.1	0.4	4.2	1.9	.
4	21	91	110	806	0.0	19.0	.	.	.	.	.	28.0	0.39	3.4	0.0	0.1	2.9	0.7	.
4	21	91	113	837	0.0	19.0	.	.	.	.	.	29.0	0.40	4.4	0.0	0.2	3.3	1.5	.
4	21	91	118	817	0.0	19.0	.	.	.	.	.	.	0.23	2.2	0.2	0.2	1.6	0.9	.
4	21	91	123	825	0.0	19.0	.	.	.	.	.	26.0	0.16	2.0	0.0	0.4	1.3	1.0	.
4	21	91	151C	748	0.0	20.6	.	.	.	.	.	4.9	1.16	14.0	0.0	1.3	11.4	3.6	0.9
4	21	91	16	758	0.0	20.0	.	.	.	.	.	5.6	0.63	9.2	0.0	0.8	7.1	3.0	1.3
4	21	91	188C	742	0.0	20.3	.	.	.	.	.	9.3	1.01	14.1	0.5	1.8	10.9	4.5	1.4
4	21	91	21AC	738	0.0	20.7	.	.	.	.	.	4.6	0.77	9.1	0.0	1.3	6.7	3.5	1.4
4	21	91	25WEC	735	0.0	20.7	.	.	.	.	.	5.3	1.13	16.6	0.4	1.6	13.1	4.9	1.3
4	21	91	26RC	732	0.0	20.6	.	.	.	.	.	4.5	1.09	10.5	0.1	0.9	7.8	3.9	1.5
4	21	91	29	730	0.0	20.7	.	.	.	.	.	4.3	1.14	11.6	0.1	1.0	8.9	3.9	1.8
4	21	91	2MC	818	0.0	20.5	.	.	.	.	.	4.8	0.53	8.0	0.0	0.8	6.2	2.5	1.4
4	21	91	36AWIC	720	0.0	20.9	.	.	.	.	.	.	1.36	14.4	0.2	1.2	10.7	5.4	1.3
4	21	91	39	1035	0.0	20.2	.	.	.	.	.	4.9	1.03	14.0	0.6	1.2	10.5	5.1	1.4
4	21	91	41	1135	0.0	20.4	.	.	.	.	.	4.4	1.41	15.0	0.4	1.4	11.4	5.3	1.4
4	21	91	45	1130	0.0	20.8	.	.	.	.	.	6.2	1.36	15.3	0.6	1.6	11.6	5.4	1.2
4	21	91	50	1037	0.0	21.0	.	.	.	.	.	4.6	1.78	20.4	0.8	2.2	15.6	7.0	1.2
4	21	91	56YC	715	0.0	21.0	.	.	.	.	.	5.4	1.50	15.2	0.4	1.7	11.4	5.6	.
4	21	91	60	718	0.0	21.0	.	.	.	.	.	5.8	1.04	11.7	0.4	1.1	8.5	4.8	.
4	21	91	65	725	0.0	21.0	.	.	.	.	.	5.6	0.84	11.1	0.2	0.5	7.8	5.0	.
4	21	91	74	731	0.0	21.0	.	.	.	.	.	7.5	0.78	10.1	0.0	0.7	7.3	4.0	.
4	21	91	8	805	0.0	20.2	.	.	.	.	.	5.5	0.67	8.7	0.0	0.8	6.5	3.2	1.1
4	21	91	84	738	0.0	21.0	.	.	.	.	.	29.0	0.76	9.2	0.1	0.6	7.1	3.0	.
4	21	91	89	742	0.0	21.0	.	.	.	.	.	17.0	0.71	10.2	0.2	0.4	8.2	2.7	.
4	21	91	96	746	0.0	20.5	.	.	.	.	.	19.0	0.63	8.6	0.1	1.0	7.1	1.9	.
4	21	91	BEC3	948	0.0	21.5	.	.	.	.	.	4.2	0.90	8.7	0.3	1.0	7.6	1.5	.
4	21	91	EC2	825	0.0	20.5	.	.	.	.	.	13.0	1.54	25.3	0.0	3.0	22.9	2.3	0.6
4	21	91	IC2	751	0.0	20.5	.	.	.	.	.	6.7	0.96	13.2	0.1	1.7	10.7	3.5	0.9
4	21	91	JC2	922	0.0	22.0	.	.	.	.	.	5.3	0.66	9.4	0.0	0.7	7.3	2.9	.
4	21	91	MC2	828	0.0	20.6	.	.	.	.	.	6.0	0.61	10.3	0.0	1.2	8.9	1.7	1.1
4	21	91	MC8	835	0.0	20.9	.	.	.	.	.	5.6	0.26	3.9	0.0	0.2	3.6	0.3	1.2
4	21	91	SC2	910	0.0	20.8	.	.	.	.	.	4.6	0.64	10.7	0.0	1.4	9.1	1.9	1.1
4	21	91	TC2	1123	0.0	21.0	.	.	.	.	.	.	1.21	15.6	0.6	1.7	11.8	5.5	1.2
4	21	91	VC3	900	0.0	21.2	.	.	.	.	.	4.3	0.50	7.8	0.0	0.9	6.5	1.8	1.2
4	21	91	WEC10	925	0.0	20.5	.	.	.	.	.	4.4	0.47	7.2	0.0	1.0	5.3	2.8	1.5
4	21	91	WEC16	940	0.0	20.7	.	.	.	.	.	4.9	0.44	3.4	0.0	0.2	2.9	0.7	1.4
4	21	91	WEC21	945	0.0	20.8	.	.	.	.	.	4.1	0.76	7.7	0.1	1.0	6.2	2.0	1.5
4	21	91	WEC26	955	0.0	21.2	.	.	.	.	.	3.7	1.26	11.3	0.0	1.5	9.6	2.3	1.6
4	21	91	WEC29CC	1000	0.0	20.9	.	.	.	.	.	.	1.11	10.1	0.1	1.1	8.2	2.5	1.3
4	21	91	WEC5VC	855	0.0	20.7	.	.	.	.	.	4.7	0.60	9.8	0.0	1.3	8.0	2.4	1.1
4	21	91	WEC6	918	0.0	20.7	.	.	.	.	.	4.4	0.59	9.5	0.0	1.1	8.0	2.0	1.2
4	21	91	WES1	840	0.0	20.6	.	.	.	.	.	5.0	0.66	7.6	0.0	1.0	6.2	1.9	1.1
4	21	91	WES2	800	0.0	20.2	.	.	.	.	.	5.0	0.73	10.2	0.0	1.2	8.2	2.7	1.3
4	21	91	WWC2TC	1105	0.0	20.8	.	.	.	.	.	4.1	1.21	13.7	0.5	1.5	9.8	5.8	1.2

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
4	21	91	WWC6	1112	0.0	20.1	.	.	.	.	.	3.5	1.08	14.7	0.3	2.1	11.4	4.9	1.3
4	21	91	WWC9	1115	0.0	21.0	.	.	.	.	.	4.0	1.62	18.8	0.0	2.0	15.8	3.8	1.2
4	21	91	YC10	917	0.0	21.5	.	.	.	.	.	2.9	1.20	11.3	0.0	3.3	8.5	4.2	.
4	21	91	YC13JC	925	0.0	21.5	.	.	.	.	.	4.1	1.00	12.2	0.0	1.5	9.8	3.3	.
4	21	91	YC17	930	0.0	21.5	.	.	.	.	.	4.0	0.78	7.4	0.0	1.1	6.2	1.4	.
4	21	91	YC27BEC	935	0.0	21.5	.	.	.	.	.	.	0.79	.	.	.	.	.	.
4	21	91	YC29	940	0.0	21.2	.	.	.	.	.	6.0	0.64	6.2	0.0	0.6	5.1	1.4	.
4	21	91	YC2HC	910	0.0	21.5	.	.	.	.	.	4.6	1.68	20.7	1.0	2.3	15.1	8.2	.
4	21	91	YC7	915	0.0	21.5	.	.	.	.	.	3.6	1.09	13.1	0.0	1.3	10.5	3.6	.
6	8	91	1	1111	0.0	26.5	.	.	.	.	.	2.3	1.04	9.1	0.9	1.5	10.7	0.0	2.0
6	8	91	101	744	0.0	25.0	.	.	.	.	.	20.0	0.79	12.1	0.3	0.5	9.4	4.0	0.5
6	8	91	104	740	0.0	25.0	.	.	.	.	.	24.0	0.61	6.8	1.1	1.0	8.0	0.0	0.5
6	8	91	106	738	0.0	24.0	.	.	.	.	.	18.0	0.72	12.0	0.6	0.7	9.7	3.2	0.5
6	8	91	110	734	0.0	24.0	.	.	.	.	.	21.0	0.50	4.5	1.0	0.6	6.3	0.0	0.4
6	8	91	113	730	0.0	23.0	.	.	.	.	.	19.0	0.70	.	.	.	.	.	0.5
6	8	91	118	724	0.0	23.5	.	.	.	.	.	20.0	0.16	2.7	0.4	0.2	0.7	3.3	0.5
6	8	91	123	718	0.0	22.6	.	.	.	.	.	15.0	0.14	0.0	0.0	0.0	0.0	0.0	0.5
6	8	91	15IC	1047	0.0	26.2	.	.	.	.	.	2.5	1.19	14.4	1.0	2.4	14.7	0.0	1.9
6	8	91	16	1057	0.0	26.1	.	.	.	.	.	3.0	1.08	14.4	0.8	1.6	11.7	3.7	2.2
6	8	91	18BC	1044	0.0	26.0	.	.	.	.	.	3.1	0.97	10.2	0.9	1.4	11.0	0.0	2.0
6	8	91	21AC	1041	0.0	25.8	.	.	.	.	.	3.2	1.22	13.8	1.1	2.0	14.7	0.0	1.8
6	8	91	25WEC	1037	0.0	25.8	.	.	.	.	.	3.3	1.04	12.5	1.0	1.8	13.4	0.0	1.6
6	8	91	26RC	1031	0.0	25.6	.	.	.	.	.	3.5	1.08	14.6	0.3	1.2	12.0	3.4	1.8
6	8	91	29	1027	0.0	25.5	.	.	.	.	.	4.2	1.59	19.8	0.6	2.0	16.7	4.1	1.5
6	8	91	2MC	1148	0.0	25.6	.	.	.	.	.	2.2	1.04	11.3	0.4	1.0	9.7	2.0	2.[illegible]
6	8	91	36AWIC	1022	0.0	25.5	.	.	.	.	.	3.4	1.06	15.0	0.3	1.6	12.0	4.1	1.[illegible]
6	8	91	39	1017	0.0	25.5	.	.	.	.	.	4.0	1.28	17.0	0.3	1.6	14.0	4.0	1.[illegible]
6	8	91	41	1013	0.0	26.0	.	.	.	.	.	4.3	1.26	15.8	1.1	2.2	16.4	0.0	1.6
6	8	91	45	1008	0.0	26.0	.	.	.	.	.	5.2	1.15	17.7	0.5	1.3	13.7	5.7	1.5
6	8	91	50	939	0.0	26.0	.	.	.	.	.	4.1	1.15	14.5	0.8	1.6	14.4	0.0	1.4
6	8	91	56YC	817	0.0	25.6	.	.	.	.	.	4.4	1.25	19.4	0.4	1.3	15.4	5.7	1.4
6	8	91	60	813	0.0	25.5	.	.	.	.	.	4.1	0.96	17.4	0.5	0.8	14.0	4.7	1.4
6	8	91	65	809	0.0	25.6	.	.	.	.	.	6.3	1.25	20.4	0.2	1.1	16.4	5.6	1.1
6	8	91	74	804	0.0	25.5	.	.	.	.	.	7.7	0.89	15.7	0.1	0.6	12.7	4.1	1.0
6	8	91	8	1103	0.0	26.1	.	.	.	.	.	2.3	0.94	11.4	0.3	1.3	9.4	2.8	1.8
6	8	91	84	800	0.0	26.0	.	.	.	.	.	9.8	0.96	12.2	0.9	1.4	12.0	0.0	0.8
6	8	91	89	753	0.0	26.0	.	.	.	.	.	9.8	1.04	13.2	1.2	0.9	12.7	0.2	0.8
6	8	91	96	749	0.0	25.3	.	.	.	.	.	16.0	0.82	14.7	0.6	0.4	11.0	5.3	0.6
6	8	91	BEC3	842	0.0	26.1	.	.	.	.	.	9.5	1.01	11.7	0.4	1.1	9.7	2.7	0.9
6	8	91	EC2	1151	0.0	26.5	.	.	.	.	.	3.3	0.88	6.6	1.1	1.0	8.3	0.0	1.5
6	8	91	IC2	1050	0.0	26.0	.	.	.	.	.	3.3	1.13	11.8	1.2	2.6	13.0	0.0	1.6
6	8	91	JC2	856	0.0	26.5	.	.	.	.	.	4.5	1.42	13.3	1.3	2.0	14.4	0.0	1.3
6	8	91	MC2	1154	0.0	26.8	.	.	.	.	.	4.3	0.94	9.5	0.5	0.9	8.0	2.0	2.0
6	8	91	MC8	1158	0.0	26.8	.	.	.	.	.	2.5	0.96	9.8	0.6	1.1	8.0	2.5	1.9
6	8	91	SC2	1231	0.0	26.9	.	.	.	.	.	2.5	1.33	12.1	0.4	1.6	10.4	2.3	1.6
6	8	91	TC2	957	0.0	26.9	.	.	.	.	.	3.7	1.24	20.2	0.7	1.5	17.0	4.2	1.2
6	8	91	VC3	1226	0.0	27.0	.	.	.	.	.	3.6	1.19	11.1	0.4	1.6	9.4	2.3	1.7
6	8	91	WEC10	1300	0.0	29.0	.	.	.	.	.	3.2	1.48	11.5	0.4	1.8	10.4	1.3	1.5
6	8	91	WEC16	1256	0.0	27.1	.	.	.	.	.	3.3	1.49	7.4	1.0	1.7	9.4	0.0	1.6
6	8	91	WEC21	1253	0.0	27.1	.	.	.	.	.	3.5	1.19	10.7	0.4	1.2	9.7	1.1	1.6

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
6	8	91	WEC26	1248	0.0	27.0	.	.	.	.	.	3.3	1.05	6.8	0.8	1.4	9.4	0.0	1.8
6	8	91	WEC29CC	1245	0.0	27.0	.	.	.	.	.	3.2	0.99	8.3	0.1	0.9	7.3	1.1	1.6
6	8	91	WEC5VC	1223	0.0	26.3	.	.	.	.	.	3.2	1.29	10.8	0.8	1.9	12.0	0.0	1.9
6	8	91	WEC6	1303	0.0	26.2	.	.	.	.	.	3.6	1.39	10.4	1.0	1.6	12.0	0.0	1.7
6	8	91	WES1	1114	0.0	26.4	.	.	.	.	.	2.2	1.09	13.1	0.7	1.8	10.4	3.9	2.0
6	8	91	WES2	1100	0.0	26.2	.	.	.	.	.	2.8	1.03	9.8	1.0	1.8	11.0	0.0	2.0
6	8	91	WWC2TC	1000	0.0	27.0	.	.	.	.	.	5.0	1.14	13.4	0.8	1.6	14.4	0.0	1.4
6	8	91	WWC6	953	0.0	26.2	.	.	.	.	.	4.0	1.32	16.7	0.7	1.8	13.4	4.6	1.7
6	8	91	WWC9	949	0.0	26.2	.	.	.	.	.	4.5	1.54	21.7	0.2	1.8	18.4	4.3	1.0
6	8	91	YC13JC	852	0.0	26.1	.	.	.	.	.	5.0	1.52	14.6	0.0	1.9	12.0	3.4	1.6
6	8	91	YC17	849	0.0	26.0	.	.	.	.	.	6.3	1.14	13.3	0.0	1.4	11.4	2.4	1.4
6	8	91	YC27BEC	837	0.0	26.1	.	.	.	.	.	7.3	0.95	12.0	0.0	1.2	9.7	3.2	1.1
6	8	91	YC29	832	0.0	25.8	.	.	.	.	.	8.3	0.74	9.7	0.4	0.9	7.3	3.4	0.8
6	8	91	YC2HC	910	0.0	26.0	.	.	.	.	.	5.5	1.29	17.8	0.4	1.8	15.0	3.7	1.5
6	8	91	YC7	903	0.0	26.2	.	.	.	.	.	3.8	1.62	17.4	0.3	2.3	15.4	2.4	1.5
6	8	91	YC7	905	0.0	26.6	.	.	.	.	.	4.6	1.72	16.4	0.6	3.7	17.4	0.0	1.5
7	26	91	1	855	0.0	29.1	.	.	.	.	.	1.7	0.96	19.5	0.0	1.6	17.6	1.8	1.6
7	26	91	101	1636	0.0	27.6	.	.	.	.	.	2.1	1.83	32.8	5.1	2.4	29.2	4.7	0.4
7	26	91	104	1643	0.0	26.4	.	.	.	.	.	2.4	0.38	9.6	0.4	0.4	8.5	1.3	0.3
7	26	91	106	1646	0.0	26.4	.	.	.	.	.	2.4	0.58	12.8	0.8	2.0	9.6	4.6	0.3
7	26	91	110	1649	0.0	25.9	.	.	.	.	.	2.9	0.65	13.3	0.9	0.8	11.8	1.7	0.3
7	26	91	113	1654	0.0	26.4	.	.	.	.	.	2.6	0.66	13.6	0.9	0.9	11.8	2.2	0.3
7	26	91	118	1709	0.0	25.1	.	.	.	.	.	4.8	0.28	5.2	0.3	0.4	0.0135.8		0.2
7	26	91	15IC	934	0.0	29.1	.	.	.	.	.	2.1	1.06	24.2	0.0	2.4	21.5	3.0	1.5
7	26	91	16	931	0.0	29.1	.	.	.	.	.	2.1	0.99	22.1	0.0	1.8	19.3	3.3	1.4
7	26	91	18BC	943	0.0	29.1	.	.	.	.	.	2.5	1.04	23.2	0.0	1.9	20.9	2.4	1.4
7	26	91	21AC	947	0.0	28.9	.	.	.	.	.	2.1	1.02	21.1	0.2	2.2	18.2	3.6	1.4
7	26	91	25WEC	950	0.0	29.1	.	.	.	.	.	2.0	0.90	19.6	0.0	1.8	17.1	3.0	1.4
7	26	91	26RC	1105	0.0	29.1	.	.	.	.	.	2.1	1.04	15.1	0.4	1.4	11.8	4.5	1.4
7	26	91	29	1108	0.0	29.2	.	.	.	.	.	2.4	1.20	25.7	0.4	2.9	22.3	4.1	1.2
7	26	91	2MC	901	0.0	29.2	.	.	.	.	.	1.8	1.04	20.3	0.0	1.6	17.9	2.7	1.6
7	26	91	36AWIC	1113	0.0	29.6	.	.	.	.	.	2.5	0.96	24.1	0.0	2.1	20.9	3.7	1.3
7	26	91	39	1117	0.0	29.7	.	.	.	.	.	2.4	1.18	25.3	0.2	2.6	21.8	4.5	1.3
7	26	91	41	1124	0.0	29.4	.	.	.	.	.	2.4	1.28	.	.	.	.	.	1.3
7	26	91	45	1127	0.0	29.4	.	.	.	.	.	2.8	0.81	29.8	0.0	3.6	25.6	5.2	1.1
7	26	91	50	1155	0.0	29.1	.	.	.	.	.	2.7	1.17	25.1	0.1	2.4	21.2	5.0	1.0
7	26	91	56YC	1315	0.0	29.3	.	.	.	.	.	3.8	1.30	28.4	0.0	2.7	24.5	4.8	0.8
7	26	91	60	1411	0.0	29.7	.	.	.	.	.	4.1	1.51	35.1	0.0	3.7	30.3	6.0	0.9
7	26	91	65	1604	0.0	29.6	.	.	.	.	.	6.7	0.83	19.3	0.6	1.4	15.7	4.9	0.8
7	26	91	71	1607	0.0	29.2	.	.	.	.	.	9.2	0.88	25.3	0.9	2.1	20.6	6.3	0.7
7	26	91	74	1615	0.0	29.4	.	.	.	.	.	8.5	1.08	30.2	1.3	2.5	25.1	6.9	0.6
7	26	91	8	921	0.0	29.2	.	.	.	.	.	2.4	0.95	20.1	0.0	2.1	17.9	2.3	1.5
7	26	91	84	1619	0.0	29.4	.	.	.	.	.	10.1	0.81	22.1	1.2	1.8	17.6	6.3	0.6
7	26	91	89	1628	0.0	29.1	.	.	.	.	.	14.5	0.90	23.0	1.2	1.7	19.5	4.5	0.5
7	26	91	96	1632	0.0	29.4	.	.	.	.	.	15.0	1.60	37.0	2.9	2.7	31.1	8.0	0.5
7	26	91	BEC3	1347	0.0	30.2	.	.	.	.	.	2.9	0.45	14.1	0.0	0.8	13.2	0.5	1.3
7	26	91	EC2	906	0.0	29.4	.	.	.	.	.	3.7	0.93	17.6	0.0	2.1	15.7	2.0	1.3
7	26	91	IC2	937	0.0	28.8	.	.	.	.	.	2.8	1.08	24.9	0.0	2.1	22.0	3.2	1.2
7	26	91	MC2	910	0.0	29.2	.	.	.	.	.	1.8	0.97	19.5	0.0	1.6	17.1	2.8	1.5
7	26	91	MC8	915	0.0	29.6	.	.	.	.	.	2.3	1.46	15.7	0.0	1.4	14.0	1.8	1.5

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
7	26	91	NR3	1703	0.0	29.7	.	.	.	.	.	7.1	0.87	19.3	0.4	0.8	16.2	4.0	0.6
7	26	91	SC2	1007	0.0	29.2	.	.	.	.	.	1.9	0.91	15.5	0.1	1.6	13.8	2.0	1.4
7	26	91	TC2	1135	0.0	29.3	.	.	.	.	.	2.7	1.30	23.8	0.7	3.4	21.5	2.4	1.2
7	26	91	VC3	1001	0.0	28.8	.	.	.	.	.	2.2	0.78	13.2	0.1	1.1	11.8	1.5	1.5
7	26	91	WEC10	1022	0.0	29.1	.	.	.	.	.	2.2	0.96	18.2	0.0	2.1	16.8	1.1	1.5
7	26	91	WEC18	1027	0.0	29.5	.	.	.	.	.	2.5	0.85	12.8	0.0	1.5	11.6	1.4	1.4
7	26	91	WEC21	1030	0.0	2′.7	.	.	.	.	.	2.5	0.78	14.4	0.0	1.3	12.9	1.5	1.4
7	26	91	WEC26	1039	0.0	29.5	.	.	.	.	.	2.1	0.68	10.6	0.1	1.0	8.8	2.4	1.6
7	26	91	WEC29CC	1043	0.0	29.7	.	.	.	.	.	2.3	0.68	10.1	0.1	0.9	8.3	2.5	1.5
7	26	91	WEC5VC	954	0.0	29.1	.	.	.	.	.	2.1	0.95	20.6	0.1	1.7	18.4	2.4	1.5
7	26	91	WEC8	1020	0.0	29.3	.	.	.	.	.	2.5	0.93	16.8	0.0	1.8	15.4	1.2	1.5
7	26	91	WES1	844	0.0	28.6	.	.	.	.	.	1.8	0.94	21.8	0.0	1.8	19.0	3.4	1.7
7	26	91	WES2	924	0.0	29.2	.	.	.	.	.	2.0	1.03	20.3	0.0	2.2	18.2	2.3	1.5
7	26	91	WES3	1611	0.0	30.8	.	.	.	.	.	3.5	1.28	29.6	0.4	2.6	25.1	5.8	1.0
7	26	91	WWC2TC	1132	0.0	29.0	.	.	.	.	.	2.7	1.37	27.4	0.1	3.1	24.5	3.2	1.0
7	26	91	WWC6	1140	0.0	29.1	.	.	.	.	.	2.1	1.13	20.5	0.0	2.3	19.0	1.2	1.2
7	26	91	WWC9	1143	0.0	30.0	.	.	.	.	.	2.9	0.86	14.1	0.0	1.6	12.7	1.6	1.1
7	26	91	YC10	1329	0.0	29.7	.	.	.	.	.	2.6	1.13	22.1	0.0	2.0	20.1	1.9	1.2
7	26	91	YC13JC	1331	0.0	30.1	.	.	.	.	.	2.6	0.67	12.5	0.0	1.2	11.8	0.3	1.3
7	26	91	YC17	1335	0.0	30.1	.	.	.	.	.	2.8	0.58	12.1	0.0	0.9	11.6	0.0	1.3
7	26	91	YC27BEC	1351	0.0	30.1	.	.	.	.	.	2.8	0.56	14.6	0.0	1.4	14.0	0.0	1.2
7	26	91	YC29	1354	0.0	30.2	.	.	.	.	.	3.5	0.68	15.7	0.0	1.5	14.9	0.4	1.1
7	26	91	YC2HC	1319	0.0	29.9	.	.	.	.	.	2.6	1.18	21.5	0.0	1.5	19.0	2.8	1.0
7	26	91	YC7	1326	0.0	29.7	.	.	.	.	.	2.5	1.05	21.9	0.0	2.1	20.1	1.7	1.0
9	12	91	1	1240	0.0	29.1	0.024	.	.	0.63	.	3.5	0.88	14.6	0.3	1.9	13.1	1.7	1.5
9	12	91	101	835	0.0	24.0	0.078	.	.	1.10	.	14.0	0.30	7.7	0.4	0.6	6.0	2.4	0.7
9	12	91	104	830	0.0	24.4	0.093	.	.	1.27	.	15.5	0.30	7.3	0.7	0.6	6.0	1.8	0.7
9	12	91	106	825	0.0	24.4	0.093	.	.	1.30	.	15.0	0.20	5.9	0.6	0.5	4.9	1.3	0.7
9	12	91	110	820	0.0	24.4	0.118	.	.	1.62	.	15.0	0.15	4.6	0.4	0.1	3.8	1.2	0.7
9	12	91	113	815	0.0	24.5	0.135	.	.	1.79	.	16.0	0.17	4.1	0.3	0.1	3.3	1.0	0.8
9	12	91	118	.	0.0	.	.	.	.	.	.	.	.	2.1	0.3	0.2	1.3	1.2	.
9	12	91	118	745	0.0	24.6	0.172	.	.	1.86	.	18.0	0.05	2.2	0.2	0.2	1.6	0.9	0.7
9	12	91	123	730	0.0	24.4	0.151	.	.	1.57	.	16.0	0.00	1.4	0.3	0.4	0.7	1.2	0.8
9	12	91	151C	1210	0.0	29.0	0.028	.	.	0.64	.	3.0	0.92	15.7	0.3	2.0	13.6	2.6	1.4
9	12	91	16	1220	0.0	29.0	0.026	.	.	0.62	.	3.1	1.24	14.2	0.3	1.5	12.5	2.0	1.3
9	12	91	188C	1400	0.0	29.5	0.030	.	.	0.65	.	2.9	1.27	15.3	0.5	2.0	13.4	2.4	1.4
9	12	91	21AC	1205	0.0	28.9	0.028	.	.	0.70	.	4.2	1.01	16.6	0.4	2.0	14.5	2.7	1.5
9	12	91	25WEC	1200	0.0	28.8	0.018	.	.	0.51	.	3.5	0.65	12.4	0.2	0.9	10.9	1.7	1.6
9	12	91	26RC	1155	0.0	28.8	0.045	.	.	1.39	.	3.9	1.30	21.0	0.6	1.9	18.7	2.6	1.5
9	12	91	29	1150	0.0	29.0	0.027	.	.	0.80	.	3.4	0.98	14.1	0.4	0.9	12.5	1.9	1.4
9	12	91	2MC	1245	0.0	29.0	0.018	.	.	0.51	.	4.0	0.69	12.3	0.3	0.9	11.1	1.2	1.5
9	12	91	36AWIC	1145	0.0	29.0	0.035	.	.	0.87	.	3.3	1.03	15.4	0.7	1.7	13.6	2.2	1.3
9	12	91	39	1140	0.0	28.5	0.035	.	.	0.95	.	3.0	1.10	17.5	0.5	1.5	15.6	2.2	1.2
9	12	91	41	1130	0.0	28.7	0.032	.	.	0.80	.	2.8	0.95	15.7	0.6	1.1	14.0	1.9	1.4
9	12	91	45	1125	0.0	28.7	0.041	.	.	0.90	.	3.5	1.21	21.6	0.5	1.8	18.9	3.2	1.3
9	12	91	50	1115	0.0	29.1	0.037	.	.	0.77	.	3.5	1.02	17.3	1.1	1.6	15.4	2.2	1.2
9	12	91	56YC	920	0.0	28.2	0.043	.	.	0.77	.	3.3	0.95	22.2	0.5	1.8	19.8	2.6	1.3
9	12	91	60	915	0.0	27.8	0.045	.	.	0.80	.	3.5	1.14	19.8	1.0	1.8	16.9	3.8	1.3
9	12	91	65	910	0.0	27.8	0.049	.	.	0.87	.	3.7	1.45	19.9	0.6	1.9	16.7	4.2	1.2
9	12	91	71	900	0.0	27.3	0.058	.	.	0.97	.	3.5	1.25	23.4	1.2	2.1	18.9	6.3	1.1

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
9	12	91	74	855	0.0	27.4	0.066	.	.	1.10	.	3.4	1.30	.	.	.	.	.	1.4
9	12	91	8	1230	0.0	28.9	0.020	.	.	0.60	.	3.4	0.67	10.6	0.4	1.2	9.1	1.9	1.5
9	12	91	84	850	0.0	27.0	0.069	.	.	1.07	.	4.5	1.25	23.8	1.1	2.4	17.8	8.8	1.0
9	12	91	89	845	0.0	26.0	0.074	.	.	1.05	.	6.0	1.22	35.9	1.2	3.5	30.0	7.8	0.9
9	12	91	96	840	0.0	24.6	0.065	.	.	0.95	.	10.0	0.81	21.8	1.0	1.9	18.7	4.0	0.9
9	12	91	BEC3	1015	0.0	28.2	0.020	.	.	0.38	.	3.2	0.61	9.1	0.5	0.9	7.8	1.7	1.5
9	12	91	EC2	1250	0.0	29.5	0.020		.	0.57	.	3.0	0.85	11.7	0.3	1.3	10.2	1.8	1.7
9	12	91	IC2	1215	0.0	29.4	0.024	.	.	0.65	.	4.5	0.70	11.5	0.3	0.7	9.8	2.2	1.4
9	12	91	MC2	1255	0.0	29.4	0.02[illegible]	.	.	0.57	.	2.5	0.86	10.7	0.6	1.9	9.6	1.3	1.6
9	12	91	MC8	1300	0.0	29.4	0.02[illegible]	.	.	0.57	.	2.5	1.02	11.1	0.4	1.4	9.8	1.6	1.5
9	12	91	NR3	800	0.0	24.6	0.049	.	.	0.81	.	6.0	1.32	21.2	0.0	1.3	18.0	4.1	1.0
9	12	91	SC2	1420	0.0	29.4	0.019	.	.	0.05	.	3.8	0.66	9.7	0.3	1.1	8.5	1.5	1.7
9	12	91	TC2	1535	0.0	29.6	0.031	.	.	0.63	.	4.0	1.24	16.0	0.2	1.7	14.7	1.2	1.0
9	12	91	VC3	1415	0.0	29.7	0.016	.	.	0.05	.	3.0	0.47	8.6	0.0	0.4	7.8	0.8	1.7
9	12	91	WEC10	1430	0.0	28.9	0.016	.	.	0.04	.	3.0	0.62	10.6	0.3	0.9	9.6	1.0	1.5
9	12	91	WEC18	1435	0.0	28.9	0.017	.	.	0.04	.	3.2	0.65	10.2	0.5	0.9	8.7	1.9	1.5
9	12	91	WEC21	1500	0.0	29.7	0.020	.	.	0.05	.	5.0	0.60	7.4	0.3	0.7	6.5	1.2	1.5
9	12	91	WEC26	1445	0.0	29.3	0.020	.	.	0.05	.	3.4	0.53	7.9	0.2	0.7	6.7	1.6	1.6
9	12	91	WEC29CC	1455	0.0	29.4	0.020	.	.	0.04	.	3.1	0.60	6.6	0.3	0.9	6.0	0.7	1.5
9	12	91	WEC5VC	1410	0.0	29.7	0.019	.	.	0.05	.	3.5	0.80	10.0	0.2	1.3	8.7	1.6	1.6
9	12	91	WEC8	1425	0.0	28.9	0.016	.	.	0.04	.	3.0	0.70	10.0	0.4	1.2	9.4	0.5	1.5
9	12	91	WES1	1235	0.0	28.9	0.021	.	.	0.60	.	3.5	0.75	12.3	0.4	1.3	10.7	1.9	1.4
9	12	91	WES2	1225	0.0	28.9	0.024	.	.	0.64	.	2.7	0.95	14.5	0.3	1.4	12.7	2.1	1.5
9	12	91	WES3	905	0.0	27.4	0.053	.	.	0.97	.	3.2	1.22	25.6	0.5	1.7	22.3	4.1	1.2
9	12	91	WWC2TC	1530	0.0	29.5	0.030	.	.	0.65	.	3.1	1.47	17.0	0.4	1.5	15.8	1.0	1.1
9	12	91	WWC6	1540	0.0	30.0	0.026	.	.	0.56	.	4.1	0.82	12.9	0.3	1.1	12.0	0.8	1.5
9	12	91	WWC9	1545	0.0	29.5	0.027	.	.	0.54	.	3.5	1.33	15.5	0.5	1.6	14.2	1.2	1.1
9	12	91	YC10	1035	0.0	28.0	0.024	.	.	0.51	.	2.5	0.96	14.8	0.6	1.3	12.9	2.4	1.5
9	12	91	YC13JC	1030	0.0	28.6	0.021	.	.	0.50	.	3.3	1.02	16.0	0.7	1.7	14.0	2.3	1.5
9	12	91	YC17	1025	0.0	28.0	0.020	.	.	0.47	.	2.7	0.92	11.6	0.4	1.1	10.2	1.6	1.5
9	12	91	YC27BEC	1005	0.0	28.0	0.020	.	.	0.42	.	3.0	0.96	12.5	0.3	1.0	10.9	1.9	1.5
9	12	91	YC29	1000	0.0	27.9	0.020	.	.	0.41	.	3.4	0.82	12.4	0.2	1.1	10.9	1.7	1.5
9	12	91	YC2HC	1045	0.0	28.4	0.045	.	.	0.86	.	3.0	1.27	20.9	0.9	2.0	17.4	4.8	1.2
9	12	91	YC7	1040	0.0	28.2	0.024	.	.	0.52	.	2.6	0.92	14.4	0.5	1.3	12.7	2.1	1.5
9	28	91	1	1640	0.0	24.3	0.021	.	.	0.69	.	2.5	1.35	19.3	0.4	2.5	17.1	2.5	1.5
9	28	91	101	.	999.0	.	.	.	.	.	.	.	1.25	4.2	0.3	0.4	3.5	1.0	.
9	28	91	101	840	0.0	18.0	0.102	0.041	0.039	1.03	0.92	28.0	1.20	3.2	0.2	0.5	2.7	0.8	0.4
9	28	91	104	915	0.0	16.8	0.084	.	.	0.88	.	27.0	0.95	3.0	0.3	0.4	2.1	1.2	0.4
9	28	91	106	920	0.0	16.6	0.080	.	.	0.92	.	24.0	0.85	2.6	0.3	0.5	1.9	1.1	0.4
9	28	91	110	925	0.0	16.7	0.101	.	.	1.01	.	29.0	0.90	2.6	0.3	0.2	1.9	1.1	0.3
9	28	91	113	925	0.0	16.6	0.094	.	.	1.06	.	27.0	0.80	2.6	0.3	0.5	1.9	1.1	0.3
9	28	91	123	950	0.0	17.0	0.127	.	.	1.19	.	28.0	0.70	2.3	0.2	0.6	1.3	1.5	0.4
9	28	91	151C	1618	0.0	24.1	0.029	.	.	0.77	.	2.6	1.25	19.3	0.8	2.5	17.1	2.5	0.8
9	28	91	16	1625	0.0	24.3	0.023	.	.	0.82	.	3.3	1.05	14.9	0.4	1.5	12.8	2.7	1.5
9	28	91	18BC	1615	0.0	23.9	.	.	.	.	.	.	.	.	.	.	.	.	1.5
9	28	91	21AC	1610	0.0	23.6	0.037	.	.	0.91	.	2.9	1.15	19.3	0.6	2.4	16.8	3.0	1.5
9	28	91	25WEC	1605	0.0	23.6	0.039	.	.	1.01	.	3.1	1.35	24.0	0.7	2.7	21.1	3.4	1.3
9	28	91	26RC	1600	0.0	23.5	0.039	.	.	0.88	.	3.4	1.35	23.2	0.6	2.8	19.8	4.4	1.3
9	28	91	29	1550	0.0	23.3	0.043	.	.	1.06	.	3.2	1.75	25.8	0.8	2.6	23.0	3.2	1.4
9	28	91	2MC	1715	0.0	24.3	0.021	.	.	0.67	.	2.5	1.35	17.7	0.6	1.7	15.5	2.6	1.5

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
9	28	91	36AWIC	1532	0.0	23.4	0.035	.	.	0.94	.	3.5	1.35	21.8	0.6	2.3	19.0	3.5	1.3
9	28	91	39	1530	0.0	22.9	0.048	.	.	1.08	.	3.8	1.35	25.0	0.7	2.8	21.6	4.2	1.5
9	28	91	41	1457	0.0	22.9	0.050	.	.	1.06	.	4.8	1.75	29.7	0.8	3.2	25.6	5.0	1.2
9	28	91	45	1453	0.0	23.0	0.043	.	.	2.05	.	3.3	1.65	27.1	0.4	2.6	24.0	3.4	1.2
9	28	91	50	1320	0.0	22.1	0.050	.	.	1.04	.	4.1	.	28.1	0.1	2.6	25.4	2.9	1.2
9	28	91	50	1345	0.0	22.6	0.050	.	.	1.04	.	4.5	1.75	29.8	0.4	3.1	27.0	2.9	1.2
9	28	91	56YC	1055	0.0	22.1	0.037	.	.	0.87	.	3.8	1.22	21.1	0.5	1.8	19.0	2.3	1.1
9	28	91	60	.	0.0	20.8	0.075	0.028	0.026	1.26	1.17	6.7	2.55	15.7	0.1	1.1	14.2	1.6	0.8
9	28	91	60	1035	0.0	20.8	0.075	0.028	0.026	1.26	.	6.7	2.60	16.3	0.3	1.5	14.4	2.2	1.0
9	28	91	65	1020	0.0	19.8	0.081	.	.	1.21	.	13.0	2.85	16.6	0.5	1.8	15.0	1.9	0.7
9	28	91	71	.	0.0	19.5	0.102	0.041	0.039	1.21	1.09	21.0	1.70	7.6	0.2	0.6	6.4	1.6	0.5
9	28	91	74	955	0.0	19.1	0.088	.	.	1.06	.	32.0	1.60	8.2	0.3	1.1	7.2	1.2	0.5
9	28	91	8	1635	0.0	24.5	0.019	.	.	0.70	.	3.0	1.05	13.6	0.4	1.7	11.8	2.3	1.4
9	28	91	84	.	0.0	19.4	0.107	0.045	0.042	1.15	1.11	27.0	1.45	5.0	0.1	0.5	4.3	1.0	0.4
9	28	91	89	920	0.0	19.0	0.098	.	.	1.08	.	28.0	1.45	5.2	0.2	0.4	4.0	1.8	0.5
9	28	91	96	900	0.0	18.7	0.100	.	.	1.05	.	.	.	.	.	.	.	.	0.4
9	28	91	BEC1	1245	0.0	23.6	.	.	.	0.37	.	5.1	1.55	23.8	1.2	2.1	21.1	3.2	0.8
9	28	91	EC2	1650	0.0	24.4	0.022	.	.	0.64	.	3.7	1.45	20.7	0.3	2.3	18.7	2.1	1.3
9	28	91	IC2	1620	0.0	24.4	0.023	.	.	0.61	.	4.0	1.65	17.9	0.5	2.1	16.6	1.2	1.1
9	28	91	MC2	1655	0.0	24.6	0.021	.	.	0.60	.	3.5	1.15	17.1	0.3	1.8	15.5	1.7	1.3
9	28	91	MC8	1705	0.0	24.1	0.022	.	.	0.49	.	4.3	1.15	19.3	0.4	1.7	16.8	3.0	1.1
9	28	91	NR3	935	0.0	18.6	0.060	0.014	0.007	0.76	0.63	17.0	0.25	18.6	0.2	1.3	16.8	1.9	0.6
9	28	91	SC2	1755	0.0	24.4	0.021	.	.	0.58	.	3.1	1.45	20.0	1.2	1.9	18.2	2.0	1.2
9	28	91	TC2	1334	0.0	23.6	0.029	.	.	0.73	.	5.0	1.25	19.3	0.8	1.8	17.1	2.5	1.0
9	28	91	VC3	1750	0.0	24.3	0.018	.	.	0.55	.	2.8	1.45	14.9	0.9	2.2	13.1	2.2	1.2
9	28	91	WEC10	1825	0.0	24.2	0.016	.	.	0.55	.	3.0	1.25	15.4	0.9	1.6	13.4	2.5	0.8
9	28	91	WEC18	1823	0.0	24.4	0.017	.	.	0.56	.	3.9	1.25	13.6	1.0	1.7	12.3	1.6	0.8
9	28	91	WEC21	1820	0.0	24.5	0.016	.	.	0.56	.	3.7	1.05	11.4	0.7	1.5	9.9	1.9	0.8
9	28	91	WEC26	1815	0.0	24.3	0.027	.	.	0.45	.	6.6	1.45	19.0	0.9	2.3	17.4	1.7	0.8
9	28	91	WEC29CC	1810	0.0	24.1	0.026	.	.	0.44	.	4.4	1.45	17.7	0.8	2.1	15.8	2.2	0.8
9	28	91	WEC5VC	1835	0.0	23.8	0.019	.	.	0.60	.	2.6	1.15	16.4	0.8	2.0	14.7	2.0	1.0
9	28	91	WEC6	1830	0.0	23.8	0.017	.	.	0.59	.	2.9	0.95	13.3	0.6	1.4	11.2	2.8	1.0
9	28	91	WES1	1638	0.0	24.2	0.023	.	.	0.77	.	2.8	1.05	15.9	0.5	1.8	13.9	2.4	1.5
9	28	91	WES2	1630	0.0	24.3	0.023	.	.	0.76	.	2.7	1.05	13.8	0.3	1.4	12.0	2.2	1.6
9	28	91	WES3	.	0.0	20.3	0.070	0.010	0.006	1.16	1.03	12.0	3.15	17.8	0.6	1.4	15.2	3.3	0.8
9	28	91	WES3	.	999.0	.	.	.	.	.	.	12.0	1.05	16.8	0.7	1.5	13.6	4.3	.
9	28	91	WWC2TC	1328	0.0	23.2	0.035	.	.	0.73	.	4.0	1.75	25.6	0.7	2.2	23.0	2.8	1.3
9	28	91	WWC6	1339	0.0	23.6	0.038	.	.	0.64	.	6.1	1.85	28.2	2.0	2.3	24.6	4.6	0.7
9	28	91	WWC9	1343	0.0	23.7	0.032	.	.	0.49	.	5.4	2.15	27.2	1.7	2.7	23.8	4.3	0.9
9	28	91	YC10	1135	0.0	22.9	0.021	.	.	0.56	.	2.9	1.05	16.0	0.6	1.8	14.2	2.1	1.2
9	28	91	YC13JC	1114	0.0	22.9	0.023	0.005	.	0.56	0.42	3.6	1.05	14.8	0.5	1.2	12.8	2.5	1.2
9	28	91	YC17	1200	0.0	23.4	0.023	.	.	0.54	.	4.4	1.25	22.4	1.1	1.9	19.8	3.2	0.9
9	28	91	YC27BEC	1126	0.0	23.0	0.028	0.006	.	0.55	0.35	5.3	1.35	20.3	1.2	1.6	18.2	2.4	0.8
9	28	91	YC29	1230	0.0	23.0	0.027	.	.	0.48	.	6.4	1.85	30.2	1.5	2.1	26.7	4.1	0.9
9	28	91	YC2HC	.	0.0	.	.	.	.	.	.	.	1.45	25.0	0.4	2.3	22.7	2.3	.
9	28	91	YC2HC	1102	0.0	22.4	0.043	0.009	.	0.80	0.61	3.1	1.65	26.8	0.7	2.3	24.6	2.2	1.3
9	28	91	YC7	1125	0.0	23.0	0.024	.	.	0.64	.	2.9	1.15	19.4	0.8	1.8	17.6	1.8	1.3
10	14	91	1	1048	0.0	21.0	0.027	.	.	0.62	.	2.6	0.57	16.3	0.5	2.0	12.8	4.9	2.1
10	14	91	101	1555	0.0	19.0	0.087	.	.	0.82	.	15.5	0.06	3.4	0.1	0.8	2.7	1.1	0.4
10	14	91	104	1550	0.0	18.7	0.080	.	.	0.71	.	15.5	0.07	3.4	0.3	0.7	2.7	1.1	0.4

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
10	14	91	106	1545	0.0	18.5	0.081	.	.	0.78	.	15.5	0.08	4.3	0.2	0.7	3.7	0.8	0.5
10	14	91	110	1540	0.0	18.2	0.075	.	.	0.68	.	15.0	0.16	4.9	0.1	1.0	4.3	0.8	0.5
10	14	91	113	1535	0.0	18.0	0.075	.	.	0.68	.	15.0	0.29	7.6	0.1	1.3	6.7	1.2	0.4
10	14	91	123	1517	0.0	17.7	0.059	.	.	0.65	.	12.0	0.00	1.3	0.1	0.5	0.0	2.1	0.7
10	14	91	151C	1005	0.0	20.8	0.053	.	.	0.76	.	5.2	0.69	17.5	0.8	2.4	13.6	5.6	1.7
10	14	91	16	1002	0.0	20.8	0.026	.	.	0.64	.	4.9	0.52	13.7	0.2	1.2	9.9	5.6	2.2
10	14	91	188C	958	0.0	20.8	0.035	.	.	0.73	.	2.7	0.36	12.7	0.5	1.7	9.6	4.4	2.3
10	14	91	21AC	954	0.0	20.8	0.039	.	.	0.76	.	2.9	0.72	17.0	0.5	1.9	13.6	4.7	2.0
10	14	91	25WEC	949	0.0	20.2	0.041	.	.	0.70	.	3.1	0.68	17.1	0.5	1.9	14.2	4.0	1.7
10	14	91	26RC	944	0.0	20.3	0.047	.	.	0.84	.	4.1	0.78	18.4	0.6	2.4	15.0	4.7	1.6
10	14	91	29	936	0.0	20.2	0.043	.	.	0.89	.	3.5	0.96	18.9	0.5	2.3	15.2	5.2	1.5
10	14	91	2MC	1053	0.0	21.2	0.023	.	.	0.57	.	2.5	0.56	13.2	0.2	1.1	10.7	3.5	2.1
10	14	91	36AWIC	919	0.0	20.0	0.041	.	.	0.90	.	5.3	0.69	16.0	0.6	2.0	12.6	4.8	1.6
10	14	91	39	912	0.0	19.9	0.045	.	.	0.92	.	5.0	1.05	21.3	0.6	2.4	17.9	4.5	1.5
10	14	91	41	902	0.0	19.7	0.041	.	.	0.90	.	4.4	0.68	15.3	0.4	1.6	11.8	5.1	1.7
10	14	91	45	854	0.0	19.5	0.050	.	.	0.87	.	6.6	.	20.7	0.9	2.3	16.8	5.4	1.5
10	14	91	50	800	0.0	19.0	0.059	.	.	0.95	.	5.8	0.62	14.9	0.5	1.9	11.5	5.0	1.0
10	14	91	56YC	1639	0.0	21.1	0.044	.	.	0.77	.	3.8	1.06	24.9	0.1	2.2	22.2	3.1	1.5
10	14	91	60	1636	0.0	21.5	0.102	.	.	1.07	.	10.0	1.17	32.7	0.8	2.7	31.0	1.0	0.9
10	14	91	65	1631	0.0	19.2	0.086	.	.	0.91	.	12.0	0.52	16.7	0.3	1.4	14.4	2.8	0.6
10	14	91	71	1622	0.0	19.0	0.085	.	.	0.92	.	13.0	0.32	11.8	0.3	1.3	10.4	1.6	0.6
10	14	91	74	1619	0.0	20.5	0.082	.	.	0.87	.	14.0	0.18	5.1	0.0	0.7	4.0	1.6	0.7
10	14	91	8	1021	0.0	20.9	0.023	.	.	0.59	.	3.6	0.35	12.2	0.3	1.4	9.9	3.2	2.2
10	14	91	84	1615	0.0	20.0	0.093	.	.	0.92	.	14.5	0.65	16.4	0.4	1.9	14.7	2.0	0.5
10	14	91	89	1608	0.0	20.0	0.088	.	.	0.88	.	15.5	0.27	8.7	0.2	1.6	7.5	1.5	0.5
10	14	91	96	1603	0.0	20.1	0.086	.	.	0.85	.	14.0	0.17	5.9	0.4	0.8	5.1	1.1	0.5
10	14	91	BEC3	1406	0.0	22.0	0.025	.	.	0.32	.	6.4	0.76	12.5	0.7	1.9	11.0	2.0	0.7
10	14	91	EC2	1057	0.0	21.0	0.029	.	.	0.62	.	4.1	0.65	19.7	0.1	1.7	15.8	5.4	1.5
10	14	91	IC2	1010	0.0	20.9	0.036	.	.	0.75	.	4.7	0.55	16.1	0.8	1.7	13.4	3.7	1.6
10	14	91	MC2	1102	0.0	21.1	0.019	.	.	0.52	.	2.5	0.32	8.4	0.6	0.9	6.9	2.0	2.2
10	14	91	MC8	1108	0.0	21.1	0.022	.	.	0.46	.	4.6	0.54	14.1	1.0	1.5	11.8	3.2	1.9
10	14	91	NR3	1530	0.0	20.5	0.047	.	.	0.45	.	12.0	1.43	25.4	1.2	3.7	21.9	4.5	0.5
10	14	91	SC2	1132	0.0	21.1	0.024	.	.	0.52	.	4.9	0.86	17.8	0.8	1.8	14.4	4.7	1.1
10	14	91	TC2	821	0.0	19.7	0.037	.	.	0.73	.	5.4	0.77	16.6	1.3	2.2	13.6	4.1	1.0
10	14	91	VC3	1126	0.0	21.1	0.021	.	.	0.46	.	4.6	.	20.5	1.2	1.7	17.1	4.6	1.2
10	14	91	WEC10	1229	0.0	21.9	0.016	.	.	0.53	.	3.2	0.48	12.5	1.0	1.3	10.4	2.9	1.5
10	14	91	WEC18	1222	0.0	21.5	0.020	.	.	0.40	.	5.5	0.49	13.1	0.7	1.0	10.7	3.3	1.1
10	14	91	WEC21	1216	0.0	21.2	0.020	.	.	0.30	.	5.3	0.56	13.4	0.7	1.4	11.0	3.4	1.1
10	14	91	WEC26	1209	0.0	21.0	0.026	.	.	0.29	.	6.6	0.38	10.4	0.6	1.2	8.8	2.0	1.1
10	14	91	WEC29CC	1204	0.0	21.0	0.024	.	.	0.25	.	6.4	0.52	11.9	0.1	1.1	9.9	2.6	0.8
10	14	91	WEC5VC	1254	0.0	21.8	0.025	.	.	0.49	.	3.4	0.78	17.2	0.7	1.6	14.4	3.7	1.7
10	14	91	WEC6	1236	0.0	21.2	0.014	.	.	0.57	.	3.6	0.42	8.9	0.5	1.2	7.2	2.3	1.6
10	14	91	WES1	1026	0.0	21.0	0.024	.	.	0.59	.	3.2	0.48	13.0	0.5	1.6	11.0	2.7	2.4
10	14	91	WES2	1018	0.0	20.9	0.023	.	.	0.59	.	2.7	0.32	11.2	0.0	1.1	8.5	3.8	2.3
10	14	91	WES3	1626	0.0	19.9	0.080	.	.	0.95	.	10.0	0.99	18.7	0.4	2.8	16.8	2.1	0.8
10	14	91	WWC2TC	813	0.0	19.8	0.040	.	.	0.74	.	4.8	0.76	19.5	1.2	2.5	16.3	4.3	1.3
10	14	91	WWC6	841	0.0	19.8	0.037	.	.	0.67	.	5.9	0.72	20.3	1.3	2.5	16.8	4.7	1.0
10	14	91	WWC9	832	0.0	19.7	0.040	.	.	0.68	.	8.4	0.97	22.2	1.7	2.4	18.2	5.6	0.7
10	14	91	YC10	1430	0.0	21.0	0.029	.	.	0.67	.	4.2	0.70	17.2	0.6	2.1	14.4	3.7	1.3
10	14	91	YC13JC	1426	0.0	21.2	0.021	.	.	0.62	.	5.3	0.50	11.4	0.5	1.6	9.4	2.8	1.0

m	d	y	sta	time	dep	tem	tp	tsp	srp	tn	dn	turb	fluo	chla	chlb	chlc	acla	pha	sd
10	14	91	YC17	1421	0.0	21.9	0.020	.	.	0.52	.	5.1	0.50	10.1	0.5	1.5	8.5	2.1	0.6
10	14	91	YC27BEC	1359	0.0	21.0	0.027	.	.	0.40	.	6.1	0.96	19.1	1.4	2.3	16.6	3.3	0.8
10	14	91	YC29	1355	0.0	21.0	0.027	.	.	0.37	.	6.9	1.00	18.9	0.8	2.2	16.6	2.9	0.7
10	14	91	YC2HC	1441	0.0	21.0	0.031	.	.	0.67	.	4.0	0.82	15.7	0.5	2.3	13.6	2.6	1.4
10	14	91	YC7	1434	0.0	21.1	0.037	.	.	0.70	.	4.2	0.88	20.1	0.5	3.1	17.9	2.5	1.5

Appendix E

Water Quality Data for the West Point Lake Forebay for 1991

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time
do	Dissolved Oxygen, mg/L
spc	Specific Conductivity, μmhos
ph	pH
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
dn	Dissolved Nitrogen, mg/L
tfe	Total Iron, mg/L
tmn	Total Manganese, mg/L
toc	Total Organic Carbon, mg/L
doc	Dissolved Organic Carbon, mg/L
turb	Turbidity, NTUs
fluo	Fluorescence, relative units
chla	Chlorophyll a, mg/m^3
chlb	Chlorophyll b, mg/m^3
chlc	Chlorophyll c, mg/m^3
acla	Acid-corrected Chlorophyll a, mg/m^3
pha	Phaeophytin, mg/m^3
sd	Secchi Disk Transparency, m

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	fluor	cla	clb	clc	acla	pha	sd
4	22	91	WES1	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12.2	0.1	1.8	10.0	2.9	.
4	22	91	WES2	1220	0.0	20.5	9.1	7.5	75.0	0.030	0.016	-0.005	0.80	0.65	.	.	0.32	.	-0.05	.	2.8	2.4	7.5	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	2.0	19.9	8.5	7.4	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	4.0	19.8	8.1	7.3	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	6.0	19.8	8.0	7.3	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	8.0	19.6	7.8	7.2	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	10.0	18.8	4.4	6.9	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	12.0	16.4	3.7	6.7	70.0	0.035	0.029	0.018	0.79	0.77	.	.	0.42	.	0.06	.	2.3	2.2	7.7	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	14.0	15.9	3.2	6.6	68.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	16.0	15.1	2.0	6.5	68.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	18.0	14.8	1.6	6.4	68.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
4	22	91	WES2	1220	20.0	14.6	1.4	6.3	69.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.4
7	26	91	WES1	844	0.0	28.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.8	0.94	21.8	0.0	1.8	19.0	3.4	1.7
7	26	91	WES1	1550	0.0	29.3	9.8	8.4	80.0	0.024	0.031	-0.005	0.74	0.55	.	.	0.12	.	0.10	.	2.9	2.5	2.7	0.93	.	.	.	.	.	1.5
7	26	91	WES1	1550	2.0	29.2	9.5	8.7	79.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	4.0	28.6	6.9	8.3	79.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	6.0	28.1	3.6	7.5	84.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	8.0	27.6	2.2	7.1	83.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	10.0	26.5	0.5	6.9	81.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	12.0	25.5	0.1	6.7	79.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	14.0	24.6	0.1	6.6	75.0	0.031	0.013	-0.005	1.11	0.94	.	.	0.54	.	0.46	.	3.1	2.7	12.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	16.0	23.9	0.1	6.5	76.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	18.0	23.3	0.1	6.5	80.0	0.039	0.016	0.017	0.98	0.88	.	.	1.50	.	1.43	.	3.2	2.8	17.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	20.0	23.1	0.1	6.5	81.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	22.0	22.6	0.1	6.5	86.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	23.0	.	.	.	.	0.087	0.070	0.073	1.39	1.29	.	.	3.41	.	1.74	.	4.0	3.0	17.0	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	23.7	21.7	0.1	6.6	110.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.5
7	26	91	WES1	1550	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.32	23.9	0.0	1.9	22.0	1.7	1.5
7	26	91	WES2	924	0.0	29.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.0	1.03	20.3	0.0	2.2	18.2	2.3	1.5
7	26	91	WES2	1740	0.0	29.6	9.8	8.8	81.0	0.029	0.010	-0.005	0.82	0.49	.	.	0.13	.	0.08	.	3.2	2.8	2.4	1.02	20.2	0.0	2.1	18.2	2.1	1.3
7	26	91	WES2	1740	2.0	29.6	9.6	8.8	80.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	4.0	29.2	8.7	8.7	77.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	6.0	28.3	3.6	7.2	85.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	8.0	27.3	2.7	7.0	86.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	10.0	26.3	2.4	6.8	80.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	12.0	25.1	1.3	6.8	74.0	0.039	0.020	0.006	1.20	1.17	.	.	0.79	.	0.38	.	2.8	2.8	14.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	14.0	24.7	0.1	6.7	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	16.0	24.0	0.1	6.6	78.0	0.040	0.014	0.008	0.99	0.98	.	.	1.37	.	1.09	.	2.9	2.7	18.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	18.0	23.6	0.1	6.6	80.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	20.0	22.9	0.1	6.6	96.0	0.072	0.067	0.066	1.42	1.39	.	.	3.28	.	1.73	.	4.0	3.6	12.0	.	.	.	.	.	.	1.3
7	26	91	WES2	1740	22.0	22.3	0.1	6.6	95.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.3
7	29	91	DAM	800	0.0	29.4	8.9	8.6	75.0	0.025	0.013	-0.005	0.64	0.42	-0.02	0.07	0.14	.	-0.05	.	.	.	2.1	.	.	.	.	.	.	.
7	29	91	DAM	800	1.0	29.5	8.9	8.7	76.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	2.0	29.5	8.9	8.8	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	3.0	29.5	9.0	8.8	74.0	0.026	0.007	-0.005	0.67	0.45	-0.02	0.09	0.13	.	-0.05	.	.	.	1.8	.	.	.	.	.	.	.
7	29	91	DAM	800	4.0	29.5	9.0	8.8	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	5.0	28.8	6.9	8.4	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	nh3	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	fluor	cla	clb	clc	acla	pha	sd
7	29	91	DAM	800	6.0	28.2	2.7	7.8	74.0	0.007	0.007	-0.005	0.79	0.63	0.02	0.22	0.10	.	-0.05	.	.	.	1.7	.	.	.	.	.	.	.
7	29	91	DAM	800	7.0	27.8	1.6	7.2	76.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	26	91	WES2	1740	999.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.19	21.5	0.0	1.9	19.5	1.8	1.3
7	29	91	DAM	800	8.0	27.4	1.8	7.1	80.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	9.0	26.9	0.8	6.9	77.0	0.017	0.006	-0.005	1.10	1.09	0.07	0.69	0.12	.	-0.05	.	.	.	1.4	.	.	.	.	.	.	.
7	29	91	DAM	800	10.0	26.1	0.9	6.8	77.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	11.0	25.7	0.5	6.8	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	12.0	25.2	0.4	6.7	72.0	0.021	0.011	-0.005	1.08	1.08	0.17	0.50	0.28	.	0.20	.	.	.	4.0	.	.	.	.	.	.	.
7	29	91	DAM	800	13.0	25.0	0.1	6.6	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	14.0	24.7	0.0	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	15.0	24.5	0.1	6.6	73.0	0.037	0.013	0.007	0.96	0.90	0.21	0.42	0.52	.	0.57	.	.	.	8.0	.	.	.	.	.	.	.
7	29	91	DAM	800	16.0	24.1	0.1	6.6	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	17.0	23.5	0.1	6.6	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	18.0	23.3	0.1	6.6	73.0	0.038	0.008	-0.005	0.82	0.74	0.29	-0.04	0.86	.	0.97	.	.	.	15.1	.	.	.	.	.	.	.
7	29	91	DAM	800	19.0	23.2	0.1	6.6	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	20.0	23.0	0.1	6.6	76.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	21.0	22.8	0.1	6.6	82.0	0.067	0.025	0.021	1.09	0.96	0.46	-0.04	1.40	.	1.47	.	.	.	16.5	.	.	.	.	.	.	.
7	29	91	DAM	800	22.0	22.4	0.1	6.6	88.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	23.0	22.0	0.1	6.7	92.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	DAM	800	23.9	21.5	0.1	6.8	102.0	0.148	0.122	0.113	1.71	1.56	1.05	-0.04	5.00	.	1.97	.	.	.	38.0	.	.	.	.	.	.	.
9	26	91	DAM	1100	0.0	24.7	6.3	6.5	75.0	0.022	0.010	.	0.64	0.51	.	.	0.31	-0.05	-0.05	-0.05	1.7	.	3.0	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	2.0	24.7	6.2	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	4.0	24.7	6.1	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	6.0	24.7	6.2	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	8.0	24.7	6.2	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	10.0	24.7	6.2	6.5	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	12.0	24.7	6.3	6.5	73.0	0.020	0.006	.	0.66	0.43	.	.	0.28	-0.05	-0.05	-0.05	1.3	.	4.0	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	14.0	24.7	4.8	6.5	71.0	0.020	0.008	.	0.70	0.58	.	.	0.33	-0.05	0.10	0.05	1.4	.	4.5	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	16.0	23.2	0.1	6.1	71.0	0.032	0.009	.	1.12	1.06	.	.	0.59	-0.05	0.67	0.67	1.0	.	9.0	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	18.0	23.1	0.0	6.0	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	20.0	23.0	0.0	6.0	71.0	0.030	0.008	.	1.17	1.03	.	.	0.70	-0.05	0.92	0.92	0.9	.	11.5	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	22.0	23.0	0.0	6.0	71.0	.	.	.	1.17	1.07	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.7
9	26	91	DAM	1100	23.0	.	0.0	.	.	0.036	0.021	.	.	.	.	.	2.97	0.15	0.99	0.99	3.0	.	35.0	.	.	.	.	.	.	1.7

Appendix F

Water Quality Data for West Point Dam Tailwater for 1991

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time
dep	Sample Depth, m
tem	Water Temperature, °C
do	Dissolved Oxygen, mg/L
pH	pH
spc	Specific Conductivity, μmhos
tp	Total Phosphorus, mg/L
tsp	Total Soluble Phosphorus, mg/L
srp	Soluble Reactive Phosphorus, mg/L
tn	Total Nitrogen, mg/L
dn	Dissolved Nitrogen, mg/L
no3no2	Nitrate Nitrite Nitrogen, mg/L
tfe	Total Iron, mg/L
dfe	Dissolved Iron, mg/L
tmn	Total Manganese, mg/L
dmn	Dissolved Manganese, mg/L
toc	Total Organic Carbon, mg/L
doc	Dissolved Organic Carbon, mg/L
turb	Turbidity, NTUs
tss	Total Suspended Solids, mg/L
alk	Total Alkalinity, mg$CaCO_3$/L

m	d	y	sta	time	dep	tfe	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
4	23	91	10	930	0.0	18.9	7.7	7.3	74.0	0.027	0.014	0.007	0.93	0.71	0.53	0.39	0.14	0.05	-0.05	2.71	.	7.0	5.2	15.1
4	23	91	10	1150	0.0	19.0	7.8	7.3	74.0	0.029	0.012	0.009	0.89	0.71	0.47	0.52	0.07	0.05	-0.05	2.82	.	7.0	4.4	15.3
4	23	91	10	1505	0.0	19.5	8.0	7.6	74.0	0.022	0.015	0.007	0.76	0.69	0.46	0.34	0.09	-0.05	-0.05	2.37	.	5.5	7.6	14.9
4	23	91	10	1645	0.0	18.7	7.4	7.1	72.0	0.027	0.014	0.008	0.86	0.69	0.46	0.53	0.07	-0.05	-0.05	2.75	.	6.4	.	13.3
4	23	91	10	1910	0.0	18.6	7.4	7.1	72.0	0.024	0.014	0.009	0.73	0.69	0.46	0.61	0.08	-0.05	-0.05	2.66	.	6.6	.	14.0
4	23	91	10	2105	0.0	18.3	7.2	7.0	72.0	0.025	0.015	0.009	0.79	0.71	0.44	0.50	0.09	-0.05	-0.05	2.79	2.73	6.6	0.4	14.4
4	23	91	10	2355	0.0	18.7	8.0	6.9	73.0	0.024	0.013	0.007	0.79	0.61	0.40	0.50	0.07	-0.05	-0.05	2.58	.	7.4	0.8	14.7
4	23	91	20	945	0.0	17.2	7.7	7.4	68.0	0.019	0.011	0.005	0.60	0.44	0.15	0.76	0.28	0.11	0.10	2.57	.	7.8	8.4	17.9
4	23	91	20	1205	0.0	17.9	8.4	7.5	68.0	0.017	0.009	-0.005	0.55	0.40	0.53	0.80	0.27	0.11	0.10	2.63	.	8.0	2.8	18.0
4	23	91	20	1515	0.0	18.6	8.7	7.3	67.0	0.018	0.009	-0.005	0.59	0.42	0.52	0.79	0.25	0.11	0.11	2.45	.	7.4	2.8	17.7
4	23	91	20	1700	0.0	19.5	8.1	7.0	72.0	0.028	0.016	0.008	0.76	0.60	0.67	0.71	0.06	0.09	-0.05	2.84	.	9.3	.	14.5
4	23	91	20	1925	0.0	18.3	6.5	6.9	72.0	0.029	0.015	0.009	0.82	0.67	0.70	0.46	0.10	-0.05	-0.05	2.83	2.76	7.0	.	14.3
4	23	91	20	2120	0.0	18.1	6.9	7.0	72.0	0.027	0.016	0.009	0.86	0.65	0.70	0.46	0.08	-0.05	-0.05	2.40	.	8.8	2.4	14.0
4	23	91	30	1210	0.0	18.2	7.9	7.4	71.0	0.028	0.023	0.018	0.73	0.66	0.58	0.55	0.21	0.07	0.06	2.46	.	6.5	0.4	16.7
4	23	91	30	1525	0.0	19.2	8.7	7.3	71.0	0.028	0.020	0.012	0.75	0.69	0.57	0.50	0.18	0.07	0.06	2.52	2.55	5.5	0.4	16.6
4	23	91	30	1710	0.0	19.6	8.6	7.1	70.0	0.031	0.014	0.007	0.70	0.64	0.56	1.12	0.15	0.12	0.05	2.97	2.63	15.0	18.4	15.9
4	23	91	30	1935	0.0	18.2	6.8	6.9	72.0	0.027	0.016	0.009	0.75	0.74	0.65	0.44	0.08	-0.05	-0.05	2.40	.	7.6	2.4	14.3
4	23	91	30	2130	0.0	18.1	7.0	7.1	72.0	0.028	0.017	0.010	0.76	0.74	0.64	0.43	0.10	-0.05	-0.05	2.71	2.66	7.5	2.0	14.0
4	23	91	40	945	0.0	17.6	6.5	6.4	72.0	0.024	0.017	0.010	0.78	0.74	0.61	0.37	0.09	-0.05	-0.05	2.52	.	7.6	2.4	14.8
4	23	91	40	1205	0.0	18.1	7.3	6.4	72.0	0.024	0.016	0.009	0.79	0.72	0.60	0.36	0.11	0.05	-0.05	2.46	.	5.5	4.1	15.2
4	23	91	40	1510	0.0	18.7	7.3	6.4	71.0	0.023	0.019	0.012	0.75	0.74	0.58	0.43	0.10	0.05	-0.05	2.65	2.46	5.3	1.2	14.2
4	23	91	40	1640	0.0	19.0	7.3	6.4	70.0	0.024	0.019	0.011	0.82	0.74	0.58	0.38	0.09	0.05	-0.05	2.35	.	4.5	1.6	15.2
4	23	91	40	1915	0.0	19.5	7.5	6.5	71.0	0.036	0.019	0.009	0.79	0.71	0.62	0.75	0.06	0.07	-0.05	2.47	.	9.5	10.8	15.0
4	23	91	40	2100	0.0	18.2	6.7	6.6	72.0	0.027	0.018	0.011	0.91	0.80	0.63	0.49	0.07	0.05	-0.05	3.08	2.72	9.5	7.6	14.4
4	23	91	40	2350	0.0	17.8	6.5	6.4	72.0	0.031	0.018	0.011	0.85	0.77	0.64	0.49	-0.05	0.05	-0.05	2.91	2.69	8.5	3.2	14.3
4	23	91	50	925	0.0	17.4	6.4	6.4	71.0	0.028	0.017	0.009	0.77	0.77	0.60	0.39	0.07	-0.05	-0.05	2.38	.	7.3	5.6	15.1
4	23	91	50	1145	0.0	17.9	7.3	6.4	72.0	0.028	0.018	0.009	0.78	0.71	0.60	0.42	0.07	0.05	-0.05	2.34	2.36	7.0	3.6	15.3
4	23	91	50	1500	0.0	18.7	7.3	6.4	73.0	0.030	0.019	0.012	0.82	0.75	0.60	0.46	0.13	0.05	0.05	2.61	.	7.0	5.6	15.8
4	23	91	50	1700	0.0	19.1	7.2	6.4	74.0	0.036	0.022	0.015	1.00	0.87	0.59	0.45	0.12	0.06	0.06	2.56	2.42	6.8	3.2	16.3
4	23	91	50	1930	0.0	19.2	7.8	6.6	71.0	0.033	0.019	0.011	0.78	0.75	0.60	0.75	0.14	0.06	-0.05	2.39	.	8.6	16.8	15.6
4	23	91	50	2120	0.0	18.2	6.7	6.5	71.0	0.030	0.019	0.010	0.78	0.75	0.66	0.63	0.07	0.06	-0.05	2.70	.	8.7	7.6	14.8
4	24	91	10	400	0.0	18.4	7.5	7.3	74.0	0.024	0.013	0.007	0.77	0.62	0.39	0.18	0.07	-0.05	-0.05	2.46	.	5.6	1.2	15.3
4	24	91	10	800	0.0	18.1	7.4	7.4	72.0	0.025	0.014	0.008	0.81	0.64	0.39	0.47	0.07	0.05	-0.05	2.58	.	5.8	0.0	13.1
4	24	91	20	15	0.0	17.3	8.0	7.1	64.0	0.018	0.009	-0.005	0.46	0.31	0.42	1.11	0.34	0.17	0.15	2.93	2.66	12.0	5.2	19.4
4	24	91	20	415	0.0	16.7	7.9	7.4	64.0	0.017	0.009	-0.005	0.47	0.46	0.43	1.14	0.36	0.15	0.13	2.70	.	11.0	1.6	18.7
4	24	91	20	815	0.0	16.7	7.9	7.1	63.0	0.017	0.009	-0.005	0.46	0.43	0.42	1.08	0.37	0.15	0.13	2.97	2.80	8.5	2.0	18.7
4	24	91	30	20	0.0	17.8	7.2	7.1	70.0	0.027	0.017	0.010	0.72	0.59	0.48	0.63	0.21	0.08	0.06	2.74	2.51	7.5	0.8	16.5
4	24	91	30	425	0.0	17.2	7.0	7.4	69.0	0.022	0.018	0.011	0.62	0.59	0.46	0.61	0.25	0.08	0.07	2.51	.	6.9	1.2	16.9
4	24	91	30	825	0.0	16.9	6.7	7.0	70.0	0.019	0.015	0.008	0.59	0.64	0.48	0.63	0.23	0.08	0.07	2.63	.	7.8	4.0	16.5
4	24	91	40	355	0.0	17.5	6.5	6.4	72.0	0.028	0.019	0.011	0.82	0.73	0.64	0.44	0.05	-0.05	-0.05	2.85	2.71	7.4	5.6	14.5
4	24	91	40	755	0.0	17.1	6.0	6.5	71.0	0.025	0.018	0.012	0.76	0.74	0.61	0.43	0.07	0.05	-0.05	2.57	.	6.5	3.2	15.1
4	24	91	50	10	0.0	17.6	6.6	6.5	72.0	0.033	0.018	0.010	0.80	0.75	0.66	0.60	0.07	0.05	-0.05	2.77	2.65	8.4	8.0	14.3
4	24	91	50	410	0.0	17.3	6.4	6.5	72.0	0.029	0.018	0.010	0.85	0.69	0.66	0.42	0.07	-0.05	-0.05	2.65	.	7.5	8.0	14.3
4	24	91	50	810	0.0	17.2	6.3	6.5	72.0	0.029	0.021	0.012	0.77	0.78	0.66	0.39	0.08	-0.05	-0.05	2.63	.	6.7	0.0	15.2

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	28	91	10B	910	0.0	27.2	5.1	6.6	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10B	910	1.0	27.3	5.0	6.6	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10B	910	2.0	27.3	5.0	6.6	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10B	910	3.0	27.3	5.0	6.6	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10D	915	0.0	27.2	4.9	6.6	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10D	915	1.0	27.2	4.8	6.6	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10D	915	2.0	27.3	4.8	6.6	76.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10E	935	0.0	27.4	4.7	6.6	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10E	935	1.0	27.3	4.5	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10E	935	2.0	27.2	4.4	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10E	935	3.0	27.2	4.3	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10E	935	3.8	27.2	4.1	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10F	920	0.0	27.2	4.7	6.6	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10F	920	1.0	27.2	4.5	6.6	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10F	920	2.0	27.1	4.4	6.5	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10F	920	3.0	27.1	4.4	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10H	925	0.0	27.2	4.6	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	10H	925	1.0	27.2	4.5	6.5	75.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	20B	1100	0.0	26.5	5.5	6.6	69.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	20B	1100	1.0	26.5	5.5	6.6	69.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30B	1130	0.0	27.0	5.2	6.7	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30B	1130	1.0	26.9	5.3	6.6	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30B	1130	2.0	26.9	5.0	6.6	70.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30B	1130	2.8	26.9	4.9	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30C	1135	0.0	27.2	4.8	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30C	1135	1.0	27.2	4.8	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30C	1135	2.0	27.0	4.8	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30D	1140	0.0	27.7	4.6	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30D	1140	1.0	27.2	4.6	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	30D	1140	1.5	27.1	4.6	6.5	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40B	1300	0.0	28.4	4.8	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40B	1300	1.0	28.4	4.7	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40B	1300	1.5	28.4	4.6	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40C	1305	0.0	28.4	4.9	6.7	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40C	1305	1.0	28.4	4.7	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40C	1305	1.5	28.4	4.6	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40D	1310	0.0	28.7	5.3	6.7	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40D	1310	1.0	28.4	4.9	6.6	70.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	40D	1310	2.0	28.3	4.7	6.6	70.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50A	1400	0.0	28.6	5.6	6.8	78.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50A	1400	1.0	28.6	5.4	6.8	78.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50C	1405	0.0	27.7	5.3	6.7	77.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50C	1405	1.0	27.7	5.2	6.6	78.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50E	1410	0.0	27.8	5.7	6.7	78.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50F	1410	1.0	27.8	5.5	6.7	77.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	28	91	50E	1410	1.8	27.8	5.3	6.7	78.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	29	91	10	1115	0.0	27.4	4.4	7.2	75.0	0.037	0.013	0.008	1.53	1.17	0.60	0.62	0.35	0.24	.	4.53	.	3.4	.	.
7	29	91	10	1255	.	26.9	2.7	6.5	72.0	0.025	0.007	-0.005	0.97	0.96	0.50	0.34	0.05	0.24	0.23	3.25	.	4.5	.	.
7	29	91	10	1310	.	27.1	2.7	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	10	1325	.	27.0	2.7	6.3	72.0	0.026	-0.005	-0.005	1.04	0.85	0.47	0.39	-0.05	0.26	0.26	2.94	.	4.5	.	.
7	29	91	10	1340	.	27.0	2.7	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	10	1355	.	27.0	2.7	6.3	72.0	0.027	0.005	-0.005	0.98	0.73	0.46	0.36	0.05	0.27	0.27	2.90	.	4.5	.	.
7	29	91	10	1430	.	26.9	2.7	6.3	72.0	0.026	0.005	-0.005	0.96	0.93	0.23	0.39	0.06	0.27	0.27	3.03	.	4.4	.	.
7	29	91	10	1500	.	26.8	2.7	6.3	72.0	0.025	0.005	-0.005	0.95	0.91	0.47	.	0.06	.	0.27	2.89	.	4.6	.	.
7	29	91	10	1600	.	27.1	2.6	6.3	71.0	0.025	0.006	-0.005	1.00	1.00	0.50	0.42	0.06	0.27	0.26	3.27	.	4.9	.	.
7	29	91	10	1700	.	26.6	2.6	6.4	64.0	0.026	0.005	-0.005	0.97	0.92	0.51	0.40	0.06	0.26	0.25	2.67	.	4.7	.	.
7	29	91	10	1800	.	26.7	2.6	6.3	72.0	0.026	0.007	-0.005	1.01	0.91	0.52	0.41	0.08	0.26	0.26	3.03	.	4.9	.	.
7	29	91	10	1955	0.0	26.8	2.8	6.4	72.0	0.031	0.009	0.005	1.15	1.02	0.55	0.41	0.09	0.25	0.24	3.27	.	4.8	.	.
7	29	91	20	1127	0.0	26.4	5.1	7.1	70.0	0.025	0.008	-0.005	0.83	0.79	0.36	0.89	0.18	0.20	0.19	3.57	.	6.7	.	.
7	29	91	20	1245	0.0	27.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1300	0.0	28.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1315	0.0	27.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1337	0.0	26.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1400	0.0	26.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1440	0.0	26.6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	20	1530	.	27.3	3.1	6.7	72.0	0.030	0.019	0.016	1.26	1.08	0.50	0.51	0.08	0.32	0.32	3.82	.	4.9	.	.
7	29	91	20	2018	0.0	26.4	3.3	6.5	72.0	0.029	0.007	-0.005	1.10	0.98	0.46	0.61	0.17	0.29	0.29	3.14	.	6.2	.	.
7	29	91	30	1135	0.0	26.8	4.7	6.9	73.0	0.037	0.021	0.015	1.02	0.98	0.42	0.73	0.33	0.20	0.15	2.91	.	.	.	.
7	29	91	30	1250	0.0	27.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	30	1305	0.0	27.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	30	1550	.	27.2	3.1	6.6	75.0	0.031	0.022	0.021	1.84	1.58	0.49	0.54	0.07	0.33	0.31	5.29	.	5.4	.	.
7	29	91	30	2030	0.0	26.3	3.3	6.5	72.0	0.029	0.009	0.005	1.05	0.95	0.50	0.60	0.14	0.31	0.29	2.77	.	6.1	.	.
7	29	91	40	1220	0.0	28.0	5.0	6.8	72.0	0.030	0.015	0.009	1.14	0.92	0.59	0.69	0.17	0.16	0.14	3.50	.	6.8	.	.
7	29	91	40	13[illegible]	0.0	28.3	4.8	6.7	71.0	0.027	0.015	0.009	1.80	1.24	1.28	0.76	0.19	0.25	0.25	3.16	.	7.2	.	.
7	29	91	40	1330	0.0	28.2	4.7	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1345	0.0	28.0	4.6	6.6	72.0	0.038	0.025	0.019	1.04	0.94	0.64	1.25	0.19	0.20	0.12	2.95	.	13.5	.	.
7	29	91	40	1400	0.0	27.8	4.6	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1415	0.0	27.6	4.7	6.6	72.0	0.047	0.025	0.018	1.17	0.98	0.60	1.26	0.24	0.25	0.11	2.89	.	11.5	.	.
7	29	91	40	1430	0.0	27.5	4.7	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1445	0.0	27.6	4.5	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1500	0.0	27.3	4.1	6.5	72.0	0.051	0.023	0.018	1.22	0.98	0.44	1.89	0.22	0.53	0.26	3.19	.	7.5	.	.
7	29	91	40	1515	0.0	27.2	3.7	6.5	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1530	0.0	27.0	3.4	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1545	0.0	26.9	3.2	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1600	0.0	26.8	3.1	6.4	72.0	0.037	0.009	0.005	1.08	1.07	0.46	1.19	0.10	0.39	0.29	2.89	.	6.8	.	.
7	29	91	40	1615	0.0	26.8	3.0	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1630	0.0	26.8	2.9	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1645	0.0	26.8	2.9	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1700	0.0	26.7	2.9	6.4	72.0	0.033	0.009	0.005	1.27	1.05	0.49	0.92	0.09	0.36	0.30	2.92	.	6.2	.	.
7	29	91	40	1715	0.0	26.7	2.9	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1730	0.0	26.7	2.9	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1745	0.0	26.6	2.8	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1947	0.0	26.5	2.8	6.5	71.0	0.030	0.008	-0.005	1.21	1.05	0.52	.	.	.	.	2.71	.	5.9	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	29	91	40A	1730	0.0	26.6	2.8	6.4	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40B	1730	0.0	26.6	2.7	6.4	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40	1800	0.0	26.6	2.8	6.4	72.0	0.031	0.011	0.007	1.01	0.94	0.51	.	.	.	.	2.71	.	5.8	.	.
7	29	91	40C	1730	0.0	26.5	2.7	6.4	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40D	1730	0.0	26.5	2.6	6.4	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40E	1730	0.0	26.5	2.6	6.4	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40F	1730	0.0	26.5	2.7	6.5	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	40G	1730	0.0	26.5	2.8	6.5	70.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	50	1157	0.0	27.8	5.1	6.9	82.0	0.061	0.037	0.023	1.38	1.37	0.62	0.90	0.23	0.18	0.16	5.42	.	9.5	.	.
7	29	91	50	1425	0.0	28.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	29	91	50	1610	.	28.1	4.4	6.8	72.0	0.066	0.013	0.008	1.24	1.09	0.47	1.89	0.23	0.50	0.18	3.73	.	15.0	.	.
7	29	91	50	2012	0.0	26.6	2.9	6.6	72.0	0.031	0.007	-0.005	1.10	0.98	0.50	0.60	0.11	0.29	0.29	2.50	.	6.6	.	.
7	29	91	60	2045	0.0	26.7	5.0	6.7	73.0	0.039	0.013	0.007	1.23	1.06	0.53	0.62	0.08	0.28	0.23	2.90	.	6.4	.	.
7	30	91	10	0	0.0	27.2	4.2	6.7	72.0	0.033	0.008	-0.005	0.88	0.08	0.35	0.55	0.25	0.26	0.26	2.92	.	3.8	.	.
7	30	91	10	800	0.0	27.1	4.8	6.8	74.0	0.039	0.021	0.017	1.24	0.86	0.30	0.68	0.32	0.30	0.30	3.39	.	4.4	.	.
7	30	91	10	1015	0.1	27.6	5.5	6.7	74.0	0.030	0.008	-0.005	0.94	0.75	0.34	0.54	0.26	0.27	0.27	2.93	.	.	.	.
7	30	91	10	1155	.	29.2	5.3	6.6	74.0	0.035	0.009	-0.005	0.94	0.74	0.34	0.56	0.21	0.28	0.28	2.66	.	.	.	.
7	30	91	10	1210	.	26.7	2.9	6.3	72.0	0.031	0.010	0.005	0.91	0.88	0.39	0.53	0.23	0.43	0.43	2.32	.	.	.	.
7	30	91	10	1225	.	27.1	3.1	6.3	73.0	0.027	0.009	-0.005	0.97	0.88	0.48	0.40	0.07	0.26	0.26	2.70	.	.	.	.
7	30	91	10	1240	.	27.2	3.1	6.3	73.0	0.027	0.009	-0.005	0.98	0.94	0.53	0.38	0.06	0.22	0.21	2.93	.	.	.	.
7	30	91	10	1255	.	27.3	2.9	6.4	73.0	0.026	0.009	-0.005	0.98	0.88	0.53	0.34	0.07	0.21	0.20	3.03	.	.	.	.
7	30	91	10	1325	.	27.2	2.8	6.4	73.0	0.026	0.010	-0.005	0.98	0.88	0.50	0.34	0.05	0.23	0.22	2.79	.	.	.	.
7	30	91	10	1400	.	27.5	2.9	6.2	73.0	0.025	0.009	-0.005	0.97	0.88	0.53	0.32	0.05	0.22	0.22	2.86	.	.	.	.
7	30	91	10	1425	0.0	26.6	2.4	6.9	73.0	0.031	0.013	0.006	1.03	0.91	0.39	0.54	0.29	0.37	0.37	4.80	.	5.5	.	.
7	30	91	10	1430	.	28.1	4.2	6.5	74.0	0.031	0.013	0.006	1.81	1.63	0.55	0.35	0.06	0.22	0.22	4.80	.	.	.	.
7	30	91	10	1435	1.0	26.6	2.3	6.7	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1435	2.0	26.6	2.4	6.7	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1435	3.0	26.6	2.4	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1500	.	27.9	4.1	6.5	74.0	0.031	0.011	-0.005	1.93	1.57	0.50	0.58	0.05	0.26	0.22	5.45	.	.	.	.
7	30	91	10	1530	.	27.5	4.3	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1600	.	27.4	3.0	6.1	73.0	0.025	0.009	-0.005	0.92	0.88	0.51	0.37	0.08	0.25	0.23	2.42	.	.	.	.
7	30	91	10	1630	.	27.2	2.9	6.1	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1700	.	27.1	3.0	6.0	73.0	0.027	0.008	-0.005	1.05	0.98	0.49	0.38	0.09	0.24	0.23	2.39	.	.	.	.
7	30	91	10	1730	.	27.0	3.0	5.8	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	10	1800	.	27.0	3.0	5.7	73.0	0.025	0.009	-0.005	0.97	0.90	0.50	0.39	0.10	0.22	0.22	2.52	.	.	.	.
7	30	91	10	1850	.	27.1	3.3	6.3	73.0	0.028	0.007	-0.005	0.99	0.99	0.51	0.38	0.08	0.20	0.19	2.72	.	4.8	.	.
7	30	91	20	20	0.0	25.4	5.8	6.7	65.0	0.029	0.007	-0.005	0.95	0.08	0.22	1.94	0.36	0.25	0.17	3.87	.	18.0	.	.
7	30	91	20	815	0.0	25.4	5.7	6.9	64.0	0.036	0.015	-0.005	0.85	0.85	0.29	1.47	0.41	0.23	0.20	4.60	.	17.0	.	.
7	30	91	20	1155	.	27.2	5.8	6.9	66.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1210	.	27.3	5.7	7.0	66.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1225	.	27.2	5.8	6.8	65.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1240	.	27.3	5.4	6.6	65.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1255	.	28.0	4.8	6.7	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1310	.	27.3	4.1	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1325	.	26.8	3.4	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1425	.	27.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1506	0.0	26.6	2.6	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1506	1.0	26.6	2.6	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	30	91	20	1506	2.0	26.6	2.6	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1506	3.0	26.6	2.6	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1520	.	27.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	2NDINTAK	1540	0.0	26.8	2.8	6.6	72.0	0.031	0.009	-0.005	0.95	0.84	0.46	0.43	0.09	0.31	0.31	.	.	5.0	.	.
7	30	91	2NDINTAK	1540	1.0	26.9	2.9	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	20	1905	.	26.8	3.7	6.4	73.0	0.029	0.007	-0.005	1.01	1.05	0.47	0.55	0.13	0.27	0.27	3.31	.	5.7	.	.
7	30	91	2NDINTAK	1540	2.0	26.9	2.8	6.8	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	30	0.0	27.2	4.2	6.7	72.0	0.025	0.008	-0.005	0.88	0.08	0.35	0.95	0.33	0.24	0.22	2.40	.	3.8	.	.
7	30	91	30	825	0.0	25.5	4.7	6.9	68.0	0.027	0.027	-0.005	1.01	0.89	0.43	1.00	0.40	0.24	0.20	3.15	.	11.0	.	.
7	30	91	30	1210	.	28.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1230	.	28.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1240	.	29.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1250	.	28.7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1300	.	28.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1315	.	27.9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1330	.	27.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1345	.	27.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1400	.	27.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	30	1915	.	26.8	3.6	6.4	74.0	0.030	0.007	-0.005	1.08	0.82	0.43	0.50	0.09	0.29	0.27	2.71	.	5.1	.	.
7	30	91	40	0	0.0	.	3.0	6.8	71.0	0.032	0.010	-0.005	1.14	1.18	0.50	0.52	0.08	0.33	0.32	2.93	.	5.5	.	.
7	30	91	40	0	1.2	26.3	2.8	6.3	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	100	1.0	26.2	2.7	6.3	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	200	0.8	26.2	2.6	6.3	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	300	0.7	26.1	2.6	6.3	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	400	0.6	26.0	2.6	6.3	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	500	0.6	26.0	2.6	6.3	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	600	0.2	26.0	2.6	6.3	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	800	.	25.5	3.3	6.5	73.0	0.021	0.009	-0.005	0.98	0.75	0.50	0.46	0.11	0.30	0.27	2.52	.	4.5	.	.
7	30	91	40	1230	0.4	27.0	3.4	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1245	0.4	26.9	3.4	6.3	72.0	.	.	.	0.85	0.75	0.50	.	.	.	.	.	.	5.8	.	.
7	30	91	40	1245	0.5	26.9	3.4	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1300	0.4	27.0	3.4	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1300	0.5	27.0	3.4	6.2	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1315	0.6	27.0	3.4	6.2	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1315	0.7	27.0	3.4	6.2	72.0	0.030	0.012	-0.005	0.90	0.76	0.50	0.72	0.14	0.29	0.23	2.63	.	6.9	.	.
7	30	91	40	1330	0.9	26.8	3.5	6.2	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1345	1.2	27.0	3.7	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1350	1.3	27.0	3.8	6.3	72.0	0.043	0.013	-0.005	0.95	0.73	0.55	1.40	0.19	0.30	0.19	3.09	.	12.5	.	.
7	30	91	40	1400	1.4	27.0	4.0	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1400	1.5	27.0	4.1	6.3	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1415	1.6	27.2	4.4	6.3	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1430	1.7	27.6	4.8	6.4	71.0	0.053	0.019	-0.005	0.86	0.76	0.46	1.94	0.31	0.39	0.16	3.09	.	14.5	.	.
7	30	91	40	1445	1.8	27.9	4.9	6.4	71.0	0.029	0.017	-0.005	.	.	.	0.51	0.15	0.27	0.24	2.77	.	.	.	.
7	30	91	40	1500	1.9	27.7	4.4	6.3	72.0	0.056	0.009	-0.005	0.90	0.76	0.22	1.89	0.22	0.53	0.26	3.24	.	14.0	.	.
7	30	91	40	1515	2.0	27.4	3.9	6.3	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1530	2.0	27.2	3.6	6.3	73.0	0.047	0.008	-0.005	1.07	0.76	0.46	1.27	0.14	0.45	0.30	2.82	.	10.0	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	30	91	40	1545	2.0	27.1	3.4	6.3	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1545	2.1	27.1	3.4	6.3	73.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1600	2.1	27.1	3.3	6.2	73.0	0.043	0.007	-0.005	1.01	0.79	0.50	1.19	0.10	0.39	0.29	2.58	.	7.6	.	.
7	30	91	40	1615	2.1	27.0	3.2	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1630	2.1	27.0	3.1	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1645	2.2	27.0	3.0	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1700	.	.	.	.	.	0.035	0.008	-0.005	0.98	0.83	0.46	0.92	0.09	0.36	0.30	2.80	.	7.2	.	.
7	30	91	40	1715	2.2	26.9	3.0	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1730	2.2	26.9	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1700	2.2	26.9	3.0	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1745	2.2	26.9	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1800	2.2	26.8	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1815	2.2	26.8	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1830	2.2	26.8	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	1855	.	26.7	2.8	6.2	73.0	0.030	0.008	-0.005	1.06	0.84	0.50	0.65	0.06	0.34	0.30	2.69	.	6.7	.	.
7	30	91	40	1900	2.3	26.7	2.8	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	2000	2.3	26.6	2.8	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	2100	2.3	26.5	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	2200	2.1	26.5	2.9	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40	2300	1.6	26.4	2.8	6.2	74.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40.5	1715	0.0	27.1	3.1	6.6	71.0	.	.	.	1.03	0.84	0.46	.	.	.	.	.	.	5.5	.	.
7	30	91	40.5	1715	1.0	27.1	3.1	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40.5	1715	2.0	27.1	2.9	6.5	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	40.5	1715	3.0	27.1	2.9	6.5	71.0	0.033	0.009	-0.005	.	.	.	0.44	0.10	0.28	0.28	.	.	.	.	.
7	30	91	50	15	0.0	26.0	3.0	6.9	72.0	0.034	0.009	-0.005	1.18	1.00	0.48	0.55	0.09	0.30	0.30	2.88	.	6.5	.	.
7	30	91	50	820	.	25.5	3.7	6.5	74.0	0.027	0.010	-0.005	1.02	0.81	0.51	0.45	0.09	0.28	0.26	2.82	.	4.5	.	.
7	30	91	50	1700	0.0	27.2	3.1	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	50	1700	1.0	27.2	3.1	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	50	1700	2.0	27.2	3.1	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	50	1700	3.0	27.2	3.1	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	50	1730	0.0	27.1	3.1	6.6	71.0	.	.	.	0.98	0.89	0.46	0.39	0.09	0.26	0.26	.	.	5.7	.	.
7	30	91	50	1912	.	27.2	3.1	6.6	72.0	0.035	0.009	-0.005	1.38	0.89	0.17	0.57	0.07	0.28	0.26	2.93	.	6.2	.	.
7	30	91	BDBELW85	1630	0.0	27.0	2.9	6.6	71.0	0.031	0.010	-0.005	0.94	0.78	0.48	0.42	0.09	0.31	0.31	.	.	.	.	.
7	30	91	BDBELW85	1630	1.0	27.0	2.8	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	BDBELW85	1630	2.0	27.0	2.8	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	BDBELW85	1630	3.0	27.0	2.8	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	HWY29	1600	0.0	27.0	2.9	6.5	72.0	0.030	0.008	-0.005	0.99	0.81	0.50	0.38	0.08	0.38	0.29	.	.	5.0	.	.
7	30	91	HWY29	1600	1.0	27.0	2.8	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	HWY29	1600	2.0	26.9	2.8	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	I85	1600	0.0	27.0	2.9	6.5	72.0	0.030	0.008	-0.005	0.99	0.81	0.50	0.38	0.08	0.38	0.29	.	.	5.0	.	.
7	30	91	I85	1600	1.0	27.0	2.8	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	I85	1600	2.0	26.9	2.8	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	INTAKE	1540	0.0	26.8	2.8	6.6	72.0	0.031	0.009	-0.005	0.95	0.84	0.46	0.43	0.09	0.31	0.31	.	.	5.0	.	.
7	30	91	INTAKE	1540	1.0	26.9	2.9	6.6	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	INTAKE	1540	2.0	26.9	2.8	6.8	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	RRBRIDGE	1518	0.0	.	.	.	.	0.031	0.010	-0.005	0.99	0.85	0.44	0.47	0.15	0.37	0.37	.	.	5.2	.	.
7	30	91	SMALLDAM	1710	.	27.4	3.3	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

m	d	y	sta	time	dep	tem	do	pH	spc	tp	tsp	srp	tn	dn	no3no2	tfe	dfe	tmn	dmn	toc	doc	turb	tss	alk
7	30	91	SMALLDAM	1710	0.0	27.4	3.3	6.6	71.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	STREM@20	1500	0.0	26.6	2.6	6.5	70.0	0.032	0.009	0.005	0.99	0.84	0.42	0.49	0.13	0.35	0.35	.	.	5.2	.	.
7	30	91	STREM@20	1500	1.0	26.5	2.5	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	STREM@20	1500	2.0	26.5	2.5	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7	30	91	STREM@20	1500	3.0	26.5	2.5	6.5	72.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	25	91	10	1730	0.0	25.0	6.8	6.6	74.0	0.047	0.013	.	0.82	0.65	.	0.21	-0.05	0.05	-0.05	2.74	.	3.0	.	.
9	25	91	20	1750	0.0	24.5	6.0	6.5	73.0	0.037	0.010	.	0.79	0.58	.	0.49	0.07	0.12	0.06	1.69	.	5.9	.	.
9	25	91	30	1800	0.0	24.5	5.9	6.5	73.0	0.033	0.012	.	0.84	0.67	.	0.50	0.07	0.11	0.06	1.50	.	5.4	.	.
9	25	91	40	1815	0.0	24.6	5.9	6.5	73.0	0.031	0.010	.	0.78	0.76	.	0.48	-0.05	0.10	0.05	1.78	.	4.9	.	.
9	25	91	50	1830	0.0	24.4	6.0	6.6	74.0	0.041	0.018	.	0.81	0.63	.	0.44	-0.05	0.10	-0.05	1.84	.	5.2	.	.
9	26	91	10	610	0.0	23.3	6.3	6.8	74.0	0.031	0.014	.	0.91	0.82	.	0.25	-0.05	0.12	0.08	2.68	.	3.4	.	.
9	26	91	10	1430	0.0	24.8	6.2	6.7	72.0	0.021	0.014	.	0.73	0.58	.	.	.	.	.	1.70	.	3.4	.	.
9	26	91	10	1910	0.0	24.3	7.5	6.8	74.0	0.022	0.005	.	0.66	0.51	.	0.65	-0.05	0.05	-0.05	1.54	.	.	.	.
9	26	91	20	620	0.0	20.1	6.9	6.8	68.0	0.050	0.024	.	0.65	0.57	.	1.88	0.23	0.30	0.13	3.22	.	19.5	.	.
9	26	91	20	1510	0.0	24.8	6.3	6.8	73.0	0.022	0.016	.	0.72	0.61	.	.	.	.	.	1.50	.	3.4	.	.
9	26	91	20	1900	0.0	24.1	7.0	6.7	72.0	0.024	0.007	.	0.70	0.57	.	0.41	-0.05	0.10	-0.05	1.46	.	.	.	.
9	26	91	30	635	0.0	21.0	6.3	6.8	70.0	0.035	0.017	.	0.73	0.61	.	1.18	0.26	0.16	0.10	2.37	.	13.0	.	.
9	26	91	30	1540	0.0	24.8	6.2	6.7	72.0	0.022	0.018	.	0.77	0.64	.	.	.	.	.	1.50	.	3.6	.	.
9	26	91	30	1845	0.0	24.3	6.8	6.7	73.0	0.024	0.007	.	0.76	0.63	.	0.47	0.06	0.10	-0.05	1.33	.	.	.	.
9	26	91	40	700	0.0	22.2	6.0	6.7	74.0	0.035	0.007	.	0.84	0.68	.	0.74	0.12	0.12	-0.05	1.67	.	11.0	.	.
9	26	91	40	1700	0.0	24.8	6.7	6.8	73.0	0.024	0.007	.	0.79	0.66	.	.	.	.	.	1.70	.	3.9	.	.
9	26	91	40	1825	0.0	24.6	6.8	6.7	74.0	0.029	0.005	.	0.94	0.74	.	0.46	0.06	0.11	-0.05	2.51	.	.	.	.
9	26	91	50	730	0.0	22.4	5.7	6.7	79.0	0.043	0.010	.	0.86	0.64	.	0.71	-0.05	0.08	-0.05	1.65	.	12.0	.	.
9	26	91	50	1800	0.0	24.9	6.7	6.7	73.0	0.025	0.008	.	0.82	0.69	.	.	.	.	.	1.50	.	4.0	.	.
9	26	91	185	1630	0.0	24.8	6.8	6.7	72.0	0.021	0.011	.	0.71	0.63	.	0.33	-0.05	0.13	0.09	1.30	.	3.6	.	.
9	26	91	INTAKE	1600	0.0	24.8	6.8	6.8	73.0	0.022	0.011	.	0.70	0.60	.	0.29	-0.05	0.14	0.10	2.10	.	3.3	.	.
9	26	91	RRBRIDGE	1530	0.0	24.9	6.1	6.8	72.0	0.024	0.012	.	0.88	0.73	.	0.30	-0.05	0.15	0.11	1.50	.	3.5	.	.
9	27	91	10	730	0.0	22.6	7.2	6.7	73.0	0.027	-0.005	.	0.77	0.63	.	0.38	-0.05	0.09	-0.05	2.16	.	.	.	.
9	27	91	10	1800	0.0	.	.	.	.	0.031	0.013	.	1.24	1.04	.	0.29	-0.05	0.06	-0.05	3.49	.	.	.	.
9	27	91	20	720	0.0	20.8	7.2	6.7	69.0	0.024	0.005	.	0.82	0.55	.	0.77	0.20	0.10	-0.05	1.99	.	.	.	.
9	27	91	20	1825	0.0	.	.	.	.	0.027	0.005	.	0.84	0.60	.	0.33	-0.05	0.09	-0.05	2.09	.	.	.	.
9	27	91	30	710	0.0	20.8	6.9	6.7	70.0	0.023	0.008	.	0.70	0.55	.	0.67	0.26	0.07	-0.05	1.51	.	.	.	.
9	27	91	30	1840	0.0	.	.	.	.	0.025	0.005	.	0.79	0.57	.	0.53	-0.05	0.08	-0.05	1.34	.	.	.	.
9	27	91	40	630	0.0	21.7	6.6	6.9	72.0	0.043	0.014	.	0.87	0.84	.	0.93	0.07	0.23	-0.05	1.95	.	.	.	.
9	27	91	40	1855	0.0	.	.	.	.	0.028	0.006	.	0.73	0.62	.	0.42	-0.05	0.08	-0.05	2.30	.	.	.	.
9	27	91	50	615	0.0	21.6	6.8	7.0	76.0	0.038	0.009	.	0.89	0.61	.	0.61	-0.05	0.08	-0.05	2.42	.	.	.	.
9	27	91	50	1910	0.0	.	.	.	.	0.027	0.005	.	0.75	0.61	.	0.46	-0.05	0.08	-0.05	1.57	.	.	.	.

Appendix G

Supplemental Water Quality Data for West Point Lake for 1992

Variable	Description
m	Sample Month
d	Sample Day
y	Sample Year
sta	Station Identification Code
time	Sample Time
secchi	Secchi Disk Transparency, m
depth	Sample Depth, m
temp	Water Temperature, °C
pH	pH
do	Dissolved Oxygen, mg/L
spc	Specific Conductivity, μmhos

m	d	y	sta	time	secchi	depth	temp	pH	do	spc
5	13	92	56YC	.	.	0.0	22.2	8.7	11.2	97.0
5	13	92	56YC	.	.	1.0	22.2	9.0	11.2	97.0
5	13	92	56YC	.	.	2.0	22.1	9.1	11.2	97.0
5	13	92	56YC	.	.	3.0	21.7	9.1	10.8	96.0
5	13	92	56YC	.	.	4.0	20.5	8.6	8.7	96.0
5	13	92	56YC	.	.	5.0	19.5	8.1	6.6	96.0
5	13	92	56YC	.	.	6.0	18.2	7.7	6.1	100.0
5	13	92	56YC	.	.	7.0	18.0	7.6	6.2	96.0
5	13	92	YC13	.	1.7	0.0	22.8	8.9	10.3	75.0
5	13	92	YC13	.	1.7	2.0	22.3	9.0	10.6	77.0
5	13	92	YC13	.	1.7	3.0	21.8	8.8	10.4	77.0
5	13	92	YC13	.	1.7	4.0	19.4	8.3	6.7	71.0
5	13	92	YC13	.	1.7	6.0	18.9	7.7	5.3	70.0
5	13	92	YC13	.	1.7	8.0	18.5	7.7	3.5	72.0
5	13	92	YC13	.	1.7	10.0	17.2	7.3	1.0	78.0
5	13	92	YC21	.	1.5	0.0	22.9	8.2	9.4	71.0
5	13	92	YC21	.	1.5	1.0	22.9	8.2	9.3	71.0
5	13	92	YC21	.	1.5	2.0	22.8	8.2	9.2	71.0
5	13	92	YC21	.	1.5	3.0	20.4	7.9	8.3	71.0
5	13	92	YC21	.	1.5	4.0	19.4	7.7	7.1	69.0
5	13	92	YC21	.	1.5	5.0	19.2	7.5	6.5	68.0
5	13	92	YC21	.	1.5	6.0	18.7	7.4	5.8	68.0
5	13	92	YC21	.	1.5	7.0	18.6	7.3	5.2	69.0
5	14	92	51	.	.	0.0	24.4	9.1	10.9	98.0
5	14	92	51	.	.	1.0	22.9	9.2	11.4	98.0
5	14	92	51	.	.	2.0	21.6	9.2	11.3	98.0
5	14	92	51	.	.	3.0	21.2	8.9	10.4	96.0
5	14	92	51	.	.	4.0	20.3	8.5	8.2	97.0
5	14	92	51	.	.	5.0	18.9	7.9	6.6	99.0
5	14	92	51	.	.	6.0	18.6	7.8	6.6	98.0
5	14	92	51	.	.	7.0	18.3	7.7	6.2	98.0
5	14	92	51	.	.	8.0	17.9	7.6	6.6	93.0
5	14	92	51	.	.	9.0	17.6	7.6	6.6	90.0
5	14	92	51	.	.	10.0	17.2	7.5	6.7	87.0
5	14	92	51	.	.	11.0	16.9	7.4	6.8	86.0
5	14	92	51	.	.	12.0	16.8	7.4	6.8	85.0
5	14	92	51	.	.	13.0	16.7	7.3	6.8	85.0
5	14	92	51	.	.	14.0	16.6	7.3	6.8	84.0
5	14	92	51	.	.	15.0	16.4	7.2	6.7	83.0
5	14	92	51	.	.	16.0	16.4	7.2	6.6	83.0
5	14	92	71	.	.	0.0	24.9	9.2	12.3	97.0
5	14	92	71	.	.	1.0	23.7	9.4	12.1	96.0
5	14	92	71	.	.	2.0	21.4	9.0	11.2	87.0
5	14	92	71	.	.	3.0	20.6	8.4	9.8	85.0
5	14	92	71	.	.	4.0	19.6	8.1	8.5	85.0
5	14	92	71	.	.	5.0	18.5	7.8	7.3	84.0
5	14	92	71	.	.	6.0	17.9	7.7	6.9	84.0
5	14	92	71	.	.	7.0	17.5	7.6	6.7	84.0
5	14	92	71	.	.	8.0	17.2	7.5	6.7	84.0
5	14	92	71	.	.	9.0	17.1	7.5	6.6	84.0
5	14	92	71	.	.	10.0	16.9	7.4	6.6	83.0
5	14	92	71	.	.	11.0	16.7	7.4	6.7	84.0
5	14	92	71	.	.	12.0	16.5	7.4	6.2	85.0
5	14	92	86	.	.	0.0	24.8	9.1	11.7	86.0

m	d	y	sta	time	secchi	depth	temp	pH	do	spc
5	14	92	86	.	.	1.0	23.3	8.9	11.1	85.0
5	14	92	86	.	.	2.0	21.9	8.8	10.1	83.0
5	14	92	86	.	.	3.0	20.4	8.1	7.5	85.0
5	14	92	86	.	.	4.0	19.5	7.8	6.9	83.0
5	14	92	86	.	.	5.0	19.0	7.6	6.5	84.0
5	14	92	86	.	.	6.0	18.3	7.5	5.9	84.0
5	14	92	86	.	.	7.0	18.2	7.5	5.6	84.0
5	14	92	86	.	.	8.0	17.8	7.4	5.9	84.0
5	14	92	86	.	.	9.0	17.6	7.3	5.9	85.0
5	14	92	86	.	.	10.0	17.1	7.3	5.5	86.0

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13. ABSTRACT *(Maximum 200 words)*

West Point Lake is a large hydropower reservoir constructed and operated by the U.S. Army Corps of Engineers on the Chattahoochee River in west-central Georgia. Water quality and mixing characteristics are markedly impacted by water and material loads from the river and by within-lake processes. In general, the lake is nutrient-rich and highly productive, and exhibits pronounced patterns in the distribution of chlorophyll and turbidity.

Data derived from LANDSAT images and limnological surveys, as well as data resulting from intensive sampling in selected areas, were used to describe and assess observed patterns in the distribution of water quality variables. Cluster analyses identified four distinct lake regions characterized as lake-like with moderate to low nutrients and productivity (cluster 1), turbid nutrient-rich and advective (cluster 4), and intermediate to high in nutrient concentration and turbidity level. The latter regions are potentially sensitive to changes in nutrient input (cluster 2) or turbidity level (cluster 3).

Conditions in the tailwater below West Point Dam were influenced by (a) hydrograph changes resulting from hydropower operation, (b) local impacts from inflowing tributaries, and (c) "loss reactions," including oxidation, adsorption, and sedimentation.

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Invertebrates	Reservoir	Water quality
LANDSAT	Sediment	

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