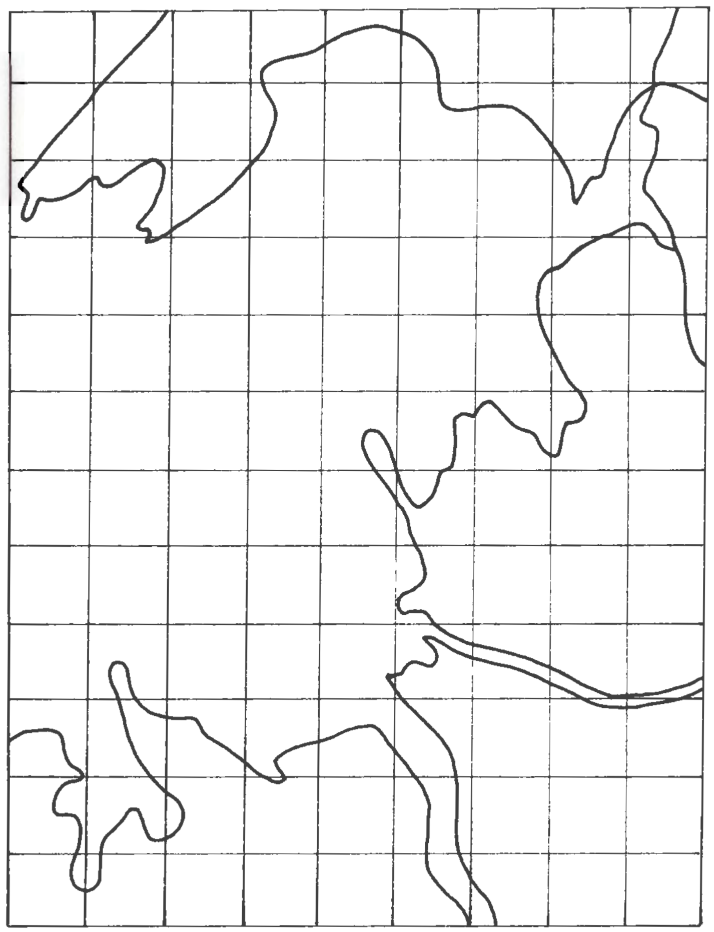
LAKE CHAMPLAIN FISH HATCHERY DISCHARGE STUDY



STATE OF VERMONT

DEPARTMENT OF WATER RESOURCES
AND ENVIRONMENTAL ENGINEERING

WATER QUALITY DIVISION

MONTPELIER, VERMONT

PREPARED FOR

VERMONT DEPARTMENT OF STATE BUILDINGS

APRIL, 1985

LAKE CHAMPLAIN FISH HATCHERY
DISCHARGE STUDY

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April 1985

Lake and Reservoir Modeling Series
Report No. 7

Vermont Department of Water Resources and
Environmental Engineering
Water Quality Division
Montpelier, Vermont 05602

MS-40-0185-3

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ACKNOWLEDGEMENTS

A number of individuals made substantial contributions to this study. Mark Webster assisted with all aspects of the field work. Tom Shields performed the daily dye release procedure. The phosphorus samples were analyzed by John Townsend and other staff of the Department of Water Resources and Environmental Engineering Laboratory, under the direction of Gerald DiVincenzo. William Walker provided advice on the study design and data analysis. Brenda Clarkson adapted programs written by William Walker for use on the Department's computer. A draft of the report was reviewed by Virginia Garrison, Wallace McLean, David Clough, and William Walker, who provided useful comments. Most of the figures were drawn by Roderick Pratt and Gary Durkee. Alison Begin typed the report.

INTRODUCTION

This study was undertaken to assist in the planning and design of wastewater treatment facilities for the proposed Lake Champlain Fish Hatchery, to be operated by the State of Vermont at Kingsland Bay, Lake Champlain. Schematic design information for the hatchery is provided in Sargent, Webster, Crenshaw, and Folley (1984). The hatchery will draw a maximum of 11.5 mgd from the lake, and circulate the water through a number of tanks and raceways where the fish will be reared. The water will then be returned to the lake, with the discharge stream passing over a fish ladder located on the shore of Hawkins Bay (see Figure 1.)

Preliminary review of the hatchery discharge plans by the Water Quality Division (Garrison, 1984) indicated that of all the constituents in the hatchery discharge, phosphorus was the one of chief concern for water quality in Lake Champlain. Preliminary water quality modeling work (Smeltzer, 1984) indicated that the possibility existed for the hatchery discharge to cause a eutrophication problem in the lake, depending on the phosphorus concentration in the discharge and the turbulent diffusion characteristics of the lake. The present study was therefore initiated to better quantify the diffusion and phosphorus transport characteristics of the nearby region of the lake and, ultimately, to provide the basis for a decision on the effluent phosphorus limit to be incorporated into a discharge permit for the hatchery.

The general scope of the study was as follows. Phosphorus transport was studied by two methods, the first involving the daily injection of a fluorescent dye into the lake at the site of the proposed discharge. The distribution of dye in the lake was monitored by boat at intervals throughout the four month, June-September, 1984 injection period. The long-term, daily dye release was chosen over the more commonly used short-term "single slug" release procedure so that the dye distribution pattern in the lake would reflect the full range of wind and current conditions existing in the lake during the summer. The second method was a "natural tracer" approach, monitoring the phosphorus discharge from Lewis and Little Otter Creeks (see Figure 1) and the resulting phosphorus distribution in the lake. The study was limited to the summer season because this was the period of critical concern for potential phosphorus pollution and nuisance algal growth.

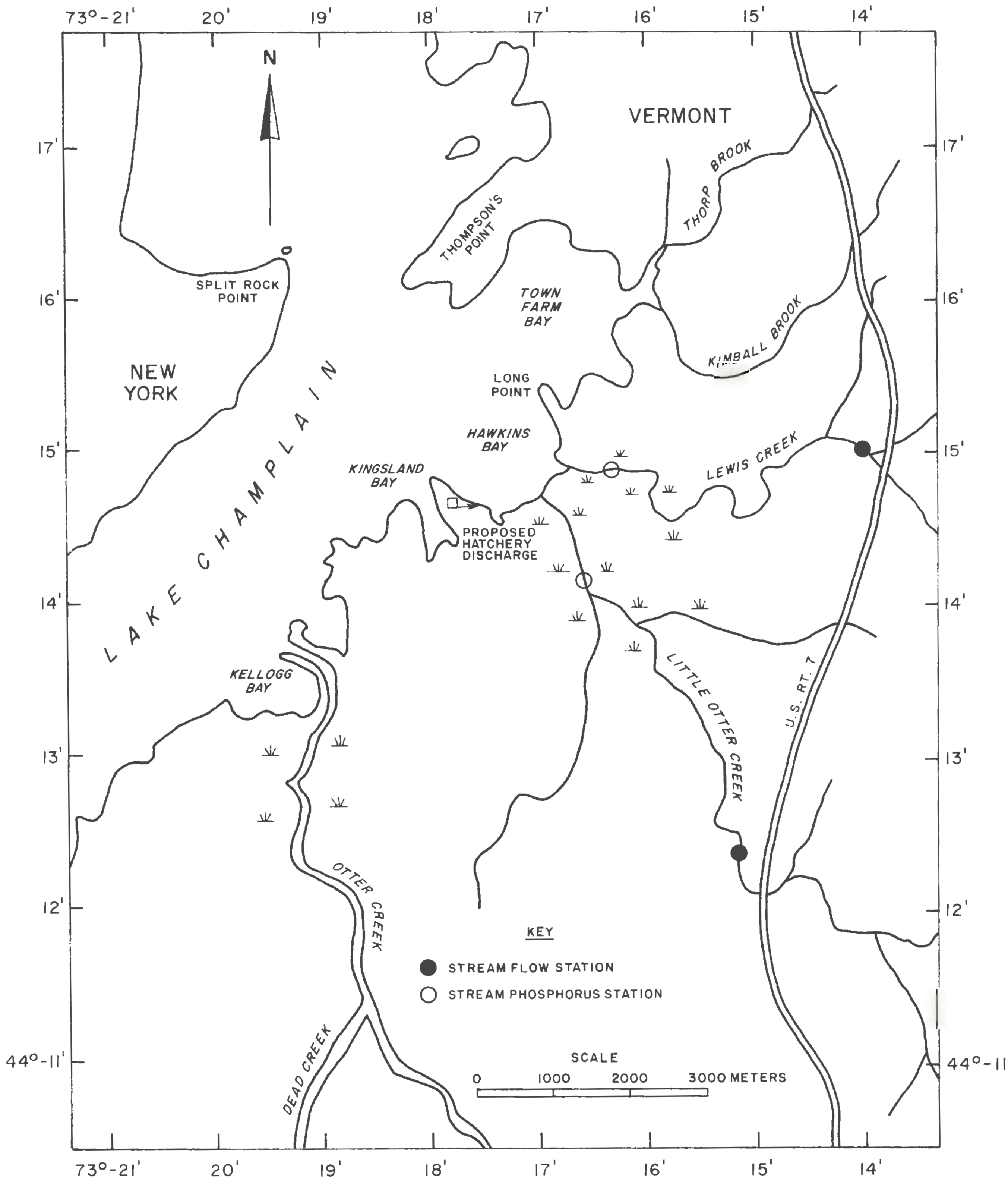


Figure 1. Map of study area.

After completion of the field work, the data was analyzed using a two-dimensional lake diffusion model. The model was calibrated to the observed dye and phosphorus concentration patterns, and then used to simulate the local effects of various phosphorus loading rates from the proposed hatchery discharge.

It should be noted that this study focused on the local impact of the hatchery discharge on the nearby region of Lake Champlain. It is important to recognize, however, that the hatchery will be one of many point sources of phosphorus to Lake Champlain, all of which have a cumulative impact in causing, to some extent, a general, lakewide increase in eutrophication. Depending on the phosphorus level in the effluent, the hatchery discharge would represent a phosphorus source of similar magnitude to one of the smaller municipal wastewater discharges on the lake. For example, with an annual average effluent phosphorus concentration of 32 ppb at 11.5 mgd, the hatchery would provide a net load of 595 lbs/yr of phosphorus to the lake, compared with loading rates from municipal facilities such as Burlington Main (12,170 lbs/yr), Vergennes (2,010 lbs/yr), Shelburne FD #2 (1,370 lbs/yr), Colchester FD #1 (940 lbs/yr), and Shelburne FD #1 (340 lbs/yr), after phosphorus removal to 1.0 mg/l at these facilities. An analysis of the cumulative lakewide impact of the hatchery discharge was beyond the scope of this study, but the hatchery discharge, as with all new discharges, should also be evaluated in relation to its cumulative impact on Lake Champlain.

METHODS

Dye Release

Rhodamine WT dye in liquid form, supplied by Crompton and Knowles Corp., was manually placed in the lake once per day at the shoreline location of the proposed hatchery discharge. Pre-measured 87 g quantities of dye (363 ml of concentrated solution) were used for the manual release procedure. Thus, over the June-September study period, the procedure provided an approximately continuous, constant dye release rate of 87 g/day.

Dye Sampling and Measurement

Dye concentrations in the lake were measured using a Turner Designs flow-through field fluorometer. Measurements were made in the field by pumping water from the surface of the lake through the flow-through fluorometer cuvette.

The fluorometer was calibrated in the field on each day of dye sampling using the same flow-through apparatus. Large volume (10 liter) standard solutions were prepared using pre-measured concentrated standard solutions diluted with lake water obtained at locations remote from the dye release point. A series of standard solutions were prepared in this manner, covering the entire concentration range to be sampled. Fluorometric units were converted to concentration values based on a linear regression of concentration vs. fluorometer units.

Lake Phosphorus Sampling

Grab samples at the lake surface were obtained and analyzed for total phosphorus according to a method modified from U.S. Environmental Protection Agency (1983).

Chlorophyll Sampling

Chlorophyll-a measurements were made in the field on surface samples by the *in vivo* fluorescence technique using the same flow-through fluorometry apparatus used for dye sampling, fitted with appropriate filters. The *in vivo* fluorescence values were converted to concentration units by obtaining a number of concurrent calibration samples on each day of chlorophyll sampling. The calibration samples were filtered in the field using Whatman (GF/A) glass fiber filters, and the filters were returned to the laboratory for analysis by the extractive fluorometric technique (American Public Health Association, 1981). Calibration was achieved by means of a linear regression of concentration (determined by the extractive method) vs. *in vivo* fluorescence value.

Position Determination

Position on the lake was determined using a Loran C receiver (Si-Tex/Koden Model 767C), programmed to provide coordinates in units of longitude and latitude to a precision of 0.01 minutes. The calibration of the receiver was periodically checked in the field at known locations.

Stream Flow and Phosphorus Sampling

Lewis Creek and Little Otter Creek were sampled for total and dissolved phosphorus at locations indicated in Figure 1. These locations were chosen to be as close to the creek mouths as possible, but far enough upstream to avoid the dilution effect of mixing with the lake. Sampling along the phosphorus gradient upstream from the lake was periodically conducted to verify that the sample locations were, in fact, upstream of the mixing zone, and truly represented the stream phosphorus concentrations.

Dissolved phosphorus in the stream samples was analyzed by the same technique as for total phosphorus, after the samples were filtered in the field using Whatman (GF/A) glass fiber filters.

Flow measurements were also made in Lewis and Little Otter Creeks at locations shown in Figure 1. Instantaneous flow rates were determined from measurements of stream cross-sectional depth and current velocity, using a top-setting (to 6/10 of the stream depth) wading rod with a Marsh-McBirney Model 201 current meter. The drainage areas at the point of measurement were determined by planimetry of topographic maps, and the flow rates were multiplied by the ratio of total stream drainage area to gaged area, in order to estimate the flow rates at the stream mouths. These ratios were 1.04 in the case of Lewis Creek, and 1.26 in the case of Little Otter Creek.

Vertical Stratification of Temperature and Phosphorus

Extensive water quality monitoring of Lake Champlain was conducted during 1983 and 1984 to assist in the design of the hatchery. This data included depth sampling for temperature and total phosphorus, the results of which are discussed in this report. The data was collected at two stations off Kingsland Bay. The temperature profiles were obtained using a bathythermograph dropped over the 0-30 m depth range. The total phosphorus samples were obtained at discrete depth intervals using a Kemmerer sampler.

Lake Depth and Water Level

For the purpose of preparing a bathymetric map of the Kingsland and Hawkins Bay areas, depth soundings were conducted on July 3, 1984 using a weighted line. Position was determined using Loran C.

Data Analysis and Modeling

Data analysis and modeling were done with the aid of two computer programs written by Dr. William Walker. The data analysis program (P2D) is documented in Walker (1984a). This program was used to reduce and display the dye and phosphorus lake concentration data in a two-dimensional spatial grid. The grid used in this study is shown in Figure 2. The 16 x 16 cell grid included 137 square lake cells, each 400 m in length.

The P2D program provided a data smoothing and interpolation procedure to estimate concentrations in each cell. A weighted average concentration was calculated for each cell, based on all concentration measurements within a specified minimum distance from the center of the cell, with the weighting factor being a power function of the inverse of distance from the cell center.

Modeling and simulation were done using the S2D program, documented in Walker (1984b). The S2D program models the horizontal transport through time of materials originating from specified discharge points. Concentrations were calculated for each cell at various time intervals, using the same cell grid as for the P2D program. Complete vertical mixing to a specified depth in each cell was assumed.

The S2D program solves a system of mass balance equations simultaneously for each cell in the grid over a sequence of finite time steps. The general format for the mass balance equation for an individual cell is given in equation 1.

$$V_i \, dc_i/dt = \sum_k \{-Q_{ik}(c_i - c_k) + E_{ik}\,(c_k - c_i)\} - V_i K c_i + W_i \qquad (1)$$

where:

V_i = volume of cell i.

c_i = concentration in cell i.

c_k = concentration in an adjacent cell k.

t = time

Q_{ik} = advective flow between cells i and k.

E_{ik} = bulk diffusion (exchange flow) between cells i and k.

K = first-order decay rate.

W_i = loading rate of mass directly to cell i.

The program provides for the specification of shoreline boundary cells into which no transport of materials takes place, and also for the specification of far-field cells in which concentration remains constant. Advective pathways must also be delineated.

The data requirements for the S2D program are indicated by equation 1. The depth of each cell must be estimated in order to calculate the cell volumes. Loading rates of phosphorus or dye at each discharge point must be quantified, and the decay rate estimated. Flow rates associated with any advection paths must also be determined. The diffusion rate is the most difficult term in the equation to evaluate directly. However, if concentration estimates are made for each cell, with the assistance of the P2D program, then the diffusion rate can be evaluated by a model calibration procedure, as discussed later in this report.

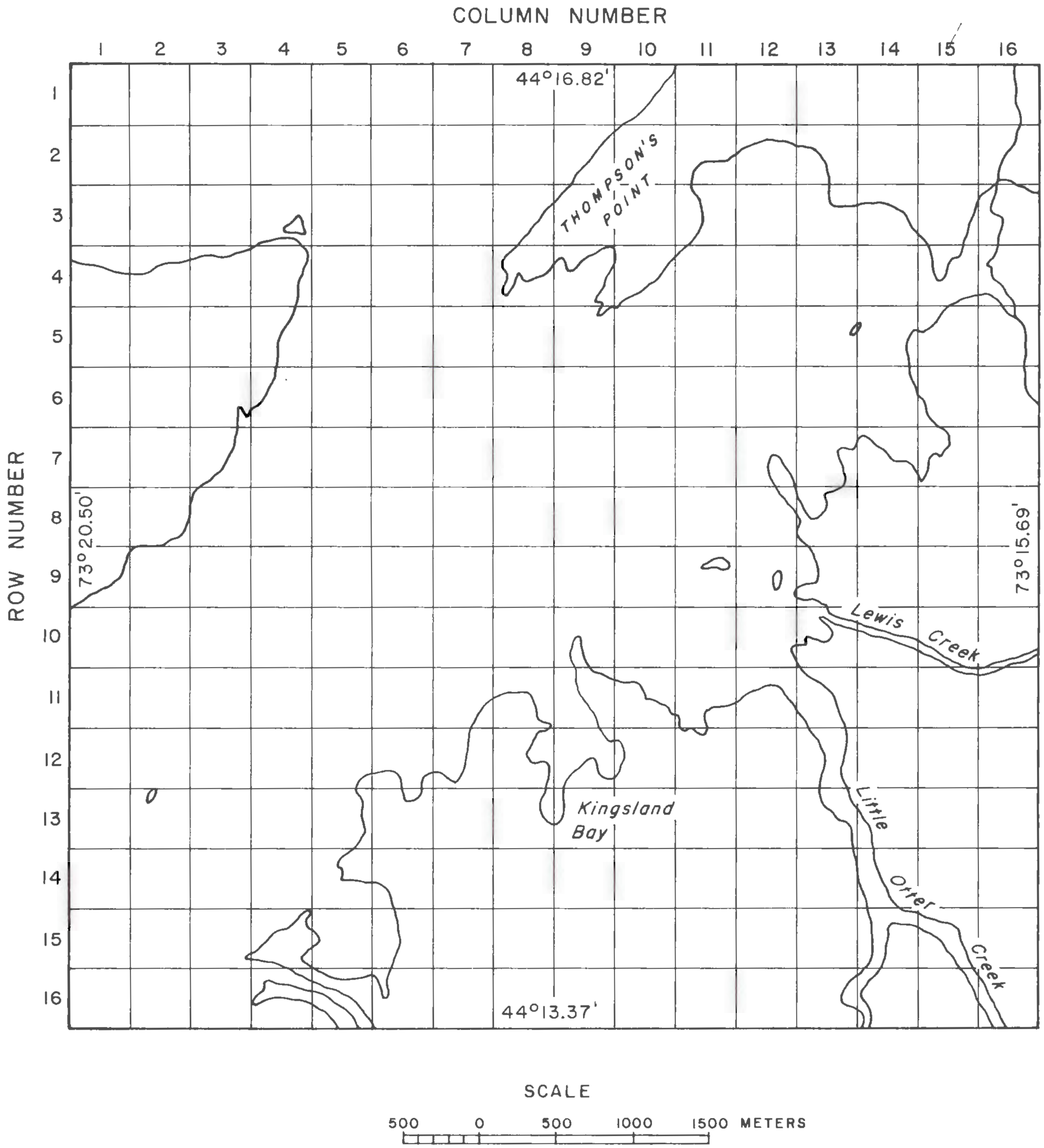


Figure 2. Cell grid used for modeling.

SAMPLING RESULTS AND EVALUATION OF MODEL TERMS

Dye Results

The distribution of dye in the lake was sampled on 11 dates during the June-September, 1984 study period. The number of sample locations varied from date to date, but in all cases a sufficient number of samples was taken to insure complete coverage of the entire area where dye was present at detectable levels. All the dye data is tabulated in Appendix A.

Dye concentrations in the lake were generally very low throughout the study. On 5 of the 11 dates sampled, dye concentrations were below the manufacturer's specified fluorometric detection limit of 0.02 ppb throughout the study area. On other dates when dye was apparently detected, the results may have been influenced by a small amount (a few ppb) of background fluorescence contributed by the plumes from Lewis and Little Otter Creeks or from other sources. The 5 dates on which no dye was detected were the following: June 18, June 26, July 10, August 15, and September 6. The dye distribution patterns on the remaining 6 dates are shown in Figures 3-8. Figures 3-8 were developed with the assistance of the P2D data display program. The unusually high concentrations measured on August 29 were the result of the release of 7 times the normal dye quantity on the previous day (necessitated by the anticipated absence of the individual responsible for the manual release during the following 7 days).

Lake Phosphorus Results

The distribution of total phosphorus in the lake was sampled on 10 dates during the June-September, 1984 study period. On each date, samples were taken at 135 or more locations distributed approximately evenly throughout the study area. The exception was September 27, on which 97 samples were distributed across a much larger sample area. All the phosphorus data is tabulated in Appendix B.

The phosphorus distribution patterns on each date are shown in Figures 9-18. Figures 9-18 were developed with the assistance of the P2D data display program. Figures 9-18 show that phosphorus levels in the study area varied over a considerable concentration range, and the spatial distribution differed somewhat from date to date. However, on most dates, certain features in the concentration pattern were apparent. The effect of the Otter Creek discharge

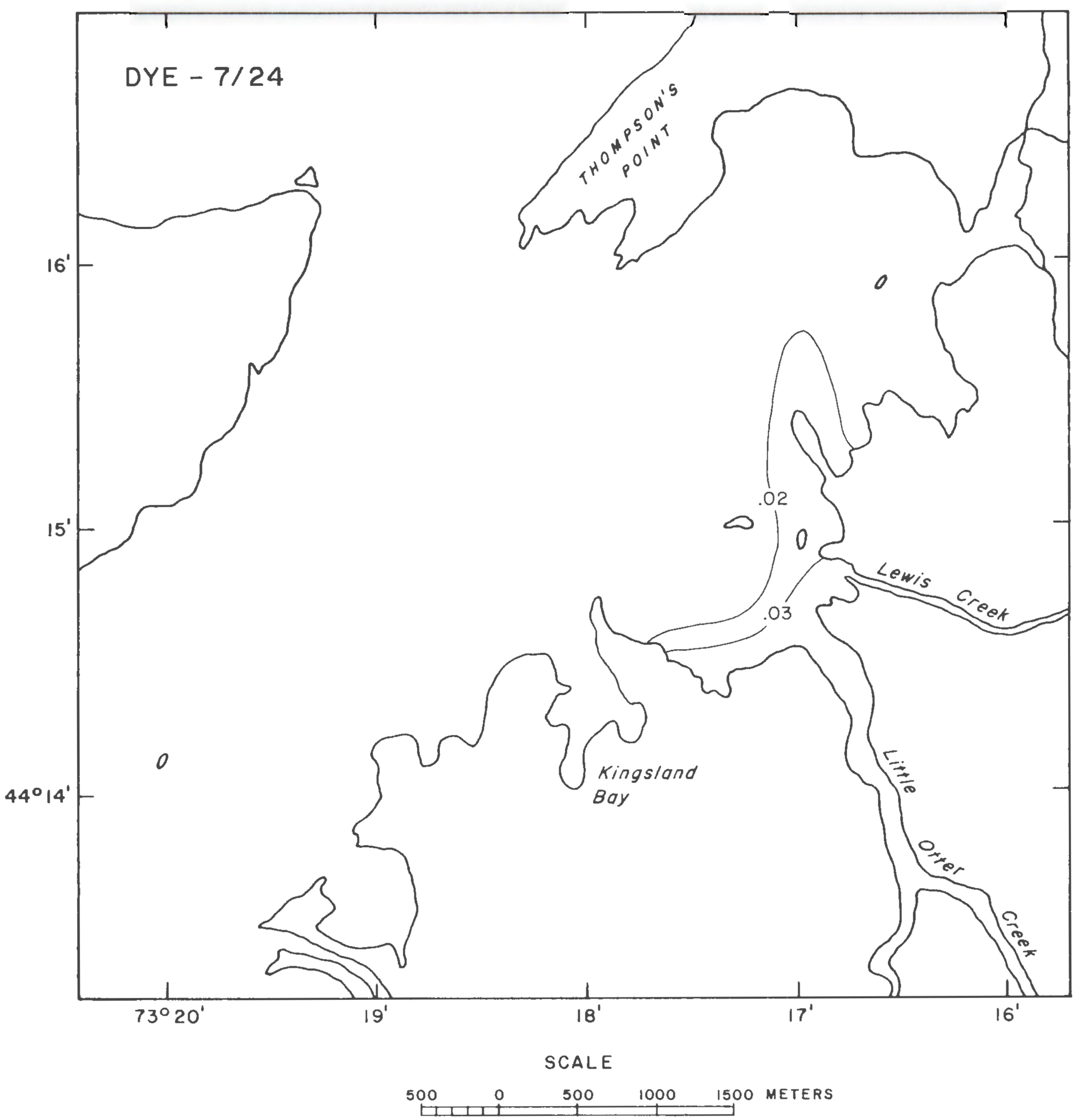


Figure 3. Dye sampling results (ppb) for July 24, 1984.

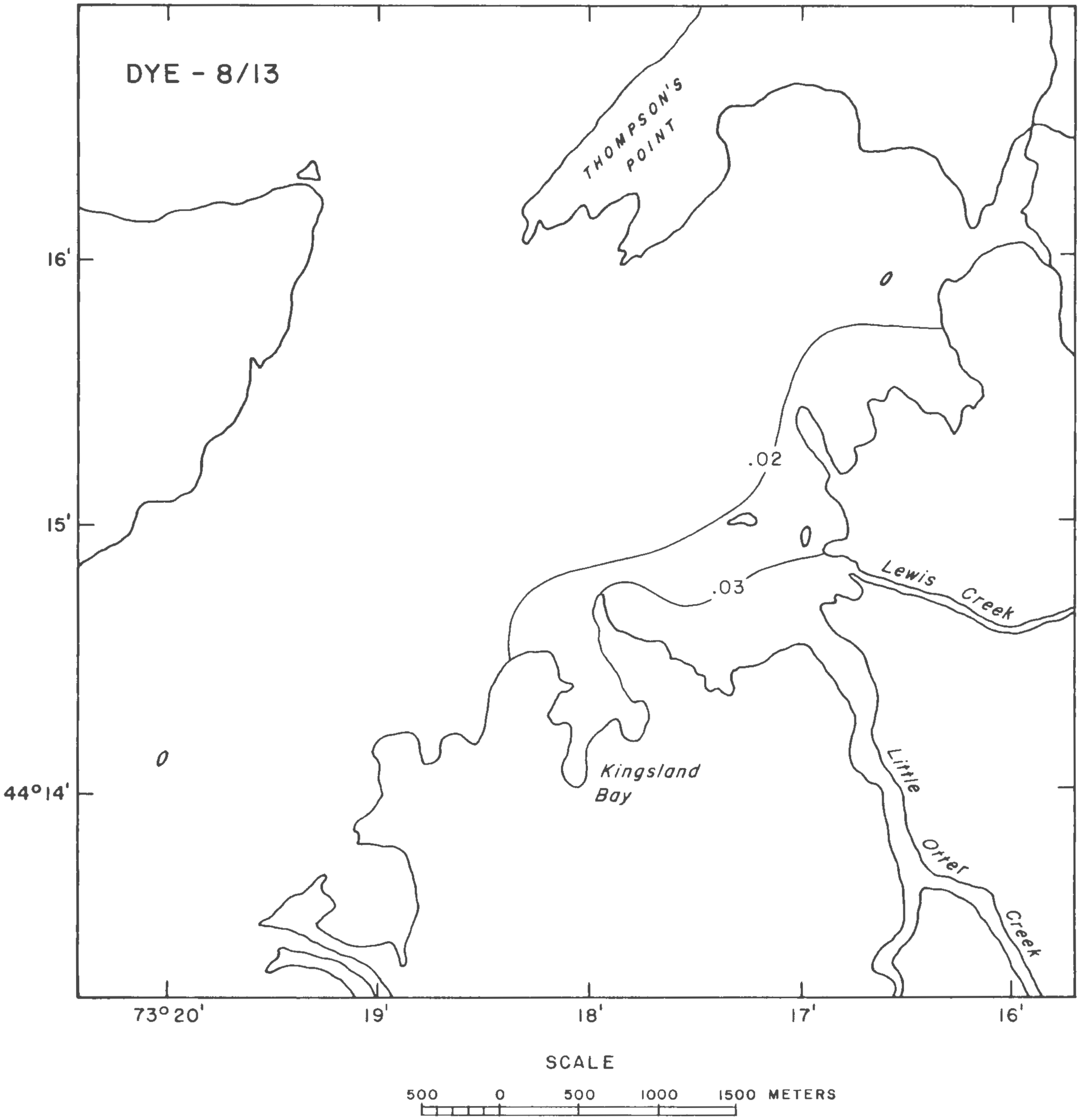


Figure 4. Dye sampling results (ppb) for August 13, 1984.

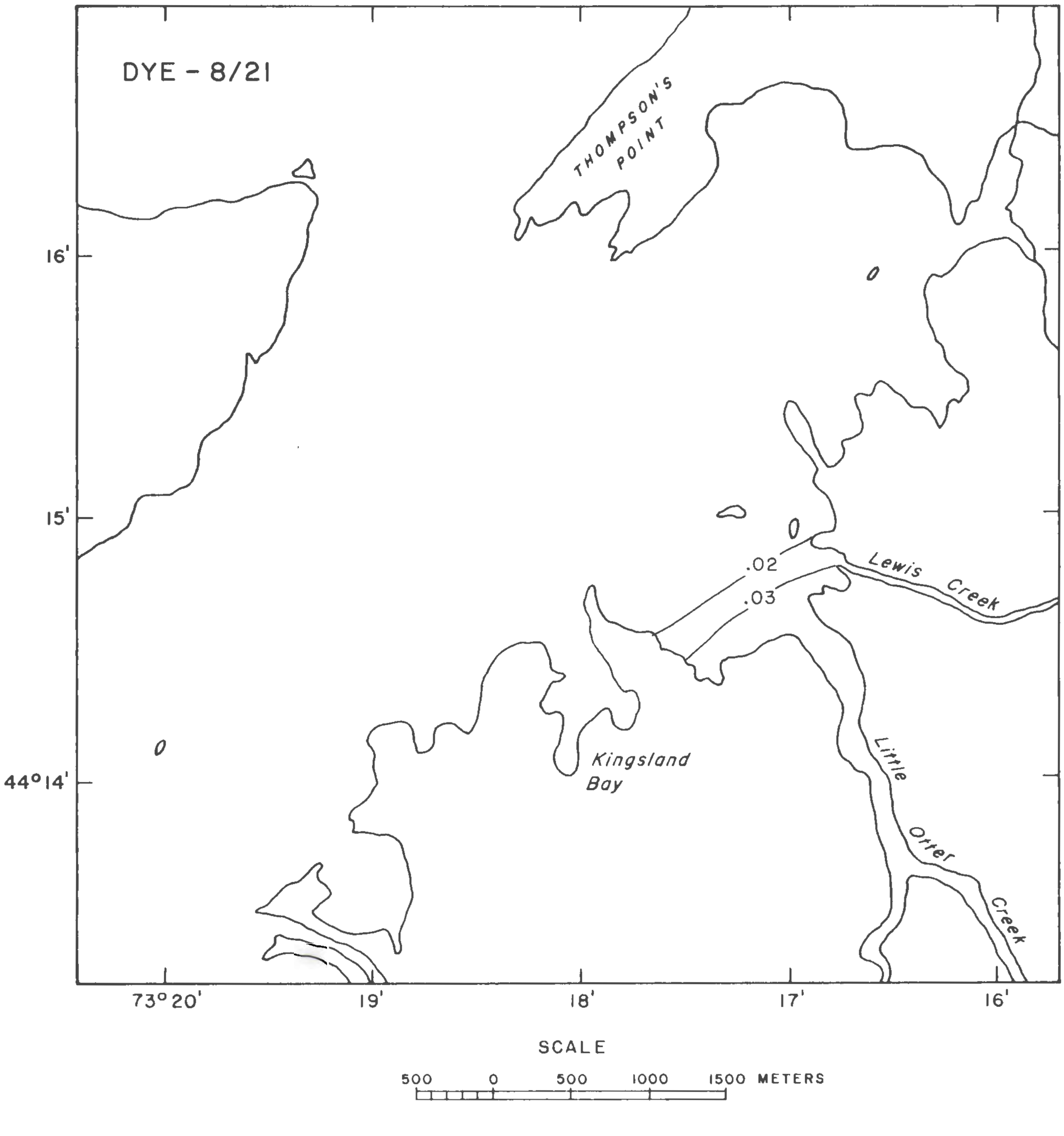


Figure 5. Dye sampling results (ppb) for August 21, 1984.

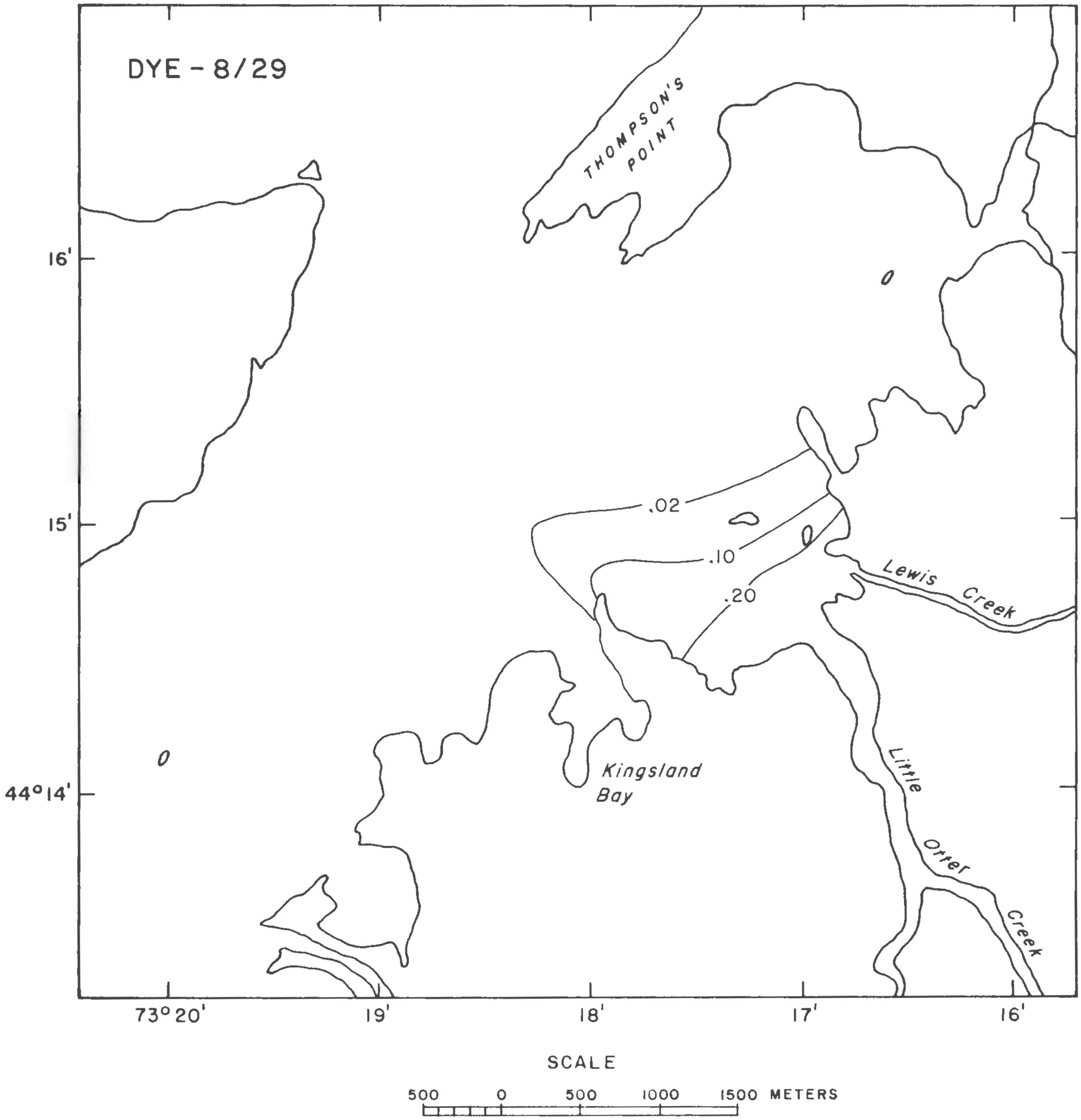


Figure 6. Dye sampling results (ppb) for August 29, 1984.

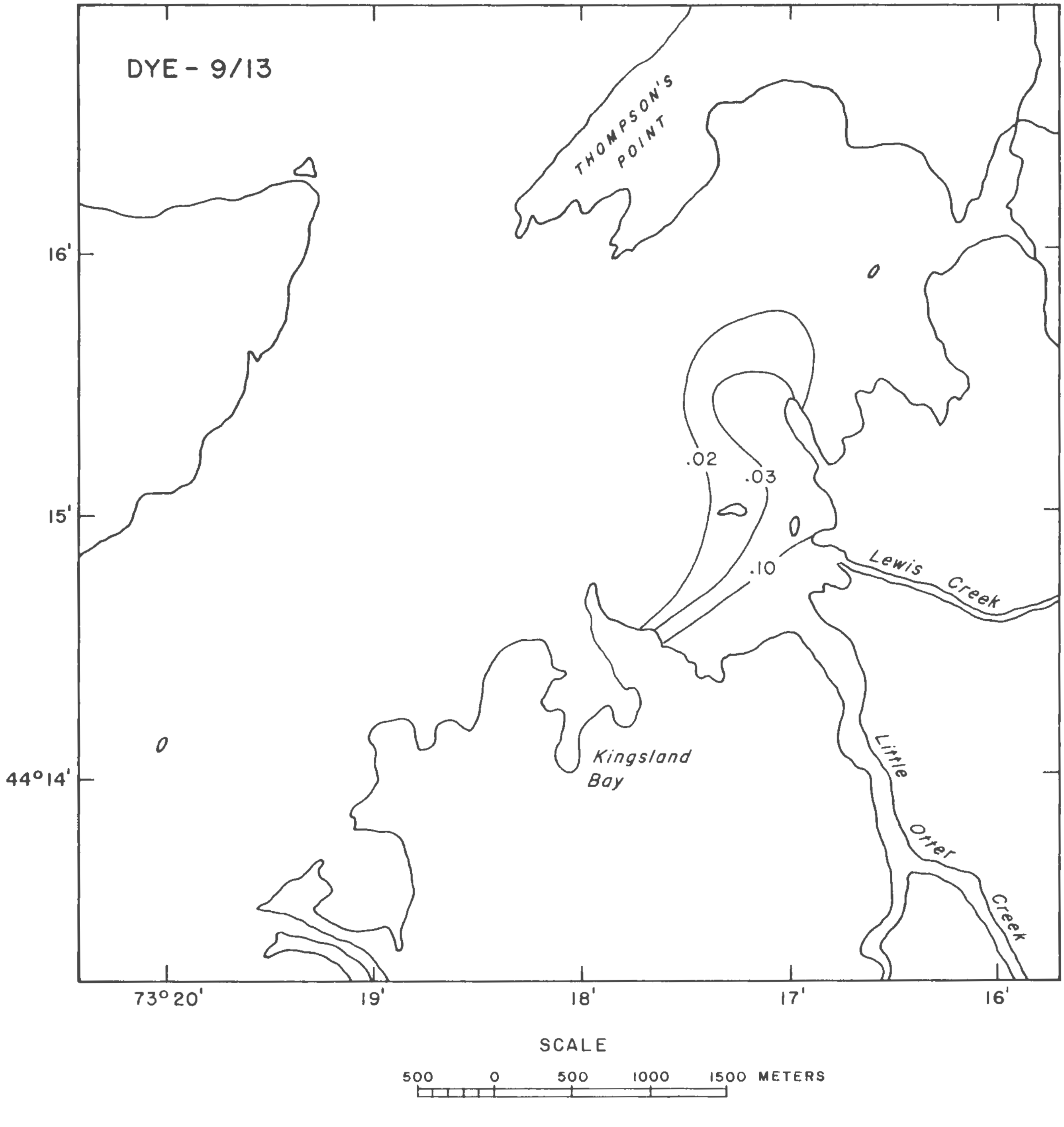


Figure 7. Dye sampling results (ppb) for September 13, 1984.

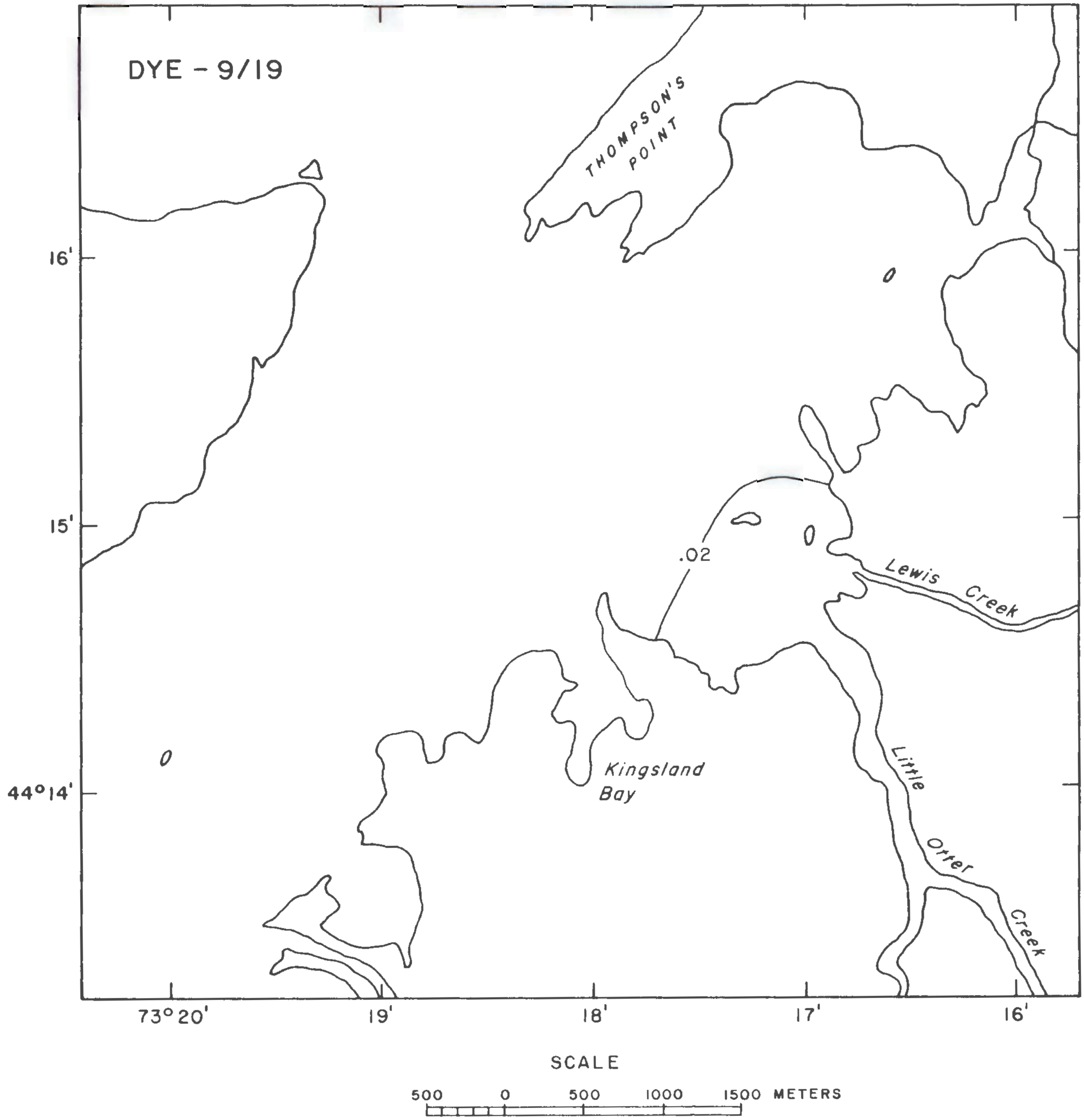


Figure 8. Dye sampling results (ppb) for September 19, 1984.

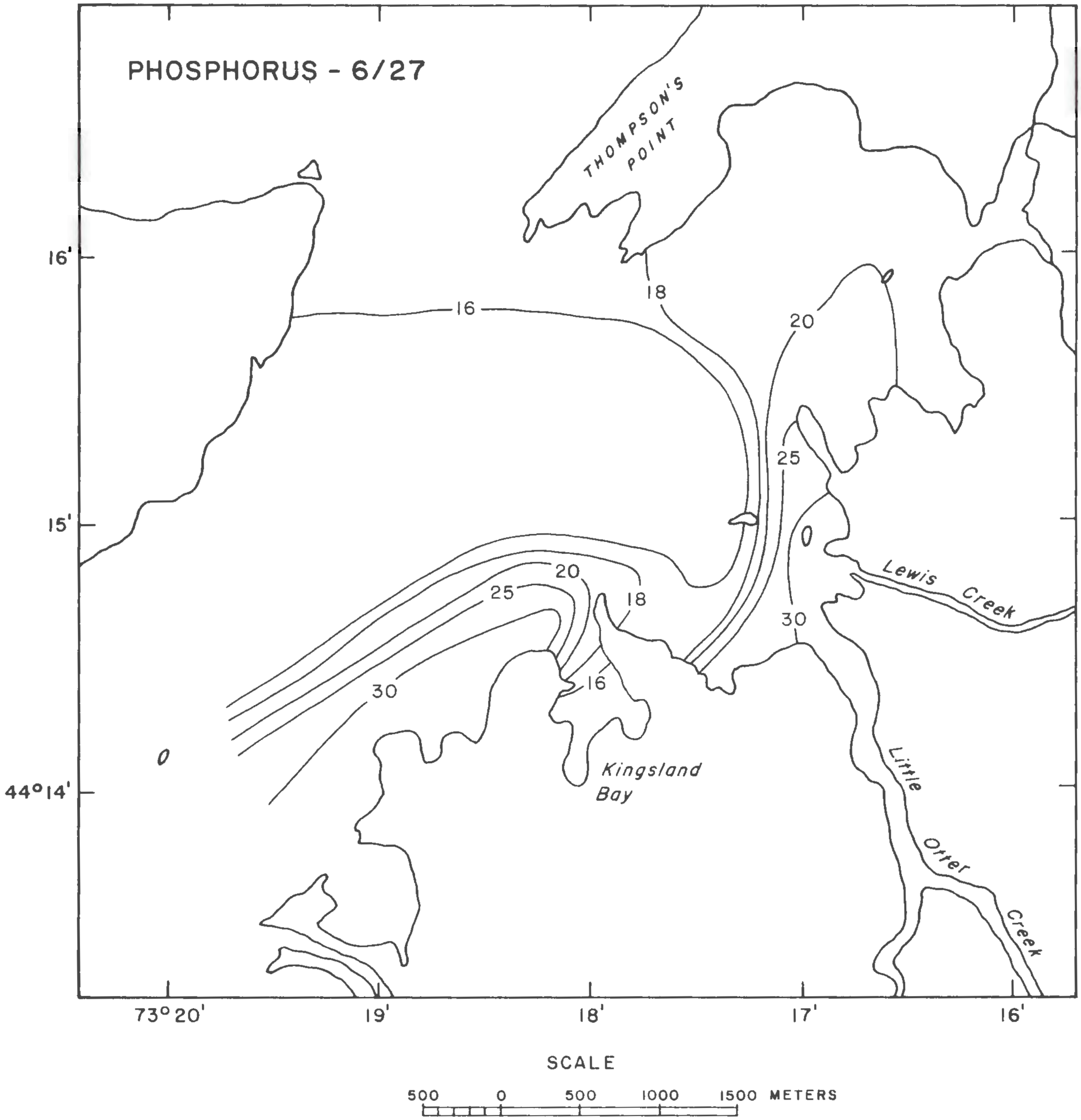


Figure 9. Phosphorus sampling results (ppb) for June 27, 1984.

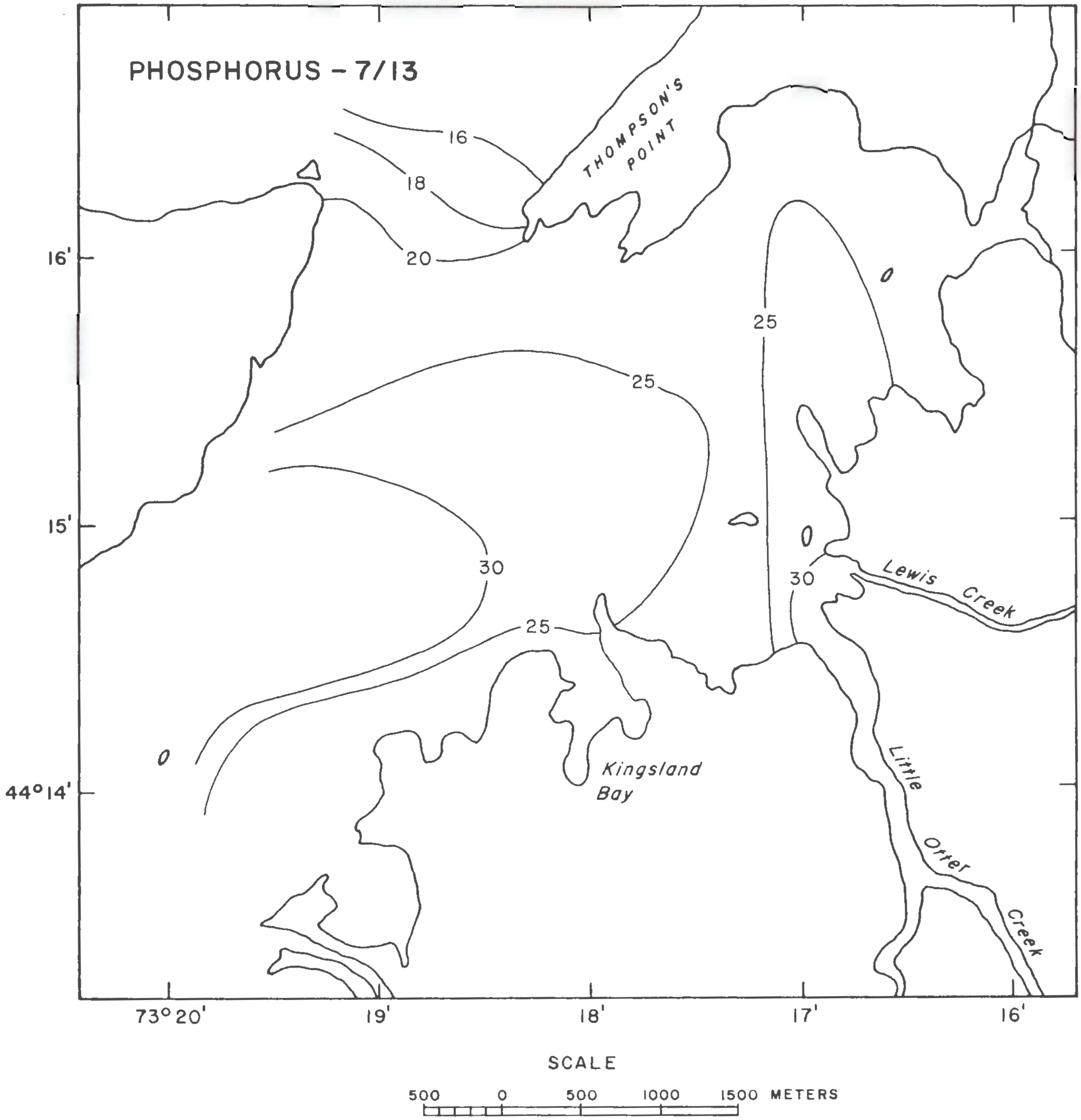


Figure 10. Phosphorus sampling results (ppb) for July 13, 1984.

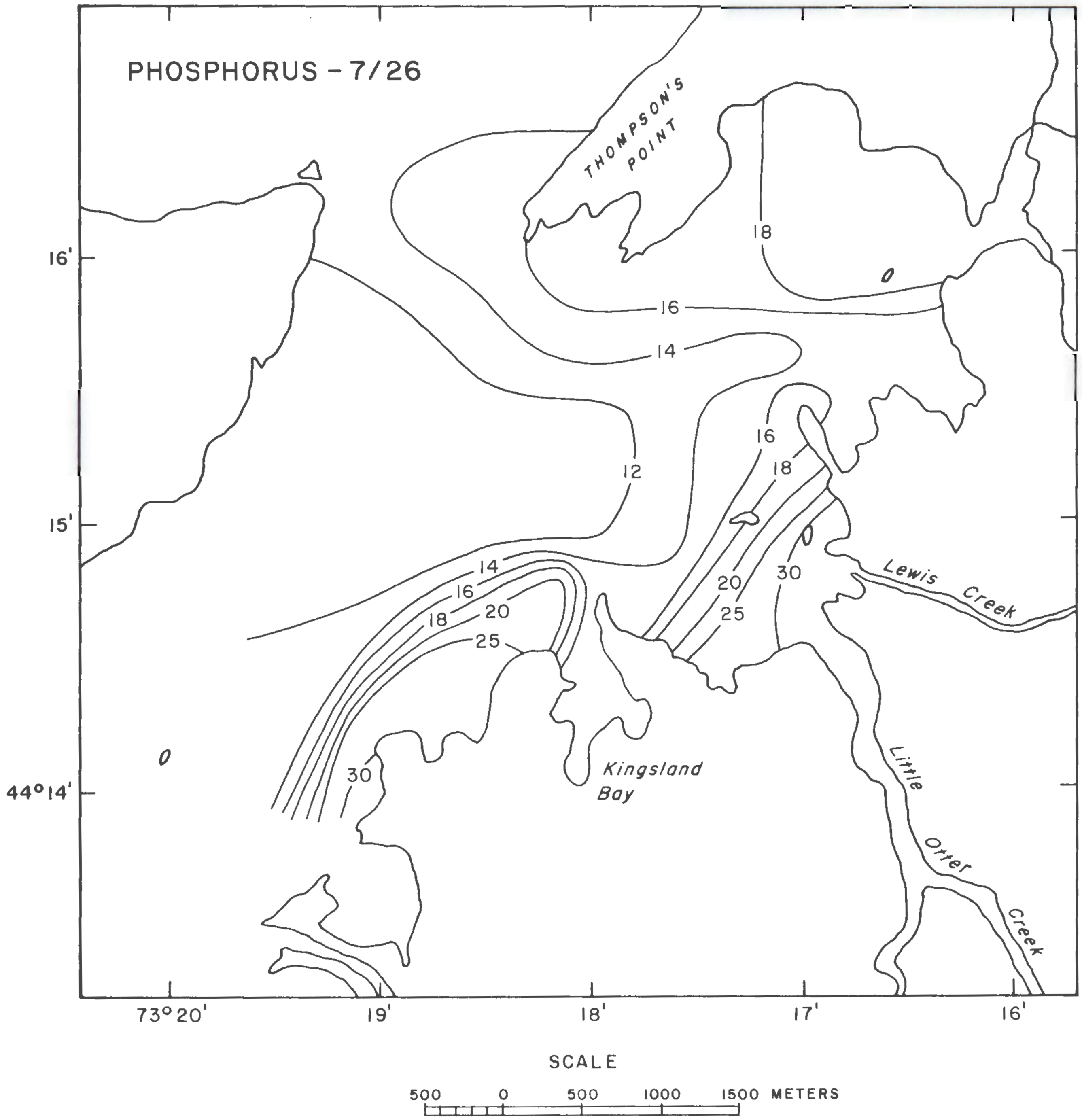


Figure 11. Phosphorus sampling results (ppb) for July 26, 1984

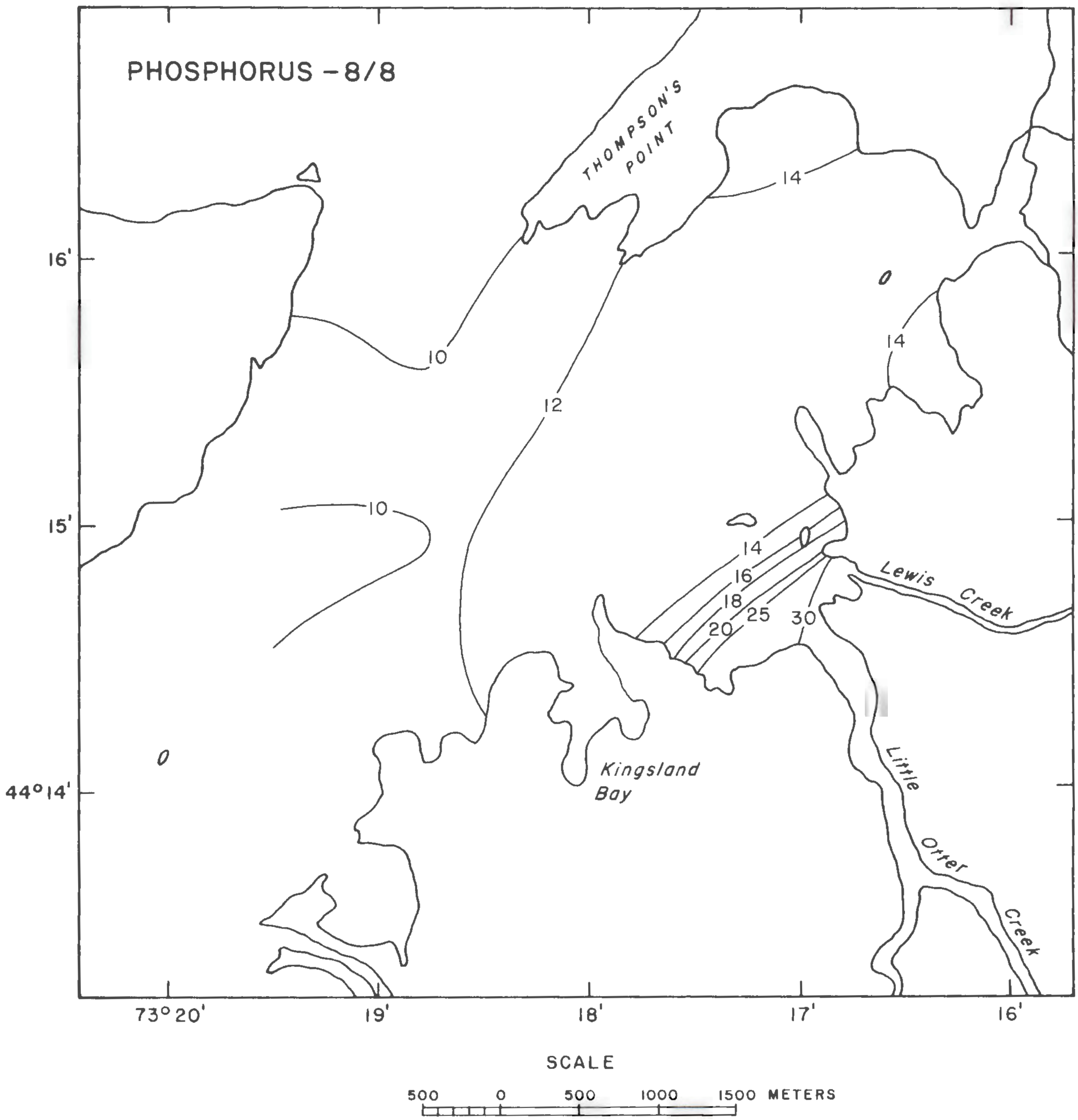


Figure 12. Phosphorus sampling results (ppb) for August 8, 1984.

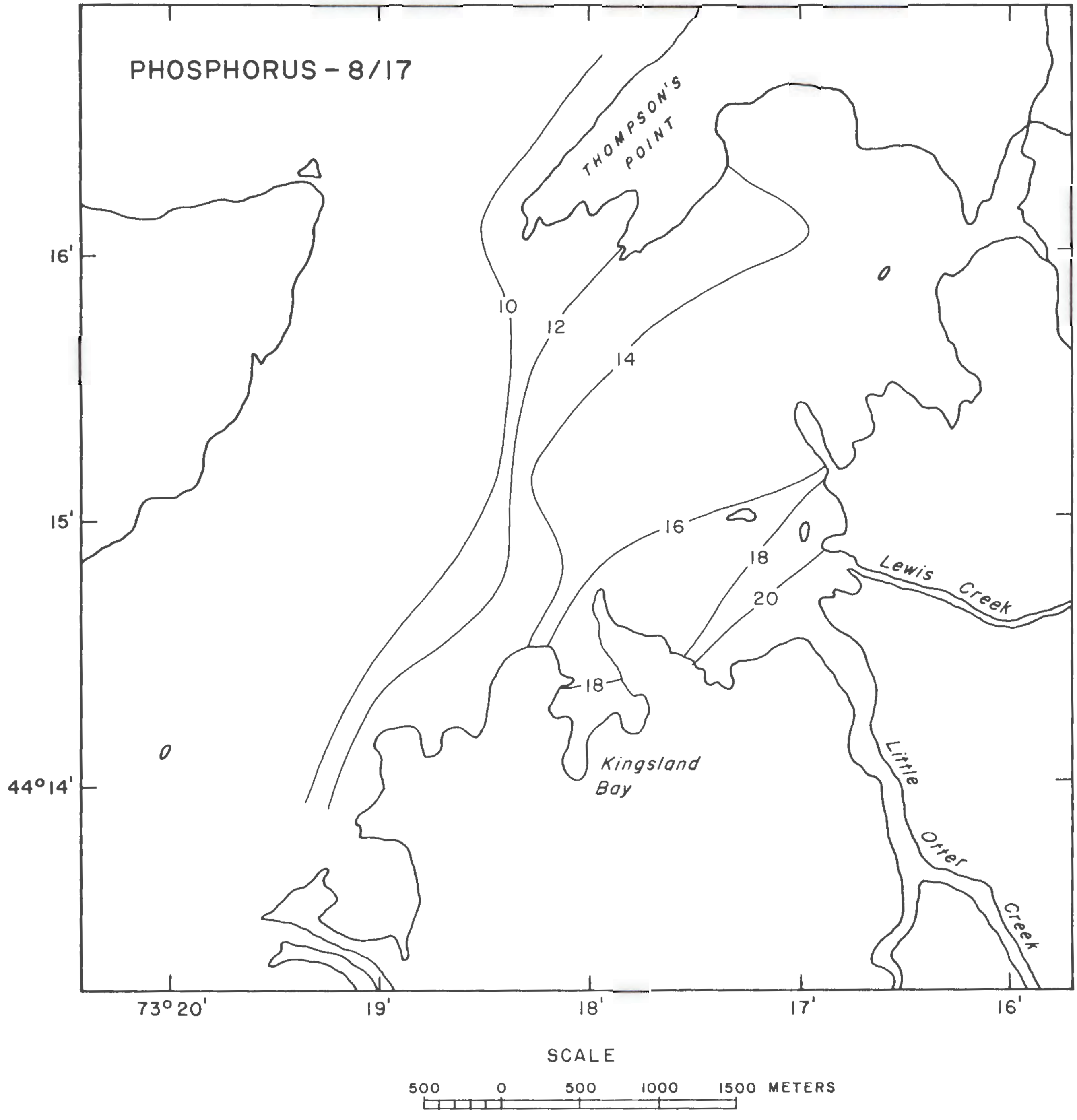


Figure 13. Phosphorus sampling results (ppb) for August 17, 1984.

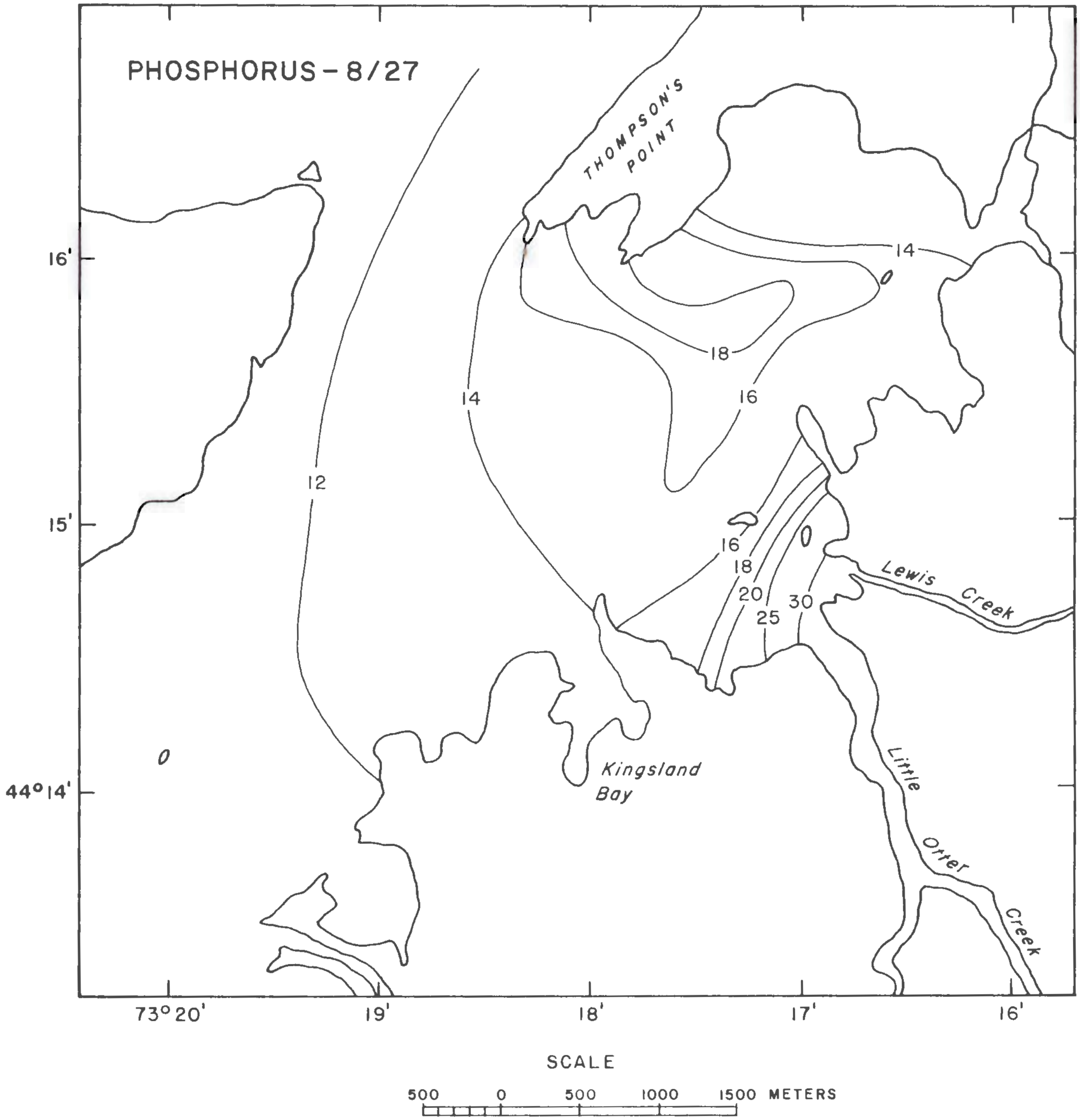


Figure 14. Phosphorus sampling results (ppb) for August 27, 1984.

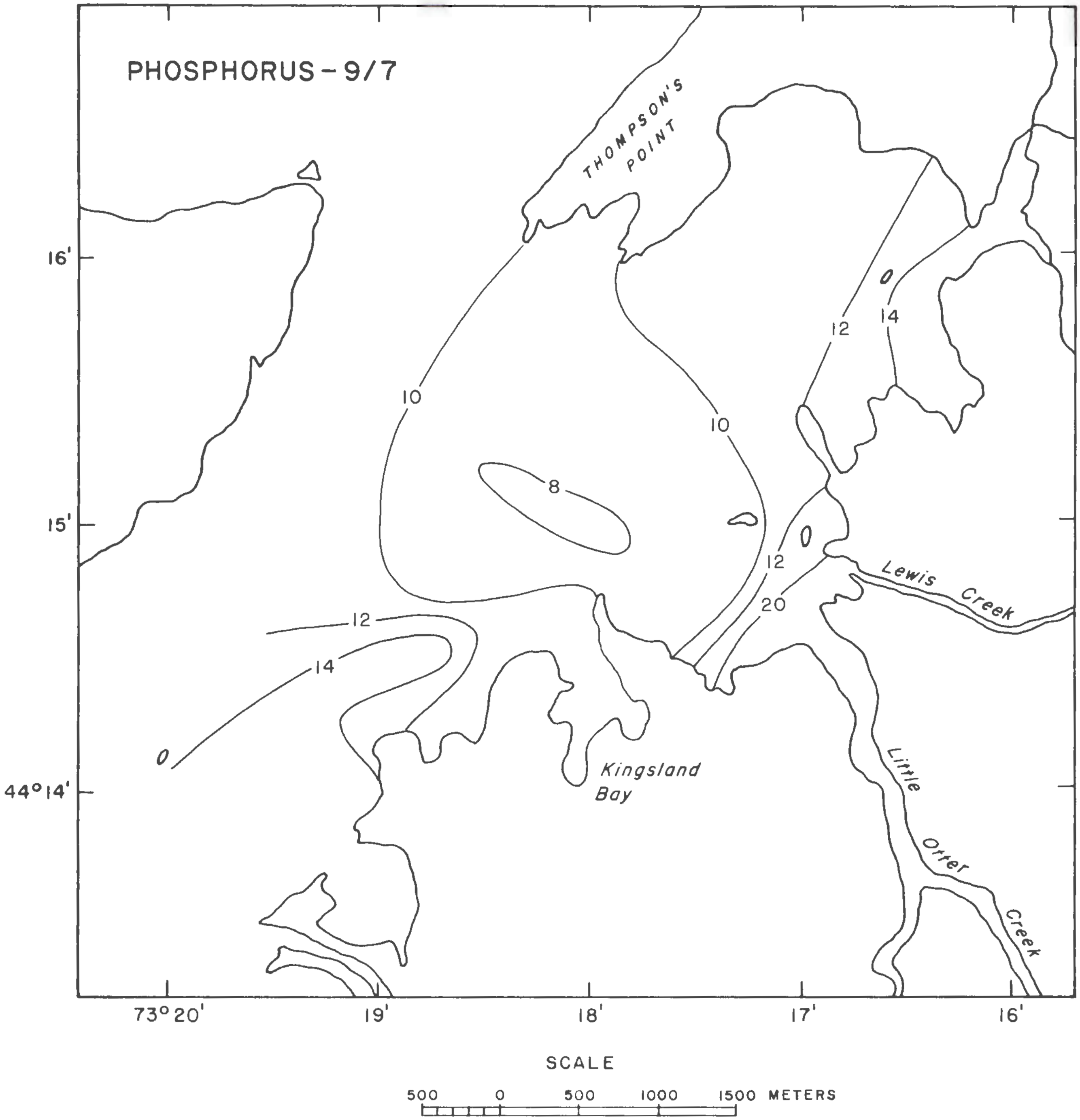


Figure 15. Phosphorus sampling results (ppb) for September 7, 1984.

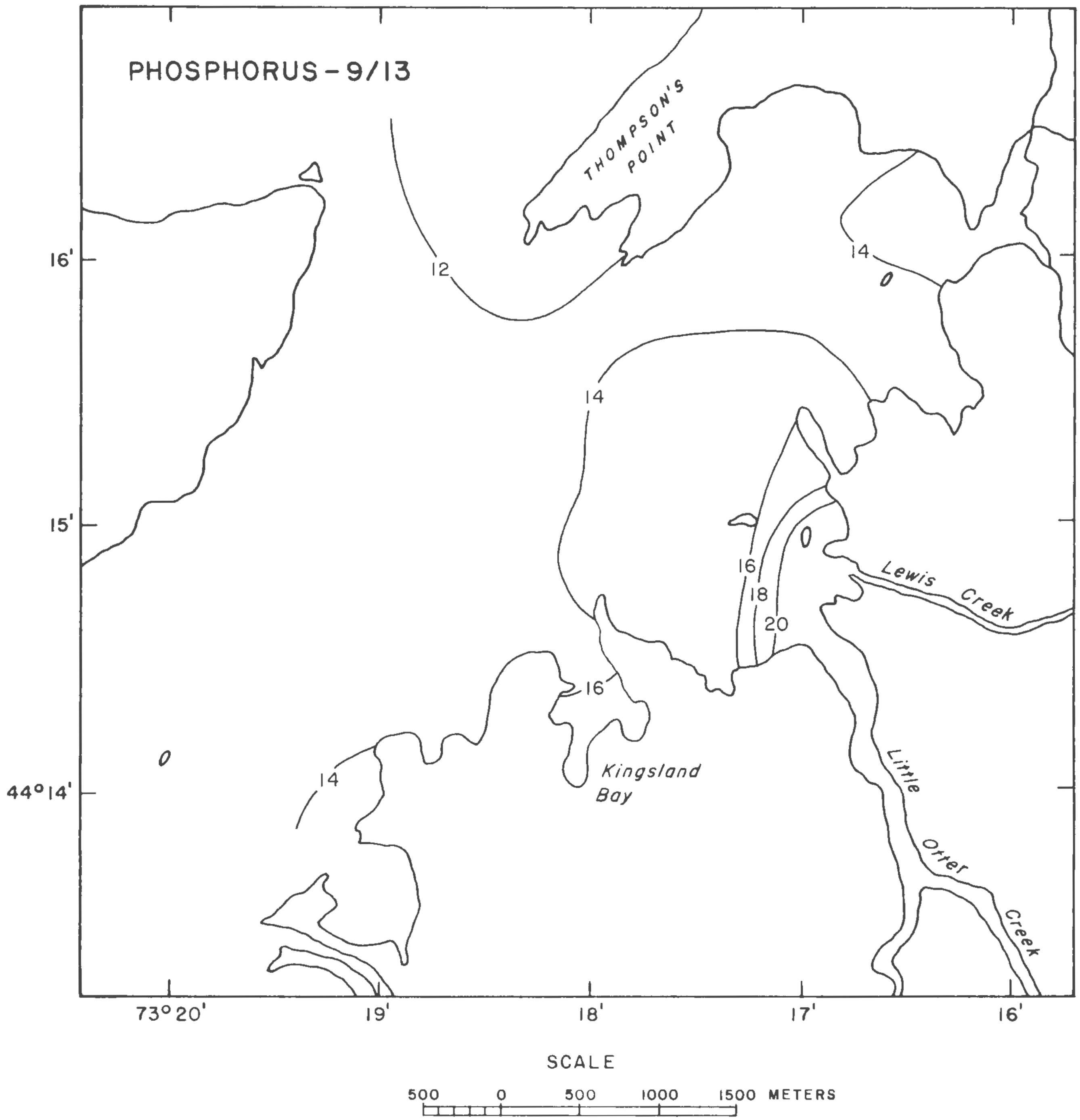


Figure 16. Phosphorus sampling results (ppb) for September 13, 1984.

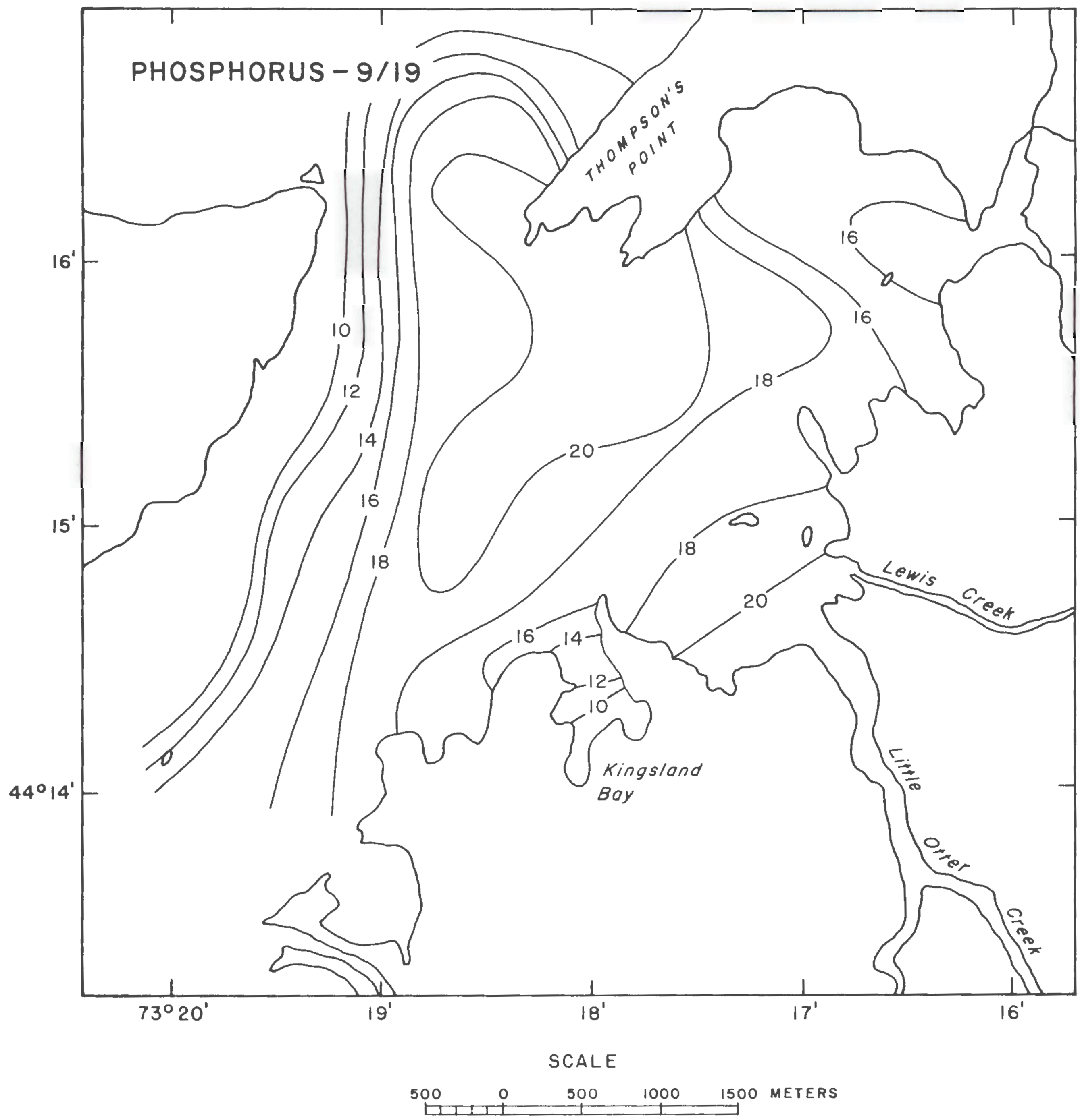


Figure 17. Phosphorus sampling results (ppb) for September 19, 1984.

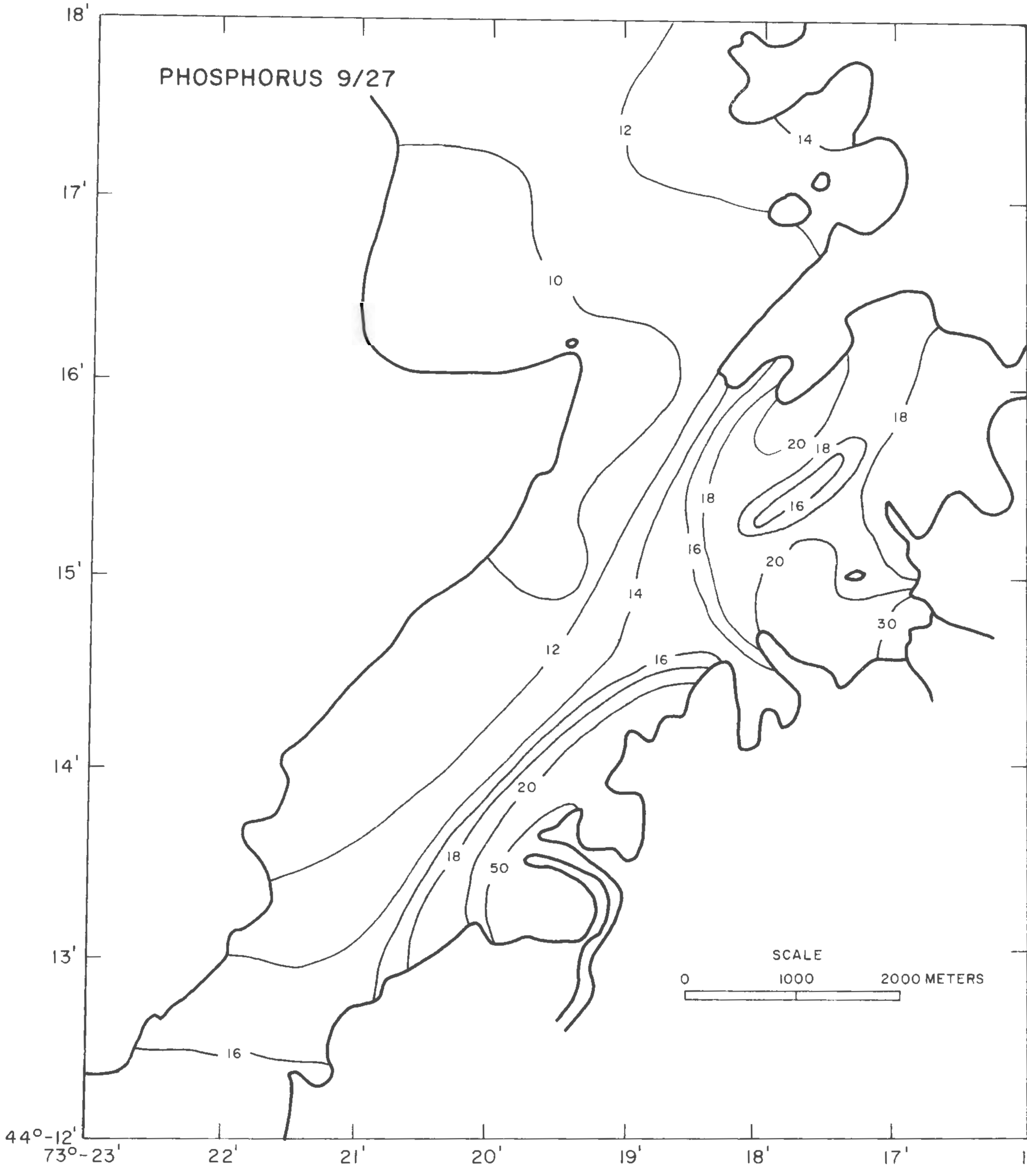


Figure 18. Phosphorus sampling results (ppb) for September 27, 1984.

could usually be seen extending northeastward up the shoreline towards Kingsland Bay. The effect of the Lewis Creek and Little Otter Creek discharges could sometimes be seen extending northward into Town Farm Bay, but on most occasions, particularly later in the summer, their effect was confined primarily to Hawkins Bay.

Chlorophyll Results

Chlorophyll-a samples were taken concurrently with the phosphorus samples on 7 dates during the study period. Generally, the chlorophyll spatial concentration patterns closely resembled the phosphorus patterns. All the chlorophyll data is tabulated in Appendix B.

Plots of chlorophyll vs. phosphorus concentration of corresponding samples were examined for each sample date. On almost all dates, strong, positive, linear relationships existed between chlorophyll and phosphorus concentrations within the study area. As an example, data obtained on September 27 is plotted in Figure 19. The slopes of these relationships, and the range of values observed differed from date to date so that it was not possible to develop a general model by plotting all the data together. The linear nature of these relationships (and the low intercepts) indicated, however, that for a given percent increase in phosphorus concentration, there would be a chlorophyll increase of roughly the same proportion. This observation was used later in this report to predict the chlorophyll response to an increase in phosphorus concentration over a portion of the study area.

Stream Phosphorus Loading

The results of flow measurements made in Lewis and Little Otter Creeks at locations indicated in Figure 1 are given in Table 1. In order to generate a continuous flow record for the study period, regression relationships were developed between the flows measured at Lewis and Little Otter Creeks and flows measured on the same date at a U.S. Geological Survey gage maintained continuously on the Otter Creek at Middlebury, Vermont. The Lewis and Little Otter Creek data was first multiplied by the ratio of total drainage area to gaged area, as described in the Methods section of this report. Provisional data for mean daily flow at the Otter Creek gage was supplied by the U.S. Geological Survey. The regression equations shown in Figures 20 and 21 were used to predict daily flows at the mouths of Lewis and Little Otter Creeks for the period of June-September, 1984, based on the daily flow data from Otter Creek.

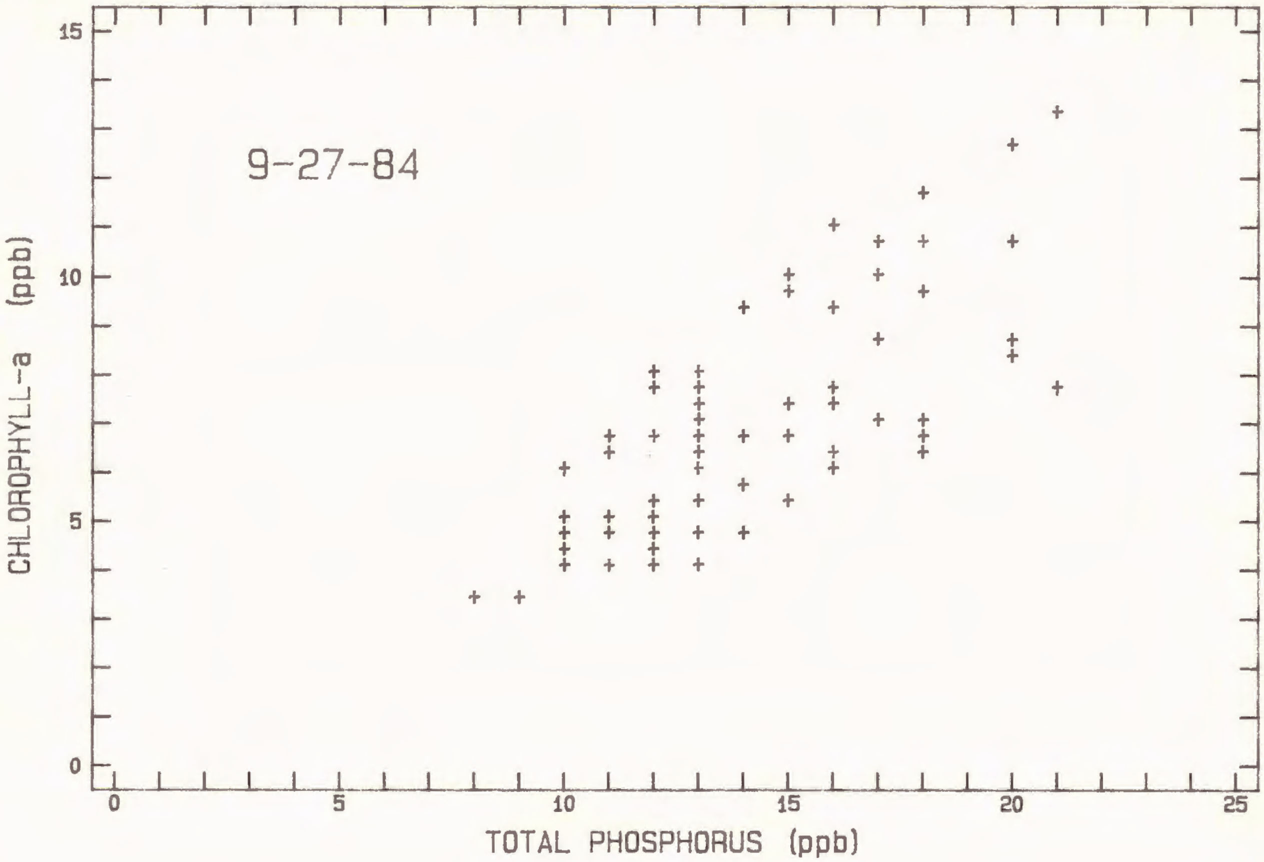


Figure 19. Plot of chlorophyll vs. total phosphorus for individual samples obtained on September 27, 1984.

Table 1. Flow rates (10^4 m^3/day) measured at Lewis and Little Otter Creeks (see Figure 1 for station locations).

Date (1984)	Lewis Creek	Little Otter Creek
6-21	8.3	1.9
6-26	7.2	2.4
7-04	4.1	1.1
7-06	9.2	5.0
7-10	7.7	2.0
7-12	9.8	2.3
7-17	7.7	2.9
7-20	8.5	4.1
7-24	7.4	1.8
7-27	5.0	1.2
8-02	4.0	1.0
8-07	3.1	0.8
8-10	3.0	0.7
8-14	3.8	1.7
8-16	3.7	1.5
8-22	2.4	0.6
8-24	5.9	2.7
8-28	3.4	0.7
8-31	3.0	0.6
9-06	2.7	0.9
9-12	4.8	1.5
9-14	5.1	1.4
9-18	5.2	1.4
9-20	3.6	0.9
9-26	2.7	0.8

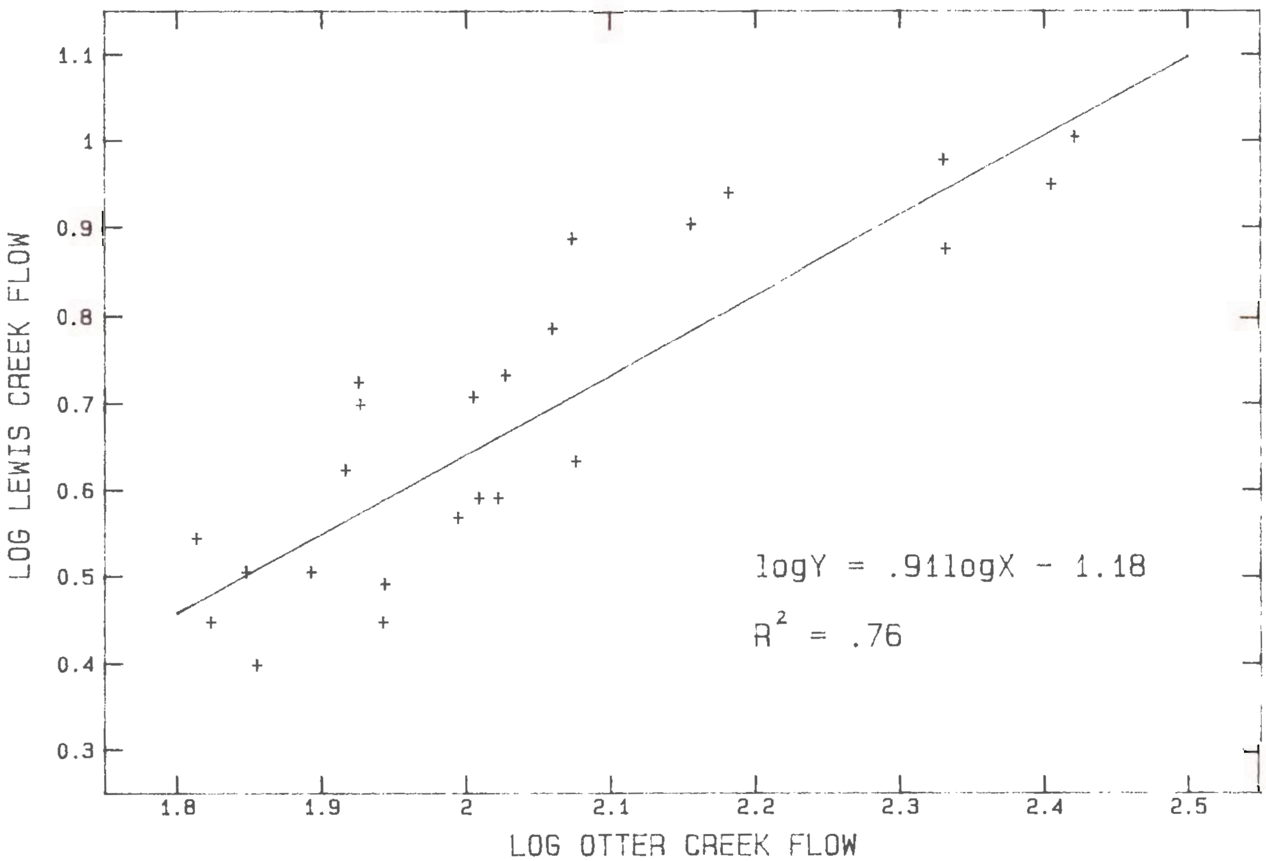


Figure 20. Regression of flow at the mouth of Lewis Creek vs. flow in Otter Creek at the Middlebury gage. Flow units are $10^4 m^3$/day.

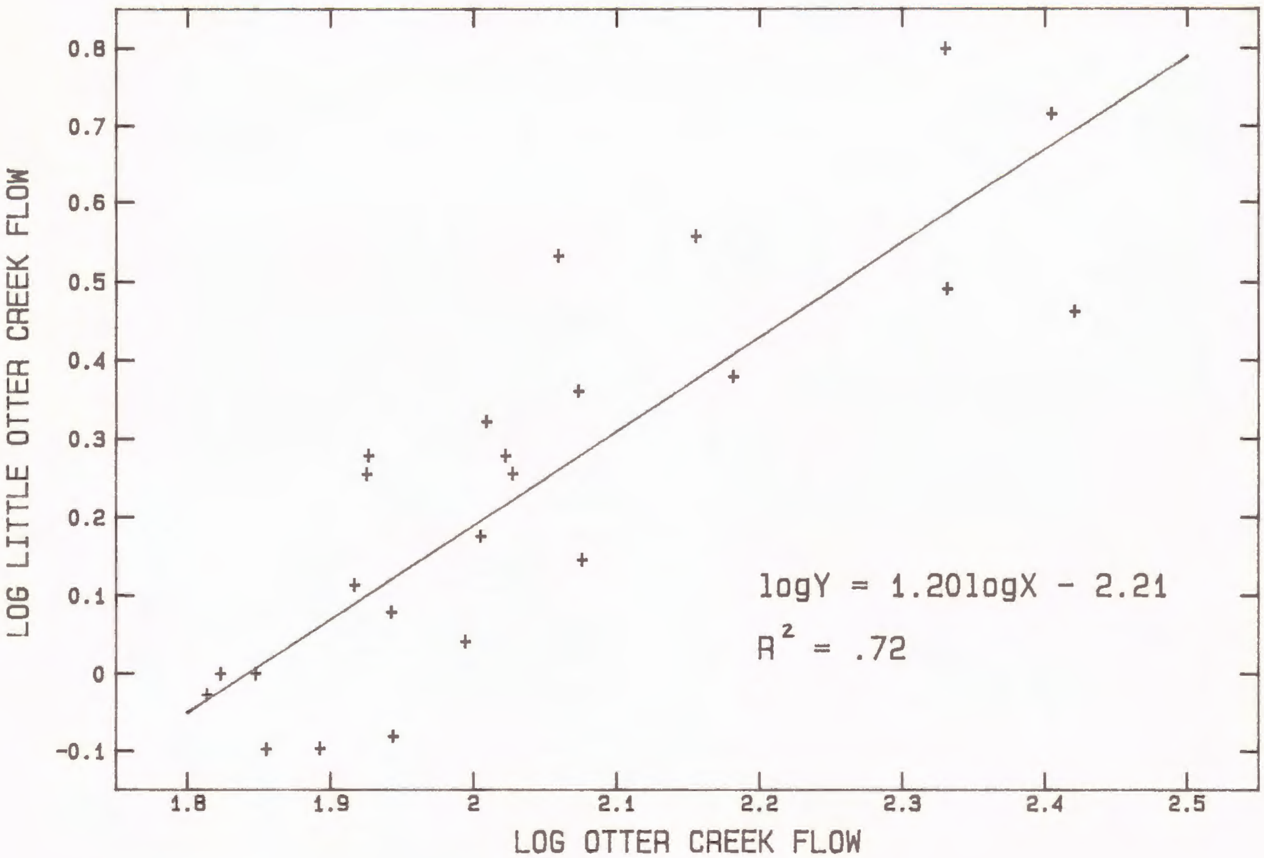


Figure 21. Regression of flow at the mouth of Little Otter Creek vs. flow in Otter Creek at the Middlebury gage. Flow units are $10^4 m^3$/day.

Phosphorus loading rates from Lewis and Little Otter Creeks were calculated from the phosphorus sampling results shown in Table 2. In order to generate a continuous phosphorus concentration record, an attempt was made to find a relationship between concentration and flow in those streams. No statistically significant relationship was found, however. Alternatively, continuous concentration records were generated by interpolating between sampling dates, assuming that each measurement applied to a period midway to the previous and the following sample date. Phosphorus loading rates for each date were calculated as the product of total phosphorus concentration and flow.

A minor inflow to Town Farm Bay also existed from Thorp and Kimball Brooks (see Figure 1). Phosphorus loading and flow from this source was assumed to be drainage area proportional to loading and flow from Lewis Creek, with the ratio between the two drainage areas being 0.036.

The phosphorus loading record for the combined inflow of Lewis and Little Otter Creeks is plotted in Figure 22. Figure 22 shows that considerable variation in daily loading rates existed during the study period. Consequently, for modeling purposes, the study period was broken into two intervals within which the loading rates were somewhat less variable. The two intervals were June-July and August-September. A statistical summary of flow and phosphorus loading rates during each interval is provided in Table 3.

Flows measured in Otter Creek during 1984 are compared with median and extreme June-September average flows for a long-term period of record in Figure 23. Figure 23 shows that flows during the 1984 study period were considerably higher than the long-term median during the first half of the summer, and were quite close to the long-term median during the latter half of the summer. Extreme flow conditions were not approached, and the summer of 1984 could be considered fairly "typical" with respect to runoff and potential phosphorus loading rates.

Wind Data

Because it was expected that recent wind conditions might influence the diffusion characteristics observed in the lake on a given date, wind data was obtained from the National Weather Service for a station at Burlington, Vermont, located 27 km north of the study area. Figure 24 shows that the prevailing wind directions at Burlington during the summer were from the southeast and the northwest. The major wind events (average daily wind speed greater than 20 km/hr) are plotted for the study period in Figure 25, with the dates of phosphorus sampling indicated. The square of the speed was used in this plot because the stress applied to the water by the wind is roughly proportional to the square of the wind velocity (Hutchinson, 1957).

Table 2. Total phosphorus (TP) and dissolved phosphorus (DP) sampling results (ppb) for Lewis and Little Otter Creeks (see Figure 1 for sampling locations).

	Lewis Creek		Little Otter Creek	
Date (1984)	TP	DP	TP	DP
6-21	57	--	97	--
6-27	56	--	96	--
7-03	74	--	115	--
7-10	80	--	92	--
7-13	57	47	73	51
7-24	60	32	86	46
7-26	51	29	93	54
8-02	63	32	90	48
8-06	70	35	108	51
8-08	63	29	113	52
8-13	62	36	96	50
8-15	78	44	108	54
8-17	87	41	128	62
8-21	64	35	72	49
8-27	43	--	52	--
8-29	42	24	61	31
9-06	42	20	58	40
9-07	43	28	61	35
9-13	57	24	66	35
9-19	35	24	52	22
9-27	73	30	59	24

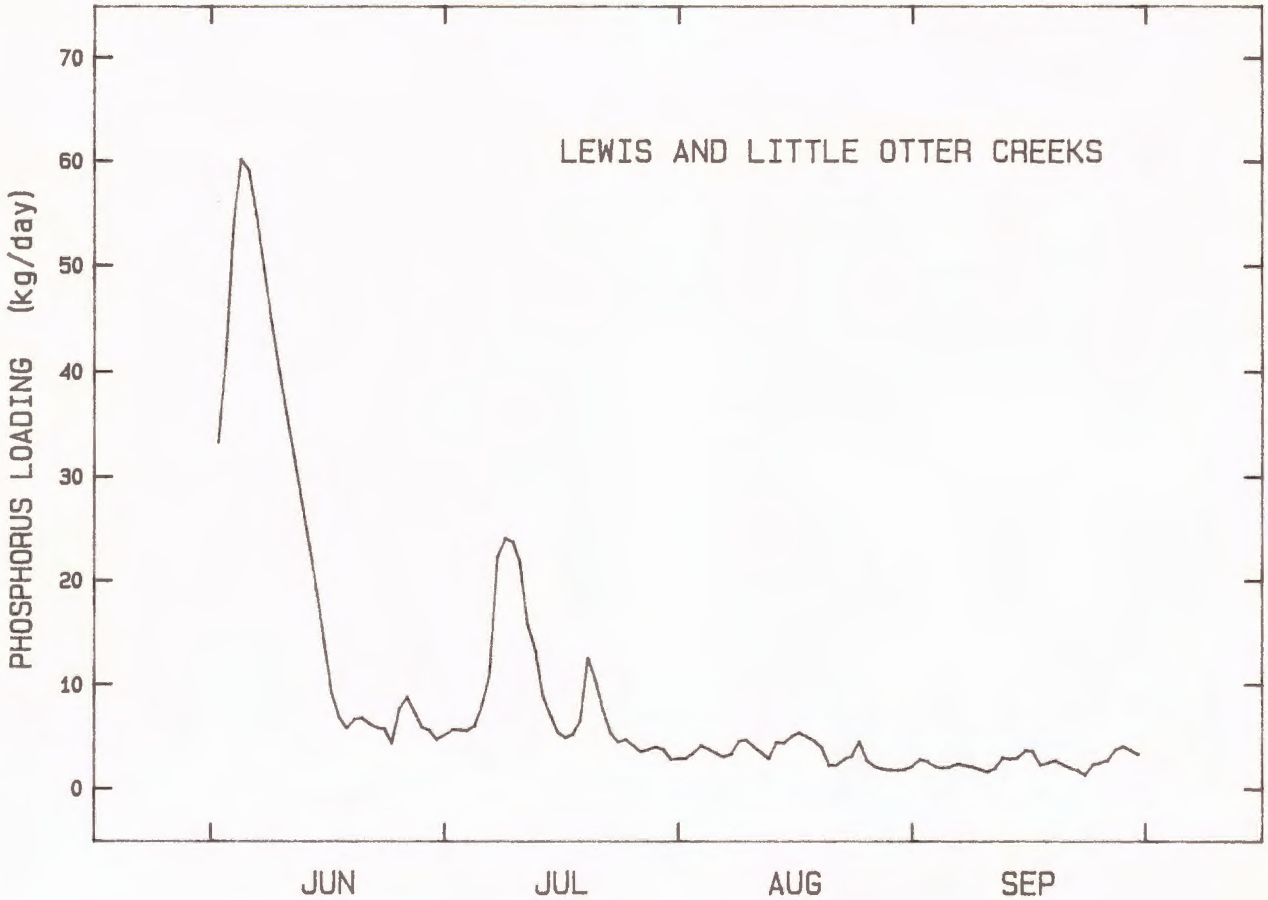


Figure 22. Plot of phosphorus loading vs. time for the combined inflow of Lewis and Little Otter Creeks.

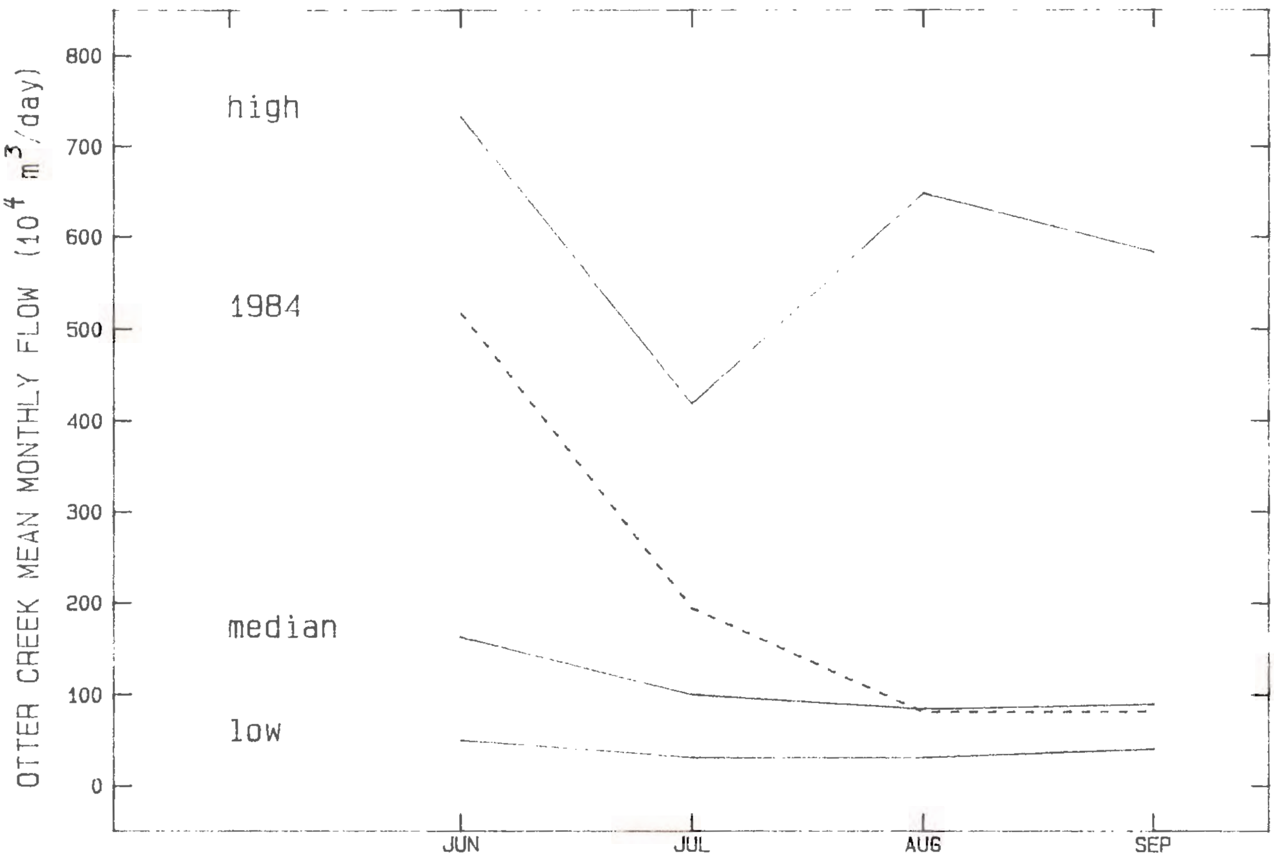


Figure 23. Comparison of mean monthly flows at the Otter Creek Middlebury gage during June-September, 1984 with the median and extreme mean monthly June-September flows for the 1903-1981 period of record.

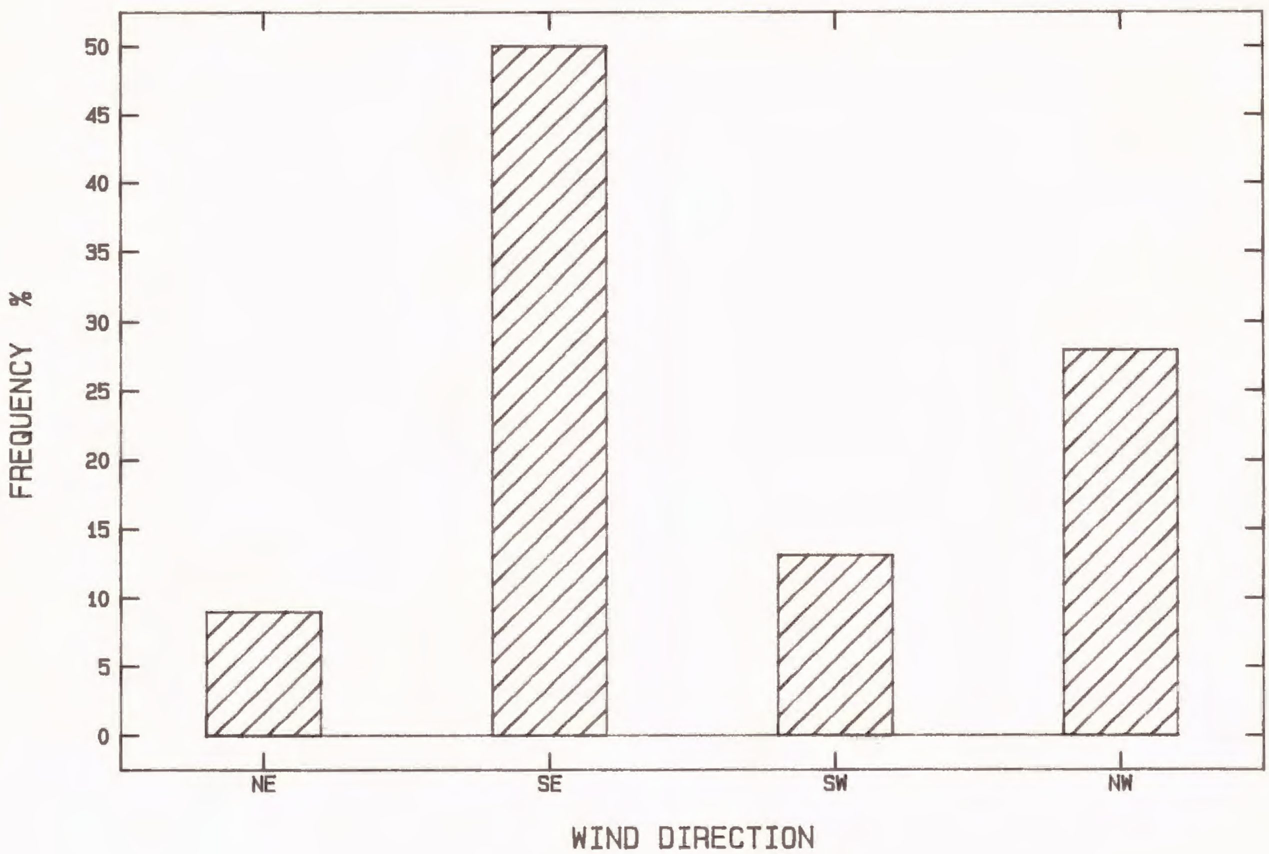


Figure 24. Frequency distribution of daily wind direction (resultant vector) recorded at Burlington, Vermont during June-September, 1984.

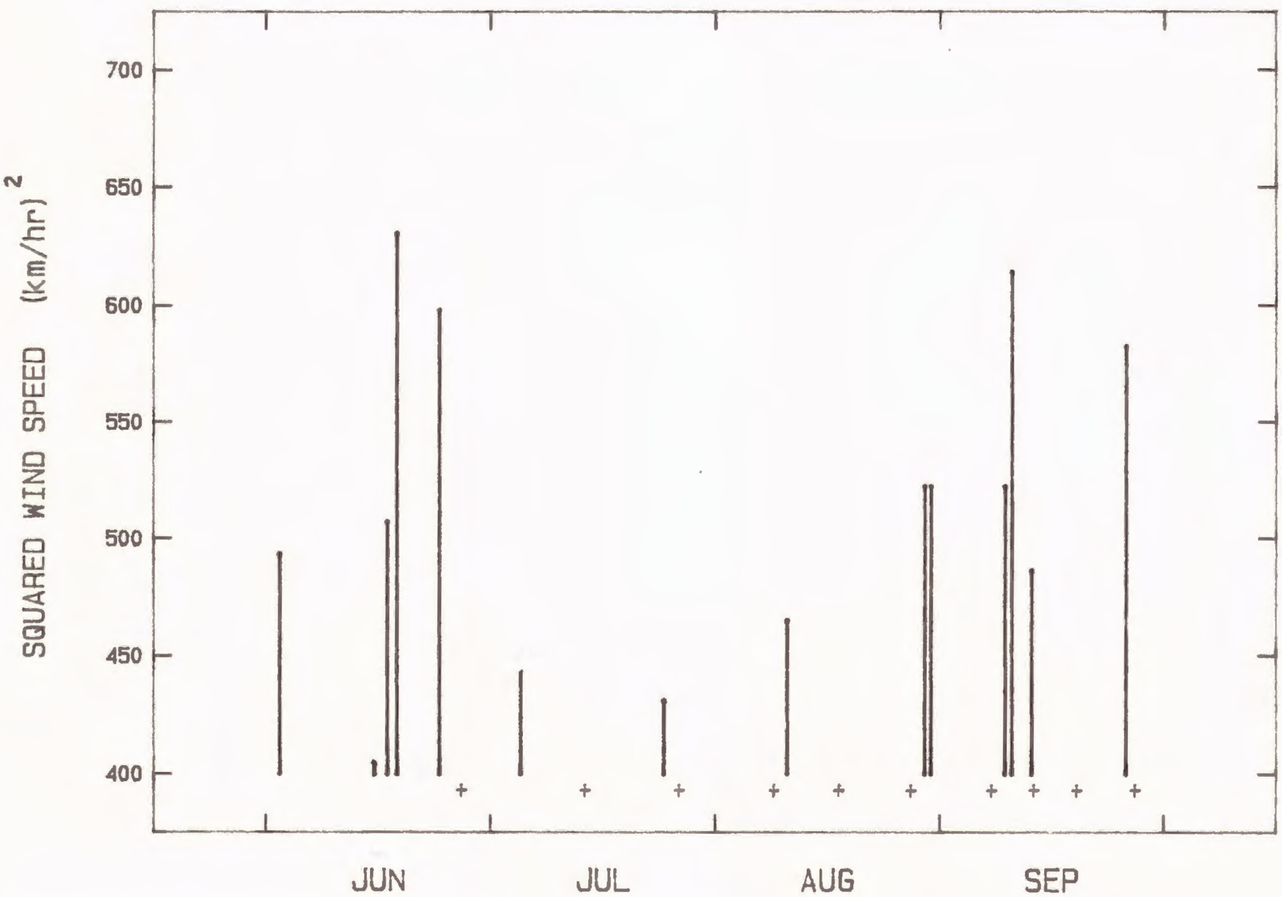


Figure 25. Plot of major wind events (average daily wind speed greater than 20 km/hr) recorded at Burlington during June-September, 1984. Dates of phosphorus sampling are indicated by a "+" along the horizontal axis.

Table 3. Statistical summary of daily flow (10^4 m^3/day) and phosphorus loading rates (kg/day) for the combined inflow of Lewis and Little Otter Creeks.

Time Period	Parameter	Mean	N	Std. Err.	Min.	Max.
June-July	Flow	21.5	61	2.7	4.2	81.2
	Loading	15.7	61	2.0	2.8	60.2
August-September	Flow	4.9	61	.12	3.4	7.0
	Loading	3.0	61	.13	1.3	5.4

Lake Depth and Water Level

A number of factors had to be considered in developing depth estimates for each of the model cells shown in Figure 2. First, the assumption had to be made that the model represented concentrations in a uniformly mixed epilimnion layer, and that transport of materials by vertical mixing to deeper water layers was negligible, relative to other transport processes. Given this assumption, the task was to evaluate the depth of the epilimnion during the study, and to determine the lake depth in the shallow areas where depths were less than the epilimnion depth.

The depth determinations were complicated by the fact that both the lake level and the epilimnion depth varied during the course of the study. A depth-time isopleth plot for temperature at a lake station located within the study area is shown in Figure 26. Figure 26 shows that the epilimnion depth declined from about 6 m in early June to about 16 m at the end of September. Based on Figure 26, an epilimnion depth of 13 m was chosen, for modeling purposes, as representing typical conditions during the summer.

Lake levels in the study area also declined during the study period, as shown in Figure 27. The depth grid used in the modeling is shown in Figure 28. The depth grid was based on soundings conducted on July 3, 1984. For modeling purposes, it was assumed that the depths shown in Figure 28 were representative of typical conditions during the summer of 1984.

Water levels in Lake Champlain during the summer of 1984 are compared with long-term median and extreme summer water levels in Figure 27. Figure 27 shows that lake levels during the summer of 1984 were significantly higher than the long-term median levels, but were well below the extreme highs for the period of record.

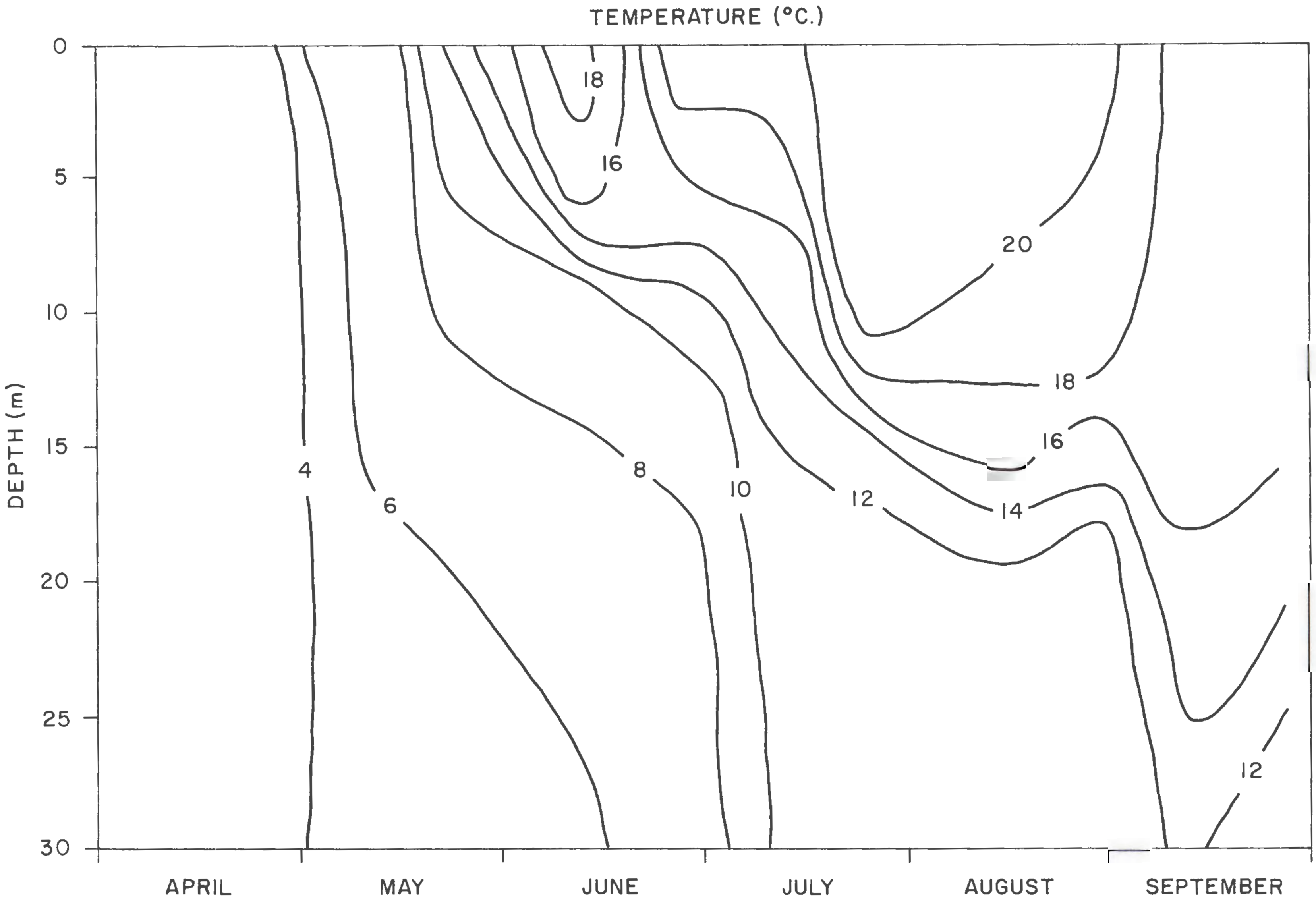


Figure 26. Depth-time isopleth plot for temperature at a station off Kingsland Bay, 1984.

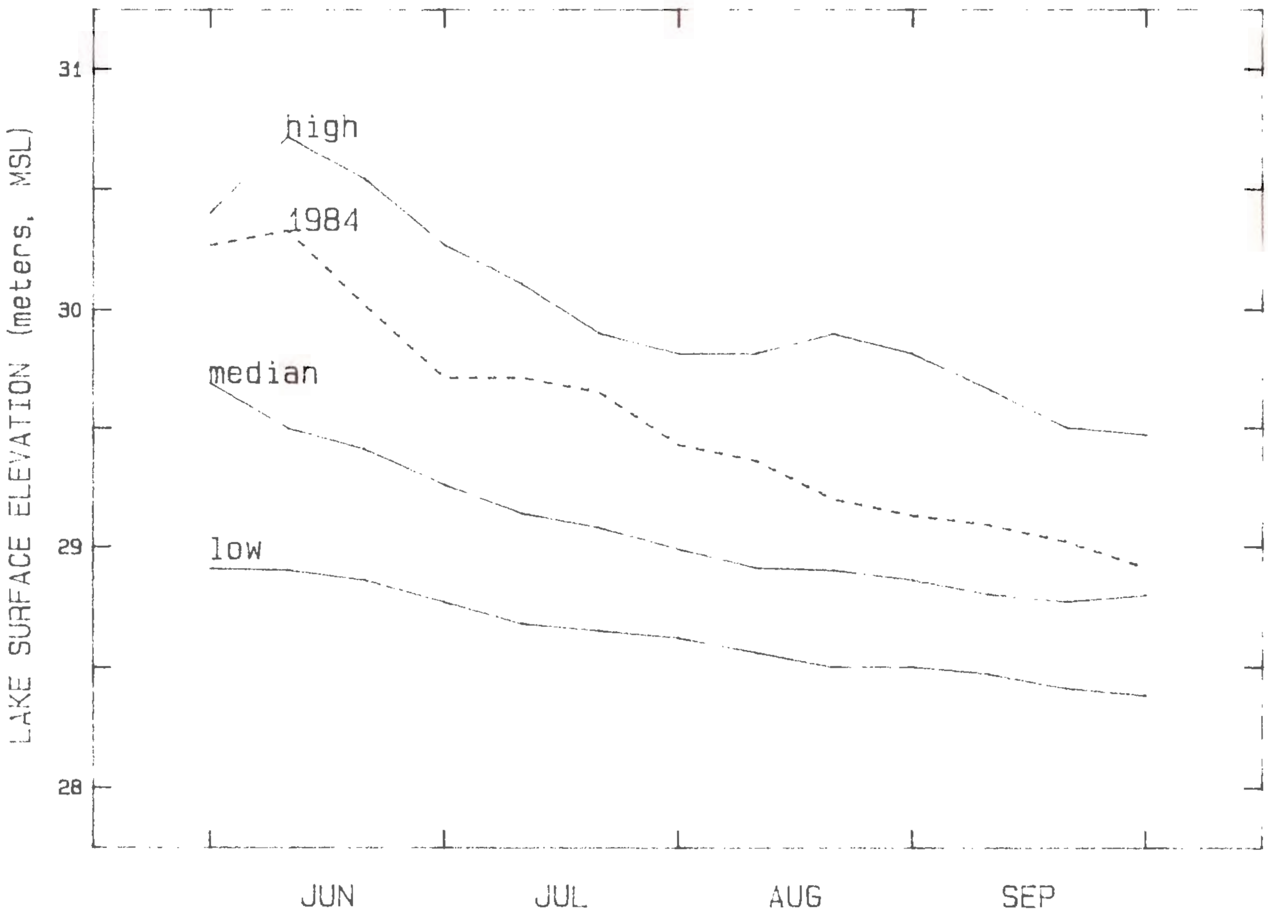


Figure 27. Lake Champlain water levels recorded at the Rouses Point gage during June-September, 1984, compared with the median and extreme levels during the 1939 to 1977 period of record. The 1984 data was supplied by the U.S. Geological Survey. The 1938 to 1977 record was obtained from International Champlain-Richelieu Board (1977).

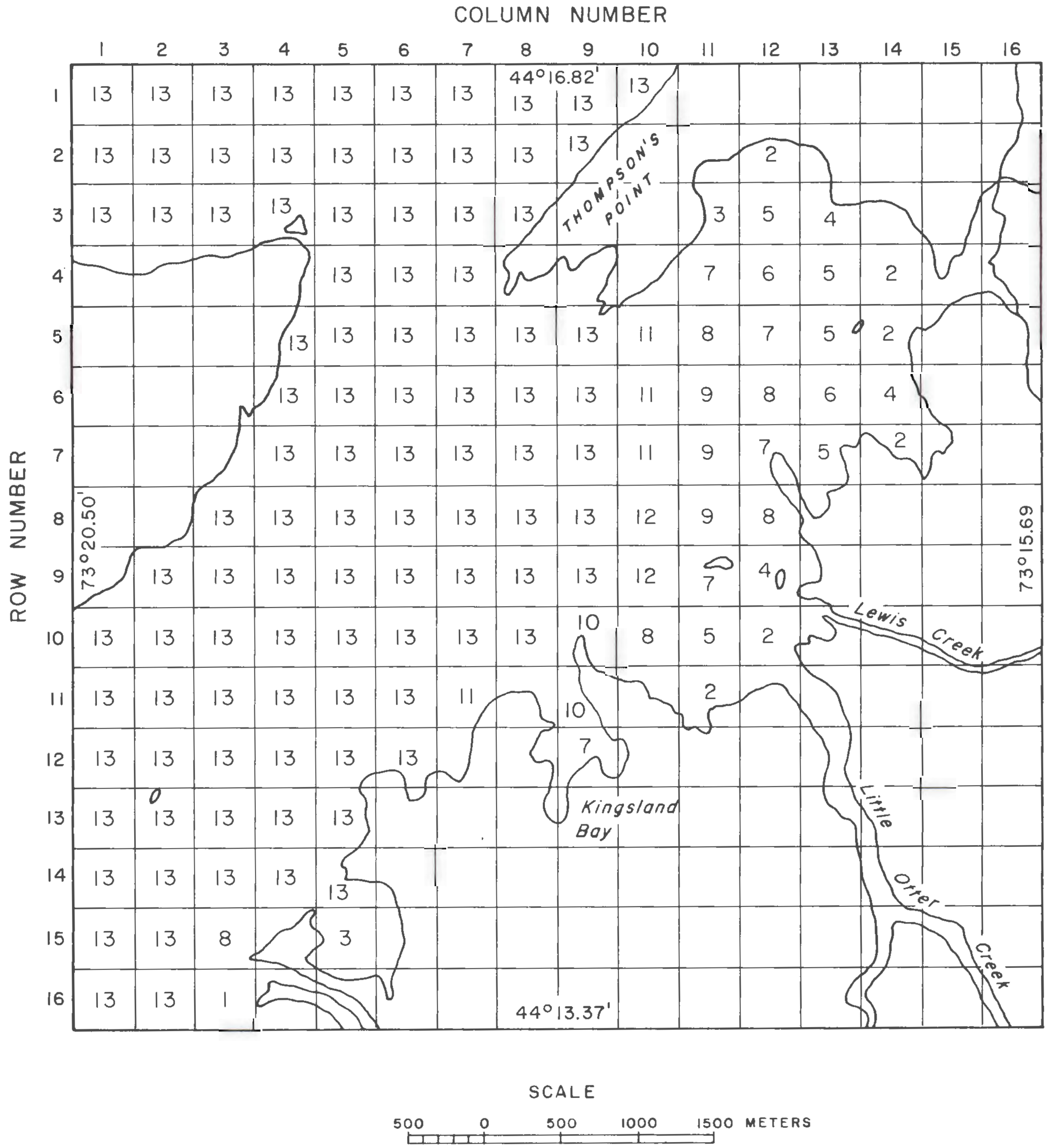


Figure 28. Depth grid (meters) used for modeling.

To check the assumption of a uniformly mixed epilimnion layer, a depth-time isopleth plot for total phosphorus in the study area is shown in Figure 29. Figure 29 shows that in early June, there was a significant depth gradient of phosphorus in the surface waters, probably as a result of phosphorus loading from heavy stream runoff occuring at the time (see Figure 22). Throughout the remainder of the summer, however, there were only very slight phosphorus depth gradients present, indicating that the surface sampling methods employed in the study adequately characterized concentrations in the entire epilimnion.

Dye Decay Rate

It was expected that rhodamine dye would decay in the lake environment, primarily as a result of processes such as photochemical degradation and adsorption onto settling particles (Wilson, 1968). An effort was therefore made to quantify dye decay rates in Lake Champlain.

Because most of the dye released into the lake was dispersed to concentrations below the fluorometric detection limit, it was not possible to estimate the decay rate by comparing recovery within the lake to the total quantity released. To obtain a decay rate estimate, two experiments were successfully completed during the study involving in situ measurement of dye decay in plastic bags.

Clear, 2-ply, 6-gallon plastic bags with spouts were obtained from Booth Bros. Dairy, Inc. These bags were filled with lake water from the study area and dye was added to the bags to achieve initial concentrations of about 1.2 ppb. In the first experiment, a set of three replicate bags was incubated at the lake surface for a period of 35 days. The second experiment involved three bags, suspended at depths of 2,4, and 9 m for a period of 20 days. During each experiment, samples were drawn at intervals from each bag and analyzed fluorometrically for dye concentration, by methods previously described. The flow-through fluorometer apparatus was modified for the bag experiments to use smaller sample volumes. The results of the bag experiments are given in Tables 4 and 5.

Dye decay rates for each bag were estimated from the slope of the regression of the natural logarithm of concentration vs. time. The dye decay rates are plotted as a function of depth in Figure 30. In Figure 30, the decay rate at the surface was based on the results of experiment #1 (Table 4),

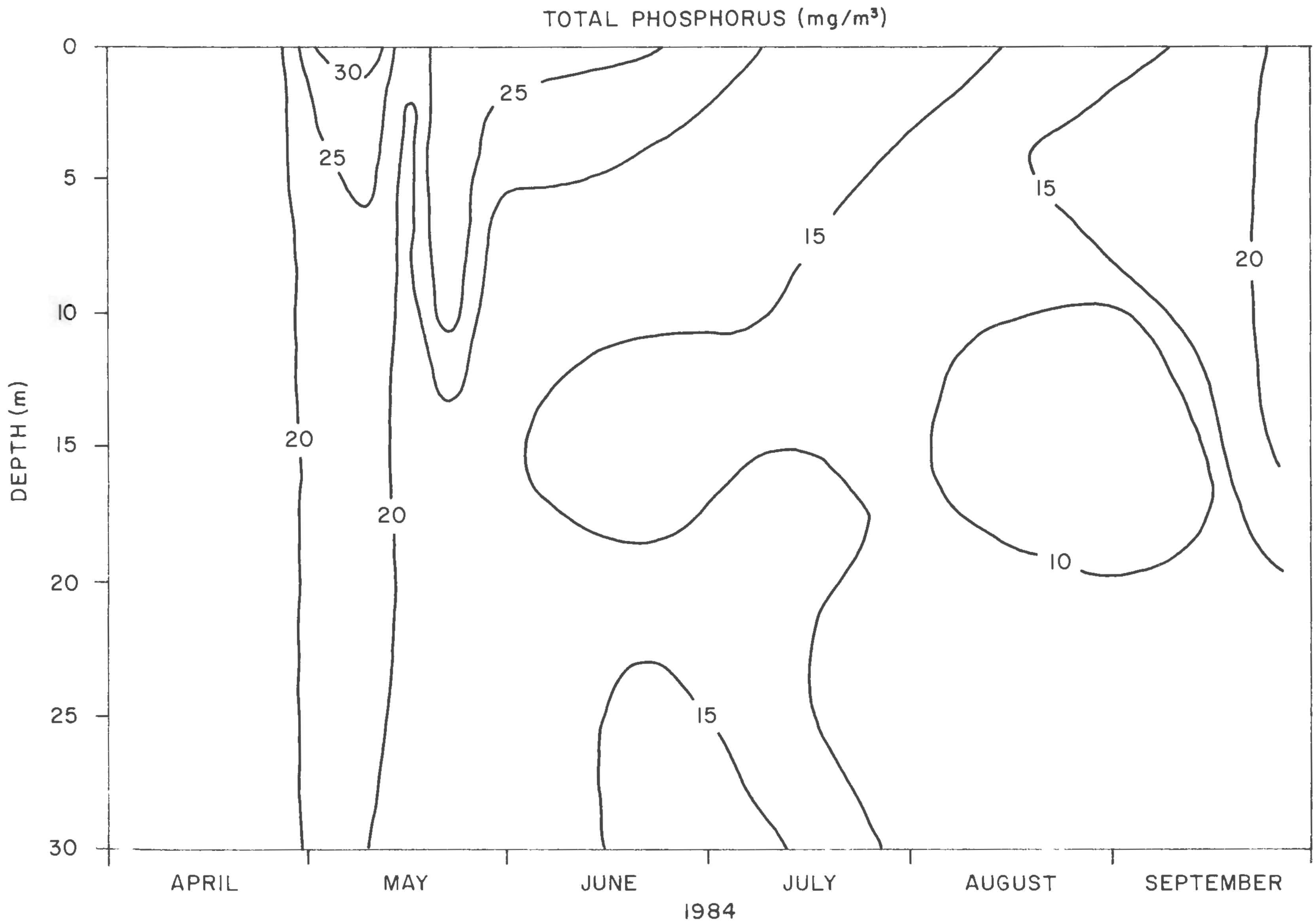


Figure 29. Depth-time isopleth plot for total phosphorus at a station off Kingland Bay, 1984.

Table 4. Results of dye decay bag experiment #1, begun on August 22, 1984. All bags were incubated at the surface. Concentrations are in ppb.

	Time (days)					
Replicate	0	7	15	21	27	35
1	1.23	.88	.52	.37	.11	.06
2	1.26	.91	.52	--	--	--
3	1.23	.88	.55	.37	--	--

Table 5. Results of dye decay bag experiment #2, begun on September 5. 1984. Single bags were incubated at three depths. Concentrations are in ppb.

	Time (days)		
Depth (m)	0	12	20
2	1.30	1.11	1.03
4	1.30	1.22	1.21
9	1.28	1.22	1.28

while the rates at the other depths were based on experiment #2 (Table 5). Figure 30 shows that the dye decay rates declined exponentially with depth, as would be expected from the fact that light intensity also declines exponentially with depth in lakes, and photochemical reactions are probably a major dye decay mechanism in Lake Champlain. To estimate the average dye decay rate in the epilimnion, the regression equation shown in Figure 30 was integrated over the 0-13 m depth range, producing an integral of 0.091 m/day, corresponding to an average dye decay rate of 0.0070 day^{-1} over the 13 m water column. It should be noted that dye decay rates measured in the bags would not include losses by adsorption and settling.

Phosphorus Decay Rate

Phosphorus "decay" in lakes occurs by the mechanism of settling of particulate matter. Empirical evidence derived from a large number of temperate lakes (Reckhow and Chapra, 1983) indicated that most lakes have annual phosphorus apparent settling velocities in the range of 4 to 22 m/yr, with mean values falling in the range of 10-16 m/yr, depending on the data set.

It is not certain, however, how well these settling rates would apply to the epilimnion of Lake Champlain during the summer. If the range of 4 to 22 m/yr were applied to the 13 m epilimnion of the lake, then a range for the first-order phosphorus decay rate of 0.0008 to 0.005 day^{-1} would result. It was found during the model calibration process (discussed later in this report) that a decay rate value of 0.001 day^{-1}, at the lower end of the range, provided the best calibration results. This was the value used in the model calibration, although the sensitivity of the model to different decay rates was also evaluated in a later report section.

Advection and Diffusion

The model used in this study (see equation 1) included terms for both advection and diffusion. However, it was anticipated that diffusive transport would dominate over advection for the large spatial scale studied. Therefore, no effort was made to quantify advective transport within the lake by identifying current patterns and measuring their velocities.

The assumption that dye and phosphorus transport could be modeled adequately by a diffusion model alone was supported by the sampling results. The lake phosphorus results (Figures 9-18) generally show a pattern of roughly

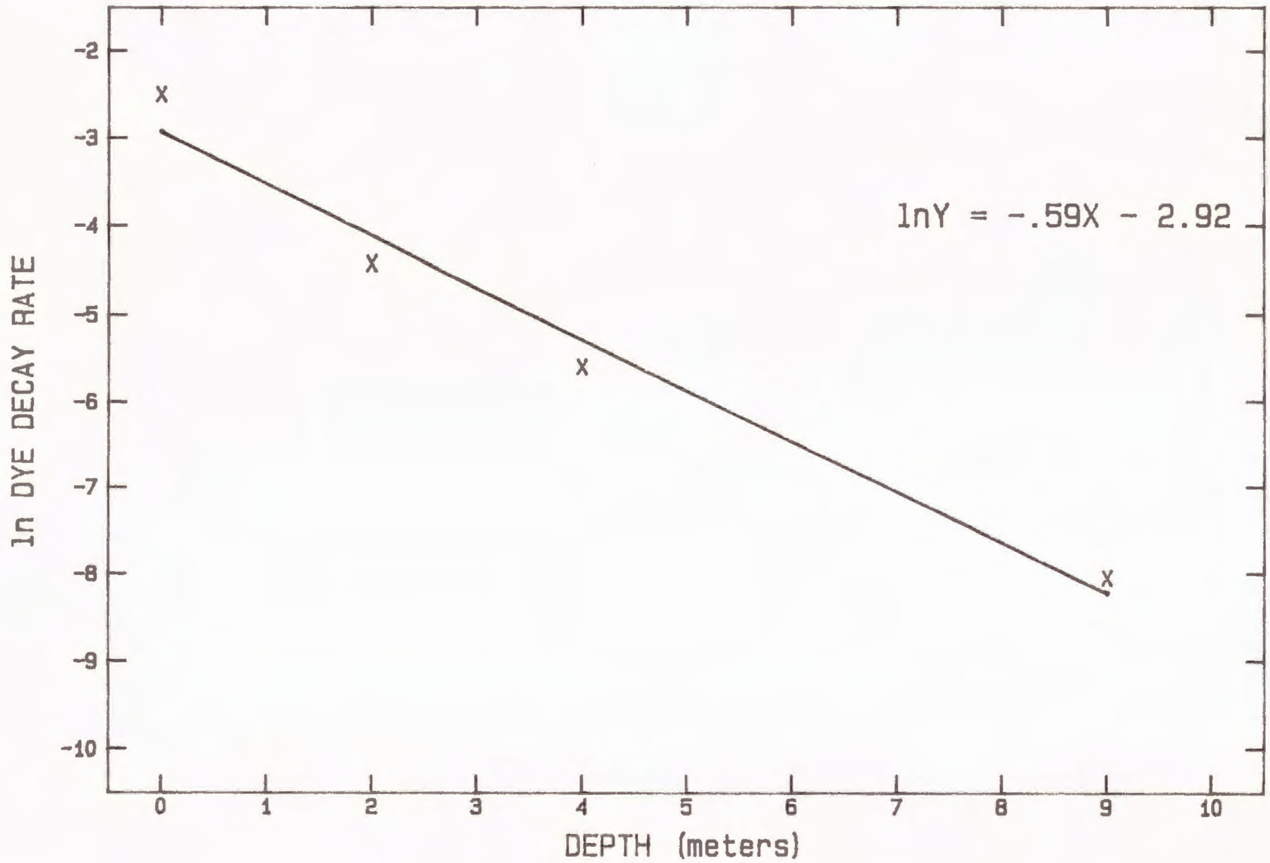


Figure 30. Regression of dye decay rate (day^{-1}) vs. depth.

concentric circular concentration contours radiating outward from the major river discharges, as would be expected from a diffusion model without advection. This is particularly well illustrated by the large scale sampling results from September 27 (Figure 18). The slight northeastward skew of the concentration contours shown on some dates may have resulted from advective transport driven by the northward lake flow or the prevailing south wind. However, this effect was minor, and it was found during the subsequent modeling work that the dye and phosphorus concentration distributions could be modeled adequately without including an advection term. The diffusion rates were evaluated by the model calibration procedure, as discussed later in this report.

MODEL CALIBRATION

The dye and phosphorus sampling efforts were intended to provide an opportunity to calibrate the model to two independent data sets: one for dye and one for phosphorus. However, the dye data proved to be of limited value for the modeling because of the very small area in which the dye was present at detectable concentrations. Therefore, the phosphorus results were used as the primary data for calibration, although the model was also calibrated to the dye data for comparative purposes.

Phosphorus Data

Before calibrating the model to the phosphorus data, the phosphorus sampling results (Figures 9-18) were examined to see whether the concentration pattern on a given date showed any relationship to recent wind or stream loading conditions. On certain dates, particularly during June and July, there were high concentrations and very sharp gradients present, while on other dates later in the summer the phosphorus concentrations were lower and somewhat more spatially homogeneous.

The concentration patterns showed no obvious relationship to major wind events, however (see Figure 25). Windy days were most frequent during the months of June and September, and there was no apparent correlation between the type of phosphorus concentration pattern present and the proximity to a major wind event.

Phosphorus loading rates varied considerably during the study period, as illustrated by Figure 22. Peak loadings occurred in June and July, with much lower stream flow and loading rates existing later in the summer. The high June and July loading rates probably accounted for the elevated phosphorus concentrations and sharp gradients observed earlier in the summer off the stream mouths. Because of these seasonal differences in loading rates, the model was calibrated to the phosphorus data separately for two time periods: June-July and August-September.

An initial attempt was made to calibrate the model to phosphorus concentrations over the entire study area. Considerable difficulty was encountered in doing this, however, because of the dominating effect of the Otter Creek inflow. A much more extensive lake sampling program extending farther southward and westward would have been necessary to adequately model the impact of Otter Creek on the lake. Because of these data limitations, it was decided to restrict the model to a smaller area of the lake nearer the hatchery discharge point, and to use the sampling data for the more distant areas to establish background, or "far-field" phosphorus concentrations. The reduced grid used for the phosphorus modeling (see Figures 31 and 32) used the same scale and cell configuration shown in Figure 28, except that all cells west of grid column 8 were eliminated. Preliminary modeling established that the effect of the Lewis and Little Otter Creek discharges were confined primarily to the area east of grid column 8.

The average phosphorus concentrations in each model cell during June-July and August-September, generated with the assistance of the P2D data display program, are shown in Figures 31 and 32. Diffusion rates were calibrated to this data using the S2D modeling program. Model input values used in the calibration process are given in Table 6. Starting with the initial phosphorus concentrations given in Table 6, the model was run through time until steady-state conditions were reached. The criterion for steady-state was that the time derivative of concentration should be less than 0.1 ppb in all model cells. For the conditions given in Table 6, the time required to achieve steady-state was about 20-30 days.

The S2D program also provided a means for statistically evaluating the fit of the simulated concentration in each cell to the observed data. The observed and estimated cell concentrations at steady-state were compared and various error statistics were calculated. A diffusion rate was calibrated so that the absolute value of the mean error across all cells was minimized. For the model input values given in Table 6, diffusion rates of 2×10^5 and 2×10^4 m^2/day were calibrated for June-July and August-September, respectively.

The phosphorus concentrations predicted from the calibrated models are compared with the observed data in Figures 31 and 32. Figure 31 shows that the calibrated fit to the June-July data was only fair, probably as a result of the great variability in lake phosphorus levels and loading rates observed during that period. The calibrated fit to the August-September data (see Figure 32) was reasonably good.

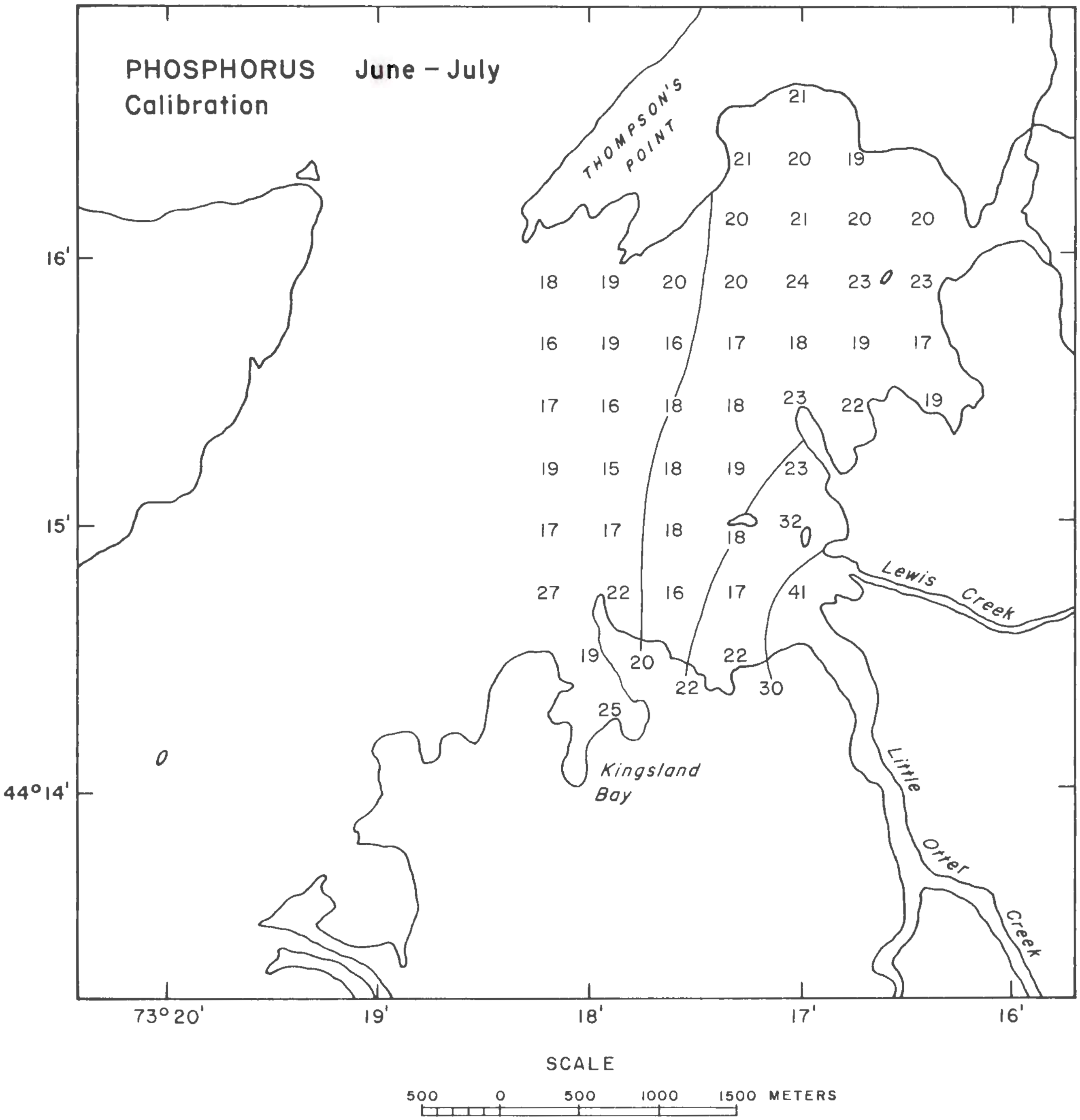


Figure 31. June-July average observed phosphorus concentrations (ppb) for each grid cell, compared with the concentration pattern predicted by the calibrated model (contour lines).

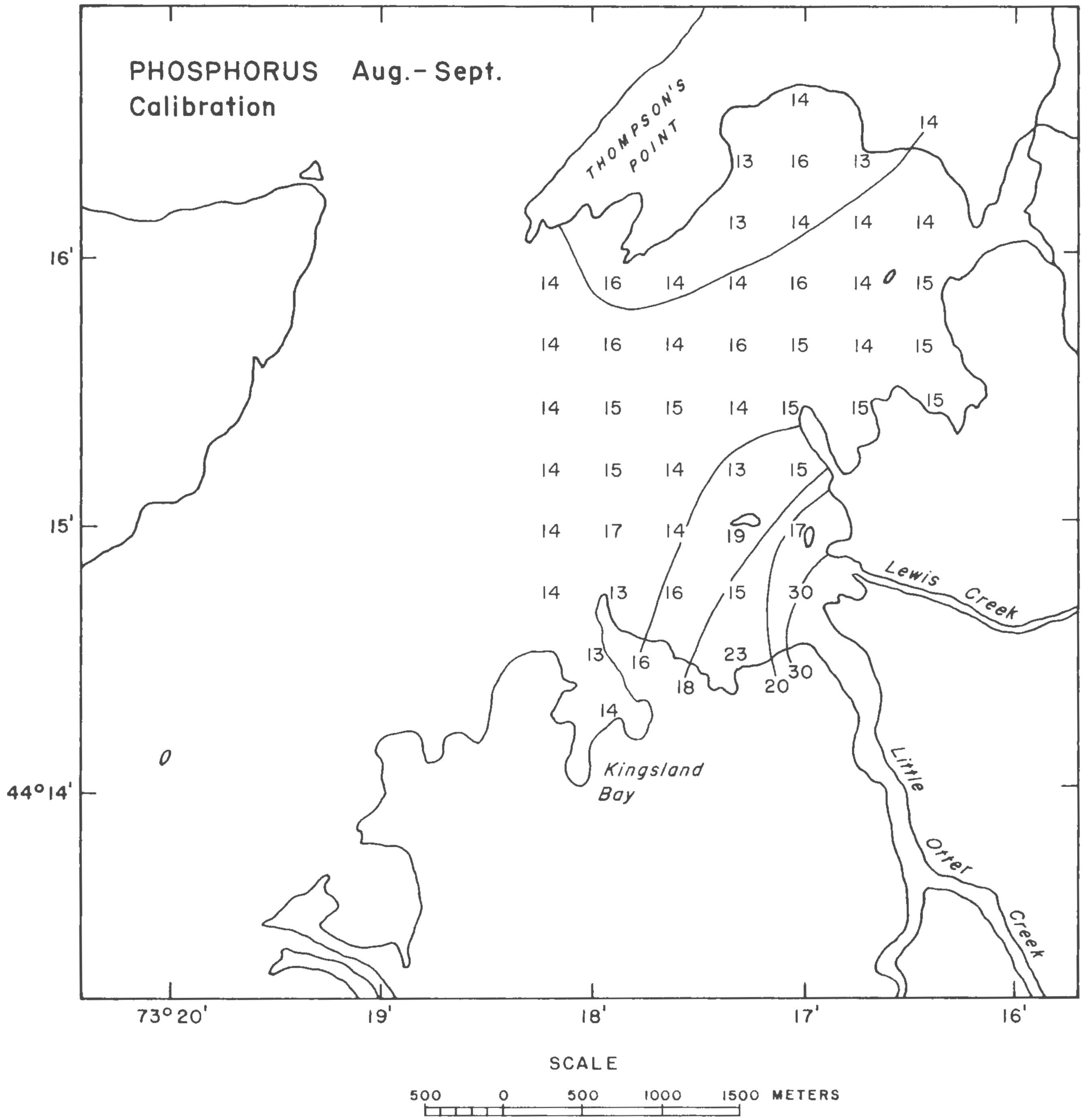


Figure 32. August-September average observed phosphorus concentrations (ppb) for each grid cell, compared with the concentration pattern predicted by the calibrated model (contour lines).

Table 6. Model input values used for calibration to the phosphorus data.

Term	June-July	August-September
Cell depths (m)	given in Figure 28	
Initial and far-field concentrations (ppb)	19	14
Phosphorus loading rate:		
Lewis and Little Otter		
Flow (m^3/day)	21.5×10^4	4.9×10^4
Concentration (ppb)	73	61
Thorp and Kimball		
Flow (m^3/day)	0.8×10^4	0.2×10^4
Concentration (ppb)	73	61
Advection other than discharge plumes (m^3/day)	0	0
Decay rate (day^{-1})	0.001	0.001
Calibrated diffusion rate (m^2/day)	2×10^5	2×10^4

Table 7. Model input values used for calibration to the dye data.

Term	Value
Cell depths (m)	given in Figure 28
Initial and far-field concentrations (ppb)	0
Dye loading rate:	
flow (m^3/day)	1.0
concentration (ppb)	87,000
Advection other than discharge plume (m^3/day)	0
Decay rate (day^{-1})	0.007
Calibrated diffusion rate (m^2/day)	7×10^5 (June - July) 2×10^5 (Aug. - Sept.)

Dye Data

Model calibration to the dye data was done by the same procedure as for the phosphorus calibration, except that the dye release was the loading source. A steady-state criterion of 0.001 ppb/day was used for the dye calibration. The average dye concentrations in each model cell observed during the two time periods (calculated with the assistance of the P2D data display program) are shown in Figures 33 and 34. Model input values used in the dye calibration process are given in Table 7. For the model input values given in Table 7, diffusion rates of 7×10^5 and 2×10^5 m^2/day were calibrated for June-July and August-September, respectively. The dye concentrations predicted from the calibrated model are compared with the observed data in Figures 33 and 34.

Calibration Discussion

The diffusion rates calibrated to the phosphorus data were considerably smaller than the diffusion rates calibrated to the dye data. This was especially true for the August-September time period. This lack of corroboration is unfortunate, and forces a decision as to which data set is more reliable. In this case, the phosphorus data clearly provides the better basis for model calibration. As noted earlier, the observed dye concentrations were at the extreme lower limits of fluorometric detection. Considerable error could have been involved in measuring such low levels. Furthermore, the dye decay rate could have been underestimated because losses by adsorption and settling were not evaluated in the bag experiments, and because of the assumption of complete dye mixing to the 13 m depth where decay rates were very low. For example, an August-September diffusion rate of 2×10^4 m^2/day (as calibrated to the phosphorus data) would have fit the dye data reasonably well if a dye decay rate in the range of 0.08 to 0.16 day^{-1} were used. This range corresponds to the decay rates measured in the surface bags (experiment #1), adjusted upwards to account for possible adsorption losses. Given these potential problems with the dye calibration, the use of the diffusion rates calibrated to the phosphorus data appears to be justified. The rates based on the phosphorus data were therefore used in all subsequent modeling and simulations.

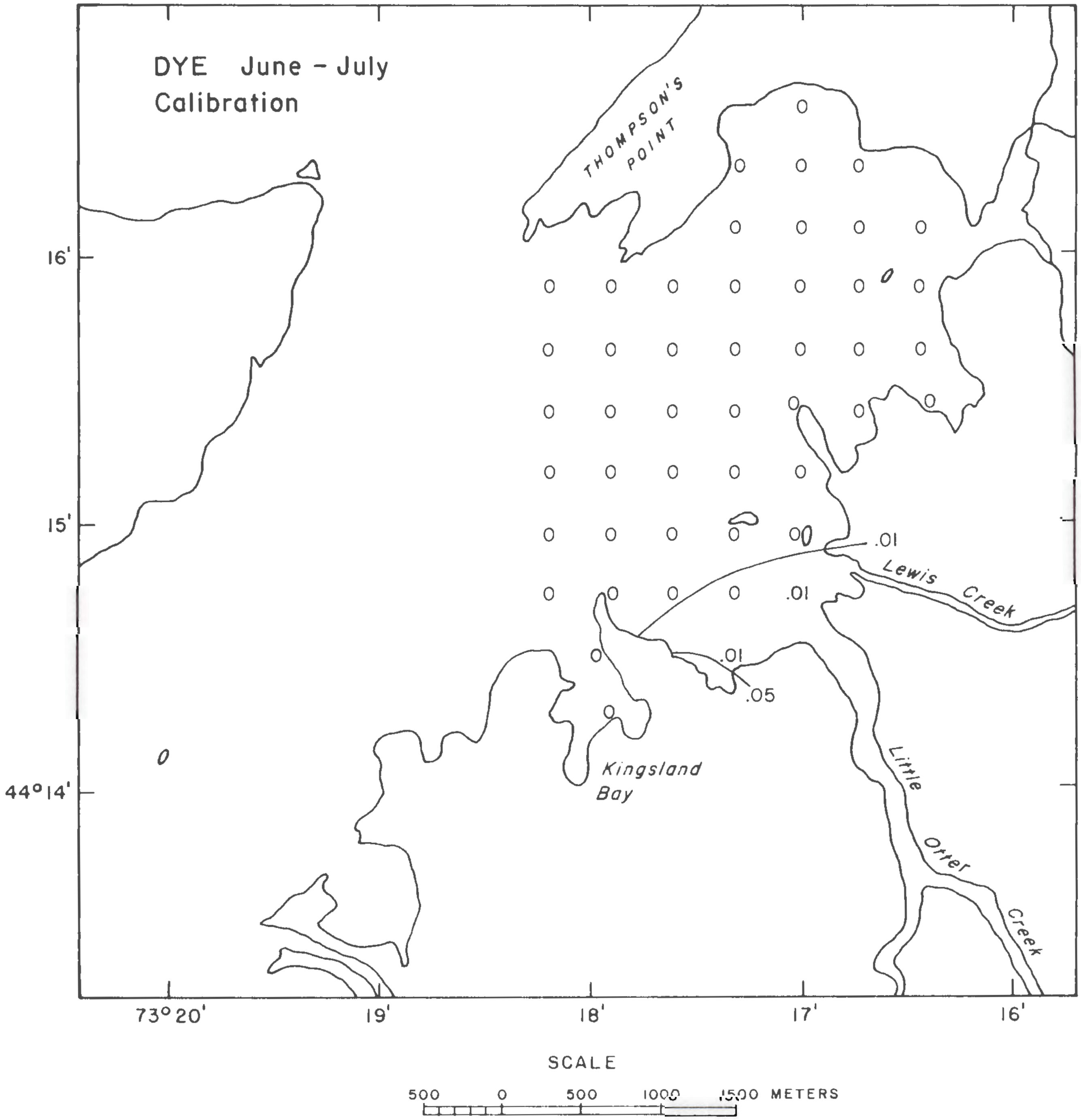


Figure 33. June-July average observed dye concentrations (ppb) for each grid cell, compared with the concentration pattern predicted by the calibrated model (contour lines).

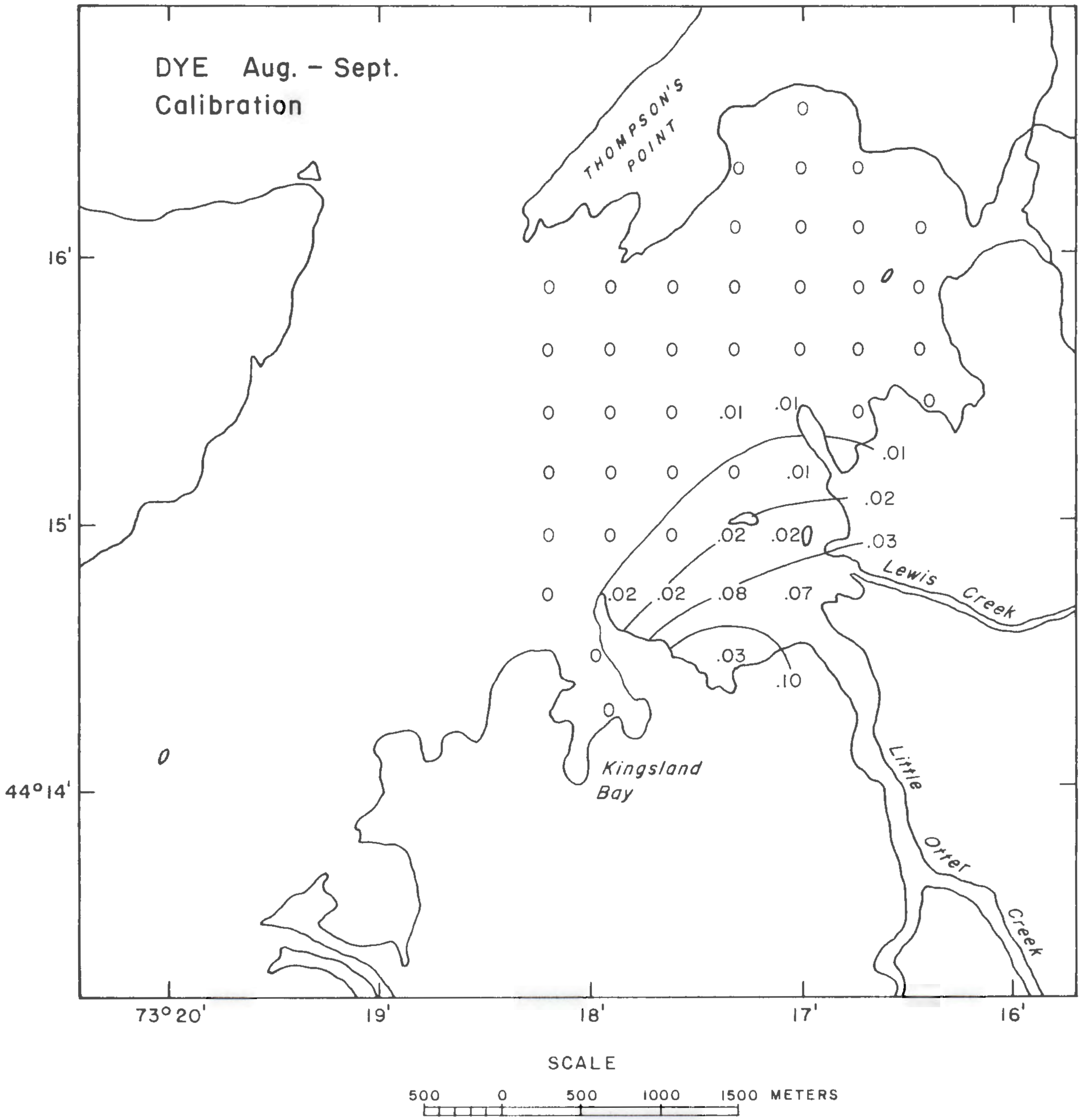


Figure 34. August-September average observed dye concentrations (ppb) for each grid cell, compared with the concentration pattern predicted by the calibrated model (contour lines).

Both the dye and the phosphorus data indicated that the August-September diffusion rate was much less than the June-July diffusion rate. There are at least two possible explanations for this observation. Average wind speeds were somewhat lower in August-September than in June-July, but the difference was not statistically significant. However, there was a mid-summer period of calm winds in July-August, as shown in Figure 25. It is possible that a delay might have existed between the time when the early summer winds calmed down and the time that lake circulation diminished. If this were true, then the reduced diffusion rate during August-September might be attributable to the mid-summer calm.

A second contributing factor to the reduced diffusion rate might have been the progressive development of extensive beds of aquatic plants in the shallower areas. The plants were not present over significant areas during June or July, but during the latter half of the summer they were quite abundant in the shallow areas, particularly in Hawkins Bay. As shown in Figure 35, submersed aquatic plants, primarily Eurasian milfoil (Myriophyllum spicatum) grew to the water's surface over about a third of Hawkins Bay during August. The presence of these plants may have inhibited diffusive mixing.

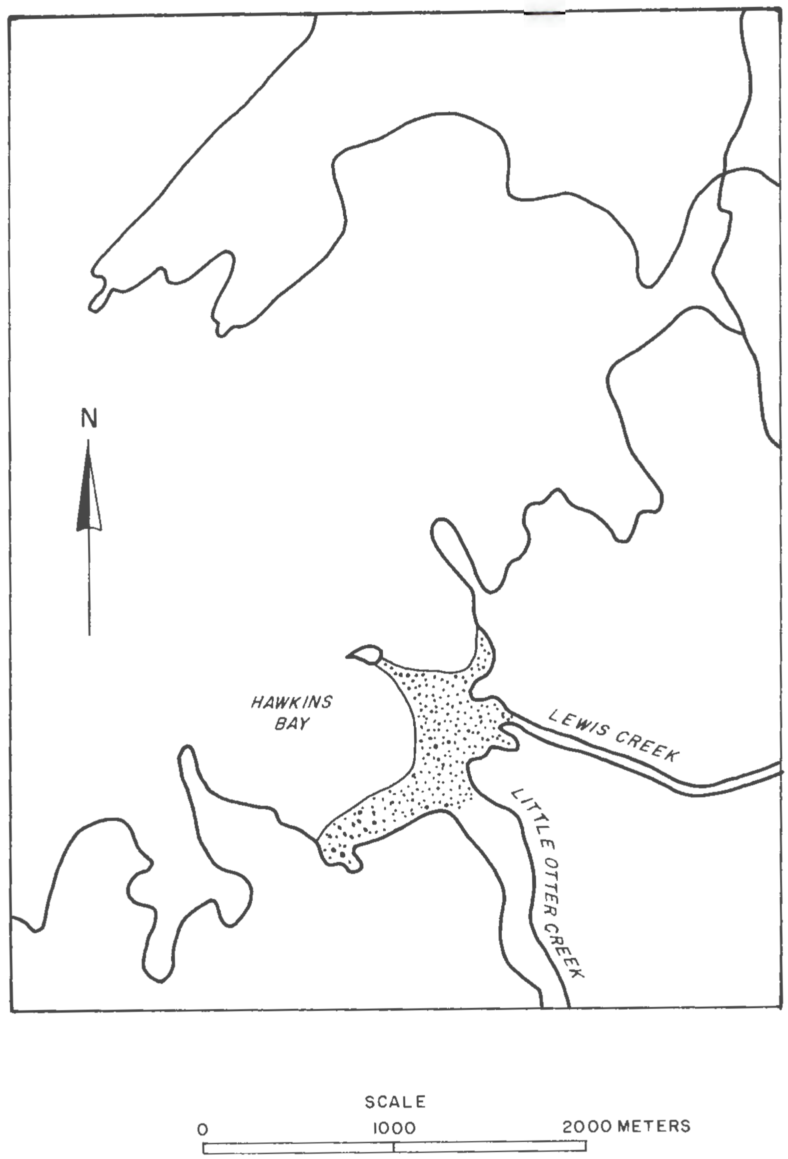


Figure 35. Area of aquatic plant growth in Hawkins Bay, mapped on August 21, 1984. Shaded area represents zone in which plants were present in dense beds extending to the water's surface.

HATCHERY DISCHARGE SIMULATIONS

The calibrated model was used to simulate the environmental impact of various phosphorus levels in the hatchery effluent. Two approaches were used in conducting these simulations. The first approach used the same model terms as were calibrated to the 1984 phosphorus data. Simulations based on this approach therefore represent the impact that the hatchery discharge would have had on the lake under 1984 conditions, assuming that all model terms were estimated accurately. The second approach involved a consideration of uncertainty in the estimates of the model terms and the sensitivity of the model conclusions to variations from the estimated values. This second approach provided a basis for determining how much confidence could be placed in the simulation results.

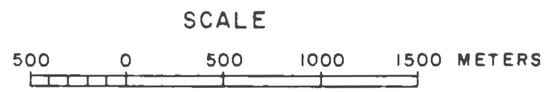
1984 Background Conditions

The model was run using the input values given in Table 6, with the additional phosphorus load from the hatchery discharge flow of 4.2×10^4 m^3/day (11.5 mgd). Various effluent phosphorus concentrations were simulated, including 25, 35, 45, 55, and 75 ppb. The simulations were limited to the August-September period when diffusion rates were critically low. The impact of a given effluent phosphorus level would be considerably less during the better diffusion conditions existing earlier in the summer. An additional simulation was done for an offshore discharge of 45 ppb located about 3000 ft offshore in the 12 m deep model cell at row 9, column 10 in Figure 28. The simulated lake phosphorus levels were compared with the levels existing during 1984 (shown in Figure 32) to determine the area that would be affected by the hatchery discharge. Figures 36-41 show the area of impact under various hatchery phosphorus loading conditions. In each of these figures, the lightly shaded regions represent the areas in which the hatchery discharge would result in an increase in the lake phosphorus level of 1-5 ppb. The darkly shaded regions represent the areas of greater than 5 ppb increase. The acreages impacted under each scenario are given in Table 8.

Figures 36-41 show that the hatchery discharge would have an impact over a considerable area of the lake during August and September at some of the higher effluent concentrations simulated (e.g. 55, 75 ppb). At the lowest effluent phosphorus concentration simulated (25 ppb), the impact was relatively minor and confined to Hawkins Bay. Figure 41 shows that discharging a 45 ppb effluent offshore would eliminate the areas of greater than 5 ppb impact that would have occurred with a 45 ppb shore discharge (Figure 38).

Table 8. The approximate area of Lake Champlain impacted by the hatchery discharge at various effluent phosphorus concentrations during August and September.

Effluent Concentration (ppb)	Area Impacted (acres): 1-5 ppb Increase	Area Impacted (acres): More than 5 ppb Increase
25	360	0
35	400	40
45	440	80
55	920	80
75	800	200
45 (offshore)	800	0



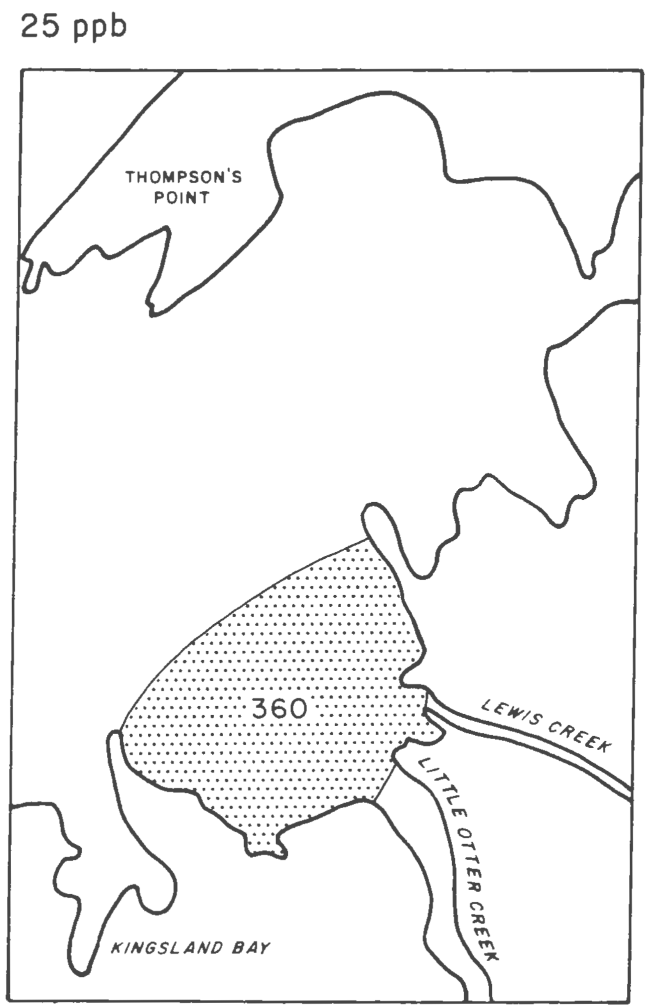


Figure 36. Hatchery discharge impact during August-September at an effluent phosphorus concentration of 25 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Corresponding acreages are indicated on the figure.

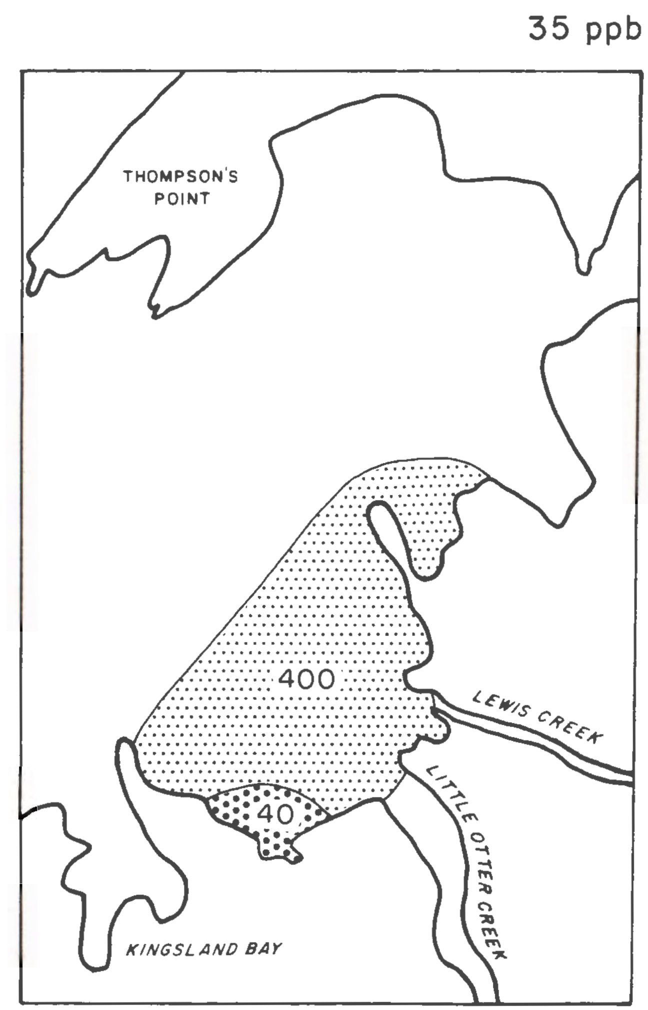
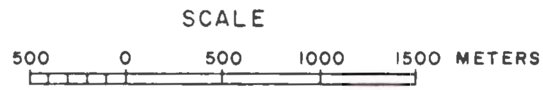
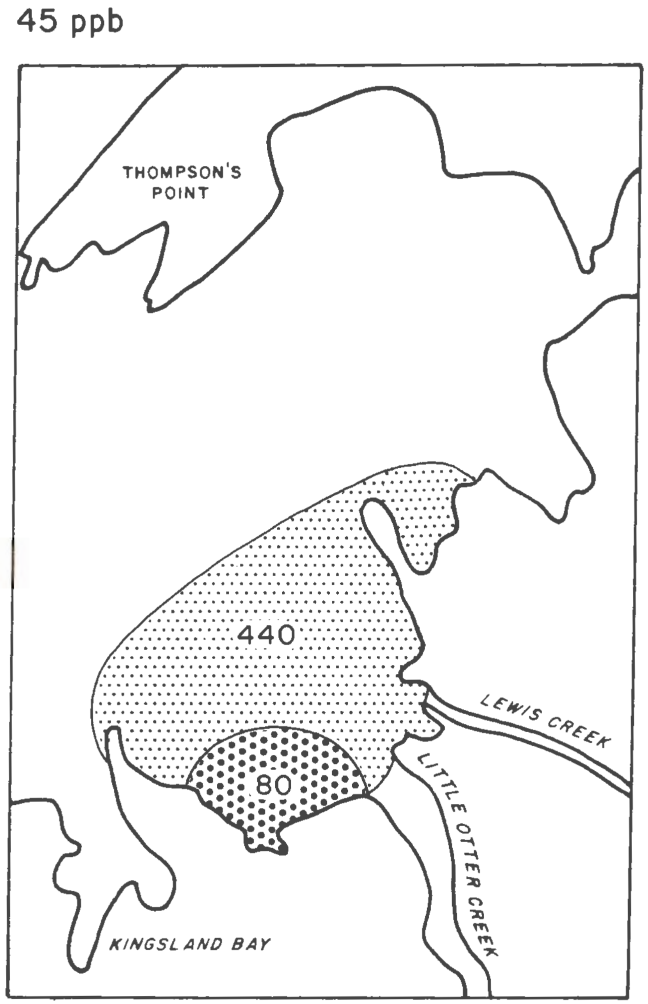


Figure 37. Hatchery discharge impact during August-September at an effluent phosphorus concentration of 35 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Darkly shaded regions are areas of greater than 5 ppb increase. Corresponding acreages are indicated on the figure.





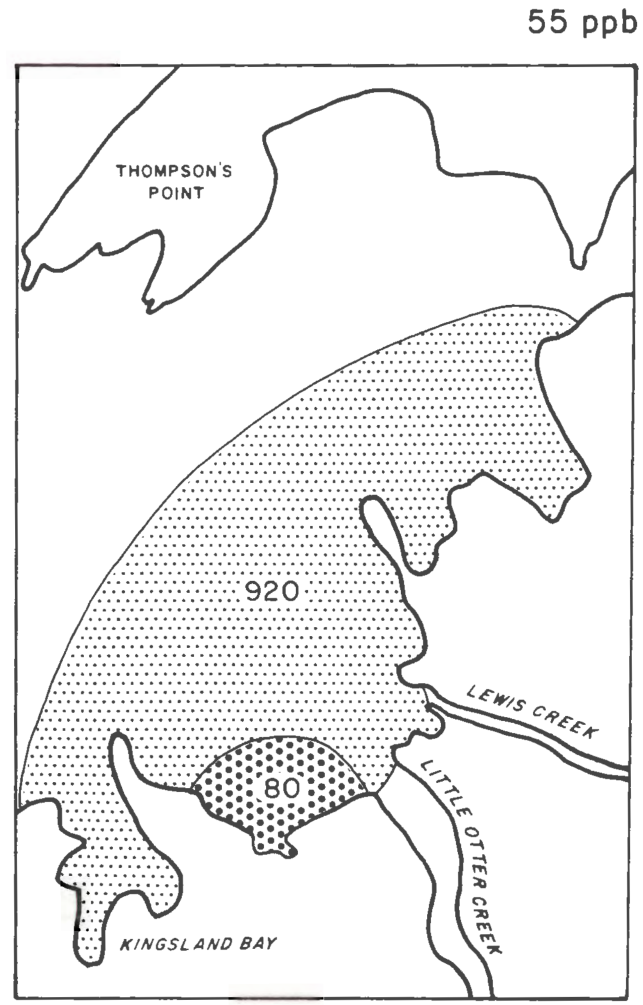
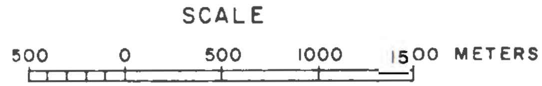


Figure 38. Hatchery discharge impact during August-September at an effluent phosphorus concentration of 45 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Darkly shaded regions are areas of greater than 5 ppb increase. Corresponding acreages are indicated on the figure.

Figure 39. Hatchery discharge impact during August-September at an effluent phosphorus concentration of 55 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Darkly shaded regions are areas of greater than 5 ppb increase. Corresponding acreages are indicated on the figure.



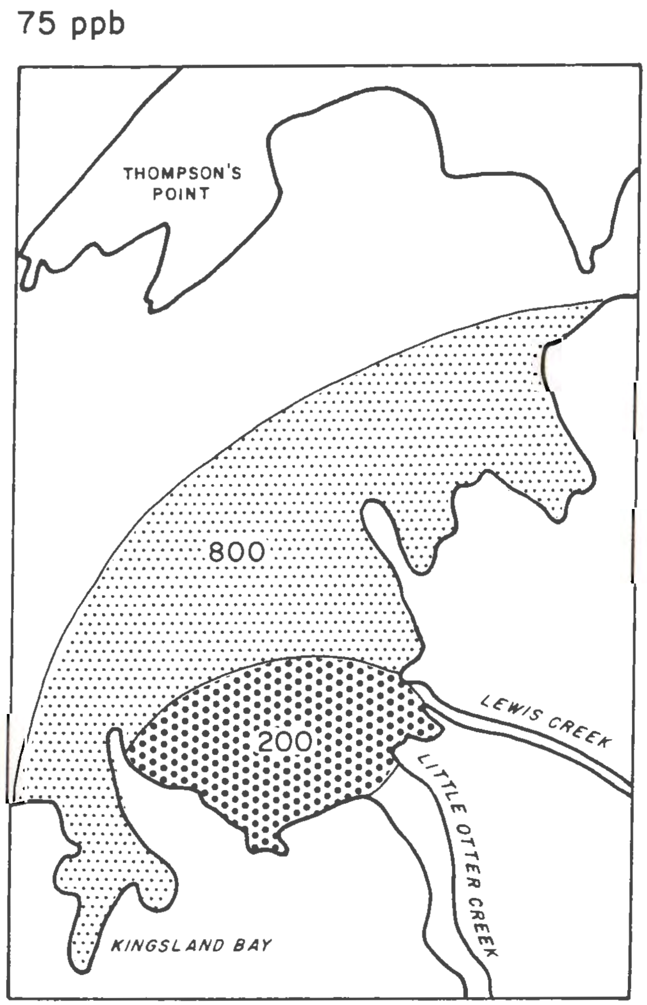


Figure 40. Hatchery discharge impact during August-September at an effluent phosphorus concentration of 75 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Darkly shaded regions are areas of greater than 5 ppb increase. Corresponding acreages are indicated on the figure.

Figure 41. Hatchery discharge impact during August-September with an offshore discharge of 45 ppb. Lightly shaded regions are areas of 1-5 ppb phosphorus increase. Corresponding acreages are indicated on the figure.

Uncertainty and Sensitivity Analysis

Because of the complexity of the calculations performed in running the simulation model, it was not possible to conduct a formal uncertainty analysis by techniques such as the Monte Carlo method (Chapra and Reckhow, 1983). It was possible, however, to estimate the uncertainty in the model input values and to examine the sensitivity of the model conclusions to possible variations in these values. The sensitivity analysis was conducted in two steps. The first step considered error in measuring the model input values under 1984 conditions. The major influence of this type of error would be on the calibrated value of the diffusion rate. The second step determined the sensitivity of the model conclusions to lake environmental conditions different from those used in the model calibration. Consideration of this type of variability permitted an evaluation of how well the model conclusions would apply to years when weather or other environmental conditions were different from those in 1984. The sensitivity analysis was limited to August-September conditions, because the simulation results showed that this was the period of most critical impact of the hatchery discharge.

To evaluate the effect of measurement error, the uncertainty in each of the model input terms was estimated. A likely range for each variable was determined and the high and low values in the range were used to recalibrate the model to the average August-September lake phosphorus concentrations. The recalibration procedures were conducted using the same statistical criteria described in the Model Calibration section. New calibrated values for the diffusion rate were obtained, reflecting the impact of variability in each input term.

The uncertainty ranges in each model term were estimated as follows. For the cell depths, Figures 26 and 27 were examined to determine the range over which the lake level and the epilimnion depth fluctuated during August and September, 1984. Lake levels declined by less than 1 meter during this period, while the epilimnion depth increased to a maximum of about 17 m later in the summer. Consequently the low end of the depth range was simulated by subtracting 1 m from the depth of each cell in Figure 28 that was more shallow than 13 m in depth. The high end of the depth range was simulated by changing the depths of the deeper cells from 13 m to 17 m. from 13 m to 17 m.

In the case of the August-September loading rate, the error statistics given in Table 3 suggest a 95% confidence range of about ± 9%, based on the variability among the daily rates. However, error in measuring flow or phosphorus concentrations might have contributed additional uncertainty, so a range of ± 20% was used for the estimates of high and low loading rates for the sensitivity analysis.

Far-field phosphorus concentrations in the lake also varied considerably during August and September, as shown in Figures 9-18. At the low end of the range, far-field concentrations of about 10 ppb were observed on September 7 (Figure 15). At the high end, far-field concentrations of about 18 ppb were observed on September 27 (Figure 18). The even higher levels recorded on September 19 (Figure 17) were considered anomalous. In conducting the sensitivity analysis for far-field concentrations, the diffusion rate was calibrated to the concentrations present on September 7 and September 27, representing the low and high far-field concentrations, respectively, rather than to the August-September average concentrations, as was done for all other model terms.

For the decay rate, the literature range was 0.0008 to 0.005 day^{-1}, as discussed earlier in this report. However, in conducting the sensitivity analysis, it was found that an adequate model calibration could not be obtained for decay rates higher than about 0.003 day^{-1}. Unrealistically low diffusion rates would have been necessary to maintain the observed phosphorus levels in the lake at the higher decay rates. For the purpose of the sensitivity analysis, therefore, a decay rate range of 0.0008 to 0.003 day^{-1} was used.

The results of the sensitivity analysis for variability derived from measurement error are shown in Table 9. The model terms were varied, one at a time, to find the new calibrated diffusion rates for the high and low ends of the variable ranges. Table 9 shows that the calibration procedure was relatively insensitive to cell depth and loading rate over the ranges used in the analysis. Use of high far-field concentrations, however, could raise the calibrated value for the diffusion rate to 1×10^5 m^2/day. Use of the higher decay rate would have dropped the calibrated diffusion rate to 4×10^3 m^2/day. This analysis suggests, therefore, an uncertainty range for the August-September diffusion rate of 4×10^3 to 1×10^5 m^2/day.

Table 9. The effect of measurement error in the model terms on the calibrated value for the diffusion rate.

Model Term	Input Value	Calibrated Diffusion Rate (m^2/day)
cell depths	low	2×10^4
	high	2×10^4
loading rate	low	7×10^3
	high	3×10^4
far-field conc.	low	2×10^4
	high	1×10^5
decay rate	low	2×10^4
	high	4×10^3
all terms	as for original calibration (Table 6)	2×10^4

The second phase of the sensitivity analysis evaluated the effect of variability in the input terms on the model conclusions. To simplify the analysis, a single model scenario was chosen, involving the impact of a 100 ppb hatchery discharge under August-September conditions. The area of the lake strongly impacted by the hatchery discharge (phosphorus concentrations increased by 5 ppb or more) was determined for the ranges of input values.

For the cell depths, the decay rate, and the diffusion rate, the ranges used in the first phase of the sensitivity analysis were maintained. It was assumed that year-to-year variations in these two terms would not exceed the ranges derived from their measurement uncertainty. Because of the model structure (see equation 1), variation in the loading rate and the far-field concentration would have no effect on the model conclusions. In other words, the hatchery discharge would impact the same number of model cells, regardless of stream loading or background lake phosphorus concentrations. Therefore, the sensitivity analysis was conducted only for cell depths, the decay rate, and the diffusion rate.

The results of the sensitivity analysis are shown in Table 10. The model terms were varied one at a time, and the sensitivity of the model conclusions to variations in each term was indicated by the number of grid cells where the addition of the hatchery discharge increased the phosphorus concentration by 5 ppb or more. Each grid cell represented an area of 1.6×10^5 m^2 (40 acres). Table 10 shows that the model conclusions were most sensitive to the diffusion rate, over the range of values used in the sensitivity analysis. As many as 17 cells or as few as one cell could be impacted by a hatchery discharge of 100 ppb, depending on the actual value of the diffusion rate. The model conclusions were much less sensitive to variations in lake level or the decay rate.

Figure 42 shows the outer limits of the areas that would be impacted with the high and low diffusion values, and with the originally calibrated value of 2×10^4 m^2/day. This figure is intended to provide at least a subjective means of evaluating the uncertainty in the model conclusions, as represented by Figures 36-41. The uncertainties in the estimates for the areas of impact for the August-September model scenarios would be roughly proportional to those shown in Figure 42. In other words, it is unlikely, but possible, that the area of impact could be about twice as large, or considerably less, than predicted using the originally calibrated model.

Table 10. Results of the sensitivity analysis.

Model Term	Input Value	* Number of Model Cells Impacted
cell depths	low	10
	high	7
decay rate	low	9
	high	6
diffusion rate	low	17
	high	1
all terms	as for original calibration (Table 6)	9

* based on a hatchery effluent phosphorus concentration of 100 ppb, and an "impact" criterion of a 5 ppb or greater increase in cell phosphorus concentration.

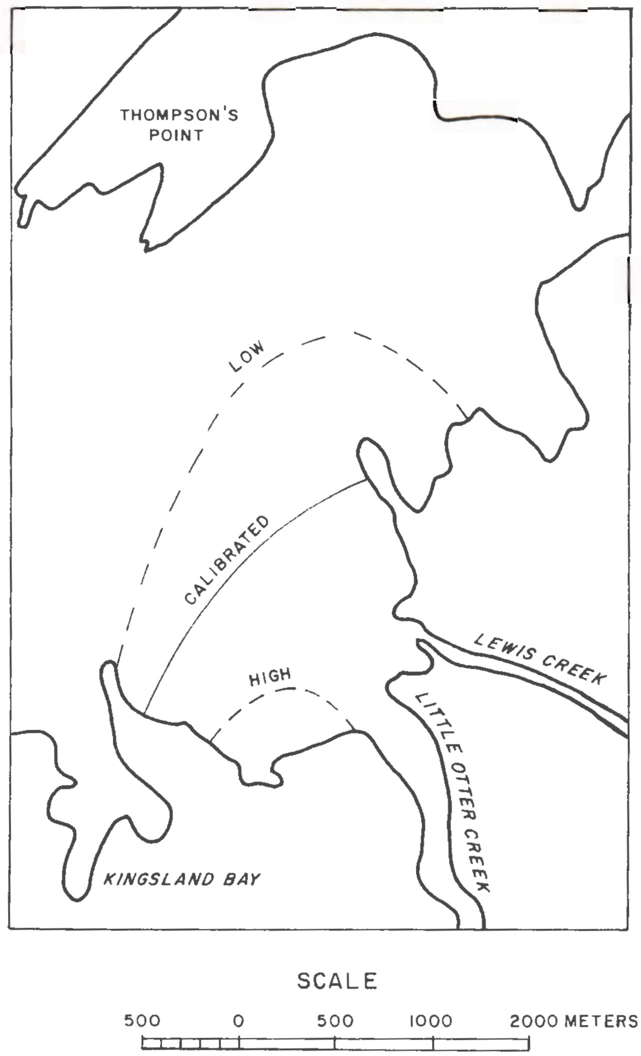


Figure 42. Outer limits of the areas of greater than 5 ppb impact for "low", "high", and "calibrated" values for the diffusion rate, using a hatchery effluent phosphorus concentration of 100 ppb.

DISCUSSION AND CONCLUSIONS

The key conclusions of this study are embodied in Figures 36-41, which illustrate the impact of various phosphorus levels in the hatchery effluent. These figures show that the hatchery discharge could have an impact over a considerable area of the lake during August and September at some of the higher effluent concentrations simulated. The impact would be relatively minor if the August-September effluent concentration were reduced to 25 ppb. Based on the consideration of uncertainty and model sensitivity, it is possible, although unlikely, that the areas of impact could be roughly twice as large as indicated in Figures 36-41. It is also possible that the areas of impact could be considerably less than indicated in these figures. These predictions (and the chlorophyll and transparency predictions discussed below) represent expected average conditions, and it should be understood that on a given day the lake water quality could differ considerably from the average condition. To some extent, the expected range of natural variability was included in the uncertainty estimate.

The current Vermont Water Quality Standards (Vermont Water Resources Board, 1985) prohibit any increase in nutrient levels in Lake Champlain which would "accelerate eutrophication....in a manner which has an undue adverse effect on any beneficial values or uses". It must be determined, therefore, whether the phosphorus increases in the lake resulting from the hatchery discharge would have such an undue adverse effect on values and uses including aesthetics, swimming, and recreation. In order to assist in the interpretation of this standard, the phosphorus changes predicted in Figures 36-4/ were transformed into more physically meaningful terms. For example, the linear nature of the chlorophyll vs. phosphorus relationship in the study area (see Figure 19) was used to predict the corresponding changes in algal abundance. A phosphorus increase of 1-5 ppb (as would occur in the lightly shaded areas of Figures 36-41) would represent a change of up to 20%, depending on the loading scenario and model cell considered. The quantity of algae suspended in the water would increase by about the same percentage. A phosphorus increase of greater than 5 ppb (as would occur in the darkly shaded regions of Figures 36-41) would correspond to an algae increase of up to 150%, depending on the loading scenario and model cell considered. The amount of algae growing attached to rocks and aquatic plants along the shoreline in the impacted zone would probably also increase, to an unknown extent.

It was also possible to predict the changes in water transparency that would result from the increased algal growth, based on the relationship between Secchi disc transparency (SD, m) and total phosphorus (P, ppb) in Lake Champlain (Smeltzer and Warren, 1983).

$$1/SD = .0093P + .058$$

This relationship indicated that a 1-5 ppb increase in phosphorus levels would reduce average transparency by up to 0.5 m (1.6 ft) from existing levels in the area, which average about 4-5 m (13-16 ft.). A greater than 5 ppb phosphorus increase, as would occur in the darkly shaded areas shown in Figures 36-41, would cause a transparency reduction of up to 2.2 m (7.2 ft).

In Figure 43, the predicted transparency changes in Hawkins Bay resulting from various August-September hatchery effluent phosphorus concentrations are compared with transparency conditions in other areas of Lake Champlain. The Lake Champlain data shown in Figure 43 represents 1979-1984 mean Secchi disc transparency values measured as part of the Vermont Lay Monitoring Program (data supplied by S. Warren). The transparency values for Hawkins Bay were based on the predicted phosphorus changes in a model cell located about 2000 feet north of the shore discharge location (row 10, column 11 in Figure 28). The predicted transparency changes would be greater than shown in Figure 43 in the model cell located closest to the discharge.

Figure 43 shows that under current conditions (no discharge) Hawkins Bay is about in the middle of the transparency range for Lake Champlain. A hatchery discharge of 45 ppb would reduce transparency to levels found off Button Bay further south in the lake. The effect of an offshore discharge of 45 ppb was not shown on Figure 43, but the transparency impact would be about the same as a 25 ppb shore discharge.

In order to arrive at a phosphorus limit for the hatchery discharge permit, the phosphorus predictions for the critical August-September period (Figures 36-41) and the transparency comparisons (Figure 43) should be used as the primary decision-making tools, with consideration given to the degree of prediction uncertainty involved. Ideally, the phosphorus level in the hatchery effluent should be reduced to as near 25 ppb as possible during the summer. Higher effluent levels will cause, to some degree, an adverse effect

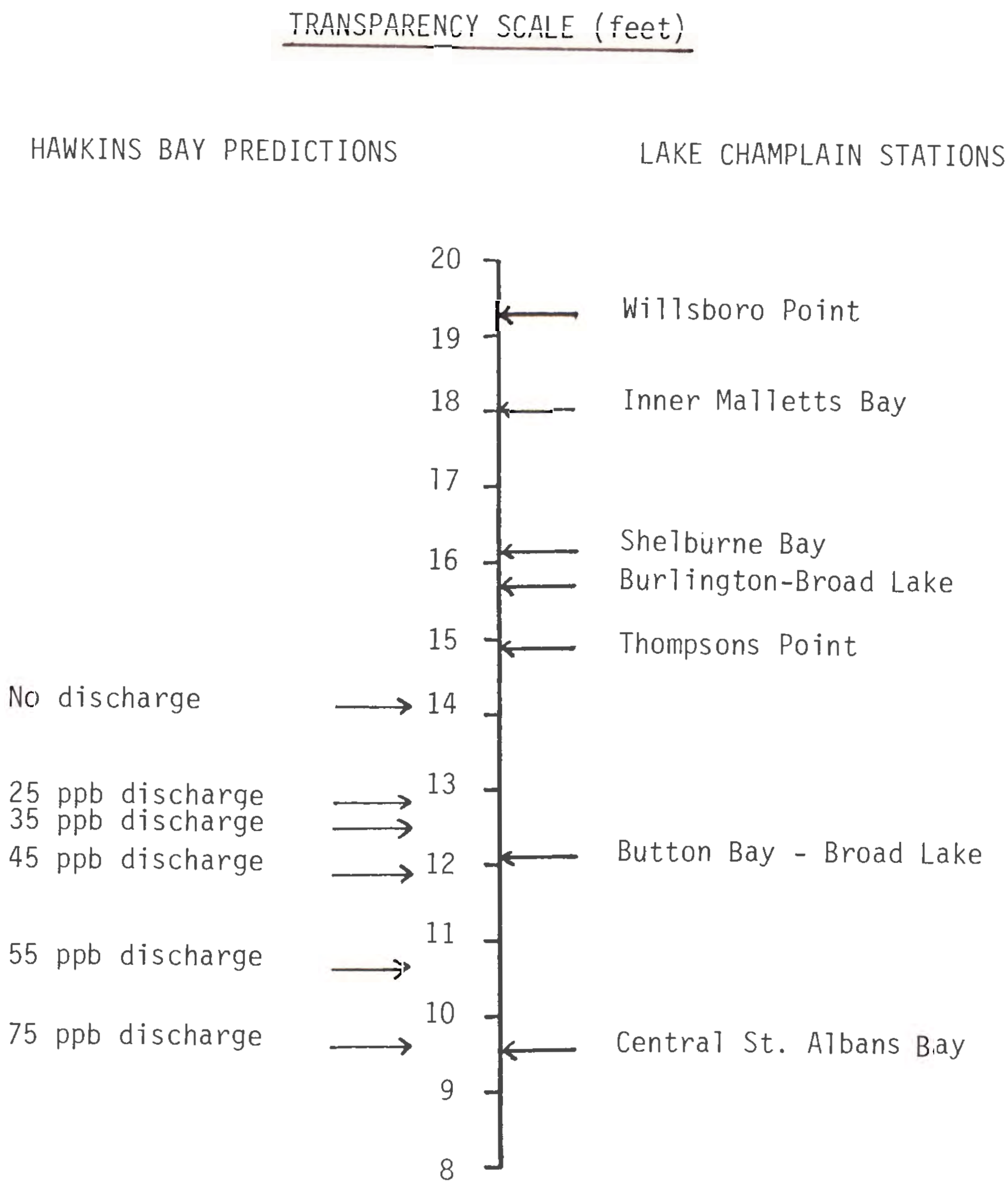


Figure 43. Predicted transparency changes in Hawkins Bay, compared with 1979-1984 mean transparency levels at seven locations in Lake Champlain.

on water quality in Hawkins Bay, manifested by increased algal "greenness" of the water and reduced water clarity. Unfortunately, the critical August-September period corresponds to the time of peak fish feeding in the hatchery. It may therefore be difficult or expensive to reduce the summer phosphorus discharge to levels as low as 25 ppb, although concentrations in the 30-50 ppb range appear to be feasible. To protect water quality in the lake, a serious effort should be made to reduce the effluent phosphorus concentration to the lowest level feasible. This effort should involve either changes in the hatchery operation, additional treatment of the waste stream, additional non-point source phosphorus controls in the region, or some combination of these.

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APPENDIX A

Dye Data

(Variable names indicate parameter and 1984 sample date.)

	Parameter Units
Latitude (LAT)	minutes at $44^{O}N$
Longitude (LON)	minutes at $73^{O}W$
Dye (DYE)	ppb

LAT6/18	LON6/18	DYE6/18
15.0000	17.5000	0.00000
14.9000	17.5000	0.00000
14.9000	17.5000	0.00000
14.7000	17.5000	0.00000
14.6000	17.5000	0.00000
[illegible]	17.5200	0.00000
[illegible]	17.6000	0.00000
[illegible]	17.4000	0.00000
14.6000	17.2000	0.00000
14.6000	17.2000	0.00000
14.6000	17.1000	0.00000
14.7000	17.1000	0.00000
14.8000	17.1000	0.00000
14.9000	17.1000	0.00000
15.0000	17.1000	0.00000
15.1000	17.1000	0.00000
15.2000	17.1000	0.00000
15.3000	17.1000	0.00000
14.7000	17.0000	0.00000
14.8500	16.8800	0.02300
14.9000	17.0000	0.00000

LAT6/26	LON6/26	DYE6/26
15.0000	19.8800	0.00000
15.0000	19.5000	0.00000
15.0000	19.0000	0.00000
15.0000	18.5000	0.00000
15.0000	18.0000	0.00000
15.0000	17.5000	0.00000
15.0000	17.0000	0.00000
16.0000	17.5000	0.00000
15.7500	17.5000	0.00000
15.5000	17.5000	0.00000
15.2500	17.5000	0.00000
15.0000	17.5000	0.00000
14.7500	17.5000	0.00000
14.5500	17.5000	0.02100
14.6000	17.5000	0.00000
14.6000	17.4000	0.00730
14.6000	17.3000	0.02300
14.6000	17.2000	0.00950
14.5800	17.1400	0.03700
14.5000	17.4000	0.03000
14.5300	17.3300	0.02600
14.6000	17.6200	0.00000
14.6200	17.0000	0.01700
14.7000	17.0000	0.00000
14.8000	17.0000	0.00000
14.9000	3.30000	0.00000
15.0000	17.0000	0.00000
15.1000	17.0000	0.00000
15.2000	17.0000	0.00000
15.3000	17.0000	0.00000
14.8400	16.7900	0.01900
14.5800	16.8600	0.05300

LAT7/10	LON7/10	DYE7/10
15.0000	17.5000	0.00740
14.9000	17.5000	0.00520
14.8000	17.5000	0.00520
14.7000	17.5000	0.00000
14.7000	17.5000	0.00000
14.6000	17.5000	0.00000
14.6000	17.6000	0.00000
14.6000	17.4000	0.00000
14.6000	17.3000	0.00000
14.6000	17.2000	0.00000
14.6300	17.0700	0.00000
17.1000	14.7000	0.00000
17.1000	14.9000	0.00000
17.1000	14.9000	0.00000
17.1000	15.0000	0.00000
15.5200	17.9200	0.00000

LAT7/24	LON7/24	DYE7/24
15.5000	19.5000	0.02200
15.5000	19.0000	0.00000
15.5000	18.5000	0.00000
15.5000	18.0000	0.00000
15.5000	17.5000	0.00000
15.5000	17.0000	0.01700
15.5000	16.5000	0.00000
15.7500	16.5000	0.00610
16.0000	16.5000	0.01600
16.2500	16.5000	0.00000
16.2500	17.0000	0.00000
16.0000	17.0000	0.00610
15.7500	17.0000	0.00930
15.2500	17.0000	0.00000
15.2500	17.5000	0.00000
15.0000	17.5000	0.00610
15.0000	17.0000	0.01600
16.0000	17.5000	0.01600
15.7500	17.5000	0.00000
14.8000	17.1000	0.09900
14.8000	17.3000	0.00000
14.8000	17.5000	0.00000
14.8000	17.7000	0.00000
14.8000	17.9000	0.00000
14.7000	17.9000	0.00000
14.7000	17.7000	0.00000
14.7000	17.5000	0.00000
14.7000	17.3000	0.00000
14.7000	17.1000	0.14325
14.6700	16.9900	0.21600
14.6000	17.1000	0.20600
14.6000	17.3000	0.02500
14.6000	17.5000	0.00000
14.9000	17.0000	0.07300
14.9000	17.2000	0.00000

LAT8/13	LON8/13	DYE8/13
15.5000	13.4500	0.00000
15.5000	19.0000	0.04200
15.5000	19.5000	0.00520
15.5000	18.0000	0.03900
15.5000	17.5000	0.02700
15.5000	17.0000	0.03900
15.5000	16.5000	[illegible]
15.6000	16.4500	0.01100
15.7000	16.4500	0.01100
15.8000	16.4500	0.00520
16.0000	16.4500	0.00000
16.1000	16.5000	0.00000
16.2000	16.5000	0.00000
16.2000	16.6000	0.00000
16.2000	16.9000	0.00000
16.2000	17.0000	0.00000
16.2000	17.2000	0.00000
16.2500	17.0000	0.00000
16.1000	17.0000	0.00000
16.0000	17.0000	0.00000
15.8000	17.0000	0.00000
15.5500	17.0000	0.01100
16.0000	17.5000	0.02400
15.8000	17.5000	0.03000
15.6000	17.5000	0.00830
15.4000	17.5000	0.00000
15.2000	17.5000	0.00000
15.1000	17.5000	0.00000
15.0000	17.5000	0.00000
14.9000	17.5000	0.00000
14.8000	17.5000	0.00000
14.7000	17.5000	0.00000
14.6000	17.5000	0.00000
14.5500	17.5000	0.01800
14.8000	17.9000	0.02700
14.8000	17.7000	0.03700
14.8000	17.5000	0.03700
14.8000	17.3000	0.02700
14.8000	17.1000	0.03700
14.7000	17.1000	0.01700
14.7000	17.3000	0.01700
14.7000	17.5000	0.01700
14.7800	17.7000	0.00740
14.7400	17.8700	0.00740
14.6800	17.0000	0.00740
14.6400	17.1000	0.03700
14.6400	17.3000	0.03700
14.5600	17.3800	0.00000
14.9000	17.0000	0.00000
14.9000	17.2000	0.05600
14.9000	17.4000	0.02400
14.9000	17.6000	0.01500
14.9000	17.8000	0.00520
14.9000	18.0000	0.00000
14.8000	17.0000	0.02700
14.6000	17.5000	0.00000

LAT8/15	LON8/15	DYE8/15
15.0000	19.5000	0.00000
15.0000	19.0000	0.00000
15.0000	18.7000	0.015[illegible]
15.0000	18.5000	0.03500
15.0000	18.0000	0.02[illegible]
15.[illegible]	17.5000	0.00000
[illegible]	17.0000	0.00000
14.[illegible]	17.2000	0.00000
14.9000	17.4000	0.00000
14.9000	17.6000	0.00000
14.9000	17.8000	0.00000
14.9000	18.0000	0.00000
14.9000	18.2000	0.00000
14.9000	18.4000	0.01500
14.8000	18.5000	0.02200
14.8000	18.3000	0.05600
14.8000	18.1000	0.06800
14.6000	18.5000	0.08200
14.6000	18.3000	0.06400
14.6000	18.1000	0.03400
14.8000	18.0000	0.07200
14.8000	17.8000	0.05200

LAT8/21	LON8/21	DYE8/21
14.5200	17.4800	0.02300
14.5500	17.3600	0.03400
14.5700	17.2500	0.02200
14.5600	17.5500	0.02300
14.6000	17.6000	0.01200
14.6000	17.5000	0.01900
14.6000	17.4000	0.01500
14.6000	17.3000	0.01500
14.6000	17.2000	0.03100
14.6000	17.1000	0.02900
14.7000	17.1000	0.01500
14.7000	17.2000	0.00000
14.7000	17.3000	0.00370
14.7000	17.4000	0.00700
14.7000	17.5000	0.00000
14.7000	17.6000	0.00000
14.7000	17.7000	0.00000
14.7000	17.8000	0.00000
14.7000	17.8700	0.00000
14.8000	18.0000	0.00000
14.8000	17.9000	0.00000
14.8000	17.8000	0.00000
14.8000	17.6000	0.00000
14.8000	17.4000	0.00000
14.8000	17.2000	0.00000
14.8000	17.0000	0.03700
14.9300	17.0500	0.00900
15.1200	17.1500	0.00000
15.2400	17.3700	0.00000
15.1000	17.8600	0.00000
14.7100	18.1500	0.00000
14.3400	17.9400	0.00000
15.5300	18.4400	0.00000

LAT8/29	LON8/29	DYE8/29
14.5400	17.4600	0.01000
14.5400	17.3200	0.00000
14.6000	17.6000	0.01000
14.6000	17.5000	0.01000
14.6000	17.4000	0.01000
14.6000	17.3000	1.14000
14.6000	17.2000	0.45000
14.6200	17.1200	0.35000
14.7000	17.1000	0.15000
14.7000	17.2000	0.65000
14.7000	17.3000	0.91000
14.7000	17.4000	0.01000
14.7000	17.5000	0.01000
14.7000	17.6000	0.03000
14.7000	17.7000	0.17000
14.7000	17.8000	0.11000
14.7000	17.8600	0.13000
14.8200	18.0000	0.01000
14.8000	17.3000	0.07000
14.8000	17.8000	0.13000
14.8000	17.7000	0.20000
14.8000	17.6000	0.04000
14.8000	17.5000	0.01000
14.8000	17.4000	0.03000
14.8000	17.3000	0.24000
14.8000	17.2000	0.30000
14.8000	17.1000	0.17000
14.8000	17.0000	0.06000
14.8000	18.1000	0.01000
14.8000	18.2000	0.01000
14.8000	18.3000	0.00000
14.8000	18.4000	0.01000
14.9000	16.9700	0.05000
14.9000	17.1000	0.33000
14.9000	17.2000	0.16000
14.9000	17.3000	0.07000
14.9000	17.4000	0.05000
15.2000	16.9000	0.02000
15.2000	17.1000	0.02000
15.2000	17.3000	0.01000
15.2000	17.5000	0.01000
15.2000	17.7000	0.01000
15.4000	17.8000	0.01000
15.4000	17.6000	0.01000
15.4000	17.4000	0.01000
15.4000	17.2000	0.01000
15.4000	17.0200	0.01000
15.3800	16.8000	0.00000
15.7900	16.8600	0.01000
15.9600	17.2500	0.01000
15.5600	18.1300	0.02000
15.2800	18.6000	0.00000
15.0000	18.7000	0.00000
14.8000	18.6000	0.00000
14.6000	18.5000	0.01000
14.6000	18.3000	0.01000
14.6000	18.0500	0.01000
14.4700	18.0500	0.00000

LAT9/6	LON9/6	DYE9/6
15.4000	18.7000	0.00000
15.2000	18.4300	0.00000
14.9700	18.1300	0.00000
14.8100	17.8900	0.00000
14.6300	17.6600	0.00000
14.5500	17.5000	0.00000
15.5700	17.3400	0.0[illegible]
14.6200	17.2800	0.00000
14.7800	17.1500	0.00980
14.9800	17.0100	0.00980
15.1700	17.0400	0.01500
15.4100	17.0400	0.01500
15.5900	16.8900	0.00980
15.8300	16.7300	0.00980
16.2200	16.6600	0.01800
16.0700	17.3100	0.00980
15.7600	17.4100	0.00000
15.3100	17.4500	0.00980
15.0200	17.4500	0.00000
14.7400	17.4900	0.00000
14.5500	17.5000	0.00000

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	10 LAT-9/13	11 LON-9/13	12 DYE-9/13	1 LAT-9/19	2 LON-9/19	4 DYE-9/19
1	16.5000	19.2500	0.00000	16.5000	19.2500	0.00000
2	16.5000	19.0000	0.00000	16.5000	19.0000	0.00000
3	16.5000	18.7500	0.00000	16.5000	18.7500	0.00000
4	16.5000	18.5000	0.00000	16.5000	18.5000	0.00000
5	16.5000	18.2500	0.00000	16.5000	18.2500	0.00000
6	16.5000	18.0000	0.00000	16.5000	18.0000	0.00000
7	16.2000	18.2500	0.00000	16.2000	18.2500	0.00000
8	16.2000	18.5000	0.00000	16.2000	18.5000	0.00000
9	16.2000	18.7500	0.00000	16.2000	18.7500	0.00000
10	16.2000	19.2500	2.79998E-03	16.2000	19.0000	0.00000
11	16.0000	19.2500	2.79998E-03	16.2000	19.2500	0.00000
12	16.0000	18.7500	0.00000	16.0000	19.2500	0.00000
13	16.0000	18.5000	0.00000	16.0000	19.0000	0.00000
14	16.0000	18.2500	0.00000	16.0000	18.7500	0.00000
15	16.0000	18.0000	8.39998E-03	16.0000	18.5000	0.00000
16	16.0000	17.5000	5.59999E-03	16.0000	18.2500	0.00000
17	16.0000	17.2500	2.79998E-03	16.0000	18.0000	0.00000
18	16.0000	17.0000	0.00000	16.0000	17.5000	0.00000
19	16.0000	16.7500	0.00000	16.0000	17.2500	0.00000
20	16.0000	16.5000	0.00000	16.0000	17.0000	0.00000
21	16.0000	16.7500	1.11999E-02	16.0000	16.7500	0.00000
22	16.2000	16.5000	0.00000	16.0000	16.5000	0.00000
23	16.2000	16.7500	0.00000	16.0000	16.2500	0.00000
24	16.2000	17.0000	0.00000	16.2000	16.5000	0.00000
25	16.2000	17.2500	0.00000	16.2000	16.7500	0.00000
26	16.3500	17.1500	5.59999E-03	16.2000	17.0000	0.00000
27	16.3900	16.9300	0.00000	16.2000	17.2500	0.00000
28	16.2900	16.7300	2.79998E-03	16.3500	17.1700	0.00000
29	15.8000	16.5000	0.00000	16.4000	16.9500	0.00000
30	15.8000	16.7500	8.39998E-03	16.3100	16.7300	0.00000
31	15.8000	17.0000	8.39998E-03	15.8000	16.5000	0.00000
32	15.8000	17.2500	1.11999E-02	15.8000	16.7500	0.00000
33	15.8000	17.5000	8.39998E-03	15.8000	17.0000	0.00000
34	15.8000	17.7500	2.79998E-03	15.8000	17.2500	0.00000
35	15.8000	18.0000	2.79998E-03	15.8000	17.5000	0.00000
36	15.8000	18.2500	0.00000	15.8000	17.7500	0.00000
37	15.8000	18.5000	0.00000	15.8000	18.0000	0.00000
38	15.8000	18.7500	0.00000	15.8000	18.2500	0.00000
39	15.8000	19.0000	0.00000	15.8000	18.5000	0.00000
40	15.6000	19.4000	2.79998E-03	15.8000	18.7500	0.00000
41	15.6000	19.0000	0.00000	15.8000	19.0000	0.00000
42	15.6000	18.7500	0.00000	15.8000	19.2500	0.00000
43	15.6000	18.5000	0.00000	15.6000	19.4000	0.00000
44	15.6000	18.2500	0.00000	15.6000	19.2500	0.00000
45	15.6000	18.0000	2.79998E-03	15.6000	19.0000	0.00000
46	15.6000	17.7500	2.79998E-03	15.6000	18.7500	0.00000
47	15.6000	17.5000	2.79998E-03	15.6000	18.5000	0.00000
48	15.6000	17.2500	2.24000E-02	15.6000	18.2500	0.00000
49	15.6000	17.0000	1.67999E-02	15.6000	18.0000	0.00[illegible]
50	15.6000	16.7500	2.79998E-03	15.6000	17.7500	0.0[illegible]
[illegible]	15.6000	16.5000	2.79998E-03	15.6000	17.5000	0.00000
52	15.6000	16.2900	2.79998E-03	15.6000	17.2500	0.00000
53	15.4000	16.7500	2.79998E-03	15.6000	17.0000	0.00000

COMMAND: PRINT DATA

VARIABLES:

CASE	10 LAT-9/13	11 LON-9/13	12 DYE-9/13	1 LAT-9/19	2 LON-9/19	4 DYE-9/19
54	15.4000	17.0000	1.96000E-02	15.6000	16.7500	0.00000
55	15.4000	17.2500	3.64000E-02	15.6000	16.5000	0.00000
56	15.4000	17.5000	0.00000	15.6000	16.2800	0.00000
57	15.4000	17.7500	2.79998E-03	15.4000	16.7500	0.00000
58	15.4000	18.0000	2.79998E-03	15.4000	17.0000	0.00000
59	15.4000	18.2500	0.00000	15.4000	17.2500	0.00000
60	15.4000	18.5000	0.00000	15.4000	17.5000	0.00000
61	15.4000	18.7500	0.00000	15.4000	17.7500	0.00000
62	15.4000	19.0000	0.00000	15.4000	18.0000	0.00000
63	15.4000	19.2500	0.00000	15.4000	18.2500	0.00000
64	15.4000	19.5000	0.00000	15.4000	18.5000	0.00000
65	15.2000	19.5000	0.00000	15.4000	18.7500	0.00000
66	15.2000	19.2500	0.00000	15.4000	19.0000	0.00000
67	15.2000	19.0000	0.00000	15.4000	19.2500	0.00000
68	15.2000	18.7500	0.00000	15.4000	19.5000	0.00000
69	15.2000	18.5000	0.00000	15.2000	19.5000	0.00000
70	15.2000	18.2500	0.00000	15.2000	19.2500	0.00000
71	15.2000	18.0000	0.00000	15.2000	19.0000	0.00000
72	15.2000	17.8000	0.00000	15.2000	18.7500	0.00000
73	15.2000	17.6000	2.79998E-03	15.2000	18.5000	0.00000
74	15.2000	17.4000	2.79998E-03	15.2000	18.2500	0.00000
75	15.2000	17.2000	2.24000E-02	15.2000	18.0000	0.00000
76	15.2000	17.0000	2.51999E-02	15.2000	17.8000	0.00000
77	15.0000	16.8700	2.24000E-02	15.2000	17.6000	0.00000
78	15.0000	17.0000	1.96000E-02	15.2000	17.4000	1.34999E-02
79	15.0000	17.1500	3.36000E-02	15.2000	17.2000	0.00000
80	15.0000	17.4000	1.40000E-02	15.2000	17.0000	4.29993E-03
81	15.0000	17.6000	2.79998E-03	15.0000	16.8600	6.63999E-02
82	15.0000	17.8000	0.00000	15.0000	17.0000	4.80000E-02
83	15.0000	18.0000	0.00000	15.0000	17.1500	0.00000
84	15.0000	18.2500	2.79998E-03	15.0000	17.4000	2.72999E-02
85	15.0000	18.5000	2.79998E-03	15.0000	17.6000	0.00000
86	15.0000	18.7500	0.00000	15.0000	17.8000	0.00000
87	15.0000	19.0000	0.00000	15.0000	18.0000	0.00000
88	15.0000	19.2500	0.00000	15.0000	18.2500	0.00000
89	15.0000	19.5000	0.00000	15.0000	18.5000	0.00000
90	14.8000	19.5000	0.00000	15.0000	18.7500	0.00000
91	14.8000	19.2500	0.00000	15.0000	19.0000	0.00000
92	14.8000	19.0000	2.79998E-03	15.0000	19.2500	0.00000
93	14.8000	18.7500	0.00000	15.0000	19.5000	0.00000
94	14.8000	18.5000	0.00000	14.8000	19.5000	0.00000
95	14.8000	18.2500	2.79998E-03	14.8000	19.2500	0.00000
96	14.8000	18.0000	2.79998E-03	14.8000	19.0000	0.00000
97	14.8000	17.8000	2.24000E-02	14.8000	18.6500	0.00000
98	14.8000	17.6000	2.79998E-03	14.8000	18.5000	0.00000
99	14.8000	17.4000	1.11999E-02	14.8000	18.2500	0.00000
100	14.8000	17.2000	1.11999E-02	14.8000	18.0000	0.00000
101	14.8000	17.0000	0.112000	14.8000	17.8000	0.00000
102	14.6000	17.2000	0.148400	14.8000	17.6000	0.00000
103	14.6000	17.4000	0.112000	14.8000	17.4000	8.89994E-03
104	14.6000	17.6000	8.40000E-02	14.6000	17.2000	0.00000
105	14.6100	18.0600	0.00000	14.6000	17.0000	0.112[illegible]
106	14.4100	18.0600	2.79998E-03	14.8500	16.5000	0.00000
107	14.3400	17.8200	8.39998E-03	14.7900	16.6300	0.00000
108	14.8900	16.9100	0.159600	14.8700	16.9100	0.00000

COMMAND: PRINT DATA

VARIABLES:

CASE	10 LAT-9/13	11 LON-9/13	12 DYE-9/13	1 LAT-9/19	2 LON-9/19	4 DYE-9/19
109	14.8200	16.6600	4.76000E-02	16.6500	17.0200	0.00000
110	14.8300	16.5000	4.76000E-02	14.1600	16.6600	0.00000
111	14.6800	17.0200	0.109200	13.6600	16.0000	0.00000
112	14.1900	16.7000	5.03999E-02	13.3600	16.0300	0.00000
113	13.6700	16.0200	5.60000E-02	14.6000	17.2800	0.00000
114	13.3800	16.0700	8.12000E-02	14.6000	17.4000	0.00000
115	14.6000	18.2500	0.00000	14.6000	17.6000	0.00000
116	14.6000	18.5000	0.00000	14.6200	18.0500	0.00000
117	14.6000	18.7500	0.00000	14.4300	18.0200	0.00000
118	14.6000	19.0000	0.00000	14.3400	17.8200	0.00000
119	14.6000	19.2500	0.00000	14.6000	18.2500	0.00000
120	14.6000	19.5000	0.00000	14.6000	18.5000	0.00000
121	14.4000	20.0000	0.00000	14.6000	18.7500	0.00000
122	14.4000	19.7500	0.00000	14.6000	19.0000	0.00000
123	14.4000	19.5000	0.00000	14.6000	19.2500	0.00000
124	14.4000	19.2500	0.00000	14.6000	19.5000	0.00000
125	14.4000	19.0000	0.00000	14.6000	19.7500	0.00000
126	14.4000	18.7500	0.00000	14.6000	20.0000	0.00000
127	14.4000	18.5000	5.59999E-03	14.4000	20.0000	0.00000
128	14.2000	19.2500	2.79998E-03	14.4000	19.7500	0.00000
129	14.2000	19.5000	0.00000	14.4000	19.5000	0.00000
130	14.2000	19.7500	0.00000	14.4000	19.2500	0.00000
131	14.2000	20.0000	5.59999E-03	14.4000	19.0000	0.00000
132	MISSING	MISSING	0.00000	14.4000	18.7500	0.00000
133	MISSING	MISSING	0.00000	14.4000	18.5000	0.00000
134	MISSING	MISSING	0.00000	14.2000	19.2500	0.00000
135	MISSING	MISSING	0.00000	14.2000	19.5000	0.00000
136	MISSING	MISSING	0.00000	14.2000	19.7500	0.00000
137	MISSING	MISSING	0.00000	14.2000	20.0000	0.00000

APPENDIX B

Phosphorus and Chlorophyll Data

(Variable names indicate parameter and 1984 sample date.)

	Parameter Units
Latitude (LAT)	minutes at 44^{o}N
Longitude (LON)	minutes at 73^{o}W
Total Phosphorus (TP)	ppb
Chlorophyll-a (CHL)	ppb

ABSTAT 3.04 FILE: B:DIFFUS REV#30

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	1 LAT-6/27	2 LON-6/27	3 TP-6/27	4 LAT-7/13	5 LON-7/13	6 TP-7/13	7 CHL-7/13
1	16.2000	19.2500	18.0000	16.5000	19.2500	17.0000	4.60000
2	16.2000	19.0000	18.0000	16.5000	19.0000	15.0000	5.00000
3	16.2000	18.7500	18.0000	16.5000	18.7500	15.0000	4.60000
4	16.2000	18.5000	18.0000	16.5000	18.5000	16.0000	3.80000
5	16.2000	18.2500	16.0000	16.5000	18.2500	16.0000	4.20000
6	16.0000	19.2500	19.0000	16.5000	18.0000	16.0000	4.20000
7	16.0000	19.0000	21.0000	16.2000	18.2500	15.0000	4.80000
8	16.0000	18.7500	18.0000	16.2000	18.5000	17.0000	4.40000
9	16.0000	18.5000	18.0000	16.2000	18.7500	17.0000	4.40000
10	16.0000	18.2500	18.0000	16.2000	19.0000	17.0000	4.60000
11	16.0000	18.0000	18.0000	16.2000	19.2500	20.0000	7.00000
12	15.8000	19.2500	18.0000	16.0000	19.2300	22.0000	7.00000
13	15.8000	19.0000	18.0000	16.0000	19.0000	23.0000	4.40000
14	15.8000	18.7500	20.0000	16.0000	18.7500	19.0000	5.60000
15	15.8000	18.5000	18.0000	16.0000	18.5000	18.0000	5.20000
16	15.8000	18.2500	17.0000	16.0000	18.2500	24.0000	7.00000
17	15.8000	18.0000	18.0000	16.0000	18.0000	24.0000	8.60000
18	15.8000	17.7500	19.0000	16.0000	17.5000	27.0000	5.00000
19	15.8000	17.5000	19.0000	16.0000	17.2500	25.0000	9.60000
20	15.8000	17.2500	18.0000	16.0000	17.0000	27.0000	9.00000
21	15.8000	17.0000	19.0000	16.0000	16.7500	24.0000	9.00000
22	15.8000	16.7500	22.0000	16.0000	16.5000	24.0000	7.40000
23	15.8000	16.5000	19.0000	16.0000	16.2500	23.0000	6.40000
24	16.0000	17.5000	19.0000	15.8000	16.5000	24.0000	8.80000
25	16.0000	17.2500	19.0000	15.8000	16.7500	27.0000	8.20000
26	16.0000	17.0000	19.0000	15.8000	17.0000	27.0000	8.20000
27	16.0000	16.7500	20.0000	15.8000	17.2500	23.0000	8.00000
28	16.0000	16.5000	18.0000	15.8000	17.5000	25.0000	6.20000
29	16.0000	16.2500	21.0000	15.8000	17.7500	24.0000	7.00000
30	16.2000	17.2500	22.0000	15.6000	18.0000	25.0000	7.00000
31	16.2000	17.0000	19.0000	15.8000	18.2500	22.0000	6.40000
32	16.2000	16.7500	18.0000	15.8000	18.5000	22.0000	5.80000
33	16.2000	16.5000	18.0000	15.8000	18.7500	21.0000	5.80000
34	16.1700	16.3000	21.0000	15.8000	19.0000	24.0000	6.60000
35	16.4000	17.2500	24.0000	15.8000	19.2500	18.0000	8.40000
36	16.3300	17.0000	19.0000	15.6000	19.3800	19.0000	8.60000
37	16.4000	16.7500	19.0000	15.6000	19.2500	27.0000	7.80000
38	15.6000	19.4300	14.0000	15.6000	19.0000	22.0000	6.60000
39	15.6000	19.2500	14.0000	15.6000	18.7500	18.0000	6.40000
40	15.6000	19.0000	15.0000	15.6000	18.5000	26.0000	7.80000
41	15.6000	18.7500	15.0000	15.6000	18.2500	20.0000	7.00000
42	15.6000	18.5000	15.0000	15.6000	18.0000	22.0000	9.00000
43	15.6000	18.2500	15.0000	15.6000	17.7500	21.0000	10.4000
44	15.6000	18.0000	15.0000	15.8000	17.5000	27.0000	10.2000
45	15.6000	17.7500	13.0000	15.8000	17.2500	21.0000	9.60000
46	15.6000	17.5000	17.0000	15.8000	17.0000	[illegible]	[illegible]
[illegible]	15.6000	17.2500	19.0000	15.6000	16.7500	23.0000	[illegible]
48	15.6000	17.0000	24.0000	15.9000	16.5000	21.0000	7.60000
49	15.6000	16.7500	24.0000	15.8000	16.2600	26.0000	8.20000
50	15.6000	16.5000	18.0000	15.4000	16.7500	36.0000	8.60000
51	15.6000	16.2500	21.0000	15.4000	17.0200	24.0000	8.60000
52	15.4000	19.5000	14.0000	15.4000	17.2500	25.0000	11.4000
53	15.4000	19.2500	15.0000	15.4000	17.5000	26.0000	10.2000

COMMAND: PRINT DATA

VARIABLES:

CASE	1 LAT-6/27	2 LON-6/27	3 TP-6/27	4 LAT-7/13	5 LON-7/13	6 TP-7/13	7 CHL-7/13
54	15.4000	19.0000	14.0000	15.4000	17.7500	26.0000	10.2000
55	15.4000	18.7500	15.0000	15.4000	18.0000	24.0000	9.00000
56	15.4000	18.5000	14.0000	15.4000	18.2500	26.0000	11.2000
57	15.4000	18.2500	15.0000	15.4000	18.5000	32.0000	9.80000
58	15.4000	18.0000	14.0000	15.4000	18.7500	33.0000	8.80000
59	15.4000	17.7500	15.0000	15.4000	19.0000	27.0000	9.60000
60	15.4000	17.5000	15.0000	15.4000	19.2500	28.0000	8.40000
61	15.4000	17.2500	14.0000	15.4000	19.5000	24.0000	9.40000
62	15.4000	17.0000	30.0000	15.3000	18.0000	23.0000	7.40000
63	15.4000	16.7500	16.0000	15.3000	17.8000	30.0000	10.4000
64	15.2000	19.7500	13.0000	15.3000	17.6000	28.0000	12.0000
65	15.2000	19.5000	21.0000	15.3000	17.4000	26.0000	11.6000
66	15.2000	19.2500	17.0000	15.3000	17.2000	22.0000	8.20000
67	15.2000	19.0000	16.0000	15.3000	17.0000	28.0000	9.00000
68	15.2000	18.7500	20.0000	15.2000	17.0000	31.0000	9.60000
69	15.2000	18.5000	16.0000	15.2000	17.2000	24.0000	11.0000
70	15.2000	18.2500	18.0000	15.2000	17.4000	26.0000	12.0000
71	15.2000	18.0000	14.0000	15.2000	17.6000	28.0000	11.8000
72	15.2000	17.8000	14.0000	15.2000	17.8000	32.0000	11.4000
73	15.2000	17.6000	13.0000	15.2000	18.0000	23.0000	11.4000
74	15.2000	17.4000	15.0000	15.2000	18.2500	30.0000	11.0000
75	15.2000	17.2000	14.0000	15.2000	18.5000	25.0000	8.00000
76	15.2000	17.0000	18.0000	15.2000	18.7500	23.0000	8.20000
77	15.2000	16.9000	34.0000	15.2000	19.0000	36.0000	7.00000
78	15.1000	18.0000	14.0000	15.2000	19.2500	25.0000	7.80000
79	15.1000	17.8000	15.0000	15.2000	19.5000	36.0000	9.20000
80	15.1000	17.6000	13.0000	15.1000	18.0000	27.0000	9.80000
81	15.1000	17.4000	15.0000	15.1000	17.8000	26.0000	9.20000
82	15.1000	17.2000	14.0000	15.1000	17.6000	23.0000	9.80000
83	15.1000	17.0000	31.0000	15.1000	17.4000	24.0000	9.20000
84	15.1000	16.9000	30.0000	15.1000	17.2000	24.0000	6.20000
85	15.0000	19.7500	16.0000	15.1000	17.0000	29.0000	5.80000
86	15.0000	19.5000	19.0000	15.0000	16.8000	34.0000	6.80000
87	15.0000	19.2500	17.0000	15.0000	17.0000	27.0000	6.80000
88	15.0000	19.0000	19.0000	15.0000	17.1700	25.0000	8.80000
89	15.0000	18.7500	15.0000	15.0000	17.4000	24.0000	10.4000
90	15.0000	18.5000	14.0000	15.0000	17.6000	27.0000	9.20000
91	15.0000	18.2500	16.0000	15.0000	17.8000	25.0000	9.40000
92	15.0000	18.0000	15.0000	15.0000	18.0000	27.0000	9.80000
93	15.0000	17.8000	16.0000	15.0000	18.2500	24.0000	10.4000
94	15.0000	17.6000	15.0000	15.0000	18.5000	34.0000	10.4000
95	15.0000	17.4000	15.0000	15.0000	18.7500	36.0000	9.00000
96	15.0000	17.1000	18.0000	15.0000	19.0000	32.0000	10.2000
97	15.0000	17.0000	34.0000	15.0000	19.2500	29.0000	8.40000
98	15.0000	16.8000	73.0000	15.0000	19.5000	25.0000	8.20000
99	14.9000	18.0000	18.0000	14.9000	18.0000	25.0000	8.60000
100	14.9000	17.8000	14.0000	14.9000	17.8000	24.0000	7.40000
101	14.9000	17.6000	15.0000	14.9000	17.6000	[illegible]	[illegible]
102	14.9000	17.4000	15.0000	14.9000	17.4000	[illegible]	[illegible]
103	14.9000	17.2000	14.0000	14.9000	17.2000	[illegible]	[illegible]
104	14.9000	17.0000	39.0000	14.9000	17.0000	26.0000	5.60000
105	14.9000	16.9000	50.0000	14.8000	17.0000	42.0000	8.60000
106	14.8000	18.7500	20.0000	14.8000	17.2000	23.0000	5.80000
107	14.8000	18.5000	26.0000	14.8000	17.4000	22.0000	6.60000
108	14.8000	18.2500	32.0000	14.8000	17.6000	23.0000	9.00000

ABSTAT 3.04 FILE: B:DIFFUS REV#30

COMMAND: PRINT DATA

VARIABLES:

CASE	1 LAT-6/27	2 LON-6/27	3 TP-6/27	4 LAT-7/13	5 LON-7/13	6 TP-7/13	7 CHL-7/13
109	14.8000	18.0000	31.0000	14.8000	17.8000	27.0000	8.20000
110	14.8000	17.8000	14.0000	14.8000	18.0000	23.0000	7.20000
111	14.8000	17.6000	14.0000	14.8000	18.2500	26.0000	8.00000
112	14.8000	17.4000	14.0000	14.8000	18.5000	37.0000	9.80000
113	14.8000	17.2000	15.0000	14.8000	18.7500	32.0000	9.80000
114	14.8000	17.0000	36.0000	14.8000	19.0000	32.0000	9.40000
115	14.8000	16.9000	57.0000	14.8000	19.2500	34.0000	9.80000
116	14.7000	17.8000	13.0000	14.8000	19.5000	38.0000	9.80000
117	14.7000	17.6000	20.0000	14.6000	19.5000	41.0000	11.4000
118	14.7000	17.4000	19.0000	14.6000	19.2500	35.0000	10.4000
119	14.7000	17.2000	15.0000	14.6000	19.0000	34.0000	10.2000
120	14.7000	17.0000	50.0000	14.6000	18.7500	32.0000	8.40000
121	14.7000	16.9000	68.0000	14.6000	18.5000	25.0000	7.40000
122	14.6000	19.7500	15.0000	14.6000	18.2500	24.0000	8.40000
123	14.6000	19.5000	15.0000	14.6000	18.0000	24.0000	7.20000
124	14.6000	19.2500	15.0000	14.4600	18.0000	24.0000	7.20000
125	14.6000	19.0000	22.0000	14.3200	17.9500	27.0000	7.20000
126	14.6000	18.7500	31.0000	14.7000	17.8000	26.0000	7.60000
127	14.6000	18.5000	34.0000	14.7000	17.6000	24.0000	8.20000
128	14.6000	18.2500	33.0000	14.7000	17.4000	21.0000	6.60000
129	14.6000	18.0000	16.0000	14.7000	17.2000	23.0000	5.40000
130	14.6000	17.6000	18.0000	14.7000	17.0500	46.0000	8.40000
131	14.6000	17.4000	20.0000	14.6000	17.2000	22.0000	4.60000
132	14.6000	17.2000	23.0000	14.6000	17.4000	22.0000	5.60000
133	14.6000	17.1500	28.0000	14.6000	17.6000	27.0000	7.20000
134	14.5000	17.4000	34.0000	14.5500	17.3600	23.0000	4.60000
135	14.5000	18.0000	15.0000	14.6300	16.8900	51.0000	MISSING
136	14.4000	18.0000	16.0000	14.3300	16.7000	65.0000	MISSING
137	14.3000	18.0000	15.0000	13.8800	16.3700	73.0000	9.80000
138	14.3000	17.8000	15.0000	13.8800	16.3700	MISSING	MISSING
139	14.4000	19.5000	30.0000	13.5300	15.9700	79.0000	MISSING
140	14.4000	19.2500	32.0000	13.3600	15.9700	104.000	MISSING
141	14.4000	19.0000	40.0000	14.8600	16.9100	65.0000	5.20000
142	14.4000	18.7500	20.0000	14.8000	16.5900	62.0000	MISSING
143	14.4000	18.5200	27.0000	14.9300	16.4600	57.0000	MISSING
144	14.2000	19.5000	40.0000	14.9300	16.4600	MISSING	MISSING
145	14.2000	19.2500	37.0000	14.9000	16.3200	65.0000	MISSING
146	14.8000	19.0000	15.0000	14.4000	18.5000	26.0000	6.80000
147	14.8000	19.2500	14.0000	14.4000	18.7500	24.0000	8.60000
148	14.8000	19.5000	15.0000	14.4000	19.0000	21.0000	7.20000
149	14.8000	19.7500	14.0000	14.4000	19.2500	21.0000	7.40000
150	14.8400	16.7600	63.0000	14.4000	19.5000	21.0000	7.40000
151	14.8100	16.5500	56.0000	14.4000	19.7500	20.0000	7.40000
152	14.9000	16.4100	41.0000	14.4000	20.0000	41.0000	15.4000
153	14.8400	16.0400	42.0000	14.2000	20.0000	38.0000	14.0000
154	14.7700	15.9500	43.0000	14.2000	19.7500	20.0000	9.40000
155	14.5700	16.8600	85.0000	14.2000	19.5000	23.0000	[illegible]
156	14.3600	16.6500	85.0000	14.2000	19.2500	24.0000	[illegible]
157	13.9400	16.5600	130.000	16.2000	16.4300	27.0000	7.40000
158	13.5800	15.9100	96.0000	16.2000	16.7500	22.0000	7.40000
159	13.1700	15.4900	111.000	16.2000	17.0000	24.0000	7.80000
160	MISSING	MISSING	MISSING	16.2000	17.2500	24.0000	7.60000
161	MISSING	MISSING	MISSING	16.3600	17.2200	25.0000	7.00000
162	MISSING	MISSING	MISSING	16.3800	16.9900	24.0000	8.20000
163	MISSING	MISSING	MISSING	16.3300	[illegible]	25.0000	8.40000

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	9 LAT-7/26	10 LON-7/26	11 TP-7/26	12 CHL-7/26	13 LAT-8/8	14 LON-8/8	15 TP-8/8	16 CHL-8/8
1	16.5000	19.2500	17.0000	4.47000	16.5000	19.2500	10.0000	2.94000
2	16.5000	19.0000	17.0000	4.47000	16.5000	19.0000	10.0000	2.54000
3	16.5000	18.7500	14.0000	4.47000	16.5000	18.7500	10.0000	1.94000
4	16.5000	18.5000	12.0000	4.31000	16.5000	18.5000	10.0000	1.94000
5	16.5000	18.2500	14.0000	3.99000	16.5000	18.2500	10.0000	1.74000
6	16.5000	18.0000	13.0000	3.99000	16.5000	18.0000	11.0000	2.14000
7	16.2000	18.2500	16.0000	4.47000	16.2000	18.2500	10.0000	2.34000
8	16.2000	18.5000	16.0000	4.79000	16.2000	18.5000	10.0000	1.94000
9	16.2000	18.7500	15.0000	4.47000	16.2000	18.7500	10.0000	2.14000
10	16.2000	19.0000	15.0000	4.47000	16.2000	19.0000	10.0000	2.54000
11	16.2000	19.2500	12.0000	4.31000	16.2000	19.2500	12.0000	2.94000
12	16.0000	19.2200	13.0000	4.31000	16.0000	19.2500	10.0000	2.74000
13	16.0000	19.0000	13.0000	4.47000	16.0000	19.0000	10.0000	2.14000
14	16.0000	18.7500	16.0000	4.31000	16.0000	18.7500	10.0000	2.14000
15	16.0000	18.5000	16.0000	4.79000	16.0000	18.5000	10.0000	2.54000
16	15.9600	18.2500	16.0000	4.79000	15.9600	18.2500	11.0000	2.54000
17	16.0000	18.0000	25.0000	4.63000	16.0000	18.0000	12.0000	2.94000
18	16.0000	17.5000	15.0000	4.31000	16.0000	17.5000	11.0000	2.54000
19	16.0000	17.2500	16.0000	4.47000	16.0000	17.2500	13.0000	2.74000
20	16.0000	17.0000	19.0000	4.31000	16.0000	17.0000	12.0000	2.34000
21	16.0000	16.7500	17.0000	4.79000	16.0000	16.7500	12.0000	2.14000
22	16.0000	16.5000	19.0000	5.27000	16.0000	16.5000	13.0000	2.14000
23	16.0000	16.2500	21.0000	5.11000	16.0000	16.2900	28.0000	3.54000
24	15.8000	16.5000	31.0000	5.43000	16.2000	16.5000	14.0000	2.34000
25	15.8000	16.7500	18.0000	4.63000	16.2000	16.7500	12.0000	2.14000
26	15.8000	17.0000	27.0000	4.31000	16.2000	17.0000	14.0000	1.94000
27	15.8000	17.2500	19.0000	4.47000	16.2000	17.2500	18.0000	2.14000
28	15.8000	17.5000	19.0000	4.47000	16.3400	17.1700	20.0000	2.14000
29	15.8000	17.7500	15.0000	4.63000	16.3600	16.9200	12.0000	2.14000
30	15.8000	18.0000	15.0000	4.31000	16.3000	16.7500	12.0000	2.34000
31	15.8000	18.2500	17.0000	4.63000	15.8000	16.5000	14.0000	2.54000
32	15.8000	18.5000	24.0000	4.63000	15.8000	16.7500	13.0000	2.54000
33	15.8000	18.7500	11.0000	4.15000	15.8000	17.0000	13.0000	2.74000
34	15.8000	19.0000	12.0000	4.15000	15.8000	17.2500	12.0000	2.74000
35	15.8000	19.2500	11.0000	3.99000	15.8000	17.5000	13.0000	2.74000
36	15.6000	19.4000	16.0000	3.99000	15.8000	17.7500	12.0000	2.94000
37	15.6000	19.2500	11.0000	3.99000	15.8000	18.0000	12.0000	3.14000
38	15.6000	19.0000	14.0000	3.99000	15.8000	18.2500	13.0000	3.74000
39	15.6000	18.7500	11.0000	3.99000	15.8000	18.5000	11.0000	2.74000
40	15.6000	18.5000	13.0000	4.15000	15.8000	18.7500	10.0000	2.14000
41	15.6000	18.2500	15.0000	4.47000	15.8000	19.0000	10.0000	2.14000
42	15.6000	18.0000	22.0000	4.63000	15.8000	19.2500	10.0000	2.54000
43	15.6000	17.7500	15.0000	4.79000	15.6000	19.4000	13.0000	4.94000
44	15.6000	17.5000	15.0000	4.47000	15.6000	19.2500	11.0000	3.54000
45	15.6000	17.2500	15.0000	4.47000	15.6000	19.0000	[illegible]	[illegible]
46	15.6000	17.0000	13.0000	4.31000	15.6000	18.7500	[illegible]	[illegible]
47	15.6000	16.7500	14.0000	4.79000	15.6000	[illegible]	[illegible]	2.94000
48	15.6000	16.5000	16.0000	[illegible]	15.6000	[illegible]	12.0000	2.94000
49	15.6000	16.3000	16.0000	4.31000	15.6000	18.0000	13.0000	2.94000
50	15.4000	16.7500	15.0000	4.63000	15.6000	17.7500	13.0000	3.34000
51	15.4000	17.0000	17.0000	4.63000	15.6000	17.5000	14.0000	2.54000
52	15.4000	17.2500	14.0000	4.63000	15.6000	17.2500	14.0000	2.54000
53	15.4000	17.5000	14.0000	[illegible]	[illegible]	17.0000	13.0000	2.54000

COMMAND: PRINT DATA

VARIABLES:

CASE	9 LAT-7/26	10 LON-7/26	11 TP-7/26	12 CHL-7/26	13 LAT-8/8	14 LON-8/8	15 TP-8/8	16 CHL-8/8
54	15.4000	17.7500	14.0000	4.63000	15.6000	16.7500	14.0000	2.54000
55	15.4000	18.0000	12.0000	4.47000	15.6000	16.5000	16.0000	2.94000
56	15.4000	18.2500	12.0000	3.99000	15.6000	16.3000	16.0000	2.94000
57	15.4000	18.5000	11.0000	3.99000	15.4000	16.7500	14.0000	3.34000
58	15.4000	18.7500	10.0000	3.83000	15.4000	17.0000	14.0000	2.94000
59	15.4000	19.0000	13.0000	3.83000	15.4000	17.2500	14.0000	3.34000
60	15.4000	19.2500	11.0000	3.99000	15.4000	17.5000	14.0000	3.54000
61	15.4000	19.5000	10.0000	3.83000	15.4000	17.7500	13.0000	3.54000
62	15.2000	19.5000	11.0000	3.67000	15.4000	18.0000	13.0000	3.34000
63	15.2000	19.2500	11.0000	3.99000	15.4000	18.2500	13.0000	3.14000
64	15.2000	19.0000	12.0000	4.15000	15.4000	18.5000	11.0000	2.54000
65	15.2000	18.7500	11.0000	3.99000	15.4000	18.7500	10.0000	2.14000
66	15.2000	18.5000	11.0000	3.83000	15.4000	19.0000	10.0000	2.14000
67	15.2000	18.2500	10.0000	3.67000	15.4000	19.2500	12.0000	2.94000
68	15.2000	18.0000	10.0000	3.67000	15.4000	19.5000	13.0000	4.54000
69	15.2000	17.8000	12.0000	4.15000	15.2000	19.5000	11.0000	2.94000
70	15.2000	17.6000	15.0000	4.47000	15.2000	19.2500	11.0000	2.34000
71	15.2000	17.4000	16.0000	4.63000	15.2000	19.0000	10.0000	2.14000
72	15.2000	17.2000	14.0000	4.63000	15.2000	18.7500	11.0000	2.14000
73	15.2000	17.0000	20.0000	4.95000	15.2000	18.5000	12.0000	2.94000
74	15.0000	16.8000	20.0000	3.99000	15.2000	18.2500	13.0000	3.54000
75	15.0000	17.0000	42.0000	5.91000	15.2000	18.0000	13.0000	3.14000
76	15.0000	17.1400	25.0000	4.95000	15.2000	17.8000	14.0000	2.94000
77	15.0000	17.4000	16.0000	4.95000	15.2000	17.6000	12.0000	2.94000
78	15.0000	17.6000	14.0000	4.63000	15.2000	17.4000	13.0000	3.14000
79	15.0000	17.8000	10.0000	4.31000	15.2000	17.2000	12.0000	2.94000
80	15.0000	18.0000	11.0000	3.99000	15.2000	17.0000	13.0000	2.94000
81	15.0000	18.2500	11.0000	3.67000	15.0000	16.8400	25.0000	4.14000
82	15.0000	18.5000	10.0000	3.83000	15.0000	17.0000	16.0000	3.14000
83	15.0000	18.7500	11.0000	3.99000	15.0000	17.1600	16.0000	3.14000
84	15.0000	19.0000	11.0000	4.31000	15.0000	17.4000	14.0000	3.34000
85	15.0000	19.2500	9.00000	3.99000	15.0000	17.6000	13.0000	2.94000
86	15.0000	19.5000	9.00000	3.83000	15.0000	17.8000	14.0000	2.94000
87	14.8000	19.5000	10.0000	4.47000	15.0000	18.0000	26.0000	2.94000
88	14.8000	19.2500	11.0000	4.47000	15.0000	18.2500	14.0000	3.34000
89	14.8000	19.0000	12.0000	4.79000	15.0000	18.5000	14.0000	2.94000
90	14.8000	18.7500	13.0000	4.63000	15.0000	18.7500	10.0000	2.14000
91	14.8000	18.5000	20.0000	5.27000	15.0000	19.0000	10.0000	2.54000
92	14.8000	18.2500	23.0000	4.79000	15.0000	19.2500	10.0000	2.74000
93	14.8000	18.0000	14.0000	4.31000	15.0000	19.5000	10.0000	2.34000
94	14.8000	17.8000	17.0000	4.15000	14.8000	19.5000	10.0000	2.34000
95	14.8000	17.6000	13.0000	4.31000	14.8000	19.2500	11.0000	2.34000
96	14.8000	17.4000	15.0000	4.63000	14.8000	19.0000	10.0000	2.34000
97	14.8000	17.2000	24.0000	4.15000	14.8000	18.7500	16.0000	2.54000
98	14.8000	17.0000	46.0000	8.47000	14.8000	18.5000	12.0000	2.94000
99	14.6000	17.2000	34.0000	7.19000	14.8000	18.2500	14.0000	2.94000
100	14.6000	17.4000	21.0000	4.79000	14.8000	18.0000	13.0000	2.74000
101	14.6000	17.6000	18.0000	4.31000	14.8000	17.8000	14.0000	3.34000
102	14.4700	18.0100	14.0000	3.67000	14.8000	18.6000	14.0000	3.14000
103	14.3300	17.8700	17.0000	3.83000	14.8000	17.4000	16.0000	3.14000
104	14.2600	18.0300	20.0000	4.15000	14.8000	17.2000	17.0000	3.14000
105	14.5800	16.8600	70.0000	10.2300	14.8000	17.0000	40.0000	7.34000
106	14.0200	16.6300	76.0000	10.8700	14.6000	17.2000	33.0000	5.54000
107	13.6500	16.0000	93.0000	9.75000	14.6000	17.4000	22.0000	3.74000
108	13.3500	16.0100	90.0000	8.95000	14.6000	17.6000	16.0000	3.34000

COMMAND: PRINT DATA

VARIABLES:

CASE	9 LAT-7/26	10 LON-7/26	11 TP-7/26	12 CHL-7/26	13 LAT-8/8	14 LON-8/8	15 TP-8/8	16 CHL-8/8
109	14.8600	16.8400	60.0000	5.43000	14.5500	18.0200	12.0000	2.74000
110	14.7800	16.5700	61.0000	5.59000	14.3300	17.8400	16.0000	2.54000
111	14.9200	16.4500	51.0000	5.27000	14.3100	18.0500	17.0000	2.54000
112	14.6000	18.2500	32.0000	5.11000	14.6100	16.8800	88.0000	14.5400
113	14.6000	18.5000	30.0000	5.27000	14.0300	16.6500	113.000	16.1400
114	14.6000	18.7500	29.0000	5.27000	13.6700	16.1000	13.0000	17.7400
115	14.6000	19.0000	26.0000	5.27000	13.3500	15.9900	106.000	13.7400
116	14.6000	19.2500	14.0000	3.83000	14.8600	16.8200	68.0000	12.5400
117	14.6000	19.5000	13.0000	3.67000	14.8400	16.5000	63.0000	10.5400
118	14.4000	20.0000	14.0000	3.83000	14.9100	16.4400	69.0000	6.74000
119	14.4000	19.7500	14.0000	3.83000	14.6000	18.2500	13.0000	3.14000
120	14.4000	19.5000	14.0000	3.83000	14.6000	18.5000	13.0000	2.74000
121	14.4000	19.2500	25.0000	5.59000	14.6000	18.7500	11.0000	2.34000
122	14.4000	19.0000	35.0000	7.51000	14.6000	19.0000	13.0000	2.54000
123	14.4000	18.7500	28.0000	5.91000	14.6000	19.2500	11.0000	2.54000
124	14.4000	18.5000	26.0000	5.91000	14.6000	19.5000	12.0000	2.74000
125	14.2000	19.2500	35.0000	6.55000	14.4000	20.0000	11.0000	2.74000
126	14.2000	19.5000	14.0000	3.83000	14.4000	19.7500	12.0000	2.54000
127	14.2000	19.7500	14.0000	3.67000	14.4000	19.5000	12.0000	2.54000
128	14.2000	20.0000	13.0000	3.83000	14.4000	19.2500	45.0000	2.74000
129	16.2000	16.5000	20.0000	4.79000	14.4000	19.0000	10.0000	2.14000
130	16.2000	16.7500	19.0000	4.47000	14.4000	18.7500	12.0000	3.14000
131	16.2000	17.0000	21.0000	4.31000	14.4000	18.5000	14.0000	2.74000
132	16.2000	17.2500	17.0000	4.15000	14.2000	19.2500	11.0000	2.34000
133	16.3700	17.1300	18.0000	4.47000	14.2000	19.5000	12.0000	2.74000
134	16.4000	16.9300	21.0000	4.63000	14.2000	19.7500	12.0000	2.74000
135	16.3200	16.7400	18.0000	4.47000	14.2000	20.0000	11.0000	2.74000
136	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
137	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
138	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
139	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
140	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
141	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
142	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
143	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
144	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
145	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
146	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
147	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
148	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
149	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
150	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
151	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
152	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
153	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
154	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
155	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
156	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
157	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
158	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
159	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
160	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
161	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
162	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
163	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING

ABSTAT 3.04 FILE: B:DIFFUS REV#34

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	17 LAT-8/17	18 LON-8/17	19 TP-8/17	20 CHL-8/17	21 LAT-8/27	22 LON-8/27	23 TP-8/27	24 CHL-8/27
1	16.5000	19.2500	10.0000	4.54000	16.5000	19.2500	10.0000	7.31999
2	16.5000	19.0000	10.0000	4.26000	16.5000	19.0000	9.00000	6.79000
3	16.5000	18.7500	10.0000	4.54000	16.5000	18.7500	12.0000	8.91000
4	16.5000	18.5000	10.0000	5.10000	16.5000	18.5000	13.0000	10.5000
5	16.5000	18.2100	10.0000	5.10000	16.5000	18.2500	13.0000	9.44000
6	16.5000	18.0000	11.0000	4.82000	16.5000	18.0000	16.0000	14.7400
7	16.2000	18.2500	11.0000	5.10000	16.2000	18.2500	13.0000	9.44000
8	16.2000	18.5000	10.0000	4.82000	16.2000	18.5000	14.0000	10.5000
9	16.2000	18.7500	9.00000	4.54000	16.2000	18.7500	14.0000	12.0900
10	16.2000	19.0000	9.00000	4.26000	16.2000	19.0000	13.0000	10.5000
11	16.2000	19.2500	12.0000	4.82000	16.2000	19.2500	8.00000	4.14000
12	16.0000	19.2500	11.0000	5.94000	15.9600	19.2500	11.0000	7.84999
13	16.0000	19.0000	9.00000	4.26000	16.0000	19.0000	13.0000	11.0300
14	16.0000	18.7500	9.00000	4.54000	16.0000	18.7500	14.0000	9.96999
15	16.0000	18.5000	11.0000	4.82000	16.0000	18.5000	14.0000	9.44000
16	16.0500	18.3200	10.0000	4.26000	16.0000	18.2500	18.0000	14.7400
17	15.9800	18.2200	14.0000	4.26000	16.0000	18.0000	16.0000	13.1500
18	16.0000	17.5000	12.0000	4.82000	16.0000	17.5000	13.0000	6.26000
19	16.1600	17.2000	12.0000	5.94000	16.0000	17.2500	14.0000	9.44000
20	16.0000	17.0000	14.0000	5.38000	16.0000	17.0000	14.0000	10.5000
21	16.0900	16.7500	15.0000	5.38000	16.0000	16.7500	12.0000	8.91000
22	16.0000	16.5000	17.0000	5.10000	16.0000	16.5000	11.0000	6.79000
23	16.0000	16.2500	22.0000	4.54000	16.0000	16.2900	16.0000	6.79000
24	16.2000	16.5000	16.0000	4.82000	16.2000	16.5000	12.0000	6.79000
25	16.2000	16.7100	14.0000	5.66000	16.2000	16.7500	14.0000	6.79000
26	16.2000	17.0000	18.0000	5.38000	16.2000	17.0000	14.0000	7.84999
27	16.2000	17.2500	15.0000	5.66000	16.2000	17.2500	12.0000	7.31999
28	16.3000	17.2500	15.0000	4.54000	16.3700	17.1300	15.0000	6.26000
29	16.3000	17.0000	17.0000	4.82000	16.3700	16.9200	13.0000	6.26000
30	16.3000	16.7500	15.0000	4.82000	16.3100	16.7300	14.0000	6.79000
31	15.8000	16.5000	15.0000	4.82000	15.8000	16.5000	15.0000	8.38000
32	15.8000	16.7500	16.0000	6.22000	15.8000	16.7500	18.0000	13.1500
33	15.8000	17.0000	16.0000	5.94000	15.8000	17.0000	19.0000	13.6800
34	15.8000	17.2500	15.0000	5.66000	15.8000	17.2500	17.0000	11.0300
35	15.8000	17.5000	15.0000	6.22000	15.8000	17.5000	16.0000	11.0300
36	15.8000	17.7500	13.0000	5.66000	15.8000	17.7500	17.0000	12.6200
37	15.8000	18.0000	14.0000	5.66000	15.8000	18.0000	23.0000	21.6300
38	15.8000	18.2500	12.0000	5.10000	15.8000	18.2500	17.0000	11.5600
39	15.8000	18.5000	10.0000	4.54000	15.8000	18.5000	16.0000	10.5000
40	15.8000	18.7500	10.0000	4.54000	15.8000	18.7500	17.0000	14.7400
41	15.8000	19.0000	10.0000	4.26000	15.8000	19.0000	15.0000	12.0900
42	15.8000	19.2500	11.0000	4.26000	15.8000	19.2500	13.0000	8.38000
43	15.6000	19.4000	12.0000	5.66000	15.6000	19.4000	12.0000	8.38000
44	15.6000	19.2500	10.0000	3.70000	15.6000	19.2500	13.0000	8.38000
45	15.6000	19.0000	11.0000	3.98000	15.6000	19.0000	15.0000	10.5000
46	15.6000	18.7500	10.0000	4.26000	15.6000	18.7500	14.0000	10.5000
47	15.6000	18.5000	10.0000	3.98000	15.6000	18.5000	15.0000	10.5000
48	15.6000	18.2500	14.0000	4.54000	15.6000	18.2500	15.0000	8.38000
49	15.6000	18.0000	14.0000	5.10000	15.6000	18.0000	16.0000	13.1500
50	15.6000	17.7500	14.0000	5.38000	15.6000	17.7500	14.0000	9.44000
51	15.6000	17.5000	16.0000	6.22000	15.6000	17.5000	20.0000	23.2200
52	15.0600	17.2500	17.0000	5.66000	15.6000	17.2500	24.0000	24.8100
53	15.6000	17.0000	13.0000	7.62000	15.6000	17.0000	13.0000	9.44000

ABSTAT 3.04 FILE: B:DIFFUS REV#34

COMMAND: PRINT DATA

VARIABLES:

CASE	17 LAT-8/17	18 LON-8/17	19 TP-8/17	20 CHL-8/17	21 LAT-8/27	22 LON-8/27	23 TP-8/27	24 CHL-8/27
54	15.6000	16.7500	16.0000	6.22000	15.6000	16.7500	15.0000	11.5600
55	15.6000	16.5000	15.0000	4.82000	15.6000	16.5000	15.0000	7.31999
56	15.6000	16.3000	13.0000	4.26000	15.6000	16.3000	15.0000	10.5000
57	15.4000	16.7500	15.0000	5.66000	15.4000	16.7500	13.0000	9.44000
58	15.4000	17.0000	15.0000	5.94000	15.4000	17.0000	16.0000	15.8000
59	15.4000	17.2500	17.0000	6.22000	15.4000	17.2500	17.0000	20.0400
60	15.4000	17.5000	15.0000	6.22000	15.4000	17.5000	14.0000	10.5000
61	15.4000	17.7500	14.0000	5.66000	15.4000	17.7500	15.0000	12.6200
62	15.4000	18.0000	15.0000	5.38000	15.4000	18.0000	16.0000	14.2100
63	15.4000	18.2500	13.0000	4.82000	15.4000	18.2500	14.0000	13.1500
64	15.4000	18.5000	10.0000	4.26000	15.4000	18.5000	15.0000	13.1500
65	15.4000	18.7500	10.0000	4.26000	15.4000	18.7500	14.0000	12.6200
66	15.4000	19.0000	9.00000	4.26000	15.4000	19.0000	14.0000	14.2100
67	15.4000	19.2500	10.0000	3.70000	15.4000	19.2500	14.0000	12.6200
68	15.4000	19.5000	10.0000	3.98000	15.4000	19.5000	11.0000	9.96999
69	15.2000	19.5000	11.0000	3.70000	15.2000	19.5000	14.0000	12.0900
70	15.2000	19.2500	10.0000	3.98000	15.2000	19.2500	15.0000	12.6200
71	15.2000	19.0000	12.0000	3.98000	15.2000	19.0000	14.0000	12.0900
72	15.2000	18.7500	10.0000	3.98000	15.2000	18.7500	14.0000	13.6800
73	15.2000	18.5000	10.0000	3.98000	15.2000	18.5000	16.0000	14.2100
74	15.2400	18.2800	18.0000	4.54000	15.2000	18.2500	14.0000	11.5600
75	15.2000	18.0000	17.0000	5.66000	15.2000	18.0000	15.0000	12.0900
76	15.2000	17.8000	16.0000	5.38000	15.2000	17.8000	15.0000	13.1500
77	15.2000	17.6000	15.0000	5.38000	15.2000	17.6000	17.0000	15.2700
78	15.2000	17.4000	14.0000	5.38000	15.2000	17.4000	14.0000	11.5600
79	15.2000	17.2000	15.0000	5.38000	15.2000	17.2000	14.0000	12.0900
80	15.2000	17.0000	14.0000	5.66000	15.2000	17.0000	18.0000	17.9200
81	15.0000	16.8500	19.0000	4.54000	15.0000	16.8400	22.0000	14.2100
82	15.0000	17.0000	19.0000	5.94000	15.0000	17.0000	18.0000	15.2700
83	15.0000	17.3300	20.0000	6.22000	15.0000	17.1600	18.0000	17.9200
84	15.0000	17.4000	16.0000	6.22000	15.0000	17.4000	15.0000	15.8000
85	15.0000	17.6000	18.0000	6.50000	15.0000	17.6000	15.0000	15.8000
86	15.0000	17.8000	16.0000	5.94000	15.0000	17.8000	15.0000	15.8000
87	15.0000	18.0000	16.0000	5.38000	15.0000	18.0000	16.0000	17.3900
88	15.0000	18.2500	14.0000	5.10000	15.0000	18.2500	16.0000	17.3900
89	15.0000	18.5000	15.0000	4.82000	15.0000	18.5000	18.0000	20.5700
90	15.0000	18.7500	9.00000	3.98000	15.0000	18.7500	14.0000	14.2100
91	15.0000	19.0000	9.00000	4.26000	15.0000	19.0000	15.0000	16.8600
92	15.0000	19.2500	9.00000	3.98000	15.0000	19.2500	13.0000	14.7400
93	15.0000	19.5000	9.00000	4.26000	15.0000	19.5000	12.0000	11.0300
94	14.8000	19.5000	9.00000	3.70000	14.8000	19.5000	15.0000	15.2700
95	14.8000	19.2500	10.0000	3.98000	14.8000	19.2500	12.0000	12.6200
96	14.8000	19.0000	9.00000	3.70000	14.8000	19.0000	14.0000	13.6800
97	14.8000	18.7500	11.0000	3.98000	14.8000	18.7500	20.0000	15.2700
98	14.8000	18.5000	12.0000	4.26000	14.8000	18.5000	21.0000	19.5100
99	14.8000	18.2500	13.0000	4.26000	14.8000	18.2500	18.0000	16.8600
100	14.9000	18.0000	16.0000	5.10000	14.8000	18.0000	15.0000	11.5600
101	14.8000	17.8000	17.0000	5.38000	14.8000	17.8000	15.0000	14.7400
102	14.8000	17.6000	16.0000	5.94000	14.8000	17.6000	18.0000	17.9200
103	14.8000	17.4000	16.0000	4.82000	14.8000	17.4000	18.0000	17.9200
104	14.8000	17.2000	16.0000	4.82000	14.8000	17.2000	15.0000	15.8000
105	14.8000	17.0000	24.0000	4.26000	14.8000	17.1000	44.0000	20.0400
106	14.6400	17.2000	42.0000	8.73999	14.6000	17.2700	20.0000	13.6800
107	14.6000	17.4000	22.0000	5.38000	14.6000	17.4000	30.0000	17.9200
108	14.6000	17.6000	27.0000	5.94000	14.6000	17.6000	17.0000	16.8600

ABSTAT 3.04 FILE: B:DIFFUS REV#34

COMMAND: PRINT DATA

VARIABLES:

CASE	17 LAT-8/17	18 LON-8/17	19 TP-8/17	20 CHL-8/17	21 LAT-8/27	22 LON-8/27	23 TP-8/27	24 CHL-8/27
109	14.5500	18.0500	18.0000	5.94000	14.5800	18.0600	14.0000	13.6800
110	14.3400	17.8100	19.0000	5.38000	14.2900	18.0300	12.0000	13.1500
111	14.3700	18.0400	18.0000	5.94000	14.3400	17.8300	10.0000	11.0300
112	14.6500	16.9300	70.0000	11.5400	14.6400	16.9600	43.0000	25.8700
113	14.0400	16.6600	139.000	22.1800	14.1200	16.6600	52.0000	31.7000
114	13.6500	16.0300	128.000	24.4200	13.8700	16.3300	52.0000	41.7700
115	13.3500	16.0000	148.000	25.2600	13.4400	16.0500	67.0000	34.3500
116	14.8600	16.8800	80.0000	12.3800	14.8900	16.9100	40.0000	14.2100
117	14.8400	16.5000	87.0000	9.30000	14.8300	16.6700	45.0000	13.6900
118	14.9200	16.4400	89.0000	9.86000	14.8600	16.5100	43.0000	14.2100
119	14.6000	18.2500	15.0000	5.66000	14.6000	18.2500	13.0000	9.96999
120	14.6000	18.5000	13.0000	4.82000	14.6000	18.5000	13.0000	11.5600
121	14.6000	18.7500	13.0000	4.26000	14.6000	18.7500	10.0000	11.5600
122	14.6000	19.0000	10.0000	4.54000	14.6000	19.0000	12.0000	14.7400
123	14.6000	19.2500	10.0000	3.98000	14.6000	19.2500	14.0000	12.6200
124	14.6000	19.5000	9.00000	3.98000	14.6000	19.5000	12.0000	11.0300
125	14.4000	19.9700	10.0000	4.26000	14.6000	19.7500	8.00000	9.96999
126	14.4000	19.5000	9.00000	3.70000	14.4000	20.0000	13.0000	9.44000
127	14.4000	19.2500	9.00000	3.70000	14.4000	19.7500	11.0000	17.3900
128	14.4000	19.0000	12.0000	3.98000	14.4000	19.5000	12.0000	16.8600
129	14.4000	18.7500	14.0000	4.54000	14.4000	19.2500	15.0000	15.8000
130	14.4000	18.5000	16.0000	4.82000	14.4000	19.0000	12.0000	15.2700
131	14.2000	19.2500	13.0000	4.26000	14.4000	18.7500	18.0000	17.9200
132	14.2000	19.5000	9.00000	3.70000	14.4000	18.5000	13.0000	13.1500
133	14.2000	19.7500	9.00000	3.70000	14.2000	19.2500	12.0000	15.8000
134	14.2000	20.0000	11.0000	4.26000	14.2000	19.5000	11.0000	13.1500
135	14.4000	19.7500	9.00000	3.70000	14.2000	19.7500	13.0000	12.6200
136	MISSING	MISSING	MISSING	MISSING	14.2000	20.0000	11.0000	12.0900
137	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
138	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
139	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
140	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
141	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
142	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
143	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
144	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
145	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
146	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
147	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
148	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
149	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
150	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
151	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
152	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
153	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
154	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
155	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
156	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
157	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
158	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
159	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
160	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
161	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
162	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
163	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING

ABSTAT 3.04 FILE: B:DIFFUS REV#35

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	25 LAT-9/7	26 LON-9/7	27 TP-9/7	28 CHL-9/7	29 LAT-9/13	30 LON-9/13	31 TP-9/13
1	16.5000	19.2500	11.0000	9.77000	16.5000	19.2500	13.0000
2	16.5000	19.0000	11.0000	9.77000	16.5000	19.0000	13.0000
3	16.5000	18.7500	12.0000	11.3300	16.5000	18.7500	12.0000
4	16.5000	18.5000	10.0000	9.77000	16.5000	18.5000	12.0000
5	16.5000	18.2000	10.0000	9.77000	16.5000	18.2500	12.0000
6	16.5000	18.0000	11.0000	8.21000	16.5000	18.0000	12.0000
7	16.2000	18.2500	11.0000	8.98999	16.2000	18.2500	12.0000
8	16.2000	18.5000	13.0000	10.5500	16.2000	18.5000	12.0000
9	16.2000	18.7500	11.0000	8.98999	16.2000	18.7500	12.0000
10	16.2000	19.0000	11.0000	9.38000	16.2000	19.2500	13.0000
11	16.2000	19.2500	12.0000	8.98999	16.0000	19.2500	14.0000
12	16.0000	19.2500	11.0000	8.98999	16.0000	18.7500	12.0000
13	16.0000	19.0000	11.0000	10.1600	16.0000	18.5000	12.0000
14	16.0000	18.7500	11.0000	10.1600	16.0000	18.2500	13.0000
15	16.0000	18.5000	11.0000	8.98999	16.0000	18.0000	14.0000
16	15.9600	18.2500	14.0000	12.5000	16.0000	17.5000	14.0000
17	16.0000	18.0000	14.0000	14.4500	16.0000	17.2500	14.0000
18	16.0000	17.5000	10.0000	7.03999	16.0000	17.0000	14.0000
19	16.0000	17.2000	12.0000	8.21000	16.0000	16.7500	17.0000
20	16.0000	17.0000	12.0000	8.21000	16.0000	16.5000	15.0000
21	16.0000	16.7500	10.0000	6.26000	16.0000	16.7500	20.0000
22	16.0000	16.5000	14.0000	7.43000	16.2000	16.5000	12.0000
23	16.0000	16.2500	23.0000	15.2300	16.2000	16.7500	12.0000
24	16.2000	16.5000	12.0000	6.26000	16.2000	17.0000	13.0000
25	16.2000	16.7500	11.0000	5.87000	16.2000	17.2500	14.0000
26	16.2000	17.0000	11.0000	5.87000	16.3500	17.1500	15.0000
27	16.2000	17.2500	10.0000	6.65000	16.3900	16.9800	14.0000
28	16.3000	17.2500	11.0000	5.87000	16.2900	16.7300	14.0000
29	16.3700	17.0300	11.0000	5.87000	15.8000	16.5000	13.0000
30	16.3000	16.7900	12.0000	5.87000	15.8000	16.7500	14.0000
31	15.8000	16.5000	15.0000	8.98999	15.8000	17.0000	14.0000
32	15.8000	16.7500	12.0000	7.43000	15.8000	17.2500	14.0000
33	15.8000	17.0000	14.0000	8.21000	15.8000	17.5000	14.0000
34	15.8000	17.2500	12.0000	8.98999	15.8000	17.7500	14.0000
35	15.8000	17.5000	12.0000	8.98999	15.8000	18.0000	14.0000
36	15.8000	17.7500	11.0000	8.98999	15.8000	18.2500	12.0000
37	15.8000	18.0000	11.0000	8.98999	15.8000	18.5000	12.0000
38	15.8000	18.2500	10.0000	8.98999	15.8000	18.7500	13.0000
39	15.8000	18.5000	10.0000	8.21000	15.8000	19.0000	14.0000
40	15.8000	18.7500	11.0000	8.21000	15.6000	19.4000	14.0000
41	15.8000	19.0000	11.0000	9.77000	15.6000	19.0000	14.0000
42	15.8000	19.2500	10.0000	9.77000	15.6000	18.7500	13.0000
43	15.6000	19.4000	11.0000	8.98999	15.6000	18.5000	14.0000
44	15.6000	19.2500	12.0000	8.98999	15.6000	18.2500	14.0000
45	15.6000	19.0000	11.0000	9.77000	15.6000	18.0000	16.0000
46	15.6000	18.7000	11.0000	8.21000	15.6000	17.7500	[illegible]
47	15.6000	18.5000	9.00000	7.43000	15.6000	17.5000	14.0000
48	15.6000	18.2500	10.0000	7.43000	15.6000	17.2500	14.0000
49	15.6000	18.0000	10.0000	8.21000	15.6000	17.0000	15.0000
50	15.6000	17.7500	10.0000	7.43000	15.6000	16.7500	14.0000
51	15.6000	17.5000	11.0000	7.43000	15.6000	16.5000	13.0000
52	15.6000	17.2500	12.0000	8.21000	15.6000	16.2900	21.0000
53	15.6000	17.0000	12.0000	7.43000	15.4000	16.7500	16.0000

COMMAND: PRINT DATA

VARIABLES:

CASE	25 LAT-9/7	26 LON-9/7	27 TP-9/7	28 CHL-9/7	29 LAT-9/13	30 LON-9/13	31 TP-9/13
54	15.6000	16.7500	13.0000	7.43000	15.4000	17.0000	15.0000
55	15.6000	16.5000	14.0000	6.65000	15.4000	17.2500	14.0000
56	15.6000	16.3000	16.0000	7.43000	15.4000	17.5000	15.0000
57	15.4000	16.7000	14.0000	7.03999	15.4000	17.7500	15.0000
58	15.4000	17.0000	11.0000	6.26000	15.4000	18.0000	15.0000
59	15.4000	17.2500	11.0000	6.65000	15.4000	18.2500	13.0000
60	15.4000	17.5000	9.00000	5.48000	15.4000	18.5000	14.0000
61	15.4000	17.7500	10.0000	6.65000	15.4000	18.7500	14.0000
62	15.4000	18.0000	9.00000	7.03999	15.4000	19.0000	14.0000
63	15.4000	18.2500	10.0000	7.43000	15.4000	19.2500	14.0000
64	15.4000	18.5000	9.00000	7.82000	15.4000	19.5000	14.0000
65	15.4000	18.7500	10.0000	6.65000	15.2000	19.5000	15.0000
66	15.4000	19.0000	12.0000	9.77000	15.2000	19.2500	14.0000
67	15.4000	19.2500	13.0000	10.5500	15.2000	19.0000	14.0000
68	15.4000	19.5000	10.0000	8.21000	15.2000	18.7500	15.0000
69	15.2000	19.5000	14.0000	11.3300	15.2000	18.5000	14.0000
70	15.2000	19.2500	13.0000	10.5500	15.2000	18.2500	14.0000
71	15.2000	19.0000	11.0000	8.21000	15.2000	18.0000	15.0000
72	15.2000	18.7500	9.00000	5.87000	15.2000	17.8000	16.0000
73	15.2000	18.5000	8.00000	5.09000	15.2000	17.6000	15.0000
74	15.2000	18.2500	11.0000	5.48000	15.2000	17.4000	15.0000
75	15.2000	18.0000	10.0000	5.87000	15.2000	17.2000	15.0000
76	15.2000	17.8000	9.00000	5.09000	15.2000	17.0000	17.0000
77	15.2000	17.6000	10.0000	5.09000	15.0000	16.8700	24.0000
78	15.2000	17.4000	9.00000	4.70000	15.0000	17.0000	20.0000
79	15.2000	17.2000	10.0000	4.70000	15.0000	17.1500	14.0000
80	15.2000	17.0000	11.0000	5.09000	15.0000	17.4000	13.0000
81	15.0000	16.8500	14.0000	7.43000	15.0000	17.6000	14.0000
82	15.0000	17.0000	13.0000	5.09000	15.0000	17.8000	14.0000
83	15.0000	17.1500	14.0000	6.65000	15.0000	18.0000	15.0000
84	15.0000	17.4000	8.00000	4.70000	15.0000	18.2500	15.0000
85	15.0000	17.6000	10.0000	4.70000	15.0000	18.5000	14.0000
86	15.0000	17.8000	8.00000	5.09000	15.0000	18.7500	14.0000
87	15.0000	18.0000	8.00000	5.87000	15.0000	19.0000	14.0000
88	15.0000	18.2500	9.00000	5.09000	15.0000	19.2500	14.0000
89	15.0000	18.5000	10.0000	6.26000	15.0000	19.5000	16.0000
90	15.0000	18.7500	9.00000	5.09000	14.8000	19.5000	14.0000
91	15.0000	19.0000	12.0000	7.82000	14.8000	19.2500	14.0000
92	15.0000	19.2500	13.0000	8.98999	14.8000	19.0000	MISSING
93	15.0000	19.5000	12.0000	8.98999	14.8000	18.7500	14.0000
94	14.8000	19.5000	12.0000	9.77000	14.8000	18.5000	14.0000
95	14.8000	19.2000	12.0000	8.21000	14.8000	18.2500	14.0000
96	14.8000	19.0000	10.0000	6.26000	14.8000	18.0000	14.0000
97	14.8000	18.7500	10.0000	6.26000	14.8000	17.8000	16.0000
98	14.8000	18.5000	10.0000	5.48000	14.8000	17.6000	15.0000
99	14.8000	18.2500	11.0000	5.09000	14.8000	17.4000	14.0000
100	14.7700	18.0000	9.00000	4.31000	14.8000	17.2000	15.0000
101	14.9000	17.8000	10.0000	3.92000	14.8000	17.[illegible]	[illegible]
102	14.6000	17.6000	10.0000	3.92000	14.6000	17.2000	22.0000
103	14.6000	17.4000	9.00000	3.92000	14.6000	17.4000	14.0000
104	14.6000	17.2000	10.0000	4.31000	14.6000	17.6000	12.0000
105	14.8000	17.0000	19.0000	7.43000	14.6100	18.0600	14.0000
106	14.6000	17.2000	16.0000	9.77000	14.4100	18.0600	16.0000
107	14.6000	17.4000	40.0000	19.1300	14.3400	17.8200	17.0000
108	14.6000	17.6000	10.0000	5.09000	14.[illegible]300	16.9100	37.0000

ABSTAT 3.04 FILE: B:DIFFUS REV#35

COMMAND: PRINT DATA

VARIABLES:

CASE	25 LAT-9/7	26 LON-9/7	27 TP-9/7	28 CHL-9/7	29 LAT-9/13	30 LON-9/13	31 TP-9/13
109	14.5000	18.0500	11.0000	4.70000	14.8200	16.6600	54.0000
110	14.3400	17.8100	19.0000	5.09000	14.8300	16.5000	57.0000
111	14.3400	18.0700	14.0000	7.43000	14.6800	17.0200	48.0000
112	14.6500	16.9300	50.0000	19.1300	14.1900	16.7000	50.0000
113	13.9800	16.6000	55.0000	22.2500	13.6700	16.0200	66.0000
114	13.8600	16.3200	61.0000	25.7600	13.3800	16.0700	80.0000
115	13.3500	15.8300	69.0000	24.2000	14.6000	18.2500	12.0000
116	14.8500	16.7300	47.0000	8.98999	14.6000	18.5000	14.0000
117	14.8400	16.5000	43.0000	8.60000	14.6000	18.7500	14.0000
118	14.9200	16.4400	43.0000	8.98999	14.6000	19.0000	14.0000
119	14.6000	18.2500	13.0000	7.43000	14.6000	19.2500	14.0000
120	14.6000	18.5000	12.0000	5.87000	14.6000	19.5000	13.0000
121	14.6000	18.7500	15.0000	9.77000	14.4000	20.0000	13.0000
122	14.6000	19.0000	14.0000	11.3300	14.4000	19.7500	14.0000
123	14.6000	19.2500	16.0000	17.9600	14.4000	19.5000	13.0000
124	14.6000	19.5000	14.0000	17.5700	14.4000	19.2500	13.0000
125	14.4000	20.0000	14.0000	14.0600	14.4000	19.0000	14.0000
126	14.4000	19.7500	15.0000	18.7400	14.4000	18.7500	14.0000
127	14.4000	19.5000	16.0000	19.1300	14.4000	18.5000	14.0000
128	14.4000	19.2500	16.0000	17.5700	14.2000	19.2500	21.0000
129	14.4000	19.0000	12.0000	10.1600	14.2000	19.5000	14.0000
130	14.4000	18.7500	12.0000	7.43000	14.2000	19.7500	13.0000
131	14.4000	18.5000	13.0000	7.03999	14.2000	20.0000	14.0000
132	14.2000	19.2500	16.0000	18.3500	MISSING	MISSING	MISSING
133	14.2000	19.5000	15.0000	15.2300	MISSING	MISSING	MISSING
134	14.2000	19.7500	15.0000	19.1300	MISSING	MISSING	MISSING
135	14.2000	20.0000	16.0000	21.4700	MISSING	MISSING	MISSING
136	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
137	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
138	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
139	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
140	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
141	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
142	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
143	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
144	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
145	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
146	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
147	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
148	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
149	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
150	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
151	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
152	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
153	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
154	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
155	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
156	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
157	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
158	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
159	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
160	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
161	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
162	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING
163	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING	MISSING

COMMAND: PRINT DATA

MISSING VALUE TREATMENT: INCLUDE

VARIABLES:

CASE	1 LAT-9/19	2 LON-9/19	3 TP-9/19	6 LAT-9/27	7 LON-9/27	8 TP-9/27	9 CHL-9/27
1	16.5000	19.2500	7.00000	12.0000	23.0000	18.0000	11.7100
2	16.5000	19.0000	10.0000	12.0000	22.5000	16.0000	MISSING
3	16.5000	18.7500	18.0000	12.0000	22.0000	18.0000	11.7100
4	16.5000	18.5000	19.0000	12.3300	21.5000	16.0000	11.0500
5	16.5000	18.2500	13.0000	12.3300	22.0000	17.0000	10.0600
6	16.5000	18.0000	14.0000	12.3300	22.5000	17.0000	10.7200
7	16.2000	18.2500	13.0000	12.6600	22.0000	15.0000	10.0600
8	16.2000	18.5000	25.0000	12.6600	21.5000	14.0000	9.40000
9	16.2000	18.7500	22.0000	13.0000	20.7000	18.0000	10.7200
10	16.2000	19.0000	9.00000	13.0000	21.0000	12.0000	8.08000
11	16.2000	19.2500	8.00000	13.0000	21.5000	13.0000	8.08000
12	16.0000	19.2500	8.00000	13.3300	21.5000	13.0000	7.42000
13	16.0000	19.0000	11.0000	13.3300	21.0000	12.0000	7.75000
14	16.0000	18.7500	20.0000	13.3300	20.5000	15.0000	9.73000
15	16.0000	18.5000	21.0000	13.4800	20.0000	20.0000	8.74000
16	16.0000	18.2500	21.0000	13.4200	19.7600	52.0000	12.7000
17	16.0000	18.0000	21.0000	13.6600	19.6000	58.0000	12.0400
18	16.0000	17.5000	19.0000	13.6600	20.0000	15.0000	7.42000
19	16.0000	17.2500	15.0000	13.6600	20.5000	13.0000	6.10000
20	16.0000	17.0000	16.0000	13.6600	21.0000	12.0000	8.08000
21	16.0000	16.7500	18.0000	13.6600	21.5000	16.0000	9.40000
22	16.0000	16.5000	14.0000	14.0000	21.0000	13.0000	7.09000
23	16.0000	16.2500	18.0000	14.0000	20.5000	13.0000	7.09000
24	16.2000	16.5000	15.0000	14.0000	20.0000	11.0000	6.43000
25	16.2000	16.7500	14.0000	14.0000	19.5000	16.0000	7.75000
26	16.2000	17.0000	14.0000	14.3300	19.0000	20.0000	10.7200
27	16.2000	17.2500	16.0000	14.3300	19.5000	13.0000	6.76000
28	16.3500	17.1700	15.0000	14.3300	20.0000	10.0000	6.10000
29	16.4000	16.9500	15.0000	14.3300	20.5000	12.0000	6.76000
30	16.3100	16.7300	16.0000	14.3300	21.0000	13.0000	7.75000
31	15.8000	16.5000	19.0000	14.6600	20.4000	12.0000	7.75000
32	15.8000	16.7500	16.0000	14.6600	20.0000	13.0000	7.75000
33	15.8000	17.0000	23.0000	14.6600	19.5000	11.0000	6.76000
34	15.8000	17.2500	20.0000	14.6600	19.0000	15.0000	6.76000
35	15.8000	17.5000	20.0000	14.6600	18.5000	14.0000	9.40000
36	15.8000	17.7500	22.0000	14.6600	17.8300	21.0000	13.3600
37	15.8000	18.0000	23.0000	14.6600	17.5000	20.0000	12.7000
38	15.8000	18.2500	23.0000	14.6600	17.0000	37.0000	8.41000
39	15.8000	18.5000	18.0000	15.0000	17.0000	17.0000	8.74000
40	15.8000	18.7500	20.0000	15.0000	17.5000	20.0000	MISSING
41	15.8000	19.0000	12.0000	15.0000	18.0000	21.0000	7.75000
42	15.8000	19.2500	9.00000	15.0000	18.5000	14.0000	6.76000
43	15.6000	19.4000	8.00000	15.0000	19.0000	16.0000	7.42000
44	15.6000	19.2500	10.0000	15.0000	19.5000	10.0000	5.11000
45	15.6000	19.0000	14.0000	15.0000	20.0000	13.0000	6.43000
46	15.6000	18.7500	16.0000	15.3300	19.5000	11.0000	5.11000
47	15.6000	16.5000	19.0000	15.3300	19.0000	12.0000	4.78000
48	15.6000	18.2500	21.0000	15.3300	18.5000	18.0000	9.73000
49	15.6000	18.0000	21.0000	15.3300	18.0000	16.0000	6.43000
50	15.6000	17.7500	20.0000	15.3300	17.5000	20.0000	10.7200
51	15.6000	17.5000	21.0000	15.6600	16.5000	18.0000	6.43000
52	15.6000	17.2500	17.0000	15.6600	17.0000	18.0000	6.76000
53	15.6000	17.0000	19.0000	15.6600	17.5000	16.0000	6.10000

COMMAND: PRINT DATA

VARIABLES:

CASE	1 LAT-9/19	2 LON-9/19	3 TP-9/19	6 LAT-9/27	7 LON-9/27	8 TP-9/27	9 CHL-9/27
54	15.6000	16.7500	17.0000	15.6600	18.0000	20.0000	8.41000
55	15.6000	16.5000	16.0000	15.6600	18.5000	17.0000	7.09000
56	15.6000	16.2800	17.0000	15.6600	19.0000	10.0000	4.78000
57	15.4000	16.7500	18.0000	15.6600	19.3400	10.0000	4.45000
58	15.4000	17.0000	21.0000	16.0000	19.0000	10.0000	4.78000
59	15.4000	17.2500	16.0000	16.0000	18.5000	12.0000	5.44000
60	15.4000	17.5000	22.0000	16.0000	17.5000	20.0000	8.74000
61	15.4000	17.7500	23.0000	16.0000	17.0000	18.0000	7.09000
62	15.4000	18.0000	23.0000	16.0000	16.5000	14.0000	4.78000
63	15.4000	18.2500	22.0000	16.3300	18.5000	10.0000	4.12000
64	15.4000	18.5000	22.0000	16.3300	19.0000	11.0000	4.78000
65	15.4000	18.7500	19.0000	16.3300	19.5000	9.00000	3.46000
66	15.4000	19.0000	14.0000	16.3300	20.0000	8.00000	3.46000
67	15.4000	19.2500	13.0000	16.3300	20.5000	10.0000	4.45000
68	15.4000	19.5000	10.0000	16.6600	20.5000	10.0000	4.78000
69	15.2000	19.5000	13.0000	16.6600	20.0000	10.0000	4.45000
70	15.2000	19.2500	15.0000	16.6600	19.5000	12.0000	5.44000
71	15.2000	19.0000	16.0000	16.6600	19.0000	12.0000	5.44000
72	15.2000	18.7500	23.0000	16.6600	18.5000	12.0000	4.12000
73	15.2000	18.5000	22.0000	16.6600	18.0000	12.0000	4.45000
74	15.2000	18.2500	20.0000	17.0000	17.5000	13.0000	4.12000
75	15.2000	18.0000	20.0000	17.0000	18.0000	12.0000	4.45000
76	15.2000	17.8000	21.0000	17.0000	18.5000	12.0000	4.45000
77	15.2000	17.6000	18.0000	17.0000	19.0000	10.0000	4.78000
78	15.2000	17.4000	18.0000	17.0000	19.5000	12.0000	4.45000
79	15.2000	17.2000	17.0000	17.0000	20.0000	10.0000	4.78000
80	15.2000	17.0000	17.0000	17.0000	20.5000	10.0000	4.45000
81	15.0000	16.8600	25.0000	17.3300	20.5000	10.0000	4.45000
82	15.0000	17.0000	18.0000	17.3300	20.0000	10.0000	4.45000
83	15.0000	17.1500	17.0000	17.3300	19.5000	11.0000	4.12000
84	15.0000	17.4000	19.0000	17.3300	19.0000	12.0000	4.78000
85	15.0000	17.6000	16.0000	17.3300	18.5000	14.0000	4.78000
86	15.0000	17.8000	17.0000	17.3300	18.0000	14.0000	4.78000
87	15.0000	18.0000	18.0000	17.3300	17.5000	15.0000	5.44000
88	15.0000	18.2500	20.0000	17.6600	18.5000	13.0000	5.44000
89	15.0000	18.5000	19.0000	17.6600	19.0000	11.0000	4.78000
90	15.0000	18.7500	22.0000	17.6600	19.5000	11.0000	4.78000
91	15.0000	19.0000	18.0000	17.6600	20.0000	11.0000	4.78000
92	15.0000	19.2500	15.0000	17.6600	20.5000	11.0000	4.78000
93	15.0000	19.5000	14.0000	18.0000	20.5000	12.0000	5.11000
94	14.8000	19.5000	16.0000	18.0000	20.0000	10.0000	5.11000
95	14.8000	19.2500	14.0000	18.0000	19.5000	11.0000	4.78000
96	14.8000	19.0000	21.0000	18.0000	19.0000	14.0000	5.77000
97	14.8000	18.6500	20.0000	18.0000	18.5000	13.0000	4.78000
98	14.8000	18.5000	17.0000	MISSING	MISSING	MISSING	MISSING
99	14.8000	18.2500	17.0000	MISSING	MISSING	MISSING	MISSING
100	14.8000	18.0000	18.0000	MISSING	MISSING	MISSING	MISSING
101	14.8000	17.8000	15.0000	MISSING	MISSING	MISSING	MISSING
[illegible]	14.8000	17.6000	26.0000	MISSING	MISSING	MISSING	MISSING
103	14.8000	17.4000	17.0000	MISSING	MISSING	MISSING	MISSING
104	14.8000	17.2000	20.0000	MISSING	MISSING	MISSING	MISSING
105	14.8000	17.0000	15.0000	MISSING	MISSING	MISSING	MISSING
106	14.8500	16.5000	35.0000	MISSING	MISSING	MISSING	MISSING
107	14.7900	16.6300	48.0000	MISSING	MISSING	MISSING	MISSING
108	14.6700	16.9100	34.0000	MISSING	MISSING	MISSING	MISSING

COMMAND: PRINT DATA

VARIABLES:

CASE	1 LAT-9/19	2 LON-9/19	3 TP-9/19	6 LAT-9/27	7 LON-9/27	8 TP-9/27	9 CHL-9/27
109	16.6500	17.0200	22.0000	MISSING	MISSING	MISSING	MISSING
110	14.1600	16.6800	45.0000	MISSING	MISSING	MISSING	MISSING
111	13.6600	16.0000	52.0000	MISSING	MISSING	MISSING	MISSING
112	13.3600	16.0300	67.0000	MISSING	MISSING	MISSING	MISSING
113	14.6000	17.2800	19.0000	MISSING	MISSING	MISSING	MISSING
114	14.6000	17.4000	18.0000	MISSING	MISSING	MISSING	MISSING
115	14.6000	17.6000	18.0000	MISSING	MISSING	MISSING	MISSING
116	14.6200	18.0500	13.0000	MISSING	MISSING	MISSING	MISSING
117	14.4300	18.0200	11.0000	MISSING	MISSING	MISSING	MISSING
118	14.3400	17.8200	8.00000	MISSING	MISSING	MISSING	MISSING
119	14.6000	18.2500	24.0000	MISSING	MISSING	MISSING	MISSING
120	14.6000	18.5000	14.0000	MISSING	MISSING	MISSING	MISSING
121	14.6000	18.7500	17.0000	MISSING	MISSING	MISSING	MISSING
122	14.6000	19.0000	20.0000	MISSING	MISSING	MISSING	MISSING
123	14.6000	19.2500	19.0000	MISSING	MISSING	MISSING	MISSING
124	14.6000	19.5000	15.0000	MISSING	MISSING	MISSING	MISSING
125	14.6000	19.7500	10.0000	MISSING	MISSING	MISSING	MISSING
126	14.6000	20.0000	9.00000	MISSING	MISSING	MISSING	MISSING
127	14.4000	20.0000	9.00000	MISSING	MISSING	MISSING	MISSING
128	14.4000	19.7500	16.0000	MISSING	MISSING	MISSING	MISSING
129	14.4000	19.5000	18.0000	MISSING	MISSING	MISSING	MISSING
130	14.4000	19.2500	19.0000	MISSING	MISSING	MISSING	MISSING
131	14.4000	19.0000	18.0000	MISSING	MISSING	MISSING	MISSING
132	14.4000	18.7500	18.0000	MISSING	MISSING	MISSING	MISSING
133	14.4000	18.5000	10.0000	MISSING	MISSING	MISSING	MISSING
134	14.2000	19.2500	20.0000	MISSING	MISSING	MISSING	MISSING
135	14.2000	19.5000	18.0000	MISSING	MISSING	MISSING	MISSING
136	14.2000	19.7500	11.0000	MISSING	MISSING	MISSING	MISSING
137	14.2000	20.0000	15.0000	MISSING	MISSING	MISSING	MISSING