2-1-1971

Hydrography and Hydrodynamics of Virginia Estuaries I: Oxygen Balance and Dye Tracer Studies at the Confluence of the York, Pamunkey, and Mattaponi Estuaries

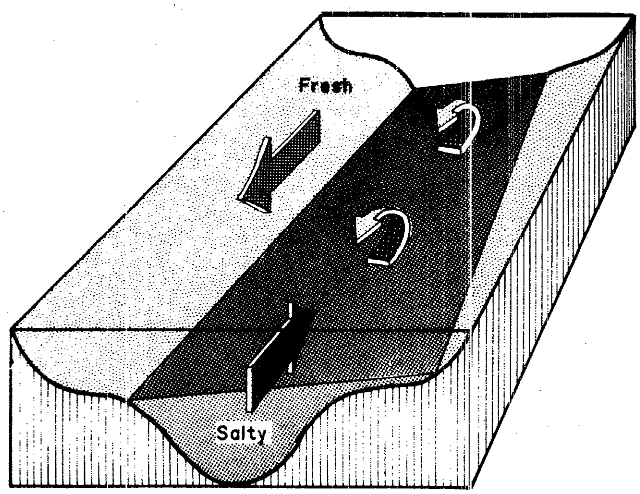
W. Harrison
Virginia Institute of Marine Science

C. S. Fang
Virginia Institute of Marine Science

J. C. Munday Jr.
Virginia Institute of Marine Science

HYDROGRAPHY AND HYDRODYNAMICS OF VIRGINIA ESTUARIES

I. Oxygen Balance and Dye Tracer Studies at the Confluence of the York, Pamunkey, and Mattaponi Estuaries



Special Report in Applied Marine Science and Ocean Engineering

Number 11

VIRGINIA INSTITUTE OF MARINE SCIENCE

GLOUCESTER POINT, VIRGINIA 23062

HYDROGRAPHY AND HYDRODYNAMICS OF VIRGINIA ESTUARIES

I. OXYGEN BALANCE AND DYE-TRACER STUDIES AT THE CONFLUENCE OF THE YORK, PAMUNKEY, AND MATTAPONI ESTUARIES

by

W. Harrison and C. S. Fang

(With a Section on Aerial Photographic Detection of Dye and Mill-waste Concentrations by J. C. Munday Jr.)

Special Report in Applied Marine Science
and
Ocean Engineering

Number 11

of the

Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

William J. Hargis, Jr.
Director

February 1971

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

FIGURE		Page

FOREWORD

Intelligent utilization and conservation of Virginia's estuaries must be predicated on a detailed knowledge of their physical characteristics. The present study is the first in a series dedicated to this goal. The study is based on field observations of distributions of temperature, salinity, flow velocities, dissolved oxygen, and a dye tracer in a complicated region of estuarine bifurcation. The field observations are utilized to develop a mathematical model that is useful for waste-load planning and the prediction of the distribution of dissolved oxygen.

It is significant that the bulk of the funding for this research study was provided by a Virginia industry, The Chesapeake Corporation of Virginia. The Chesapeake Corporation manufactures paper and is located at West Point, Virginia, at the confluence of the three estuaries investigated. It was the willingness of The Chesapeake Corporation to underwrite the field research coupled with the desire of the Virginia Institute of Marine Science to understand the environment there that brought the present study to fruition.

ACKNOWLEDGMENTS

We wish to express our appreciation to Mr. Harold Slone, VIMS, for his reduction of the voluminous dye-survey data. Dr. J. C. Munday Jr. assisted in the dye study and Dr. M. M. Nichols provided advice on aerial photography. Graduate Student Assistants that participated in this project were Messrs. Paul Bullock, Ballard Mullins, and John Windsor. Our cooperative boat captains were Messrs. Walter Harris, James Payne, and Vendell Kellum, Jr. Mr. David South and Mr. Stanley Jackowski, of The Chesapeake Corporation of Virginia, assisted in part of the field efforts.

Funding of the major portion of this research was by The Chesapeake Corporation of Virginia. The interest of Mr. A. W. Plummer, Technical Director of The Chesapeake Corporation, is appreciated.

The Virginia Division of Highways provided aerial photography for the batch-release phase of the dye study and provided personnel for leveling of tide-gauge installations. Mr. M. E. Penney, VIMS, aided in reduction of the air-photo data.

ABSTRACT

Rhodamine WT dye was released continuously for 19 days at the Eltham and Lord Delaware bridges. Monitoring runs were made at time of high and low-water slack on the fifth, ninth, and nineteenth days after commencing the dye release. Maps of the dye-concentration data indicate that local winds can have a significant effect upon dispersion of dye (or other solutes). At times of high-water slack, dye-concentrations decline (in up-estuary directions) from high values near the release points to intermediate values about two nautical miles upriver. Concentrations increase again to secondary maxima at a distance of one tidal excursion (3.4 to 4.1 nautical miles from the release points.

At times of low-water slack, the dye-concentration values decrease nearly linearly up-estuary from the release points. In the down-estuary direction, and for a no-wind condition, dye concentrations at low water slack will be greatest on or slightly southwest of the shoal extending south of West Point. The time of passage of a batch release of dye was about seven days, for the 15-nautical-mile distance between West Point and Clay Bank.

A steady-state, one-dimensional mathematical model was developed using Camp's equations. Data gathered in the dye study and from the extensive hydrographic survey were utilized to estimate the parameters of the model. The DO and BOD distributions along the channel of the lower Pamunkey and upper York estuaries were predicted by the model for the low-water-slack condition. The fourteen-consecutive-day, low-flow rate for Hanover (45 cfs) was used along with a corresponding low-flow rate of 300 cfs at West Point. Estimates of inflows to various reaches of the Pamunkey between Hanover and West Point were based on minimum runoff and were computed by proportioning the difference in flow between the 300 cfs value at West Point and the 45 cfs value at Hanover.

Results indicate that for a BOD waste loading of 30,000 pounds per day, at a point 1/4-mile above the Eltham Bridge, the DO concentration would drop below 4 ppm at a point 1.1 miles down-estuary from the bridge during high water temperature (27°C) and at low water slack. From probability considerations, this minimum DO value would occur for a low-flow condition that could be expected once in 10 years.

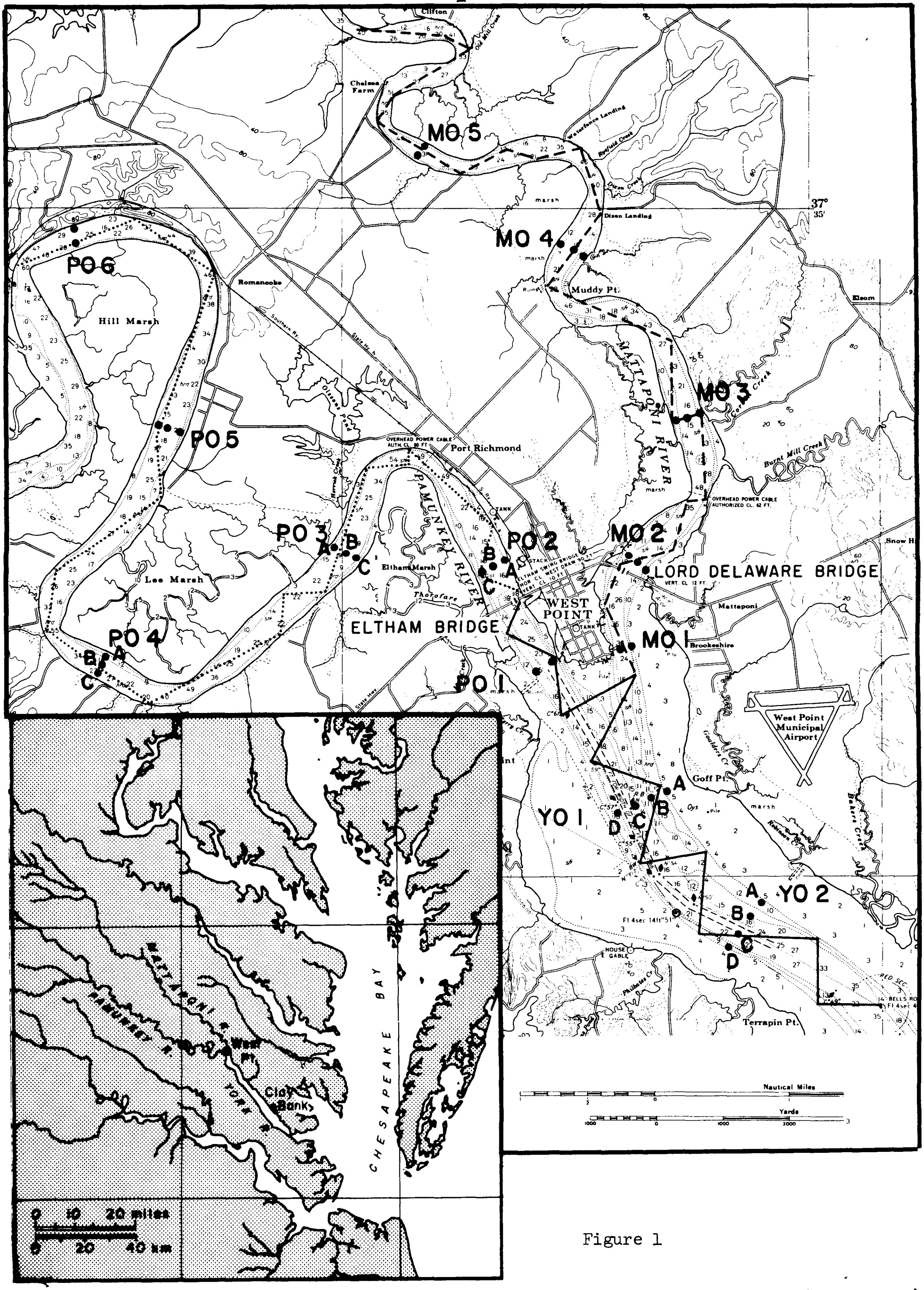


Figure 1

Area of investigation and cruise tracks for vessels monitoring dye in the York (solid line), Mattaponi (dashed line), and Pamunkey (dotted line) River estuaries. Transects (PO1, YO2, MO4, etc.) and stations (A, B, C, or D) for hydrographic survey also shown.

INTRODUCTION

Purpose of Study

This study was undertaken for the purpose of increasing knowledge of the hydraulic characteristics of the region around West Point, Virginia (fig. 1), where the York River estuary branches into the Pamunkey and Mattaponi River estuaries. West Point is the site of The Chesapeake Corporation of Virginia's paper mill. The primary aim of the study was to provide a mathematical model that could be used to describe the variation of dissolved oxygen (DO) in the Pamunkey-York channel.

The only previous published work on this area (Anonymous, 1969) was done by the Chesapeake Bay Institute of the Johns Hopkins University in the spring of 1961. It consisted of four days of observations of temperature, salinity, and current velocity at each of two anchor stations, in the Pamunkey and Mattaponi rivers, respectively. Two dye-tracer experiments were conducted, also, but the results were inconclusive.

Approach

The approach adopted in the present study involved:

1) the monitoring of fluorescent dye releases for assessing, a) steady-state concentrations of a solute in the system and b) dispersion in the system;

2) the execution of a detailed hydrographic survey for determining the distribution of temperature, salinity, dissolved oxygen, and flow velocities; and

3) the development of a mathematical computer model for the prediction of the distribution of dissolved oxygen.

Study Area

The upper estuary of the York River includes the Pamunkey and Mattaponi rivers. The streams of the York River basin flow in a southeasterly direction from their source in the foothills of the Blue Ridge Mountains in Virginia to the Chesapeake Bay near Yorktown, Virginia. The York River is formed by the confluence of the Mattaponi and Pamunkey rivers at West Point. The York River's entire course of about 35 miles is an estuary. The Pamunkey and Mattaponi have strongly meandering channels and are tidal for 56 and 41 miles, respectively, above the West Point junction.

Table 1.- Normal Monthly Average Precipitation and Temperature for Tidewater Area of Virginia.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr. Avg.
Temp. (°F)	40.3	41.1	47.4	57.2	66.6	74.6	78.1	76.8	71.3	60.8	51.5	41.3	58.8
													Yr. Tot.
Precip. (in.)	3.37	3.02	3.53	3.23	3.61	3.57	5.41	5.37	3.88	3.06	2.98	2.84	43.87

Table 2.- Average Monthly Total Precipitation and Average Temperature for the Period 1958-1967.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
West Pt. Temp. (°F)	37.2	38.8	46.6	57.7	66.6	73.1	77.0	76.3	69.4	58.7	49.6	38.2
Walkerton Temp. (°F)	36.1	33.8	45.3	56.6	65.4	72.4	76.6	75.7	68.4	57.6	48.5	37.2
West Pt. Precip. (in.)	3.22	3.92	3.64	2.88	3.91	4.18	6.06	5.30	2.95	3.13	2.99	3.21
Walkerton Precip. (in.)	2.94	3.87	3.68	2.98	4.07	4.33	5.00	4.74	2.97	2.96	3.31	3.50

The mean range of tide at the mouth of the York River is 2.0 feet, increasing to 2.9 feet at West Point at the head of the stream. At Walkerton, on the Mattaponi, 29 miles upstream from the mouth, the mean range is 3.9 feet and at New Castle on the Pamunkey, 52 miles upstream from the mouth, it is 2.0 feet.

The drainage basin comprises 2663 square miles, of which 909 square miles belong to the Mattaponi and 1477 square miles belong to the Pamunkey. Crossing the Fall Line Belt, the slopes are about 10 feet per mile, and in the coastal plain about 1.5 feet per mile above the tidal portions. The rainfall of the basin averages about 41 inches per year, and runoff amounts to about 2600 cubic feet per second at West Point. The minimum runoff is about 300 cubic feet per second.

Other than those towns near the river mouth, the only sizable town in the coastal plain in the York River basin is West Point. It has a population of about 2500, and contains one major industry, The Chesapeake Corporation of Virginia. This industry consists of a pulp mill that manufactures finished paper and Kraft board.

Distribution of Precipitation

The annual precipitation on the York River watershed varies from 40 to 50 inches. The average for the entire area amounts to 41.2 inches, while for the area above West Point it is 41 inches. The annual snowfall is very small. It varies from 8 inches at the coast to about 18 inches at the western edge of the watershed. The mean for the total area is 14.3 inches. The three months of highest rainfall are June, July, and August. The maximum for the year occurs in August. The three months of next greatest rainfall are March, April, and May. The minimum rainfall occurs in November. The lowest runoff (stream flow) usually occurs in August-November; the apparent descrepancy between high rainfall and low-runoff in August is related to the fact that a greater proportion of rainfall occurs as runoff in cool months (Chow, 1964, p. 12-5). Thus, also, the greatest runoff occurs during the spring.

Climate

Climatologically, the area is characterized by mild winters, hot summers, and precipitation well distributed throughout the year, with slightly less precipitation in the fall months than in the rest of the year. Table 1 shows the normal monthly average temperatures and precipitation for the Tidewater area (U. S. Dept. Commerce, ESSA, 1967).

There are two climatological observation stations on the river system being studied: one at Walkerton, on the Mattaponi, and one at West Point. Table 2 gives values of monthly average temperature and total monthly precipitation for the ten-year period 1958-1967 (ibid., 1958-1967).

The Chesapeake Corporation of Virginia

The Chesapeake Corporation of Virginia is located in West Point, Virginia, on the east bank of the Pamunkey River, approximately 1 1/4 miles north of the junction with the Mattaponi River (fig. 1). The paper plant presently employs about 925 people and manufactures quality unbleached Kraft pulp, linerboard, and paper at its principal site. Average daily production is about 1050 tons. The mill also produces sulfate pulp. At the present time the mill takes about 13.7 mgd of water from wells for process purposes. All wastes are directly discharged into the Pamunkey River without any treatment. According to South (1969), the average daily BOD discharged is about 30 pounds per ton.

DYE STUDIES

Project Plan

Two types of dye releases were conducted:

1) a continuous 19-day-long release at the Lord Delaware and Eltham Bridges (fig. 1) and

2) a batch release on slack-before-flood at a point just upstream of the Eltham Bridge.

Monitoring of the dye distributions from the continuous releases was by ships following the tracks shown on figure 1. The monitoring took place on the sixth, tenth, and nineteenth days after initiation of pumping of dye.

The batch release of dye was monitored from a vessel during the flood-tide half cycle immediately after release and during the second ebb cycle after release. Monitoring was also accomplished at a continuously-recording station on the Eltham Bridge for 14 days after release.

As a check on time-of-passage of the dye cloud, at a point far down-stream of the batch release, it was decided to monitor the dye concentration for 10 consecutive days along a transect near Clay Bank (fig. 1).

Data Acquisition Systems

Fluorometers.- G. K. Turner Associates Model 110 or 111 filter fluorometers were used to monitor dye concentrations. The fluorometers were equipped with flow-through doors so that estuarine water could be pumped continuously through the instruments while the survey boats were underway.

The filter combinations used in each fluorometer were: one Corning Glass Works glass filter CS 1-60 and one Eastman Kodak Company Wratten 61, combined for the excitation filter, and one CS 4-97 and one CS 3-66 in combination for the measurement filter. General-purpose UV lamps (with white phosphor coatings) were used. These lamps provide broad-band ultraviolet, blue, and green light. The excitation filter isolated a green band peaking at 546 nm, providing for excitation of the main absorption band of Rhodamine WT which peaks at 558 nm. The measurement filter peaked at 590 nm, providing for measurement of Rhodamine WT fluorescence which peaks at 582 nm.

Hewlett Packard Company Model 680, electric-writing recorders with event markers were used. Little Giant underwater electric pumps were used to pump river water through the fluorometers while underway. Opaque polyethylene hose was used for piping.

The power supply for a given fluorometer, pump, and recorder system consisted of a Sears Roebuck and Company 1250 watt, 115-volt gasoline-driven generator. A Sola Electric Company harmonic-neutralized, constant-voltage regulator with voltage and frequency meters was placed between the generator and instrument system, according to the recommendation of Wilson (1968, fig. 7).

Aerial photography.- Aerial photography was employed to delineate patterns of dye distribution following the batch release, especially the patterns of high concentration where under normal operation fluorometer measurements cannot be made.

The Virginia Department of Highways agreed to obtain the aerial photographs. Flight lines were arranged to cover the first three legs of the Pamunkey River above West Point. The legs were flown just before the batch release to obtain background coverage, and then on each hour until dusk. All photographs were a nadir view from 1800 feet (548 m) with 60 percent overlap, taken with a Wild RC-8 camera having a 6-inch focal length and a 9 x 9-inch format.

The film used was Kodak Double-X Aerographic (Estar base) Film 2405. A Wratten 15 (G) filter was employed. The film was developed for 16 minutes at 20°C (68°F) in DK50. The film-filter combination was satisfactory for imaging Rhodamine WT dye. A better filter would have been spectrally more selective than the panchromatic 2405.

Execution

Continuous releases.- Rhodamine WT dye, sold by the E. I. DuPont Co. in 250 lb. drums (20% solution), was released continuously from the wooden platforms under the swing sections of the Eltham and Lord Delaware bridges (fig. 1). Cole-Palmer (#7190-8) metering pumps were used.

The dye-release rates in the Pamunkey and Mattaponi were adjusted to be in the ratio 1.6/1. This corresponds to the ratios of the drainage areas, the Pamunkey having 1477 square miles and the Mattaponi 909 square miles. The 20 percent Rhodamine WT solution was released at the rate of 17.9 liters per 24 hours on the Mattaponi and 28.4 liters per 24 hours on the Pamunkey. This converts to 4.27 kg/24 hrs and 6.75 kg/24 hrs, respectively,

Table 3.- Dye release and monitoring schedule (local time).

DYE RELEASE TIMES		Slack Water	DYE MONITORING TIMES		
Mattaponi	Pamunkey		York	Mattaponi	Pamunkey
Start: 12 OCT 69 1200 hrs	12 OCT 69 1200 hrs				
				17 Oct. 69	
		(LS)	1148-1352 hrs	1215-1321 hrs	1305-1442 hrs
			and	and	and
		(HS)	1810-1921 hrs	1729-2015 hrs	1942-2205 hrs
				21 Oct. 69	
		(HS)	0918-1117 hrs	1000-1133 hrs	1054-1211 hrs
			and	and	and
		(LS)	1633-1745 hrs	1645-1802 hrs	1746-2006 hrs
				30 Oct. 69	
		(LS)	0742-1158 hrs*	1002-1148 hrs	1052-1139 hrs
			and	and	and
		(HS)	1543-1701 hrs	1601-1756 hrs	1712-1901 hrs
End: 30 OCT 69 1745 hrs					

*The early starting time reflects the long run, page A37, from Gloucester Point to the usual starting point at Bells Rock.

on a 100 percent basis. The total dye released during the 19-day study was 77.8 kg into the Mattaponi and 122.7 kg into the Pamunkey.

The dye release and monitoring schedule that was followed is presented in Table 3. The objective of the three monitoring boats, that followed the three course tracks shown on figure 1, was to monitor the dye during periods of high and low slack water on a given monitoring day. Because slack water moves quickly up or down the estuaries it was necessary that the monitoring boat cruise rapidly in the direction of slack-water movement. This accounts for most variations in the times given for the three sampling boats under the "Dye Monitoring Times" heading of Table 3. Also, some adjustment in slack-water times predicted in the tidal-current tables was necessary during execution of the field work due to tide-wave variations caused by winds and other factors.

Periodic bucket samples were taken for checks on temperature, turbidity, and dye-concentration, during underway operations.

No problems were encountered in the monitoring activities, with the exception that on tight turns bubbles were sometimes generated which gave erroneous readings during passage through the continuous-flow doors of the fluorometers.

Batch release.- A batch release of dye, introduced just upstream of the Eltham Bridge (fig. 1) in the form of a cross-channel line source, was made between 1153-1203 hours on 31 October 1969. The amount released was 41.9 kg and the time of injection corresponded to low-water slack.

Immediately prior to the dye release, a monitoring run was conducted to determine background concentration of dye that remained from the continuous release. The new dye was then followed upriver during the flood current. Numerous crossings of the high concentration zones were made by the monitoring boat. Data were also obtained via the aerial photography. The following day, on 1 November, the dye was monitored by boat between 0640 and 0900 hrs (high-water slack) and 1219 to 1403 hrs (low-water slack).

The fluorometer sampling system was then transferred to the wooden platform beneath the swing section on the Eltham Bridge where it remained until 14 November for the purpose of continuously monitoring the declining dye concentration. A sampling vessel also made transects across the York River at Clay Bank (fig. 1), monitoring dye concentrations once each day at a low-slack water between November 1 and 9. These boat and bridge measurements were designed to provide information on time of dye passage.

Data Reduction

All fluorometers were calibrated before and after boat runs with standard dye solutions prepared with distilled water, following the outline given by Wilson (1968, p. 20). The calibration data were used to reduce the recorder strip-chart data to dye-concentration values. All of the dye-concentration values appearing on the figures in this report (Appendix A, pages A2-A37) are in parts per billion (ppb) of Rhodamine WT. The concentration values have been corrected for background fluorescence using samples of standard river water that were obtained prior to introduction of the dye into the estuaries. (The standard water was made up by combining equal volumes of samples of water taken while making shake-down cruises along each of the three courses of figure 1).

The water samples taken during the field study were carefully run in the laboratory as a check on the boat measurements. Selected water samples were checked for turbidity. Suspended sediment concentrations were found to be negligible and no corrections to the fluorescence values were required for this variable. Although variations in water temperature were small, temperature corrections were applied to the fluorescence values.

Boat position data and values of fluorescence from the strip charts were used to produce contour maps of dye concentrations (Appendix A).

HYDROGRAPHIC SURVEY*

Project Plan

It was desired to obtain, as nearly as possible, a synoptic three-dimensional picture of velocity, temperature, salinity, and dissolved oxygen in the area of interest. Measurements were taken hourly over two full tidal cycles. Flow velocity, temperature, and salinity measurements were made once every two meters, or, in shallow depths, at the surface and bottom. Dissolved oxygen was sampled at one depth only, except in the vicinity of The Chesapeake Corporation outfall (see Appendix C). Laterally, the number of sampling stations per transect (see fig. 1) was chosen according to the width of the stream, in order to gain an adequate representation of the lateral variation of the quantities being measured. Longitudinally, the transect spacing was chosen to provide a reasonably complete description of the down-channel variation of the parameters. In the vicinity of West Point, the spacing between transects (fig. 1) was less than elsewhere, so that the effect of The Chesapeake Corporation's outfall could be examined more closely. Transect locations were chosen, wherever possible, to be at lease four river widths from bends, so as to avoid the disturbance of flow caused by bends.

---

*This portion of the report has been extracted from a comprehensive report on the entire Mattaponi-Pamunkey system that is being prepared by Dr. Paul V. Hyer, Department of Oceanography (VIMS), for the Virginia Division of Water Resources, the Virginia State Water Control Board, and the Virginia Institute of Marine Science.

Data Acquisition Systems

Field-station boats were of the Thunderbird type, and each was equipped with instruments for measuring current velocity and water temperature, and with bottles for collecting water samples for salinity and dissolved-oxygen determination at different depths. Water current speed and direction were measured using Marine Advisors, Inc., Q-9 current meters with S-11 readouts and Hydro Products Corp. Model 460 and 465 current sensors with Model 451-A and 452 deck readouts. Temperature was measured using a thermistor with a deck readout. Salinity samples were analyzed at the laboratory using a Beckman RS-78 induction salinometer. Oxygen samples were analyzed by the azide modification of the Winkler method.

Where a transect had more than one station, small foam buoys were attached to Danforth anchors. A short length of polypropylene line was left floating in the water so that the boat could be tied temporarily to the buoy. By running from one station to the next as quickly as sampling was completed, a boat could cover all the stations on a transect within a few minutes.

Field measurements of bottom profiles were made in January, 1970. The instrument used was a battery-powered Raytheon Corporation DE-719 sonic depth sounder. The transducer head was mounted from the port side of the stern of a thirteen-foot Boston Whaler. A crew of two sufficed for the field operation; one to operate the instrument and the other to control the boat.

A total of six days of field operations were required for the bathymetry. Calibration was accomplished by means of "bar checks;" that is, the instrument recorded the echo from a Secchi disk and the disk was held at a succession of known depths.

The Virginia Division of Water Resources maintained, at the time of the survey, permanent tide gauges at West Point and at Elsing Green on the Pamunkey. In addition to these, VIMS erected temporary bubbler-type tide gauges at the Newcastle bridge on the Pamunkey, and at Aylett Landing on the Mattaponi. These temporary gauges were leveled by the Highway Department.

The field boats were supported by the R/V Langley. This converted ferryboat served as a center for instrument repair, food, crew changes, and communication with VIMS.

Data Reduction

Velocity and temperature data, along with bottle numbers for salinity and oxygen samples, were recorded on special forms devised for field use. After the survey, this information and the results of the laboratory analysis were transferred to standard oceanographic data forms. The data were then punched on IBM cards, and stored on disks to await further analysis.

Execution of Field Survey

Stations at the transects shown on figure 1 were manned according to the schedule given in Table 4 below.

Table 4.- Hydrographic Survey Schedule, Region of West Point, Virginia; Autumn 1969.

Survey Transects (fig. 1)	Dates and times during which measurements were made
P03, P04, P05	16 October 0830 hrs through 17 October 0930 hrs.
P01, P02, Y01, Y02, M01, M02	17 October 1400 hrs through 18 October 1300 hrs.
M04, M05	20 October 0700 hrs through 21 October 0800 hrs.
P01 Y01, Y02, M01, M02, M03	21 October 1100 hrs through 22 October 1200 hrs.

Various calculations were performed on the disk data. Section averages of the salinity, dissolved oxygen, and temperature were calculated to provide input values for the mathematical model. Vertical integrals of the longitudinal component of velocity were calculated. These integrals and bottom-profile measurements were used to obtain tidal-exchange fluxes, using a form of Harlacher's method.

Channel widths were determined from USGS 7.5-minute topographic quadrangles. Cross-sectional areas were calculated by planimetry, using the bottom-profile data. Section lengths were determined from C&GS navigation charts. The volume of a section was taken to be the mean of the end cross-sectional area times the section length.

Measurements from the strip-chart records of the temporary tide gauges were corrected with respect to sea level, corrected for variations in the paper feed rate, and replotted.

MATHEMATICAL MODEL

Oxygen Balance Studies

A river is a vital, living community containing many forms of life in vast numbers. When organic material is deposited into a body of water, the river community rapidly adjusts itself to the change in food supply, the availability of sufficient oxygen, and the dissipation of waste products. Often this results in a noticeable decrease in the dissolved oxygen content in a stream below a source of waste; followed by an increasing oxygen concentration still farther downstream.

This evaluation of estuarine water quality was based primarily on a "sanitary water analysis;" that is, upon variations in temperature, dissolved oxygen (DO), biological oxygen demand (BOD), and bacterial composition. Temperature, DO, and BOD are interrelated. As organic matter having a BOD is added to the river by sewage and industrial discharges, bacteria attack and alter the organic material, converting it to cell material and carbon dioxide. During this alteration DO is consumed. This bacterial process removes the organic matter from the stream. If the BOD is sufficiently high, the DO may be lowered to the point that it cannot support fish and other aquatic life. When the DO is at or near zero, anaerobic decomposition may occur. Such decomposition often results in gasification, producing carbon dioxide, methane, and hydrogen sulfide. The most noticeable results are "rotten egg" odors, black water, and discoloration of paint on nearby structures.

The interplay of the de-oxygenation of water by biochemical decomposition of organic material, and the re-oxygenation or re-aeration by the atmosphere, creates a curved profile of the dissolved oxygen concentration along the path of the water movement. This profile, in the terminology of the sanitary engineer, is referred to as "the dissolved oxygen sag."

By obtaining water samples at various points downstream from a waste source and determining their DO, the oxygen-sag curve may be drawn. Several methods are available to mathematically describe this curve. They are based upon adding the re-aeration, photosynthesis, and other sources of oxygen and subtracting the biochemical oxygen demand, sludge deposits, and other uses of oxygen with respect to time. Once the stream parameters are known for existing conditions, and the mathematical model is solved, certain parameters can be altered to reflect a new and hypothetical set of conditions, such as increased waste loads or the installation of sewage-treatment plants. A new oxygen-sag curve can then be calculated to reflect the new conditions.

Mass transfer equation.- The general equation for the conservation of mass of a substance in a turbulent fluid may be written in the following form:

$$\frac{\partial C}{\partial t} + u\frac{\partial C}{\partial x} + v\frac{\partial C}{\partial y} + w\frac{\partial C}{\partial z} = \frac{\partial}{\partial x}\left(D_x\frac{\partial C}{\partial x}\right) + \frac{\partial}{\partial y}\left(D_y\frac{\partial C}{\partial y}\right) + \frac{\partial}{\partial z}\left(D_z\frac{\partial C}{\partial z}\right) + S_o - S_i \qquad (1)$$

where C = the concentration of the diffusing substance,

x, y & z = coordinate directions x (length), y (depth), z (width),

u, v & w = velocity components corresponding to the x, y & z directions,

D_x, D_y, & D_z = turbulent diffusion coefficients corresponding to the coordinate directions,

S_o = source; net non-advective rate of addition of the substance across the boundaries of the system, and

S_i = sink; the net rate of removal of substance from the system.

In dealing with the distribution of a contaminant it is frequently convenient to use the one-dimensional approximation in which the instantaneous concentration is considered to be uniform over each cross-section, and all spatial variations are in the longitudinal direction of the estuary. This one-dimensional approximation was adopted here.

The one-dimensional form of equation (1) is obtained by ignoring $\frac{\partial C}{\partial y}$ and $\frac{\partial C}{\partial z}$ in comparison with $\frac{\partial C}{\partial x}$. Therefore,

$$\frac{\partial C}{\partial t} + u\frac{\partial C}{\partial x} = \frac{\partial}{\partial x}\left(D_x \frac{\partial C}{\partial x}\right) + S_o - S_i \qquad (2)$$

The analysis is restricted to slack water at high or low tide. If a pollutant is released continuously, its concentration at any transect will increase in time until an equilibrium value is achieved. At this point the concentration remains constant in time and the steady state is achieved.

Therefore, the determination of longitudinal dispersion coefficients is of fundamental importance to the analysis of the distribution of pollutants, biochemical oxygen demand, and dissolved oxygen in estuaries.

For convenience and manageability, the study scope was limited to description of pollutant and water-quality concentrations in terms of averages across a cross-section and over a tidal cycle. Only the steady state solutions are developed. The study region of the Pamunkey and Mattaponi rivers are tidal regions. The fresh water flows are relatively small. The dispersion force will be much greater than the advective force.

DO-BOD equations.- The amount of oxygen that is used in oxidizing the organic matter in a stream may be expressed by means of the following formula

$$y = L\left(1 - 10^{-k_1 t}\right) \qquad (3)$$

in which y is the amount of oxygen used in time t, L is the first stage oxygen demand, and k_1 may be determined by a series of measurements of the rate of utilization of oxygen by the wastes. For the present study, values in the range 0.0 - 1.0 were used.

In a similar manner, the rate at which the oxygen content of the stream is replenished from the atmosphere may be estimated. The rate of replenishment of the oxygen content of the stream is expressed by means of adding terms to equation (3) involving k_2 values. The k_2 values cannot be determined in the laboratory but must be computed from the results of analyses of the water in the stream at a number of different stations. Values of K_2 in the range 0.0 to 0.3 were used. The computation of k_2 values is much less precise than for k_1 values because of the complexity of the problem and the uncontrollable factors encountered in a natural stream.

The rate of utilization of oxygen may be combined with the rate of replenishment of the oxygen from the atmosphere. The resulting equation describes changes in the oxygen concentration in a stream that result from the introduction of decomposable organic matter.

While it is not possible to express the reactions that produce this relationship in an exact formulation, a general mathematical formulation relating organic pollution and the dissolved oxygen concentration level in a river was developed in 1925 by H. W. Streeter and E. B. Phelps. Their equation is:

$$D = \frac{k_1 \; La}{k_2 - k_1} \left(e^{-k_1 t} - e^{-k_2 t} \right) + Da \; e^{-k_2 t} \qquad (4)$$

where La = ultimate BOD at the upstream end of a reach in mg/l,
k_1 = the rate constant of deoxygenation in units per day,
k_2 = the rate constant for re-aeration in units per day,
Da = the oxygen deficit at the upstream end of the reach in mg/l, and
t = the flow time in days from the upstream end of the reach to the point in question.

The study region of the Pamunkey and Mattaponi rivers is tidal, and longitudinal mixing dominates. Camp (1963) has modified the Streeter-Phelps equation by introducing other parameters such as a dispersion coefficient and a mean tidal velocity. With the assumption that the rate of atmospheric re-aeration is proportional to the degree of under-saturation of dissolved oxygen, and that the rate of settling-out of decomposable organic matter is proportional to the BOD remaining to be satisfied, the oxygen profile for the steady state condition can be expressed as the following equation:

$$E \frac{d^2C}{dx^2} - U \frac{dC}{dx} + 2.3 \; k_2(C_s - C) + \alpha - 2.3 \; k_1 L = 0 \qquad (5)$$

The BOD profile for the steady state condition is given by

$$E \frac{d^2L}{dx^2} - U \frac{dL}{dx} - 2.3 \; (k_1 + k_3) \; L + P = 0 \qquad (6)$$

Integrating equation (6) between distance a and b for the boundary conditions

$L = L_a$ at $x = 0$, and L is a constant for $x = \infty$, yields

$$L_b = \left[L_a - \frac{P}{2.3\ (k_1 + k_3)} \right] 10^{j_1 x} + \frac{P}{2.3\ (k_1 + k_3)} ,$$

where

$$j_1 = 0.434 \left[\frac{U}{2E} \sqrt{\frac{U^2}{4E^2} + \frac{2.3\ (k_1 + k_3)}{E}} \right] . \qquad (7)$$

With the boundary conditions $C = C_s$ at $x = 0$, and
$C = C_s$ at $x = \infty$,

equation (5) is integrated to

$$D_b = \frac{k_1}{k_2 - k_1 - k_3} \left(L_a - \frac{P}{2.3\ (k_1 + k_3)} \right) (10^{j_1 x} - 10^{j_2 x})$$
$$+ \frac{k_1}{k_2} \left[\frac{P}{2.3\ (k_1 + k_3)} - \frac{\alpha}{2.3\ k_1} \right] (1 - 10^{j_2 x}) + D_a \cdot 10^{j_2 x} \qquad (8)$$

where U = the temporal mean velocity over several tide cycles,
- C_s = the saturation concentration of dissolved oxygen,
- C = the concentration of dissolved oxygen at any station x distance from station a,
- P = the rate of addition of BOD to the overlying water from the bottom deposits,
- E = the turbulent mixing coefficient,
- k_3 = the rate constant for the settling out of BOD to the bottom deposits per day,
- D_b = the oxygen deficit at some downstream station b in ppm,
- L_b = the ultimate BOD load at station b in ppm,
- α = the rate of oxygen production by photosynthesis, and

$$j_2 = 0.434 \left[\frac{U}{2E} \sqrt{\frac{U^2}{4E^2} + \frac{2.3\ k_2}{E}} \right] . \qquad (9)$$

The turbulent diffusion coefficient (or longitudinal mixing coefficient), E, for a mixed-flow estuary may be evaluated for a particular stream flow from the average chlorides, or salinity, provided the velocity U is not negligible and the chloride concentration at the upstream station is larger than one percent of the normal value at the lower end of the estuary. For this evaluation

$$S_a = S_b \cdot 10^{-0.434\ Ux/E} \qquad (10)$$

in which S_b = the average salinity or chloride concentration in mg/liter at the downstream point and x = the distance upstream to a station where the concentration is S_a. The S_a and S_b values should equal the average for several tidal cycles.

When the salinity in a reach in an estuary is less than 1 percent of that in the water below the estuary, the modified Taylor's equation (1954) may be used to determine the turbulent diffusion coefficient in which

$$E = 77\ [n]\ \frac{Q}{A}\ R^{5/6} \tag{11}$$

and where n = Manning's roughness coefficient, Q = average flow over several tidal cycles, A = the average cross-sectional area, and R = the average hydraulic radius in the reach. The values used in this report appear in Table 5.

Evaluation of Parameters

Low-flow distribution.- The oxidation of a pollutant is a time-dependent process. Oxygen demands exerted by polluting matter occur at varying distances downstream from their point of entry depending on the rate of flow. River flow depends on rainfall, which is extremely variable and unpredictable. A normal stream may range from a low of 10 percent of the average yearly flow, during a drought, to a maximum of several hundred times the average yearly flow during a flood.

Waste waters containing organic pollutants are diluted when they are discharged into estuaries. The worst nuisance occurs during periods of low flow. It would be uneconomical to augment low water flows to the point where the dilution of the sewage discharge was sufficient to reduce the amount of sewage treatment required. Experience has shown that several days are required before changes in river flow are reflected by changes in the biological characteristics of a river; that is, several days of low flow are necessary before a nuisance arises in a stream which is carrying a maximum pollutional load.

The flow rates selected for use in this study are the minimum flows for seven and fourteen consecutive days, which occur once in ten years. This corresponds to flows which will occur less than two percent and five percent of the time, respectively. The flow measurements used in making the necessary statistical analysis were obtained from U. S. Geological Survey for the gaging station at Hanover, for the Pamunkey River, and the station at Beulahville, for the Mattaponi.

The Hanover gaging station on the Pamunkey River is located two miles east of Hanover, at the bridge on State Highway 614. The records of this station cover a period of 24 years (1943 through 1967). The drainage area above Hanover is 1072 square miles. The Beulahville station on the Mattaponi River is located 0.4 miles upstream from bridge on State Highway 628, 2.8 miles north of Beulahville. The records of this station also

Table 5.- Values of the Turbulent Diffusion Coefficient (E) for the Transects of Figure 1.

High Water Slack			Low Water Slack		
Transect	Ft.^{2}/Sec.	Mi.^{2}/Day	Transect	Ft.^{2}/Sec.	Mi.^{2}/Day
Y02	1720	5.3	Y02	1100	3.4
Y01	1660	5.1	Y01	1090	3.4
P01	1600	5.0	P01	1080	3.3
P02	1880	5.8	P02	1070	3.3
P03	2550	7.9	P03	1050	3.2
P04	2880	8.9	P04	1480	4.6
P05	2070	6.4	P05	1230	3.8
P06	1420	4.7	P06	810	2.5
M01	840	2.6	M01	770	2.4
M02	640	2.0	M02	320	1.0
M03	860	2.7	M03	530	1.7
M04	670	2.1	M04	540	1.7
M05	720	2.2	M05	380	1.2

Table 6.- Drainage Areas and Accumulated Distances, through Transect P06 (Figure 1), for the Pamunkey River.

Transect	Distance from West Point (ft)	Distance from West Point (mi)	Drainage area (sq. mi.)	Cumulative Drainage Area (sq. mi.)
P07	70500	13.4		
			14.3	1418.9
P06	55800	10.6		
			12.7	1431.6
P05	42700	8.1		
			12.8	1444.4
P04	29500	5.6		
			12.7	1457.1
P03	16400	3.1		
			12.6	1469.7
P02	3280	.6		
			3.1	1472.8
P01	0	0		

cover a period of 24 years (1943 through 1967). The drainage area above the gaging station above Beulahville is 619 square miles.

The flow data from these two gaging stations have been plotted as probability deficiency curves in figures 2 through 5. The curves are based on studies made by the USGS of the seven and fourteen consecutive days of minimum mean daily flow in a water year.

Because the Pamunkey and Mattaponi rivers are tidal in the study region, there are no stream-gaging stations downstream from Hanover and Beulahville. Flow speeds and times of travel were obtained by considering the volume of flow, the cross-section area of the river, and the results of the dye tests described elsewhere in this report.

Owing to the lack of adequate flow or discharge data at West Point it was assumed that 300 cfs represented the fourteen-consecutive-day low flow for the York River at West Point that would occur no more than once within a ten-year period. This 300 cfs value was suggested by an experienced engineer from the Norfolk District of the U. S. Army Corps of Engineers. [A House Document (U. S. Government, 1930, p. 3) mentions a minimum runoff of "only about 300 cfs"]. Specific flows for each reach were computed by proportioning the difference in flow between the Hanover gaging station (fig. 3, "45 cfs") and the assumed value of 300 cfs at West Point, according to the drainage areas for each reach. Drainage areas for each reach were measured from U. S. Geological Survey topographic maps. The drainage areas and distances between each transect, up to P06 (fig. 1), are presented in Table 6.

<u>Determination of flow times</u>.- In order to solve the oxygen sag equations (7 and 8) it is necessary to know the time required for flows to travel through the various reaches. In many streams, including the Pamunkey River, the speed of flow is a function of the volume of flow, the greater the volume the greater the speed. This is calculated by Manning's equation:

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2} \qquad (12)$$

where Q = discharge in cu. ft.-per second,
n = Manning's roughness coefficient,
A = the channel cross-sectional area in square feet,
R = the hydraulic radius in feet, and
S = the bottom slope.

Because we are interested only in periods of low flow, the above equation can be approximated and rewritten as follows:

$$Q = \frac{1.486}{n} B\,Y^{5/3} S_f^{1/2}$$

where Y = average depth in feet,
B = the average width in feet, and
S_f = the frictional slope.

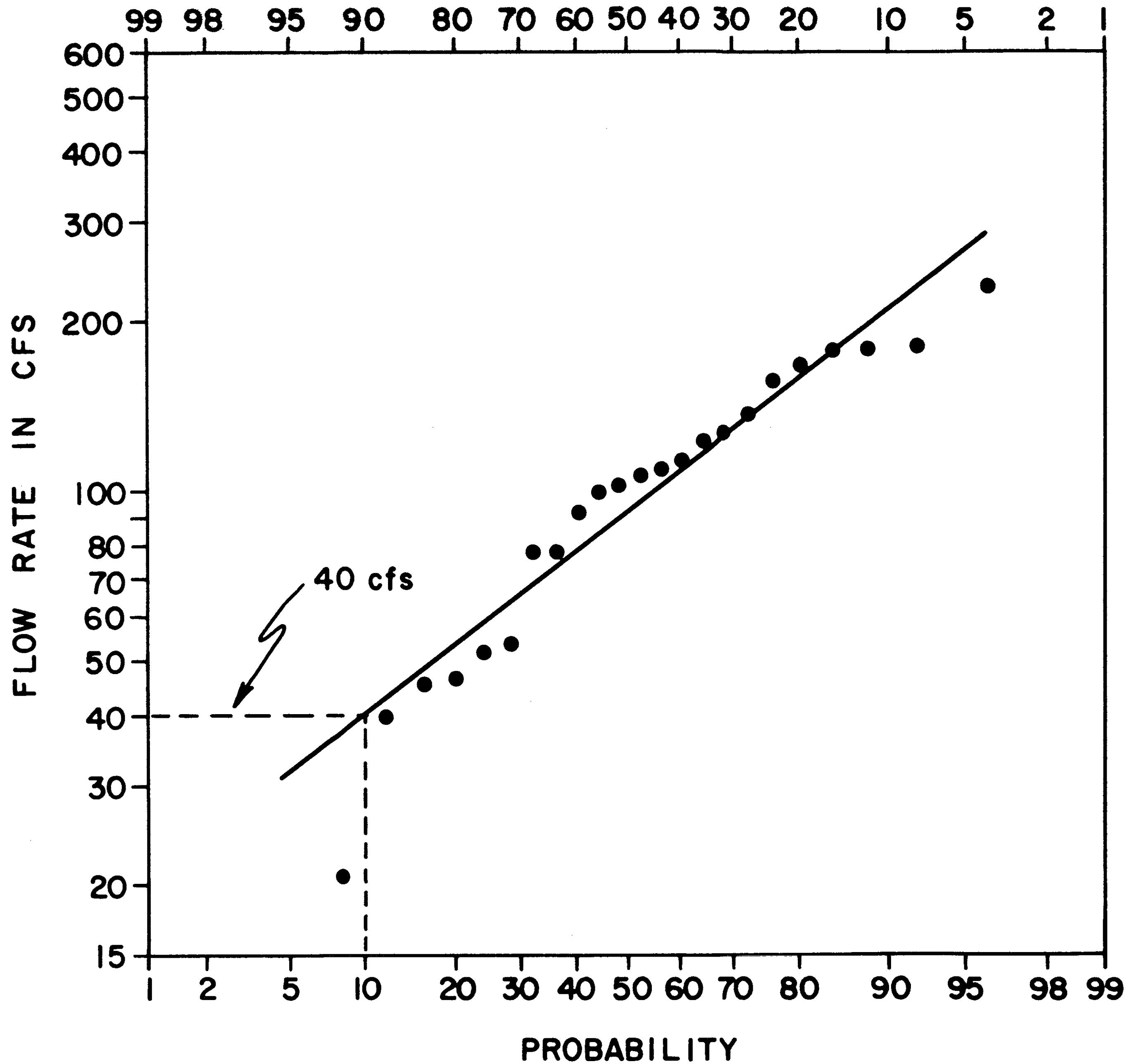


Fig. 2.- Seven-consecutive-day low-flow deficiency curves for the Pamunkey River at U.S.G.S. gauging station at Hanover, Virginia. (Drainage area 1072 sq. mi. Period of record 1943-1967, inclusive).

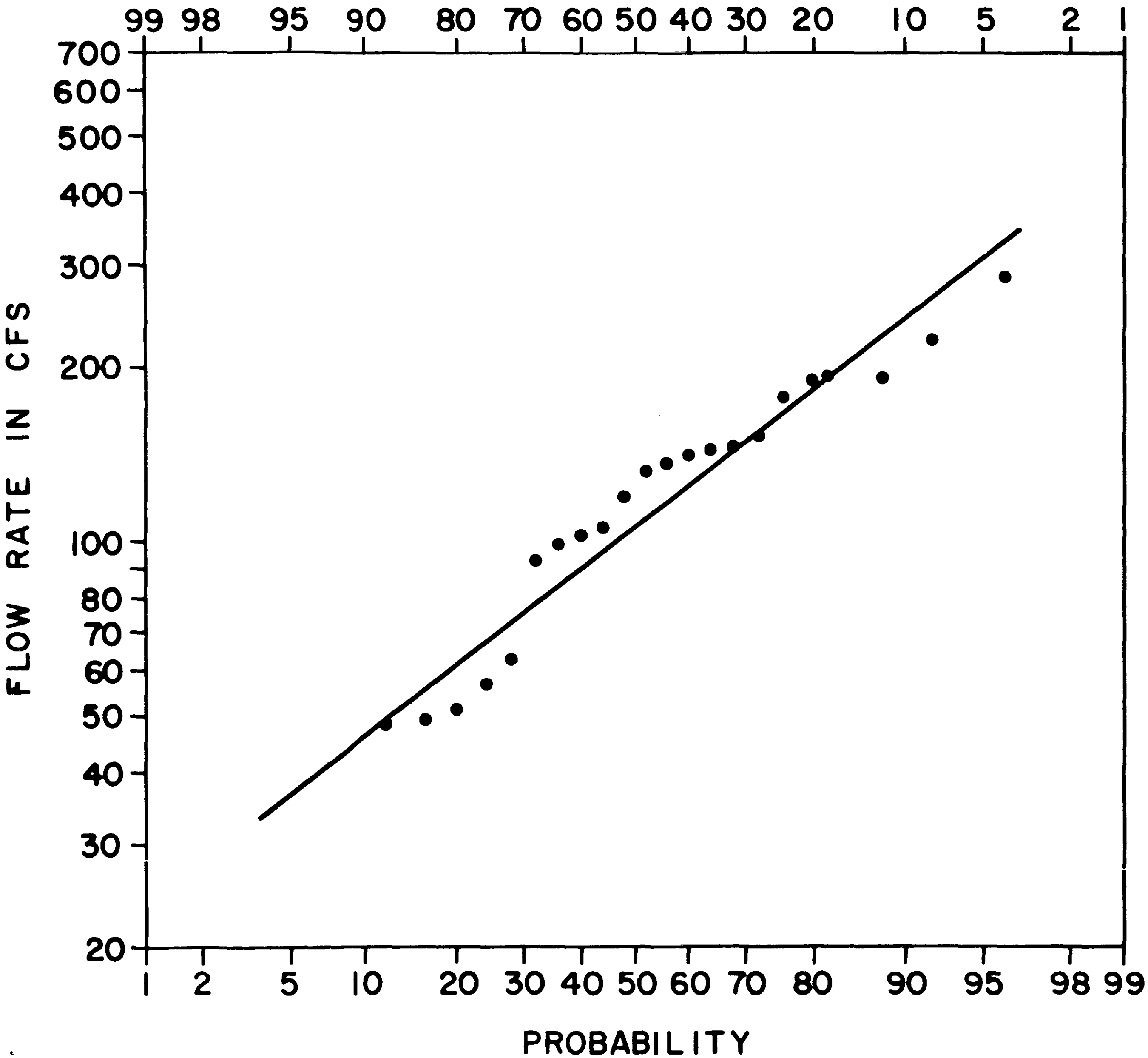


Fig. 3.- Fourteen-consecutive-day low-flow deficiency curves for the Pamunkey River at U.S.G.S. gauging station at Hanover, Virginia. (Drainage area 1072 sq. mi. Period of record 1943-1967, inclusive).

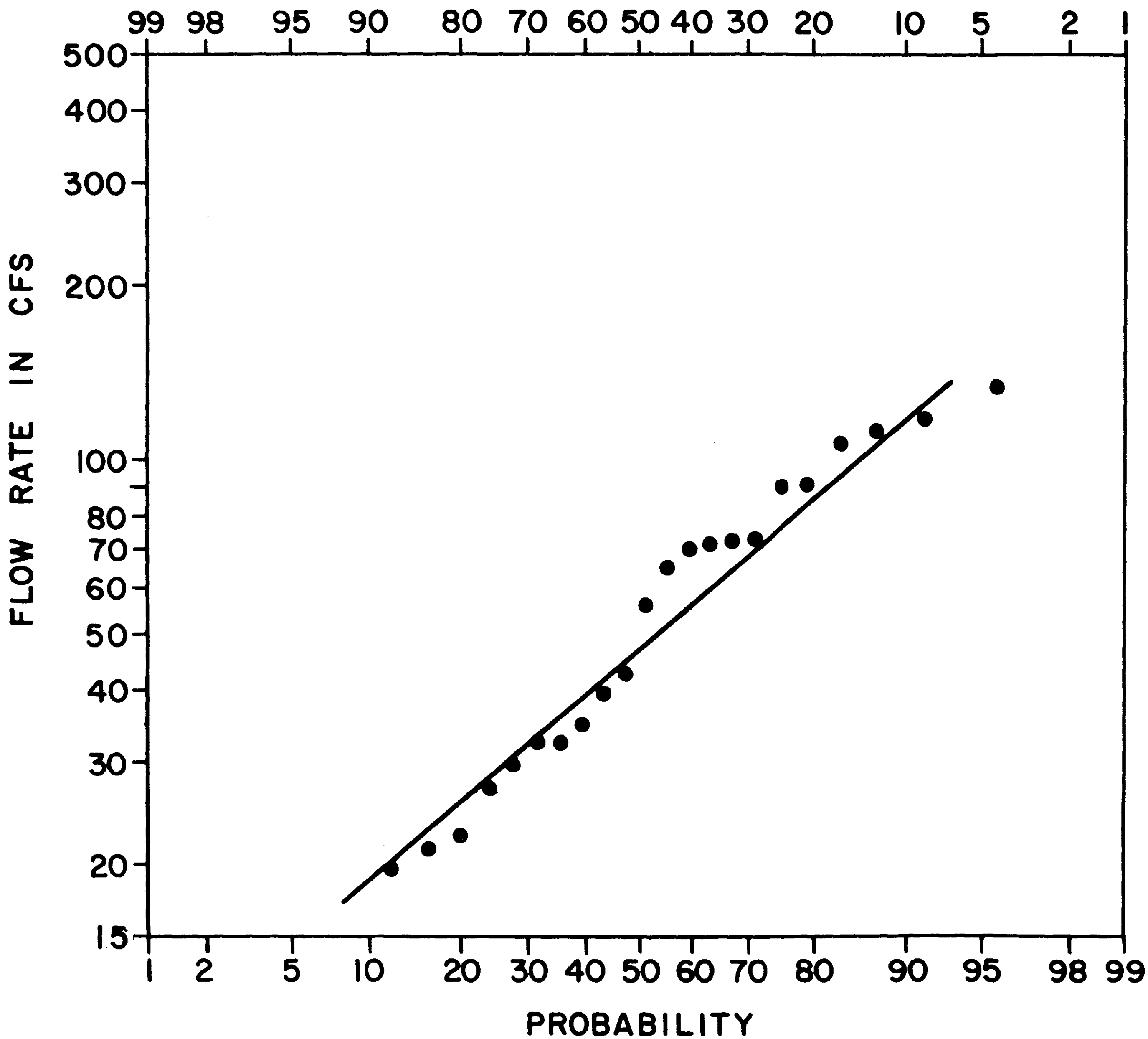


Fig. 4.- Seven-consecutive-day low-flow deficiency curves for the Mattaponi River at U.S.G.S. gauging station at Beulahville, Virginia. (Drainage area 619 sq. mi. Period of record 1943-1967).

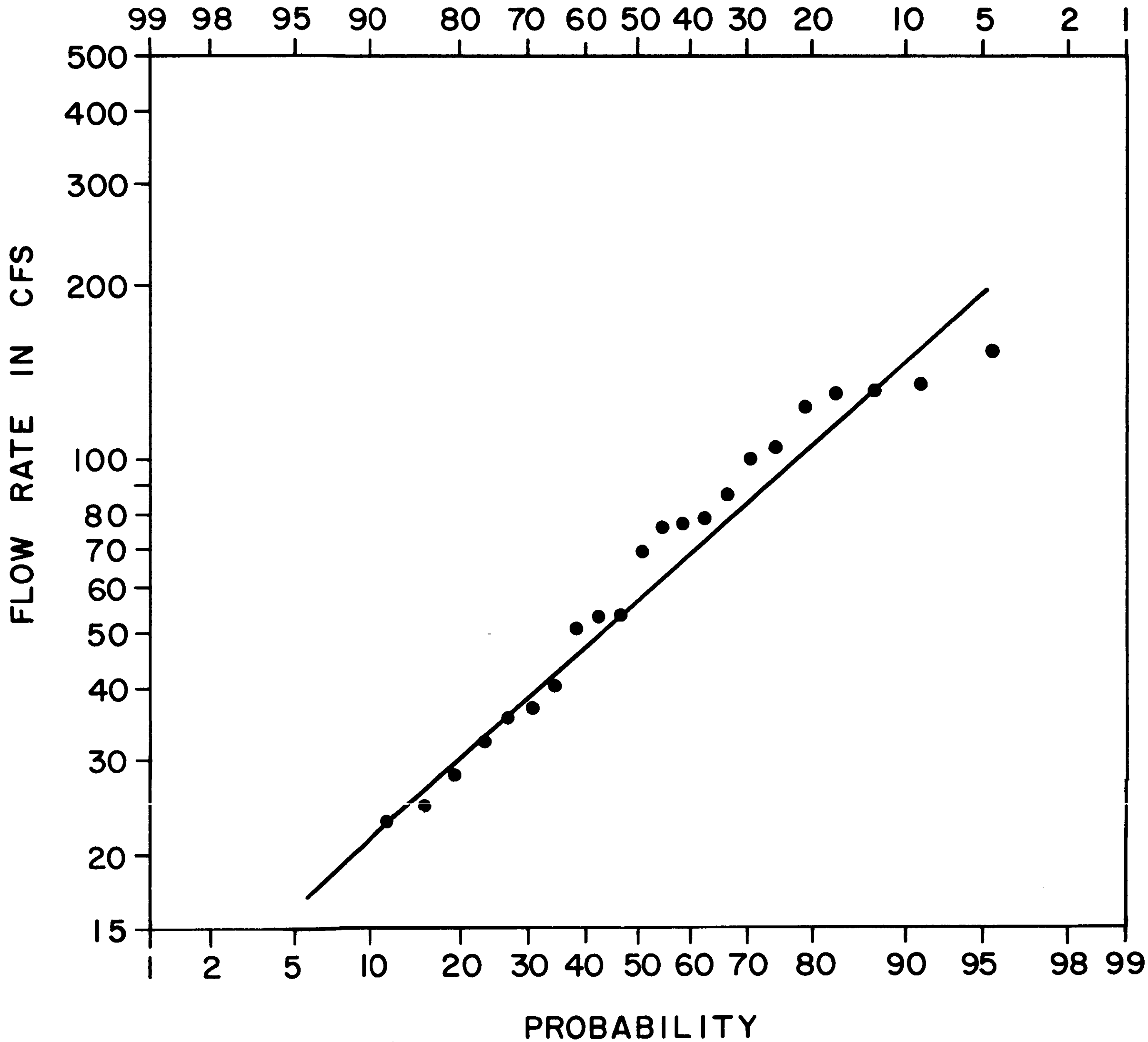


Fig. 5.- Fourteen-consecutive-day low-flow deficiency curves for the Mattaponi River at U.S.G.S. gauging station at Beulahville, Virginia. (Drainage area 619 sq. mi. Period of record 1943-1967, inclusive).

Manning's roughness coefficient n is assumed to be 0.03. The 10 percent figure calculated for low flow was taken from the deficiency probability curves for the two gaging stations, Hanover and Beulahville. Additional flows derived from the drainage areas between the gaging stations and West Point were estimated for each river starting with the Corps of Engineers' estimate of 300 cfs for West Point and working backward to the 45-cfs, fourteen-consecutive-day low-flow value (fig. 3) at Hanover and the 22-cfs value at Beulahville.

The average depths (Y) were calculated for all reaches using equation (13). All speeds were then calculated from Manning's equation (12) based on the corresponding average depths. Times of travel for all reaches were then calculated by dividing each reach length by the corresponding flow speeds. The times of travel computed by these hydraulic methods were found to be comparable with measurements of dye travel.

Benthic oxygen demand.- Because of low scouring velocities in estuaries, sewage effluents and industrial wastes deposited in polluted water courses may exert heavy oxygen demands on the overlying waters. This is true if conditions favor the accumulation of sludge over relatively long periods of time. Settleable solids are deposited on the stream bottom by sedimentation. When waste water is discharged into a tidal reach of high salt content, chemical coagulation can be induced. This causes the finely divided colloidal particles to aggregate and settle out as bottom sediment. Moreover, due to bacterial activities, part of the BOD contributed by biological flocculation is removed from the flowing water in the stream. In the mathematical equations the rate of loss of BOD from the stream due to settling is given by

$$\frac{dL}{dt} = k_3 L \tag{14}$$

where k_3 = rate constant for settling of BOD day^{-1}. (Values used for k_3 ranged between 0.0 to 3.0). There is not enough dissolved oxygen to maintain aerobic conditions in bottom sediments which are relatively fine in texture but have a very high oxygen demand. Some of the anaerobic decomposition products diffuse upward through the pore water of the sediments to the overlying water and exert BOD in the flowing water. Therefore, the oxygen demand of the bottom sediments upon the overlying water becomes an important part of oxygen-balance studies.

Oxygen demands of benthic deposits used in the study are designated P and have the dimension mg/l/day.

A method of estimating the benthic oxygen demand consists of measuring the volatile content of river bottom sludge samples and computing the oxygen demand. Another method consists of placing samples of bottom samples in bottles and measuring the oxygen uptake over various time intervals.

Values of P used in this report (0.0-1.0) were assigned to those reaches of the river where prior bottom samples had indicated settling might occur. The benthic demand represents an unpredictable factor that requires constant updating to reflect the changing estuarine conditions.

Photosynthesis.- In stream pollution studies careful consideration should be given to the role played by plant photosynthesis in the overall oxygen balance of the stream. There are about 15,000 acres of salt marsh in the Pamunkey River estuary and 8,238 acres in the Mattaponi River estuary (Table 7). The marsh vegetation, algae, and aquatic plants in a stream share the common characteristic of all chlorophyll-containing plants of being able to convert carbon dioxide into organic substance and release molecular oxygen to the environment. The amount of oxygen produced during photosynthesis varies with the intensity of sunlight and the density of the plant population. In addition, at night the same plants extract oxygen from the water for respiration. For use in the present study, the overall net production of DO by photosynthesis is expressed in the mathematical equations as α and has the dimensions of mg/l/day. Values of α can be derived from light and dark-bottom tests. Values of α were not determined in the present study, but were estimated from data available in the literature (Fair and Geyer, 1968). A problem exists in estimating adequately documenting the effect on DO of the marshes in the Pamunkey estuary.

Re-aeration.- There is a continuous interchange of oxygen at the gas-liquid interface between stream water and the atmosphere. When the concentration of dissolved oxygen in the water falls below the saturation concentration, there will be a net mass transfer of oxygen from atmosphere to the water, referred to as re-aeration. The difference between the saturation concentration and actual concentration of dissolved oxygen in the water is called the oxygen deficit. The rate of oxygen transfer depends on the properties of the gas-liquid interface, the gradient of the deficit, the intensity of turbulence of the stream flow, and temperature. Expressed mathematically

$$\frac{dD}{dt} = k_2 D \qquad (15)$$

where D = dissolved oxygen deficit in mg/l,
k_2 = re-aeration coefficient in days, and
t = time in days^{-1}.

The re-aeration rate k_2 can be determined using the O'Connor-Dobbins formula, where

$$k_2 = \frac{(D_c U)^{1/2}}{H^{3/2}} \qquad (16)$$

D_c = molecular diffusivity of oxygen in water (0.000081 ft^2/hr. @ 20°C)
H = water mean depth (feet)
U = mean tidal velocity (feet per hour).

Table 7.- Wetland Acreage in the Pamunkey and Mattaponi River Basins by Regions.[1]

Regions	Wooded Marsh	Marsh	Open Creeks	Woodland	Tidal Flats	Sand	Ponds	Totals
PAMUNKEY RIVER:								
King William	0	639	290	0	0	0	0	929
New Kent	2406	2378	389	0	349	0	132	5654
Old Church	0	2617	515	0	0	0	62	3194
Tunstall	896	334	212	0	191	0	26	1659
West Point		3123	88	0	151	0	209	3571
TOTALS:	3302	9091	1494	0	691	0	429	15007
MATTAPONI RIVER:								
Aylett	0	642	294	0	0	11	110	1057
Beulahville	213	0	51	0	0	0	7	271
King & Queen	0	2202	33	0	224	0	0	2459
King William	0	609	15	0	7	15	7	653
Truhart	0	668	7	0	0	0	0	675
West Point	125	2646	235	22	0	7	88	3123
TOTALS:	338	6767	635	22	231	33	212	8238

[1] Compiled by Dr. T. Wright (VIMS), unpublished manuscript.

For different temperatures, k_2 can be corrected by following equations:

$$k_T = k_{20} (\Delta)^{T-20} \qquad (17)$$

where Δ = 1.015 to 1.047 and
T = temperature degrees celcius. (18)

A number of formulae have been suggested for estimating the rate constant for atmospheric re-aeration. They are useful mainly for relatively clean waters. For polluted streams, experimentally determined rate constants are usually used, if available.

Oxygen saturation C_s.- The maximum quantity of oxygen which can dissolve in equilibrium with the partial pressure of oxygen in the atmosphere is termed C_s. The partial pressure is determined by the volume percentage of oxygen in the atmosphere in contact with water, approximately 21 percent, and it depends on the temperature, the barometric pressure, and the degree of water-vapor saturation. Furthermore, the saturation value of DO is affected by the chemical characteristics of the water, such as the concentration of dissolved salts. C_s decreases with an increase in temperature, water-vapor pressure, and concentration of solids, and increases with barometric pressure. As salinity increases, the solubility of oxygen decreases, being only about 82 percent (Camp, 1963) as great for sea water as for fresh water. In oxygen-balance studies of tidal estuaries, the solubility of oxygen should be adjusted for the average salt content in each reach.

In the present study an empirical equation was derived based on temperature and salt content, using tables published by Green and Carrett (1967).

$$C_{SAT} = 14.6244 - 0.367134\,T + 0.0044972\,T^2 - 0.0966\,S + 0.00205\,ST + 0.0002739\,S^2 \qquad (19)$$

where T = temperature degrees celcius
S = salinity ‰, and
C_{SAT} = saturation concentration of DO in ppm.

Temperature.- In the relationship of BOD stabilization and DO concentration, temperature plays an important role. An increase in temperature has two effects: (1) the organic material is stabilized at a faster rate (and, therefore, the DO is utilized at a higher rate); and (2) the saturation value for dissolved oxygen is reduced, thereby decreasing the amount of oxygen that a stream can dissolve. Under normal conditions, the critical stream situation, resulting in undesirable water quality, usually develops at low stream flows and at elevated temperatures. High water temperatures not only reduce the capacity of the stream to dissolve oxygen but also increase the rate of de-oxygenation by microorganisms. For the Pamunkey River, low flow occurs in late summer and autumn. This period often coincides with the highest temperatures of the year. From the viewpoint of stream pollution abatement, this certainly represents the worst combination of these two significant factors. Measurements of water temperature during the summer months indicate that the average water temperature in July and August is about 25°C, with occasional days when temperature is as high as 27°C. For this study we have used a temperature of 27°C.

Description of the Model

Information required.- The portion of the river to be considered is divided into N reaches. The first reach is at the upstream end, and the nth reach at the downstream end.

The following parameters are used to compute changes in dissolved oxygen and BOD load within each reach.

k_1 = de-oxygenation rate constant ($days^{-1}$)

k_2 = re-aeration rate constant ($days^{-1}$)

k_3 = settling-out rate constant ($days^{-1}$)

x = rate of DO production by algae (ppm/day)

P = rate of BOD addition from bottom deposits (ppm/day)

C_{si} = saturation concentration, dissolved oxygen (ppm)

T_o = temperature at which above values were determined (°C)

T = time of travel (days)

E = dispersion coefficient (sq. mi/day)

U = mean velocity of the flowing stream in mi/day

D_i = DO deficit in ppm at upstream end
E_i = DO deficit in ppm at downstream end

L_i = BOD load in ppm at upstream end
F_i = BOD load in ppm at downstream end

The definitions of DO and BOD variables are in Figure 6.

Equations.- In the mathematical model, the Camp equations (7 and 8) are applied in two ways:

1) to compute the values of dissolved oxygen deficit and BOD (E_i and F_i) at the downstream end using the values at the upstream end (D_i and L_i), and,

2) to compute the DO deficit (E'_i) at a point of constraint, using D_i and L_i.

Mass balance equation.- At any tributary and point of introduction of waste water, the dissolved oxygen and BOD concentration of the inflow are assumed to mix instantaneously and uniformly with the dissolved oxygen and BOD in the river. Holley, and others (1970), have indicated that the one-dimensional mass-balance equation is not applicable to a dispersing cloud immediately after introduction of the pollutant into a flow. There is an initial period during which the motion of the cloud is controlled primarily by the distribution of convective velocities within the flow cross section. Therefore, the simple continuity equation was used as the mixing equation in this study.

$$S_d \, q_d = S_u \, q_u + S_i \, q_i \tag{20}$$

where: q_u = discharge upstream

q_d = discharge downstream

q_i = inflow

S_d = concentration of DO or BOD downstream

S_u = concentration of DO or BOD

S_i = concentration of DO or BOD in the inflow

The river discharge is considered constant along specified reaches of the river. At a junction point, the river discharge downstream q_d, is the specified discharge for the river at the point of junction. The inflow q_i, is the discharge specified in the input data for a tributary or waste effluent. Before the mass balance equation is applied, the river discharge upstream from the point of junction, q_u, is computed by subtracting q_i from q_d.

Ultimate BOD.- In the computer program, for convenience, the input data of BOD is 5-day 20°C carbonaceous BOD, but for calculation the ultimate BOD was used. For the waste effluents and tributaries in this report the ultimate BOD is computed by the following equation:

$$L = \frac{C_B \cdot e^{0.02(T-20)}}{1 - 10^{-0.5}} + B_n \tag{21}$$

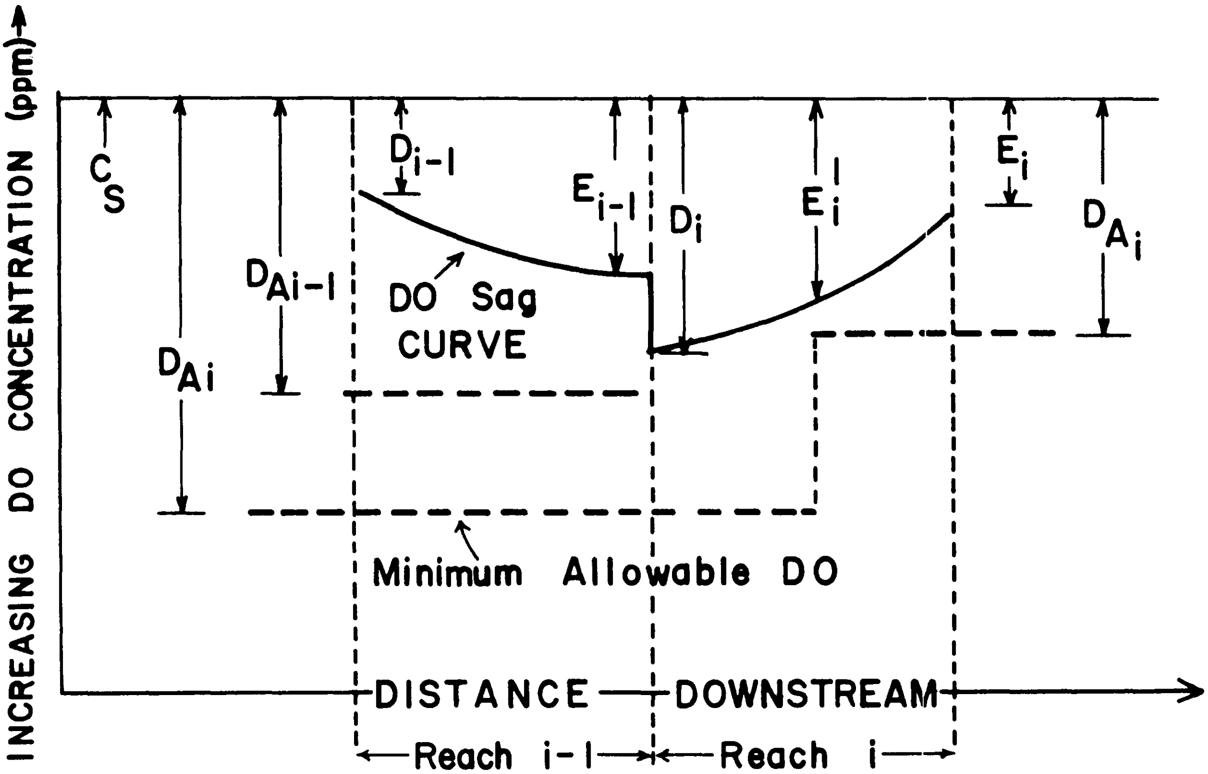
C_B = carbonaceous BOD (5-day 20°C)

B_n = nitrogenous BOD

L = ultimate BOD

T = temperature in °C, and

e = 2.7182



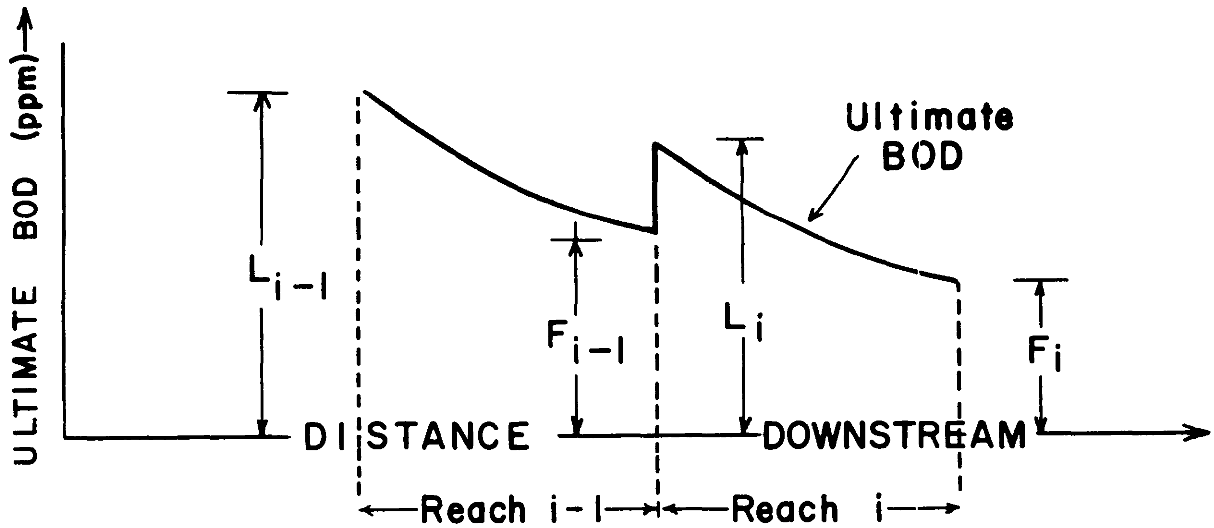


Fig. 6.- Definition of variables for dissolved oxygen (DO) and bio-chemical oxygen demand (BOD).

Dissolved oxygen saturation C_s.- The saturation concentration of dissolved oxygen is calculated for each reach by equation (19).

Temperature correction for k_1 and k_2.- The values of k_1 and k_2 in the input data are assumed to be for 20°C. The values of k_1 and k_2 at temperature T used in the model, can be computed by following equations, respectively:

$$(k_1)_T = (k_1)_{20} \cdot 1.046^{(T-20)} \tag{22}$$

and

$$(k_2)_T = (k_2)_{20} \cdot 1.0241^{(T-20)} \tag{23}$$

Procedures.- Picking a starting point upstream, at which the DO and BOD load are known, the values of DO and BOD load at desired downstream points along the river can be computed by repeated application of the equations along the river. The mixing equations can be used to compute changes at points of inflow. Camp equations are valid only for reaches where the discharge, velocity, river parameters, and temperature remain constant. Therefore, the distance between transects has to be relatively small, so that the total error produced by different river parameters will be negligible.

After values at the downstream end of a transect have been computed, the values at the upstream end of the next transect are obtained by consideration of the type of change or changes which may occur between transects. The river discharge and the river water-quality parameters may change from reach to reach.

Assumptions:

1) The concentrations of BOD and DO are assumed to remain constant, and only the discharge changes. Thus, the flow increment to each reach is assumed to have the same BOD and DO concentrations as the estuary itself at the upstream boundary of the reach.

2) Within each reach, the water-quality parameters will be assumed constant. Different sets of parameters would be used for other reaches.

3) The continuity equations are applied to compute the BOD and DO concentrations downstream from the tributary, as well as downstream of the outfalls for the paper-mill effluent.

Description of the Computer Program

Main program.- A flow chart of the main program is shown in figure 7. The listing of the Fortran IV computer program and its input is contained in Appendix D.

Subroutines.- Subroutine INPDA reads the input data and prints a copy of the input data if specified by the user. If any data groups are missing after all data prepared for the first simulation have been read, an appropriate error message is printed and the program then reads the data for the next simulation.

Subroutine CMAX determines the downstream point nearest to X_u at which a change occurs.

Subroutine CONJ is for applying the continuity equations.

Function FTBOD computes ultimate BOD from the values of 5-day, 20°C carbonaceous BOD and nitrogenous BOD.

Function NOCC finds the transect number corresponding to the initial value of X_u.

Preparation of input data.- The data deck for one computer run would be composed of the following cards in the indicated order:

1) The title card for this simulation. Card columns 1-70 may be used, which contain the information identifying the particular set of conditions under investigation.

2) Cards containing the data for all data groups. The data groups may be arranged in any order, except that the data group specifying treatment plant types must follow the data group for waste effluents. Each data group must be preceded by a title card, which contains the following:

   The identification number of the data group and number of items in the data group are in card column 1-5 and 6-10 respectively. The number must be integer, right-justified in the field. Columns from 11-70 may be used for comments to identify the data group or leave it blank.

3) A card containing the number 99 in card columns 4 and 5 indicates the end of data for the starting run.

4) If the whole input data or a part of it is needed to change further computations, the procedure as described above in items 1 to 3 has to follow.

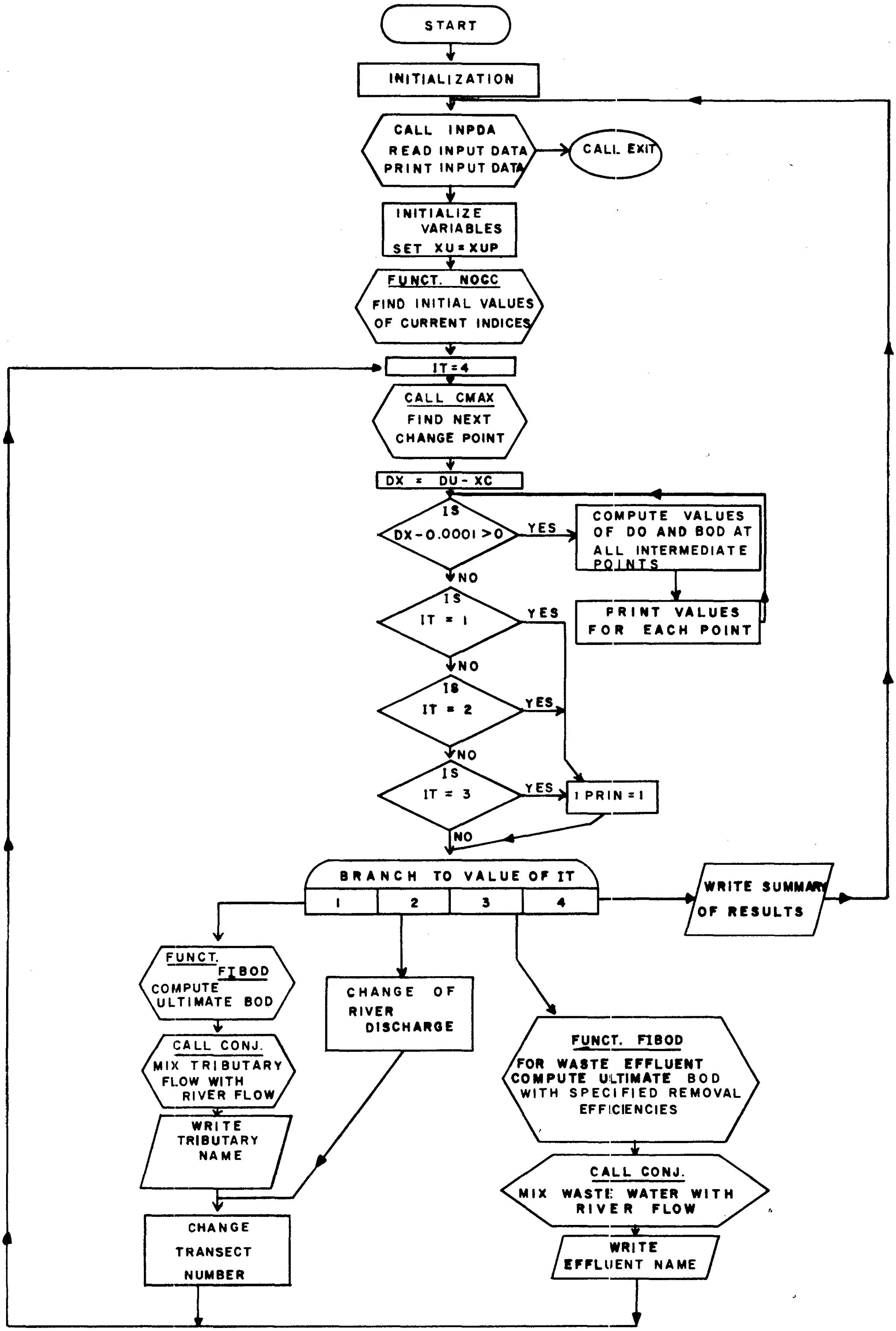


Fig. 7. Flow chart of the main computer program.

Data groups 1, 3, 4, and 5 are divided into data subgroups. For these groups, each subgroup of data is preceded by a subgroup title card, which contains the number of the subgroup in card columns 6-10, followed by comments in card columns 11-70. Columns 1-5 must be blank. In data groups 1, 2, 3, 4, and 5, the data values must be placed in order, from downstream to upstream. The computing procedure is from upstream to downstream. The same card format is employed for any number which may contain a decimal point. Up to 7 numbers may be entered on one card, in columns 1-10, 11-20, ..., 61-70.

Data Group 1: Tributaries

As described above, the title card contains the number 1 in column 5, the number of tributaries in columns 6-10; followed by a comment in columns 11-70. At least one tributary must be described in the input data. The data for tributaries are divided into the following subgroups:

Subgroup 1: Name of Tributaries: The subgroup title card contains a 1 in column 10. Three names of tributaries can be entered in one card in columns 1-16, 21-36, and 41-56. They must be in order from downstream to upstream.

Each data subgroup is preceded by a subgroup title card. The remaining data for tributaries are as follows (see Appendix D):

a) name
b) location (river miles)
c) flow rate (cfs)
d) DO (mg/l), dissolved oxygen
e) BOD (5 day 20°C lb/day) carbonaceous BOD
f) BOD (lb/day), nitrogenous BOD

Data Group 2: Speed

Title Card: "2" in column 5, number of reaches in columns 6-10. The velocity in each reach will be computed from the equation

$$V \text{ (miles/day)} = a\, Q^b \qquad (24)$$

Because these data appear only once in the input data deck, there are no subgroups. The location of upstream ends of hydraulic reaches are given first with 7 decimal numbers from columns 1 to 70 per card, followed on a new set of cards by the values of a, then the values of b.

Data Group 3: River-quality parameters

Title card: "3" in column 5, number of reaches in columns 6-10. All data are decimal numbers in data subgroups.

Within each reach, the water quality parameters will be assumed constant. The following data will be required for each reach.

a) k_1 (days)
b) k_2 (days)
c) k_3 (days)

d) a (mg/l/day)
e) P (mg/l/day)
f) Temp °C
g) Salinity ppm
h) E sq/mi/day
i) U ft/sec

Data Group 4: River Discharge

Title Card: "4" in column 5, number of reaches in columns 6-10.

The total river flow in cfs, considered constant over each reach of the river. The discharges are given with 7 decimal numbers from columns 1 to 70 per card. Each decimal number has to be within 10 columns.

Data Group 5: Waste Outfalls

Title Card: "5" in column 5, number of waste outfalls in columns 6-10.

Subgroup one is names of waste outfalls. The names of the plants or towns are entered, three names per card in card columns 1-16, 21-36, and 41-56.

All subgroups are as follows:

a) names
b) location (river miles)
c) flow rate (mgd)
d) BOD (5-day 20°C) (lb/day)
e) BOD (N) (lb/day
f) treatment alternatives

In subgroup (f), the cards following the subgroup title card (the number 6 in column 10, followed by a comment) are a repetition of the following types of data:

There are four alternatives which are: no treatment, primary treatment, secondary treatment and tertiary treatment. For each alternative, the removal efficiencies for carbonaceous and nitrogenous BOD and effluent DO (mg/l) are in card columns 1-10, 11-20, and 21-30 respectively. For each waste-water effluent, a card of type of treatment is followed by a series of cards of removal efficiencies describing each alternative.

Data Group 6: Initial Conditions

Title card contains "6" in column 5, data consists of a single card which contains the following information:

1) the upstream starting point in the river at which computations are to begin, in river miles;

2) discharge (cfs), in card columns 11-20;

3) BOD (ppm), in card columns 21-30;

4) DO (ppm), in card columns 31-40;

5) the downstream point at which computations are to be terminated, in river miles, in columns 41-50.

Data Group 7: Maximum Distance Increment, in miles

Title card contains "7" in column 5. The distance (miles) between points at which the DO and BOD are to be computed, in columns 1-10 in the following card in decimal numbers.

Data Group 8: Input-output Options

Title card contains "8" in column 5, followed by a comment in columns 11-70. In the following card, in card column 5, the number 1 indicates the input data are to be printed in the output. A blank or zero causes omission of this output.

In column 10, the number 1 causes output of the computed values at each point along the river.

Data Group 9: Base for River Constants

The title card contains "9" in column 5, followed by a comment in columns 11-70. In the following card, the river constants k_1, k_2, and k_3 in the Camp equations may be interpreted as exponents of either base e = 2.71828 or base 10, at the option of the user, in columns 1-10. Unless specified by inclusion of this data group in the input, the river constants are assumed to be exponents of base 10.

Data Group 10: Treatment Selection

For each community or industrial waste-water effluent, the waste removal efficiencies in the program are designated 1, 2, 3, and 4, corresponding to no treatment, primary treatment, secondary treatment, and tertiary treatment, respectively.

Title cards contain "10" in columns 4 and 5, followed by a comment in columns 11-70. The selections for each site are integer numbers, to be entered fourteen per card in 5-column fields, starting with columns 1-5, and ending with columns 66-70. Again, the integer values must be right-justified within each field. The community or waste-water effluent order must corresponding with the ordering used in Data Group 5.

<u>Output description</u>.- A sample of program output is contained in Appendix E. The output consists of the following:

1) A copy of the input data.

2) The values of time accumulated from the starting calculated point, DO, oxygen saturation, ultimate BOD, and river discharge at all points are computed. The title card for the computation is printed at the top of each page, followed by the column headings. The names of communities and tributaries are printed as they are encountered under the column heading description. The number following the work "GROUP" indicates the data group in which the end of a reach has been detected.

3) Data modifications to a specific input data group or subgroup wipe out the previous data values, and are then retained for use hereafter.

RESULTS AND DISCUSSION

Dye Study

Continuous release.- Dye-release patterns for the continuous release are presented in Appendix A, pages A2-A37. Values of the contours are in ppb, and represent dye concentration after correction for background fluorescence. The down-estuary variation in dye concentration between Gloucester Point and West Point at the end of the continuous release is presented on page A37.

The contours on the figures in Appendix A are limited almost exclusively to water depths of greater than 2 m; that is, to channel areas. This is more typically the case in the York River portion of the study area than elsewhere because of the greater percentage of shoals there. Contours for dye concentration are dashed where information is poor (page A14) or lacking (page A2) where interpretations could not be made.

Dye patterns for the York River portion of the study area are informative. On high-slack water (pages A2, A14, A24) one sees that a "tongue" of low-dye-concentration surface water has advanced up the York River channel leaving higher-dye-concentration water to the sides. Waters of high dye concentration are found just off West Point at the end of flood tide. Such waters are believed to represent the slug of high-dye-concentration water that developed at the release points on the previous high-water slack and which was propagated down-estuary and then back up over the ensuing tidal cycle.

There is a general tendency for the waters of highest dye concentration to occur to the southwest or southeast of the West Point peninsula at the end of flood tide (pages A2, A14, A24). The distribution patterns of these highest-dye-concentration waters are strongly influenced by wind.

Table 8 gives the hourly wind speeds and directions for Byrd Field, about 30 miles from West Point, during the study point. Prior to the sampling run shown on page A2, the wind was blowing from the compass sector between 290 to 350 degrees, for 15 hours, at speeds of 02 to 10 knots. Prior to the sampling run shown on page A14, the wind blew from the sector between 250 and 330 degrees, for nine hours at 7-13 knots, and previous to that, it blew from the 180-to-230 degree sector for 49 hours at 2-12 knots. The foregoing winds had the effect of transporting the peak dye concentrations to the eastern side of the uppermost York River estuary (pages A2 and A14).

The dye distributions of October 17 and 21 were found to be significantly altered during the sampling run of 30 October 1969. As seen on page A24, the peak dye concentration has now been crowded to the western side of the upper York estuary. Winds (Table 8) blew from the 360-to-80-degree compass sector for 67 hours prior to the sampling run, at speeds of 2 to 13 knots. Thus, the wind factor in the environment is of importance even when the peak speeds are as low as 10-12 knots.

Table 8.- Hourly wind speed and direction as measured at Richmond's Byrd Field, October 12 - November 9, 1969. [Direction (D) in degrees true x 10; speed (S) in knots]

Time (nearest hour)	Oct. 12		Oct. 13		Oct. 14		Oct. 15		Oct. 16		Oct. 17		Oct. 18		Oct. 19	
	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S
01	34	4	1	6	00	0	1	12	33	3	25	3	25	4	12	4
02	4	3	36	4	00	0	1	8	00	0	19	4	5	2	23	2
03	34	4	34	5	13	3	1	14	36	3	00	0	34	4	19	3
04	35	4	36	5	00	0	3	11	36	3	00	0	00	0	18	4
05	2	6	36	6	00	0	1	10	36	3	00	0	35	3	19	5
06	1	5	35	6	27	3	1	14	00	0	31	3	00	0	19	3
07	35	6	36	6	29	5	36	9	13	2	33	2	5	3	19	3
08	1	5	36	6	27	5	1	12	29	2	32	2	00	0	19	4
09	36	8	36	8	26	3	3	11	18	2	00	0	23	2	21	8
10	2	8	36	5	23	2	3	9	18	5	31	4	25	2	24	8
11	3	9	2	6	34	5	3	12	23	6	33	10	36	2	26	6
12	3	10	36	6	36	6	3	13	22	5	29	10	24	10	22	6
13	4	7	8	6	2	4	3	10	26	6	32	10	24	6	23	7
14	2	10	3	6	2	11	6	10	25	7	29	9	24	7	21	7
15	3	10	5	5	2	9	2	9	23	8	32	10	24	3	20	8
16	2	10	2	5	2	12	2	8	24	7	30	10	21	4	20	8
17	3	8	1	3	2	14	3	4	24	5	32	8	21	4	18	4
18	36	5	7	2	36	10	4	5	18	3	35	7	15	2	20	5
19	4	6	7	3	1	13	5	5	21	6	35	5	15	4	18	3
20	3	5	8	4	36	12	5	5	22	6	35	5	18	2	19	4
21	2	5	8	2	36	9	9	3	23	4	1	4	18	2	19	3
22	2	5	10	2	36	8	3	4	23	6	36	3	14	3	19	5
23	33	5	00	0	1	13	1	3	24	6	5	3	17	2	20	6
24	1	5	00	0	1	15	1	3	24	7	32	4	17	2	19	4

Table 8.(Cont'd)

Time (nearest hour)	Oct. 20		Oct. 21		Oct. 22		Oct. 23		Oct. 24		Oct. 25		Oct. 26		Oct. 27	
	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S
01	19	5	22	10	23	3	35	6	1	6	19	4	19	5		
02	19	2	23	12	21	3	36	12	36	6	21	3	00	0	00	0
03	21	4	25	10	20	3	36	9	35	4	19	3	25	3	00	0
04	21	5	26	10	24	7	1	13	1	6	18	3	19	4	20	3
05	19	8	28	9	24	7	1	11	1	5	21	3	20	3	22	2
06	18	6	29	7	26	6	1	7	2	6	22	2	00	0	00	0
07	19	7	30	10	27	7	1	5	36	4	16	5	21	3	00	0
08	20	6	33	11	26	8	2	8	1	6	18	5	19	4	00	0
09	21	6	32	13	27	8	1	11	3	7	21	5	19	4	26	5
10	23	10	32	13	27	13	36	13	6	6	21	5	18	3	26	6
11	23	12	30	10	28	12	35	11	3	6	24	5	20	3	29	8
12	22	11	33	9	28	14	1	12	4	2	27	5	20	3	29	6
13	23	11	31	9	33	9	3	7	00	0	34	5	19	3	34	5
14	22	10	26	9	30	12	2	4	27	2	22	6	13	6	32	3
15	22	12	27	7	33	12	35	8	20	4	24	3	15	7	33	2
16	23	11	28	9	34	10	1	11	21	6	25	3	19	5	23	2
17	19	8	32	3	35	10	34	9	18	4	21	2	15	4	18	2
18	19	5	00	0	3	9	36	4	14	3	00	0	13	4	4	10
19	21	5	00	0	1	8	2	4	14	3	16	3	12	2	3	8
20	21	6	12	3	1	10	1	5	17	4	21	4	11	2	2	9
21	22	10	00	0	1	7	3	7	15	3	20	7	12	3	1	8
22	22	12	20	3	1	10	3	9	15	4	21	2	12	2	1	12
23	22	10	33	3	36	8	2	7	18	2	00	0	12	2	2	11
24	22	10	24	3	36	3	1	4	00	0	19	3	00	0	2	14

Table 8.(Cont'd)

Time (nearest hour)	Oct. 28		Oct. 29		Oct. 30		Oct. 31		Nov. 1		Nov. 2		Nov. 3		Nov. 4	
	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S
01	3	12	36	5	3	6	5	7	8	5	9	5	35	2	25	5
02	3	12	1	5	1	5	1	5	8	5	12	9	34	2	29	8
03	2	11	36	6	36	5	3	5	10	8	10	10	1	2	29	3
04	2	8	1	7	1	5	1	4	13	8	10	10	36	2	32	2
05	1	8	36	5	34	5	36	6	11	5	11	12	18	2	32	3
06	36	8	1	6	36	4	1	4	10	7	10	11	14	2	32	3
07	1	7	8	8	36	5	3	5	11	9	13	17	00	0	31	3
08	1	9	3	9	2	5	5	6	12	10	14	13	00	0	35	2
09	36	12	4	11	4	8	7	8	11	8	14	9	18	2	5	5
10	1	13	5	8	4	9	7	8	11	8	10	4	20	5	4	5
11	2	11	2	7	2	5	6	8	13	10	29	2	21	6	36	6
12	36	10	6	5	4	7	7	7	14	15	36	6	17	8	19	2
13	3	10	6	5	7	6	10	8	13	12	34	6	16	7	17	2
14	3	12	5	5	9	5	11	9	11	10	36	8	18	7	22	2
15	2	11	4	8	9	8	13	10	11	14	34	6	17	7	23	3
16	2	12	6	5	9	9	9	10	11	10	36	6	16	8	22	3
17	1	8	5	7	7	6	9	7	9	5	35	4	16	4	19	2
18	36	6	4	4	8	5	12	7	10	8	2	3	14	6	24	7
19	36	5	6	5	7	4	8	5	9	10	1	6	18	4	23	6
20	1	5	6	3	00	0	10	9	12	8	00	0	18	6	27	6
21	2	5	5	2	7	3	9	7	10	7	00	0	19	5	28	10
22	1	7	5	3	36	4	9	5	10	10	35	3	21	7	32	9
23	36	6	4	5	5	5	10	8	11	8	23	4	24	10	35	5
24	36	5	4	5	4	5	7	5	11	10	00	0	25	7	1	12

Table 8. (Cont'd)

Time (nearest hour)	Nov. 5		Nov. 6		Nov. 7		Nov. 8		Nov. 9	
	D	S	D	S	D	S	D	S	D	S
01	36	10	28	11	34	3	35	6	1	7
02	1	11	26	9	36	2	35	4	35	7
03	1	9	26	10	33	3	29	4	35	6
04	33	5	25	10	35	4	24	4	33	7
05	32	6	25	11	34	4	24	4	34	6
06	31	4	25	11	35	4	26	4	35	7
07	30	4	24	9	35	4	27	3	32	7
08	34	5	25	11	1	8	30	5	33	9
09	33	4	24	10	36	9	27	5	35	10
10	36	7	25	12	36	10	27	4	34	11
11	32	9	30	12	35	11	28	3	32	11
12	33	11	32	12	35	11	27	5	33	13
13	34	12	32	13	35	10	24	5	32	10
14	31	12	32	12	34	10	23	6	30	9
15	30	11	32	12	35	9	22	3	33	10
16	28	10	35	9	36	10	19	4	35	10
17	32	7	36	6	35	11	8	3	35	12
18	30	12	35	4	35	10	5	5	33	8
19	30	12	33	3	33	5	5	4	32	8
20	30	13	30	4	32	5	4	8	33	10
21	29	13	31	5	34	9	1	7	33	10
22	28	10	34	4	33	5	36	5	34	7
23	28	12	36	4	30	5	36	8	33	8
24	27	10	36	3	29	4	36	8	35	9

The effect of winds on the distribution of the dye is testimony to the fact that the dye was not completely mixed throughout the water column or, more significantly, from bank to bank.

Wu (1969) has considered the effects of wind on dispersion in wide channels and has calculated the longitudinal dispersion coefficient for various combinations of stream-flow and wind conditions. Comparison of the wind effects shown on pages A14 and A24 with Wu's (1969, Table 1) indicates that wind conditions will indeed have a significant effect upon the dispersion of pollutants in the region of the study. Wu points out that the differences he finds in dispersion coefficients obtained under upstream and downstream wind conditions may partially explain the wide scatter of field data. He emphasizes the importance of considering prevailing winds when designing outfalls for pollutants that will be discharged into wide channels (such as the York River immediately south of West Point) or into short reaches of natural streams.

Dye patterns at the time of low-slack water (pages A8, A21, A31) indicate the rather close adherence of surface dye-concentration maxima to channel talwegs. The sinuous pattern of dye-concentration isolines to the south of West Point further reflects the tendency of the high-speed flows emanating from the channels of the Pamunkey and Mattaponi to attempt to conform to the channel depths of the upper York River estuary. The meandering of the channels is another factor, in addition to the wind factor mentioned above, that influences dispersion in the system.

For no-wind conditions, and assuming linear superimposition of dye entering the upper York from the Pamunkey and Mattaponi, the dye-concentration levels in Appendix A (pages A2, A8, A14, A21, A24, and A31) may be assumed to describe the mixing of waters in this complex region of estuarine bifurcation. The secondary dye-concentration peak, shown on page A8 about 1.0 mile south of West Point, is believed to represent the slug of peak-dye-concentration water that developed at the release points on the previous low-water slack and was propagated up-estuary and then back down in the ensuing tidal cycle. Another but less pronounced, dye-concentration peak was expected at the downstream end of the survey area but actually occurred just outside of it. This peak corresponds to the peak-concentration water that developed at the release points on the previous high-water slack and was propagated down-estuary on the ebb tide.

Pages A8 and A21 suggest that on low-water slack the greatest (steady-state) concentration of a (conservative) pollutant, introduced into the Pamunkey-Mattaponi estuaries in the vicinity of the bridges, would occur slightly to the southwest of the shoal (delimited by the 6-foot depth contour) extending south of the West Point peninsula. However, the leading edge of the tongue of peak-dye-concentration water (pages A8 and A21) has probably been crowded onto the shoal by the westerly winds mentioned earlier. The pattern on page A31 is likewise influenced by the north-northeasterly winds mentioned earlier.

If one examines the longitudinal (down-estuary) decrease in dye concentration in the Pamunkey channel of the York River (fig. 8), he finds that on October 21 concentrations up to 1.3 nautical miles downstream of the Eltham Bridge at low-water slack were higher than on October 30 at low-water slack. At high-water slack, however, concentrations were higher on October 30. This again is believed due to the winds that prevailed prior to the sampling run on October 30. Apparently, the maximum dye concentration (page A31) was blown to the west of the York-Pamunkey channel at the time of low-water slack on October 30. Because the concentration values of figure 8 are for the channels only, some of the October 21 values are greater than the October 30 ones.

The longitudinal (up-estuary) distribution of dye in the Pamunkey River at the end of the nineteen-day continuous release is shown in figure 9. On high-water slack the dye-concentration values peak at the site of a strong bend in the river, four nautical miles upstream of the Eltham Bridge. A similar condition is found for the Mattaponi River (fig. 10). At low-water slack the decrease in dye upstream of the bridges is nearly a linear function of distance (figs. 9 and 10). The greater longitudinal variations in dye concentration at high-water slack relative to those observed at low-water slack (figs. 9 and 10) are believed due to the nonuniform mixing of new dye as it moves upstream. (This point will be amplified in the section covering the aerial photography of the batch release). Fischer (1969) points out that bends in streams induce secondary currents that alter the rates of both transverse mixing and longitudinal dispersion.

It is important to explain the dye-concentration peaks found at high-slack water between 3.5 and 4.0 nautical miles above the release point at the Eltham Bridge on the Pamunkey (fig. 9) and between 3.2 and 4.0 nautical miles above the release point on the Mattaponi river (fig. 10). These peaks represent the up-estuary translation of peak-dye-concentration waters that are developed during the previous low water at each dye-release point. The peaks have moved a distance of one tidal excursion. Thus, for the Pamunkey estuary on October 30 (pages A28, A29, and A30) and on October 21 (pages A18, A19, and A20), one sees a cyclical variation in dye-concentration values, from the highest near the Eltham Bridge to intermediate some two miles up-estuary, to high again at the first (easternmost) bend in the estuary (Lee Marsh, page A29).

It is to be expected that the BOD load introduced just above the Eltham Bridge would cause corresponding variations in DO values, as measured at the time of high-water slack. Thus, at the time of high-water slack a primary DO sag would be expected in the vicinity of the paper-mill outfalls, and a secondary DO sag would be expected near Lee Marsh.

The Mattaponi data for peak dye concentration at the time of high-water slack tell a similar story to that for the Pamunkey. On October 17, the secondary concentration maximum at high-water slack (page A4, 0.6 ppb) is located about 4.0 nautical miles up-estuary from the Lord Delaware Bridge. On October 21, the peak concentration value is 0.75 ppb (page A16), and on 30 October it is 1.25 ppb (A26).

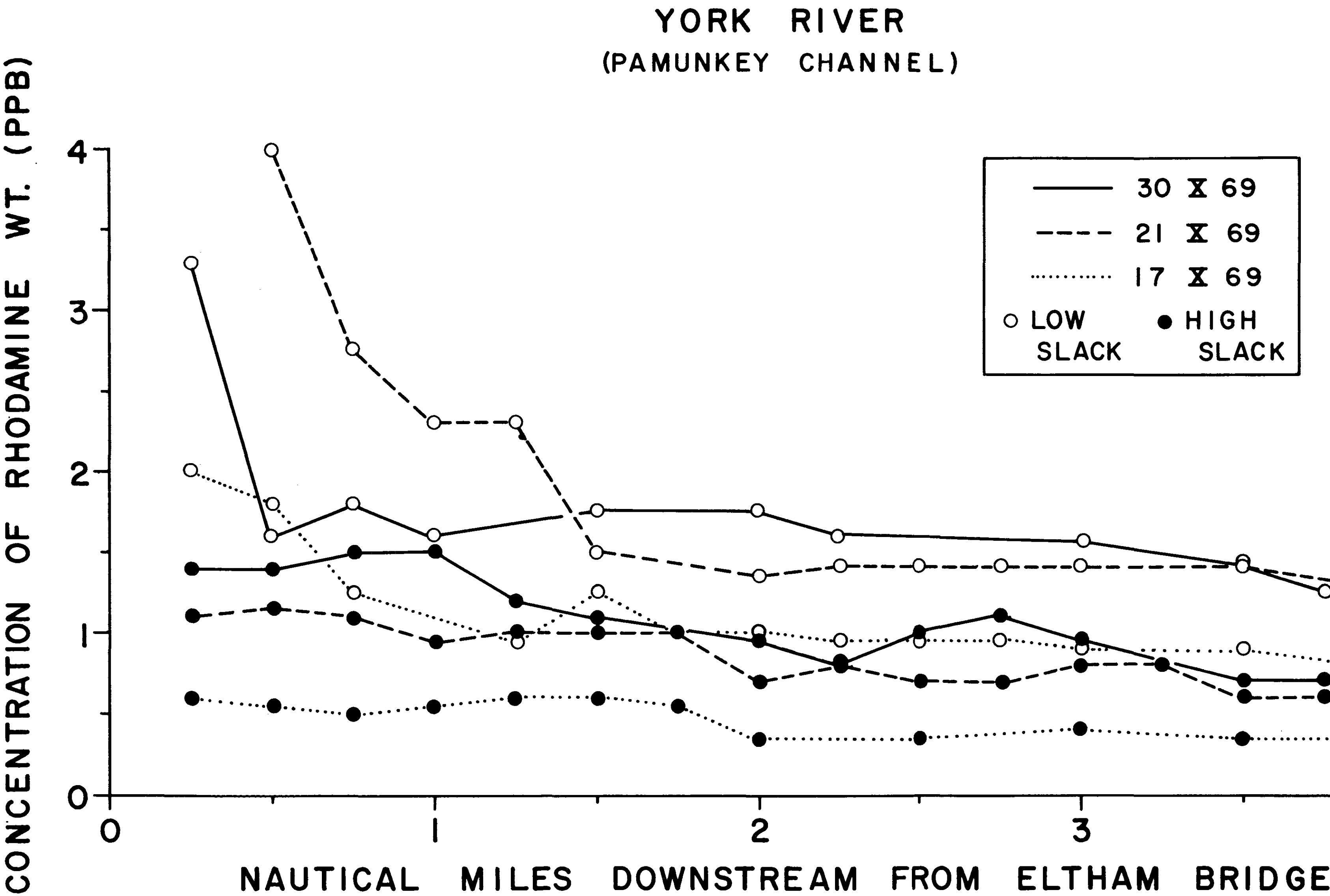


Fig. 8.- Dye concentration versus distance downstream from dye-release point in the channel of the Pamunkey-York estuaries.

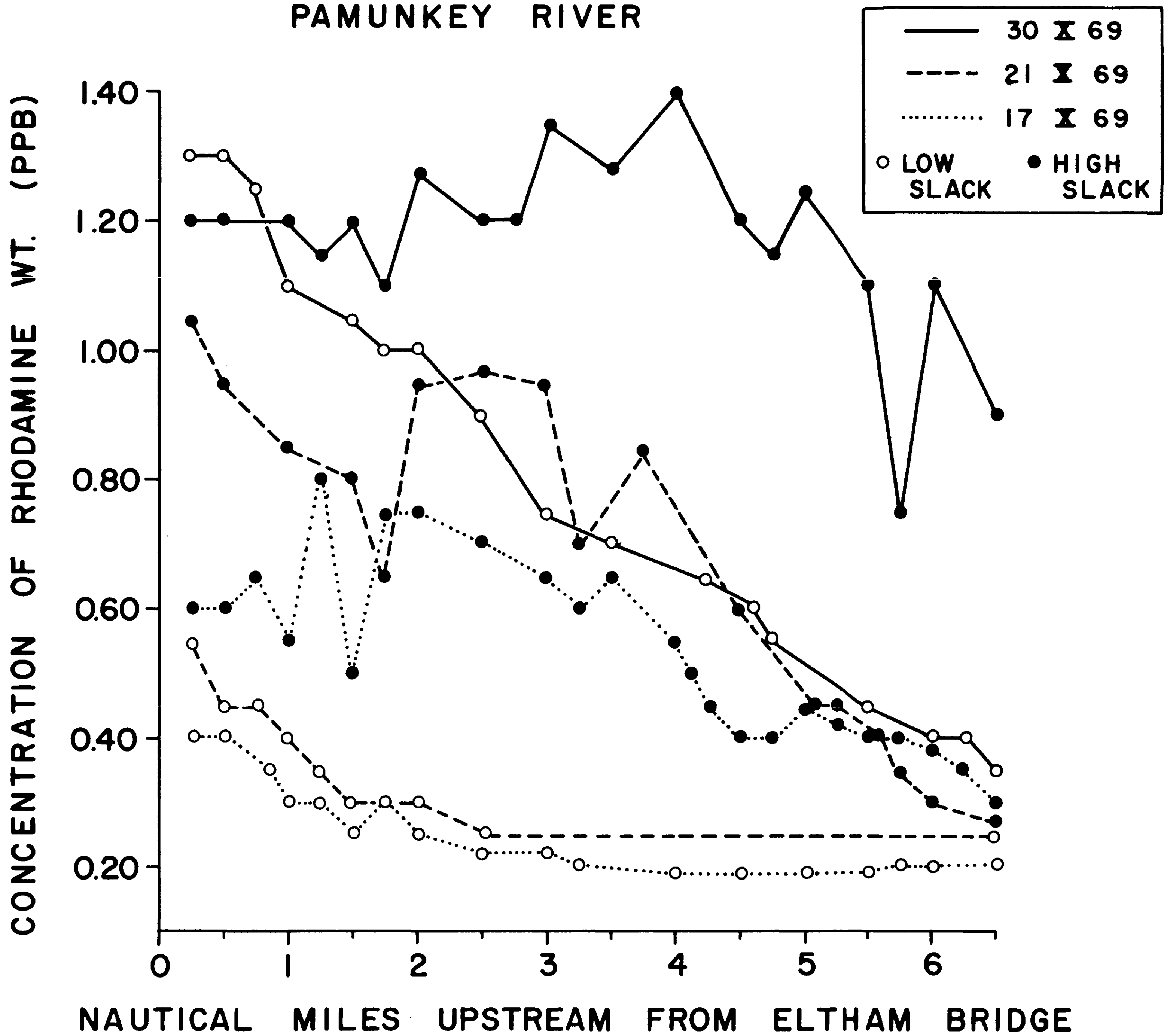


Fig. 9.- Dye concentration versus distance upstream from dye-release point in the Pamunkey estuary.

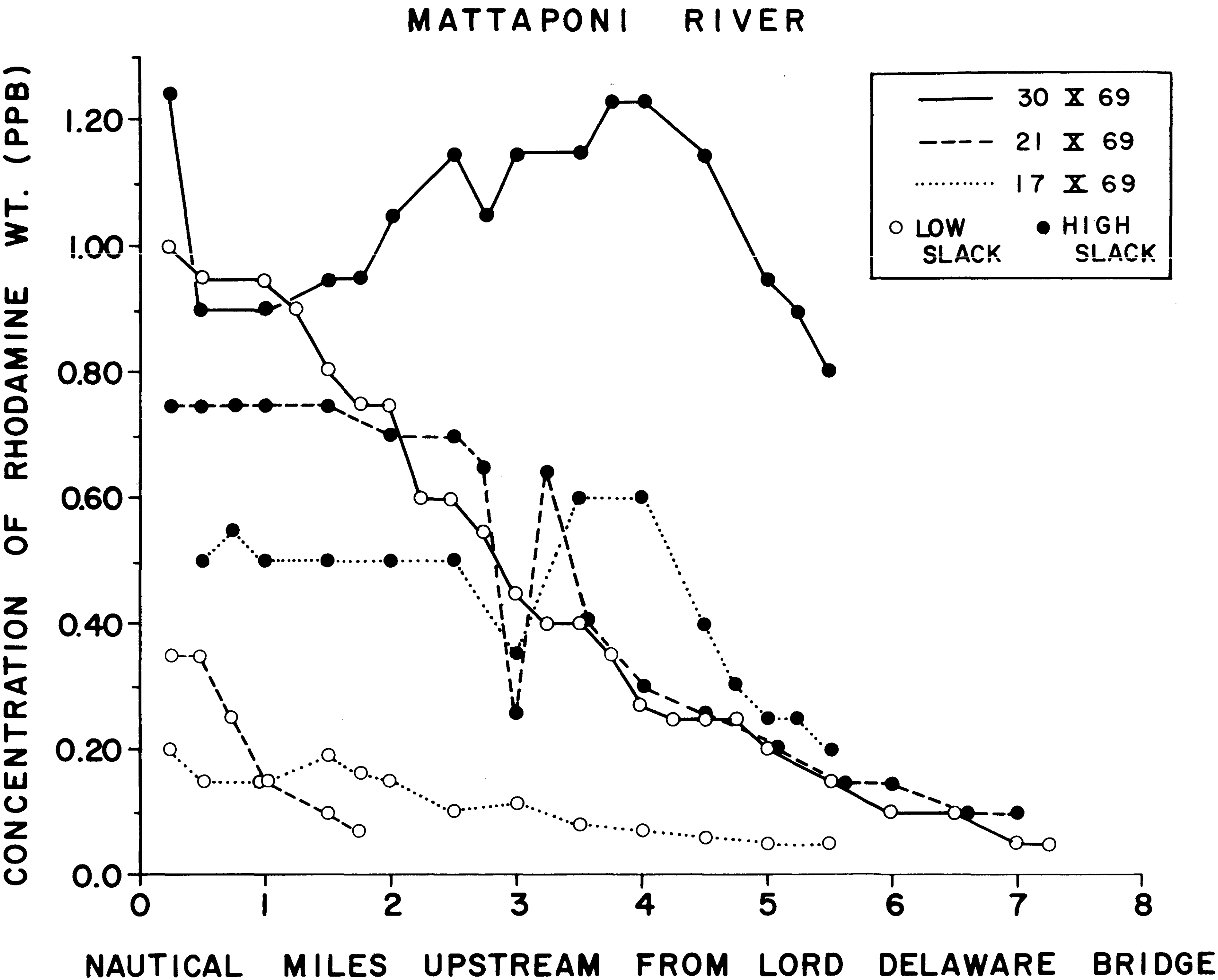


Fig. 10.- Dye concentration versus distance upstream from dye-release point in the Mattaponi estuary.

Page A37 shows the gradient in dye concentration for the entire straight section of the York River between Gloucester Point and West Point (for low-water slack) at the end of the 19-day continuous release. The values have been somewhat smoothed and are based on continuous readings made along a single zig-zag boat course that followed the channel of the York River.

The difference in dye concentration between surface and subsurface water in the vicinity of West Point is shown in figure 11. A monitoring run was begin at 1112 hrs on October 30 opposite the veneer plant at West Point. Two pumps were used; the usual surface pump and one towed 15 feet below the surface. Hoses and connecting fittings were used which permitted switching from one pump to the other in a matter of seconds. The monitoring run began at dead slack water (1112 hrs); by the end of the run (1225 hrs) a weak flood current was in evidence.

The data of figure 11 indicate that surface dye concentrations near the end of the continuous release were higher (by 0.15 to 0.27 ppb) than the dye concentrations at the 15-foot level. This finding reflects the delay in complete mixing of dye during the continuous release; that is, a finite time is required for new dye introduced at the release point to spread through the water column.

Batch release: Aerial photography (by J. C. Munday Jr.).- A few hand-held 35-mm color photographs were taken through the aircraft window at the beginning of the experiment. Appendix B, page B1, shows the dye just after being released, at 1206 EDT; page B2 shows the dye about 1000 m up-estuary, at 1300 EDT.

Contact prints of the negatives of the aerial film were assembled into mosaics. Overlays of the mosaics were prepared, showing water-mass boundaries, boat transects, and dye concentrations measured from the boat (see pages B3-B13). Note that the dye values were obtained over 25 minutes, a long period which encompassed the few minutes duration of the overflight.

Page B3 shows the first leg of the Pamunkey River (found in section P1 of the maps on page A1) about 20 minutes before the dye was released. The water image is partially obscured by smoke, and modified in places by cloud shadows. Foam lines are visible toward the bottom of the page. Water-mass boundaries can be distinguished along the river banks and adjacent to the docks of the pulp and paper mill. The boat seen under the smoke cover is the measurement vessel. It has entered a patch of mill effluent which is beginning to move upstream with the start of a flood-tide current.

The results of surface data obtained at the same time, prior to dye release, are given on the overlay to page B3. The dye concentrations along the transects signify background ("baseline") noise in terms of equivalent ppb of dye. This noise originated in suspended and dissolved materials, and residual dye from the continuous release that had been conducted during the previous nineteen days. The values are low and constant, running between 0.35 to 0.38 ppb, except for slightly lower values of 0.25 to 0.28

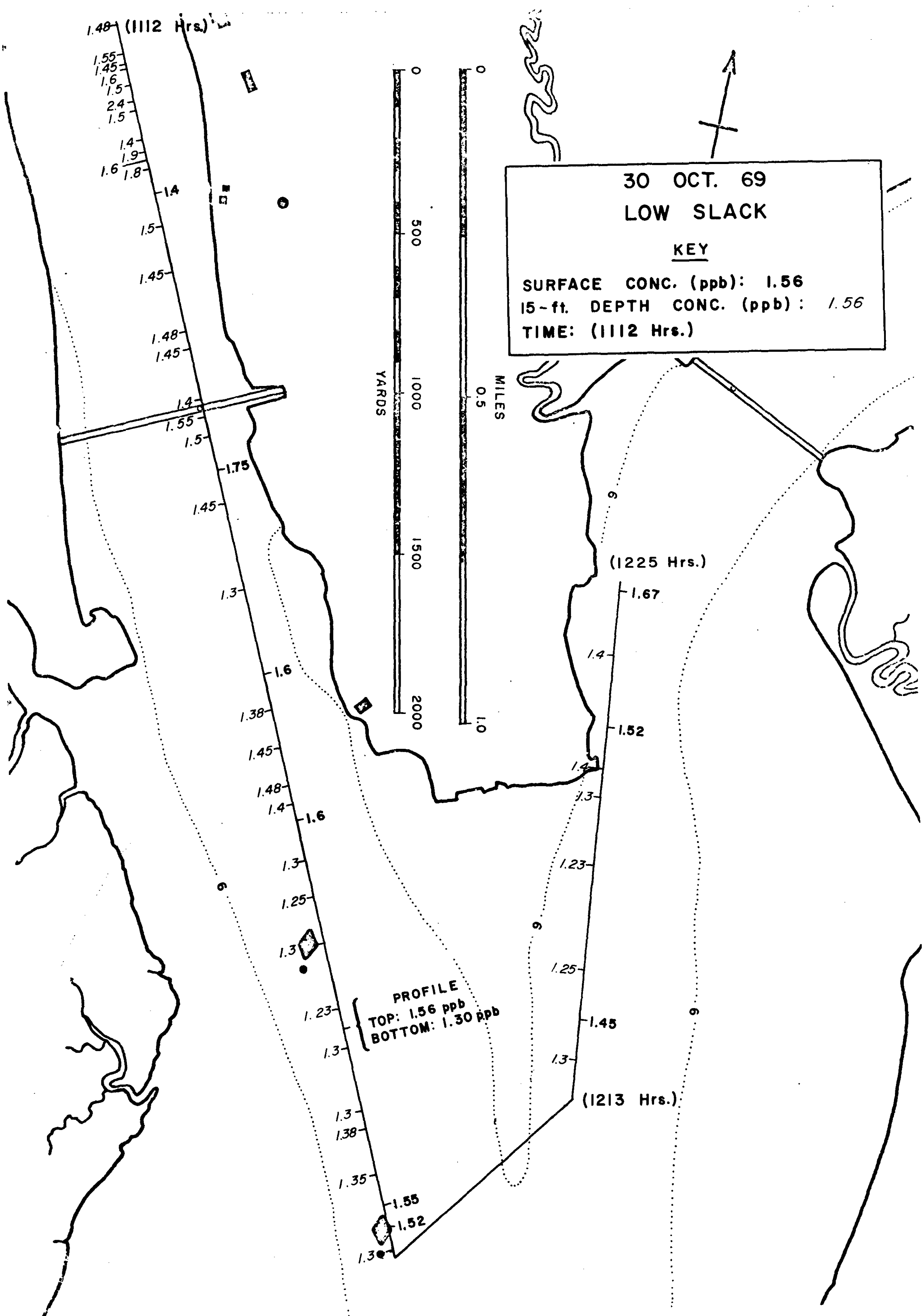


Fig. 11.- Dye-concentration values of surface waters (bold numbers) and subsurface waters (italicized numbers) in the immediate vicinity of West Point on October 30, 1969, at low water slack.

ppb where the boat traversed the mill effluent. Thus, the effluent had only a small effect on the fluorometer readings. The effect of the effluent on photographic density, however, is easily visible on page B3. It must be concluded that in regions of effluent there is little correlation between photographic film density and fluorometer signal. This is an unfortunate result, because it means that wherever dye and effluent appear together, the fluorometer signal cannot be used to convert film densities to dye concentrations. Because the dye was nearly always located in the midst of effluent, the photography in general cannot be used to produce quantitative maps of dye concentrations.

Nevertheless, the photography can be used to qualitatively delineate dye and effluent patches. The delineations (page B3) appear on the overlay.

Pages B4 and B5 show the second leg of the estuary (section P1 on page A1) before dye release. The water image is uniform. Sun-glint patterns were visible on the original negatives, showing waves aligned as if moving upstream. On the downwind bank of the river, it appears that turbid water resulting from wave action against the shoreline is moving along the bank and into the marsh channels.

Page B6 shows the first leg just after dye release. The boat is moving upstream away from the dye patch. The mill effluent patch has moved further upriver, making a smaller angle with the shoreline. Foam lines, compared with those on page B3, have shifted and concentrated.

On page B7, one hour later at 1300 EDT, the dye patch has moved half the length of the river leg. The color photograph of page B2, which was taken a few minutes before that of page B7, shows that a considerable portion of the dye is in (or under) the effluent patch. This portion of dye is not clearly indicated on page B7. Hindsight indicates that Kodak 8442 aerial color film would have shown the dye better than Kodak 2405 aerial black and white with a Wratten 15G filter.

Near the upriver end of page B7, there seems to be an infolding of the effluent patch by turbulent waters. The boat is just upriver of the infolding areas.

Turbulence in the estuarine flow is visible immediately upriver of the Eltham Swing Bridge pilings.

The overlay to page B7 shows the results of the boat run starting at 1300 hours, with an outline from the photographs of the effluent and dye patches. In the dye patch, the fluorometer reading was > 27 ppb, and elsewhere, 1.0 to 1.3 ppb.

Pages B8, B9, and B10 were obtained one hour later, at 1400 hours. The leading edges of the dye and effluent had moved around the first bend and 0.5 nautical miles up the second leg. Considerable mixing of the dye and effluent patches with surrounding water masses has occurred, such that boundaries are indistinct and the patches are separated into pieces. Oil slicks can be seen on page B8. The turbulence caused by the Eltham Swing

Bridge pilings is now severe, owing to greater current speed. Turbulence in all parts of the river has increased.

The overlay to page B8 shows the fluorometer results for 1352 to 1419. Maximum dye concentrations are again > 27 ppb.

Pages B11 and B12, obtained near 1505, show that the leading edge of the mill effluent has turned the bend at the end of the second leg. The boat is just ahead of the leading edge of the mill effluent. It is clear that some effluent has survived to this point as an integral mass. However, as seen downriver in pages B11 and B12, and also in page B13, effluent behind the leading edge back to the mill outfall appears to be well mixed with surrounding water.

The overlays to pages B11 and B12, with fluorometer results from 1432 to 1502 hours, indicates two patches of dye. The first is, as expected, near the leading edge of the mill effluent. The second dye patch is near the first river bend, apparently having been left behind the leading edge of the mill effluent. Concentrations well above background values along the line of travel between these patches indicate that the dye has undergone substantial spreadings.

Page B14, at 1605 hours, is of the short third leg of the river (section P2 on page A1). The flood-tide current is slowing, and dye and effluent have reached only the terminal bend of this leg. Turbulence and infolding are prominently outlined by foam lines. The finger-like aspect of the effluent is similar to photographs of batch-releases of dye shown by Fischer (1968, p. A14) and Wilson, et al. (1969, fig. 6).

Pages B15, B16, and B17 show the second and first legs a few minutes later. Contrast in these three plates is low because of cloudiness and the low sun angle.

The overlays show the corresponding fluorometer results over a run from the short third leg downriver to the outfall. The dye is spread widely but still of substantial concentration in the third leg, as evidenced by concentrations between 7 and 17 ppb, while in downriver sections the dye has a concentration of only 1 to 3 ppb.

The aerial photography as a whole indicates that the Pamunkey River in ebb flow is well-mixed at the surface. In flood flow, the turbulence and mixing of mill effluent with river water is greatest at bends in the river. In a single flood tide, mill effluent traveled from the outfalls to the upriver end of the short third leg of the river (Lee Marsh bend).

Batch release: Time of passage.- Figure 12 shows the declining concentration of dye, monitored at the Eltham Bridge, as a function of time during the days following the batch release. The values have been corrected for standard river-water fluorescence but have not been corrected for the background dye concentration remaining from the continuous release. The fluorescence values do not reach zero, probably because the flow-through cell became progressively fouled under the continuous pumping.

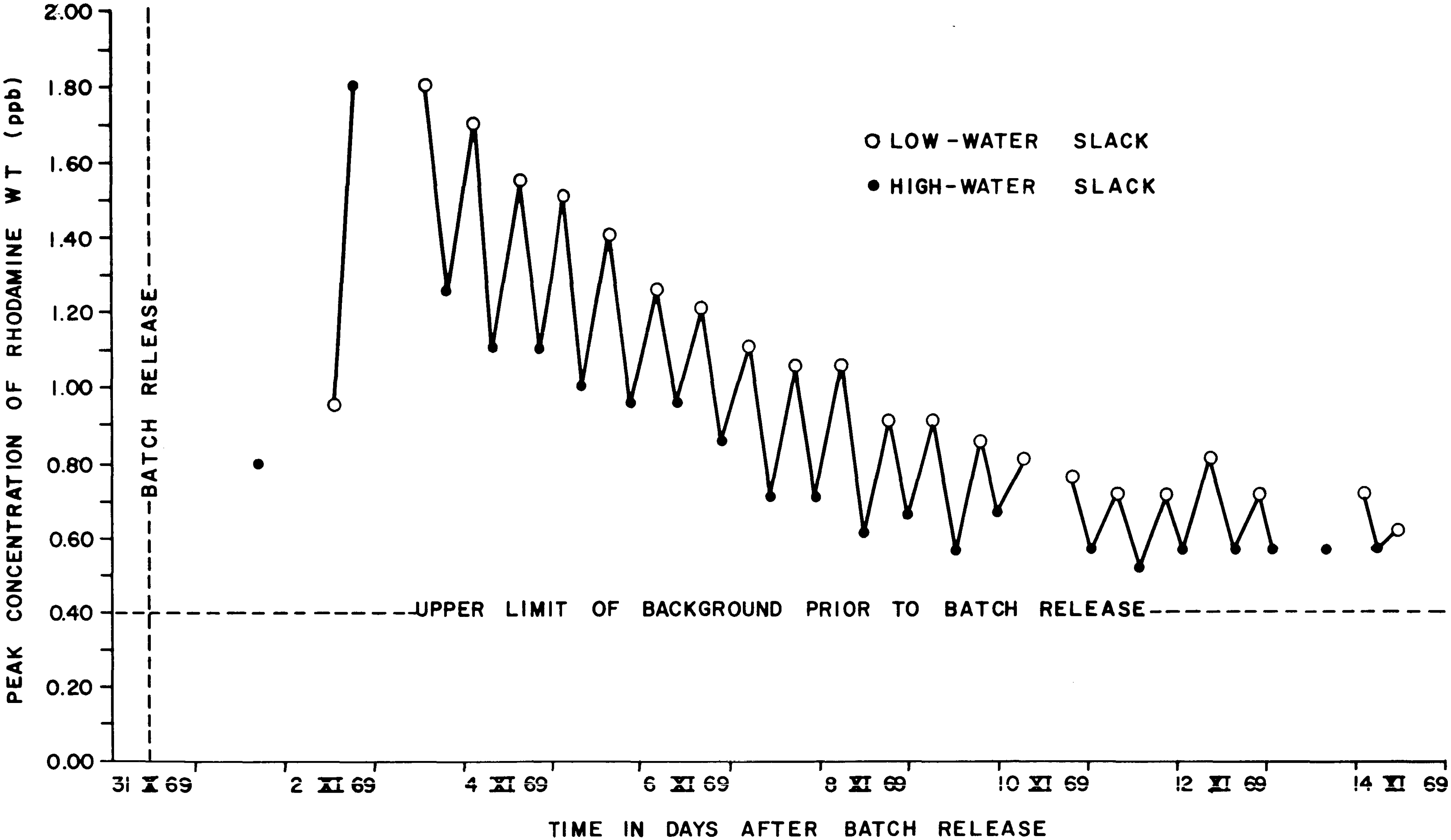


Fig. 12.- Change in dye concentration as a function of time at Eltham Bridge monitoring station.

Figure 12 presents a problem. Why is the dye concentration higher on low-water slack than on high-water slack, if the dye is undergoing advection in the down-estuary direction? The answer will lie in a careful reconstruction of the effect of winds and estimated estuarine discharge on the batch release during the monitoring period. Such an analysis is beyond the scope of this study.

Values of the declining dye concentration were obtained also at a cross-river transect 15 nautical miles down-estuary near Clay Bank (fig. 1). The transect was run once daily, on a low-water-slack condition, along a line from the entrance of the Aberdeen Creek channel to the opposite side of the estuary. Concentration values are given in figures 13-15. Significant cross-channel variations in concentration are observed (figs. 13 and 14), with a tendency for the lowest values to be near the center of the estuary (but not mid-channel) toward the end (fig. 14) of the monitoring period. If one looks only at mid-channel concentration data (fig. 15), a rough idea of the time of passage of the peak concentration can be obtained. The time of passage was of the order of 150 to 200 hours (six to eight days).

Hydrographic Survey

An example of the data obtained from transects Y01, P01, P02, P03, and P04 (fig. 1) is found in the computer printout of Appendix C. The tide curve from the West Point gauge is presented in figure 16. Stream geometry data for the thirteen transects of figure 1 are presented in Table 9. These and other data were used to develop the mathematical model.

Mathematical Model

There are two principal sources of estuarine pollution located at West Point. These are the sanitary sewage from the municipal sewage system and the industrial waste waters from the paper mill. The sanitary sewage amounts to about 0.25 mgd (million gallons per day) and contains about 150 lbs per day of 5-day, 20°C BOD (biochemical oxygen demand) material. The paper mill discharges about 14 mgd of industrial waste waters that contain about 30,000 lbs per day of 5-day, 20°C, BOD material. The sanitary sewage from the town is discharged through one outlet into the Mattaponi, while the industrial waste waters are discharged through two outlets into the Pamunkey estuary.

For purposes of determining the degree of waste-water treatment which would be required to maintain water-quality standards, we first made estimates of the limiting pollution loads which may be placed on the Pamunkey estuary at West Point. Field measurements were then made to determine DO concentrations, current velocities, salinities, temperatures, and tidal characteristics of the estuary. A one-dimensional, steady-state model of the Pamunkey-York River was then developed, using Camp's (1963) equations. This model predicts concentrations of BOD and DO under equilibrium or steady-state conditions for various flow conditions and waste loads.

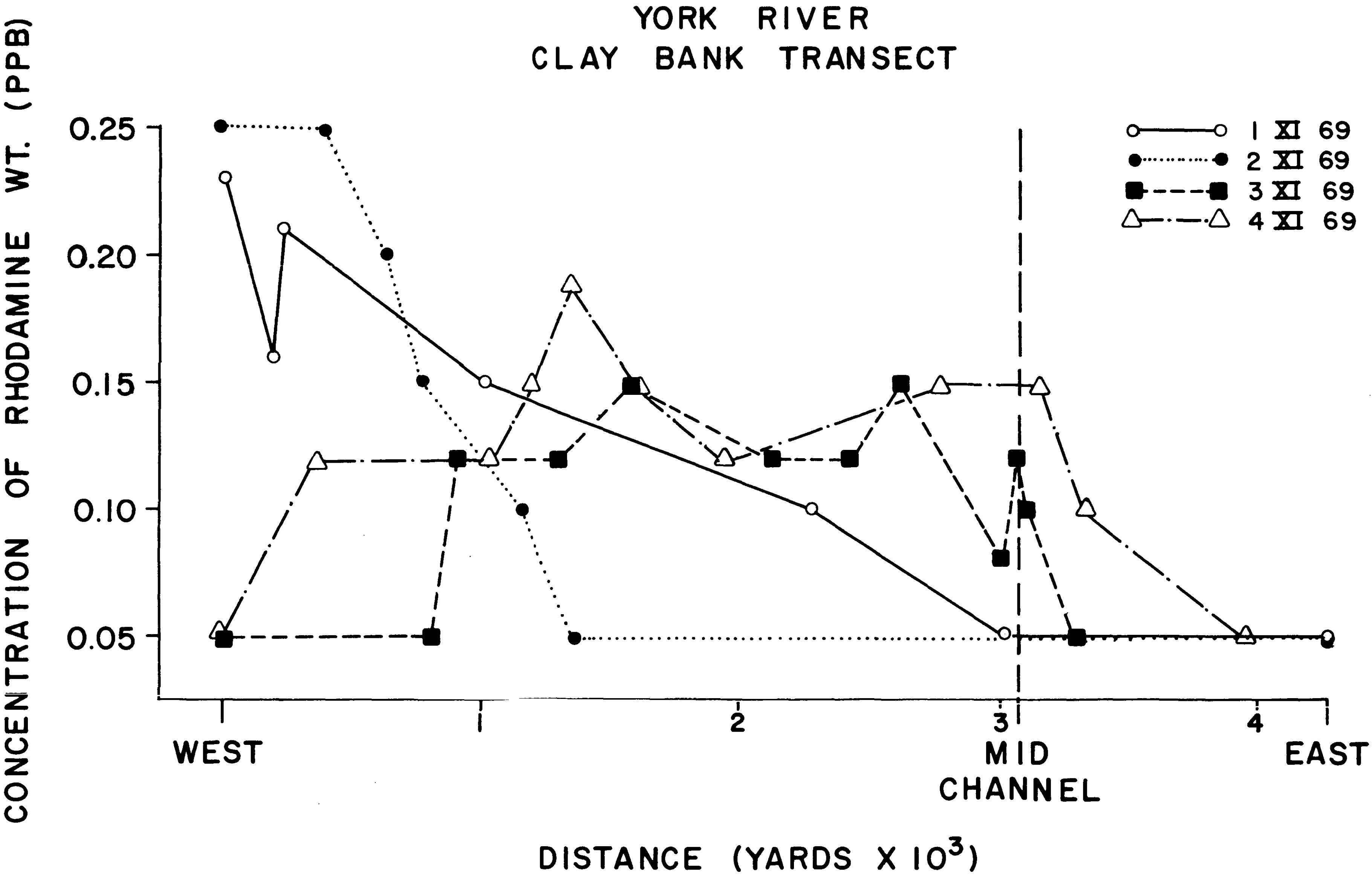


Fig. 13.- Dye concentrations along the Clay Bank transect at times of low water slack on November 1-4, 1969.

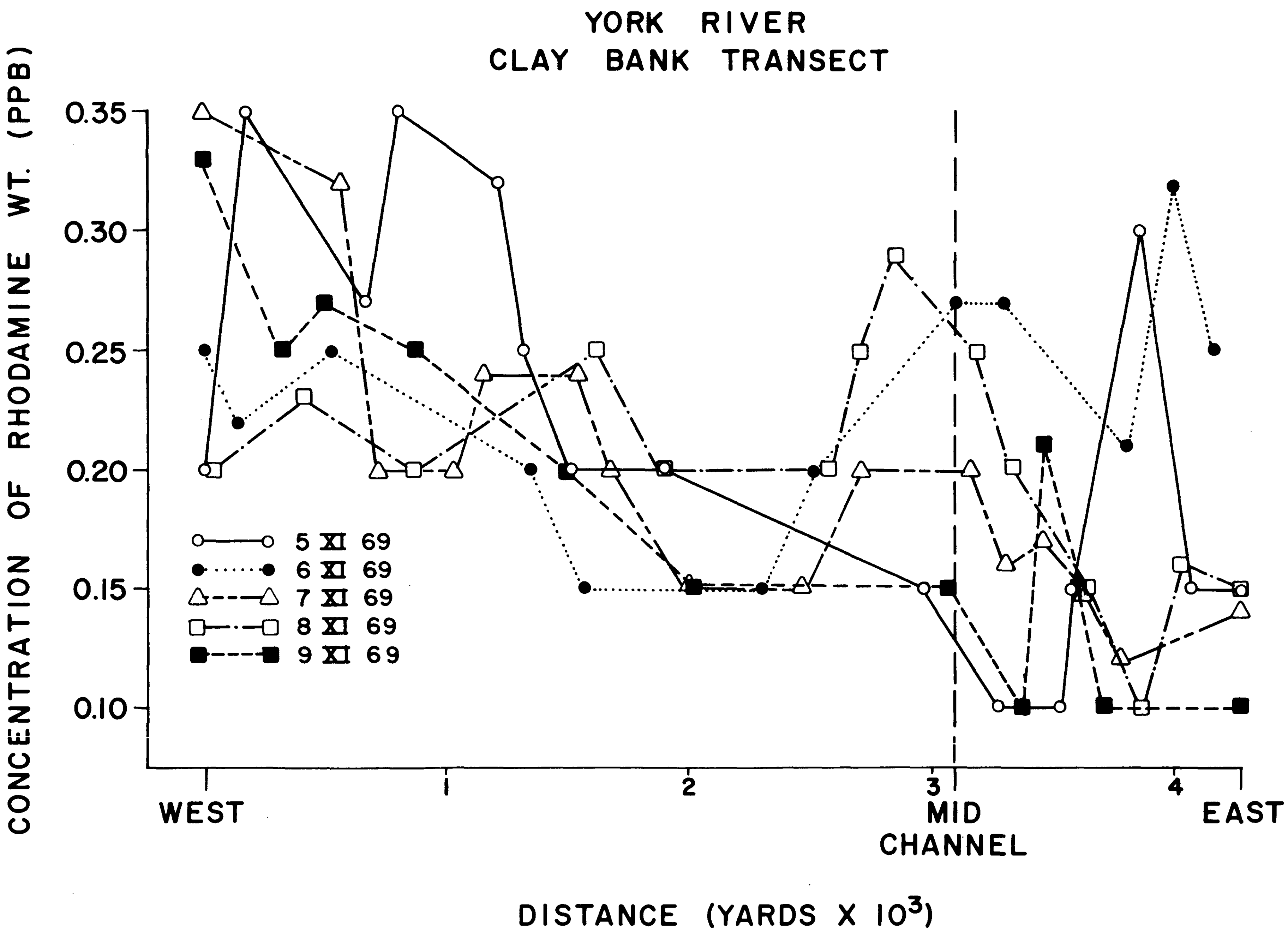


Fig. 14.- Dye concentrations along the Clay Bank transect at times of low water slack on November 5-9, 1969.

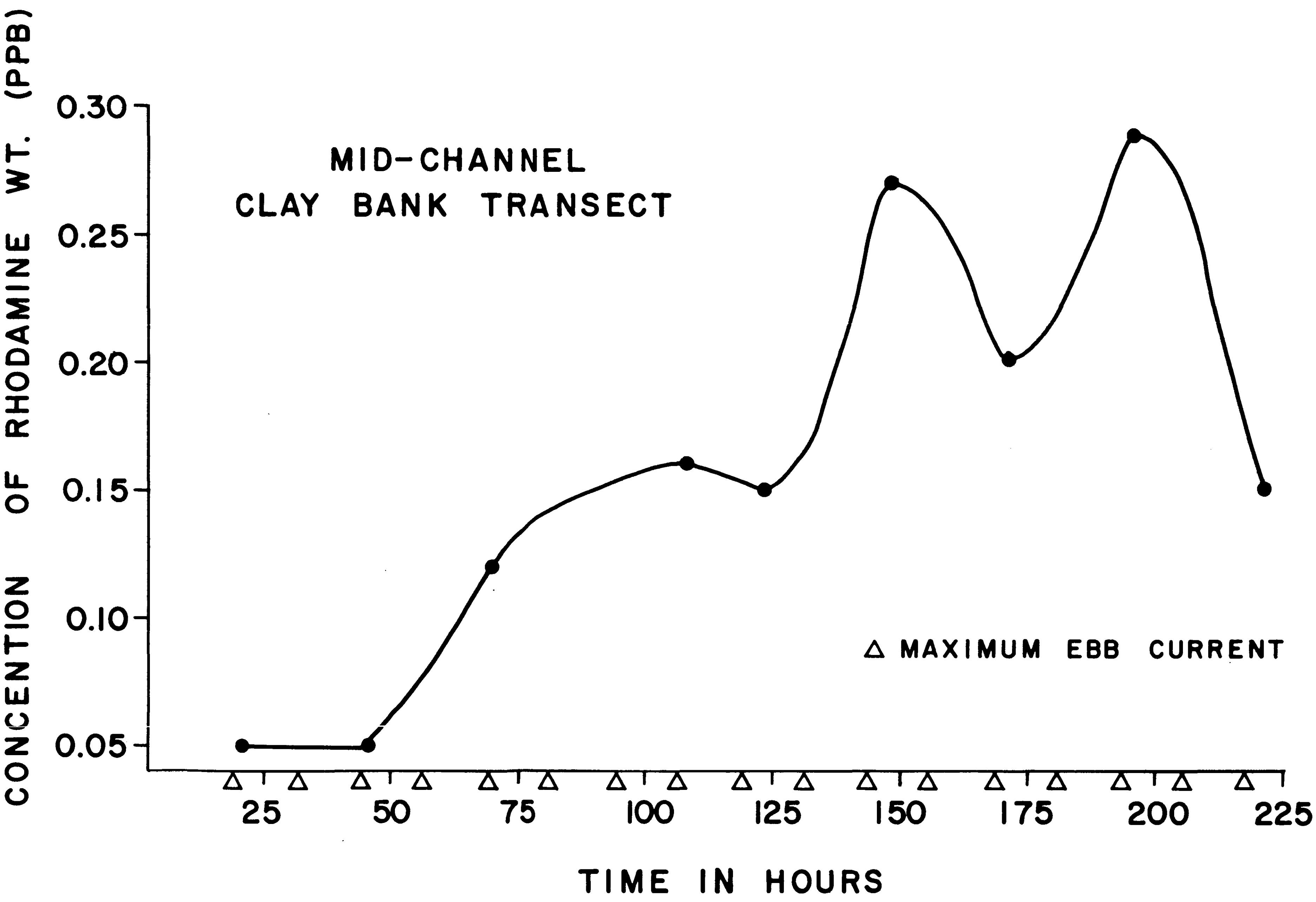


Fig. 15.- Dye-concentration values at mid-channel, Clay Bank transect, as a function of time, for the period November 1-9, 1969.

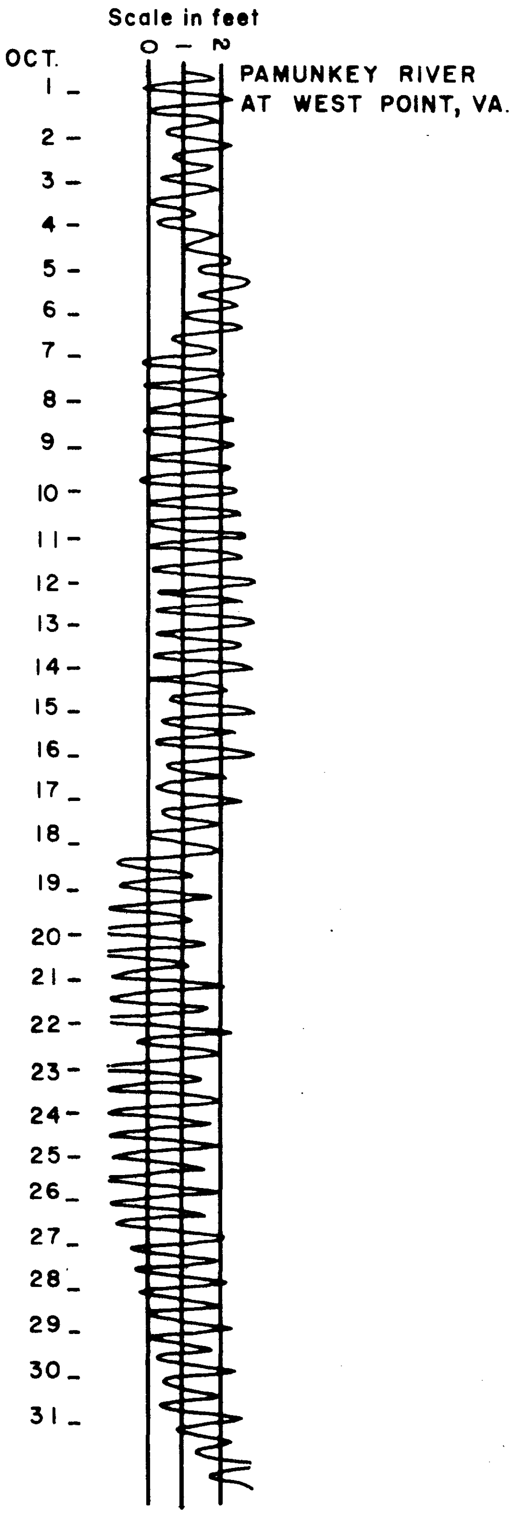


Fig. 16.- Tide curve for the gauge at West Point, October 1-31, 1969. (The tick mark for "OCT 1" stands for 0000 hours on October 1st).

Table 9.- Stream Geometry at the Thirteen Transects of Figure 1.

Transect	Cross-sectional area (ft^2)	River width (ft)	Mean depth (ft)
P06	16000	1150	13.9
P05	20750	1490	13.9
P04	20125	1350	14.9
P03	29250	1540	19.0
P02	37500	1800	20.9
P01	46900	2540	18.5
Y01	71250	7800	9.1
Y02	63500	5100	12.5
M05	16500	1000	16.5
M04	24250	1530	15.8
M03	20500	1380	14.9
M02	30500	1740	17.6
M01	27000	3200	8.4

This mathematical (computer) model can handle other water-quality characteristics such as phosphorous, toxic materials, grease, floating solids, and so on.

Results of the application of the mathematical model are only as good as the rate parameters used in the computations. An extensive collection of physical, chemical, and biological data is essential if the model is to be refined. Collection and analysis of the necessary data for a medium-sized estuary which has not previously been surveyed may require from three to five years of effort. The surveys of the present study could only be considered a "foundation effort." A superstructure of additional field data is needed before the model can be adequately refined.

Parameters which required numerical evaluation for use in the model include flow speeds, dispersion coefficients, unit rates of BOD decay, atmospheric re-aeration, tidal exchange, waterway geometry, and waste loadings.

Owing to limited time and resources, we did not conduct sufficient experiments to measure all of the necessary parameters. We have, however, made estimates of the parameters by utilizing all of the available data from the Pamunkey and similar estuaries. It must be emphasized that the York-Pamunkey estuary is a dynamic system and additional field surveys should be undertaken to re-evaluate the system parameters under conditions other than those that obtained at the time of the surveys described herein.

Depending upon its level of verification, the present model can provide reasonable projections of future conditions--projections that would be mere guesswork without the model. The predictive ability of the model will be enhanced as better data become available. Camp's equations represent a widely accepted mathematical procedure for estimating the effects of pollution in an estuary. They represent the best tools available for engineering decisions and the model proposed here may be used for guidance in waste-treatment studies for the West Point area. Figure 17, for example, gives the computer results for the distribution of DO under different waste-water treatment plans for the fourteen-consecutive-day low-flow condition mentioned earlier. Figure 18 gives the computer results for the distribution of BOD for the same flow conditions. Figures 19 and 20 give the DO and BOD conditions for a low-flow condition slightly higher than that upon which figures 17 and 18 are based.

A final comment is in order. The dye studies have shown the complexities of dispersion caused by two factors: 1) the tight bends of the Pamunkey and Mattaponi estuaries and 2) winds. The effects of the channel bends are only crudely accounted for in the mathematical model; the effects of winds are not accounted for at all. Future studies of this kind should include evaluations of wind effects on pollutant dispersion and distribution patterns. At the very least, estimates of extreme effects should be made, as based upon statistical analyses of historical wind data. While Camp-type mathematical models are useful for steady-state, non-wind conditions, their confidence limits should be considered in light of wind effects not included in the modeling. Finally, the need for routine analyses of wind effects in estuarine systems is clear.

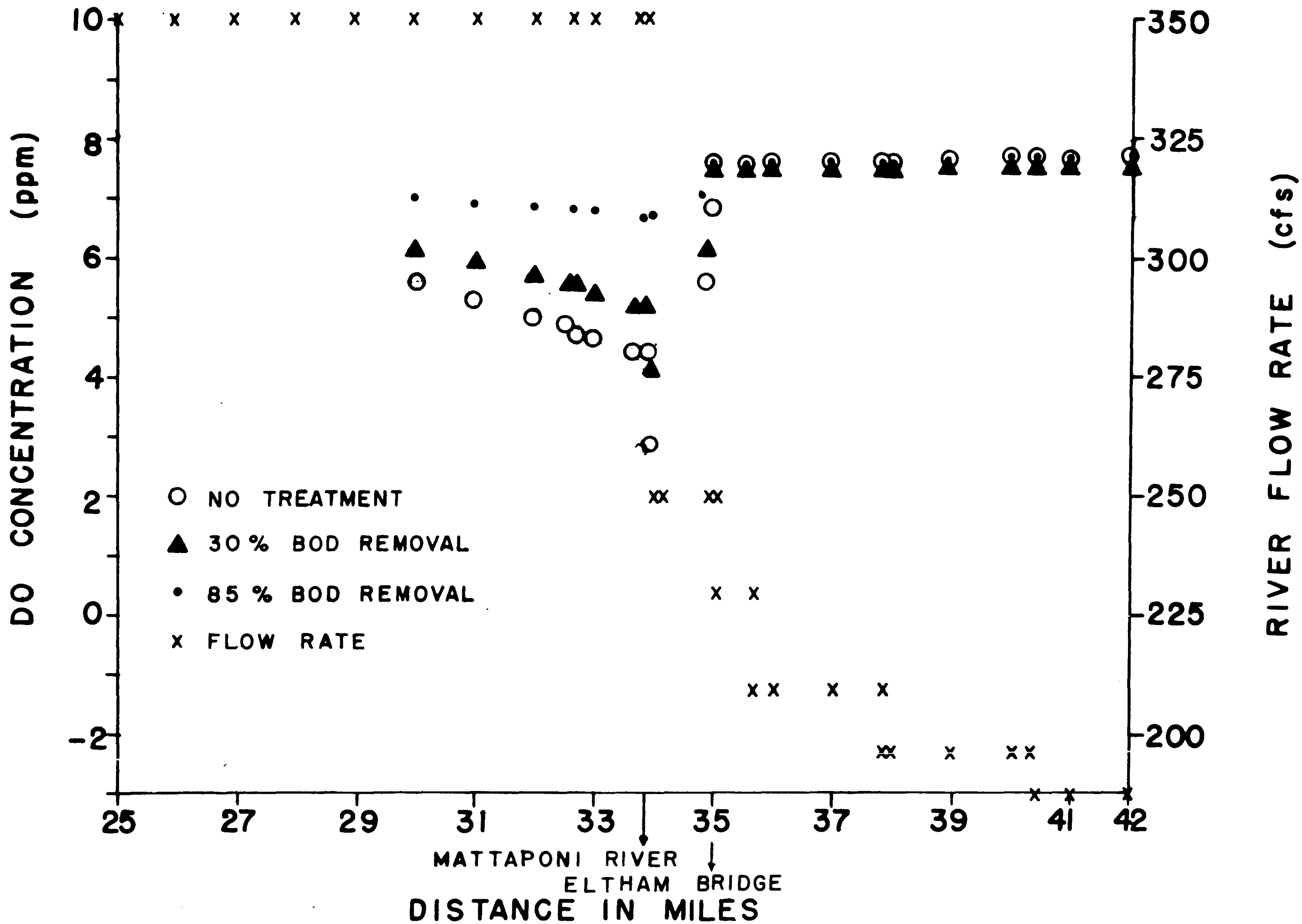


Fig. 17.- Computer program output for DO distribution in the Pamunkey-York channel near West Point, with respect to BOD removal efficiencies of three levels of waste treatment, for the fourteen-consecutive-day low-flow condition.

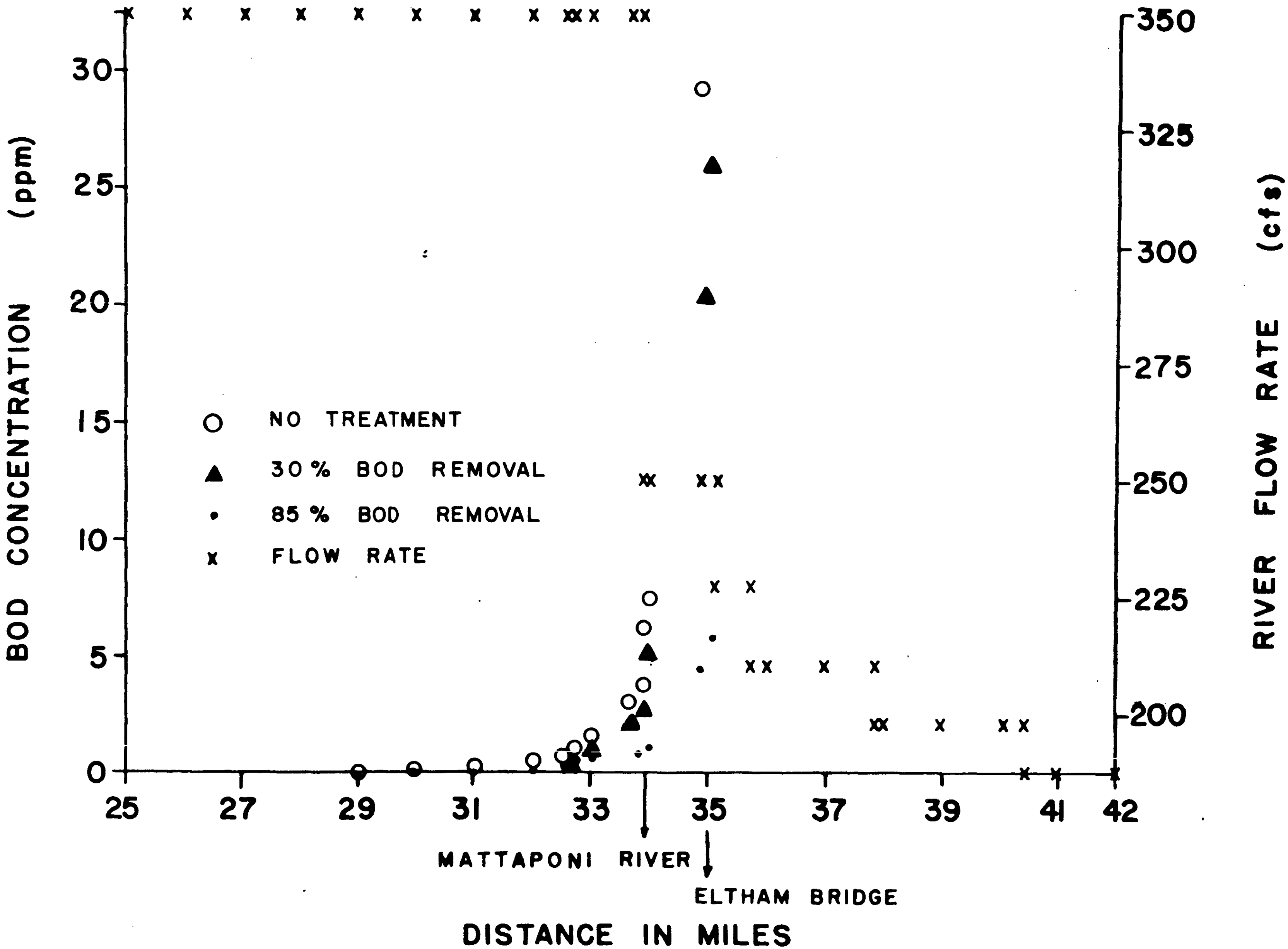


Fig. 18.- Computer program output for BOD distribution in the Pamunkey-York channel near West Point, with respect to BOD removal efficiencies of three levels of waste treatment, for the fourteen-consecutive-day low-flow condition.

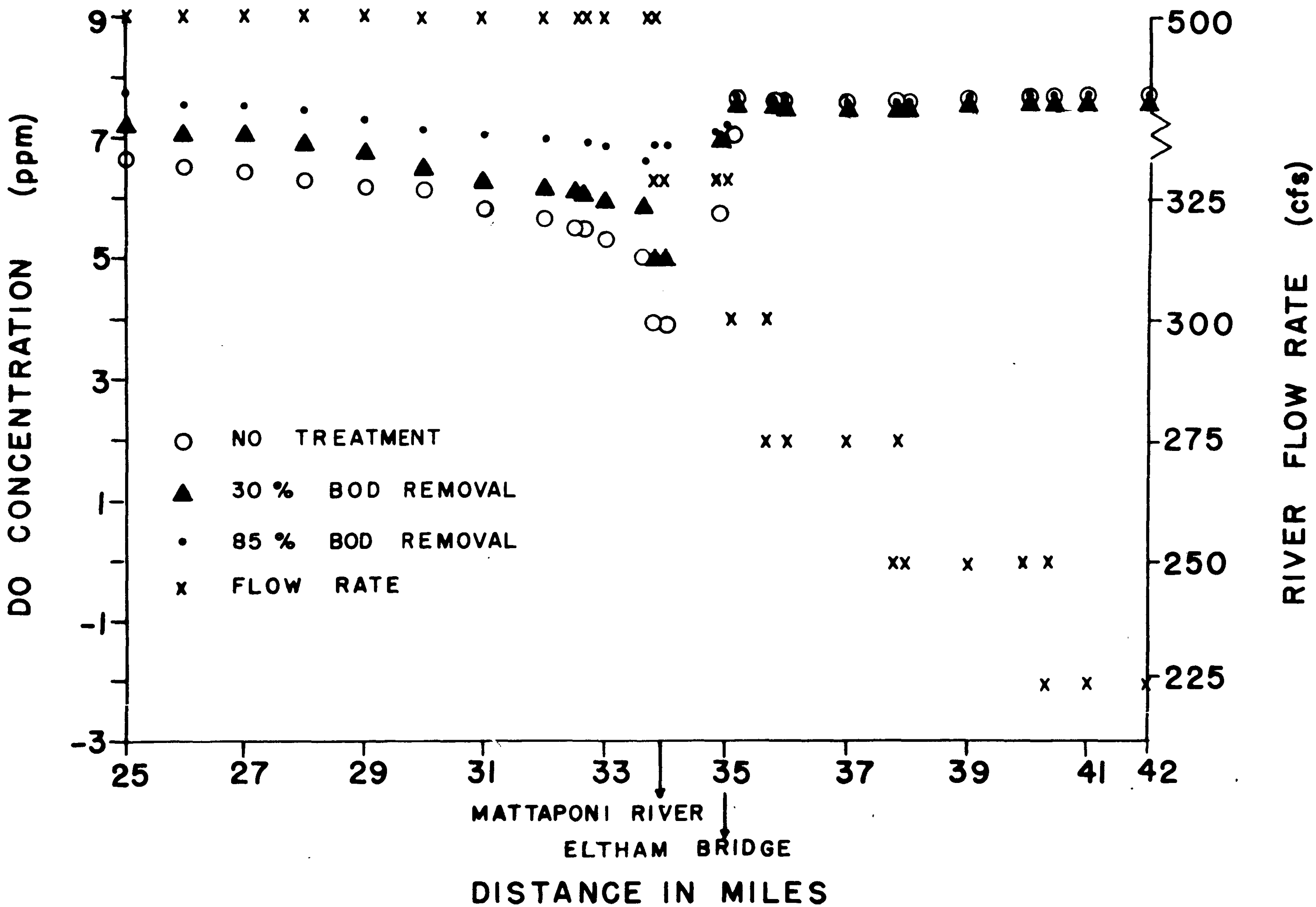


Fig. 19.- Computer program output for DO distribution in the Pamunkey-York channel near West Point, with respect to removal efficiencies of three levels of waste treatment, for a low-flow conditon slightly higher than that of figure 17.

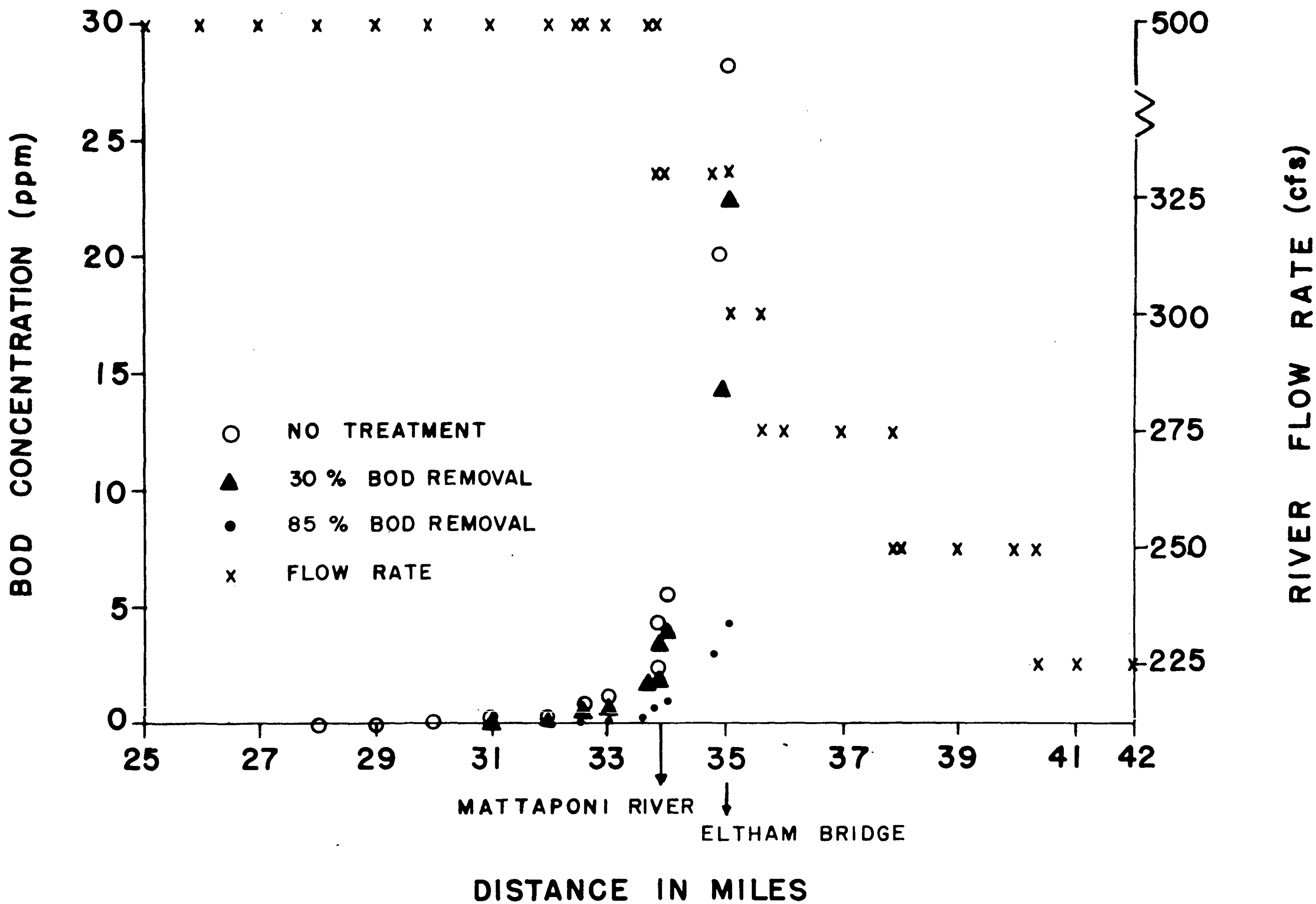


Fig. 20.- Computer program output for BOD distribution in the Pamunkey-York channel near West Point, with respect to BOD removal efficiencies of three levels of waste treatment, for a low-flow condition slightly higher than that of figure 18.

REFERENCES

Anonymous, 1969, The Pamunkey and Mattaponi River cruise; spring 1961: Chesapeake Bay Institute, The Johns Hopkins Univ., Ref. 69-2 (Spec. Rept. 15), Baltimore, Md., 72 p.

Batchelor, G. K., 1964, Diffusion from sources in a turbulent boundary layer: Archiwum Mechaniki Stosowanej, v. 16, no. 3, p. 661-670.

Buchanan, T. J., 1964, Time of travel of soluble contaminants in streams: Am. Soc. Civil Engineers, Sanitary Eng. Div. Jour., v. 90, no. SA3, Paper 3932, p. 1-12.

Camp, T. R., 1963, Water and its impurities: Reinhold, New York.

Chow, V. T., 1964, Handbook of applied hydrology: McGraw-Hill, New York.

Dagan, G., 1969, Dispersivity tensor for turbulent uniform channel flow: Jour. Hydraul. Div., Amer. Soc. Civil Eng., v. 95, p. 1699-1712.

Elder, J. W., 1959, The dispersion of marked fluid in turbulent shear flow: Jour. Fluid Mechanics, v. 5, p. 544-560.

Fair, G. M., and Geyer, J. C., 1968, Water and waste-water engineering: Wiley, New York.

Fischer, Hugo B., 1968, Methods for predicting dispersion coefficients in natural streams, with applications to lower reaches of the Green and Duwamish Rivers, Washington: U. S. Geol. Survey Prof. Paper 582-A, Washington, D. C., p. A1-A27.

_______________, 1969, The effect of bends on dispersion in streams: Water Resources Research, v. 5, no. 2, p. 496-506.

Glover, R. E., 1964, Dispersion of dissolved or suspended materials in flowing streams: U. S. Geol. Survey Prof. Paper 433-B, 32 p.

Godfrey, R. G., and Frederick, B. J., 1963, Dispersion in natural streams: U. S. Geol. Survey open-file report, 75 p.

Godfrey, R. G., and Frederick, B. J., 1970, Stream dispersion at selected sites: U. S. Geol. Survey Prof. Paper 433-K, Washington, D. C., p. K1-K38.

Green, E. J., and Carrett, D. E., 1967, New tables for oxygen saturation of seawater: Jour. Marine Res., v. 25, no. 2.

Holley, E. R., 1969, Unified view of diffusion and dispersion: Jour. Hydraul. Div., Amer. Soc. Civil Eng., v. 95, HY2, p. 621-631.

Holley, E. R., Harleman, D. R. F., and Fischer, H. B., 1970, Dispersion in homogenous estuary flow: Jour. Hydraul. Div., Amer. Soc. Civil Eng., p. 1691-1709.

Kishiel, C. C., and Shapiro, M. A., Ficke, J. F., Morgan, P. V., and Spear, R. D., 1964, Tracer studies with rhodamine-B in a 3.2 kilometer reach of the upper Ohio River: Verh. Internat. Verein. Limnol., v. 15, p. 265-275.

Orlob, G. T., 1958, Eddy diffusion in open channel flow: Univ. California Water Resources Center Contr. 19, 144 p.

Paulson, R. W., 1970, Variation of the longitudinal dispersion coefficient in the Delaware River estuary as a function of freshwater inflow: Water Resources Research, v. 6, no. 2, p. 516-526.

Pritchard, D. W., 1969, Dispersion and flushing of pollutants in estuaries: Proc. Amer. Soc. Civil Eng., Hydraul. Div., p. 115-124.

Rouse, Hunter, 1950, Engineering hydraulics: New York, John Wiley & Sons, 1039 p.

Scott, C. H., Norman, V. W., and Fields, F. K., 1969, Reduction of fluorescence of two tracer dyes by contact with a fine sediment: U. S. Geol. Survey Prof. Paper 650-B, Washington, D. C., p. B164-B168.

South, D. W., 1969, Investigation of the effect of mill waste on water quality in the Pamunkey and York rivers by The Chesapeake Corporation of Virginia: Informal report of The Chesapeake Corporation of Virginia, West Point, Va., 205 p.

Taylor, G. I., 1954, The dispersion of matter in turbulent flow through a pipe: Royal Soc. London Proc., ser. A, v. 223, p. 446-468.

U. S. Army, Corps of Engineers, 1970, Review report on York and Pamunkey rivers, Virginia: Dept. Army, Norfolk District, Corps of Engineers, Norfolk, Va. 23510.

U. S. Government, 1930, Pamunkey River, Virginia, House of Representatives, Document No. 54, 71st Congress, U. S. Gov't. Printing Off., 142 p.

Virginia Division of Water Resources, 1970, York River basin comprehensive water resources plan: Vol. I. Introduction; Vol. II. Economic base study, Richmond, Va.; Vol. III. Hydrologic analysis.

Wilson, James F., Jr., 1968, Fluorometric procedures for dye tracing: Chapter 12 in Book 3, Applications of Hydraulics; U. S. Geological Survey, Washington, D. C., p. A1-A31.

Wilson, J. F., Cobb, E. D., and Yotsukura, N., 1969, Movement of a solute in the Potomac River estuary at Washington, D. C., at low inflow conditions: U. S. Geological Survey Circ. 529-B, Washington, D. C., p. 1-14.

Wright, R. R., and Collings, M. R., 1964, Application of fluorescent tracing techniques to hydrologic studies: Am. Water Works Assoc. Jour., v. 56, no. 6, p. 748-754.

Wu, Jin, 1969, An estimation of wind effects on dispersion in wide channels: Water Resources Research, v. 5, no. 5, p. 1097-1104.

APPENDIX A

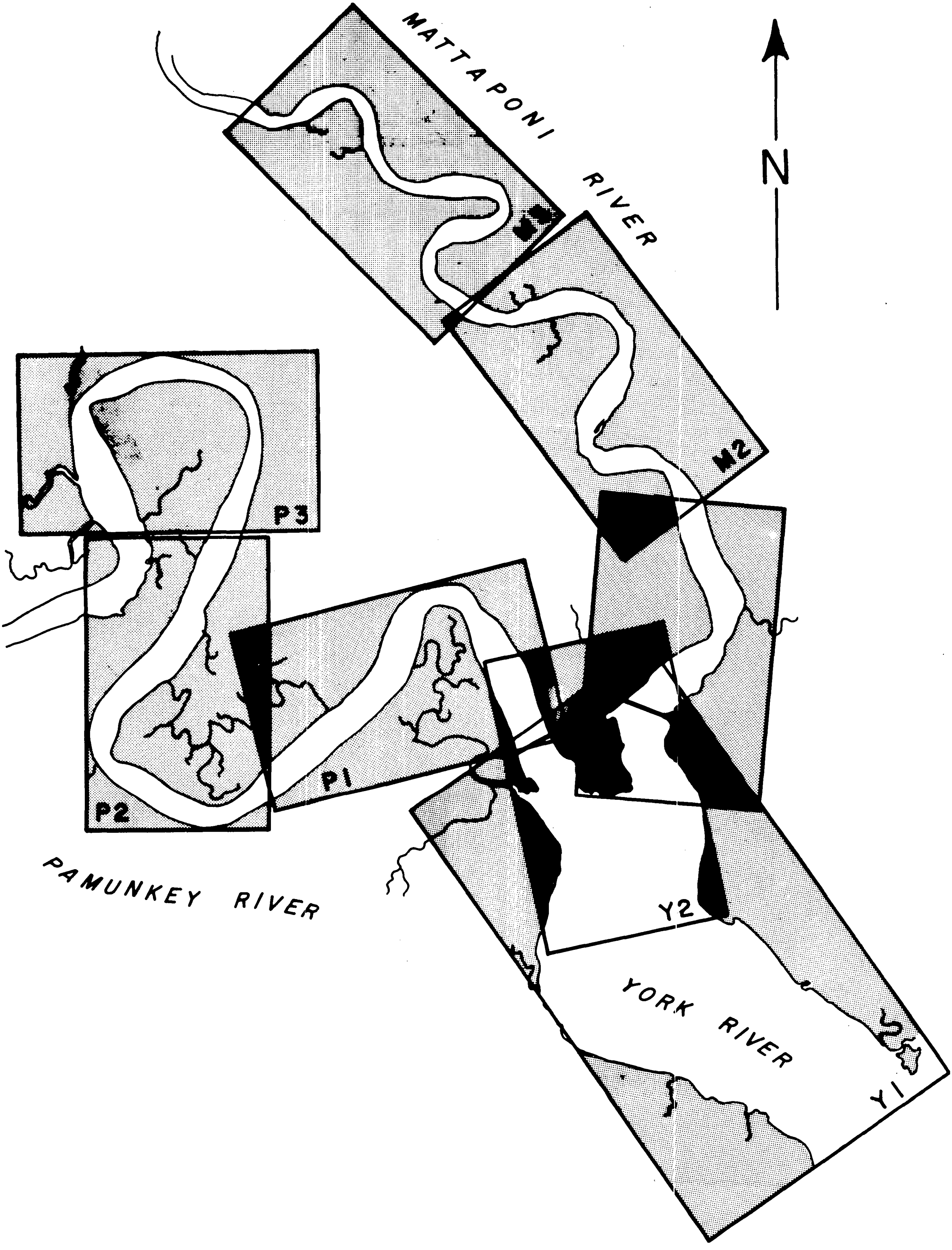
DYE TRACER DISTRIBUTIONS RESULTING FROM THE CONTINUOUS DYE RELEASES

KEY TO APPENDIX A

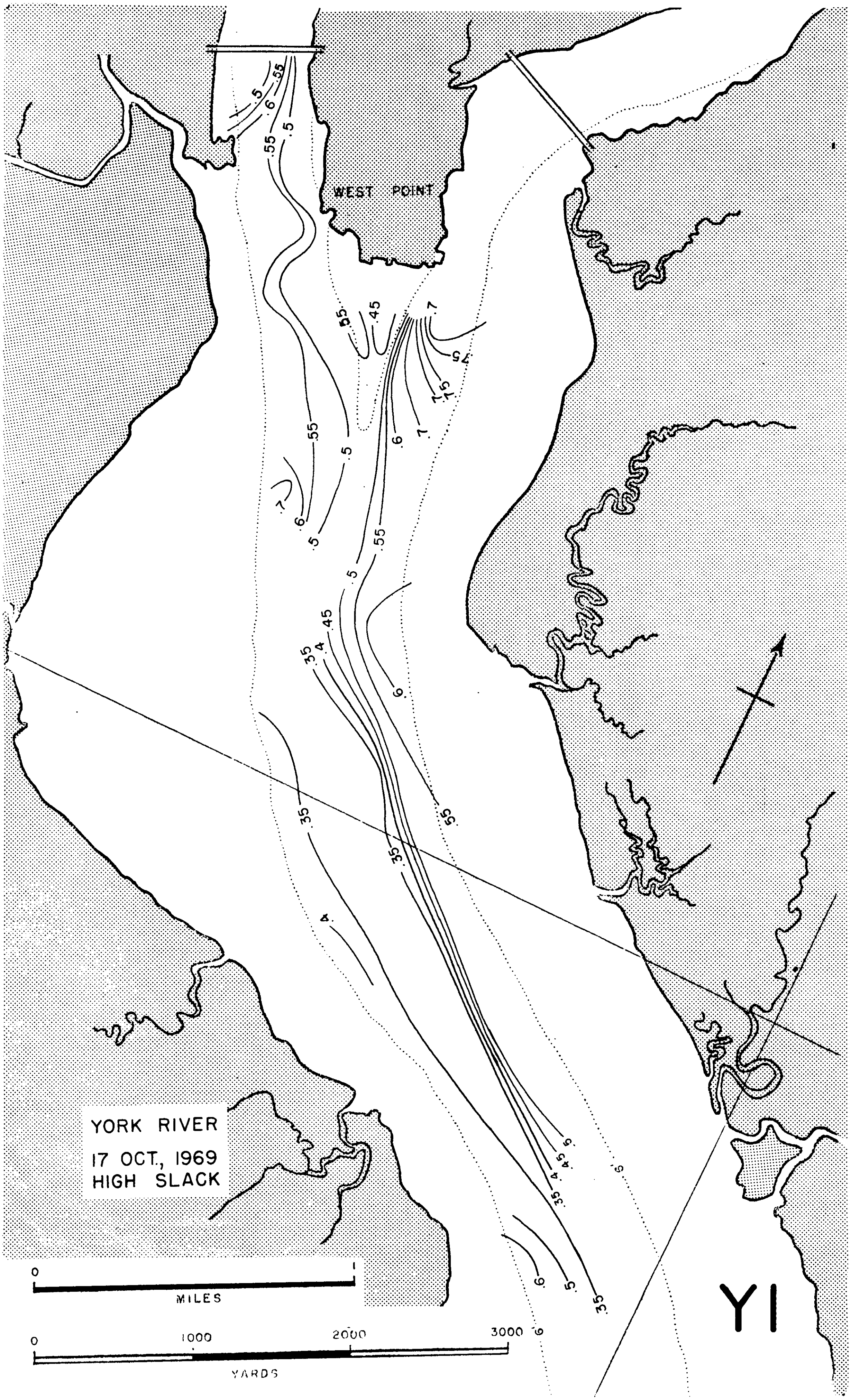
Page	Map	Subject
A1	Index	Locations of submaps Y1, Y2; P1 - P3; and M1 - M3, that show dye-distribution patterns
A2	Y1	17 Oct. 69, high slack
A3	M1	17 Oct. 69, high slack
A4	M2	17 Oct. 69, high slack
A5	M3	17 Oct. 69, high slack
A6	P1	17 Oct. 69, high slack
A7	P2	17 Oct. 69, high slack
A8	Y1	17 Oct. 69, low slack
A9	M1	17 Oct. 69, low slack
A10	M2	17 Oct. 69, low slack
A11	M3	17 Oct. 69, low slack
A12	P1	17 Oct. 69, low slack
A13	P2	17 Oct. 69, low slack
A14	Y1	21 Oct. 69, high slack
A15	M1	21 Oct. 69, high slack
A16	M2	21 Oct. 69, high slack
A17	M3	21 Oct. 69, high slack
A18	P1	21 Oct. 69, high slack
A19	P2	21 Oct. 69, high slack
A20	P3	21 Oct. 69, high slack
A21	Y1	21 Oct. 69, low slack
A22	M1	21 Oct. 69, low slack
A23	P1	21 Oct. 69, low slack

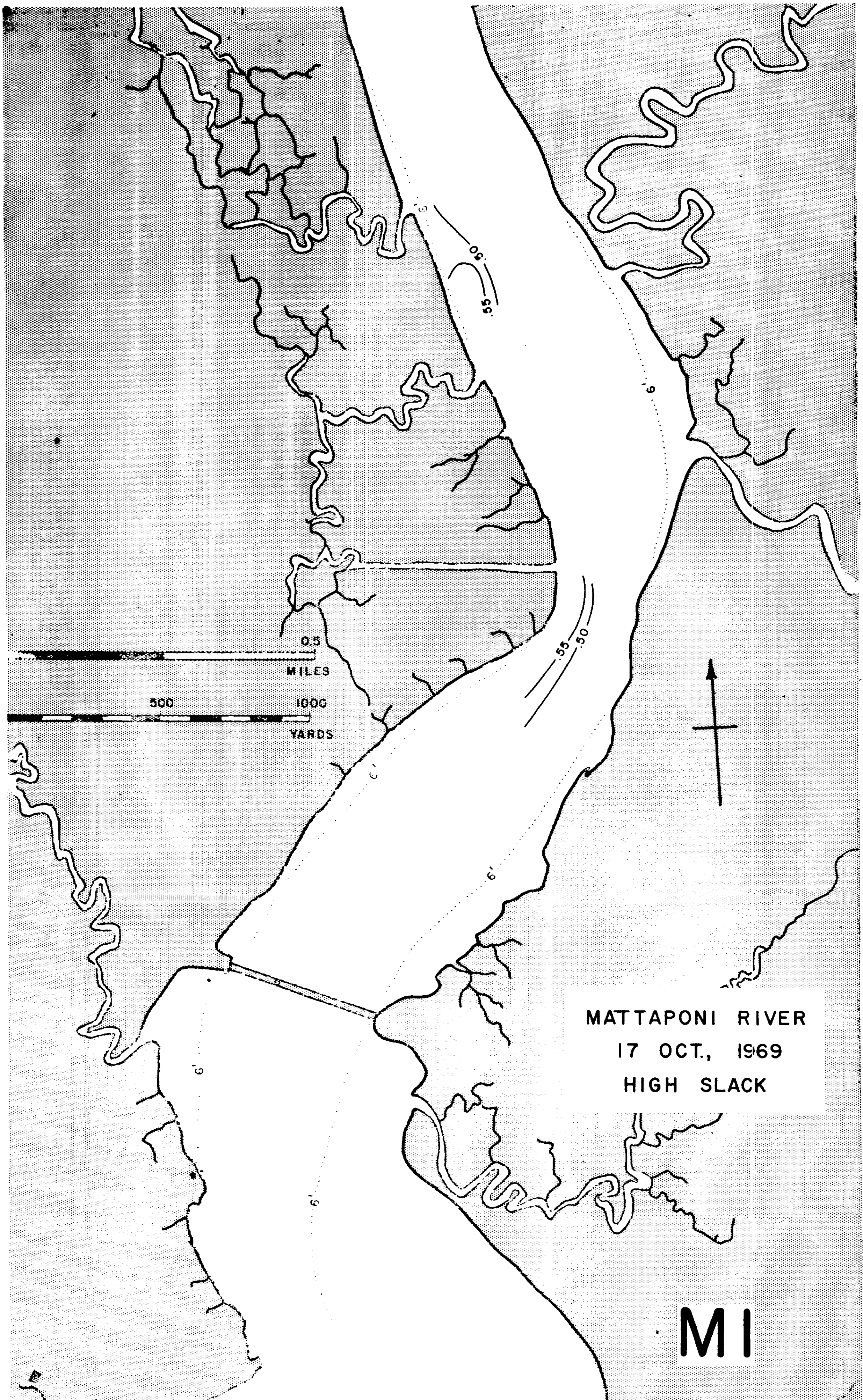
NOTE: All dye-concentration values on these maps are in parts per billion (ppb)

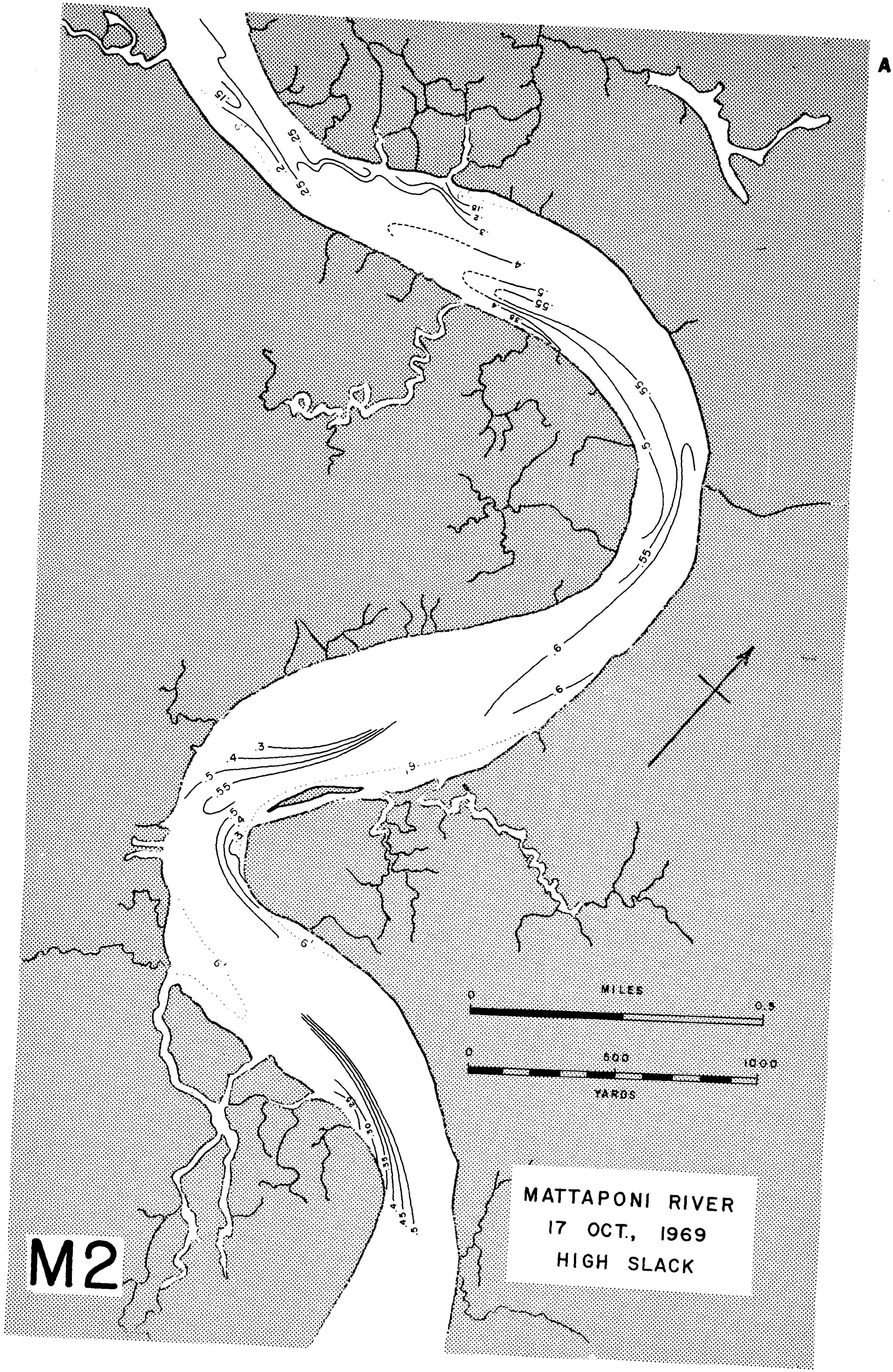
Page	Map	Subject
A24	Y1	30 Oct. 69, high slack
A25	M1	30 Oct. 69, high slack
A26	M2	30 Oct. 69, high slack
A27	M3	30 Oct. 69, high slack
A28	P1	30 Oct. 69, high slack
A29	P2	30 Oct. 69, high slack
A30	P3	30 Oct. 69, high slack
A31	Y2	30 Oct. 69, low slack
A32	M1	30 Oct. 69, low slack
A33	M2	30 Oct. 69, low slack
A34	M3	30 Oct. 69, low slack
A35	P1	30 Oct. 69, low slack
A36	P2	30 Oct. 69, low slack
A37	York River	30 Oct. 69, low slack

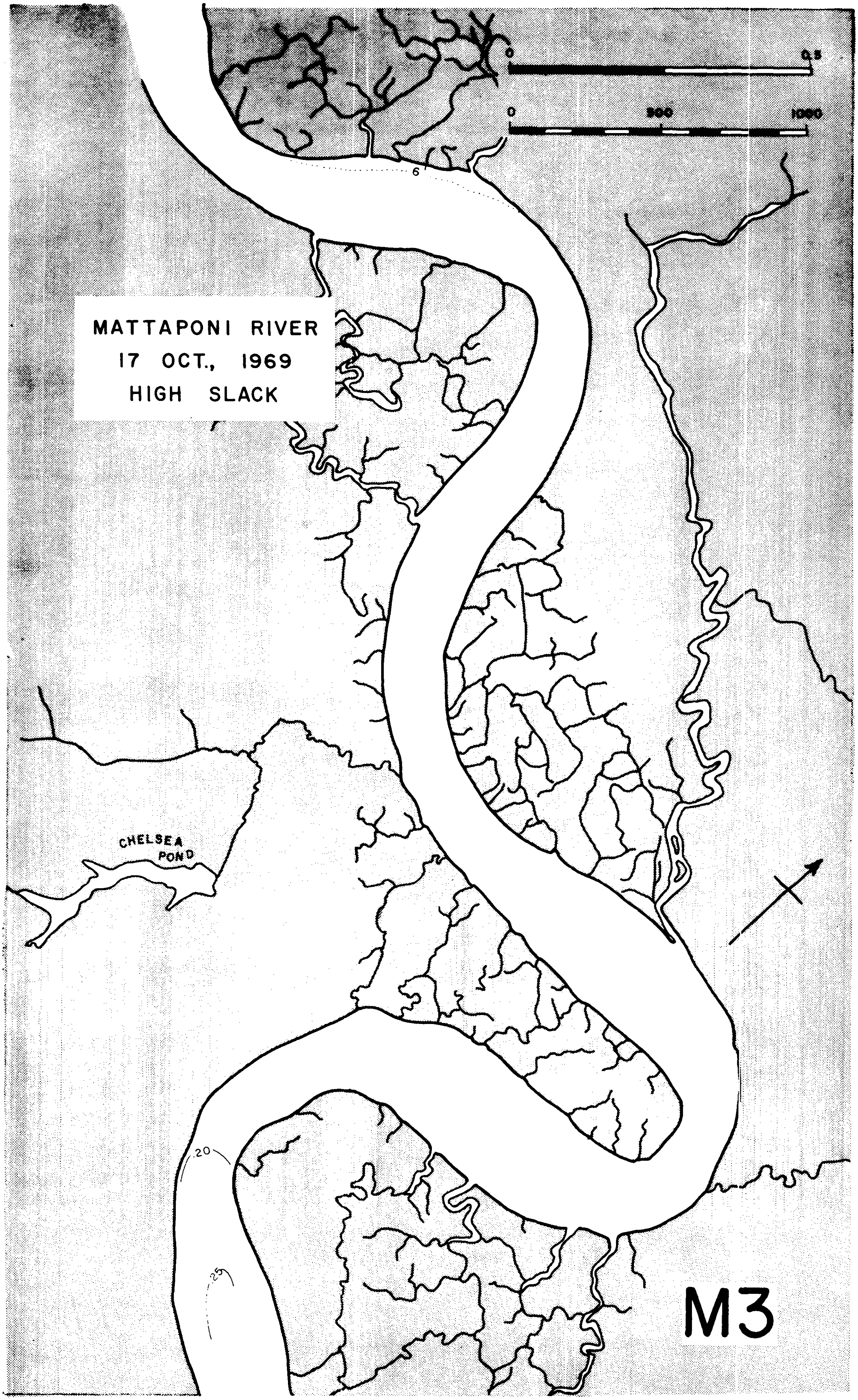


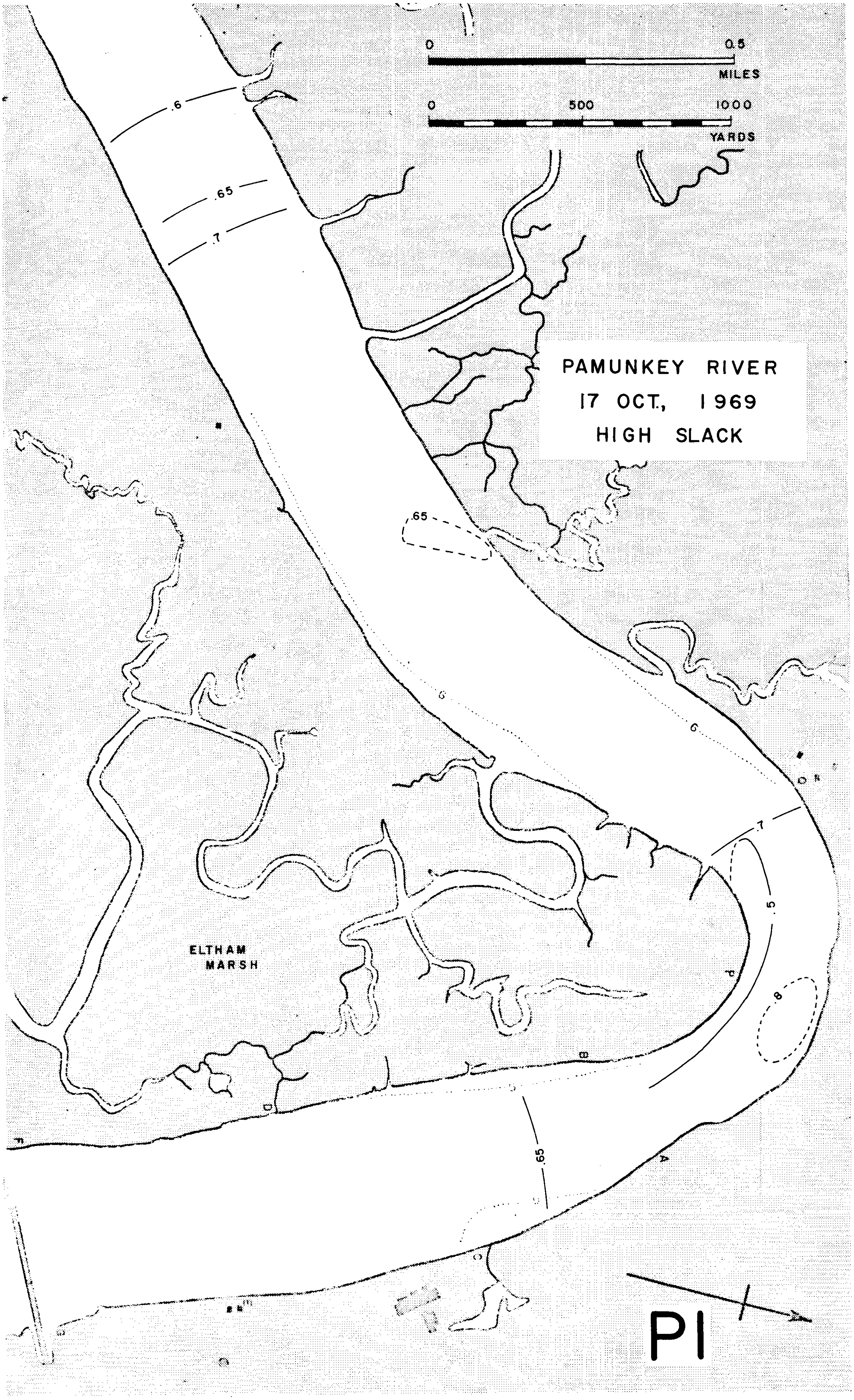
MATTAPONI RIVER
N
M1
M2
P3
P2
P1
PAMUNKEY RIVER
Y2
YORK RIVER
Y1


WEST POINT
YORK RIVER
17 OCT., 1969
HIGH SLACK
0
1
MILES
0
1000
2000
3000
YARDS
YI

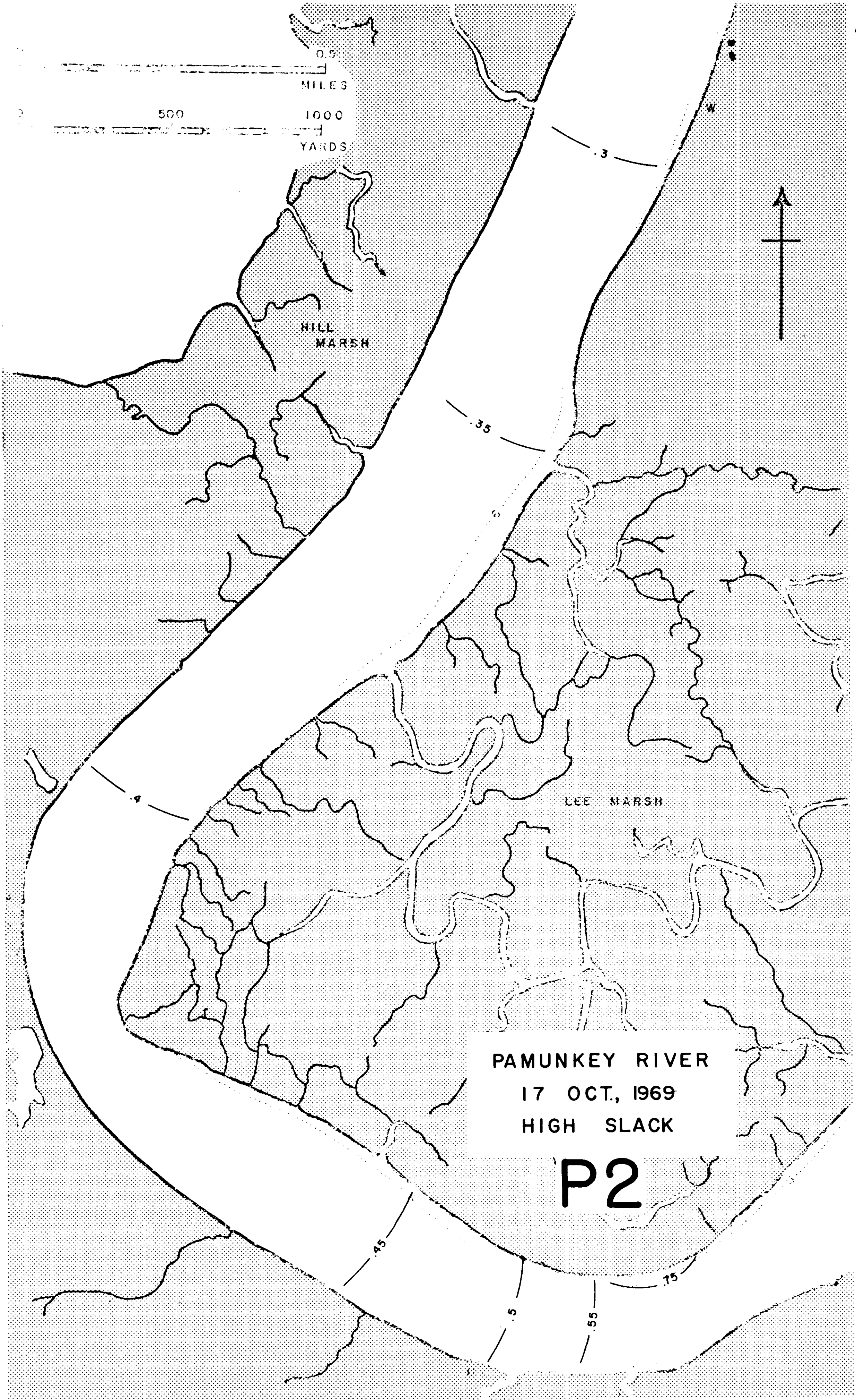

.50
.55
6'
.55
.50
0.5
MILES
500
1000
YARDS
6'
6'
6'
6'
MATTAPONI RIVER
17 OCT., 1969
HIGH SLACK
M1


MILES
0
0.5
0
500
1000
YARDS
MATTAPONI RIVER
17 OCT., 1969
HIGH SLACK
M2

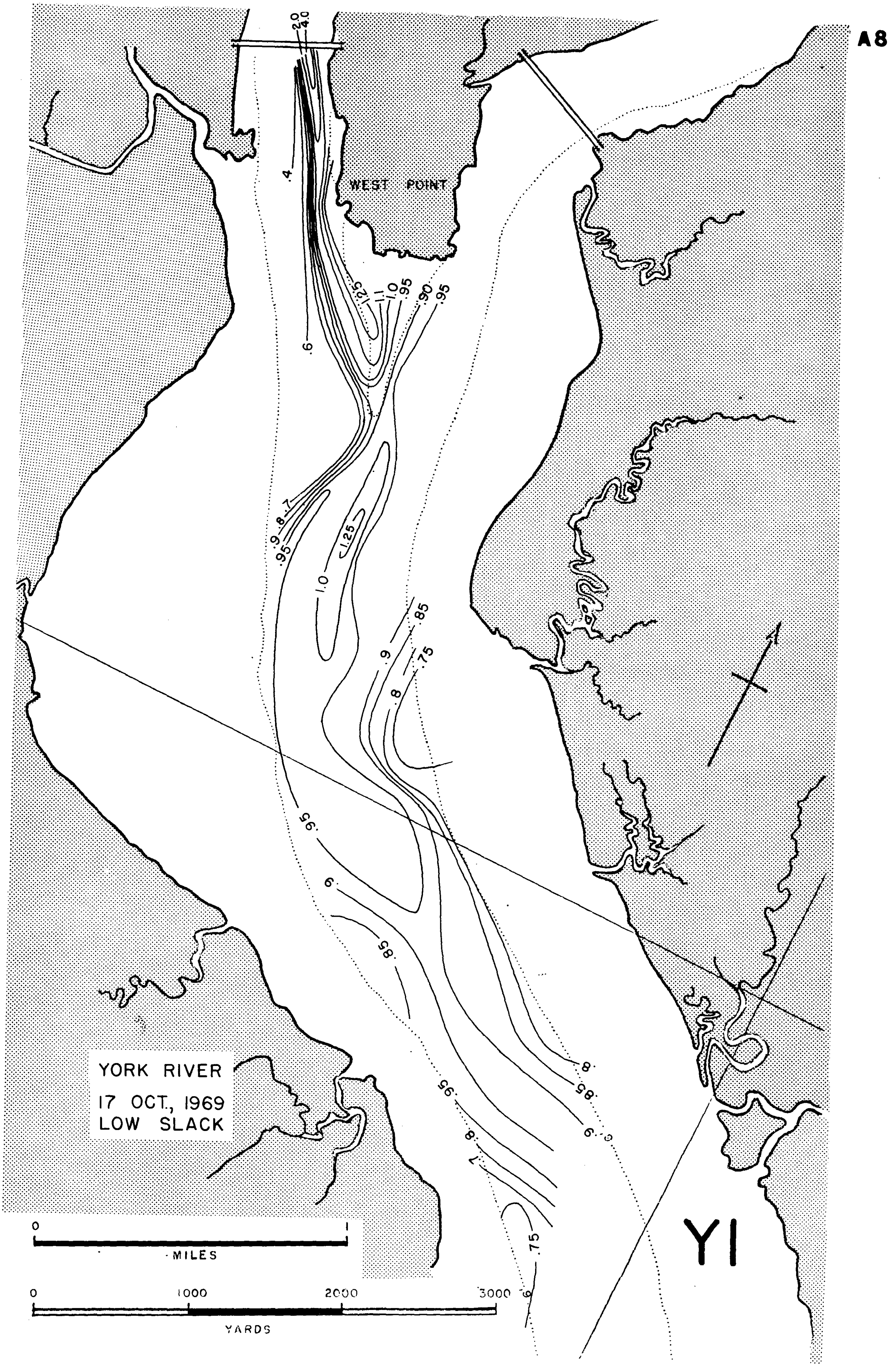

MATTAPONI RIVER
17 OCT., 1969
HIGH SLACK
0
0.5
0
500
1000
6
CHELSEA
POND
20
25
M3

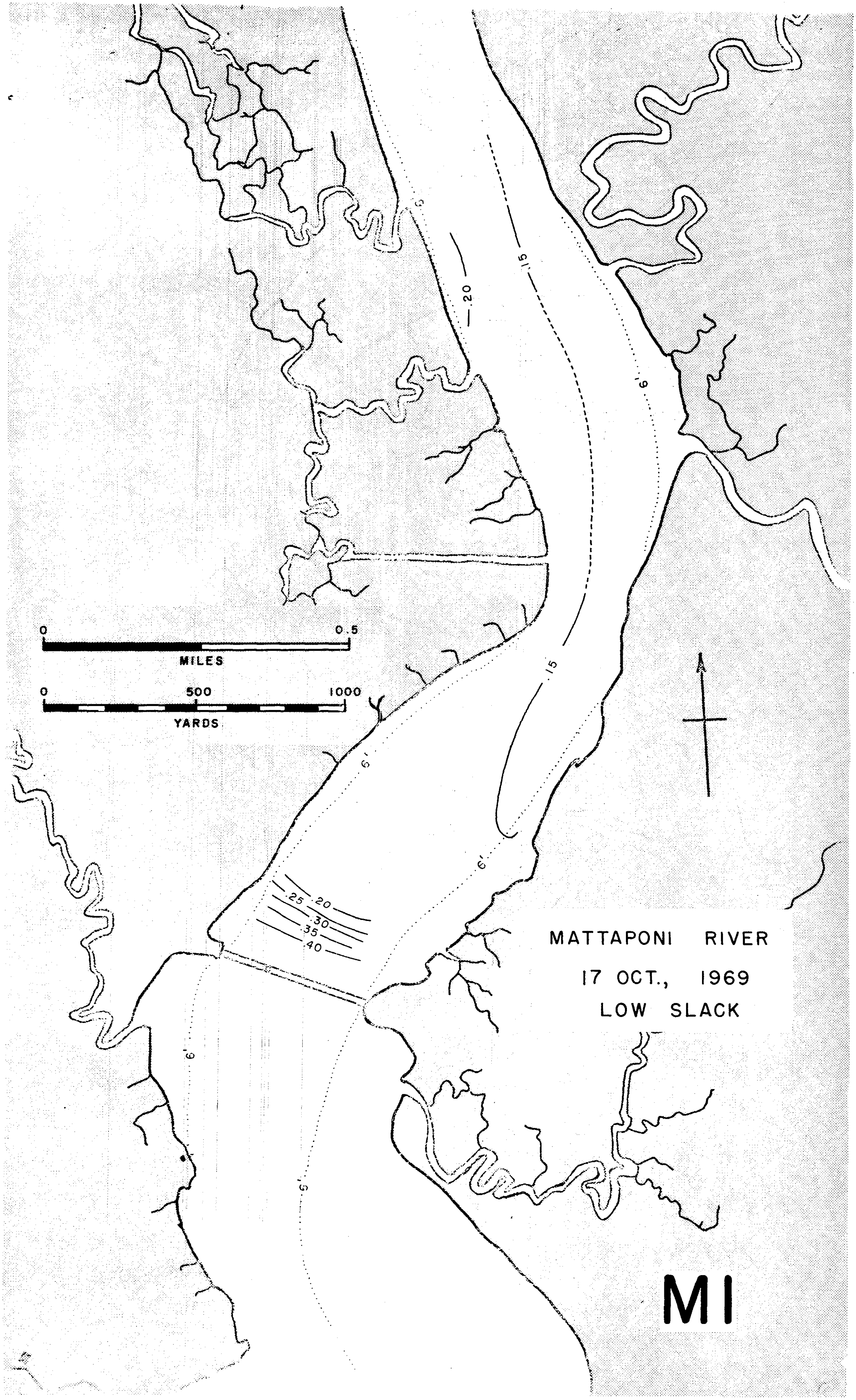


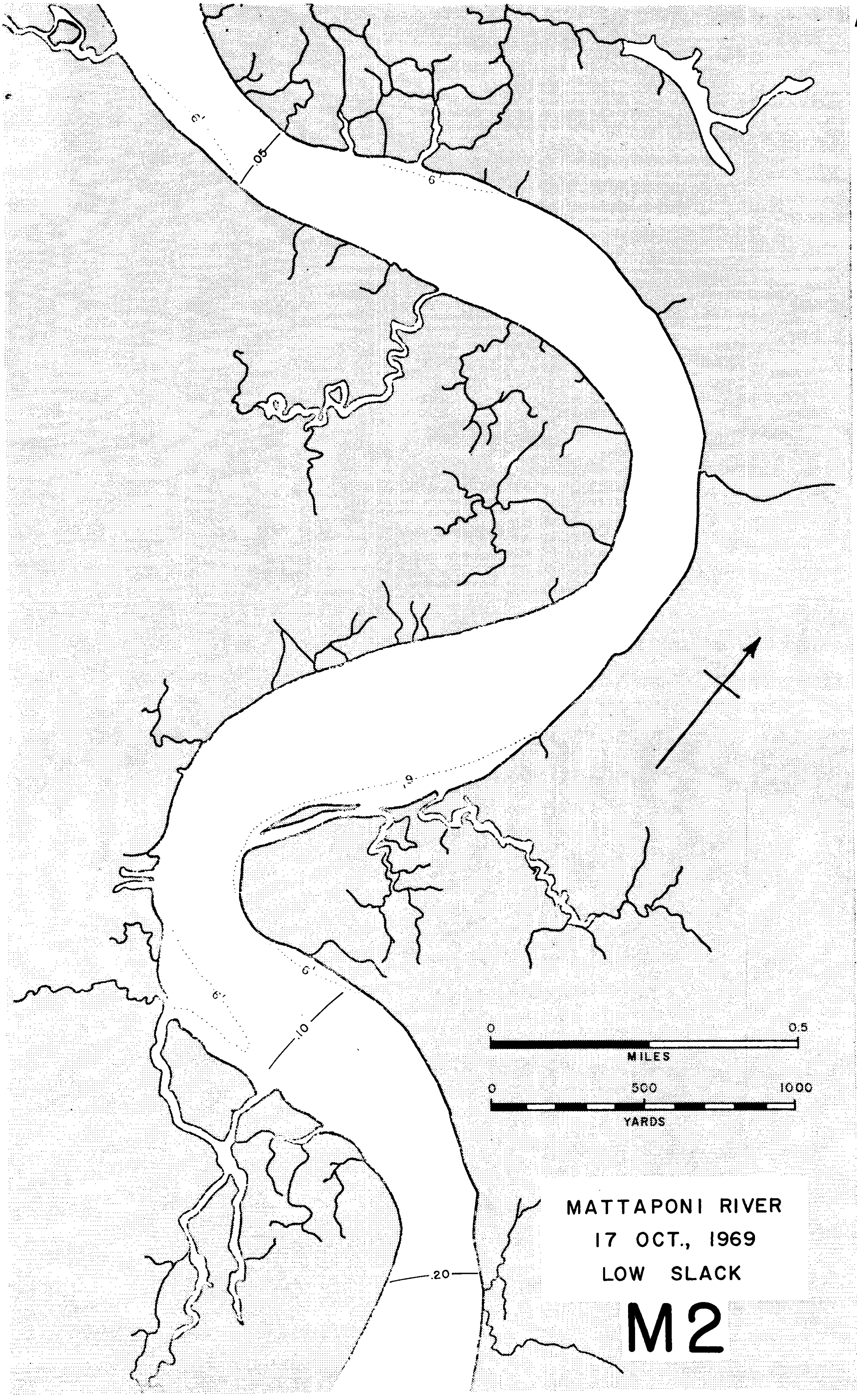
0
0.5
MILES
0
500
1000
YARDS
PAMUNKEY RIVER
17 OCT., 1969
HIGH SLACK
.6
.65
.7
.65
.6
.6
.7
.5
.8
.5
.65
ELTHAM
MARSH
P1

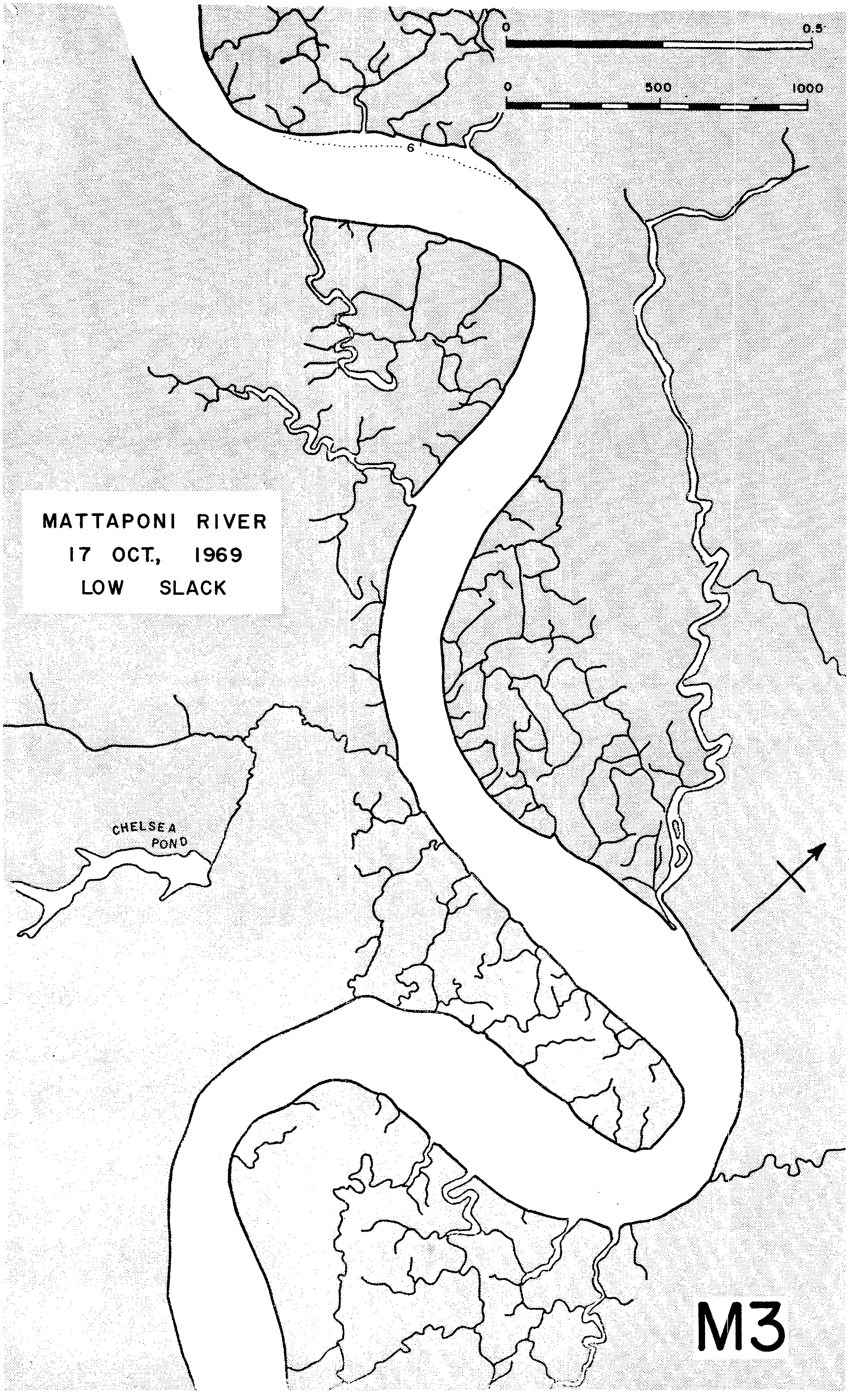


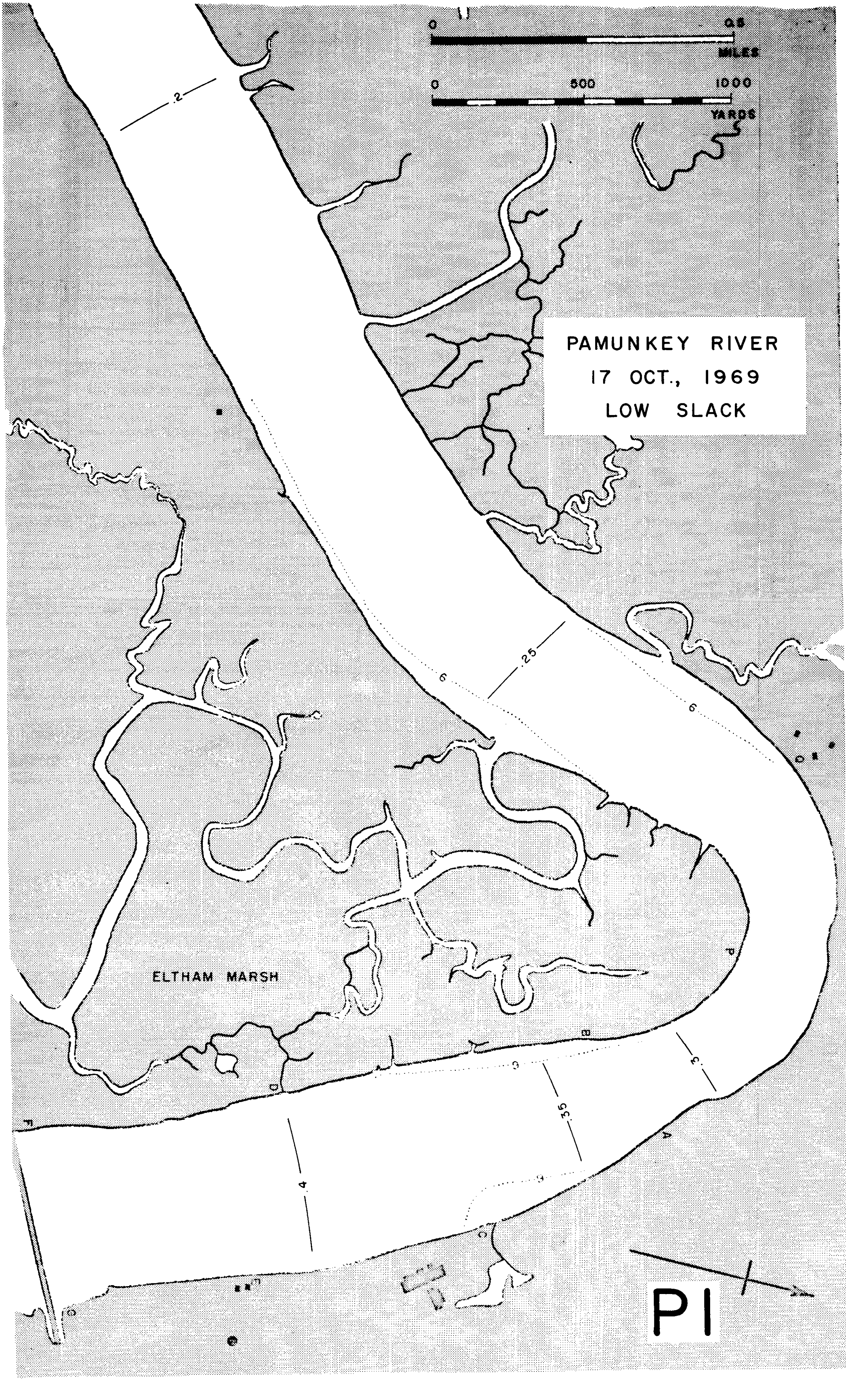
0.5
MILES
500
1000
YARDS
.3
HILL
MARSH
.35
.4
LEE MARSH
.45
.5
.55
.75
PAMUNKEY RIVER
17 OCT., 1969
HIGH SLACK
P2


WEST POINT
YORK RIVER
17 OCT., 1969
LOW SLACK
YI
0
1
MILES
0
1000
2000
3000
YARDS

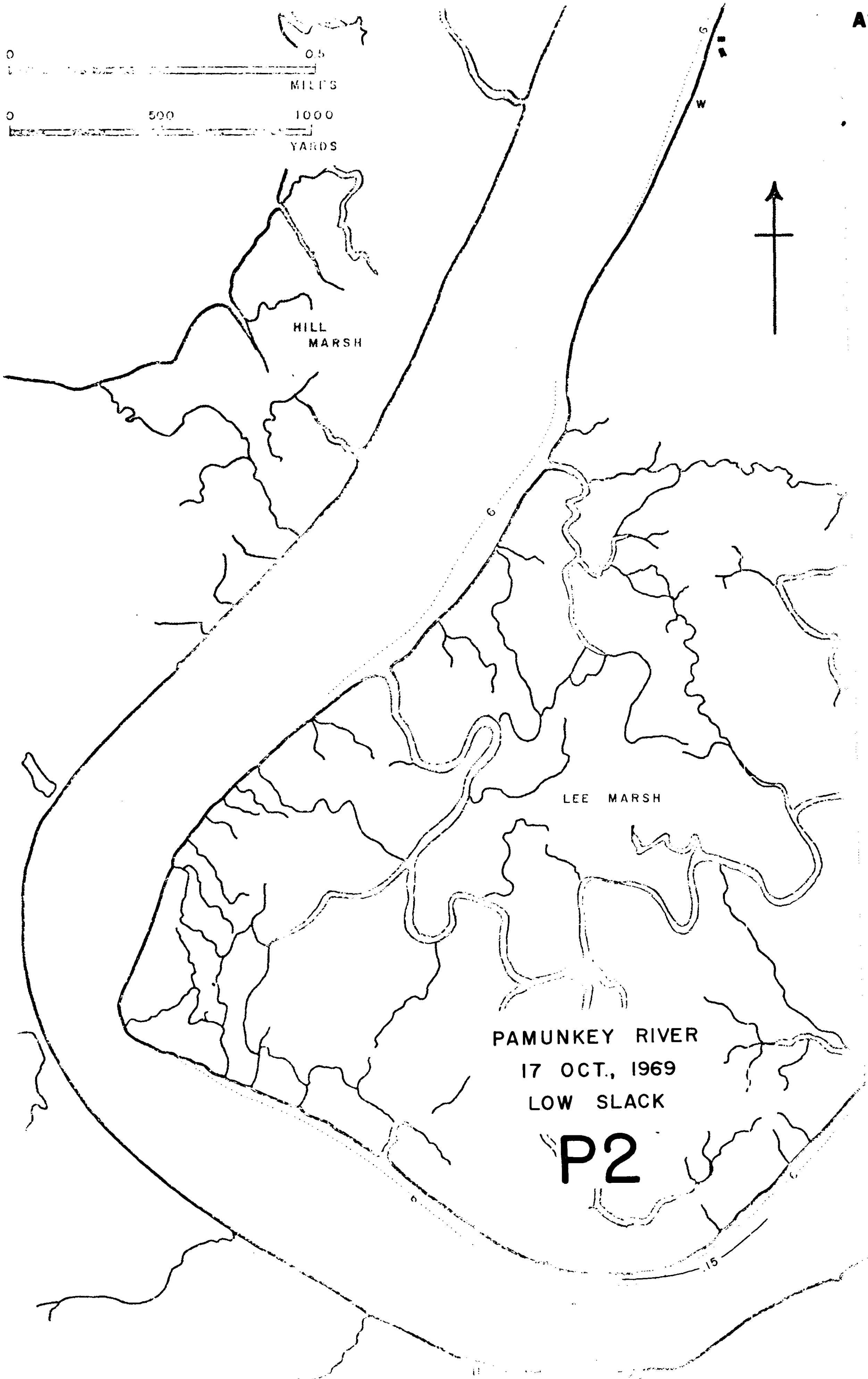

0
0.5
MILES
0
500
1000
YARDS
6'
20
15
.25
.20
.30
.35
.40
MATTAPONI RIVER
17 OCT., 1969
LOW SLACK
M1

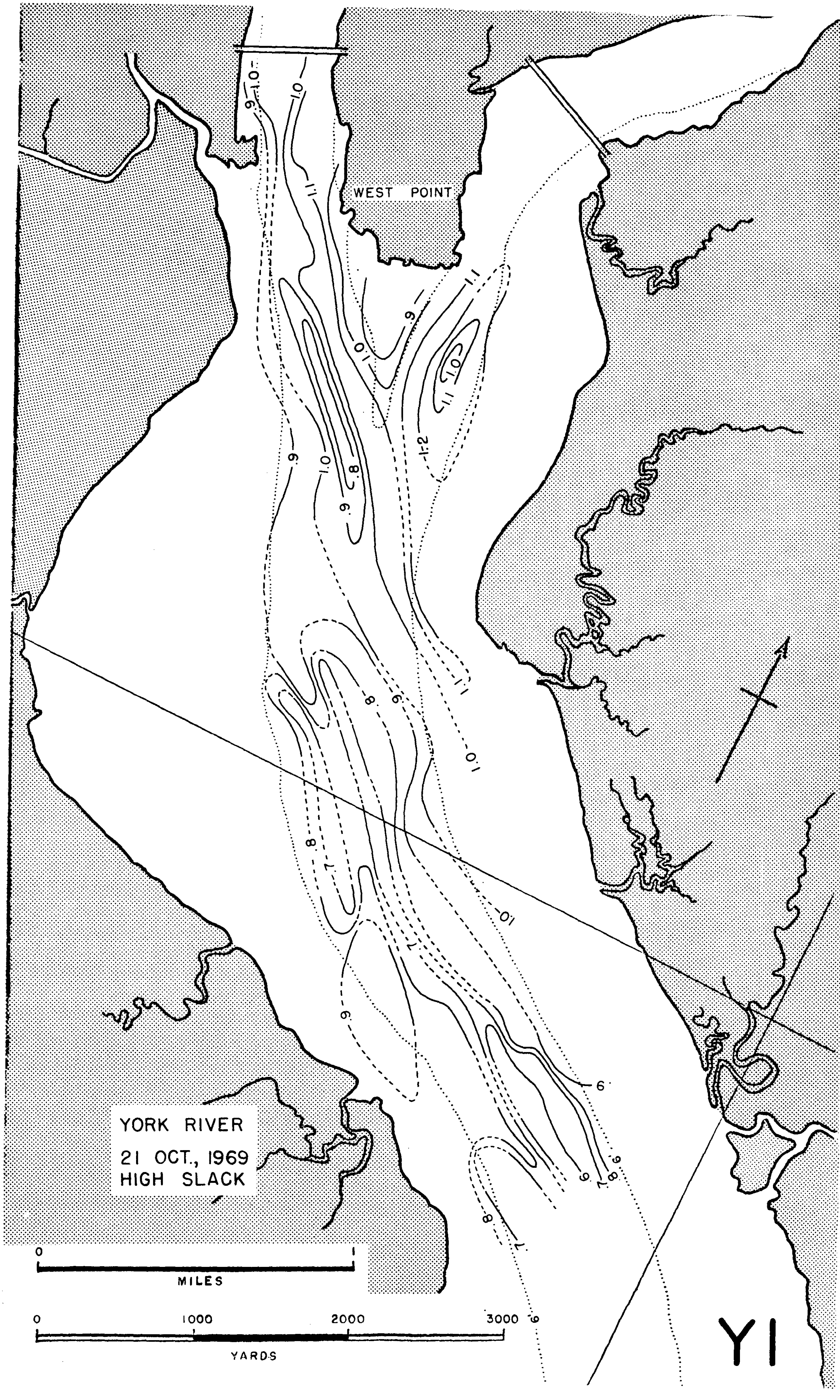

6'
.05
6'
.19
6'
6'
.10
.20
0
0.5
MILES
0
500
1000
YARDS
MATTAPONI RIVER
17 OCT., 1969
LOW SLACK
M2

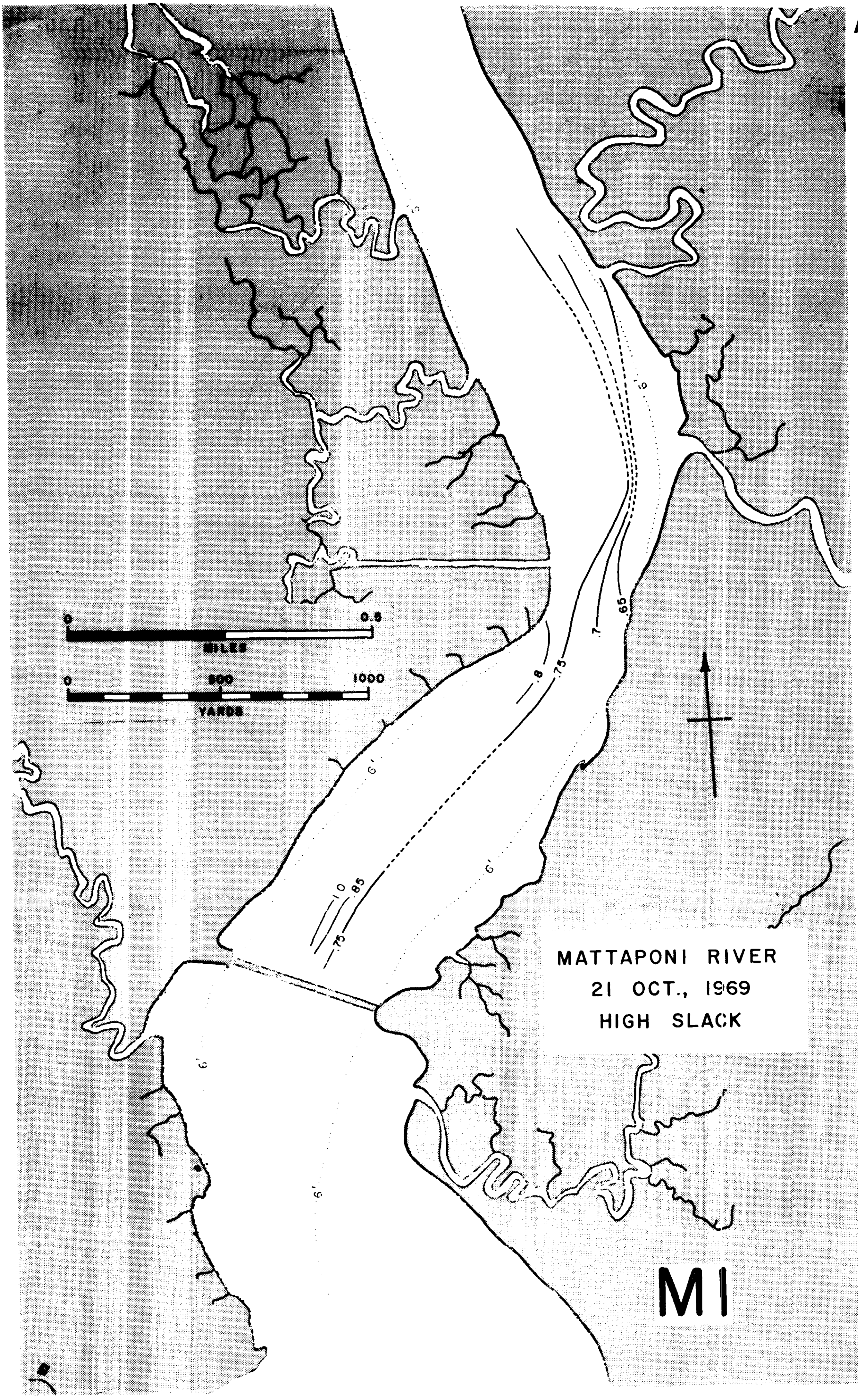

0
0.5
0
500
1000
6
MATTAPONI RIVER
17 OCT., 1969
LOW SLACK
CHELSEA
POND
M3



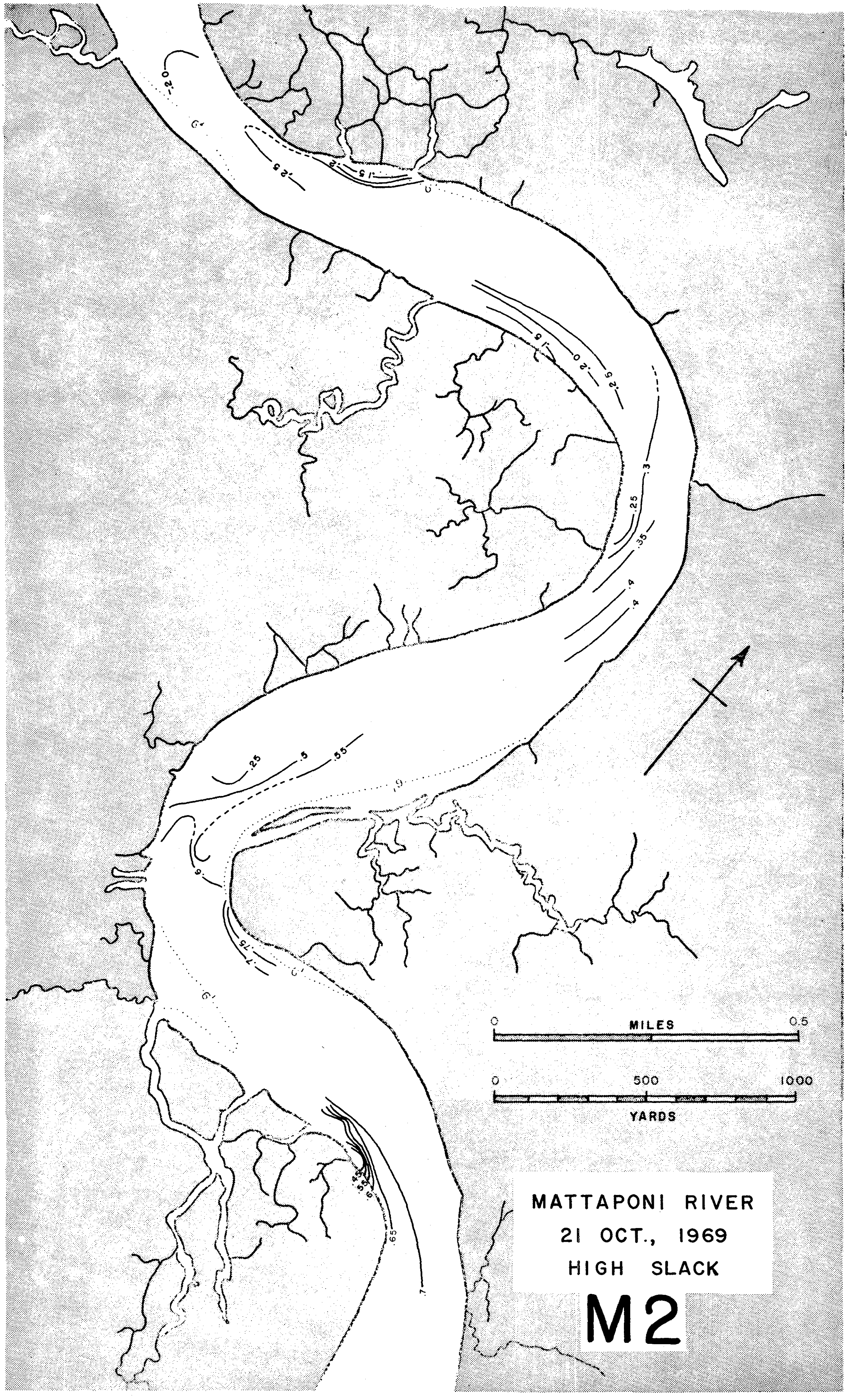
0
0.5
MILES
0
500
1000
YARDS
PAMUNKEY RIVER
17 OCT., 1969
LOW SLACK
.2
.25
6
6
ELTHAM MARSH
.3
.35
.4
P1

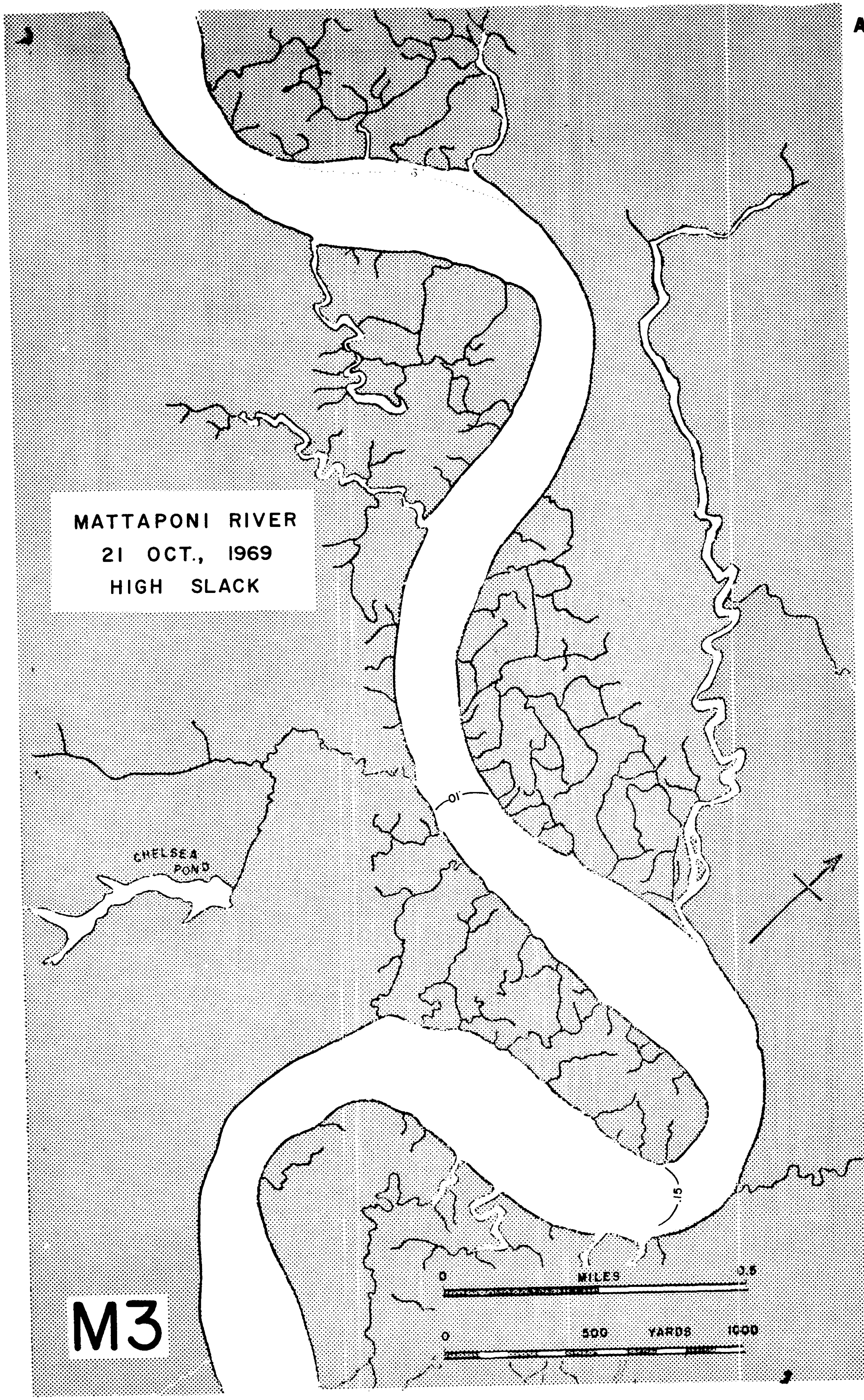

0
0.5
MILES
0
500
1000
YARDS
HILL
MARSH
LEE MARSH
6
W
15
PAMUNKEY RIVER
17 OCT., 1969
LOW SLACK
P2

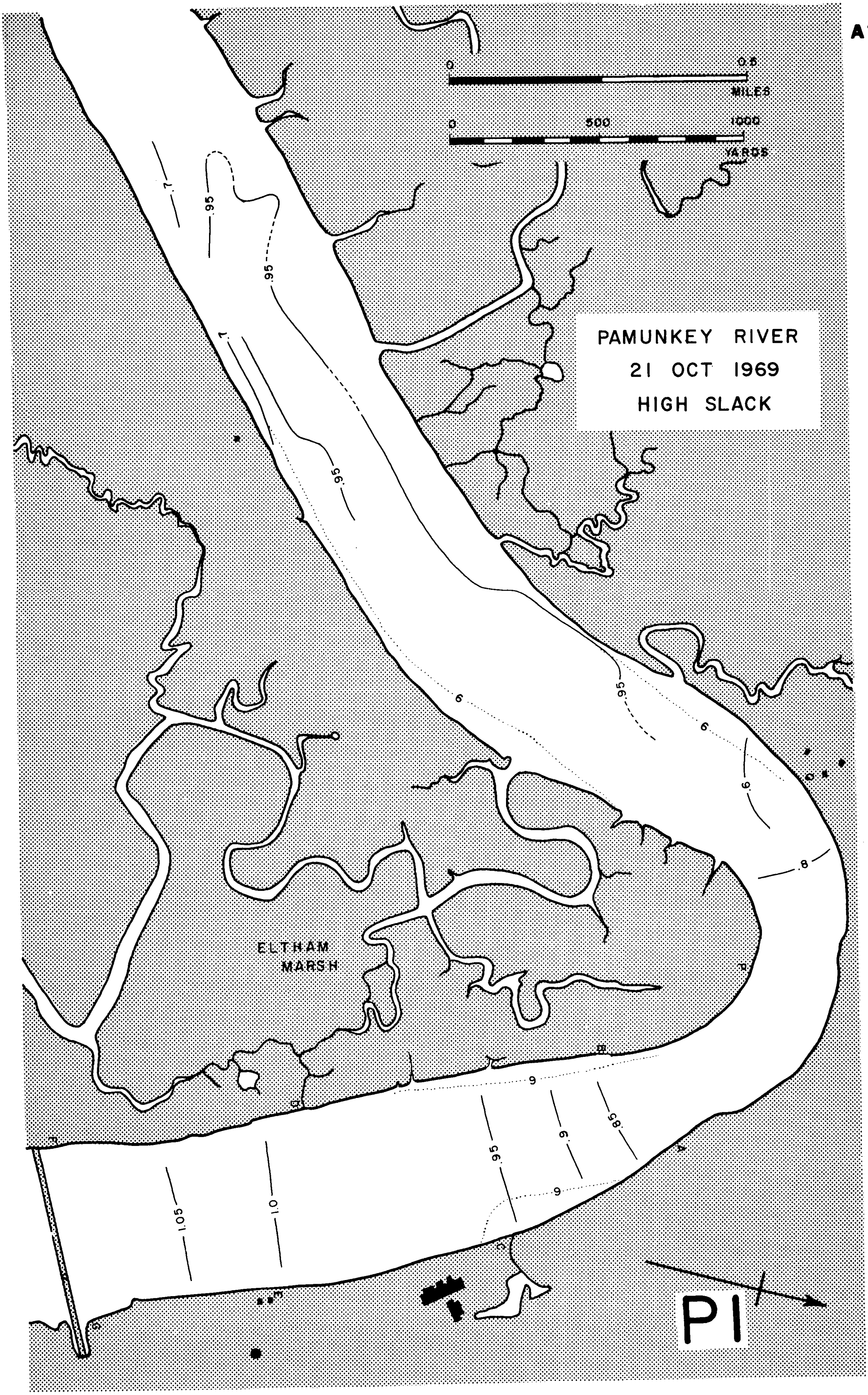

WEST POINT
YORK RIVER
21 OCT., 1969
HIGH SLACK
MILES
0
0
1000
2000
3000
YARDS
Y1



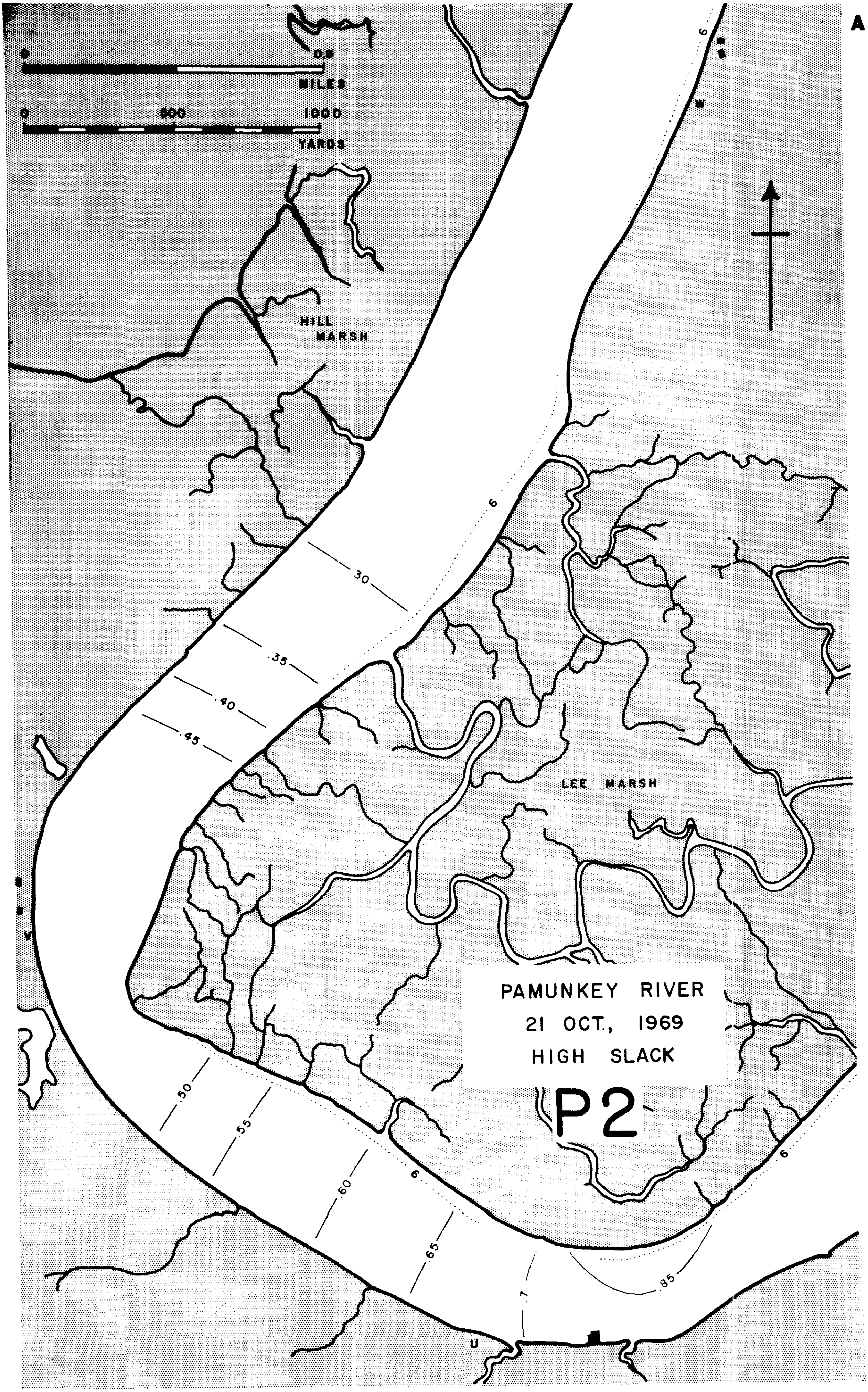
0
0.5
MILES
0
500
1000
YARDS
6'
6'
.65
.7
.75
.8
6'
6'
1.0
.85
.75
6'
6'
MATTAPONI RIVER
21 OCT., 1969
HIGH SLACK
M1

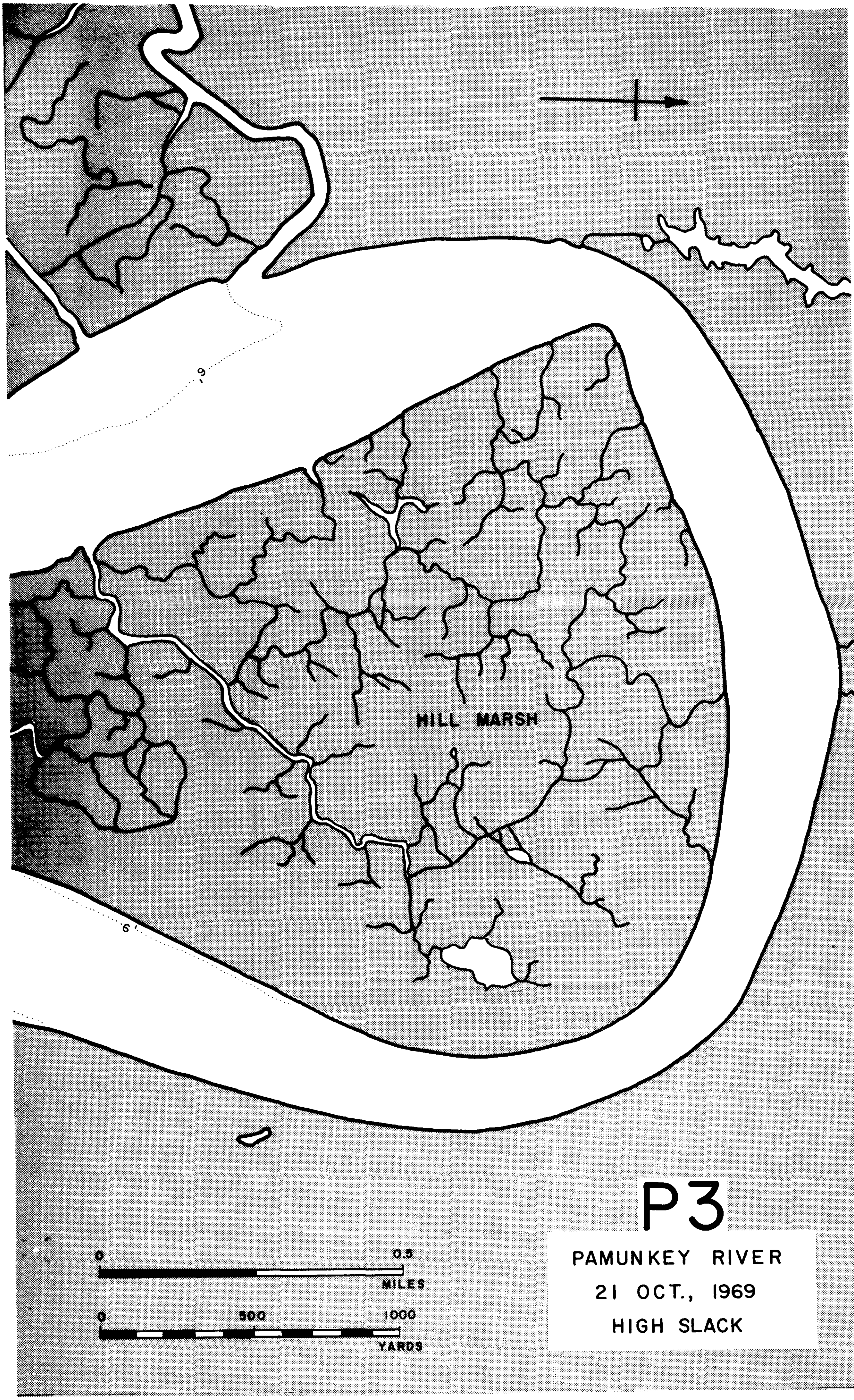

MATTAPONI RIVER
21 OCT., 1969
HIGH SLACK
M2
MILES
0
0.5
0
500
1000
YARDS

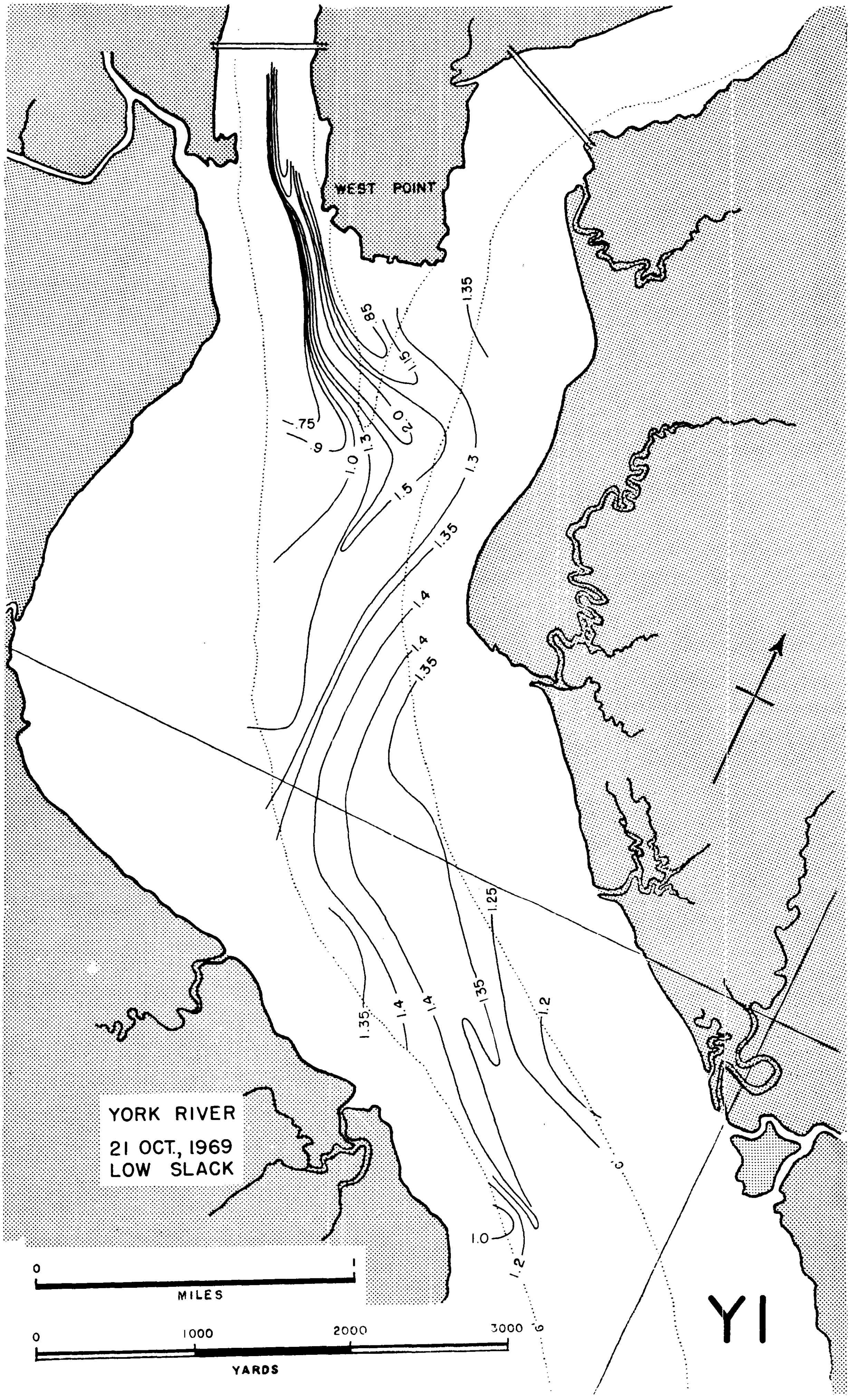

MATTAPONI RIVER
21 OCT., 1969
HIGH SLACK
CHELSEA POND
.10
.15
0
MILES
0.5
0
500
YARDS
1000
M3

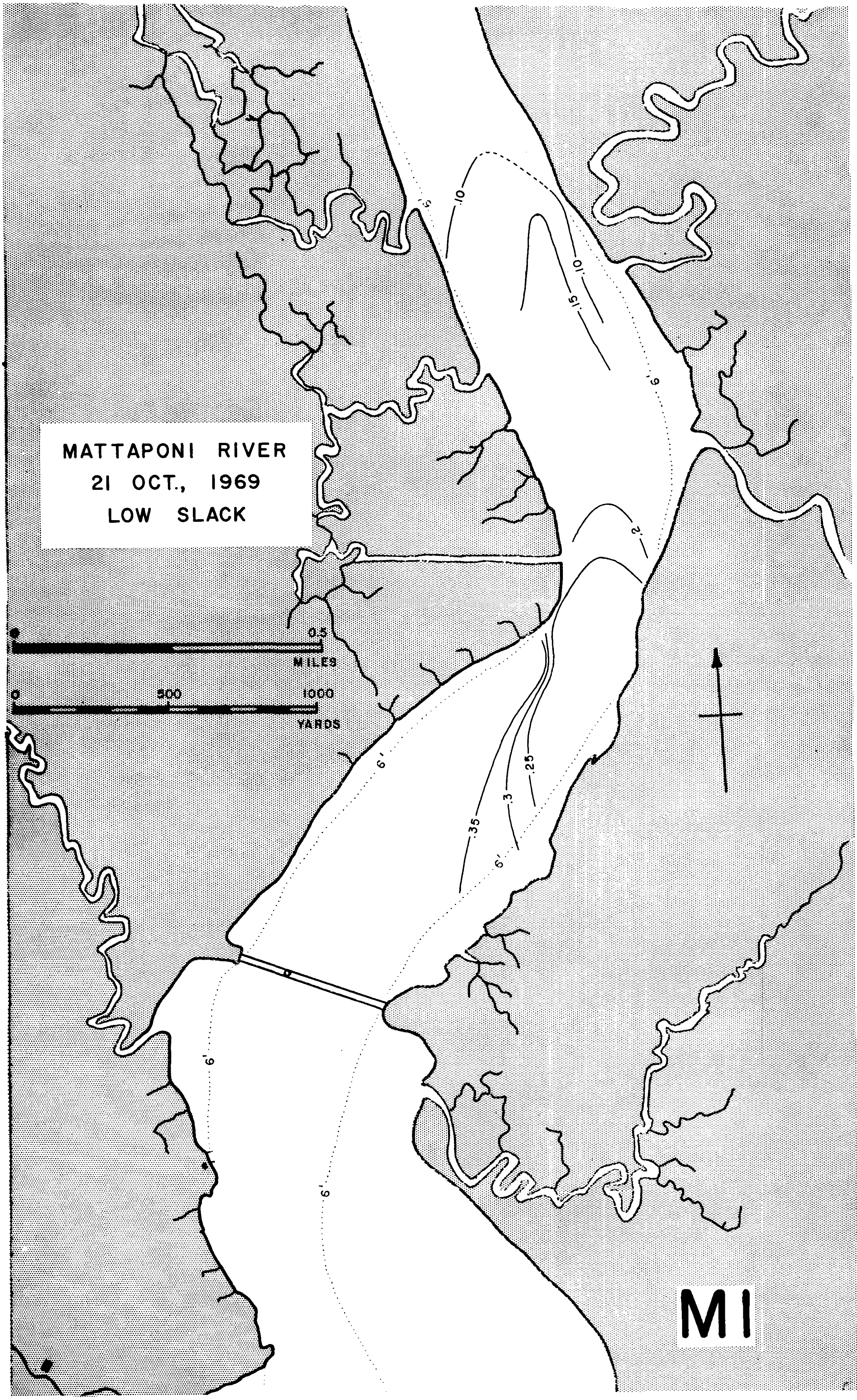


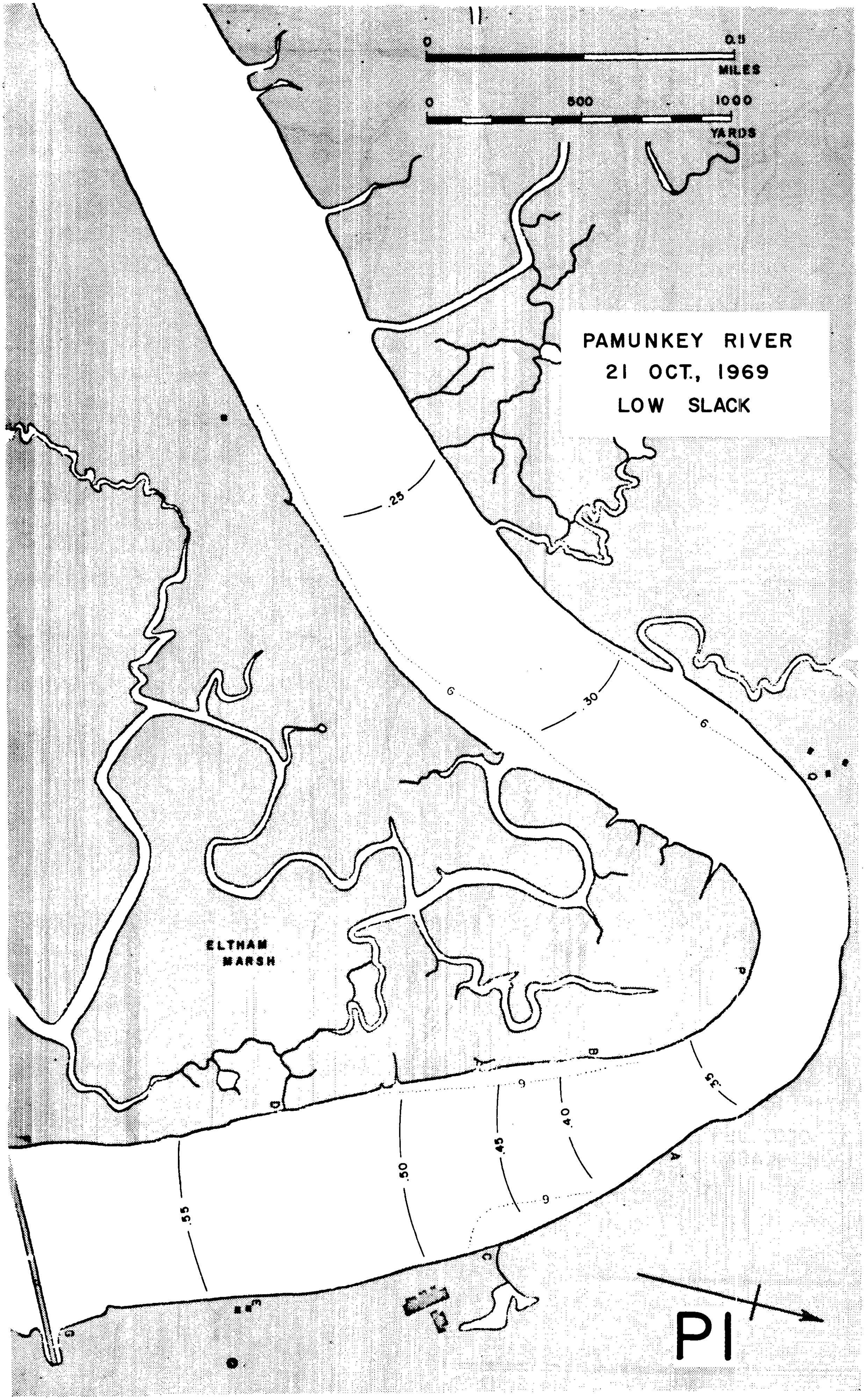
PAMUNKEY RIVER
21 OCT 1969
HIGH SLACK
0
0.5
MILES
0
500
1000
YARDS
ELTHAM
MARSH
.7
.95
.95
.7
.95
.6
.95
.6
.6
.8
.9
.9
.85
.95
.9
1.0
1.05
P1

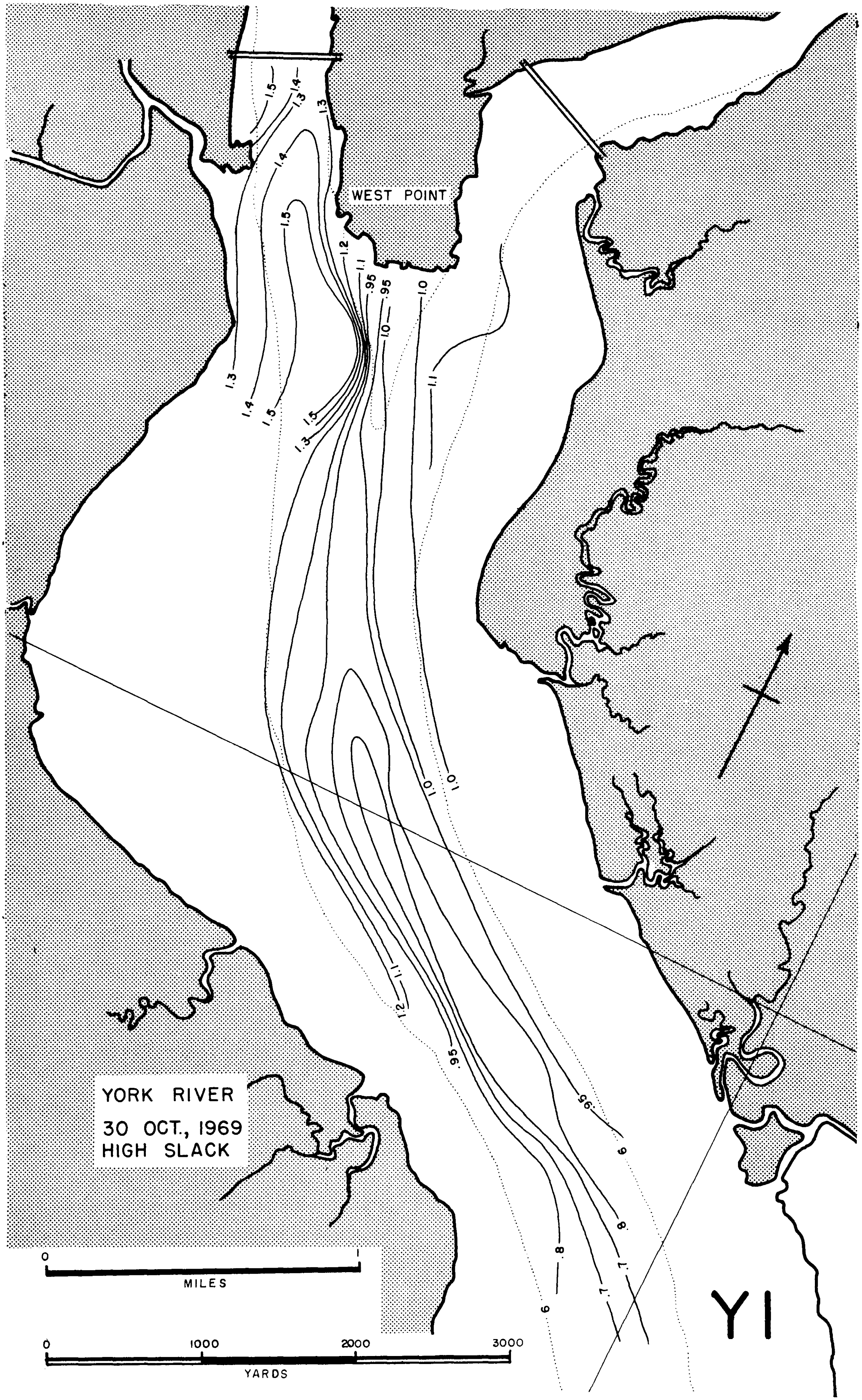

0
0.5
MILES
0
500
1000
YARDS
HILL
MARSH
LEE MARSH
.30
.35
.40
.45
.50
.55
.60
.65
.7
.85
6
6
6
PAMUNKEY RIVER
21 OCT., 1969
HIGH SLACK
P2


HILL MARSH
9
6
0
0.5
MILES
0
500
1000
YARDS
P3
PAMUNKEY RIVER
21 OCT., 1969
HIGH SLACK

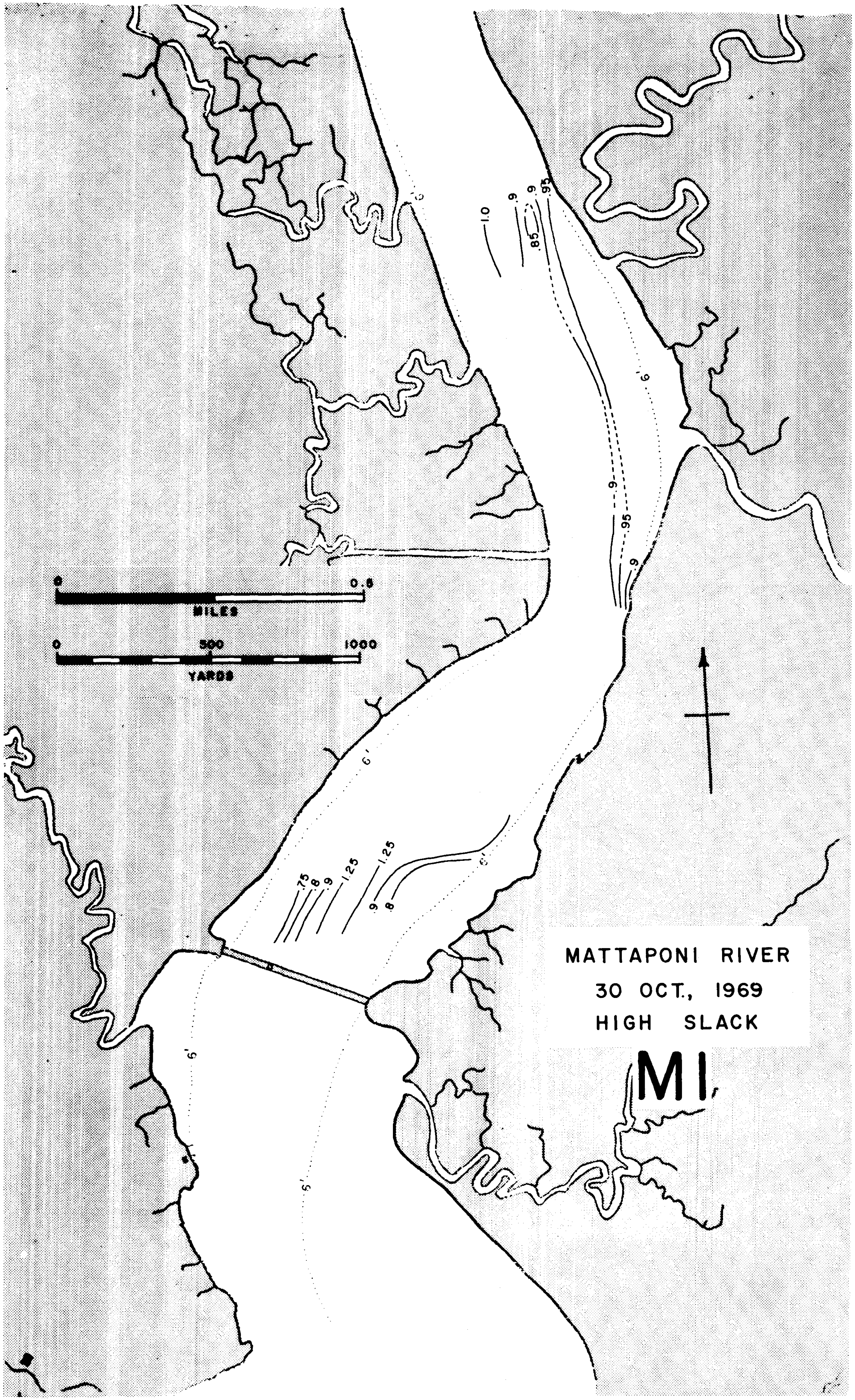

WEST POINT
.85
1.5
1.35
1.75
.9
1.0
1.3
2.0
1.5
1.3
1.35
1.4
1.4
1.35
1.25
1.35
1.4
1.4
1.35
1.2
1.0
1.2
YORK RIVER
21 OCT., 1969
LOW SLACK
0
1
MILES
0
1000
2000
3000
YARDS
Y1

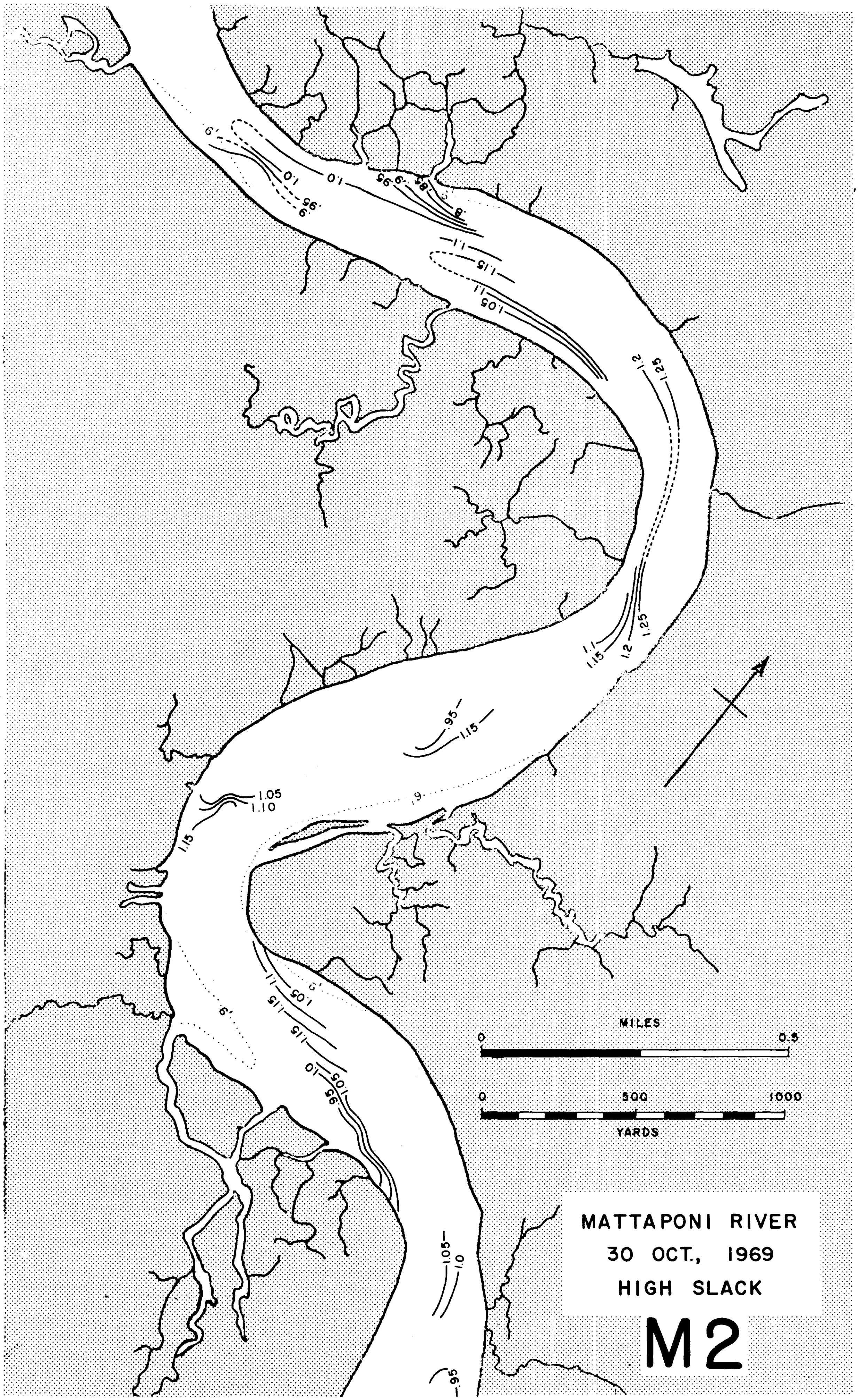

MATTAPONI RIVER
21 OCT., 1969
LOW SLACK
0
0.5
MILES
0
500
1000
YARDS
.5
.10
10
.15
6'
.2
.25
.3
.35
6'
6'
6'
6'
M1

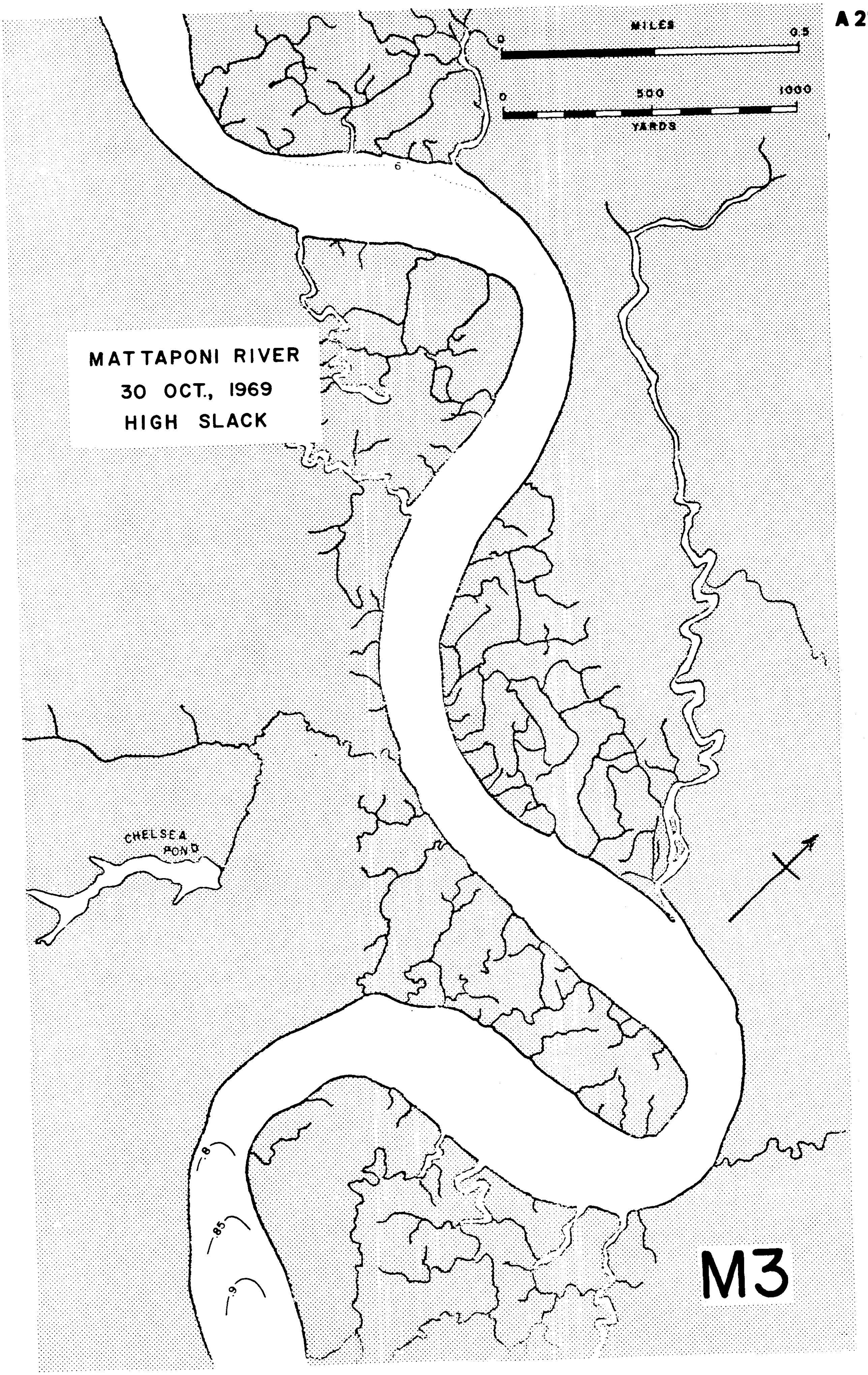

0
0.5
MILES
0
500
1000
YARDS
PAMUNKEY RIVER
21 OCT., 1969
LOW SLACK
.25
.30
6
.35
.40
.45
.50
.55
ELTHAM
MARSH
P1

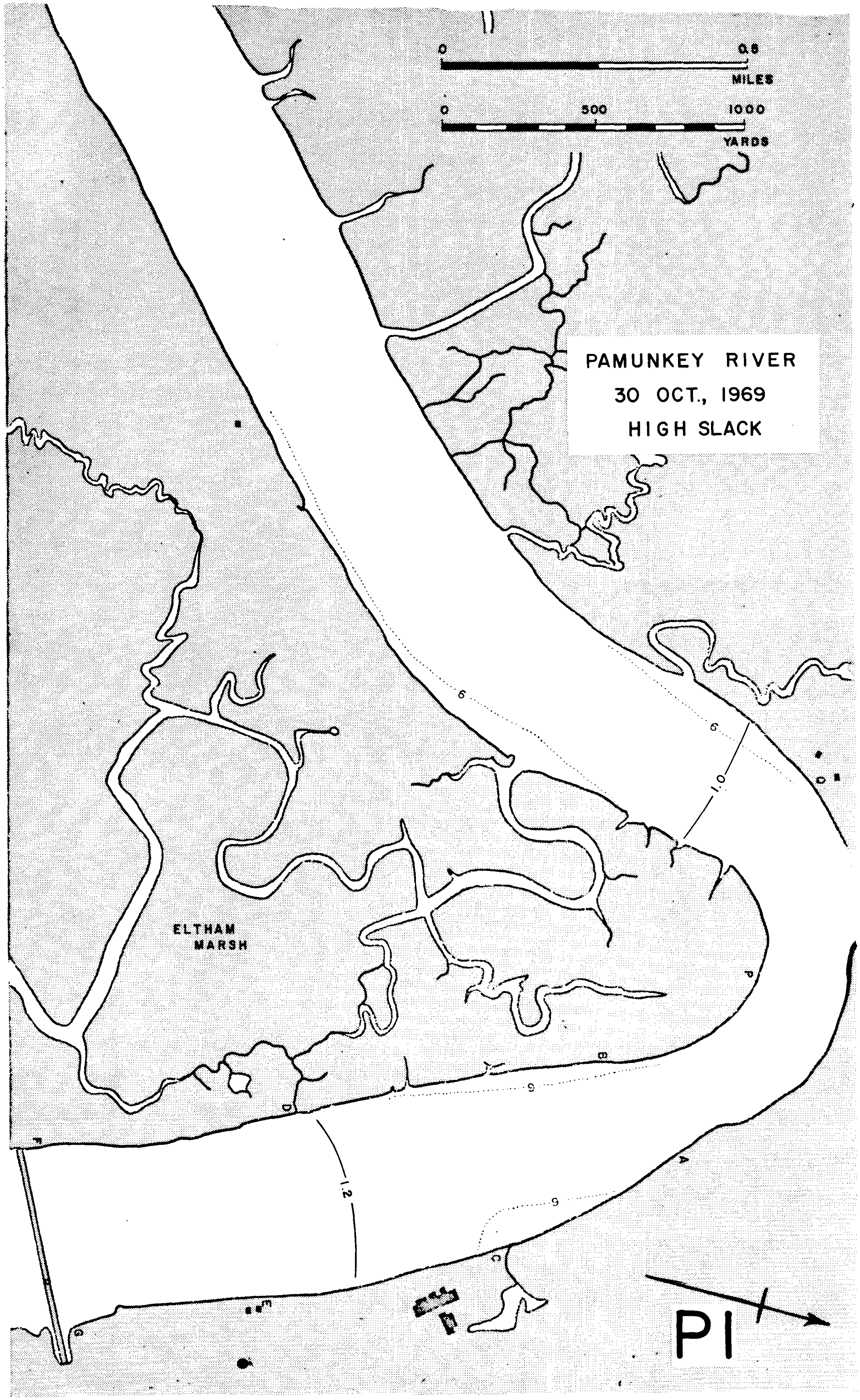


WEST POINT
YORK RIVER
30 OCT., 1969
HIGH SLACK
1.5
1.4
1.3
1.2
1.1
1.0
.95
.9
.8
.7
.6
0
1
MILES
0
1000
2000
3000
YARDS
Y1

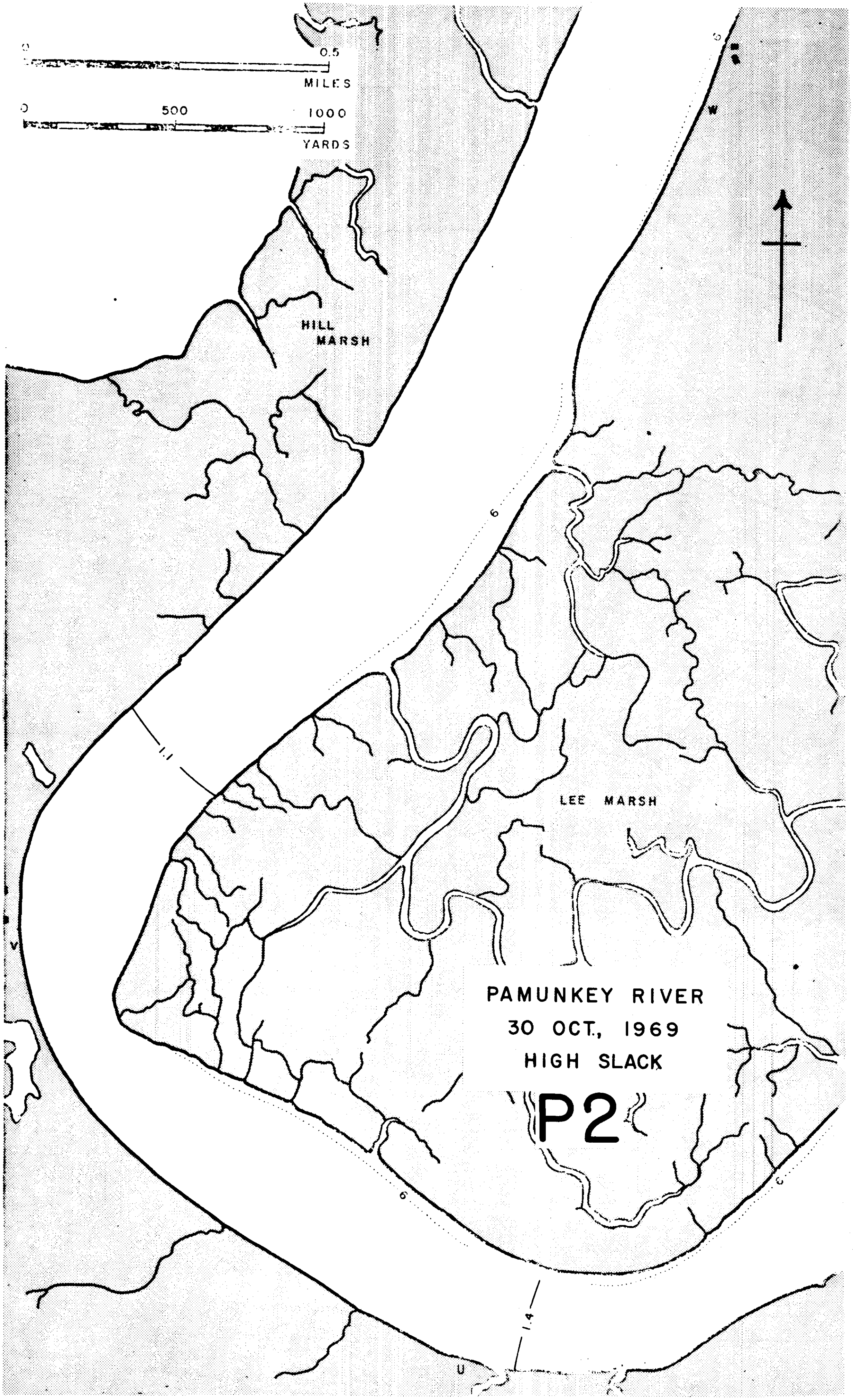

0
0.5
MILES
0
500
1000
YARDS
MATTAPONI RIVER
30 OCT., 1969
HIGH SLACK
MI

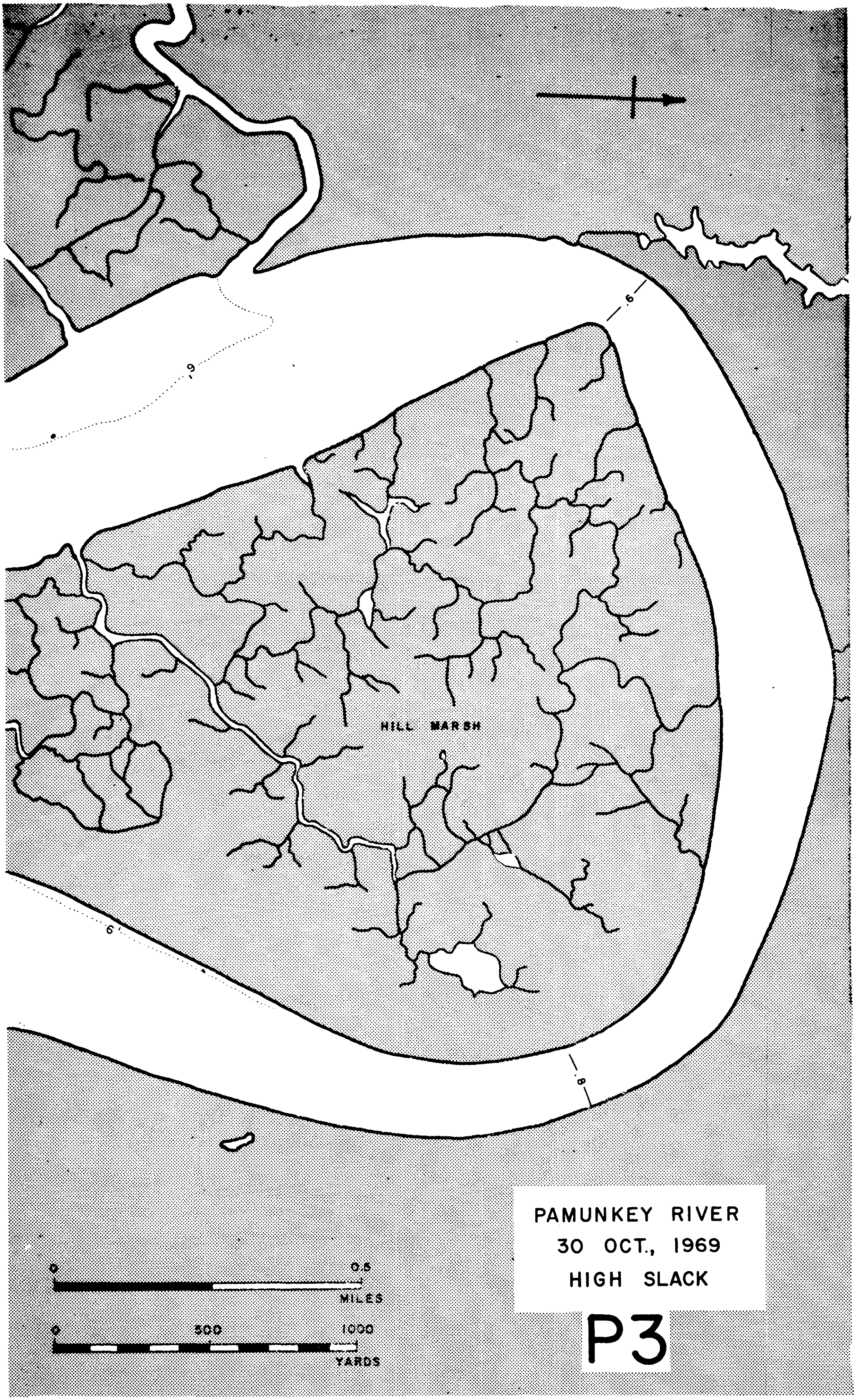

MATTAPONI RIVER
30 OCT., 1969
HIGH SLACK
M2
MILES
0
0.5
0
500
1000
YARDS
1.0
.95
.9
.8
1.1
1.15
1.05
1.2
1.25
1.10


MILES
0
0.5
0
500
1000
YARDS
MATTAPONI RIVER
30 OCT., 1969
HIGH SLACK
6
CHELSEA
POND
.8
.85
.9
M3



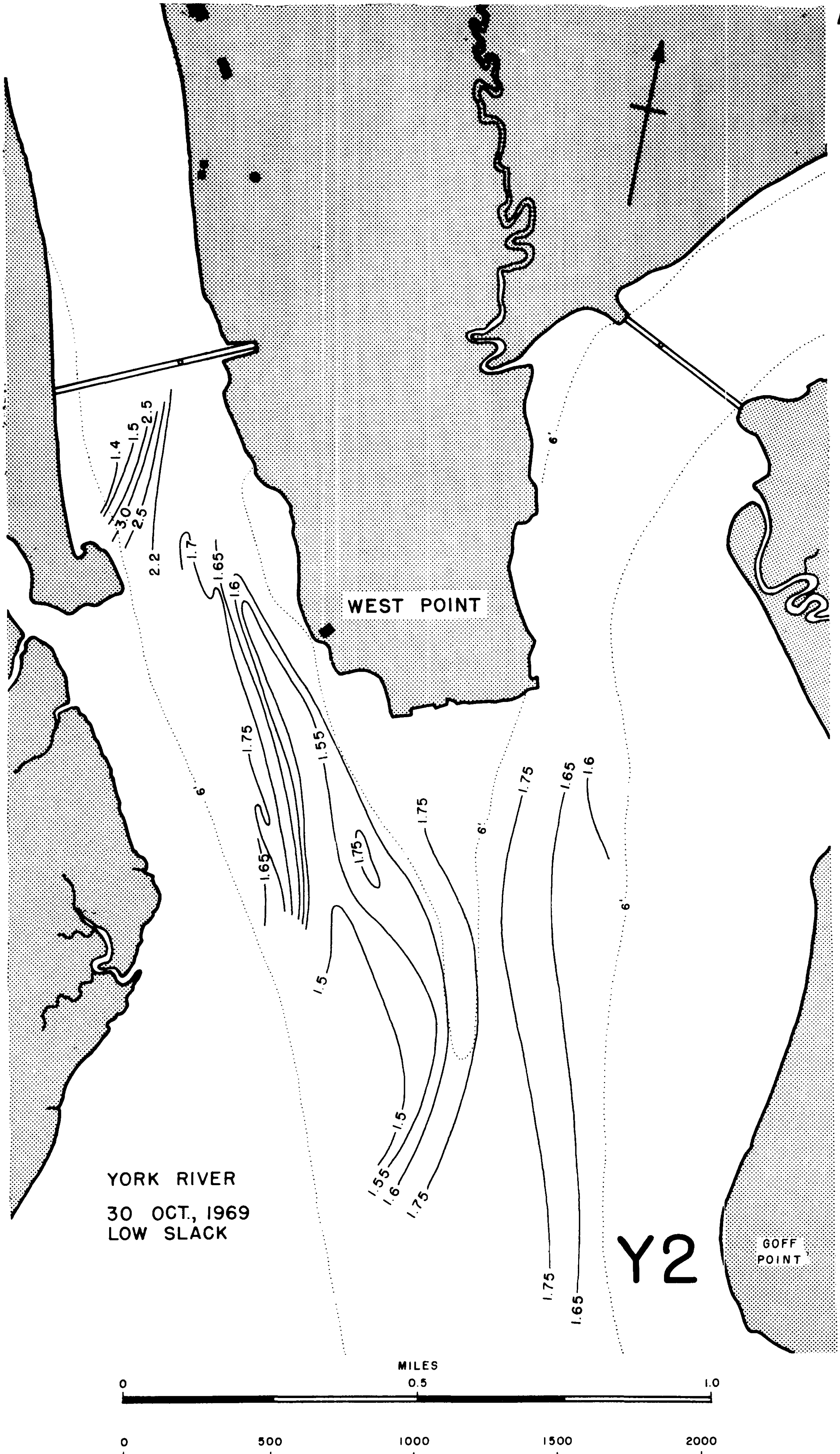
0
0.5
MILES
0
500
1000
YARDS
PAMUNKEY RIVER
30 OCT., 1969
HIGH SLACK
ELTHAM
MARSH
6
6
1.0
1.2
A
B
C
D
PI

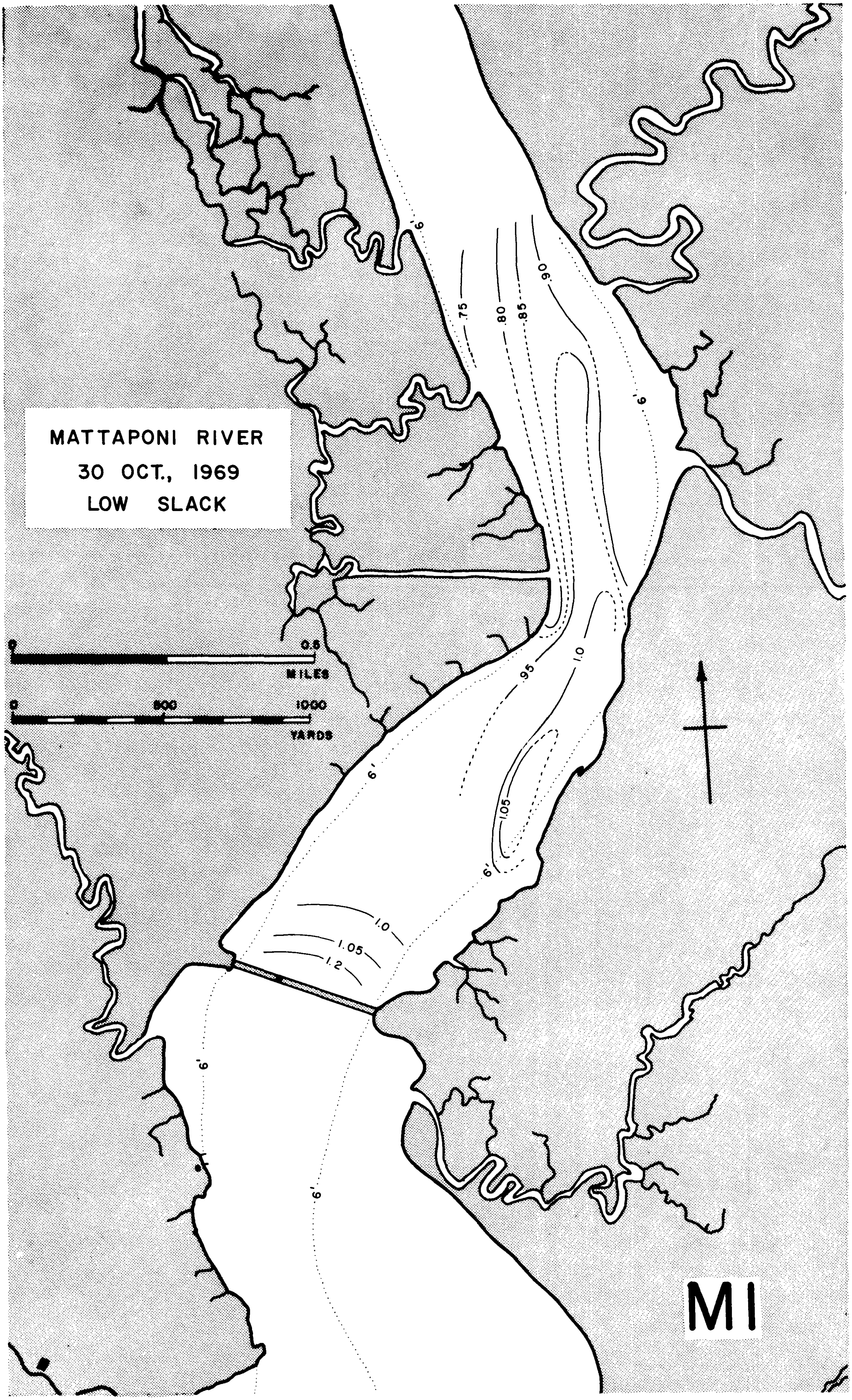

0
0.5
MILES
0
500
1000
YARDS
HILL
MARSH
LEE MARSH
6
6
6
6
1.1
1.4
W
V
U
PAMUNKEY RIVER
30 OCT., 1969
HIGH SLACK
P2

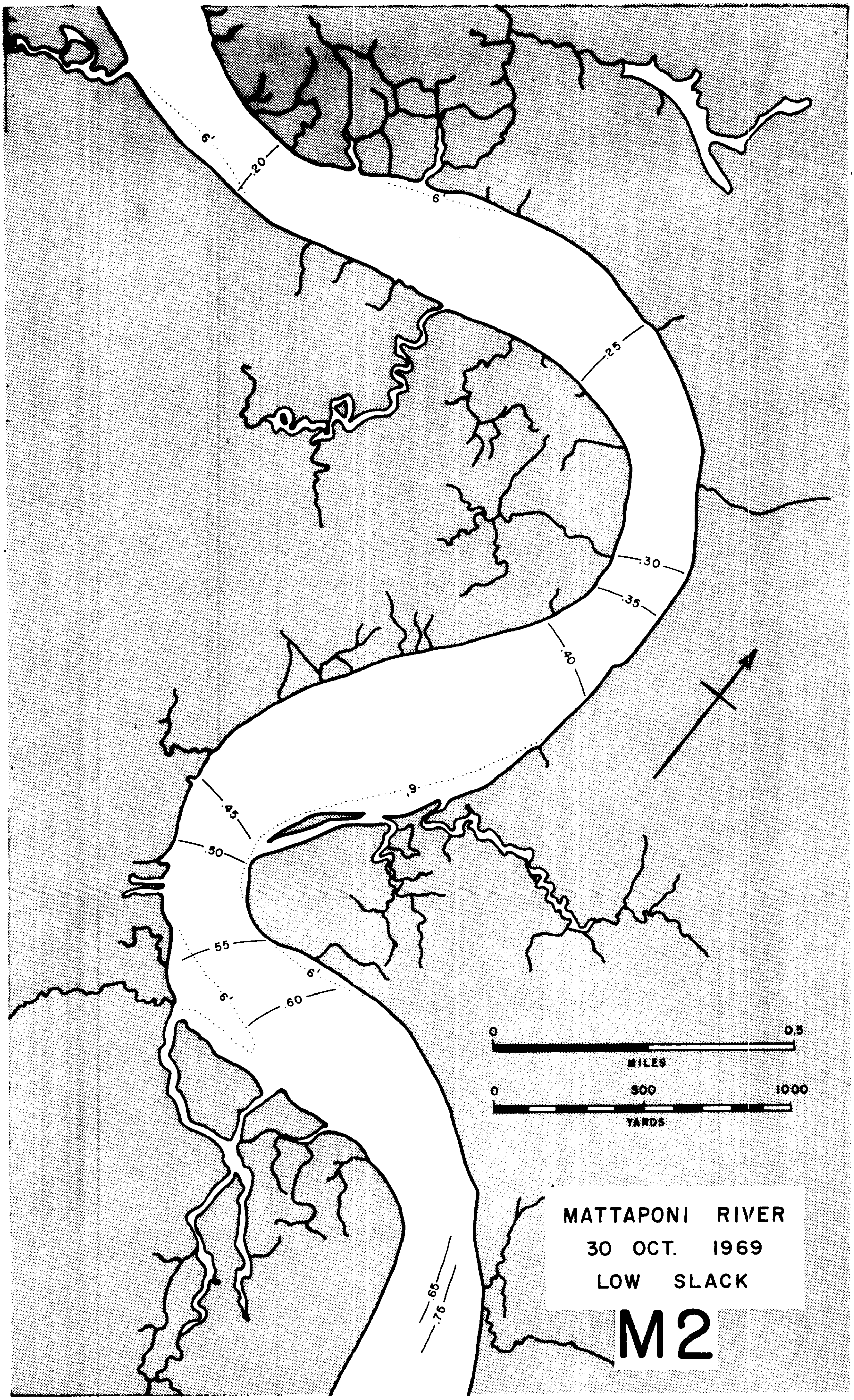


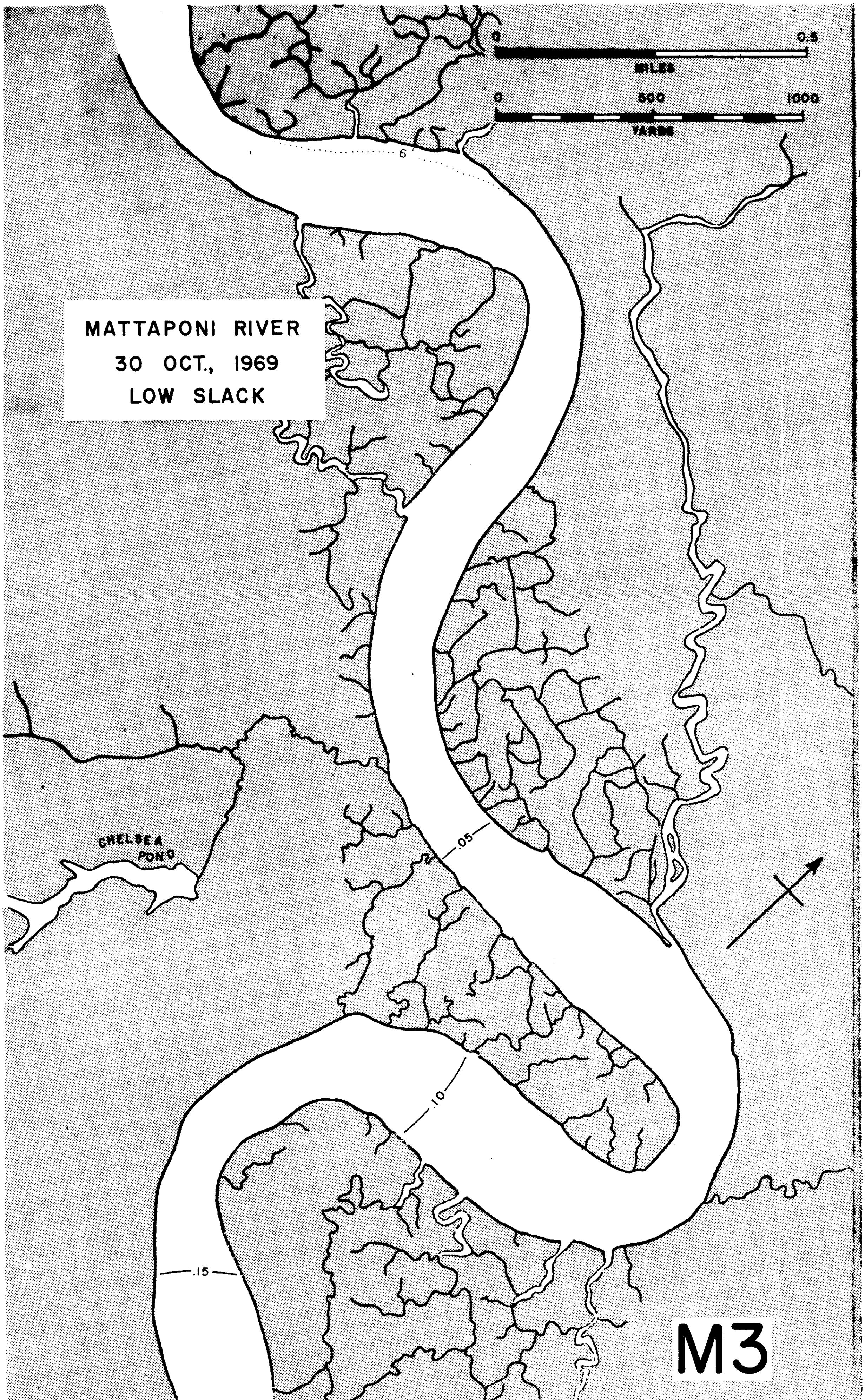
PAMUNKEY RIVER
30 OCT., 1969
HIGH SLACK

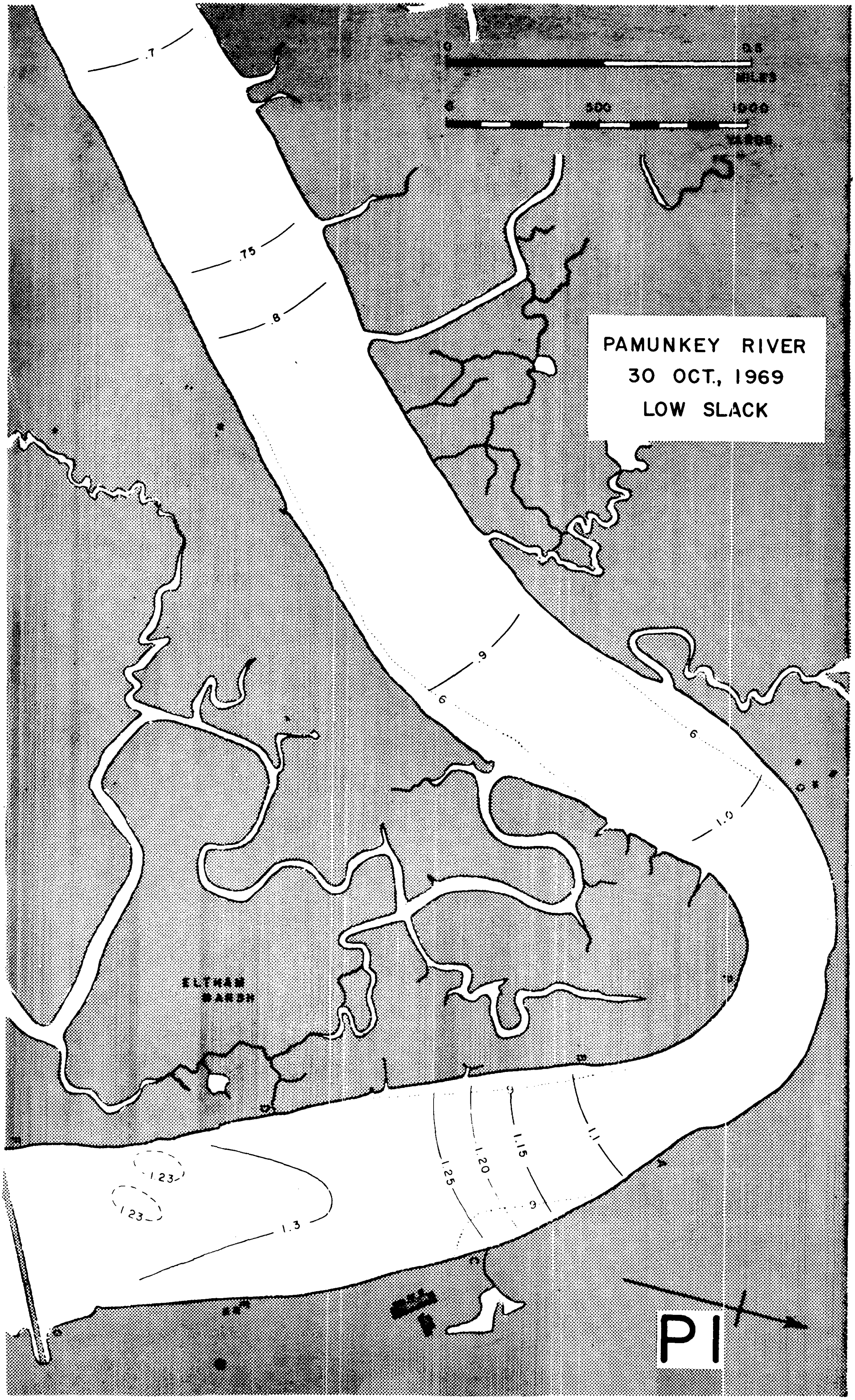
P3

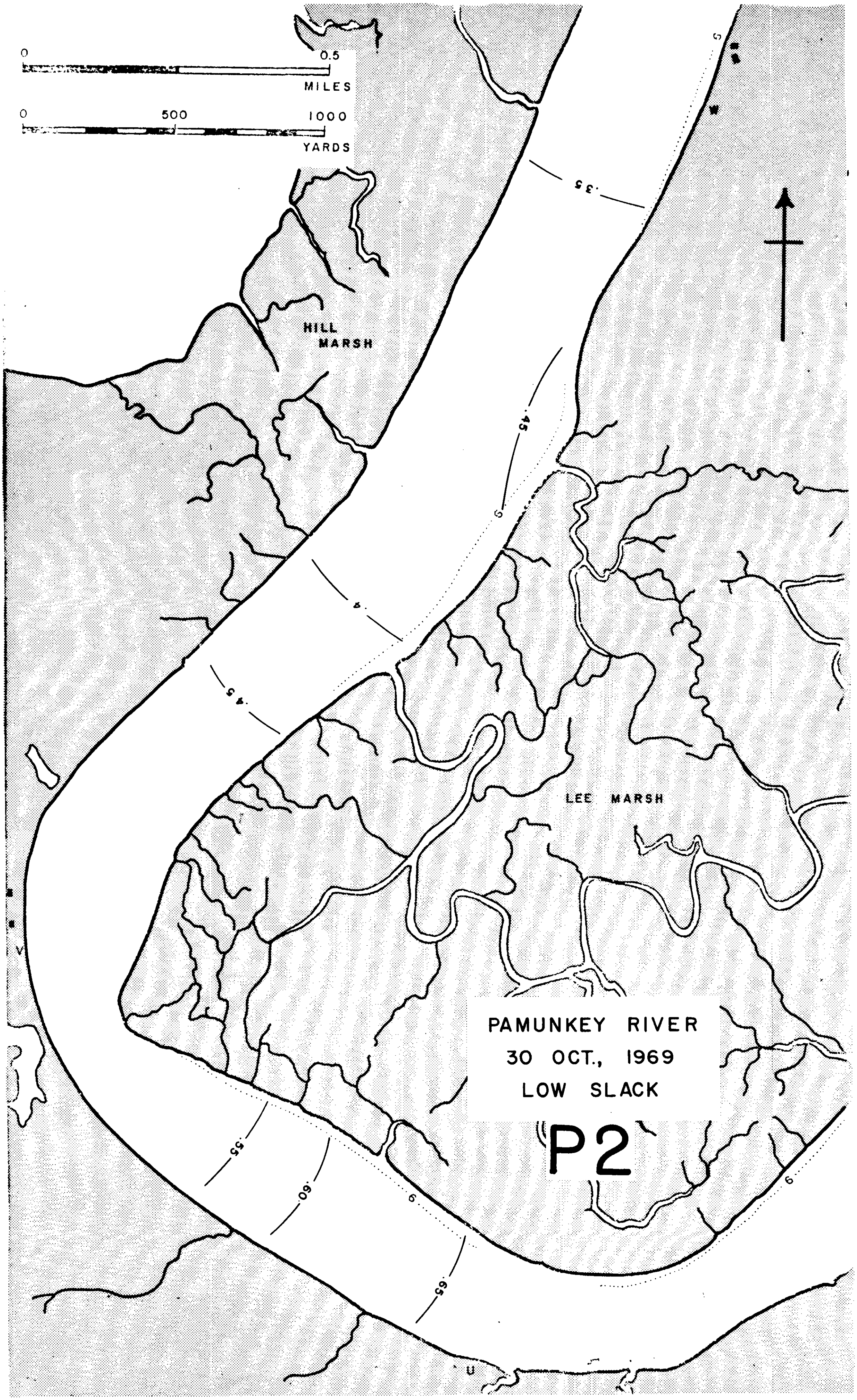

WEST POINT
YORK RIVER
30 OCT., 1969
LOW SLACK
Y2
GOFF POINT
1.4
1.5
2.5
3.0
2.5
2.2
1.7
1.65
1.6
1.75
1.55
1.65
1.75
1.5
1.75
1.55
1.6
1.75
1.5
1.75
1.65
1.6
1.75
1.65
6'
MILES
0
0.5
1.0
0
500
1000
1500
2000

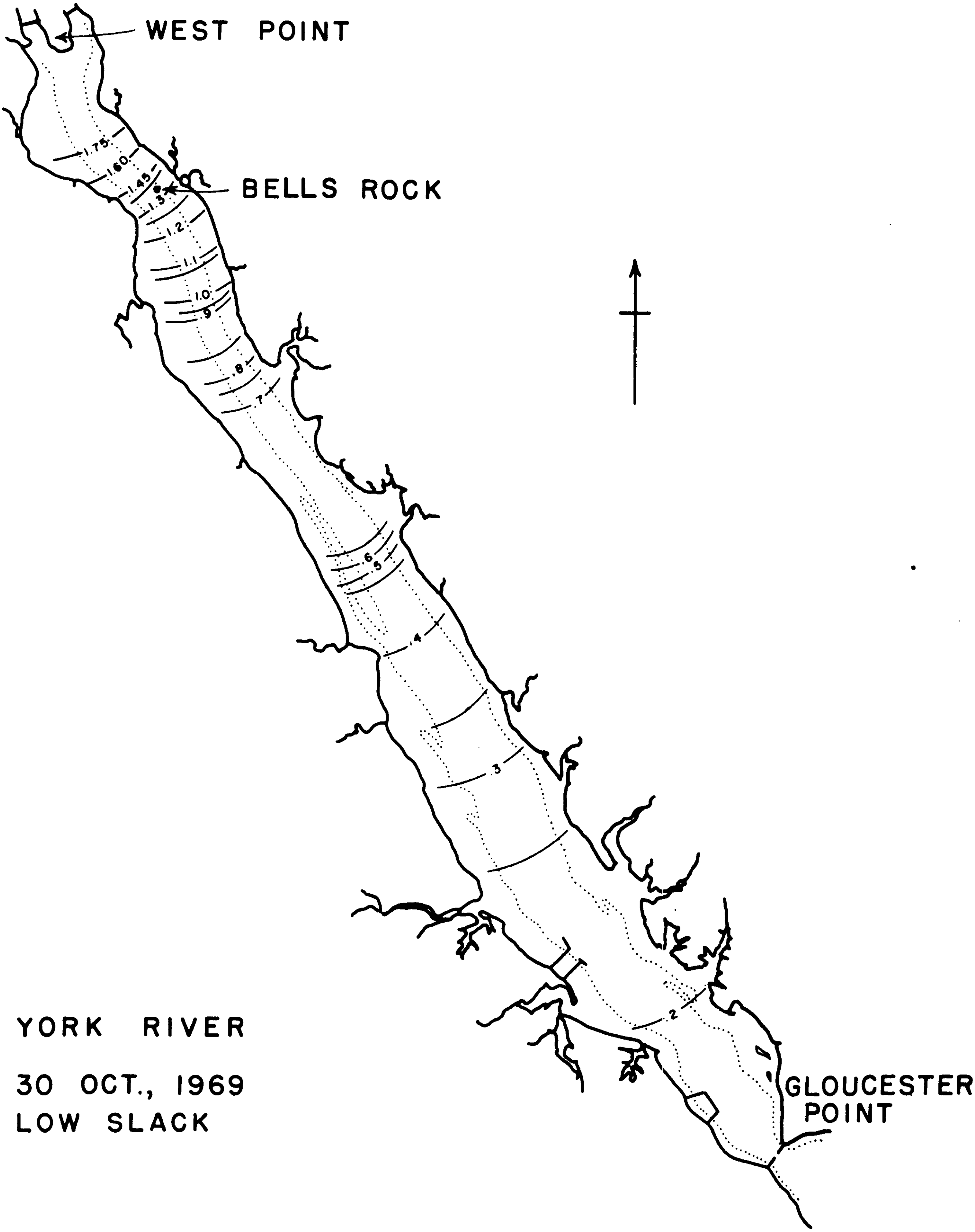

MATTAPONI RIVER
30 OCT., 1969
LOW SLACK
0
0.5
MILES
0
500
1000
YARDS
.6
.75
.80
.85
.90
6'
1.0
.95
1.05
1.0
1.05
1.2
6'
6'
6'
6'
M1


6'
.20
6
.25
.30
.35
.40
.9
.45
.50
.55
6'
6'
.60
.65
.75
0
0.5
MILES
0
500
1000
YARDS
MATTAPONI RIVER
30 OCT. 1969
LOW SLACK
M2


MATTAPONI RIVER
30 OCT., 1969
LOW SLACK
0 0.5
MILES
0 500 1000
YARDS
6
.05
.10
.15
CHELSEA POND
M3


PAMUNKEY RIVER
30 OCT., 1969
LOW SLACK
0
0.5
MILES
0
500
1000
YARDS
.7
.75
.8
.9
.6
.6
1.0
1.1
1.15
1.20
1.25
1.23
1.23
1.3
ELTHAM
MARSH
P1


0
0.5
MILES
0
500
1000
YARDS
HILL MARSH
LEE MARSH
PAMUNKEY RIVER
30 OCT., 1969
LOW SLACK
P2



YORK RIVER

30 OCT., 1969
LOW SLACK

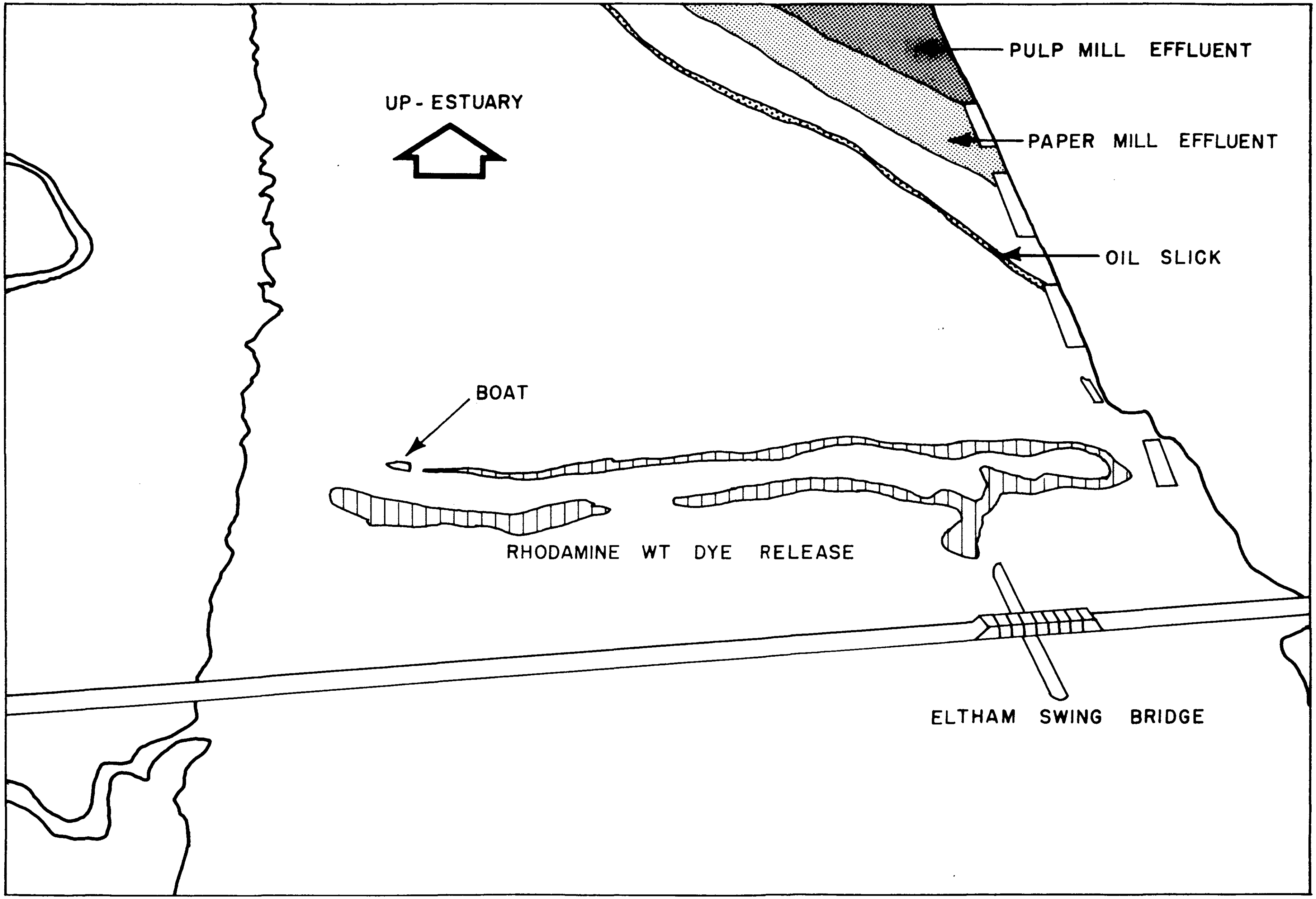
APPENDIX B

DYE TRACER DISTRIBUTION RESULTING FROM THE BATCH RELEASE.

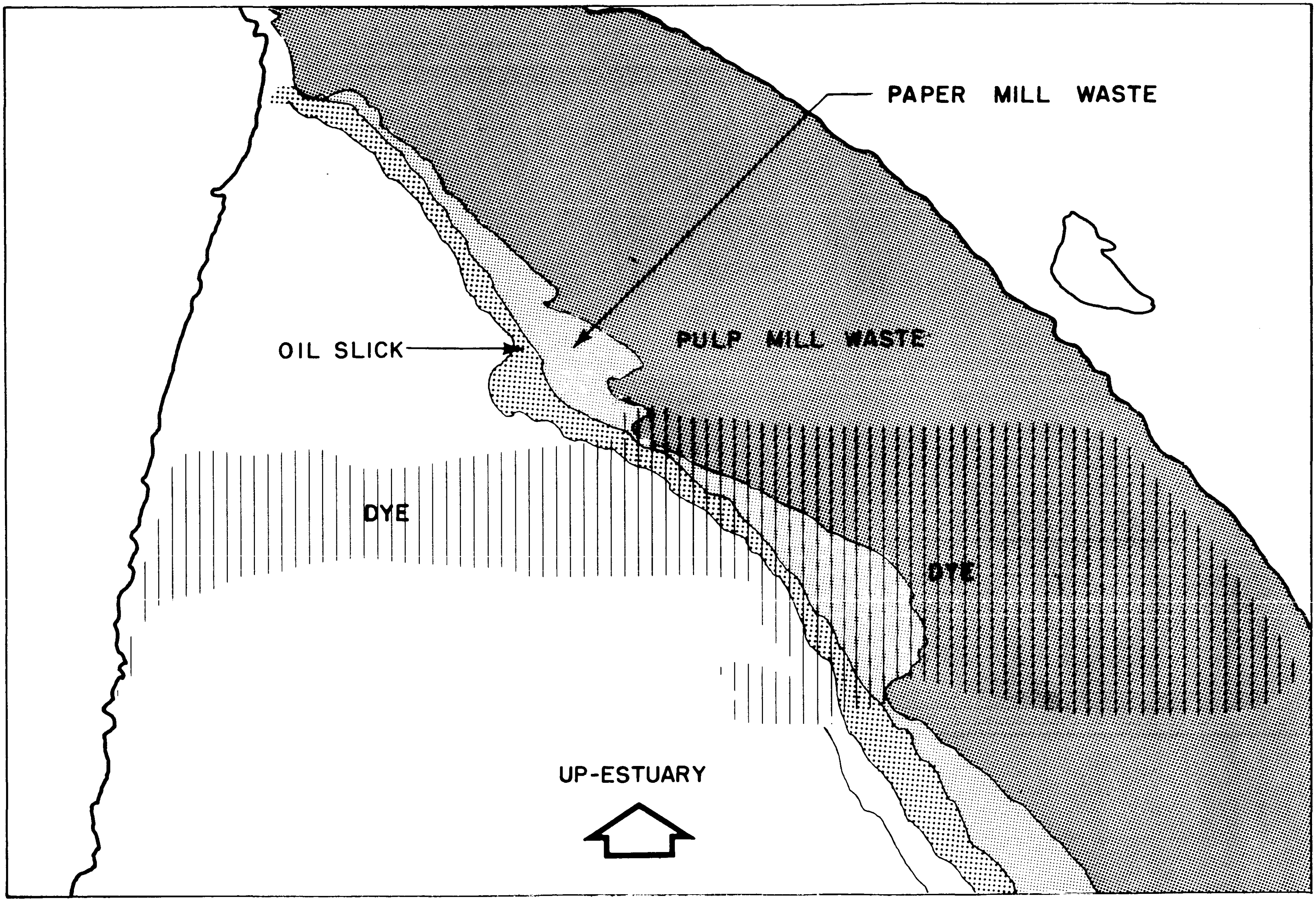
KEY TO APPENDIX B

Page	Map	Subject
B1	P1, Y2	31 Oct. 69, batch release at low slack, color photograph, 1206 hours EDT.
B2	P1, Y2	31 Oct. 69, batch release one hour after release, color photograph, 1300 hours EDT.
B3	P1, Y2	31 Oct. 69, before batch release, aerial mosaic of first leg of Pamunkey River, 1145 hours EDT.
B4, B5	P1, P2	31 Oct. 69, before batch release, aerial mosaic of second leg, 1150 hours EDT.
B6	P1, Y2	31 Oct. 69, batch release, aerial mosaic of first leg, 1210 hours EDT.
B7	P1, Y2	31 Oct. 69, one hour after release, aerial mosaic of first leg, 1300 hours EDT.
B8	P1, Y2	31 Oct. 69, two hours after release, aerial mosaic of first leg, 1402 hours EDT.
B9, B10	P1, P2	31 Oct. 69, two hours after release, aerial mosaic of second leg, 1407 hours EDT.
B11, B12	P1, P2	31 Oct. 69, three hours after release, aerial mosaics of second leg, 1505 hours EDT.
B13	P1, Y2	31 Oct. 69, three hours after release, aerial mosaic of first leg, 1505 hours EDT.
B14	P2	31 Oct. 69, four hours after release, aerial mosaic of third leg, 1605 hours EDT.
B15, B16	P1, P2	31 Oct. 69, four hours after release, aerial mosaics of second leg, 1607 hours EDT.
B17	P1, Y2	31 Oct. 69, four hours after release, aerial mosaic of first leg, 1612 hours EDT.

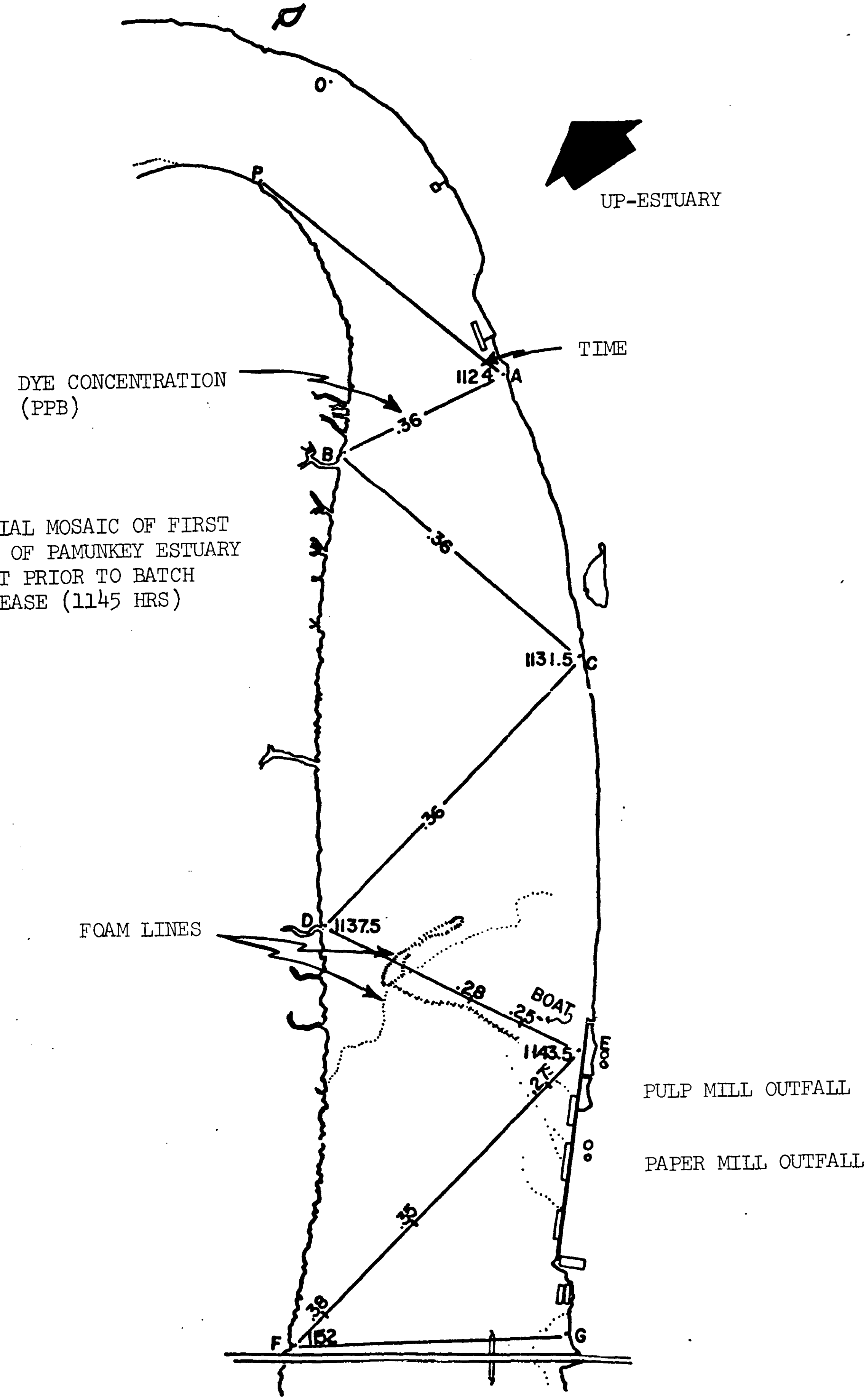
NOTE: All dye-concentration values on pages B1 through B17 are in parts per billion (ppb), and times are in military hours. Boat transects are indicated by dashed lines, foam lines by hachures, and water masses and dye and effluent boundaries by dotted lines.



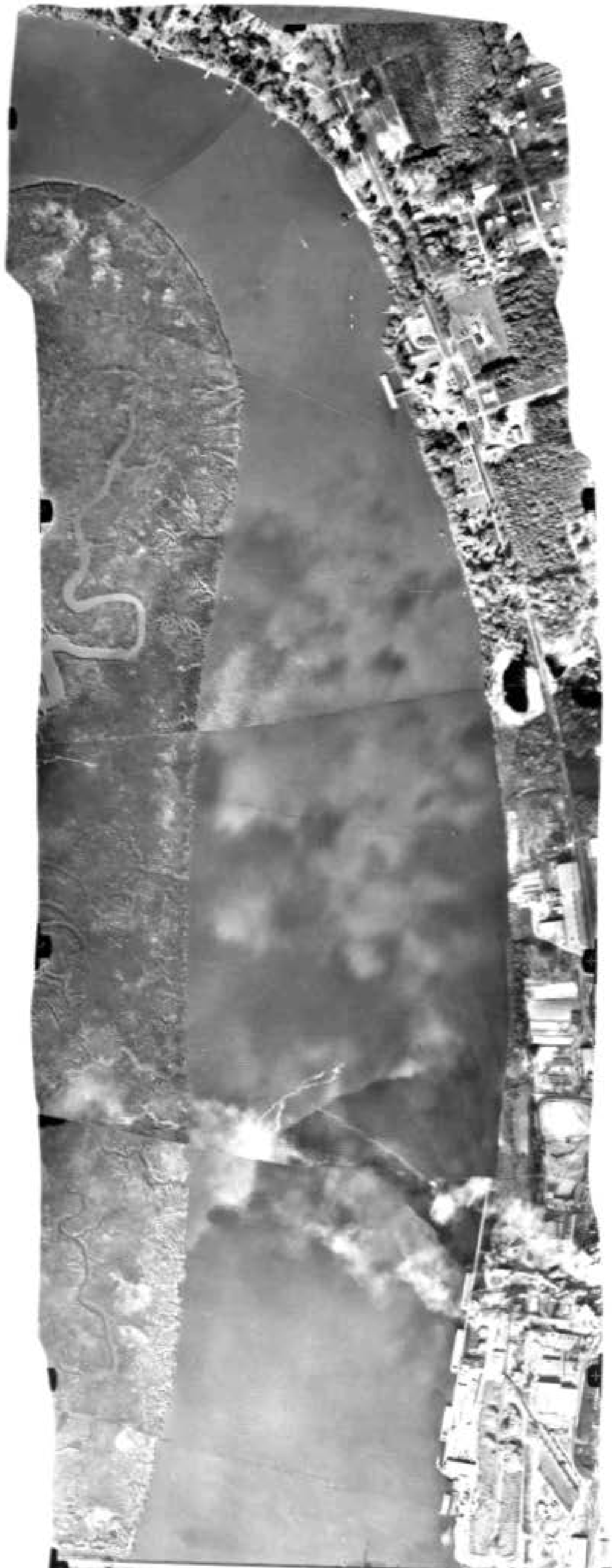
Batch release of Rhodamine WT-dye, in lower Pamunkey estuary, at low water slack, 31 October 1969, 1206 EDT.



Dye-patch, mill-effluent, and oil slicks one hour after dye release (1300 hours).

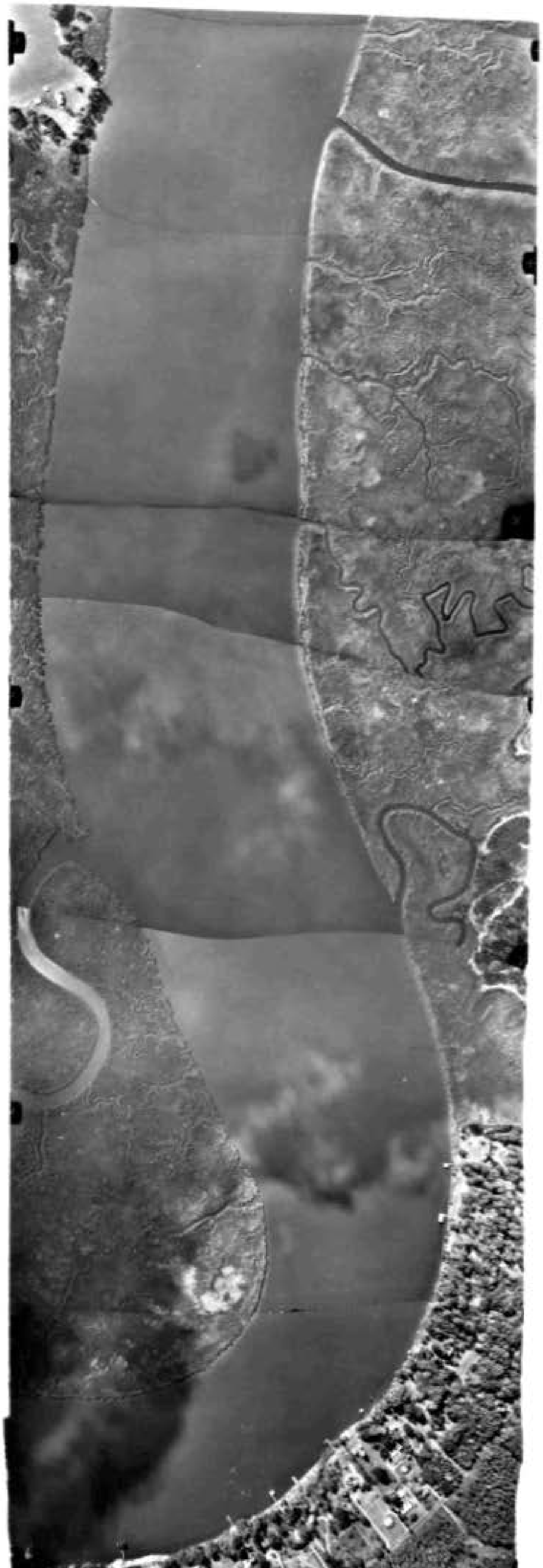


AERIAL MOSAIC OF FIRST LEG OF PAMUNKEY ESTUARY JUST PRIOR TO BATCH RELEASE (1145 HRS)



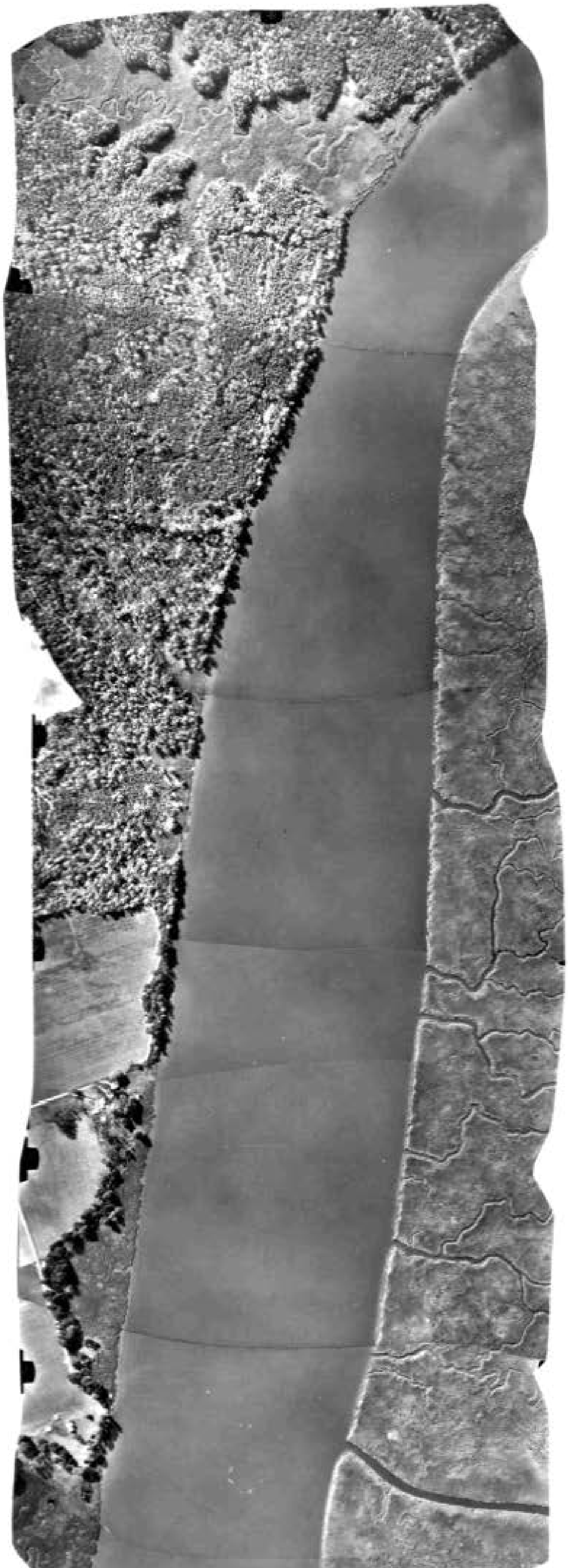
AERIAL MOSAIC OF SECOND LEG OF PAMUNKEY ESTUARY JUST PRIOR TO BATCH RELEASE (1150 HRS)

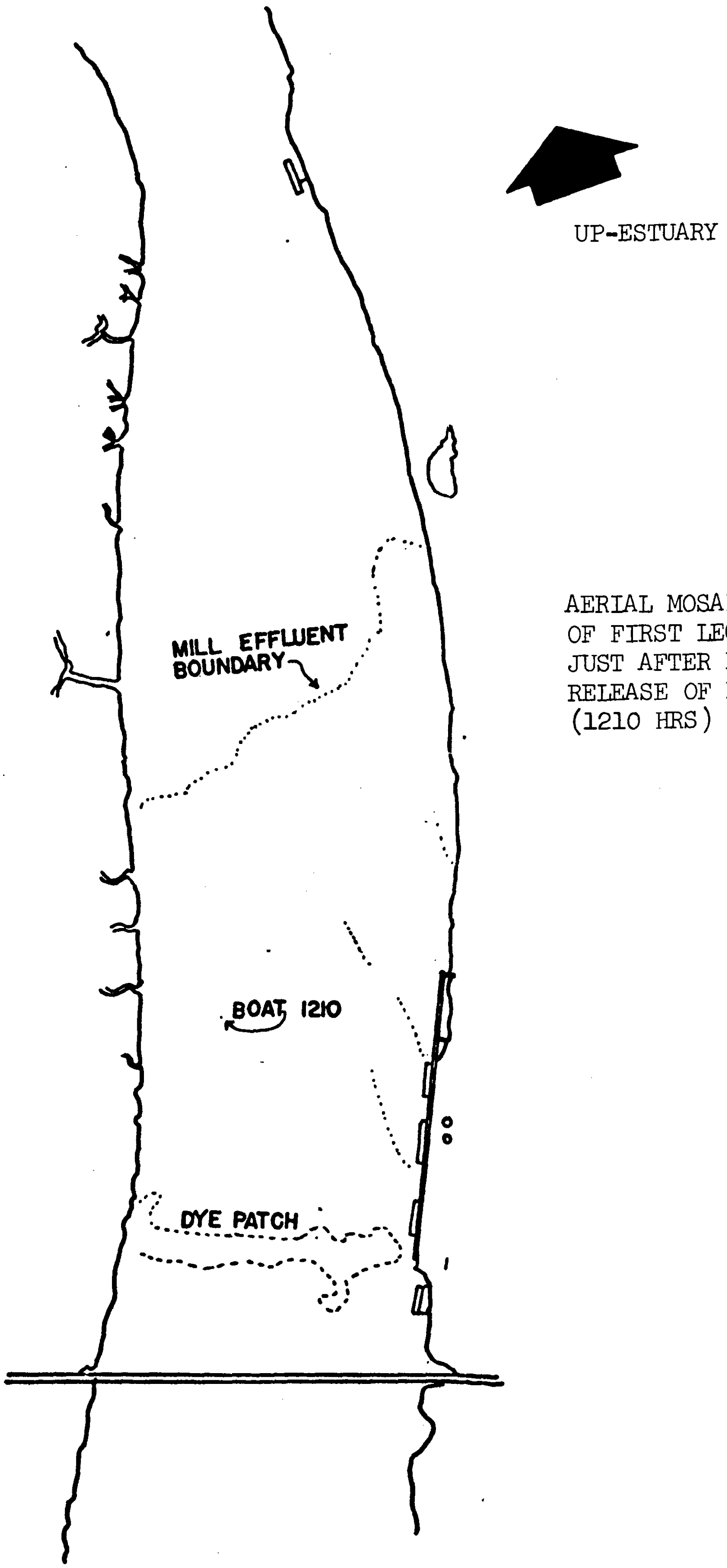
Estuary surface essentially featureless; up-estuary direction is toward bottom of page.



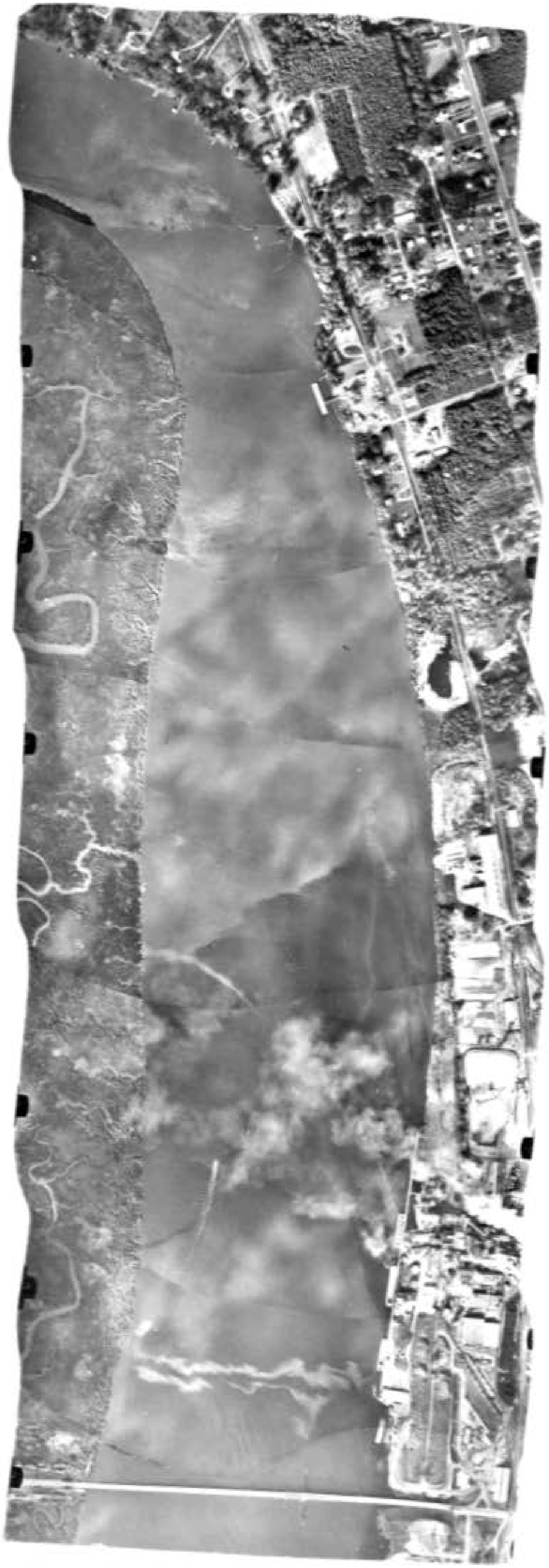
AERIAL MOSAIC OF SECOND LEG OF PAMUNKEY ESTUARY JUST PRIOR TO BATCH RELEASE (1150 HRS)

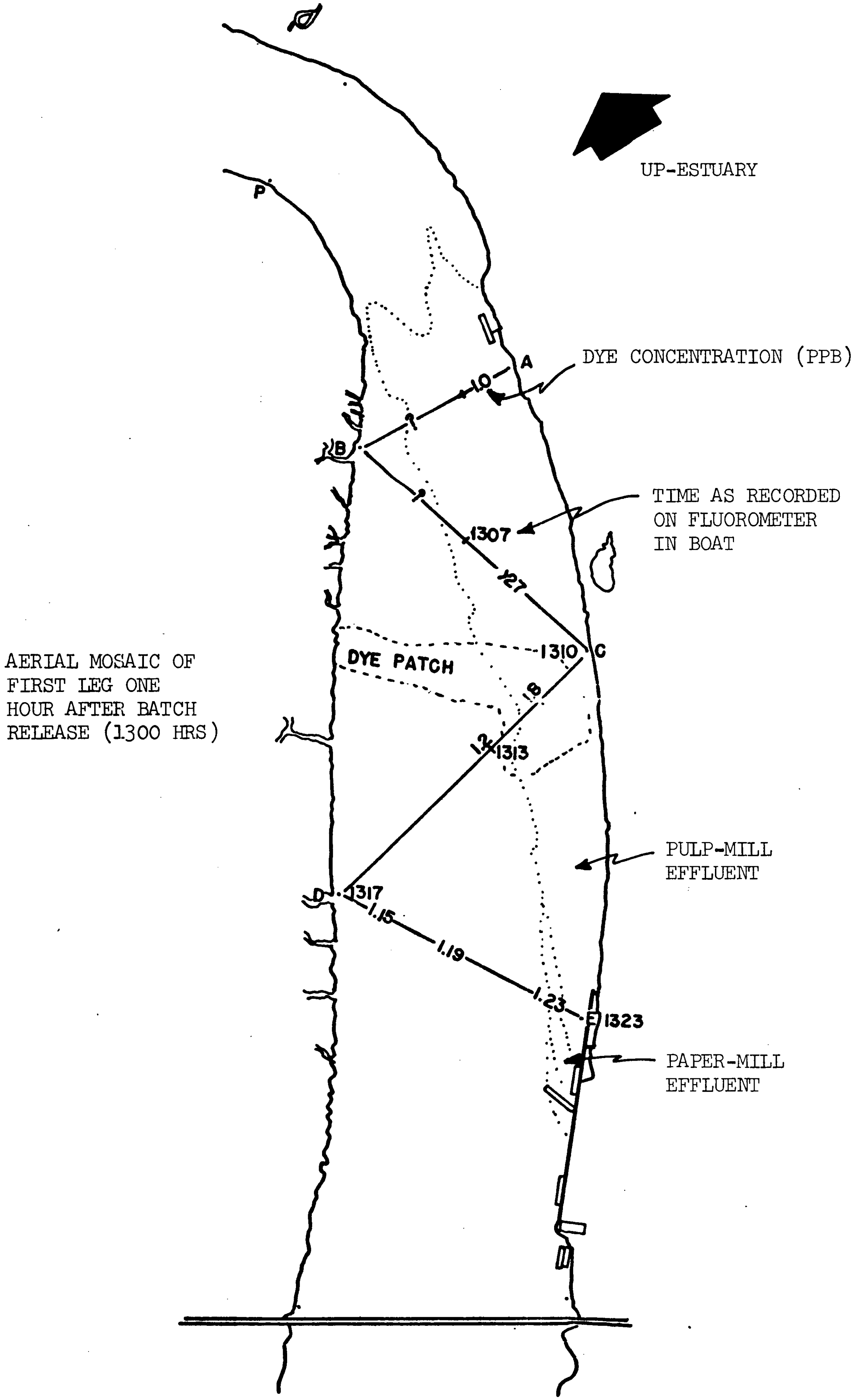
Estuary surface is essentially featureless; up-estuary direction is toward bottom of page.

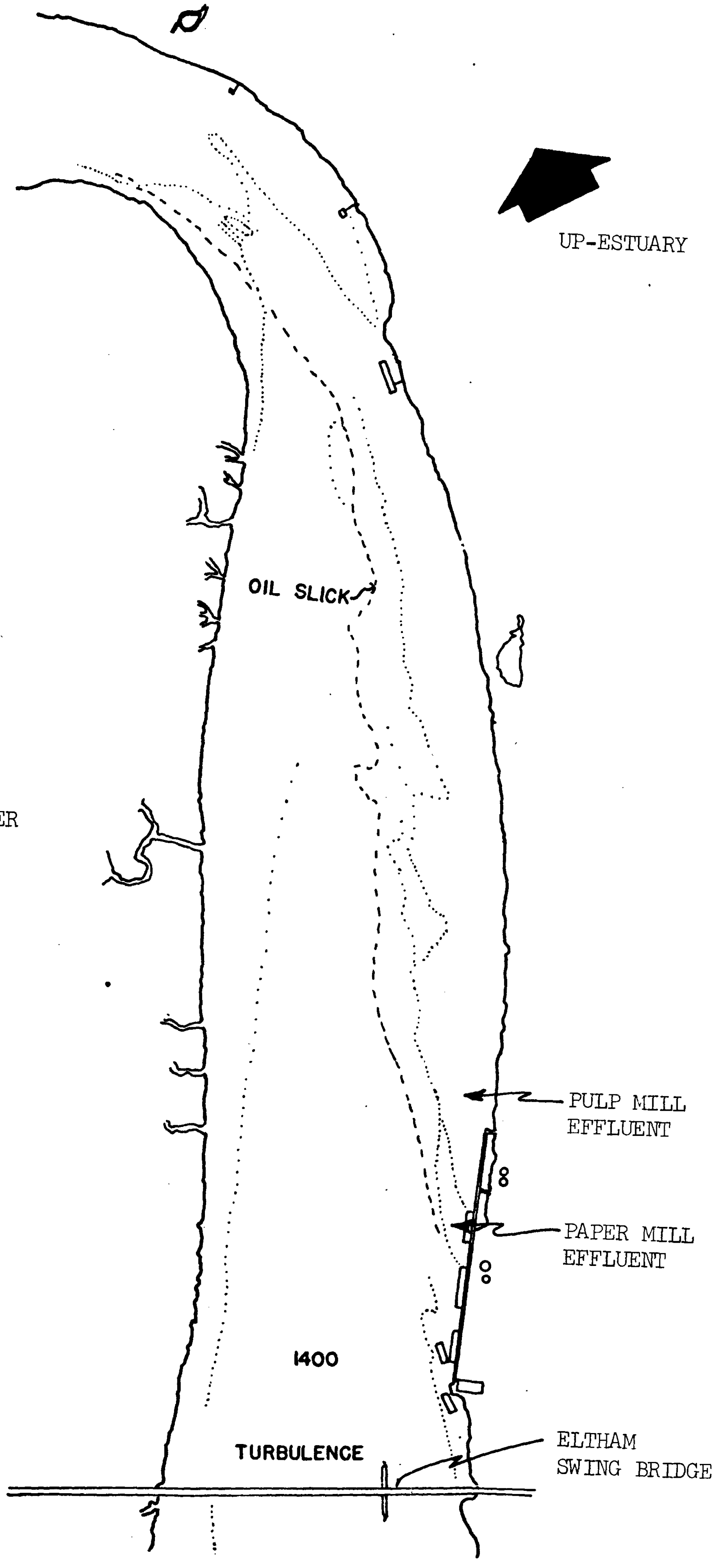




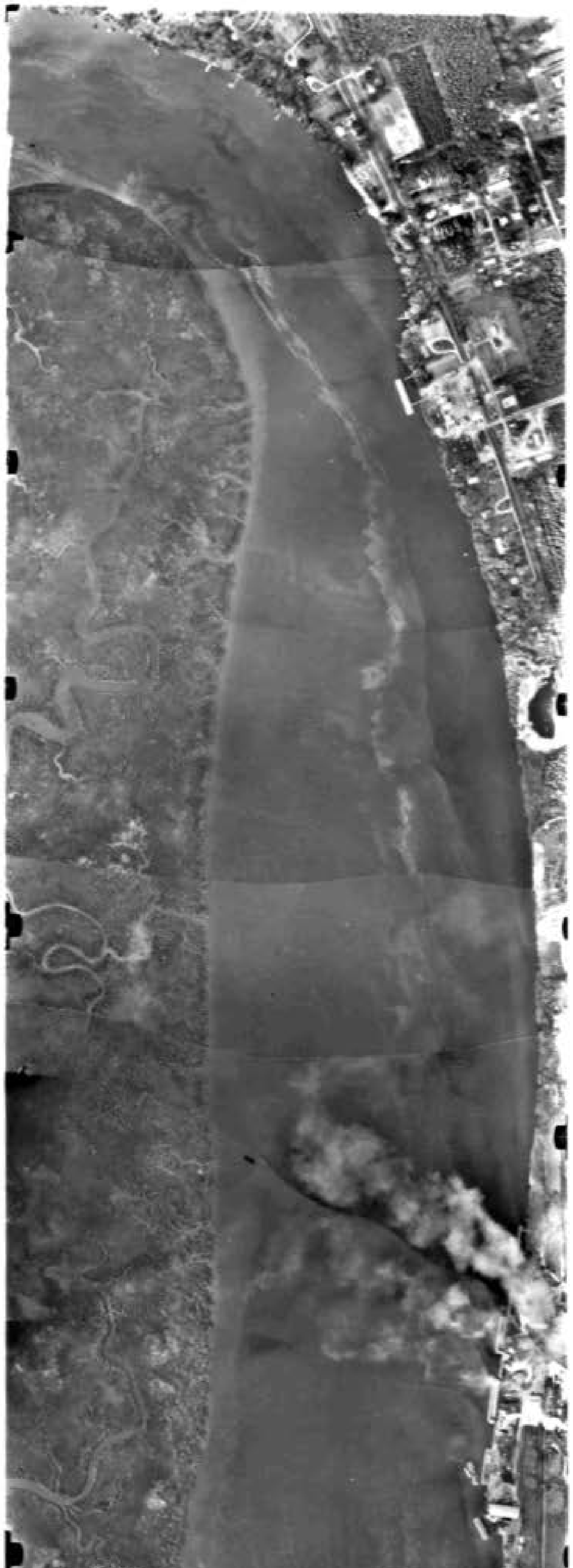
AERIAL MOSAIC
OF FIRST LEG
JUST AFTER BATCH
RELEASE OF DYE
(1210 HRS)

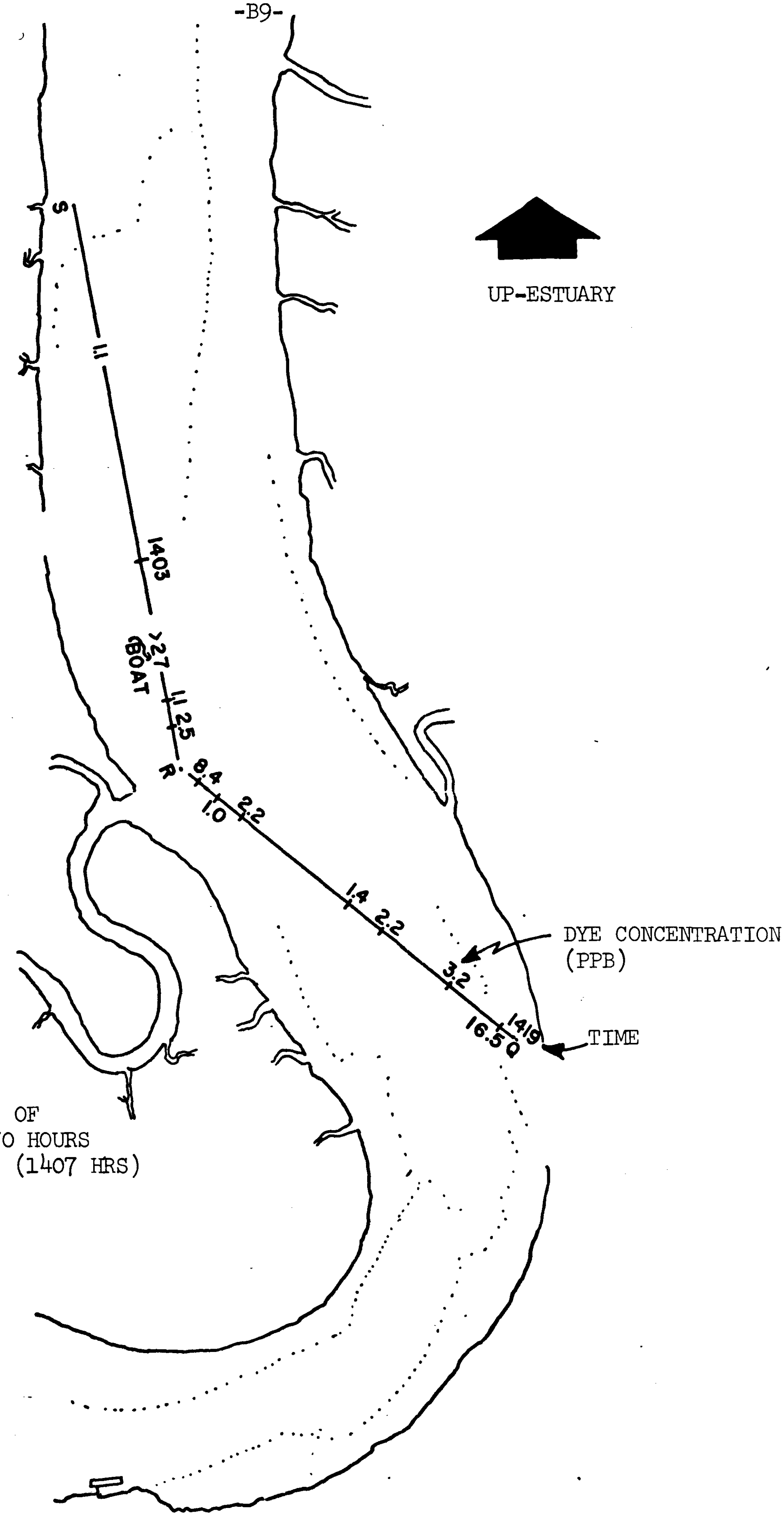



UP-ESTUARY
P
A
DYE CONCENTRATION (PPB)
1.0
B
TIME AS RECORDED
ON FLUOROMETER
IN BOAT
1307
1.27
1310
C
DYE PATCH
AERIAL MOSAIC OF
FIRST LEG ONE
HOUR AFTER BATCH
RELEASE (1300 HRS)
1.8
1.2
1313
PULP-MILL
EFFLUENT
D
1317
1.15
1.19
1.23
E
1323
PAPER-MILL
EFFLUENT



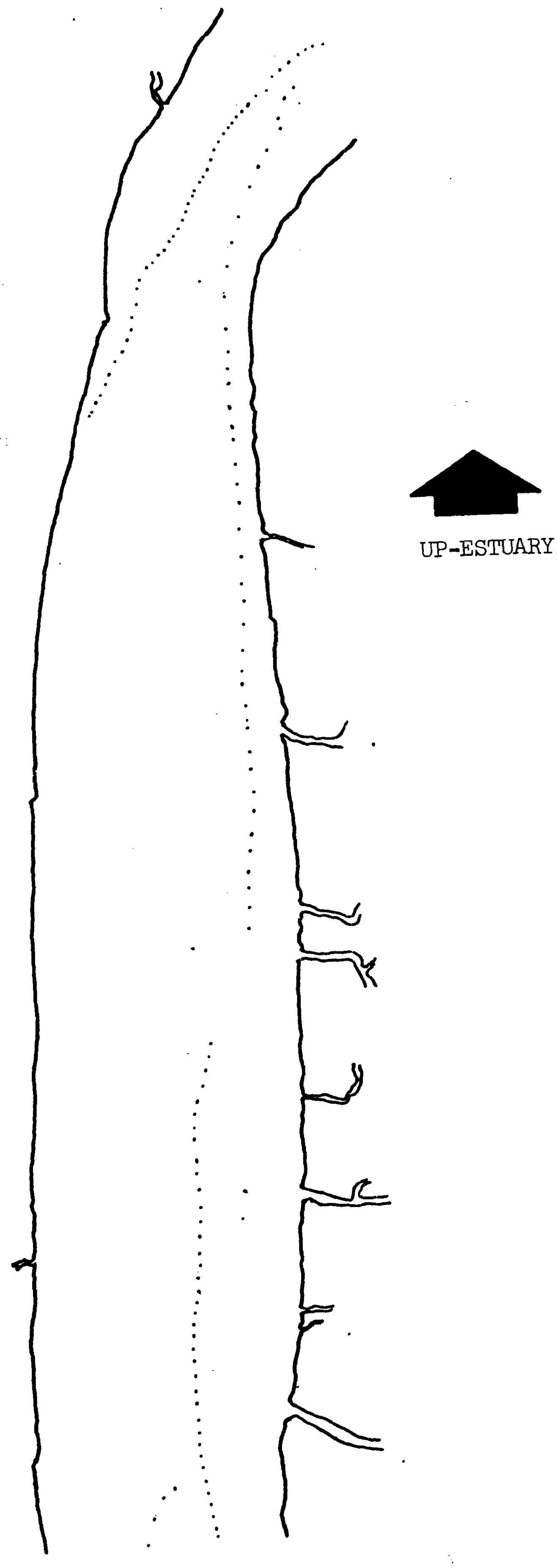
AERIAL MOSAIC
OF FIRST LEG
TWO HOURS AFTER
BATCH RELEASE
(1402 HRS)

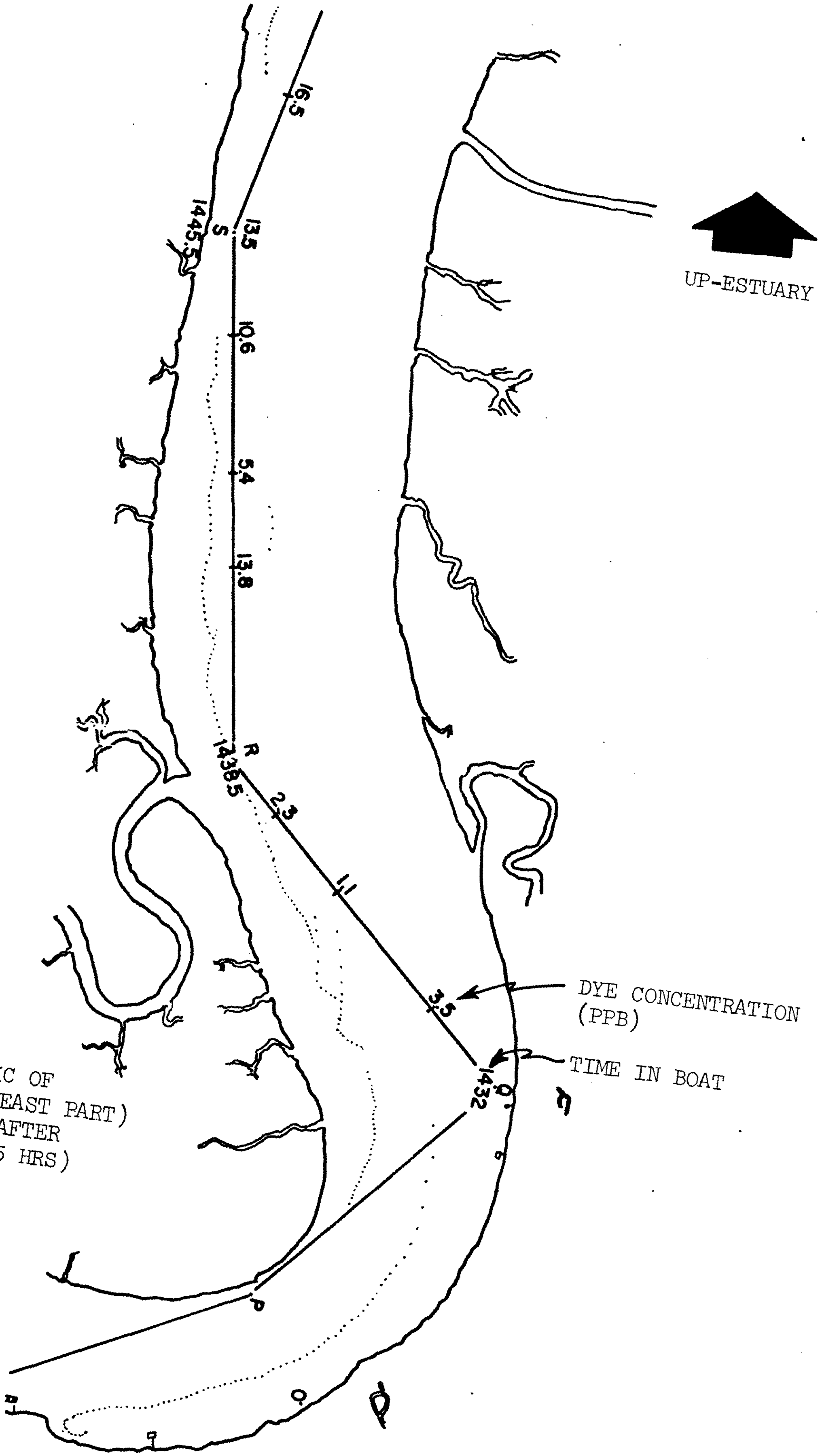




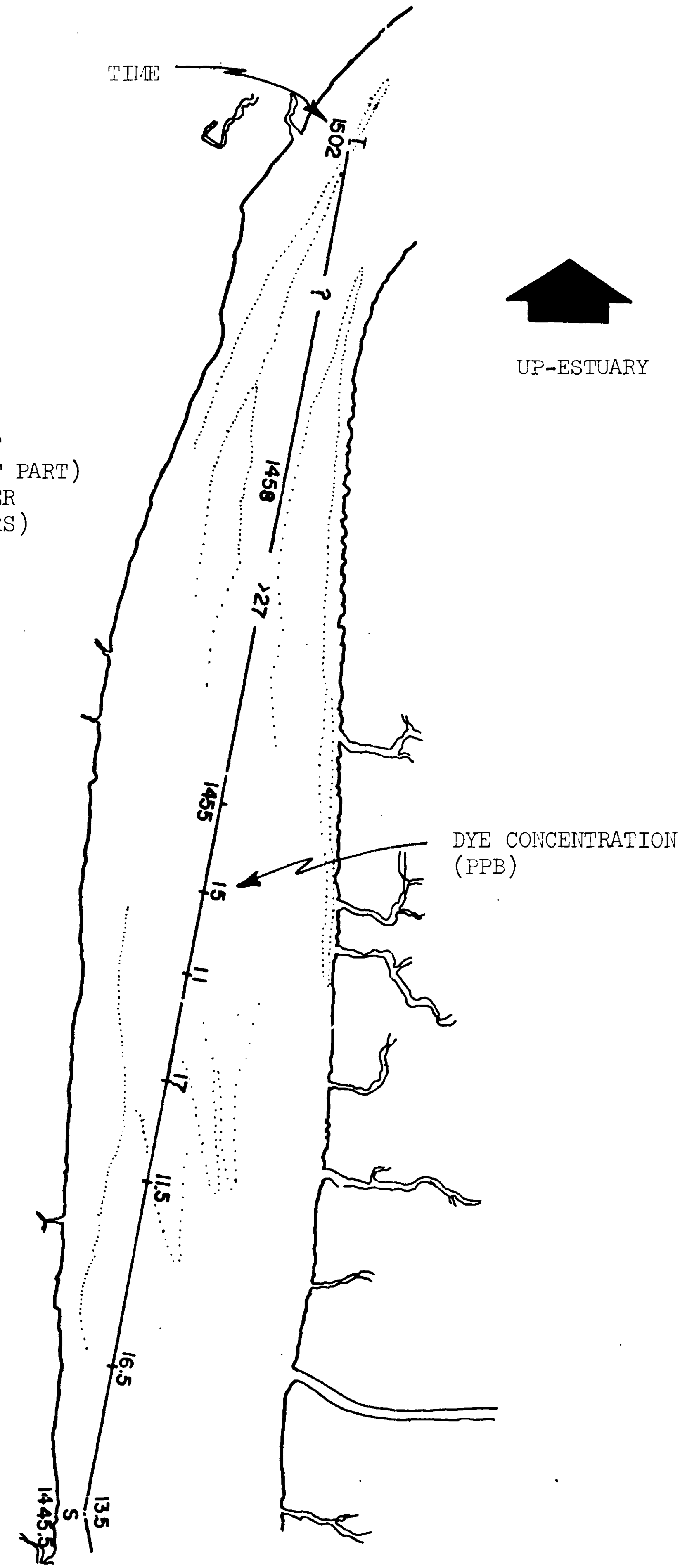
AERIAL MOSAIC OF
SECOND LEG TWO HOURS
AFTER RELEASE (1407 HRS)

AERIAL MOSAIC
OF SECOND LEG
(WEST PART) TWO
HOURS AFTER RELEASE
(1407 HRS)

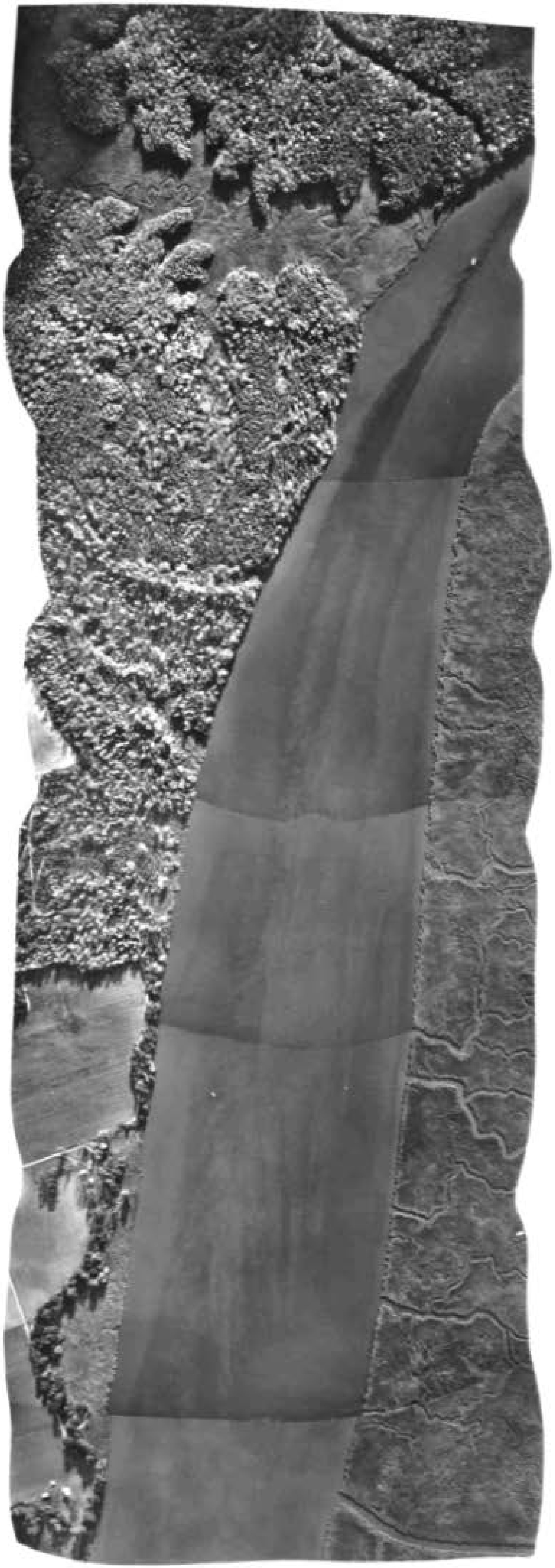


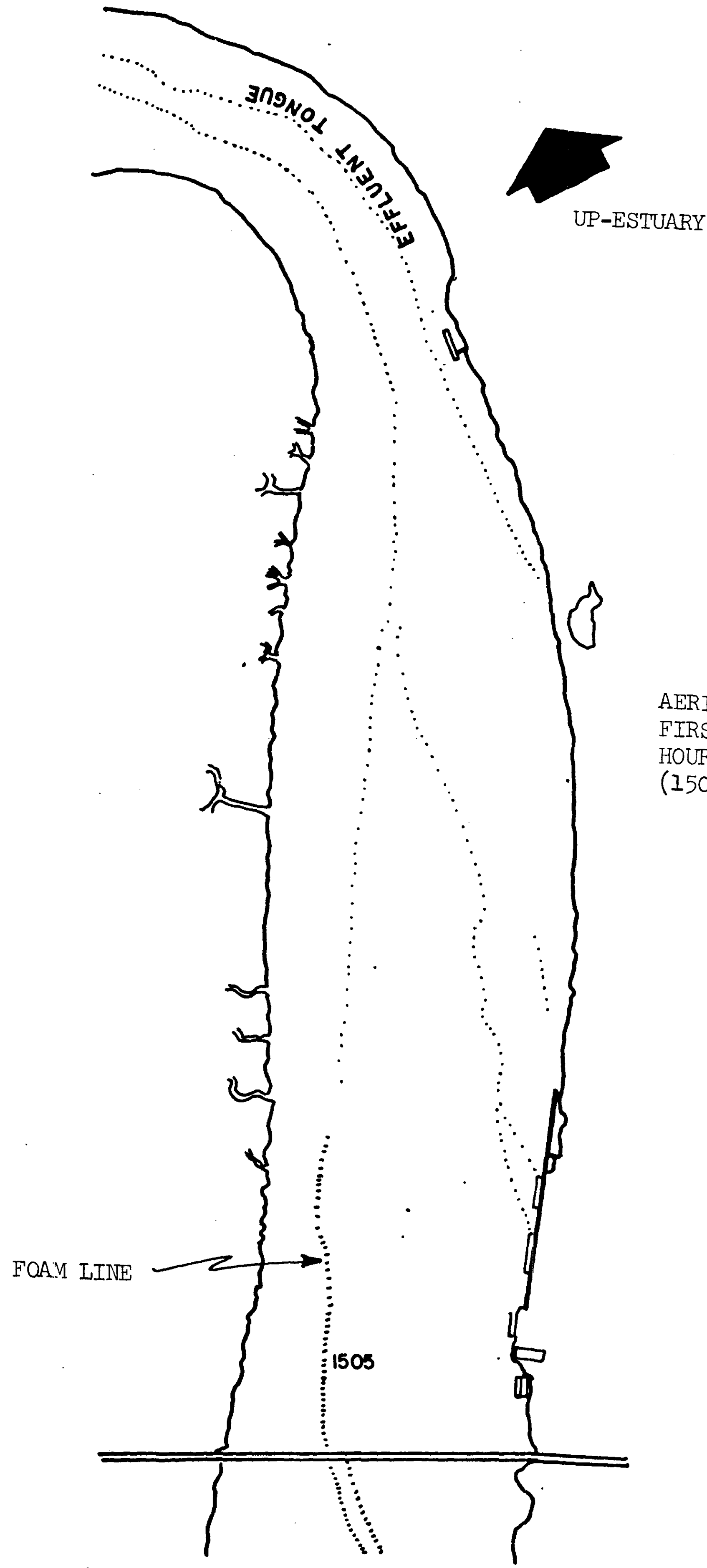


AERIAL MOSAIC OF SECOND LEG (EAST PART) THREE HOURS AFTER RELEASE (1505 HRS)

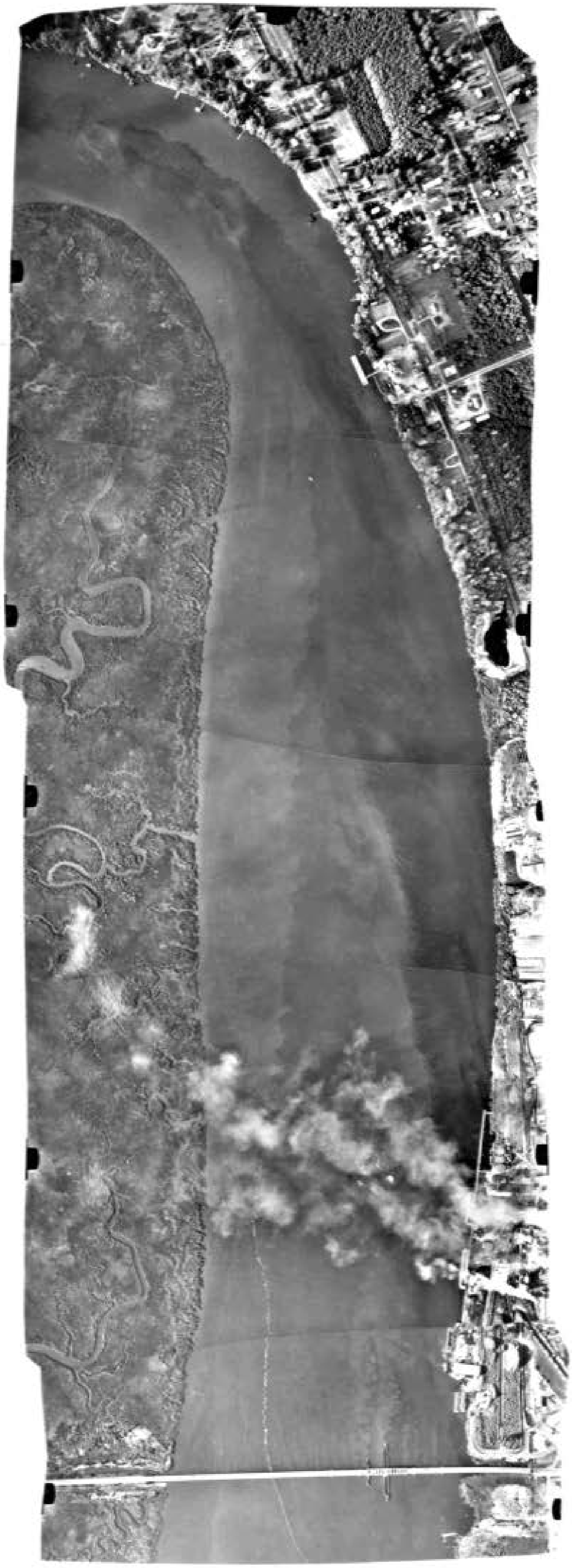


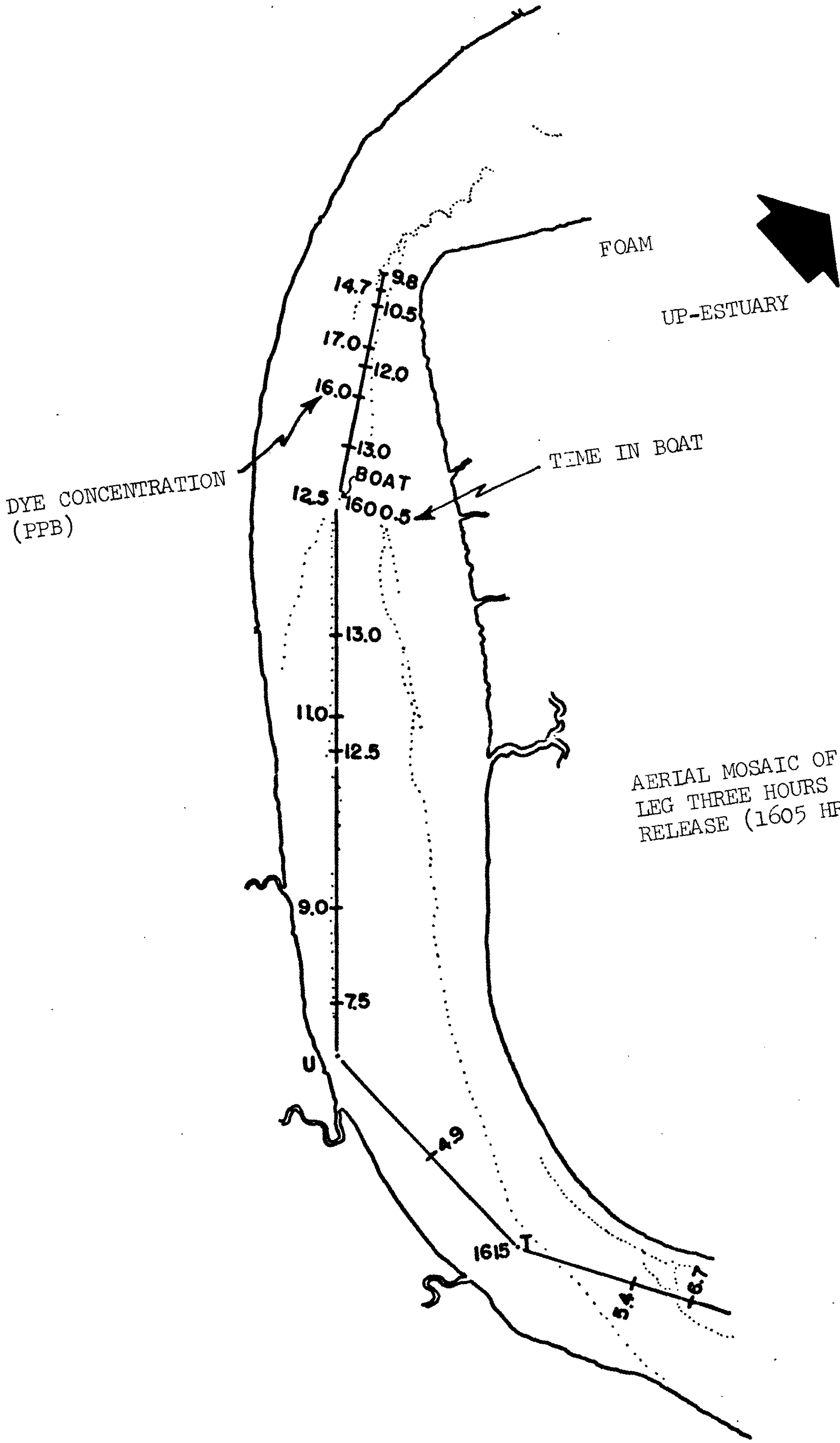
AERIAL MOSAIC OF
SECOND LEG (WEST PART)
THREE HOURS AFTER
RELEASE (1505 HRS)



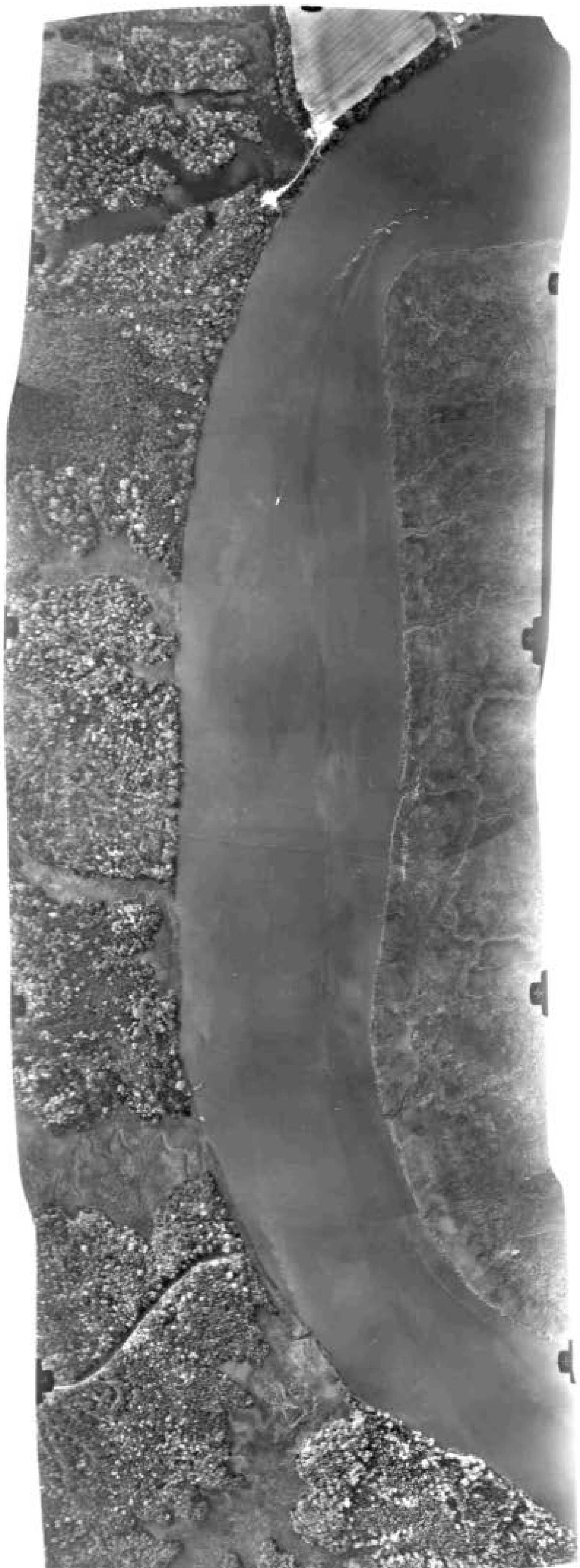


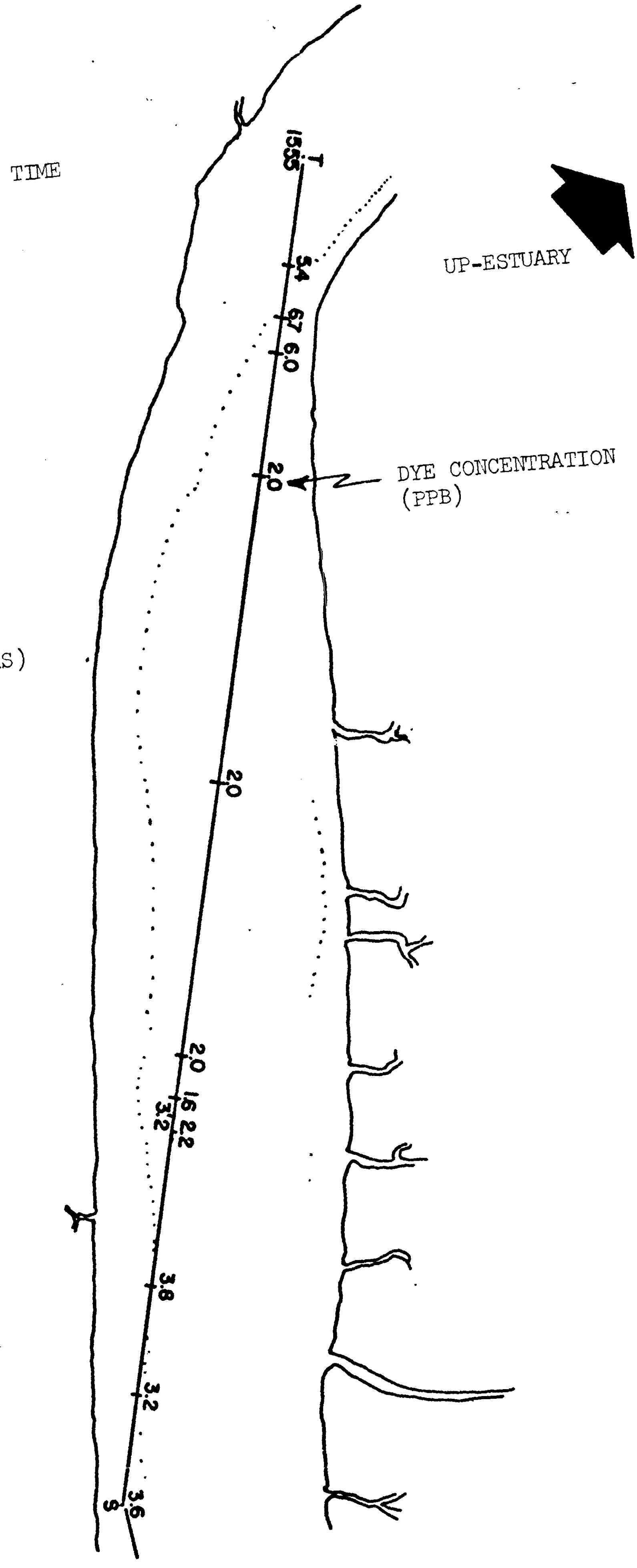
AERIAL MOSAIC OF FIRST LEG, THREE HOURS AFTER RELEASE (1505 HRS)



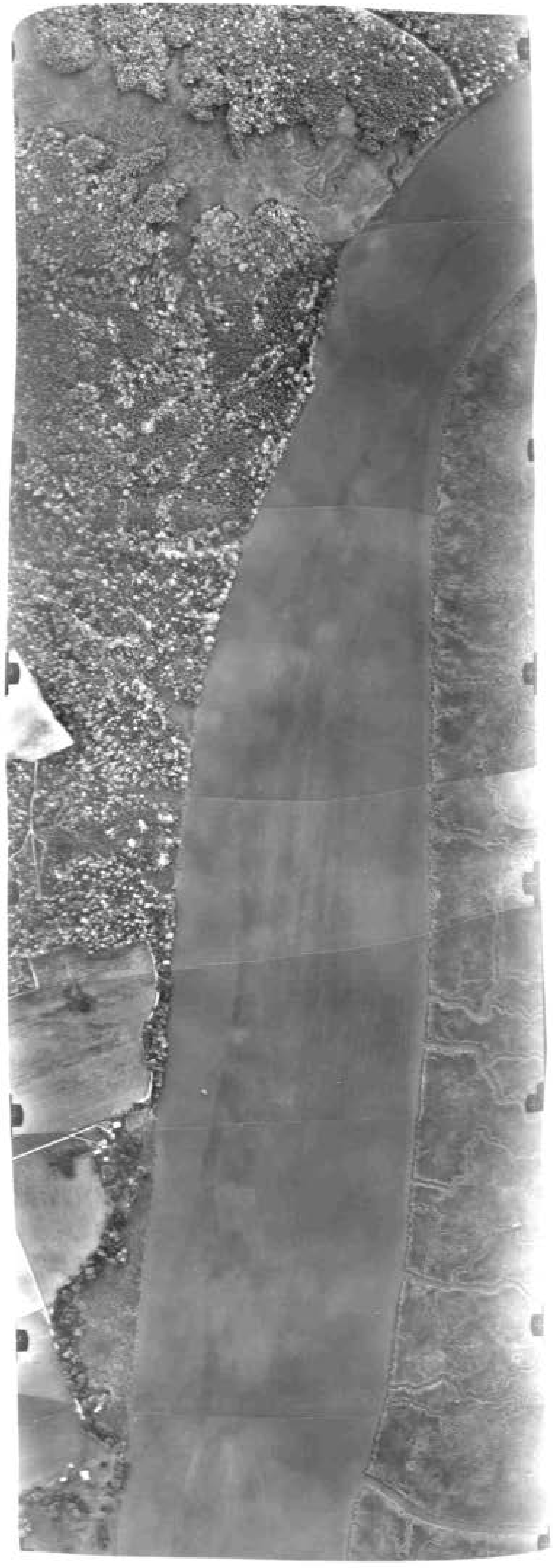


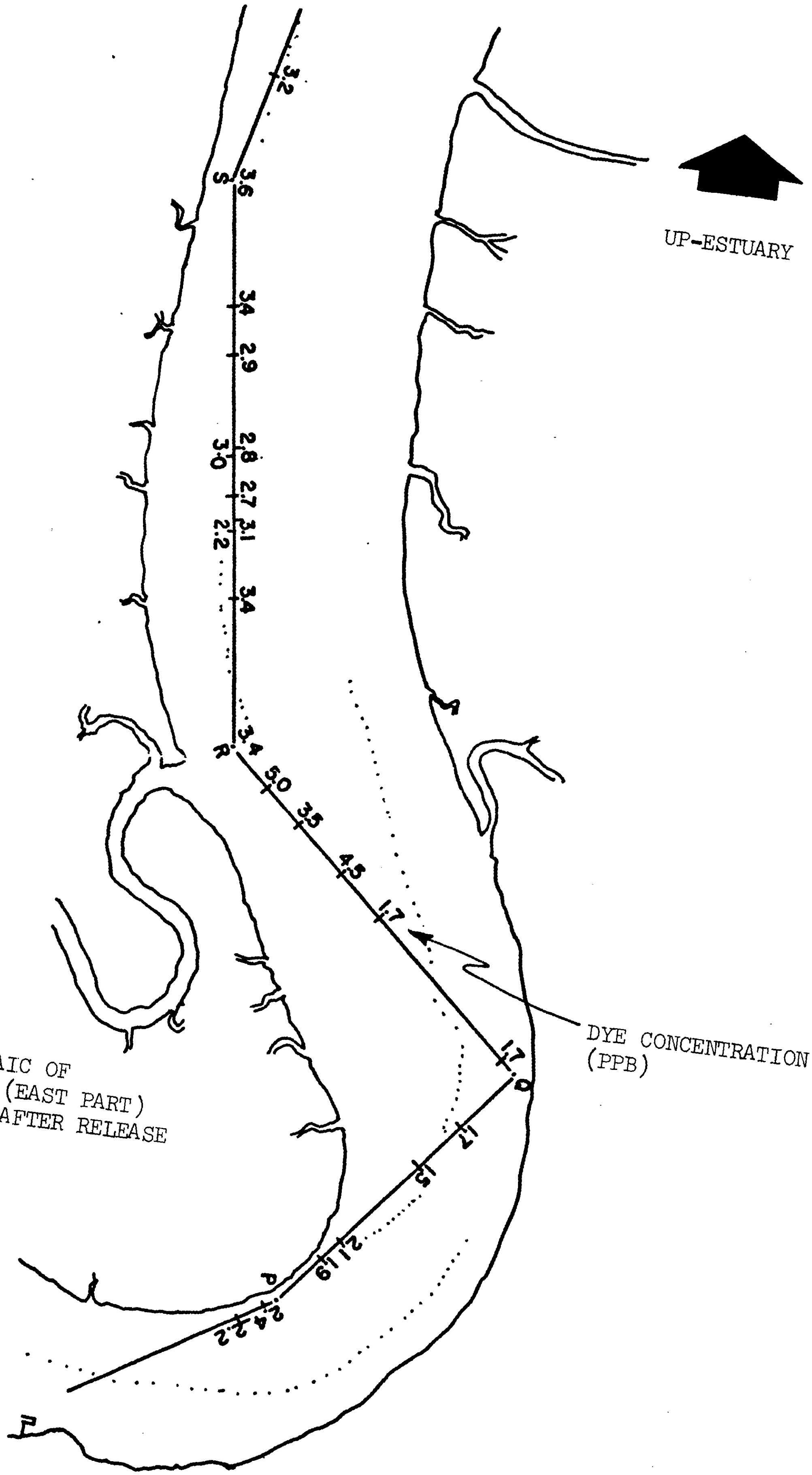
AERIAL MOSAIC OF THIRD LEG THREE HOURS AFTER RELEASE (1605 HRS)



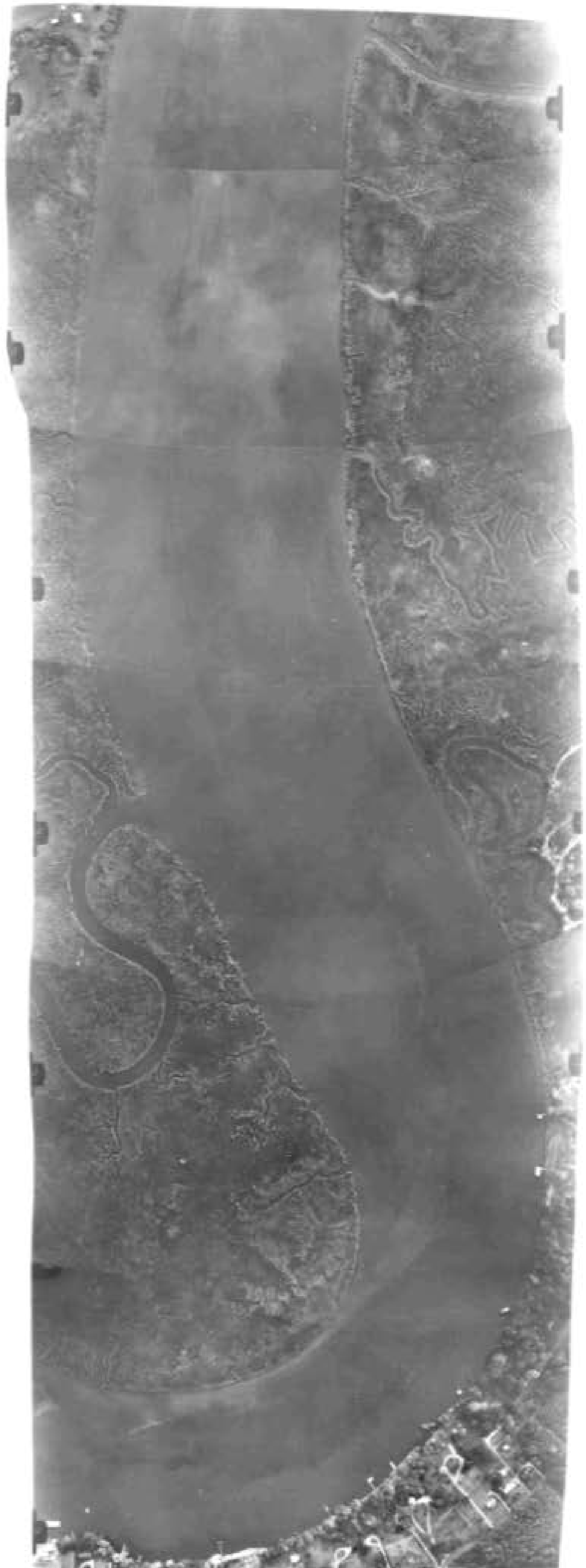


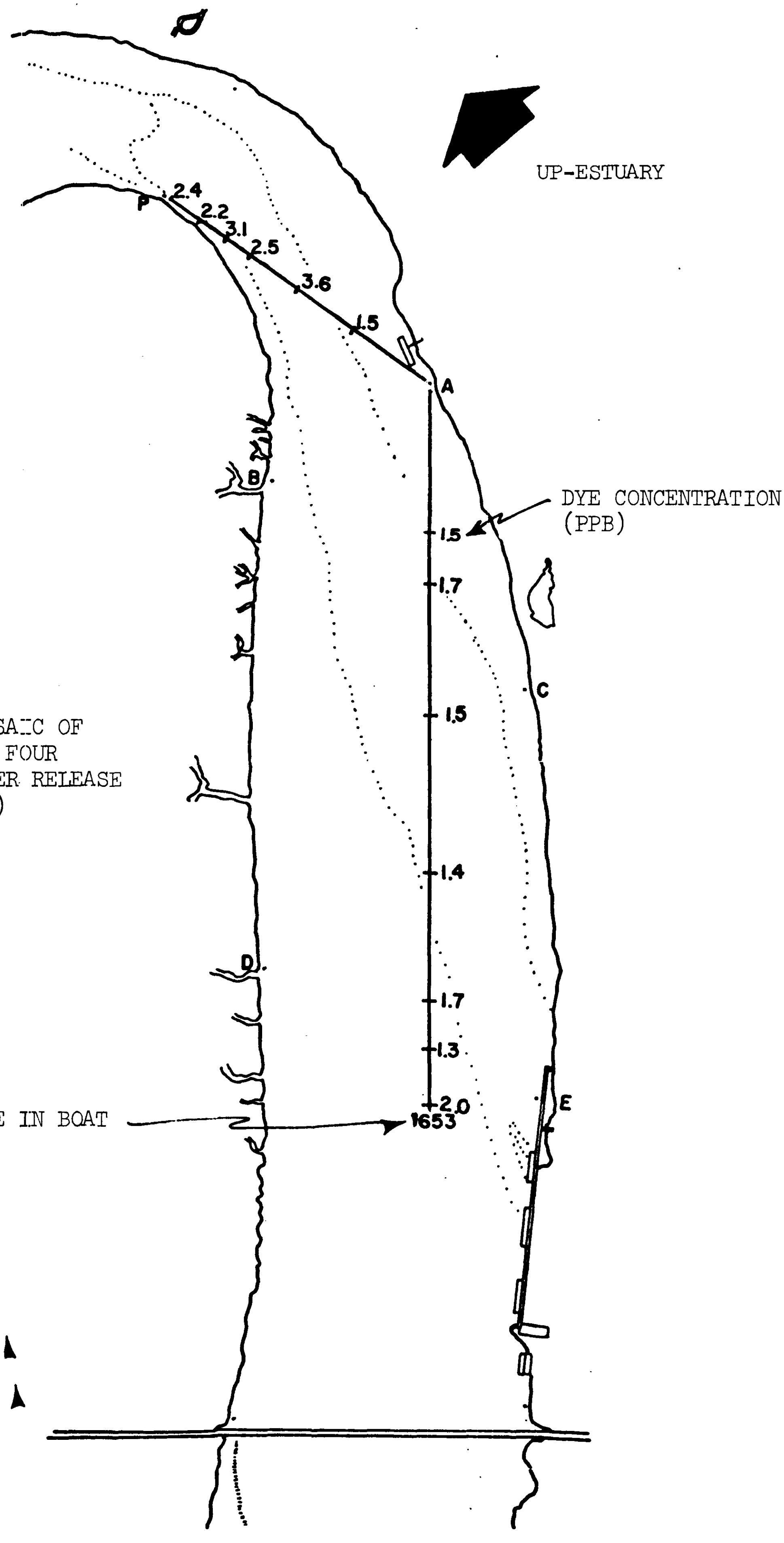
AERIAL MOSAIC
OF SECOND LEG
(WEST PART)
FOUR HOURS AFTER
RELEASE (1607 HRS)



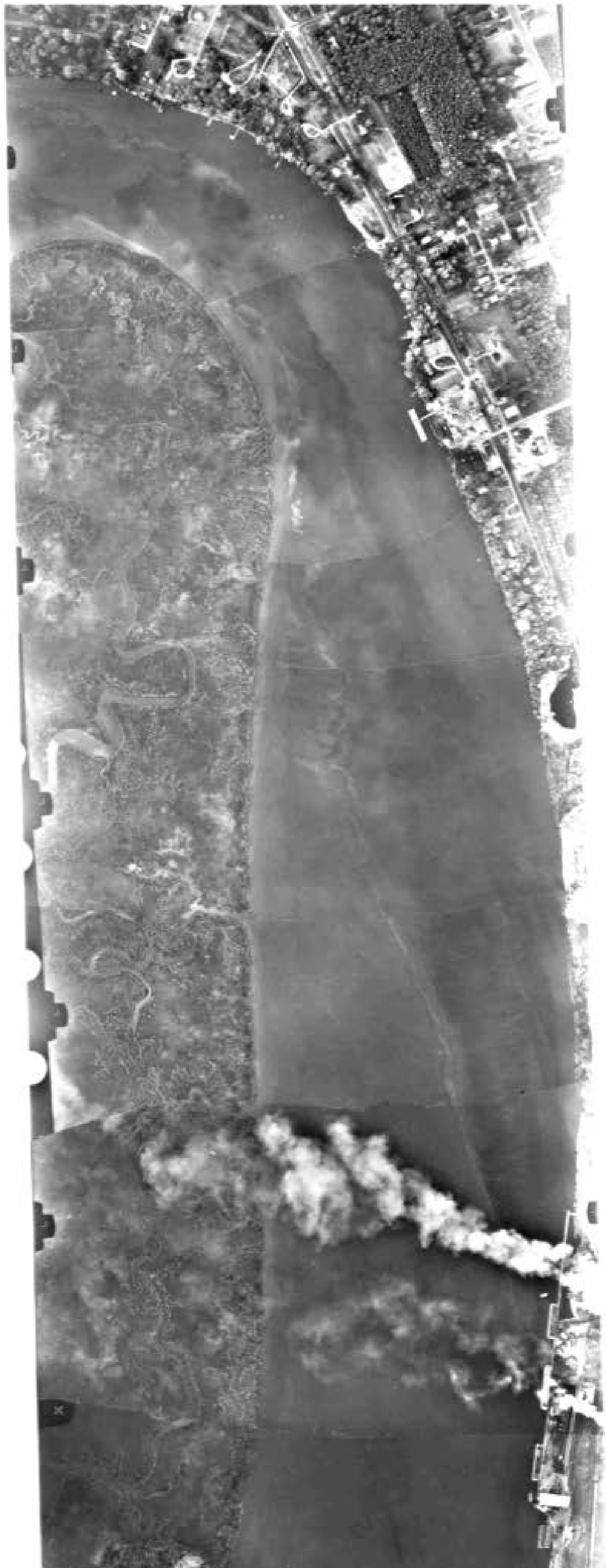


AERIAL MOSAIC OF
SECOND LEG (EAST PART)
FOUR HOURS AFTER RELEASE
(1607 HRS)





AERIAL MOSAIC OF
FIRST LEG FOUR
HOURS AFTER RELEASE
(1612 HRS)



APPENDIX C

HYDROGRAPHIC STATION DATA FOR CERTAIN OF THE STATIONS

SHOWN ON FIGURE 1.

EXPLANATION OF PRINTOUT FOR APPENDIX C

<u>DATE</u>

Recorded in numeric code in order of day, month, year.
Heading - - DA/MO/YR

<u>TIME</u>

Recorded in hours and tenth's.
Heading - - TIM

<u>OPERATION CODE</u>

Four digit alphanumeric code indicating the name of the operation.
Heading - - DNO.

<u>LATITUDE AND LONGITUDE</u>

Recorded in degrees minutes and tenths.
Degrees are separated from minutes and tenths by a hyphen.
LATITUDE is recorded first.
Heading - - DG-MIN

<u>WATER DEPTH</u>

Total depth of water. Recorded in meters.
Heading - - WD

<u>NUMBER OF OBSERVATIONS</u>

A two digit number indicating the number of depths sampled in each sampling period.
Heading - - NC

<u>DEPTH SAMPLED</u>

The depth, in meters and tenths, at which the temperature, salinity, current direction and current speed were measured.
Heading - - DPT

<u>INSTRUMENT CODES</u>

Ahead of each measurement there is a one digit alphameric code indicating the instrument used in obtaining the data.

H - Temperature instrument ARA ET 100 Marine (Unit 706)

R - Salinity bottle sample analyzed on an Induction Salinometer RS-7A.

S - Current speed and direction by Savonius type hydro current Meter (Unit A). Direction is <u>toward</u> which current is flowing.
Heading - - I

<u>TEMPERATURE</u>

Recorded to nearest tenth of a degree Celsius.
Heading - - TEMP

<u>SALINITY</u>

Recorded to nearest tenth or hundredth of a part per thousand.
Heading - - SALN

CARD CODE

A unique four digit numeric code identifying those samples from the same sampling series.
Heading - - CCOD

CURRENT DIRECTION

A two digit integer indicating the direction toward which current is flowing. Recorded in tens of degrees (mag.); *e.g.,* 350 degrees = 35.
Heading - - DR

CURRENT SPEED

Recorded to the nearest hundredth of a meter per second.
Heading - - VEL

DISSOLVED OXYGEN

Recorded to the nearest tenth of a milligram per liter.
Heading - - DO

STATION CODE

A three digit alphanumeric code indicating the station occupied.
Heading - - STA

CA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCD	I	CR	I	VEL	I	DC	COL	STA
16/10/69	17.8		CYR1		37-33.4	76-51.7	4.5						C3	CC.C	⊦	19.5	R	6.C5	1381	S	11	S	C.C4				343
16/10/69	17.8		CYR1		37-33.4	76-51.7	4.5						C3	C2.C	⊦	19.6	R	7.88	1381	S	6	S	C.63				343
16/10/69	17.8		CYR1		37-33.4	76-51.7	4.5						C3	C4.C	⊦	19.8	R	8.C7	1381	S	7	S	C.C9				343
16/10/69	18.8		CYR1		37-33.4	76-51.7	4.5						C3	CC.C	⊦	19.4	R	6.81	1382	S	19	S	C.5C				343
16/1C/69	18.8		CYR1		37-33.4	76-51.7	4.5						C3	C2.C	⊦	19.6	R	6.79	1382	S	21	S	C.44				343
16/10/69	18.8		CYR1		37-33.4	76-51.7	4.5						C3	C4.C	⊦	19.7	R	7.7C	1382	S	19	S	C.25				343
16/1C/69	19.8		CYR1		37-33.4	76-51.7	4.C						C3	CC.C	⊦	19.4	R	5.97	1383	S	19	S	C.94				343
16/10/69	19.8		CYR1		37-33.4	76-51.7	4.C						C3	C2.C	⊦	19.5	R	6.32	1383	S	19	S	C.81				343
16/10/69	19.8		CYR1		37-33.4	76-51.7	4.C						C3	C3.C	⊦	19.7	R	6.32	1383	S	19	S	C.5C				343
16/10/69	2C.8		CYR1		37-33.4	76-51.7	5.C						C3	CC.C			R	3.C4	1384								343
16/1C/69	2C.8		CYR1		37-33.4	76-51.7	5.C						C3	C2.C			R	3.C4	1384								343
16/10/69	2C.8		CYR1		37-33.4	76-51.7	5.C						C3	C4.C			R	3.14	1384								343
16/10/69	C8.5		CYR1		37-31.6	76-52.1	5.C						C3	CC.C	⊦	19.5	R	5.12	1385	A	12	A	C.4C			PO4A	351
16/1C/69	C8.5		CYR1		37-31.6	76-52.1	5.C						C3	C2.C	⊦	19.6	R	5.51	1385	A	13	A	C.75				351
16/1C/69	C8.5		CYR1		37-31.6	76-52.1	5.C						C3	C4.C	⊦	19.6	R	5.78	1385	A	15	A	C.42				351
16/1C/69	C9.5		CYR1		37-31.6	76-52.1	5.C						C3	CC.C	⊦	19.6	R	4.33	1386	A	12	A	C.6C			PO4A	351
16/10/69	C9.5		CYR1		37-31.6	76-52.1	5.C						C3	C2.C	⊦	19.7	R	4.56	1386	A	14	A	C.55				351
16/10/69	C9.5		CYR1		37-31.6	76-52.1	5.C						C3	C4.C	⊦	19.7	R	4.76	1386	A	15	A	C.24				351

CA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCD I CR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA
16/1C/69	1C.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	19.7	R	3.81	1387	A	14	A	C.16			PO4A	351
16/1C/69	1C.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.7	R	3.94	1387	A	13	A	C.12				351
16/1C/69	1C.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.6	R	4.1C	1387	A	18	A	C.C5				351
16/1C/69	11.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	19.8	R	3.67	1388	A	36	A	C.14			PO4A	351
16/1C/69	11.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.7	R	3.8C	1388	A	33	A	C.17				351
16/1C/69	11.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.7	R	3.63	1388	A	35	A	C.2C				351
16/1C/69	12.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	19.9	R	4.47	1389	A	33	A	C.6C			PO4A	351
16/1C/69	12.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.9	R	4.49	1389	A	32	A	C.6C				351
16/1C/69	12.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.8	R	4.6C	1389	A	32	A	C.44				351
16/1C/69	13.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	2C.1	R	5.23	139C	A	32	A	C.9C			PO4A	351
16/1C/69	13.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.8	R	5.66	139C	A	31	A	C.85				351
16/1C/69	13.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.6	R	6.3C	139C	A	31	A	C.5C				351
16/1C/69	14.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	19.8	R	7.5C	1391	A	32	A	C.75			PO4A	351
16/1C/69	14.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.8	R	7.54	1391	A	33	A	C.75				351
16/10/69	14.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.8	R	7.53	1391	A	33	A	C.6C				351
16/1C/69	15.5		CYR1		37-31.6	76-52.1	5.C					C3	CC.C	F	19.9	R	8.92	1392	A	33	A	C.65			PO4A	351
16/10/69	15.5		CYR1		37-31.6	76-52.1	5.C					C3	C2.C	F	19.9	R	8.95	1392	A	32	A	C.65				351
16/10/69	15.5		CYR1		37-31.6	76-52.1	5.C					C3	C4.C	F	19.8	R	9.C2	1392	A	33	A	C.47				351

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	16.5		CYR1		37-31.6	76-52.1	5.C						C3	CC.C	⊢	19.9	R	8.99	1393	A	29	A	C.75			PO4A	351
16/10/69	16.5		CYR1		37-31.6	76-52.1	5.C						C3	C2.C	⊢	19.9	R	9.43	1393	A	32	A	C.12				351
16/10/69	16.5		CYR1		37-31.6	76-52.1	5.C						C3	C4.C	⊢	19.8	R	9.8C	1393	A	34	A	C.32				351
16/10/69	17.5		CYR1		37-31.6	76-52.1	5.C						C3	CC.C	⊢	19.7	R	8.80	1394	A	15	A	C.12			PO4A	351
16/1C/69	17.5		CYR1		37-31.6	76-52.1	5.C						C3	C2.C	⊢	19.7	R	9.99	1394	A	21	A	C.C6				351
16/10/69	17.5		CYR1		37-31.6	76-52.1	5.C						C3	C4.C	⊢	19.7	R	1C.C7	1394	A	11	A	C.C6				351
16/10/69	18.5		CYR1		37-31.6	76-52.1	5.C						C3	CC.C	⊢	19.5	R	7.69	1395	A	13	A	C.4C			PO4A	351
16/10/69	18.5		CYR1		37-31.6	76-52.1	5.C						C3	C2.C	⊢	19.7	R	6.23	1395	A	13	A	C.42				351
16/10/69	18.5		CYR1		37-31.6	76-52.1	5.C						C3	C4.C	⊢	19.7	R	9.87	1395	A	13	A	C.23				351
16/10/69	19.5		CYR1		37-31.6	76-52.1	4.5						C3	CC.C	⊢	19.6	R	6.96	1396	A	12	A	C.9C			PO4A	351
16/1C/69	19.5		CYR1		37-31.6	76-52.1	4.5						C3	C2.C	⊢	19.8	R	9.C3	1396	A	14	A	C.7C				351
16/1C/69	19.5		CYR1		37-31.6	76-52.1	4.5						C3	C4.C	⊢	19.8	R	9.2C	1396	A	16	A	C.5C				351
16/1C/69	2C.5		CYR1		37-31.6	76-52.1	4.5						C3	CC.C	⊢	19.6	R	7.13	1397	A	13	A	C.9C			PO4A	351
16/10/69	2C.5		CYR1		37-31.6	76-52.1	4.5						C3	C2.C	⊢	19.7	R	7.72	1397	A	14	A	C.75				351
16/1C/69	2C.5		CYR1		37-31.6	76-52.1	4.5						C3	C4.C	⊢	19.8	R	7.88	1397	A	14	A	C.5C				351
16/10/69	21.5		CYR1		37-31.6	76-52.1	4.5						C3	CC.C	T	19.5	R	6.C5	1398	A	19	A	C.8C			PO4A	351
16/10/69	21.5		CYR1		37-31.6	76-52.1	4.5						C3	C2.C			R	6.26	1398	A	13	A	C.7C				351
16/10/69	21.5		CYR1		37-31.6	76-52.1	4.5						C3	C4.C			R	6.4C	1398	A	14	A	C.5C				351

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	22.5		CYR1		37-31.6	76-52.1	4.C						C3	CC.C	T	19.7	R	4.97	1399	A	13	A	C.6C			PO4A	351
16/10/69	22.5		CYR1		37-31.6	76-52.1	4.C						C3	C2.C			R	5.18	1399	A	14	A	C.5C				351
16/10/69	22.5		CYR1		37-31.6	76-52.1	4.C						C3	03.C			R	5.31	1399	A	15	A	C.C5				351
16/10/69	23.5		CYR1		37-31.6	76-52.1	4.C						C3	CC.C			R	3.87	14CC	A	14	A	C.38			PO4A	351
16/10/69	23.5		CYR1		37-31.6	76-52.1	4.C						C3	C2.C			R	3.9C	14CC	A	14	A	C.31				351
16/10/69	23.5		CYR1		37-31.6	76-52.1	4.C						C3	C3.C					1400	A	16	A	C.23				351
17/10/69	CC.6		CYR1		37-31.6	76-52.1	4.C						C3	CC.C	T	19.4	R	3.6C	14C1	A	13	A	0.5C			PO4A	351
17/10/69	CC.6		CYR1		37-31.6	76-52.1	4.C						C3	C2.C			R	3.67	14C1			A	C.CO				351
17/10/69	CC.6		CYR1		37-31.6	76-52.1	4.C						C3	03.C			R	3.85	14C1	A	36	A	C.C2				351
17/10/69	C1.5		CYR1		37-31.6	76-52.1	4.C						C3	CC.C	T	19.4	R	3.57	14C2	A	35	A	C.13			PO4A	351
17/10/69	C1.5		CYR1		37-31.6	76-52.1	4.C						C3	C2.C			R	3.76	14C2	A	32	A	C.24				351
17/10/69	C1.5		CYR1		37-31.6	76-52.1	4.C						C3	C3.C			R	4.21	14C2	A	33	A	C.3C				351
17/10/69	C2.5		CYR1		37-31.6	76-52.1	4.5						C3	CC.C	T	19.4	R	4.1C	14C3	A	31	A	C.45			PO4A	351
17/10/69	C2.5		CYR1		37-31.6	76-52.1	4.5						C3	C2.C			R	4.27	14C3	A	32	A	C.49				351
17/10/69	C2.5		CYR1		37-31.6	76-52.1	4.5						C3	C4.C			R	5.C3	14C3	A	32	A	C.33				351
17/10/69	C3.6		CYR1		37-31.6	76-52.1	4.5						C3	CC.C	T	19.5	R	5.39	14C4	A	34	A	C.75			PO4A	351
17/10/69	C3.6		CYR1		37-31.6	76-52.1	4.5						C3	C2.C			R	6.C9	14C4	A	32	A	C.25				351
17/10/69	C3.6		CYR1		37-31.6	76-52.1	4.5						C3	C4.C			R	6.51	14C4	A	31	A	C.12				351

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	CNC	DG-MIN	DG-MIN	WD	NC	DPT	I	TEMP	I	SALN	CCCD	I	DR	I	VEL	COL	STA
17/10/69	04.5	CYR1	37-31.6	76-52.1	4.0	03	00.0	T	19.5	R	6.30	1405	A	33	A	0.38	PO4A	351
17/10/69	04.5	CYR1	37-31.6	76-52.1	4.0	03	02.0			R	6.60	1405	A	33	A	0.37		351
17/10/69	04.5	CYR1	37-31.6	76-52.1	4.0	03	03.0			R	6.70	1405	A	33	A	0.26		351
17/10/69	05.7	CYR1	37-31.6	76-52.1	4.5	03	00.0	T	19.2	R	6.41	1406	A	14	A	0.10	PO4A	351
17/10/69	05.7	CYR1	37-31.6	76-52.1	4.5	03	02.0			R	6.91	1406	A	11	A	0.05		351
17/10/69	05.7	CYR1	37-31.6	76-52.1	4.5	03	04.0			R	7.14	1406	A	11	A	0.06		351
17/10/69	06.5	CYR1	37-31.6	76-52.1	4.5	03	00.0	T	18.8	R	5.76	1407	A	12	A	0.31	PO4A	351
17/10/69	06.5	CYR1	37-31.6	76-52.1	4.5	03	02.0			R	6.78	1407	A	14	A	0.29		351
17/10/69	06.5	CYR1	37-31.6	76-52.1	4.5	03	04.0			R	7.21	1407	A	13	A	0.21		351
17/10/69	07.5	CYR1	37-31.6	76-52.1	4.5	03	00.0	T	19.3	R	4.85	1408	A	12	A	0.70	PO4A	351
17/10/69	07.5	CYR1	37-31.6	76-52.1	4.5	03	02.0			R	6.47	1408	A	13	A	0.55		351
17/10/69	07.5	CYR1	37-31.6	76-52.1	4.5	03	04.0			R	6.56	1408	A	15	A	0.33		351
17/10/69	08.5	CYR1	37-31.6	76-52.1	4.0	03	00.0	T	19.6	R	4.78	1409	A	12	A	0.80	PO4A	351
17/10/69	08.5	CYR1	37-31.6	76-52.1	4.0	03	02.0			R	5.38	1409	A	13	A	0.70		351
17/10/69	08.5	CYR1	37-31.6	76-52.1	4.0	03	04.0			R	5.56	1409	A	14	A	0.49		351
17/10/69	09.5	CYR1	37-31.6	76-52.1	4.0	03	00.0	T	19.5	R	3.96	1410	A	14	A	0.70	PO4A	351
17/10/69	09.5	CYR1	37-31.6	76-52.1	4.0	03	02.0			R	4.22	1410	A	14	A	0.65		351
17/10/69	09.5	CYR1	37-31.6	76-52.1	4.0	03	04.0			R	4.35	1410	A	14	A	0.38		351

Columns with no entries on this page: VS, ARA, T, AT, WD (second), WV, DV, I (after VEL), DO.

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCD I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA
16/10/69	C8.5		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.1	R	5.C6	1411	A	12	A	C.8C			PO4B	352
16/10/69	C8.5		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.4	R	5.1C	1411	A	13	A	C.8C	B	5.52		352
16/10/69	C8.5		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.5	R	5.29	1411	A	14	A	C.65				352
16/10/69	C8.5		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.6	R	5.42	1411	A	15	A	C.33				352
16/10/69	C9.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.6	R	4.22	1412	A	11	A	C.6C			PO4B	352
16/10/69	C9.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.6	R	4.25	1412	A	13	A	C.55	B	5.28		352
16/10/69	C9.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.6	R	4.27	1412	A	14	A	C.38				352
16/10/69	C9.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.7	R	4.6C	1412	A	14	A	C.22				352
16/10/69	1C.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.7	R	3.68	1413	A	11	A	C.11			PO4B	352
16/10/69	1C.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.7	R	3.71	1413	A	11	A	C.C9	B	6.CC		352
16/10/69	1C.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.7	R	3.89	1413	A	C9	A	C.C7				352
16/10/69	1C.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.7	R	4.25	1413	A	18	A	C.C8				352
16/10/69	11.6		CYR1		37-31.6	76-52.2	6.C					C4	CC.C	F	19.7	R	3.91	1414	A	29	A	C.24			PO4B	352
16/10/69	11.6		CYR1		37-31.6	76-52.2	6.C					C4	C2.C	F	19.6	R	4.17	1414	A	32	A	C.26	B	5.92		352
16/10/69	11.6		CYR1		37-31.6	76-52.2	6.C					C4	C4.C	F	19.6	R	4.4C	1414	A	32	A	C.34				352
16/10/69	11.6		CYR1		37-31.6	76-52.2	6.C					C4	C5.C	F	19.6			1414	A	32	A	C.41				352
16/10/69	12.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.7	R	4.75	1415	A	32	A	C.8C			PO4B	352
16/10/69	12.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.7	R	4.73	1415	A	3C	A	C.75	B	5.02		352
16/10/69	12.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.7	R	4.74	1415	A	31	A	C.75				352
16/10/69	12.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.6	R	5.87	1415	A	32	A	C.6C				352
CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA

DA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
16/10/69	13.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	2C.C	R	5.42	1416	A	32	A	1.CC			PO4B	352
16/10/69	13.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.7	R	5.91	1416	A	31	A	1.CC	B	4.9C		352
16/10/69	13.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.6	R	6.57	1416	A	31	A	C.9C				352
16/10/69	13.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.6	R	6.59	1416	A	31	A	C.65				352
16/10/69	14.6		CYR1		37-31.6	76-52.2	8.C					C5	CC.C	F	19.8	R	7.47	1417	A	33	A	C.95			PO4B	352
16/10/69	14.6		CYR1		37-31.6	76-52.2	8.C					C5	C2.C	F	19.8	R	7.45	1417	A	33	A	C.95	B	4.28		352
16/10/69	14.6		CYR1		37-31.6	76-52.2	8.C					C5	C4.C	F	19.8	R	7.73	1417	A	32	A	C.95				352
16/10/69	14.6		CYR1		37-31.6	76-52.2	8.C					C5	C6.C	F	19.8	R	7.76	1417	A	32	A	C.75				352
16/10/69	14.6		CYR1		37-31.6	76-52.2	8.C					C5	C7.C	F	19.8	R	7.77	1417	A	33	A	C.65				352
16/10/69	15.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.9	R	8.96	1418	A	3C	A	C.75			PO4B	352
16/10/69	15.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.9	R	9.C6	1418	A	32	A	C.8C	B	4.52		352
16/10/69	15.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.8	R	9.13	1418	A	31	A	C.7C				352
16/10/69	15.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.8	R	9.15	1418	A	32	A	C.5C				352
16/10/69	16.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.7	R	9.76	1419	A	31	A	C.37			PO4B	352
16/10/69	16.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.8	R	9.77	1419	A	31	A	C.38	B	4.34		352
16/10/69	16.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.8	R	9.93	1419	A	32	A	C.36				352
16/10/69	16.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.8	R	9.94	1419	A	33	A	C.25				352
16/10/69	17.6		CYR1		37-31.6	76-52.2	7.C					C4	CC.C	F	19.7	R	8.11	1420	A	16	A	C.16			PO4B	352
16/10/69	17.6		CYR1		37-31.6	76-52.2	7.C					C4	C2.C	F	19.7	R	9.72	1420	A	13	A	C.C9	B	5.14		352
16/10/69	17.6		CYR1		37-31.6	76-52.2	7.C					C4	C4.C	F	19.7	R	10.C5	142C	A	12	A	C.C1				352
16/10/69	17.6		CYR1		37-31.6	76-52.2	7.C					C4	C6.C	F	19.7	R	10.17	142C	A	14	A	C.C2				352

DA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CO	COL	STA
16/10/69	18.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	H	19.7	R	8.C3	1421	A	12	A	C.6C			PO4B	352
16/10/69	18.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C	H	19.8	R	9.32	1421	A	13	A	C.6C	B	5.22		352
16/10/69	18.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C	H	19.8	R	9.62	1421	A	13	A	C.43				352
16/10/69	18.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C	H	19.8	R	9.79	1421	A	12	A	C.36				352
16/10/69	19.8		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	H	19.5	R	6.37	1422	A	13	A	C.95			PO4B	352
16/10/69	19.8		CYR1		37-31.6	76-52.2	6.C						C4	C2.C	H	19.7	R	7.66	1422	A	12	A	C.85	B	5.08		352
16/10/69	19.8		CYR1		37-31.6	76-52.2	6.C						C4	C4.C	H	19.8	R	8.18	1422	A	14	A	C.7C				352
16/10/69	19.8		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	8.32	1422	A	14	A	C.5C				352
16/10/69	2C.6		CYR1		37-31.6	76-52.2	6.5						C4	CC.C	H	19.6	R	7.C5	1423	A	14	A	C.9C			PO4B	352
16/10/69	2C.6		CYR1		37-31.6	76-52.2	6.5						C4	C2.C	H	19.7	R	7.1C	1423	A	11	A	C.85	B	5.2C		352
16/10/69	2C.6		CYR1		37-31.6	76-52.2	6.5						C4	C4.C	H	19.7	R	7.24	1423	A	11	A	C.7C				352
16/10/69	2C.6		CYR1		37-31.6	76-52.2	6.5						C4	C5.C	H	19.7	R	7.2C	1423	A	12	A	C.6C				352
16/10/69	21.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C			R	5.75	1424	A	13	A	C.8C			PO4B	352
16/10/69	21.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	5.78	1424	A	13	A	C.70	B	5.6C		352
16/10/69	21.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	5.72	1424	A	13	A	C.6C				352
16/10/69	21.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	5.69	1424	A	13	A	C.5C				352
16/10/69	22.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	T	19.1	R	4.7C	1425	A	14	A	C.65			PO4B	352
16/10/69	22.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	4.75	1425	A	14	A	C.6C	B	6.08		352
16/10/69	22.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	4.86	1425	A	14	A	C.39				352
16/10/69	22.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	5.C9	1425	A	14	A	C.3C				352

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	23.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C			R	3.79	1426	A	14	A	C.35			PO4B	352
16/10/69	23.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	3.8C	1426	A	13	A	C.33	B	6.6C		352
16/10/69	23.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	3.1C	1426	A	13	A	C.18				352
16/1C/69	23.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	4.26	1426	A	15	A	C.C9				352
17/1C/69	CC.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	T	19.4	R	3.49	1427	A	14	A	C.C1			PO4B	352
17/10/69	CC.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	3.6C	1427	A	2C	A	C.C4	B	7.42		352
17/10/69	CC.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	3.86	1427	A	27	A	C.9C				352
17/10/69	CC.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	4.28	1427	A	33	A	C.11				352
17/1C/69	C1.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	T	19.4	R	4.21	1428	A	32	A	C.26			PO4B	352
17/1C/69	C1.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	3.93	1428	A	31	A	C.32	B	6.46		352
17/1C/69	C1.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	4.59	1428	A	32	A	C.45				352
17/10/69	C1.7		CYR1		37-31.6	76-52.2	6.C						C4	C5.C			R	4.C8	1428	A	31	A	C.36				352
17/1C/69	C2.7		CYR1		37-31.6	76-52.2	6.5						C4	CC.C	T	19.4	R	4.54	1429	A	31	A	C.65			PO4B	352
17/1C/69	C2.7		CYR1		37-31.6	76-52.2	6.5						C4	C2.C			R	5.83	1429	A	31	A	C.65	B	4.98		352
17/1C/69	C2.7		CYR1		37-31.6	76-52.2	6.5						C4	C4.C			R	5.43	1429	A	31	A	C.65				352
17/1C/69	C2.7		CYR1		37-31.6	76-52.2	6.5						C4	C5.C			R	6.C6	1429	A	33	A	C.55				352
17/1C/69	C4.C		CYR1		37-31.6	76-52.2	6.C						C4	CC.C			R	5.91	143C	A	31	A	C.6C			PO4B	352
17/10/69	C4.C		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	6.37	143C	A	31	A	C.6C	B	4.6C		352
17/1C/69	C4.C		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	6.64	143C	A	31	A	C.5C				352
17/10/69	C4.C		CYR1		37-31.6	76-52.2	6.C						C4	C6.C			R	7.CC	143C	A	31	A	C.31				352

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	DNO	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NO	DPT	I	TEMP	I	SALN	OOOO	I	DR	I	VEL	I	DC	COL	STA
17/10/69	05.0		CYR1		37-31.6	76-52.2	6.0						04	00.0	T	18.9	R	6.86	1431	A	35	A	0.25			PO4B	352
17/10/69	05.0		CYR1		37-31.6	76-52.2	6.0						04	02.0			R	6.93	1431	A	32	A	0.25	B	4.51		352
17/10/69	05.0		CYR1		37-31.6	76-52.2	6.0						04	04.0			R	7.23	1431	A	31	A	0.17				352
17/10/69	05.0		CYR1		37-31.6	76-52.2	6.0						04	06.0			R	7.27	1431	A	31	A	0.00				352
17/10/69	05.9		CYR1		37-31.6	76-52.2	6.8						04	00.0	T	19.2	R	6.09	1432	A	14	A	0.16			PO4B	352
17/10/69	05.9		CYR1		37-31.6	76-52.2	6.8						04	02.0			R	6.94	1432	A	13	A	0.12	B	4.00		352
17/10/69	05.9		CYR1		37-31.6	76-52.2	6.8						04	04.0			R	7.15	1432	A	12	A	0.06				352
17/10/69	05.9		CYR1		37-31.6	76-52.2	6.8						04	06.0			R	7.31	1432	A	10	A	0.08				352
17/10/69	06.6		CYR1		37-31.6	76-52.2	6.0						04	00.0	T	19.2	R	6.03	1433	A	12	A	0.48			PO4B	352
17/10/69	06.6		CYR1		37-31.6	76-52.2	6.0						04	02.0			R	6.47	1433	A	13	A	0.40	B	4.81		352
17/10/69	06.6		CYR1		37-31.6	76-52.2	6.0						04	04.0			R	6.95	1433	A	13	A	0.32				352
17/10/69	06.6		CYR1		37-31.6	76-52.2	6.0						04	06.0			R	7.30	1433	A	13	A	0.12				352
17/10/69	07.6		CYR1		37-31.6	76-52.2	6.0						04	00.0	T	19.0	R	4.63	1434	A	13	A	0.80			PO4B	352
17/10/69	07.6		CYR1		37-31.6	76-52.2	6.0						04	02.0			R	5.74	1434	A	13	A	0.70	B	5.12		352
17/10/69	07.6		CYR1		37-31.6	76-52.2	6.0						04	04.0			R	6.46	1434	A	14	A	0.53				352
17/10/69	07.6		CYR1		37-31.6	76-52.2	6.0						04	06.0			R	6.68	1434	A	14	A	0.31				352
17/10/69	08.6		CYR1		37-31.6	76-52.2	6.0						04	00.0	T	19.5	R	4.59	1435	A	14	A	0.80			PO4B	352
17/10/69	08.6		CYR1		37-31.6	76-52.2	6.0						04	02.0			R	4.69	1435	A	13	A	0.80	B	5.61		352
17/10/69	08.6		CYR1		37-31.6	76-52.2	6.0						04	04.0			R	5.12	1435	A	13	A	0.60				352
17/10/69	08.6		CYR1		37-31.6	76-52.2	6.0						04	06.0			R	5.31	1435	A	14	A	0.20				352

DA/MO/YR TIM VS DNO ARA DG-MIN DG-MIN WD T AT WD WV DV NO DPT I TEMP I SALN OOOO I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	C9.7		CYR1		37-31.6	76-52.2	6.C						C4	CC.C	T	19.6	R	3.81	1436	A	13	A	C.65			PO4B	352
17/10/69	C9.7		CYR1		37-31.6	76-52.2	6.C						C4	C2.C			R	3.87	1436	A	14	A	C.63	B	5.83		352
17/10/69	C9.7		CYR1		37-31.6	76-52.2	6.C						C4	C4.C			R	4.C2	1436	A	13	A	C.44				352
17/10/69	C9.7		CYR1		37-31.6	76-52.2	6.C						C4	C6.C			R	4.37	1436	A	13	A	C.34				352
16/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	⊢	19.1	R	4.85	1437	A	12	A	C.8C			PO4C	353
16/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C4	C2.C	⊢	19.4	R	4.89	1437	A	13	A	C.8C				353
16/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C4	C4.C	⊢	19.5	R	4.88	1437	A	15	A	C.75				353
16/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C4	C6.C	⊢	19.6	R	4.92	1437	A	15	A	C.55				353
16/10/69	C9.7		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	⊢	19.5	R	4.C9	1438	A	13	A	C.60			PO4C	353
16/10/69	C9.7		CYR1		37-31.5	76-52.2	7.C						C4	C2.C	⊢	19.6	R	4.12	1438	A	14	A	C.5C				353
16/10/69	C9.7		CYR1		37-31.5	76-52.2	7.C						C4	C4.C	⊢	19.6	R	4.14	1438	A	14	A	C.44				353
16/10/69	C9.7		CYR1		37-31.5	76-52.2	7.C						C4	C6.C	⊢	19.6	R	4.15	1438	A	14	A	C.34				353
16/10/69	1C.7		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	⊢	19.6	R	3.62	1439	A	12	A	C.8C			PO4C	353
16/10/69	1C.7		CYR1		37-31.5	76-52.2	7.C						C4	C2.C	⊢	19.6	R	3.71	1439	A	16	A	C.6C				353
16/10/69	1C.7		CYR1		37-31.5	76-52.2	7.C						C4	C4.C	⊢	19.6	R	3.81	1439	A	1C	A	C.C3				353
16/10/69	1C.7		CYR1		37-31.5	76-52.2	7.C						C4	C6.C	⊢	19.6	R	4.14	1439	A	28	A	C.75				353
16/10/69	11.7		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	⊢	19.8	R	3.92	1440	A	32	A	C.37			PO4C	353
16/10/69	11.7		CYR1		37-31.5	76-52.2	7.C						C4	C2.C	⊢	19.8	R	4.C9	144C	A	32	A	C.44				353
16/10/69	11.7		CYR1		37-31.5	76-52.2	7.C						C4	C4.C	⊢	19.7	R	4.44	144C	A	31	A	C.41				353
16/10/69	11.7		CYR1		37-31.5	76-52.2	7.C						C4	C6.C	⊢	19.7	R	4.5C	144C	A	32	A	C.34				353

CA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
16/10/69	12.7		CYR1		37-31.5	76-52.2	8.0					05	00.0	H	19.7	R	4.94	1441	A	32	A	0.75			PO4C	353
16/10/69	12.7		CYR1		37-31.5	76-52.2	8.0					05	02.0	H	19.6	R	4.91	1441	A	32	A	0.80				353
16/10/69	12.7		CYR1		37-31.5	76-52.2	8.0					05	04.0	H	19.6	R	5.06	1441	A	32	A	0.65				353
16/10/69	12.7		CYR1		37-31.5	76-52.2	8.0					05	06.0	H	19.6	R	5.20	1441	A	32	A	0.55				353
16/10/69	12.7		CYR1		37-31.5	76-52.2	8.0					05	07.0	H	19.6	R	5.28	1441	A	32	A	0.44				353
16/10/69	13.7		CYR1		37-31.5	76-52.2	9.0					05	00.0	H	19.7	R	5.76	1442	A	31	A	0.80			PO4C	353
16/10/69	13.7		CYR1		37-31.5	76-52.2	9.0					05	02.0	H	19.7	R	6.02	1442	A	31	A	0.85				353
16/10/69	13.7		CYR1		37-31.5	76-52.2	9.0					05	04.0	H	19.7	R	6.01	1442	A	31	A	0.85				353
16/10/69	13.7		CYR1		37-31.5	76-52.2	9.0					05	06.0	H	19.7	R	6.13	1442	A	32	A	0.70				353
16/10/69	13.7		CYR1		37-31.5	76-52.2	9.0					05	08.0	H	19.7	R	6.22	1442	A	32	A	0.50				353
16/10/69	14.7		CYR1		37-31.5	76-52.2	9.0					05	00.0	H	19.8	R	7.46	1443	A	34	A	0.70			PO4C	353
16/10/69	14.7		CYR1		37-31.5	76-52.2	9.0					05	02.0	H	19.8	R	7.54	1443	A	33	A	0.70				353
16/10/69	14.7		CYR1		37-31.5	76-52.2	9.0					05	04.0	H	19.8	R	7.48	1443	A	32	A	0.75				353
16/10/69	14.7		CYR1		37-31.5	76-52.2	9.0					05	06.0	H	19.9	R	7.81	1443	A	32	A	0.65				353
16/10/69	14.7		CYR1		37-31.5	76-52.2	9.0					05	08.0	H	19.9	R	7.83	1443	A	31	A	0.60				353
16/10/69	15.7		CYR1		37-31.5	76-52.2	9.0					05	00.0	H	19.8	R	8.79	1444	A	33	A	0.50			PO4C	353
16/10/69	15.7		CYR1		37-31.5	76-52.2	9.0					05	02.0	H	19.8	R	8.92	1444	A	32	A	0.65				353
16/10/69	15.7		CYR1		37-31.5	76-52.2	9.0					05	04.0	H	19.8	R	9.13	1444	A	32	A	0.55				353
16/10/69	15.7		CYR1		37-31.5	76-52.2	9.0					05	06.0	H	19.8	R	9.15	1444	A	32	A	0.55				353
16/10/69	15.7		CYR1		37-31.5	76-52.2	9.0					05	08.0	H	19.8	R	9.16	1444	A	31	A	0.34				353

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA
16/10/69	16.8		CYR1		37-31.5	76-52.2		9.0					05	00.0	H	19.7	R	9.62	1445	A	33	A	0.18			PO4C	353
16/10/69	16.8		CYR1		37-31.5	76-52.2		9.0					05	02.0	H	19.8	R	9.79	1445	A	34	A	0.21				353
16/10/69	16.8		CYR1		37-31.5	76-52.2		9.0					05	04.0	H	19.8	R	9.98	1445	A	34	A	0.20				353
16/10/69	16.8		CYR1		37-31.5	76-52.2		9.0					05	06.0	H	19.8	R	10.00	1445	A	34	A	0.16				353
16/10/69	16.8		CYR1		37-31.5	76-52.2		9.0					05	08.0	H	19.8	R	10.01	1445	A	31	A	0.08				353
16/10/69	17.7		CYR1		37-31.5	76-52.2		8.0					05	00.0	H	19.6	R	8.10	1446	A	15	A	0.30			PO4C	353
16/10/69	17.7		CYR1		37-31.5	76-52.2		8.0					05	02.0	H	19.7	R	9.91	1446	A	12	A	0.20				353
16/10/69	17.7		CYR1		37-31.5	76-52.2		8.0					05	04.0	H	19.7	R	10.08	1446	A	11	A	0.12				353
16/10/69	17.7		CYR1		37-31.5	76-52.2		8.0					05	06.0	H	19.7	R	10.12	1446	A	14	A	0.08				353
16/10/69	17.7		CYR1		37-31.5	76-52.2		8.0					05	07.0			R	10.09	1446								353
16/10/69	18.8		CYR1		37-31.5	76-52.2		6.0					04	00.0	H	19.6	R	7.48	1447	A	14	A	0.75			PO4C	353
16/10/69	18.8		CYR1		37-31.5	76-52.2		6.0					04	02.0	H	19.7	R	9.01	1447	A	19	A	0.70				353
16/10/69	18.8		CYR1		37-31.5	76-52.2		6.0					04	04.0	H	19.8	R	9.16	1447	A	12	A	0.60				353
16/10/69	18.8		CYR1		37-31.5	76-52.2		6.0					04	05.0	H	19.8	R	9.38	1447	A	14	A	0.55				353
16/10/69	20.0		CYR1		37-31.5	76-52.2		7.5					04	00.0	H	19.3	R	6.40	1448	A	14	A	1.00			PO4C	353
16/10/69	20.0		CYR1		37-31.5	76-52.2		7.5					04	02.0	H	19.5	R	6.77	1448	A	14	A	1.00				353
16/10/69	20.0		CYR1		37-31.5	76-52.2		7.5					04	04.0	H	19.7	R	7.50	1448	A	14	A	0.80				353
16/10/69	20.0		CYR1		37-31.5	76-52.2		7.5					04	06.0	H	19.7	R	7.68	1448	A	13	A	0.55				353
16/10/69	20.8		CYR1		37-31.5	76-52.2		7.5					04	00.0	H	19.5	R	6.75	1449	A	12	A	0.85			PO4C	353
16/10/69	20.8		CYR1		37-31.5	76-52.2		7.5					04	02.0	H	19.5	R	6.72	1449	A	13	A	0.85				353
16/10/69	20.8		CYR1		37-31.5	76-52.2		7.5					04	04.0	H	19.6	R	6.72	1449	A	13	A	0.80				353
16/10/69	20.8		CYR1		37-31.5	76-52.2		7.5					04	06.0	H	19.6	R	6.72	1449	A	16	A	0.50				353
DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
16/10/69	22.C		CYR1		37-31.5	76-52.2	7.5						C5	CC.C			R	5.45	1450	A	13	A	C.80			PO4C	353
16/10/69	22.C		CYR1		37-31.5	76-52.2	7.5						C5	C2.C			R	5.45	1450	A	14	A	C.80				353
16/10/69	22.C		CYR1		37-31.5	76-52.2	7.5						C5	C4.C			R	5.43	1450	A	14	A	C.70				353
16/10/69	22.C		CYR1		37-31.5	76-52.2	7.5						C5	C6.C			R	5.41	1450	A	14	A	C.C5				353
16/1C/69	22.C		CYR1		37-31.5	76-52.2	7.5						C5	C7.C			R	5.41	1450								353
16/1C/69	22.8		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	T	19.6	R	4.28	1451	A	13	A	0.7C			PO4C	353
16/1C/69	22.8		CYR1		37-31.5	76-52.2	7.C						C4	C2.C			R	4.3C	1451	A	13	A	C.6C				353
16/1C/69	22.8		CYR1		37-31.5	76-52.2	7.C						C4	C4.C			R	4.43	1451	A	14	A	C.5C				353
16/1C/69	22.8		CYR1		37-31.5	76-52.2	7.C						C4	C6.C			R	4.53	1451	A	14	A	C.25				353
16/10/69	23.9		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	T	19.1	R	3.67	1452	A	14	A	C.31			PO4C	353
16/1C/69	23.9		CYR1		37-31.5	76-52.2	7.C						C4	C2.C			R	3.68	1452	A	14	A	C.29				353
16/1C/69	23.9		CYR1		37-31.5	76-52.2	7.C						C4	C4.C			R	3.8C	1452	A	14	A	C.16				353
16/1C/69	23.9		CYR1		37-31.5	76-52.2	7.C						C4	C6.C			R	4.42	1452	A	12	A	C.C2				353
17/1C/69	CC.9		CYR1		37-31.5	76-52.2	7.C						C4	CC.C	T	19.4	R	3.47	1453	A	26	A	0.C2			PO4C	353
17/1C/69	CC.9		CYR1		37-31.5	76-52.2	7.C						C4	C2.C			R	3.56	1453	A	3C	A	C.C2				353
17/1C/69	CC.9		CYR1		37-31.5	76-52.2	7.C						C4	C4.C			R	3.77	1453	A	33	A	C.C5				353
17/10/69	CC.9		CYR1		37-31.5	76-52.2	7.C						C4	C6.C			R	4.21	1453	A	32	A	C.10				353
17/1C/69	C1.8		CYR1		37-31.5	76-52.2	6.5						C4	CC.C	T	19.4	R	3.81	1454	A	32	A	C.35			PO4C	353
17/10/69	C1.8		CYR1		37-31.5	76-52.2	6.5						C4	C2.C			R	4.12	1454	A	31	A	C.4C				353
17/10/69	C1.8		CYR1		37-31.5	76-52.2	6.5						C4	C4.C			R	5.14	1454	A	32	A	C.55				353
17/10/69	C1.8		CYR1		37-31.5	76-52.2	6.5						C4	C6.C			R	5.18	1454	A	32	A	C.4C				353

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
17/10/69	02.8		CYR1		37-31.5	76-52.2	7.5					05	00.0	T	19.6	R	5.42	1455	A	33	A	0.65			PO4C	353
17/10/69	02.8		CYR1		37-31.5	76-52.2	7.5					05	02.0			R	5.55	1455	A	33	A	0.70				353
17/10/69	02.8		CYR1		37-31.5	76-52.2	7.5					05	04.0			R	5.75	1455	A	33	A	0.70				353
17/10/69	02.8		CYR1		37-31.5	76-52.2	7.5					05	06.0			R	5.78	1455	A	32	A	0.55				353
17/10/69	02.8		CYR1		37-31.5	76-52.2	7.5					05	07.0			R	5.79	1455	A	33	A	0.40				353
17/10/69	04.2		CYR1		37-31.5	76-52.2	8.0					05	00.0			R	6.47	1456	A	33	A	0.40			PO4C	353
17/10/69	04.2		CYR1		37-31.5	76-52.2	8.0					05	02.0			R	6.71	1456	A	32	A	0.44				353
17/10/69	04.2		CYR1		37-31.5	76-52.2	8.0					05	04.0			R	6.87	1456	A	31	A	0.45				353
17/10/69	04.2		CYR1		37-31.5	76-52.2	8.0					05	06.0			R	6.99	1456	A	31	A	0.37				353
17/10/69	04.2		CYR1		37-31.5	76-52.2	8.0					05	07.0			R	6.99	1456	A	30	A	0.31				353
17/10/69	05.4		CYR1		37-31.5	76-52.2	8.0					05	00.0	T	19.2	R	7.02	1457	A	34	A	0.65			PO4C	353
17/10/69	05.4		CYR1		37-31.5	76-52.2	8.0					05	02.0			R	7.28	1457	A	34	A	0.11				353
17/10/69	05.4		CYR1		37-31.5	76-52.2	8.0					05	04.0			R	7.46	1457	A	31	A	0.10				353
17/10/69	05.4		CYR1		37-31.5	76-52.2	8.0					05	06.0			R	7.52	1457	A	32	A	0.03				353
17/10/69	05.4		CYR1		37-31.5	76-52.2	8.0					05	08.0			R	7.53	1457	A	33	A	0.03				353
17/10/69	06.1		CYR1		37-31.5	76-52.2	7.0					05	00.0	T	18.6	R	5.66	1458	A	12	A	0.42			PO4C	353
17/10/69	06.1		CYR1		37-31.5	76-52.2	7.0					05	02.0			R	6.61	1458	A	12	A	0.38				353
17/10/69	06.1		CYR1		37-31.5	76-52.2	7.0					05	04.0			R	7.12	1458	A	12	A	0.24				353
17/10/69	06.1		CYR1		37-31.5	76-52.2	7.0					05	06.0			R	7.41	1458	A	12	A	0.13				353
17/10/69	06.1		CYR1		37-31.5	76-52.2	7.0					05	07.0			R	7.45	1458	A	12	A	0.10				353

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCD	I	CR	I	VEL	I	DO	COL	STA
17/10/69	C6.7		CYR1		37-31.5	76-52.2	7.C						C5	CC.C	T	19.3	R	5.74	1459	A	12	A	C.58			PO4C	353
17/10/69	C6.7		CYR1		37-31.5	76-52.2	7.C						C5	C2.C			R	6.C5	1459	A	15	A	0.58				353
17/10/69	C6.7		CYR1		37-31.5	76-52.2	7.C						C5	C4.C			R	6.7C	1459	A	13	A	0.43				353
17/1C/69	C6.7		CYR1		37-31.5	76-52.2	7.C						C5	C6.C			R	7.C5	1459	A	13	A	C.26				353
17/1C/69	C6.7		CYR1		37-31.5	76-52.2	7.C						C5	C7.C			R	7.15	1459	A	14	A	C.25				353
17/10/69	C7.7		CYR1		37-31.5	76-52.2	7.C						C5	CC.C			R	4.28	1460	A	13	A	C.8C			PO4C	353
17/10/69	C7.7		CYR1		37-31.5	76-52.2	7.C						C5	C2.C			R	5.26	1460	A	13	A	C.75				353
17/1C/69	C7.7		CYR1		37-31.5	76-52.2	7.C						C5	C4.C			R	5.74	146C	A	14	A	C.6C				353
17/1C/69	C7.7		CYR1		37-31.5	76-52.2	7.C						C5	C6.C			R	5.93	146C	A	15	A	C.42				353
17/10/69	C7.7		CYR1		37-31.5	76-52.2	7.C						C5	C7.C			R	5.9C	1460	A	15	A	C.32				353
17/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C5	CC.C	T	19.4	R	4.15	1461	A	14	A	C.80			PO4C	353
17/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C5	C2.C			R	4.27	1461	A	13	A	C.75				353
17/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C5	C4.C			R	4.86	1461	A	14	A	C.55				353
17/10/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C5	C6.C			R	5.C3	1461	A	14	A	C.39				353
17/1C/69	C8.7		CYR1		37-31.5	76-52.2	7.C						C5	C7.C			R	5.C5	1461	A	15	A	C.29				353
17/10/69	C9.9		CYR1		37-31.5	76-52.2	7.C						C5	CC.C	T	19.6	R	3.66	1462	A	13	A	0.55			PO4C	353
17/10/69	C9.9		CYR1		37-31.5	76-52.2	7.C						C5	C2.C			R	3.67	1462	A	13	A	C.55				353
17/10/69	C9.9		CYR1		37-31.5	76-52.2	7.C						C5	C4.C			R	3.98	1462	A	13	A	C.44				353
17/10/69	C9.9		CYR1		37-31.5	76-52.2	7.C						C5	C6.C			R	3.75	1462	A	13	A	C.3C				353
17/1C/69	C9.9		CYR1		37-31.5	76-52.2	7.C						C5	C7.C			R	3.73	1462	A	14	A	C.19				353

CA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCD I CR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
16/10/69	08.5		CYR1		37-32.5	76-50.0	5.0						03	00.0	H	19.5	R	6.69	1463	Y	06	Y	0.81			P03A	361
16/10/69	08.5		CYR1		37-32.5	76-50.0	5.0						03	02.0	H	19.6	R	6.83	1463	Y	06	Y	0.63				361
16/10/69	08.5		CYR1		37-32.5	76-50.0	5.0						03	04.0	H	19.6	R	6.99	1463	Y	06	Y	0.50				361
16/10/69	09.5		CYR1		37-32.5	76-50.0	6.0						04	00.0	H	19.6	R	5.51	1464	Y	07	Y	0.63			P03A	361
16/10/69	09.5		CYR1		37-32.5	76-50.0	6.0						04	02.0	H	19.6	R	6.03	1464	Y	07	Y	0.41				361
16/10/69	09.5		CYR1		37-32.5	76-50.0	6.0						04	04.0	H	19.6	R	6.16	1464	Y	07	Y	0.13				361
16/10/69	09.5		CYR1		37-32.5	76-50.0	6.0						04	05.0	H	19.6	R	6.22	1464	Y	07	Y	0.75				361
16/10/69	10.5		CYR1		37-32.5	76-50.0	6.0						04	00.0	H	19.7	R	4.92	1465	Y	07	Y	0.30			P03A	361
16/10/69	10.5		CYR1		37-32.5	76-50.0	6.0						04	02.0	H	19.6	R	5.32	1465	Y	08	Y	0.14				361
16/10/69	10.5		CYR1		37-32.5	76-50.0	6.0						04	04.0	H	19.6	R	5.75	1465	Y	36	Y	0.03				361
16/10/69	10.5		CYR1		37-32.5	76-50.0	6.0						04	05.0	H	19.6	R	6.04	1465	Y	27	Y	0.10				361
16/10/69	11.5		CYR1		37-32.5	76-50.0	6.0						04	00.0	H	19.8	R	5.30	1466	Y	29	Y	0.13			P03A	361
16/10/69	11.5		CYR1		37-32.5	76-50.0	6.0						04	02.0	H	19.8	R	5.61	1466	Y	28	Y	0.30				361
16/10/69	11.5		CYR1		37-32.5	76-50.0	6.0						04	04.0	H	19.8	R	6.21	1466	Y	24	Y	0.41				361
16/10/69	11.5		CYR1		37-32.5	76-50.0	6.0						04	05.0	H	19.8	R	6.59	1466	Y	23	Y	0.31				361
16/10/69	12.5		CYR1		37-32.5	76-50.0	7.0						04	00.0	H	19.6	R	6.03	1467	Y	36	Y	0.50			P03A	361
16/10/69	12.5		CYR1		37-32.5	76-50.0	7.0						04	02.0	H	19.6	R	6.67	1467	Y	25	Y	0.63				361
16/10/69	12.5		CYR1		37-32.5	76-50.0	7.0						04	04.0	H	19.6	R	7.12	1467	Y	25	Y	0.56				361
16/10/69	12.5		CYR1		37-32.5	76-50.0	7.0						04	06.0	H	19.6	R	7.14	1467	Y	24	Y	0.31				361

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	13.5		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.9	R	8.C2	1468	Y	24	Y	C.87			P03A	361
16/10/69	13.5		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.8	R	8.28	1468	Y	25	Y	C.88				361
16/10/69	13.5		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.8	R	8.3C	1468	Y	25	Y	C.63				361
16/10/69	13.5		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.8	R	8.27	1468	Y	25	Y	C.48				361
16/10/69	14.5		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.8	R	9.84	1469	Y	24	Y	C.83			P03A	361
16/10/69	14.5		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.8	R	9.74	1469	Y	25	Y	0.75				361
16/10/69	14.5		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.8	R	9.82	1469	Y	25	Y	C.56				361
16/10/69	14.5		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.8	R	9.77	1469	Y	25	Y	C.48				361
16/10/69	15.5		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.7	R	1C.65	1470	Y	24	Y	C.75			P03A	361
16/10/69	15.5		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.7	R	1C.78	1470	Y	24	Y	C.69				361
16/1C/69	15.5		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.6	R	1C.82	1470	Y	25	Y	0.56				361
16/10/69	15.5		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.6	R	10.82	1470	Y	26	Y	C.38				361
16/10/69	16.5		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.6	R	11.12	1471	Y	24	Y	C.45			P03A	361
16/10/69	16.5		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.6	R	11.17	1471	Y	23	Y	C.4C				361
16/1C/69	16.5		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.5	R	11.22	1471	Y	24	Y	C.33				361
16/10/69	16.5		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.5	R	11.28	1471	Y	24	Y	C.2C				361
16/10/69	17.5		CYR1		37-32.5	76-5C.C	6.C					C4	CC.C	H	19.5	R	8.68	1472	Y	C7	Y	C.25			P03A	361
16/10/69	17.5		CYR1		37-32.5	76-5C.C	6.C					C4	C2.C	H	19.6	R	1C.88	1472	Y	C6	Y	C.C5				361
16/10/69	17.5		CYR1		37-32.5	76-5C.C	6.C					C4	C4.C	H	19.5	R	11.22	1472	Y	C4	Y	C.C8				361
16/1C/69	17.5		CYR1		37-32.5	76-5C.C	6.C					C4	05.C	H	19.5	R	11.26	1472	Y	C3	Y	C.C9				361

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCD	I	CR	I	VEL	I	DO	COL	STA
16/10/69	18.5		CYR1		37-32.5	76-50.0	7.0					04	00.0	H	19.5	R	9.43	1473	Y	08	Y	0.55			P03A	361
16/10/69	18.5		CYR1		37-32.5	76-50.0	7.0					04	02.0	H	19.5	R	10.88	1473	Y	07	Y	0.46				361
16/10/69	18.5		CYR1		37-32.5	76-50.0	7.0					04	04.0	H	19.5	R	10.99	1473	Y	07	Y	0.38				361
16/10/69	18.5		CYR1		37-32.5	76-50.0	7.0					04	06.0	H	19.5	R	11.03	1473	Y	06	Y	0.30				361
16/10/69	19.5		CYR1		37-32.5	76-50.0	6.0					04	00.0	H	19.5	R	8.70	1474	Y	06	Y	1.00			P03A	361
16/10/69	19.5		CYR1		37-32.5	76-50.0	6.0					04	02.0	H	19.6	R	9.73	1474	Y	06	Y	0.68				361
16/10/69	19.5		CYR1		37-32.5	76-50.0	6.0					04	04.0	H	19.7	R	10.27	1474	Y	06	Y	0.60				361
16/10/69	19.5		CYR1		37-32.5	76-50.0	6.0					04	05.0	H	19.7	R	10.36	1474	Y	06	Y	0.48				361
16/10/69	20.5		CYR1		37-32.5	76-50.0	6.0					04	00.0	H	19.7	R	8.77	1475	Y	06	Y	0.10			P03A	361
16/10/69	20.5		CYR1		37-32.5	76-50.0	6.0					04	02.0	H	19.7	R	9.09	1475	Y	07	Y	0.70				361
16/10/69	20.5		CYR1		37-32.5	76-50.0	6.0					04	04.0	H	19.7	R	9.26	1475	Y	07	Y	0.60				361
16/10/69	20.5		CYR1		37-32.5	76-50.0	6.0					04	05.0	H	19.8	R	9.32	1475	Y	06	Y	0.43				361
16/10/69	21.5		CYR1		37-32.5	76-50.0	5.5					04	00.0	H	19.7	R	7.82	1476	Y	07	Y	0.73			P03A	361
16/10/69	21.5		CYR1		37-32.5	76-50.0	5.5					04	02.0	H	19.7	R	7.87	1476	Y	07	Y	0.65				361
16/10/69	21.5		CYR1		37-32.5	76-50.0	5.5					04	04.0	H	19.7	R	7.92	1476	Y	07	Y	0.58				361
16/10/69	21.5		CYR1		37-32.5	76-50.0	5.5					04	05.0	H	19.7	R	7.86	1476	Y	06	Y	0.46				361
16/10/69	22.5		CYR1		37-32.5	76-50.0	5.5					04	00.0	H	19.6	R	6.85	1477	Y	07	Y	0.63			P03A	361
16/10/69	22.5		CYR1		37-32.5	76-50.0	5.5					04	02.0	H	19.6	R	6.96	1477	Y	07	Y	0.55				361
16/10/69	22.5		CYR1		37-32.5	76-50.0	5.5					04	04.0	H	19.7	R	7.01	1477	Y	07	Y	0.45				361
16/10/69	22.5		CYR1		37-32.5	76-50.0	5.5					04	05.0	H	19.7	R	7.04	1477	Y	07	Y	0.30				361

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCD I CR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA
16/10/69	23.5		CYR1		37-32.5	76-50.C	5.5						C4	CC.C	H	19.5	R	5.97	1478	Y	C7	Y	C.55			P03A	361
16/10/69	23.5		CYR1		37-32.5	76-50.0	5.5						04	C2.C	H	19.6	R	6.58	1478	Y	C7	Y	C.32				361
16/10/69	23.5		CYR1		37-32.5	76-5C.C	5.5						C4	C4.C	H	19.6	R	6.56	1478	Y	C7	Y	C.15				361
16/10/69	23.5		CYR1		37-32.5	76-5C.C	5.5						04	C5.C	H	19.7	R	6.61	1478	Y	C7	Y	C.C9				361
17/10/69	CC.5		CYR1		37-32.5	76-5C.C	5.5						C4	CC.C	H	19.5	R	5.46	1479	Y	07	Y	C.23			P03A	361
17/10/69	CC.5		CYR1		37-32.5	76-5C.C	5.5						C4	C2.C	H	19.6	R	5.93	1479	Y	C7	Y	C.C3				361
17/10/69	CC.5		CYR1		37-32.5	76-5C.C	5.5						C4	C4.C	H	19.7	R	6.41	1479	Y	26	Y	C.15				361
17/10/69	CC.5		CYR1		37-32.5	76-5C.C	5.5						C4	C5.C	H	19.7	R	6.76	1479	Y	26	Y	C.14				361
17/10/69	C1.5		CYR1		37-32.5	76-50.C	6.C						C4	CC.C	H	19.4	R	5.56	1480	Y	27	Y	C.16			P03A	361
17/10/69	C1.5		CYR1		37-32.5	76-50.C	6.C						04	C2.C	H	19.5	R	6.C2	148C	Y	26	Y	C.28				361
17/10/69	C1.5		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.6	R	6.47	1480	Y	25	Y	C.38				361
17/10/69	C1.5		CYR1		37-32.5	76-5C.C	6.C						C4	C5.C	H	19.5	R	6.63	1480	Y	23	Y	C.25				361
17/10/69	C2.5		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.5	R	6.38	1481	Y	24	Y	C.48			P03A	361
17/10/69	C2.5		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.6	R	7.14	1481	Y	25	Y	C.55				361
17/10/69	C2.5		CYR1		37-32.5	76-50.C	6.C						C4	C4.C	H	19.7	R	7.53	1481	Y	25	Y	C.43				361
17/10/69	C2.5		CYR1		37-32.5	76-50.C	6.C						C4	C5.C	H	19.7	R	7.6C	1481	Y	25	Y	C.35				361
17/10/69	C3.5		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.4	R	7.61	1482	Y	25	Y	C.6C			P03A	361
17/10/69	C3.5		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.6	R	8.C9	1482	Y	25	Y	C.53				361
17/10/69	C3.5		CYR1		37-32.5	76-5C.C	6.C						04	C4.C	H	19.6	R	8.29	1482	Y	25	Y	C.45				361
17/10/69	C3.5		CYR1		37-32.5	76-5C.C	6.C						C4	C5.C	H	19.6	R	8.35	1482	Y	25	Y	C.35				361

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCD	I	DR	I	VEL	I	DC	COL	STA
17/10/69	04.5		CYR1		37-32.5	76-50.0	6.0					04	00.0	H	19.3	R	8.23	1483	Y	24	Y	0.41			P03A	361
17/10/69	04.5		CYR1		37-32.5	76-50.0	6.0					04	02.0	H	19.6	R	8.84	1483	Y	24	Y	0.36				361
17/10/69	04.5		CYR1		37-32.5	76-50.0	6.0					04	04.0	H	19.6	R	9.17	1483	Y	25	Y	0.26				361
17/10/69	04.5		CYR1		37-32.5	76-50.0	6.0					04	05.0	H	19.6	R	9.21	1483	Y	26	Y	0.19				361
17/10/69	05.5		CYR1		37-32.5	76-50.0	6.0					03	00.0	H	19.2	R	8.29	1484	Y	07	Y	0.50			P03A	361
17/10/69	05.5		CYR1		37-32.5	76-50.0	6.0					03	02.0	H	19.5	R	8.47	1484	Y	12	Y	0.09				361
17/10/69	05.5		CYR1		37-32.5	76-50.0	6.0					03	04.0	H	19.5	R	9.57	1484	Y	04	Y	0.05				361
17/10/69	06.6		CYR1		37-32.5	76-50.0	6.0					03	00.0	H	19.0	R	7.38	1485	Y	07	Y	0.45			P03A	361
17/10/69	06.6		CYR1		37-32.5	76-50.0	6.0					03	02.0	H	19.5	R	8.69	1485	Y	07	Y	0.40				361
17/10/69	06.6		CYR1		37-32.5	76-50.0	6.0					03	04.0	H	19.6	R	9.07	1485	Y	06	Y	0.25				361
17/10/69	07.6		CYR1		37-32.5	76-50.0	6.0					03	00.0	H	19.2	R	6.87	1486	Y	07	Y	0.45			P03A	361
17/10/69	07.6		CYR1		37-32.5	76-50.0	6.0					03	02.0	H	19.4	R	7.83	1486	Y	07	Y	0.60				361
17/10/69	07.6		CYR1		37-32.5	76-50.0	6.0					03	04.0	H	19.5	R	8.12	1486	Y	06	Y	0.40				361
17/10/69	08.5		CYR1		37-32.5	76-50.0	6.0					03	00.0	H	19.0	R	6.57	1487	Y	06	Y	0.43			P03A	361
17/10/69	08.5		CYR1		37-32.5	76-50.0	6.0					03	02.0	H	19.4	R	6.88	1487	Y	07	Y	0.60				361
17/10/69	08.5		CYR1		37-32.5	76-50.0	6.0					03	04.0	H	19.4	R	7.15	1487	Y	06	Y	0.40				361
17/10/69	09.5		CYR1		37-32.5	76-50.0	6.0					03	00.0	H	19.0	R	5.58	1488	Y	07	Y	0.80			P03A	361
17/10/69	09.5		CYR1		37-32.5	76-50.0	6.0					03	02.0	H	19.3	R	5.77	1488	Y	08	Y	0.45				361
17/10/69	09.5		CYR1		37-32.5	76-50.0	6.0					03	04.0	H	19.4	R	6.38	1488	Y	06	Y	0.28				361

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCD I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	C8.7		CYR1		37-32.5	76-5C.C	5.C						C4	CC.C	⊢	19.C	R	6.29	1489	Y	C7	Y	C.83			P03B	362
16/10/69	C8.7		CYR1		37-32.5	76-5C.C	5.C						C4	C2.C	⊢	19.C	R	6.73	1489	Y	C7	Y	C.60	B	4.46		362
16/10/69	C8.7		CYR1		37-32.5	76-5C.C	5.C						C4	C4.C	⊢	19.C	R	6.82	1489	Y	C7	Y	C.75				362
16/10/69	C8.7		CYR1		37-32.5	76-5C.C	5.C						C4	C5.C	⊢	19.C	R	6.93	1489	Y	C6	Y	C.25				362
16/1C/69	C9.6		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	⊢	19.1	R	5.28	149C	Y	C8	Y	C.55			P03B	362
16/1C/69	C9.6		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	⊢	19.4	R	5.68	149C	Y	C7	Y	C.39	B	5.2C		362
16/1C/69	C9.6		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	⊢	19.6	R	6.07	149C	Y	C7	Y	C.21				362
16/1C/69	C9.6		CYR1		37-32.5	76-50.C	6.C						04	05.C	⊢	19.6	R	6.31	149C	Y	C7	Y	C.11				362
16/1C/69	1C.6		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	⊢	19.3	R	4.93	1491	Y	1C	Y	C.2C			P03B	362
16/1C/69	1C.6		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	⊢	19.4	R	5.44	1491	Y	C9	Y	C.1C	B	5.26		362
16/1C/69	1C.6		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	⊢	19.6	R	5.96	1491	Y	23	Y	C.12				362
16/1C/69	1C.6		CYR1		37-32.5	76-5C.C	6.C						C4	05.C	⊢	19.6	R	6.14	1491	Y	24	Y	C.13				362
16/1C/69	11.6		CYR1		37-32.5	76-5C.C	7.C						C4	CC.C	⊢	19.6	R	5.55	1492	Y	27	Y	C.25			P03B	362
16/1C/69	11.6		CYR1		37-32.5	76-5C.C	7.C						C4	C2.C	⊢	19.6	R	5.82	1492	Y	26	Y	C.30	B	5.14		362
16/1C/69	11.6		CYR1		37-32.5	76-5C.C	7.C						C4	C4.C	⊢	19.5	R	6.73	1492	Y	26	Y	C.38				362
16/10/69	11.6		CYR1		37-32.5	76-5C.C	7.C						C4	C6.C	⊢	19.5	R	6.94	1492	Y	25	Y	C.25				362
16/10/69	12.6		CYR1		37-32.5	76-5C.C	7.C						C4	CC.C	⊢	19.2	R	6.59	1493	Y	26	Y	C.56			P03B	362
16/10/69	12.6		CYR1		37-32.5	76-5C.C	7.C						C4	C2.C	⊢	19.5	R	5.98	1493	Y	25	Y	C.63	B	5.26		362
16/10/69	12.6		CYR1		37-32.5	76-5C.C	7.C						C4	C4.C	⊢	19.6	R	6.C4	1493	Y	25	Y	C.5C				362
16/1C/69	12.6		CYR1		37-32.5	76-50.C	7.C						C4	C6.C	⊢	19.6	R	7.15	1493	Y	26	Y	C.33				362

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA
16/10/69	13.6		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.5	R	8.4C	1494	Y	24	Y	C.39			P03B	362
16/10/69	13.6		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.7	R	8.59	1494	Y	24	Y	C.81	B	5.18		362
16/10/69	13.6		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.7	R	8.57	1494	Y	25	Y	C.51				362
16/10/69	13.6		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.7	R	8.54	1494	Y	26	Y	C.45				362
16/10/69	14.7		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.6	R	9.82	1495	Y	24	Y	C.94			P03B	362
16/10/69	14.7		CYR1		37-32.5	76-50.C	7.C					C4	C2.C	H	19.6	R	9.98	1495	Y	24	Y	C.75				362
16/10/69	14.7		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.6	R	9.98	1495	Y	25	Y	C.75				362
16/10/69	14.7		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.6	R	9.97	1495	Y	25	Y	0.56				362
16/10/69	15.6		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.6	R	1C.7C	1496	Y	25	Y	C.81			P03B	362
16/10/69	15.6		CYR1		37-32.5	76-50.C	7.C					C4	C2.C	H	19.6	R	1C.83	1496	Y	24	Y	C.63	B	5.94		362
16/10/69	15.6		CYR1		37-32.5	76-50.C	7.C					C4	C4.C	H	19.6	R	10.84	1496	Y	25	Y	C.56				362
16/10/69	15.6		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.6	R	10.84	1496	Y	24	Y	C.33				362
16/10/69	16.6		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.2	R	1C.73	1497	Y	22	Y	C.26			P03B	362
16/10/69	16.6		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.6	R	11.C1	1497	Y	23	Y	0.38	B	5.98		362
16/10/69	16.6		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.6	R	11.12	1497	Y	23	Y	C.26				362
16/10/69	16.6		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.6	R	11.14	1497	Y	24	Y	C.18				362
16/10/69	17.7		CYR1		37-32.5	76-5C.C	7.C					C4	CC.C	H	19.5	R	8.55	1498	Y	C7	Y	C.27			P03B	362
16/10/69	17.7		CYR1		37-32.5	76-5C.C	7.C					C4	C2.C	H	19.5	R	10.76	1498	Y	C9	Y	C.1C	B	6.1C		362
16/10/69	17.7		CYR1		37-32.5	76-5C.C	7.C					C4	C4.C	H	19.5	R	11.27	1498	Y	C8	Y	C.13				362
16/10/69	17.7		CYR1		37-32.5	76-5C.C	7.C					C4	C6.C	H	19.5	R	11.29	1498	Y	C6	Y	C.C9				362

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC CCL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
16/10/69	18.7		CYR1		37-32.5	76-50.0	7.0						04	00.0	F	19.3	R	8.93	1499	Y	08	Y	0.60			P03B	362
16/10/69	18.7		CYR1		37-32.5	76-50.0	7.0						04	02.0	F	19.6	R	10.53	1499	Y	07	Y	0.55	B	6.20		362
16/10/69	18.7		CYR1		37-32.5	76-50.0	7.0						04	04.0	F	19.6	R	10.53	1499	Y	07	Y	0.45				362
16/10/69	18.7		CYR1		37-32.5	76-50.0	7.0						04	06.0	F	19.6	R	10.51	1499	Y	06	Y	0.24				362
16/10/69	19.7		CYR1		37-32.5	76-50.0	7.0						04	00.0	F	19.4	R	9.02	1500	Y	06	Y	0.10			P03B	362
16/10/69	19.7		CYR1		37-32.5	76-50.0	7.0						04	02.0	F	19.7	R	10.07	1500	Y	06	Y	0.70	B	5.08		362
16/10/69	19.7		CYR1		37-32.5	76-50.0	7.0						04	04.0	F	19.7	R	10.34	1500	Y	06	Y	0.60				362
16/10/69	19.7		CYR1		37-32.5	76-50.0	7.0						04	06.0	F	19.7	R	10.30	1500	Y	06	Y	0.46				362
16/10/69	20.7		CYR1		37-32.5	76-50.0	6.0						04	00.0	F	19.6	R	9.23	1501	Y	06	Y	0.93			P03B	362
16/10/69	20.7		CYR1		37-32.5	76-50.0	6.0						04	02.0	F	19.7	R	8.91	1501	Y	07	Y	0.63	B	4.76		362
16/10/69	20.7		CYR1		37-32.5	76-50.0	6.0						04	04.0	F	19.8	R	9.31	1501	Y	07	Y	0.53				362
16/10/69	20.7		CYR1		37-32.5	76-50.0	6.0						04	05.0	F	19.8	R	9.30	1501	Y	06	Y	0.35				362
16/10/69	21.6		CYR1		37-32.5	76-50.0	5.5						04	00.0	F	19.7	R	7.64	1502	Y	07	Y	0.42			P03B	362
16/10/69	21.6		CYR1		37-32.5	76-50.0	5.5						04	02.0	F	19.7	R	7.70	1502	Y	07	Y	0.58	B	4.20		362
16/10/69	21.6		CYR1		37-32.5	76-50.0	5.5						04	04.0	F	19.7	R	7.79	1502	Y	07	Y	0.39				362
16/10/69	21.6		CYR1		37-32.5	76-50.0	5.5						04	05.0	F	19.7	R	7.85	1502	Y	06	Y	0.33				362
16/10/69	22.6		CYR1		37-32.5	76-50.0	5.5						04	00.0	F	19.5	R	6.64	1503	Y	07	Y	0.70			P03B	362
16/10/69	22.6		CYR1		37-32.5	76-50.0	5.5						04	02.0	F	19.6	R	6.94	1503	Y	07	Y	0.58	B	4.54		362
16/10/69	22.6		CYR1		37-32.5	76-50.0	5.5						04	04.0	F	19.7	R	7.08	1503	Y	07	Y	0.35				362
16/10/69	22.6		CYR1		37-32.5	76-50.0	5.5						04	05.0	F	19.7	R	7.14	1503	Y	07	Y	0.21				362

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA
16/10/69	23.6		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.5	R	5.88	1504	Y	07	Y	C.5C			P03B	362
16/10/69	23.6		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.6	R	6.16	1504	Y	07	Y	C.3C	B	4.74		362
16/10/69	23.6		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.6	R	6.59	15C4	Y	C7	Y	C.15				362
16/10/69	23.6		CYR1		37-32.5	76-5C.C	6.C						C4	C5.C	H	19.7	R	6.67	15C4	Y	C6	Y	C.C6				362
17/10/69	CC.6		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.4	R	5.50	15C5	Y	C7	Y	C.16			P03B	362
17/10/69	CC.6		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.6	R	6.C7	1505	Y	33	Y	C.C5	B	4.86		362
17/10/69	CC.6		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.6	R	6.35	1505	Y	28	Y	C.C9				362
17/10/69	CC.6		CYR1		37-32.5	76-5C.C	6.C						C4	05.C	H	19.6	R	6.57	1505	Y	26	Y	C.C6				362
17/10/69	C1.6		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.3	R	6.C2	1506	Y	23	Y	0.23			P03B	362
17/10/69	C1.6		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.5	R	6.1C	1506	Y	25	Y	C.38	B	5.C6		362
17/10/69	C1.6		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.5	R	6.82	15C6	Y	24	Y	C.35				362
17/10/69	C1.6		CYR1		37-32.5	76-5C.C	6.C						C4	05.C	H	19.5	R	6.86	15C6	Y	24	Y	C.28				362
17/10/69	C2.7		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.3	R	6.52	1507	Y	26	Y	C.49			P03B	362
17/10/69	C2.7		CYR1		37-32.5	76-5C.C	6.C						C4	C2.C	H	19.6	R	7.C2	15C7	Y	24	Y	C.53				362
17/10/69	C2.7		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.6	R	7.85	1507	Y	24	Y	C.43				362
17/10/69	C2.7		CYR1		37-32.5	76-5C.C	6.C						C4	05.C	H	19.6	R	7.86	1507	Y	25	Y	0.33				362
17/10/69	C3.7		CYR1		37-32.5	76-5C.C	6.C						C4	CC.C	H	19.2	R	7.62	1508	Y	25	Y	C.58			P03B	362
17/10/69	C3.7		CYR1		37-32.5	76-50.C	6.C						C4	C2.C	H	19.5	R	8.03	1508	Y	24	Y	C.6C				362
17/10/69	C3.7		CYR1		37-32.5	76-5C.C	6.C						C4	C4.C	H	19.6	R	8.55	15C8	Y	24	Y	C.45				362
17/10/69	C3.7		CYR1		37-32.5	76-5C.C	6.C						C4	C5.C	H	19.6	R	8.59	1508	Y	25	Y	0.33				362

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT WD WV DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
17/10/69	C4.5		CYR1		37-32.5	76-50.C	6.C		C4	CC.C	⊦	19.2	R	8.13	1509	Y	25	Y	C.29			P03B	362
17/10/69	C4.5		CYR1		37-32.5	76-50.C	6.C		C4	C2.C	⊦	19.6	R	8.7C	15C9	Y	24	Y	C.39	B	4.64		362
17/10/69	C4.5		CYR1		37-32.5	76-5C.C	6.C		C4	C4.C	⊦	19.6	R	9.34	1509	Y	25	Y	C.27				362
17/10/69	C4.5		CYR1		37-32.5	76-5C.C	6.C		C4	C5.C	⊦	19.6	R	9.43	1509	Y	26	Y	C.22				362
17/10/69	C5.9		CYR1		37-32.5	76-5C.C	7.C		C4	CC.C	⊦	18.3	R	8.22	1510	Y	C6	Y	C.2C			P03B	362
17/10/69	C5.9		CYR1		37-32.5	76-5C.C	7.C		C4	C2.C	⊦	19.4	R	8.76	151C	Y	C8	Y	0.16	B	4.1C		362
17/10/69	C5.9		CYR1		37-32.5	76-5C.C	7.C		C4	C4.C	⊦	19.5	R	9.38	151C	Y	C5	Y	C.11				362
17/10/69	C5.9		CYR1		37-32.5	76-5C.C	7.C		C4	C6.C	⊦	19.5	R	9.44	151C	Y	C6	Y	C.C7				362
17/10/69	C6.7		CYR1		37-32.5	76-5C.C	7.C		C4	CC.C	⊦	18.1	R	7.56	1511	Y	C7	Y	C.5C			P03B	362
17/10/69	C6.7		CYR1		37-32.5	76-50.C	7.C		C4	C2.C	⊦	19.1	R	8.41	1511	Y	C6	Y	C.4C	B	4.02		362
17/10/69	C6.7		CYR1		37-32.5	76-5C.C	7.C		C4	C4.C	⊦	19.4	R	8.93	1511	Y	C6	Y	C.33				362
17/10/69	C6.7		CYR1		37-32.5	76-5C.C	7.C		C4	C6.C	⊦	19.5	R	9.C2	1511	Y	C5	Y	C.33				362
17/10/69	C7.7		CYR1		37-32.5	76-5C.C	6.C		C3	CC.C	⊦	18.7	R	6.75	1512	Y	C6	Y	C.43			P03B	362
17/10/69	C7.7		CYR1		37-32.5	76-5C.C	6.C		C3	C2.C	⊦	19.3	R	7.56	1512	Y	C7	Y	C.5C	B	4.41		362
17/10/69	C7.7		CYR1		37-32.5	76-50.C	6.C		C3	C4.C	⊦	19.5	R	8.22	1512	Y	C6	Y	C.38				362
17/10/69	C8.7		CYR1		37-32.5	76-50.C	6.C		C3	CC.C	⊦	18.9	R	6.18	1513	Y	C7	Y	C.4C			P03B	362
17/10/69	C8.7		CYR1		37-32.5	76-50.C	6.C		C3	C2.C	⊦	19.3	R	6.54	1513	Y	C7	Y	C.55	B	4.73		362
17/10/69	C8.7		CYR1		37-32.5	76-5C.C	6.C		C3	C4.C	⊦	19.4	R	7.37	1513	Y	C6	Y	C.35				362

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	C9.7		CYR1		37-32.5	76-5C.C	6.C						C3	CC.C	⊢	19.4	R	5.11	1514	Y	C7	Y	C.7C			P03B	362
17/10/69	C9.7		CYR1		37-32.5	76-5C.C	6.C						C3	C2.C	⊢	19.4	R	5.42	1514	Y	C7	Y	C.5C	B	3.72		362
17/10/69	C9.7		CYR1		37-32.5	76-5C.C	6.C						C3	C4.C	⊢	19.4	R	6.26	1514	Y	C6	Y	C.3C				362
16/10/69	C8.9		CYR1		37-32.4	76-49.9	5.C						C3	CC.C	⊢	19.1	R	6.C8	1515	Y	C8	Y	C.71			P03C	363
16/10/69	C8.9		CYR1		37-32.4	76-49.9	5.C						C3	C2.C	⊢	19.4	R	6.25	1515	Y	C7	Y	C.69				363
16/10/69	C8.9		CYR1		37-32.4	76-49.9	5.C						C3	C4.C	⊢	19.5	R	6.62	1515	Y	07	Y	0.65				363
16/10/69	C9.7		CYR1		37-32.4	76-49.9	6.C						C4	CC.C	⊢	19.4			1516	Y	C8	Y	C.45			P03C	363
16/10/69	C9.7		CYR1		37-32.4	76-49.9	6.C						C4	C2.C	⊢	19.3			1516	Y	C7	Y	C.23				363
16/10/69	C9.7		CYR1		37-32.4	76-49.9	6.C						C4	C4.C	⊢	19.4			1516	Y	C6	Y	C.25				363
16/10/69	C9.7		CYR1		37-32.4	76-49.9	6.C						C4	05.C	⊢	19.5			1516	Y	C6	Y	C.C5				363
16/10/69	1C.7		CYR1		37-32.4	76-49.9	6.C						C4	CC.C	⊢	19.5	R	5.42	1517	Y	18	Y	C.C5			P03C	363
16/10/69	1C.7		CYR1		37-32.4	76-49.9	6.C						C4	C2.C	⊢	19.5	R	5.76	1517	Y	23	Y	C.14				363
16/10/69	1C.7		CYR1		37-32.4	76-49.9	6.C						C4	C4.C	⊢	19.4	R	6.C9	1517	Y	21	Y	C.31				363
16/10/69	1C.7		CYR1		37-32.4	76-49.9	6.C						C4	C5.C	⊢	19.5	R	6.3C	1517	Y	21	Y	C.26				363
16/10/69	11.7		CYR1		37-32.4	76-49.9	7.C						C4	CC.C	⊢	19.4	R	5.58	1518	Y	24	Y	C.33			P03C	363
16/1C/69	11.7		CYR1		37-32.4	76-49.9	7.C						C4	C2.C	⊢	19.4	R	6.41	1518	Y	25	Y	C.45				363
16/1C/69	11.7		CYR1		37-32.4	76-49.9	7.C						C4	C4.C	⊢	19.3	R	7.13	1518	Y	24	Y	C.5C				363
16/1C/69	11.7		CYR1		37-32.4	76-49.9	7.C						C4	C6.C	⊢	19.2	R	6.93	1518	Y	25	Y	C.35				363

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	CV	NO	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
16/10/69	12.7		CYR1		37-32.4	76-49.9	7.0					04	00.0	F	19.2	R	6.27	1519	Y	26	Y	0.56			P03C	363
16/10/69	12.7		CYR1		37-32.4	76-49.9	7.0					04	02.0	F	19.6	R	7.15	1519	Y	25	Y	0.75				363
16/10/69	12.7		CYR1		37-32.4	76-49.9	7.0					04	04.0	F	19.6	R	6.27	1519	Y	25	Y	0.63				363
16/10/69	12.7		CYR1		37-32.4	76-49.9	7.0					04	06.0	F	19.6	R	6.69	1519	Y	25	Y	0.50				363
16/10/69	13.7		CYR1		37-32.4	76-49.9	7.0					04	00.0	F	19.8	R	8.40	1520	Y	24	Y	0.88			P03C	363
16/10/69	13.7		CYR1		37-32.4	76-49.9	7.0					04	02.0	F	19.9	R	8.59	1520	Y	25	Y	0.75				363
16/10/69	13.7		CYR1		37-32.4	76-49.9	7.0					04	04.0	F	19.8	R	8.57	1520	Y	25	Y	0.63				363
16/10/69	13.7		CYR1		37-32.4	76-49.9	7.0					04	06.0	F	19.8	R	8.54	1520	Y	25	Y	0.50				363
16/10/69	14.9		CYR1		37-32.4	76-49.9	7.0					04	00.0	F	19.7	R	9.97	1521	Y	26	Y	0.81			P03C	363
16/10/69	14.9		CYR1		37-32.4	76-49.9	7.0					04	02.0	F	19.7	R	10.07	1521	Y	24	Y	0.88				363
16/10/69	14.9		CYR1		37-32.4	76-49.9	7.0					04	04.0	F	19.8	R	10.13	1521	Y	25	Y	0.75				363
16/10/69	14.9		CYR1		37-32.4	76-49.9	7.0					04	06.0	F	19.8	R	10.22	1521	Y	24	Y	0.50				363
16/10/69	15.7		CYR1		37-32.4	76-49.9	7.0					04	00.0	F	19.5	R	9.77	1522	Y	26	Y	0.37			P03C	363
16/10/69	15.7		CYR1		37-32.4	76-49.9	7.0					04	02.0	F	19.7	R	10.21	1522	Y	24	Y	0.49				363
16/10/69	15.7		CYR1		37-32.4	76-49.9	7.0					04	04.0	F	19.7	R	10.78	1522	Y	24	Y	0.49				363
16/10/69	15.7		CYR1		37-32.4	76-49.9	7.0					04	06.0	F	19.6	R	10.83	1522	Y	25	Y	0.40				363
16/10/69	16.7		CYR1		37-32.4	76-49.9	7.0					04	00.0	F	19.5	R	9.28	1523	Y	23	Y	0.14			P03C	363
16/10/69	16.7		CYR1		37-32.4	76-49.9	7.0					04	02.0	F	19.6	R	11.04	1523	Y	24	Y	0.25				363
16/10/69	16.7		CYR1		37-32.4	76-49.9	7.0					04	04.0	F	19.5	R	11.25	1523	Y	23	Y	0.23				363
16/10/69	16.7		CYR1		37-32.4	76-49.9	7.0					04	06.0	F	19.5	R	11.26	1523	Y	24	Y	0.34				363

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NO DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
16/10/69	17.8		CYR1		37-32.4	76-49.9	7.C					C4	CC.C	F	19.4	R	9.C7	1524	Y	07	Y	C.37			P03C	363
16/10/69	17.8		CYR1		37-32.4	76-49.9	7.C					C4	C2.C	F	19.5	R	10.97	1524	Y	C7	Y	C.19				363
16/10/69	17.8		CYR1		37-32.4	76-49.9	7.C					C4	C4.C	F	19.5	R	11.18	1524	Y	C6	Y	C.21				363
16/10/69	17.8		CYR1		37-32.4	76-49.9	7.C					C4	C6.C	F	19.5	R	11.28	1524	Y	C5	Y	C.13				363
16/10/69	18.8		CYR1		37-32.4	76-49.9	7.C					C4	CC.C	F	19.C	R	9.06	1525	Y	C7	Y	C.7C			P03C	363
16/10/69	18.8		CYR1		37-32.4	76-49.9	7.C					C4	C2.C	F	19.6	R	10.44	1525	Y	C7	Y	C.6C				363
16/10/69	18.8		CYR1		37-32.4	76-49.9	7.C					C4	C4.C	F	19.6	R	10.73	1525	Y	C6	Y	C.48				363
16/10/69	18.8		CYR1		37-32.4	76-49.9	7.C					C4	C6.C	F	19.6	R	10.79	1525	Y	C6	Y	C.4C				363
16/10/69	19.8		CYR1		37-32.4	76-49.9	7.C					C4	CC.C	F	19.3	R	9.12	1526	Y	C6	Y	1.C5			P03C	363
16/10/69	19.8		CYR1		37-32.4	76-49.9	7.C					C4	C2.C	F	19.7	R	9.77	1526	Y	C6	Y	C.7C				363
16/10/69	19.8		CYR1		37-32.4	76-49.9	7.C					C4	C4.C	F	19.7	R	1C.22	1526	Y	C6	Y	C.6C				363
16/10/69	19.8		CYR1		37-32.4	76-49.9	7.C					C4	C6.C	F	19.7	R	1C.27	1526	Y	C6	Y	C.48				363
16/10/69	2C.8		CYR1		37-32.4	76-49.9	6.C					C4	CC.C	F	19.5	R	7.55	1527	Y	C6	Y	C.93			P03C	363
16/10/69	2C.8		CYR1		37-32.4	76-49.9	6.C					C4	C2.C	F	19.7	R	8.48	1527	Y	C7	Y	C.68				363
16/10/69	2C.8		CYR1		37-32.4	76-49.9	6.C					C4	C4.C	F	19.8	R	8.99	1527	Y	C6	Y	C.5C				363
16/10/69	2C.8		CYR1		37-32.4	76-49.9	6.C					C4	C5.C	F	19.8	R	9.CC	1527	Y	C6	Y	C.88				363
16/10/69	21.8		CYR1		37-32.4	76-49.9	6.C					C4	CC.C	F	19.5	R	7.19	1528	Y	08	Y	C.4C			P03C	363
16/10/69	21.8		CYR1		37-32.4	76-49.9	6.C					C4	C2.C	F	19.6	R	7.38	1528	Y	C8	Y	C.6C				363
16/10/69	21.8		CYR1		37-32.4	76-49.9	6.C					C4	C4.C	F	19.7	R	7.62	1528	Y	C7	Y	C.88				363
16/10/69	21.8		CYR1		37-32.4	76-49.9	6.C					C4	05.C	F	19.7	R	7.81	1528	Y	C7	Y	C.31				363

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
16/10/69	22.7		CYR1		37-32.4	76-49.9	6.C						C4	CC.C	⊢	19.5	R	6.71	1529	Y	C7	Y	C.53			P03C	363
16/10/69	22.7		CYR1		37-32.4	76-49.9	6.C						C4	C2.C	⊢	19.6	R	6.76	1529	Y	C7	Y	C.39				363
16/10/69	22.7		CYR1		37-32.4	76-49.9	6.C						C4	C4.C	⊢	19.6	R	6.86	1529	Y	C7	Y	C.5C				363
16/10/69	22.7		CYR1		37-32.4	76-49.9	6.C						C4	C5.C	⊢	19.6	R	6.93	1529	Y	C7	Y	C.6C				363
16/10/69	23.7		CYR1		37-32.4	76-49.9	6.C						C4	CC.C	⊢	19.4	R	5.94	1530	Y	C7	Y	C.38			P03C	363
16/10/69	23.7		CYR1		37-32.4	76-49.9	6.C						C4	C2.C	⊢	19.5	R	6.11	1530	Y	C7	Y	C.18				363
16/10/69	23.7		CYR1		37-32.4	76-49.9	6.C						C4	C4.C	⊢	19.6	R	6.38	1530	Y	04	Y	C.C3				363
16/10/69	23.7		CYR1		37-32.4	76-49.9	6.C						C4	C5.C	⊢	19.6	R	6.62	1530	Y	24	Y	C.C3				363
17/10/69	CC.8		CYR1		37-32.4	76-49.9	5.5						C4	CC.C	⊢	19.3	R	5.52	1531	Y	C7	Y	C.C9			P03C	363
17/10/69	CC.8		CYR1		37-32.4	76-49.9	5.5						C4	C2.C	⊢	19.5	R	5.89	1531	Y	32	Y	C.C5				363
17/10/69	CC.8		CYR1		37-32.4	76-49.9	5.5						C4	C4.C	⊢	19.5	R	6.37	1531	Y	25	Y	C.15				363
17/10/69	CC.8		CYR1		37-32.4	76-49.9	5.5						C4	C5.C	⊢	19.6	R	6.61	1531	Y	24	Y	C.13				363
17/10/69	C1.8		CYR1		37-32.4	76-49.9	6.5						C4	CC.C	⊢	19.3	R	5.82	1532	Y	23	Y	C.28			P03C	363
17/10/69	C1.8		CYR1		37-32.4	76-49.9	6.5						C4	C2.C	⊢	19.5	R	6.67	1532	Y	25	Y	C.5C				363
17/10/69	C1.8		CYR1		37-32.4	76-49.9	6.5						C4	C4.C	⊢	19.6	R	7.2C	1532	Y	25	Y	C.45				363
17/10/69	C1.8		CYR1		37-32.4	76-49.9	6.5						C4	C6.C	⊢	19.6	R	7.25	1532	Y	25	Y	C.25				363
17/10/69	C2.8		CYR1		37-32.4	76-49.9	6.C						C4	CC.C	⊢	19.4	R	6.81	1533	Y	25	Y	C.5C			P03C	363
17/10/69	C2.8		CYR1		37-32.4	76-49.9	6.C						C4	C2.C	⊢	19.5	R	7.19	1533	Y	25	Y	C.55				363
17/10/69	C2.8		CYR1		37-32.4	76-49.9	6.C						C4	C4.C	⊢	19.6	R	7.24	1533	Y	25	Y	C.5C				363
17/10/69	C2.8		CYR1		37-32.4	76-49.9	6.C						C4	C5.C	⊢	19.6	R	8.C9	1533	Y	25	Y	0.53				363

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC DPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
17/10/69	03.7		CYR1		37-32.4	76-49.9	6.0					04	00.0	H	19.1	R	7.60	1534	Y	24	Y	0.48			P03C	363
17/10/69	03.7		CYR1		37-32.4	76-49.9	6.0					04	02.0	H	19.5	R	7.85	1534	Y	24	Y	0.45				363
17/10/69	03.7		CYR1		37-32.4	76-49.9	6.0					04	04.0	H	19.6	R	7.95	1534	Y	25	Y	0.46				363
17/10/69	03.7		CYR1		37-32.4	76-49.9	6.0					04	05.0	H	19.6	R	8.92	1534	Y	24	Y	0.40				363
17/10/69	04.7		CYR1		37-32.4	76-49.9	6.0					04	00.0	H	19.1	R	8.16	1535	Y	27	Y	0.23			P03C	363
17/10/69	04.7		CYR1		37-32.4	76-49.9	6.0					04	02.0	H	19.5	R	9.18	1535	Y	25	Y	0.23				363
17/10/69	04.7		CYR1		37-32.4	76-49.9	6.0					04	04.0	H	19.6	R	9.38	1535	Y	24	Y	0.16				363
17/10/69	04.7		CYR1		37-32.4	76-49.9	6.0					04	05.0	H	19.6	R	9.41	1535	Y	24	Y	0.12				363
17/10/69	06.7		CYR1		37-32.4	76-49.9	7.0					04	00.0	H	19.1	R	7.54	1536	Y	09	Y	0.38			P03C	363
17/10/69	06.7		CYR1		37-32.4	76-49.9	7.0					04	02.0	H	19.2	R	8.22	1536	Y	07	Y	0.33				363
17/10/69	06.7		CYR1		37-32.4	76-49.9	7.0					04	04.0	H	19.5	R	8.81	1536	Y	07	Y	0.23				363
17/10/69	06.7		CYR1		37-32.4	76-49.9	7.0					04	05.0	H	19.5	R	9.25	1536	Y	07	Y	0.19				363
17/10/69	07.0		CYR1		37-32.4	76-49.9	6.5					04	00.0	H	18.9	R	7.79	1537	Y	07	Y	0.55			P03C	363
17/10/69	07.0		CYR1		37-32.4	76-49.9	6.5					04	02.0	H	19.3	R	7.90	1537	Y	07	Y	0.45				363
17/10/69	07.0		CYR1		37-32.4	76-49.9	6.5					04	04.0	H	19.5	R	8.63	1537	Y	06	Y	0.30				363
17/10/69	07.0		CYR1		37-32.4	76-49.9	6.5					04	05.0	H	19.5	R	8.78	1537	Y	06	Y	0.23				363
17/10/69	07.9		CYR1		37-32.4	76-49.9	6.5					04	00.0	H	18.8	R	6.34	1538	Y	07	Y	0.44			P03C	363
17/10/69	07.9		CYR1		37-32.4	76-49.9	6.5					04	02.0	H	19.3	R	7.28	1538	Y	06	Y	0.60				363
17/10/69	07.9		CYR1		37-32.4	76-49.9	6.5					04	04.0	H	19.5	R	7.97	1538	Y	06	Y	0.41				363
17/10/69	07.9		CYR1		37-32.4	76-49.9	6.5					04	05.0	H	19.5	R	8.08	1538	Y	06	Y	0.41				363

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
17/10/69	C8.8		CYR1		37-32.4	76-49.9		6.5					C4	CC.C	⊢	18.8	R	5.59	1539	Y	C7	Y	C.73			P03C	363
17/10/69	C8.8		CYR1		37-32.4	76-49.9		6.5					C4	C2.C	⊢	19.3	R	6.4C	1539	Y	C7	Y	C.55				363
17/10/69	C8.8		CYR1		37-32.4	76-49.9		6.5					C4	C4.C	⊢	19.4	R	7.2C	1539	Y	C6	Y	C.4C				363
17/10/69	C8.8		CYR1		37-32.4	76-49.9		6.5					C4	C5.C	⊢	19.5	R	7.32	1539	Y	C6	Y	C.3C				363
17/10/69	C9.8		CYR1		37-32.4	76-49.9		6.5					C4	CC.C	⊢	19.C	R	4.C5	1540	Y	C7	Y	C.61			P03C	363
17/10/69	C9.8		CYR1		37-32.4	76-49.9		6.5					C4	C2.C	⊢	19.3	R	5.12	154C	Y	C8	Y	C.45				363
17/10/69	C9.8		CYR1		37-32.4	76-49.9		6.5					C4	C4.C	⊢	19.4	R	6.25	1540	Y	C6	Y	C.29				363
17/10/69	C9.8		CYR1		37-32.4	76-49.9		6.5					C4	C5.C	⊢	19.4	R	6.39	1540	Y	C6	Y	C.18				363

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
18/10/69	1C.5		CYRI		37-3C.5	76-47.5	4.C						C3	CC.C	H	18.7	R	9.55	1713	A	25	A	C.45			YO1D	434
18/10/69	1C.5		CYRI		37-3C.5	76-47.5	4.C						C3	C2.C	H	18.6	R	1C.19	1713	A	25	A	C.25	B	5.54		434
18/10/69	1C.5		CYRI		37-3C.5	76-47.5	4.C						C3	C3.C	H	18.6	R	1C.68	1713	A	24	A	C.18	B	6.46		434
18/10/69	11.4		CYRI		37-3C.5	76-47.5	4.C						C3	CC.C	H	18.8	R	9.16	1714	A	21	A	C.C5			YO1D	434
18/10/69	11.4		CYRI		37-3C.5	76-47.5	4.C						C3	C2.C	H	18.7	R	9.41	1714	A	21	A	C.C2	B	8.CC		434
18/10/69	11.4		CYRI		37-3C.5	76-47.5	4.C						C3	C3.C	H	18.8	R	1C.66	1714	A	26	A	C.C2	B	7.56		434
18/10/69	12.6		CYRI		37-3C.5	76-47.5	4.C						C3	CC.C	H	19.2	R	8.13	1715	A	21	A	C.27			YO1D	434
18/10/69	12.6		CYRI		37-3C.5	76-47.5	4.C						C3	C2.C	H	18.9	R	9.C2	1715	A	2C	A	C.C4	B	5.34		434
18/10/69	12.6		CYRI		37-3C.5	76-47.5	4.C						C3	C3.C	H	19.1			1715	A	23	A	C.C2				434
18/10/69	13.6		CYRI		37-3C.5	76-47.5	5.C						C3	CC.C	H	19.7	R	7.67	1716	A	14	A	C.C9			YO1D	434
18/10/69	13.6		CYRI		37-3C.5	76-47.5	5.C						C3	C2.C	H	18.8	R	9.19	1716	A	18	A	C.33	B	7.CC		434
18/10/69	13.6		CYRI		37-3C.5	76-47.5	5.C						C3	C4.C	H	18.7	R	1C.59	1716	A	25	A	C.22	B	5.88		434
17/10/69	18.C		CYRI		37-29.9	76-46.1	3.5						C2	CC.C	H	19.1	R	12.7C	1718	U	13						441
17/10/69	18.C		CYRI		37-29.9	76-46.1	3.5						C2	C2.C	H	19.3	R	13.54	1718	U	13						441
17/10/69	19.1		CYRI		37-29.9	76-46.1	3.5						C2	CC.C	H	18.8	R	12.94	1719	U	13						441
17/10/69	19.1		CYRI		37-29.9	76-46.1	3.5						C2	C2.C	H	19.2	R	13.37	1719	U	12						441

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
18/10/69	03.4		CYR1		37-30.5	76-47.5	5.0						03	00.0	F	18.5	R	10.71	1707	A	36	A	0.42			YO1D	434
18/10/69	03.4		CYR1		37-30.5	76-47.5	5.0						03	02.0	F	19.1	R	10.93	1707	A	35	A	0.46	B	5.64		434
18/10/69	03.4		CYR1		37-30.5	76-47.5	5.0						03	04.0	F	19.2	R	10.26	1707	A	35	A	0.44	B	4.76		434
18/10/69	04.4		CYR1		37-30.5	76-47.5	4.0						03	00.0	F	18.3	R	11.75	1708	A	36	A	0.42			YO1D	434
18/10/69	04.4		CYR1		37-30.5	76-47.5	4.0						03	02.0	F	18.6	R	12.17	1708	A	35	A	0.34	B	6.66		434
18/10/69	04.4		CYR1		37-30.5	76-47.5	4.0						03	03.0	F	18.8	R	12.36	1708	A	36	A	0.27	B	5.56		434
18/10/69	06.8		CYR1		37-30.5	76-47.5	2.5						02	00.0	F	18.0	R	11.17	1709	A	31	A	0.15			YO1D	434
18/10/69	06.8		CYR1		37-30.5	76-47.5	2.5						02	02.0	F	18.7			1709	A	24	A	0.04	B	7.66		434
18/10/69	07.6		CYR1		37-30.5	76-47.5	2.5						02	00.0	F	17.3	R	10.88	1710	A	21	A	0.47			YO1D	434
18/10/69	07.6		CYR1		37-30.5	76-47.5	2.5						02	02.0	F	18.3	R	12.29	1710	A	22	A	0.29	B	8.06		434
18/10/69	08.7		CYR1		37-30.5	76-47.5	4.0						03	00.0	F	17.8	R	10.65	1711	A	22	A	0.55			YO1D	434
18/10/69	08.7		CYR1		37-30.5	76-47.5	4.0						03	02.0	F	18.2	R	11.20	1711	A	23	A	0.42	B	7.88		434
18/10/69	08.7		CYR1		37-30.5	76-47.5	4.0						03	03.0	F	18.3	R	11.33	1711	A	22	A	0.34	B	6.50		434
18/10/69	09.5		CYR1		37-30.5	76-47.5	4.0						03	00.0	F	18.4	R	10.46	1712	A	21	A	0.53			YO1D	434
18/10/69	09.5		CYR1		37-30.5	76-47.5	4.0						03	02.0	F	18.6	R	11.21	1712	A	23	A	0.37	B	8.44		434
18/10/69	09.5		CYR1		37-30.5	76-47.5	4.0						03	03.0	F	18.7	R	11.38	1712	A	22	A	0.23	B	8.50		434

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	CV	NO	DPT	I	TEMP	I	SALN	CCCD	I	DR	I	VEL	I	DO	COL	STA
17/10/69	21.3		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	19.2	R	11.43	1701	A	16	A	0.60			Y01D	434
17/10/69	21.3		CYR1		37-30.5	76-47.5	4.0					03	02.0			R	12.04	1701	A	17	A	0.50	B	5.28		434
17/10/69	21.3		CYR1		37-30.5	76-47.5	4.0					03	03.0			R	12.62	1701	A	16	A	0.36	B	4.10		434
17/10/69	22.2		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	18.9	R	10.90	1702	A	16	A	0.45			Y01D	434
17/10/69	22.2		CYR1		37-30.5	76-47.5	4.0					03	02.0	⊢	19.1	R	11.03	1702	A	17	A	0.39	B	5.70		434
17/10/69	22.2		CYR1		37-30.5	76-47.5	4.0					03	03.0	⊢	19.2	R	11.65	1702	A	16	A	0.22	B	4.68		434
17/10/69	23.4		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	18.7	R	10.38	1703	A	16	A	0.24			Y01D	434
17/10/69	23.4		CYR1		37-30.5	76-47.5	4.0					03	02.0	⊢	18.9	R	10.47	1703	A	16	A	0.19	B	5.10		434
17/10/69	23.4		CYR1		37-30.5	76-47.5	4.0					03	03.0	⊢	19.0	R	10.92	1703	A	17	A	0.05	B	4.92		434
18/10/69	00.3		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	18.8	R	9.57	1704	A	19	A	0.12			Y01D	434
18/10/69	00.3		CYR1		37-30.5	76-47.5	4.0					03	02.0	⊢	18.9	R	10.05	1704	A	20	A	0.12	B	5.40		434
18/10/69	00.3		CYR1		37-30.5	76-47.5	4.0					03	03.0	⊢	18.9	R	10.38	1704	A	18	A	0.10	B	5.40		434
18/10/69	01.0		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	18.8	R	9.05	1705	A	21	A	0.10			Y01D	434
18/10/69	01.0		CYR1		37-30.5	76-47.5	4.0					03	02.0	⊢	18.9	R	10.01	1705	A	26	A	0.08	B	4.56		434
18/10/69	01.0		CYR1		37-30.5	76-47.5	4.0					03	03.0	⊢	18.9	R	10.05	1705	A	28	A	0.07	B	4.08		434
18/10/69	02.3		CYR1		37-30.5	76-47.5	4.0					03	00.0	⊢	18.5	R	9.35	1706	A	36	A	0.20			Y01D	434
18/10/69	02.3		CYR1		37-30.5	76-47.5	4.0					03	02.0	⊢	19.0	R	10.67	1706	A	02	A	0.34	B	3.20		434
18/10/69	02.3		CYR1		37-30.5	76-47.5	4.0					03	03.0	⊢	18.9	R	10.93	1706	A	01	A	0.33	B	4.24		434

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NO DPT I TEMP I SALN CCCD I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	16.2		CYR1		37-3C.5	76-47.5	5.C					C3	CC.C	H	19.2	R	12.93	1695	A	C4	A	C.41			Y01D	434
17/10/69	16.2		CYR1		37-3C.5	76-47.5	5.C					C3	C2.C			R	14.CC	1695	A	35	A	C.36	B	6.65		434
17/10/69	16.2		CYR1		37-3C.5	76-47.5	5.C					C3	C4.C			R	14.C3	1695	A	35	A	C.25	B	6.28		434
17/10/69	17.C		CYR1		37-3C.5	76-47.5	5.C					C3	CC.C	H	18.7	R	13.24	1696	A	36	A	C.28			Y01D	434
17/1C/69	17.C		CYR1		37-3C.5	76-47.5	5.C					C3	C2.C			R	13.3C	1696	A	36	A	C.18				434
17/10/69	17.C		CYR1		37-3C.5	76-47.5	5.C					C3	C4.C			R	14.C8	1696	A	36	A	C.16				434
17/10/69	17.8		CYR1		37-3C.5	76-47.5	5.C					C3	CC.C	H	19.C	R	12.CC	1697	A	17	A	C.24			Y01D	434
17/10/69	17.8		CYR1		37-3C.5	76-47.5	5.C					C3	C2.C			R	12.72	1697	A	18	A	C.C9	B	4.18		434
17/10/69	17.8		CYR1		37-3C.5	76-47.5	5.C					C3	C4.C			R	14.11	1697	A	14	A	C.C3	B	3.57		434
17/10/69	19.1		CYR1		37-3C.5	76-47.5	4.C					C3	CC.C	H	18.8	R	12.63	1698	A	18	A	C.63			Y01D	434
17/10/69	19.1		CYR1		37-3C.5	76-47.5	4.C					C3	C2.C			R	12.67	1698	A	18	A	C.55	B	3.43		434
17/1C/69	19.1		CYR1		37-3C.5	76-47.5	4.C					C3	C3.C			R	13.33	1698	A	18	A	C.45	B	4.24		434
17/1C/69	19.6		CYR1		37-3C.5	76-47.5	4.C					C3	CC.C			R	11.97	1699	A	17	A	C.6C			Y01D	434
17/10/69	19.6		CYR1		37-3C.5	76-47.5	4.C					C3	C2.C			R	11.98	1699	A	17	A	C.5C	B	4.61		434
17/10/69	19.6		CYR1		37-3C.5	76-47.5	4.C					C3	C3.C			R	12.11	1699	A	18	A	C.38	B	5.C4		434
17/1C/69	2C.2		CYR1		37-3C.5	76-47.5	4.C					C3	CC.C	H	18.8	R	11.7C	1700	A	17	A	C.70			Y01D	434
17/1C/69	2C.2		CYR1		37-3C.5	76-47.5	4.C					C3	C2.C			R	12.13	1700	A	17	A	C.6C	B	6.87		434
17/10/69	2C.2		CYR1		37-3C.5	76-47.5	4.C					C3	C3.C			R	12.11	17CC	A	17	A	C.4C	B	6.63		434

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NO	DPT	I	TEMP	I	SALN	CCCD	I	OR	I	VEL	I	DO	COL	STA
18/10/69	10.2		CYR1		37-30.5	76-47.3	5.5						04	00.0	H	18.7	R	8.50	1690	A	21	A	0.47			Y01C	433
18/10/69	10.2		CYR1		37-30.5	76-47.3	5.5						04	02.0	H	18.7	R	9.83	1690	A	22	A	0.49	B	7.56		433
18/10/69	10.2		CYR1		37-30.5	76-47.3	5.5						04	04.0	H	18.9	R	11.20	1690	A	24	A	0.27				433
18/10/69	10.2		CYR1		37-30.5	76-47.3	5.5						04	05.0	H	18.9	R	11.44	1690	A	21	A	0.17	B	7.02		433
18/10/69	11.2		CYR1		37-30.5	76-47.3	6.0						04	00.0	H	18.8	R	7.66	1691	A	20	A	0.33			Y01C	433
18/10/69	11.2		CYR1		37-30.5	76-47.3	6.0						04	02.0	H	18.8	R	9.27	1691	A	23	A	0.47	B	6.94		433
18/10/69	11.2		CYR1		37-30.5	76-47.3	6.0						04	04.0	H	18.8	R	10.90	1691	A	22	A	0.21				433
18/10/69	11.2		CYR1		37-30.5	76-47.3	6.0						04	05.0	H	18.9	R	11.20	1691	A	20	A	0.75	B	7.62		433
18/10/69	12.3		CYR1		37-30.5	76-47.3	5.5						04	00.0	H	19.3	R	7.75	1692	A	20	A	0.19			Y01C	433
18/10/69	12.3		CYR1		37-30.5	76-47.3	5.5						04	02.0	H	18.9	R	9.14	1692	A	21	A	0.20	B	5.02		433
18/10/69	12.3		CYR1		37-30.5	76-47.3	5.5						04	04.0	H	18.8	R	10.34	1692	A	24	A	0.07				433
18/10/69	12.3		CYR1		37-30.5	76-47.3	5.5						04	05.0	H	18.9	R	10.83	1692	A	02	A	0.13	B	3.30		433
18/10/69	13.2		CYR1		37-30.5	76-47.3	6.0						04	00.0	H	19.4	R	7.75	1693	A	28	A	0.05			Y01C	433
18/10/69	13.2		CYR1		37-30.5	76-47.3	6.0						04	02.0	H	18.8	R	9.19	1693	A	32	A	0.11	B	6.30		433
18/10/69	13.2		CYR1		37-30.5	76-47.3	6.0						04	04.0	H	18.8	R	10.08	1693	A	32	A	0.14				433
18/10/69	13.2		CYR1		37-30.5	76-47.3	6.0						04	05.0	H	18.9	R	10.89	1693	A	30	A	0.21	B	6.04		433
17/10/69	14.8		CYR1		37-30.5	76-47.5	5.0						03	00.0	H	19.4	R	12.10	1694	A	35	A	0.55			Y01D	434
17/10/69	14.8		CYR1		37-30.5	76-47.5	5.0						03	02.0			R	13.02	1694	A	34	A	0.50	B	6.61		434
17/10/69	14.8		CYR1		37-30.5	76-47.5	5.0						03	04.0			R	13.19	1694	A	35	A	0.46	B	5.30		434
DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NO	DPT	I	TEMP	I	SALN	CCCD	I	OR	I	VEL	I	DO	COL	STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
18/10/69	C5.2		CYR1		37-3C.5	76-47.3	6.C					C4	CC.C	H	18.4	R	12.C1	1685	A	36	A	C.21			Y01C	433
18/10/69	C5.2		CYR1		37-3C.5	76-47.3	6.C					C4	C2.C	H	19.C	R	12.61	1685	A	34	A	C.19	B	3.94		433
18/10/69	C5.2		CYR1		37-3C.5	76-47.3	6.C					C4	C4.C	H	19.1	R	12.67	1685	A	34	A	0.11				433
18/10/69	C5.2		CYR1		37-3C.5	76-47.3	6.C					C4	C5.C	H	19.1	R	12.82	1685	A	36	A	C.C9	B	5.92		433
18/10/69	C6.5		CYR1		37-3C.5	76-47.3	5.C					C3	CC.C	H	18.3	R	11.86	1686	A	19	A	C.15			Y01C	433
18/10/69	C6.5		CYR1		37-3C.5	76-47.3	5.C					C3	C2.C	H	18.4	R	12.73	1686	A	3C	A	C.11	B	8.62		433
18/10/69	C6.5		CYR1		37-3C.5	76-47.3	5.C					C3	C4.C	H	19.1	R	12.71	1686	A	31	A	0.C4	B	6.98		433
18/10/69	C7.2		CYR1		37-3C.5	76-47.3	6.C					C4	CC.C	H	17.6	R	11.23	1687	A	2C	A	C.33			Y01C	433
18/10/69	C7.2		CYR1		37-3C.5	76-47.3	6.C					C4	C2.C	H	18.4	R	11.83	1687	A	22	A	C.3C	B	7.1C		433
18/10/69	C7.2		CYR1		37-3C.5	76-47.3	6.C					C4	C4.C	H	19.C	R	12.72	1687	A	21	A	C.21	B	8.48		433
18/10/69	C7.2		CYR1		37-3C.5	76-47.3	6.C					C4	05.C	H	19.C	R	12.82	1687	A	22	A	C.13	B	6.96		433
18/10/69	C8.4		CYR1		37-3C.5	76-47.3	6.C					C4	CC.C	H	18.5	R	1C.38	1688	A	2C	A	C.65			Y01C	433
18/10/69	C8.4		CYR1		37-3C.5	76-47.3	6.C					C4	C2.C	H	18.6	R	11.32	1688	A	21	A	C.48	B	6.9C		433
18/10/69	C8.4		CYR1		37-3C.5	76-47.3	6.C					C4	C4.C	H	18.9	R	12.31	1688	A	21	A	C.34				433
18/10/69	C8.4		CYR1		37-3C.5	76-47.3	6.C					C4	05.C	H	18.9	R	12.34	1688	A	22	A	C.28	B	6.76		433
18/10/69	C9.2		CYR1		37-3C.5	76-47.3	5.5					C4	CC.C	H	18.6	R	9.79	1689	A	22	A	C.55			Y01C	433
18/10/69	C9.2		CYR1		37-3C.5	76-47.3	5.5					C4	C2.C	H	18.7	R	1C.58	1689	A	22	A	C.5C	B	8.5C		433
18/10/69	C9.2		CYR1		37-3C.5	76-47.3	5.5					C4	C4.C	H	18.9	R	11.8C	1689	A	2C	A	C.36	B	8.1C		433
18/10/69	C9.2		CYR1		37-3C.5	76-47.3	5.5					C4	C5.C	H	18.9	R	11.89	1689	A	21	A	C.31	B	6.86		433

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	23.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.9	R	8.88	1679	A	16	A	C.34			YO1C	433
17/10/69	23.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.1	R	9.74	1679	A	16	A	C.34	B	5.14		433
17/10/69	23.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	1C.89	1679	A	17	A	C.24				433
17/10/69	23.1		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.3	R	11.26	1679	A	16	A	C.17	B	5.26		433
18/10/69	CC.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.9	R	9.C3	168C	A	19	A	C.15			YO1C	433
18/10/69	CC.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.C	R	9.54	1680	A	17	A	C.22				433
18/10/69	CC.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	11.C3	1680	A	17	A	C.C6				433
18/10/69	CC.1		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.3	R	11.22	168C	A	12	A	C.C3	B	4.76		433
18/10/69	C1.2		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.8	R	8.93	1681	A	26	A	C.C1			YO1C	433
18/10/69	C1.2		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.C	R	9.93	1681	A	31	A	C.C2	B	4.68		433
18/10/69	C1.2		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	1C.68	1681	A	36	A	C.C9				433
18/10/69	C1.2		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.3	R	1C.46	1681	A	36	A	C.C9	B	5.4C		433
18/10/69	C2.2		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.5	R	9.41	1682	A	35	A	C.18			YO1C	433
18/10/69	C2.2		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.1	R	1C.57	1682	A	C2	A	C.24	B	4.52		433
18/10/69	C2.2		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	1C.78	1682	A	C2	A	C.29				433
18/10/69	C2.2		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.1	R	1C.88	1682	A	36	A	C.31	B	5.14		433
18/10/69	C3.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.5	R	1C.18	1683	A	36	A	C.20			YO1C	433
18/10/69	C3.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.C	R	11.C4	1683	A	36	A	C.34	B	4.66		433
18/10/69	C3.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	12.C4	1683	A	35	A	C.3C				433
18/10/69	C3.1		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.2	R	12.2C	1683	A	35	A	C.3C	B	5.4C		433

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
17/10/69	18.7		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	18.8	R	11.78	1674	A	18	A	C.55			Y01C	433
17/10/69	18.7		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C			R	12.77	1674	A	18	A	C.4C	B	4.32		433
17/10/69	18.7		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C			R	13.96	1674	A	17	A	C.19				433
17/10/69	18.7		CYR1		37-30.5	76-47.3	6.C						C4	C5.C			R	14.12	1674	A	17	A	C.18	B	4.32		433
17/10/69	1S.6		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	1S.2	R	11.73	1675	A	16	A	C.73			Y01C	433
17/10/69	1S.6		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C			R	11.77	1675	A	18	A	C.55	B	4.63		433
17/10/69	1S.6		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C			R	12.56	1675	A	17	A	C.34				433
17/10/69	1S.6		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C			R	13.98	1675	A	16	A	0.26	B	3.22		433
17/1C/69	2C.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	1S.2	R	11.C4	1676	A	18	A	C.70			Y01C	433
17/1C/69	2C.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C			R	11.56	1676	A	18	A	0.65	B	4.53		433
17/10/69	2C.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C			R	12.72	1676	A	17	A	C.55				433
17/10/69	2C.1		CYR1		37-30.5	76-47.3	6.C						C4	C5.C			R	13.63	1676	A	17	A	C.39	B	4.92		433
17/1C/69	21.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	1S.2	R	10.27	1677	A	17	A	C.65			Y01C	433
17/10/69	21.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C			R	10.82	1677	A	17	A	C.6C	B	6.41		433
17/10/69	21.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C			R	12.1C	1677	A	17	A	C.6C				433
17/10/6S	21.1		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C			R	12.85	1677	A	17	A	C.5C	B	5.92		433
17/10/69	22.1		CYR1		37-3C.5	76-47.3	6.C						C4	CC.C	H	19.1	R	9.44	1678	A	17	A	C.41			Y01C	433
17/10/69	22.1		CYR1		37-3C.5	76-47.3	6.C						C4	C2.C	H	19.2	R	1C.26	1678	A	17	A	C.44	B	5.94		433
17/1C/69	22.1		CYR1		37-3C.5	76-47.3	6.C						C4	C4.C	H	19.2	R	11.38	1678	A	16	A	C.31				433
17/10/69	22.1		CYR1		37-3C.5	76-47.3	6.C						C4	C5.C	H	19.3	R	11.8S	1678	A	16	A	C.32	B	5.8C		433

CA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	CCL	STA
17/10/69	18.C		CYR1		37-3C.6	76-47.1	3.5						C3	CC.C	F	19.C	R	12.C7	1669	A	17	A	C.45			Y01B	432
17/10/69	18.C		CYR1		37-3C.6	76-47.1	3.5						C3	C2.C			R	12.3C	1669	A	17	A	C.64	B	4.47		432
17/10/69	18.C		CYR1		37-3C.6	76-47.1	3.5						C3	C3.C			R	12.C6	1669	A	15	A	C.25				432
17/10/69	14.6		CYR1		37-3C.5	76-47.3	7.C						C4	CC.C	F	19.5	R	12.C6	1670	A	35	A	C.68			Y01C	433
17/10/69	14.6		CYR1		37-3C.5	76-47.3	7.C						C4	C2.C			R	12.36	1670	A	35	A	C.6C	B	6.69		433
17/10/69	14.6		CYR1		37-3C.5	76-47.3	7.C						C4	C4.C			R	12.66	1670	A	35	A	C.6C				433
17/10/69	14.6		CYR1		37-3C.5	76-47.3	7.C						C4	C6.C			R	12.74	1670	A	35	A	C.48	B	6.38		433
17/10/69	15.9		CYR1		37-3C.5	76-47.3	7.C						C4	CC.C	F	19.5	R	13.31	1671	A	36	A	C.44			Y01C	433
17/10/69	15.9		CYR1		37-3C.5	76-47.3	7.C						C4	C2.C			R	13.57	1671	A	35	A	C.39	B	6.96		433
17/10/69	15.9		CYR1		37-3C.5	76-47.3	7.C						C4	C4.C			R	13.7C	1671	A	35	A	C.32				433
17/10/69	15.9		CYR1		37-3C.5	76-47.3	7.C						C4	C6.C			R	13.76	1671	A	36	A	C.25	B	6.58		433
17/10/69	16.8		CYR1		37-3C.5	76-47.3	7.C						C4	CC.C	F	19.C	R	13.69	1672	A	36	A	C.3C			Y01C	433
17/10/69	16.8		CYR1		37-3C.5	76-47.3	7.C						C4	C2.C			R	13.73	1672	A	35	A	C.35				433
17/10/69	16.8		CYR1		37-3C.5	76-47.3	7.C						C4	C4.C			R	13.87	1672	A	35	A	C.27				433
17/10/69	16.8		CYR1		37-3C.5	76-47.3	7.C						C4	C6.C			R	13.C2	1672	A	36	A	C.21				433
17/10/69	17.7		CYR1		37-3C.5	76-47.3	7.C						C4	CC.C	F	18.7	R	13.93	1673	A	19	A	C.14			Y01C	433
17/10/69	17.7		CYR1		37-3C.5	76-47.3	7.C						C4	C2.C			R	13.81	1673	A	31	A	C.C7	B	4.36		433
17/10/69	17.7		CYR1		37-3C.5	76-47.3	7.C						C4	C4.C			R	13.84	1673	A	3C	A	C.11				433
17/10/69	17.7		CYR1		37-3C.5	76-47.3	7.C						C4	C6.C			R	14.15	1673	A	35	A	C.C6	B	4.45		433

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I DC CCL STA

DA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CO	COL	STA
18/10/69	1C.C		CYR1		37-3C.7	76-47.C	3.C					C2	CC.C	H	18.2	R	9.7C	1661	A	19	A	C.22			Y01A	431
18/10/69	1C.C		CYR1		37-3C.7	76-47.C	3.C					C2	C2.C	H	18.7	R	10.C3	1661	A	24	A	C.C8	B	6.18		431
18/1C/69	11.C		CYR1		37-3C.7	76-47.C	3.C					C2	CC.C	H	18.9	R	8.61	1662	A	2C	A	C.16			Y01A	431
18/10/69	11.0		CYR1		37-3C.7	76-47.C	3.C					C2	C2.C	H	18.7	R	1C.11	1662	A	2C	A	C.C3	B	6.36		431
18/10/69	12.C		CYR1		37-3C.7	76-47.C	3.C					C2	CC.C	H	19.5	R	8.C8	1663	A	18	A	C.C4			Y01A	431
18/10/69	12.0		CYR1		37-3C.7	76-47.C	3.C					C2	C2.C	H	18.8	R	9.78	1663	A	C5	A	C.C3	B	5.C6		431
18/1C/69	13.0		CYR1		37-3C.7	76-47.C	3.C					C2	CC.C	H	18.3	R	8.23	1664	A	2C	A	C.11			Y01A	431
18/10/69	13.0		CYR1		37-3C.7	76-47.C	3.C					C2	C2.C	H	18.8	R	1C.15	1664	A	22	A	C.19	B	6.5C		431
17/10/69	14.4		CYR1		37-3C.6	76-47.1	4.C					C3	CC.C	H	19.5	R	11.93	1665	A	35	A	C.5C			Y01B	432
17/10/69	14.4		CYR1		37-3C.6	76-47.1	4.C					C3	C2.C			R	12.C7	1665	A	35	A	C.49	B	4.59		432
17/10/69	14.4		CYR1		37-3C.6	76-47.1	4.C					C3	C4.C			R	12.3C	1665	A	35	A	C.34				432
17/10/69	15.4		CYR1		37-3C.6	76-47.1	4.5					C3	CC.C	H	19.4	R	12.66	1666	A	33	A	C.42			Y01B	432
17/1C/69	15.4		CYR1		37-3C.6	76-47.1	4.5					C3	C2.C			R	12.65	1666	A	34	A	C.38	B	5.57		432
17/1C/69	15.4		CYR1		37-3C.6	76-47.1	4.5					C3	C4.C			R	12.69	1666	A	34	A	0.31				432
17/1C/69	16.7		CYR1		37-3C.6	76-47.1	4.C					C3	CC.C			R	12.5C	1667	A	36	A	C.C9			Y01B	432
17/1C/69	16.7		CYR1		37-3C.6	76-47.1	4.C					C3	C2.C			R	13.26	1667	A	29	A	C.C9	B	6.98		432
17/10/69	16.7		CYR1		37-3C.6	76-47.1	4.C					C3	C4.C			R	13.39	1667	A	36	A	C.12				432

DA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WC T	AT	WC	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
18/10/69	C2.0		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	18.1	R	1C.CC	1654	A	36	A	C.31			Y01A	431
18/10/69	C2.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C	F	18.3	R	11.3C	1654	A	35	A	C.33	B	4.36		431
18/10/69	C2.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C	F	18.6	R	11.34	1654	A	36	A	C.25				431
18/10/69	C3.C		CYR1		37-3C.7	76-47.C	4.C					C3	CC.C	F	18.3	R	10.95	1655	A	36	A	C.36			Y01A	431
18/10/69	C3.C		CYR1		37-3C.7	76-47.0	4.C					C3	C2.C	F	18.5	R	1C.96	1655	A	36	A	C.35	B	3.0C		431
18/10/69	C3.C		CYR1		37-3C.7	76-47.C	4.C					C3	C3.C	F	18.6	R	11.71	1655	A	35	A	C.3C				431
18/10/69	C4.C		CYR1		37-3C.7	76-47.0	4.C					C3	CC.C	F	18.3	R	11.28	1656	A	35	A	C.21			Y01A	431
18/10/69	C4.C		CYR1		37-3C.7	76-47.C	4.C					C3	C2.C	F	18.5	R	11.52	1656	A	35	A	0.2C	B	6.34		431
18/10/69	C4.0		CYR1		37-3C.7	76-47.C	4.C					C3	C3.C	F	18.6	R	11.54	1656	A	34	A	C.15				431
18/10/69	C6.2		CYR1		37-3C.7	76-47.C	2.C					C2	CC.C	F	17.6	R	11.22	1657	A	24	A	0.25			Y01A	431
18/10/69	C6.2		CYR1		37-3C.7	76-47.C	2.C					C2	C2.C	F	18.6	R	12.1C	1657	A	29	A	C.13	B	6.16		431
18/10/69	C7.C		CYR1		37-3C.7	76-47.C	2.C					C2	CC.C	F	17.4	R	1C.97	1658	A	2C	A	C.37			Y01A	431
18/10/69	C7.0		CYR1		37-3C.7	76-47.C	2.C					C2	C2.C			R	11.97	1658					B	7.1C		431
18/10/69	C8.0		CYR1		37-3C.7	76-47.C	3.5					C2	CC.C	F	18.C	R	1C.78	1659	A	2C	A	C.21			Y01A	431
18/10/69	C8.C		CYR1		37-3C.7	76-47.C	3.5					C2	C2.C	F	18.C	R	11.4C	1659	A	21	A	C.CC	B	7.7C		431
18/10/69	C9.C		CYR1		37-3C.7	76-47.C	3.C					C2	CC.C	F	18.7	R	1C.28	166C	A	2C	A	C.32			Y01A	431
18/10/69	C9.C		CYR1		37-3C.7	76-47.C	3.C					C2	C2.C	F	18.7	R	1C.27	1660	A	22	A	C.2C	B	6.76		431

CA/MC/YR TIM VS CNC ARA DG-MIN DG-MIN WC T AT WC WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

CA/PC/YR	TIP	VS	CNC	ARA	CG-PIN	CG-PIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEPP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
17/10/69	2C.0		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	19.C	R	1C.93	1648	A	17	A	C.46			YO1A	431
17/10/69	2C.0		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C			R	11.43	1648	A	17	A	C.37	B	4.9C		431
17/10/69	2C.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C			R	11.51	1648	A	17	A	C.31				431
17/10/69	21.C		CYR1		37-3C.7	76-47.0	3.5					C3	CC.C	F	19.4	R	10.68	1649	A	15	A	C.34			YO1A	431
17/10/69	21.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C			R	10.72	1649	A	15	A	C.28	B	6.32		431
17/10/69	21.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C			R	1C.71	1649	A	17	A	C.22				431
17/10/69	22.C		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	19.2	R	1C.C6	1650	A	14	A	C.21			YO1A	431
17/10/69	22.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C	F	19.2	R	1C.97	1650	A	14	A	C.11	B	5.98		431
17/10/69	22.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C	F	19.2	R	9.97	1650	A	16	A	C.C7				431
17/10/69	23.C		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	18.8	R	9.44	1651	A	17	A	C.16			YO1A	431
17/10/69	23.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C	F	19.C	R	9.69	1651	A	17	A	C.11	B	5.74		431
17/10/69	23.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C	F	19.1	R	9.75	1651	A	17	A	C.11				431
18/10/69	CC.C		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	18.8	R	9.11	1652	A	18	A	C.C4			YO1A	431
18/10/69	CC.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C	F	19.2	R	9.54	1652	A	28	A	C.C2	B	5.82		431
18/10/69	CC.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C			R	9.64	1652	A	C9	A	C.C2				431
18/10/69	C1.C		CYR1		37-3C.7	76-47.C	3.5					C3	CC.C	F	18.9	R	9.24	1653	A	36	A	C.15			YO1A	431
18/10/69	C1.C		CYR1		37-3C.7	76-47.C	3.5					C3	C2.C	F	19.1	R	1C.65	1653	A	36	A	C.11	B	5.68		431
18/10/69	C1.C		CYR1		37-3C.7	76-47.C	3.5					C3	C3.C	F	19.2	R	11.CC	1653	A	35	A	C.C9				431

CA/PC/YR TIP VS CNC ARA CG-PIN CG-PIN WC T AT WC WV CV NC CPT I TEPP I SALN CCCC I CR I VEL I CO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CO	COL	STA
17/10/69	14.1		CYR1		37-3C.7	76-47.C	3.5						C3	CC.C	M	19.4	R	11.19	1642	A	33	A	C.32			YO1A	431
17/10/69	14.1		CYR1		37-3C.7	76-47.C	3.5						C3	C2.C			R	11.31	1642	A	33	A	C.33	B	6.83		431
17/10/69	14.1		CYR1		37-3C.7	76-47.C	3.5						C3	C3.C			R	11.35	1642	A	34	A	C.25				431
17/10/69	15.C		CYR1		37-3C.7	76-47.C	3.5						C3	CC.C	M	19.2	R	11.41	1643	A	33	A	C.26			YO1A	431
17/10/69	15.C		CYR1		37-3C.7	76-47.C	3.5						C3	C2.C			R	11.81	1643	A	33	A	C.25	B	6.53		431
17/10/69	15.C		CYR1		37-3C.7	76-47.C	3.5						C3	C3.C			R	11.87	1643	A	35	A	C.22				431
17/10/69	16.4		CYR1		37-3C.7	76-47.C	3.5						C3	CC.C			R	11.69	1644	A	18	A	C.C8			YO1A	431
17/10/69	16.4		CYR1		37-3C.7	76-47.C	3.5						C3	C2.C			R	12.22	1644	A	23	A	C.C5	B	6.75		431
17/10/69	16.4		CYR1		37-3C.7	76-47.C	3.5						C3	C3.C			R	12.71	1644	A	C7	A	C.C5				431
17/10/69	17.2		CYR1		37-3C.7	76-47.C	3.5						C3	CC.C	M	18.8	R	11.71	1645	A	18	A	C.24			YO1A	431
17/10/69	17.2		CYR1		37-3C.7	76-47.C	3.5						C3	C2.C			R	12.1C	1645	A	17	A	C.2C	B	3.99		431
17/10/69	17.2		CYR1		37-3C.7	76-47.C	3.5						C3	C3.C			R	13.18	1645	A	17	A	C.15				431
17/10/69	18.2		CYR1		37-3C.7	76-47.C	4.C						C3	CC.C	M	19.2	R	11.65	1646	A	16	A	C.44			YO1A	431
17/10/69	18.2		CYR1		37-3C.7	76-47.C	4.C						C3	C2.C			R	12.75	1646	A	18	A	C.34	B	4.26		431
17/10/69	18.2		CYR1		37-3C.7	76-47.C	4.C						C3	C3.C			R	13.99	1646	A	18	A	C.24				431
17/10/69	19.3		CYR1		37-3C.7	76-47.C	3.5						C3	CC.C			R	11.C1	1647	A	17	A	C.55			YO1A	431
17/10/69	19.3		CYR1		37-3C.7	76-47.C	3.5						C3	C2.C			R	12.C4	1647	A	16	A	C.40	B	4.67		431
17/10/69	19.3		CYR1		37-3C.7	76-47.C	3.5						C3	C3.C			R	12.45	1647	A	17	A	C.3C				431
CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CO	COL	STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CO	COL	STA
18/10/69	1C.O		CYR1		37-31.6	76-48.2	8.5						C5	CC.C			R	9.63	1627							P01B	422
18/10/69	1C.C		CYR1		37-31.6	76-48.2	8.5						C5	C2.C			R	9.17	1627					B	4.62		422
18/10/69	1C.O		CYR1		37-31.6	76-48.2	8.5						O5	C4.C			R	10.3C	1627								422
18/10/69	1C.O		CYR1		37-31.6	76-48.2	8.5						C5	C6.C			R	9.34	1627								422
18/10/69	1C.C		CYR1		37-31.6	76-48.2	8.5						C5	C8.C			R	10.28	1627					B	5.22		422
18/10/69	11.C		CYR1		37-31.6	76-48.2	8.5						C5	CC.C	C	19.1	R	9.49	1628							P01B	422
18/10/69	11.C		CYR1		37-31.6	76-48.2	8.5						C5	C2.C	C	18.9	R	1C.C5	1628					B	4.66		422
18/10/69	11.C		CYR1		37-31.6	76-48.2	8.5						C5	C4.C	C	18.8	R	9.71	1628								422
18/10/69	11.C		CYR1		37-31.6	76-48.2	8.5						C5	C6.C	C	19.8	R	10.5C	1628								422
18/10/69	11.C		CYR1		37-31.6	76-48.2	8.5						C5	C8.C	C	18.7	R	9.57	1628					B	5.0C		422
18/10/69	12.C		CYR1		37-31.6	76-48.2	8.C						C5	CC.C	C	19.1	R	10.76	1624	B	16	B	C.36			P01B	422
18/10/69	12.C		CYR1		37-31.6	76-48.2	8.C						C5	C2.C	C	19.C	R	9.1C	1624	B	17	B	C.34				422
18/10/69	12.C		CYR1		37-31.6	76-48.2	8.C						C5	C4.C	C	18.9	R	10.88	1624	B	15	B	C.16				422
18/10/69	12.C		CYR1		37-31.6	76-48.2	8.C						C5	C6.C	C	18.8	R	9.16	1624	B	C2	B	C.C2				422
18/10/69	12.C		CYR1		37-31.6	76-48.2	8.C						C5	C8.C	C	18.7	R	10.83	1624	B	35	B	C.68	B	4.7C		422
18/1C/69	13.C		CYR1		37-31.6	76-48.2	8.C						C5	CC.C	C	19.2	R	9.58	1625	B	16	B	C.23			P01B	422
18/1C/69	13.C		CYR1		37-31.6	76-48.2	8.C						C5	C2.C	C	19.C	R	10.75	1625	B	15	B	C.11	B	4.9C		422
18/1C/69	13.C		CYR1		37-31.6	76-48.2	8.C						C5	C4.C	C	18.9	R	9.53	1625	B	36	B	C.C8				422
18/1C/69	13.C		CYR1		37-31.6	76-48.2	8.C						C5	C6.C	C	18.7	R	10.27	1625	B	C2	B	C.16				422
18/1C/69	13.C		CYR1		37-31.6	76-48.2	8.C						C5	C8.C	C	18.7	R	9.13	1625	B	36	B	C.17	B	4.92		422

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
18/10/69	06.0		CYR1		37-31.6	76-48.2	8.0						05	00.0	0	18.2			1639	B	28					P01B	422
18/10/69	06.0		CYR1		37-31.6	76-48.2	8.0						05	02.0	0	18.3	R	9.10	1639	B	27			B	5.90		422
18/10/69	06.0		CYR1		37-31.6	76-48.2	8.0						05	04.0	0	18.8			1639	B	34						422
18/10/69	06.0		CYR1		37-31.6	76-48.2	8.0						05	06.0	0	19.2			1639	B	02			B	6.20		422
18/10/69	06.0		CYR1		37-31.6	76-48.2	8.0						05	08.0	0	19.2			1639	B	01						422
18/10/69	07.0		CYR1		37-31.6	76-48.2	8.0						05	00.0	0	17.6			1640	B	14					P01B	422
18/10/69	07.0		CYR1		37-31.6	76-48.2	8.0						05	02.0	0	18.5			1640	B	17			B	6.00		422
18/10/69	07.0		CYR1		37-31.6	76-48.2	8.0						05	04.0	0	19.0			1640	B	17						422
18/10/69	07.0		CYR1		37-31.6	76-48.2	8.0						05	06.0	0	19.1			1640	B	16						422
18/10/69	07.0		CYR1		37-31.6	76-48.2	8.0						05	07.5	0	19.1			1640	B	15			B	6.66		422
18/10/69	08.0		CYR1		37-31.6	76-48.2	8.5						05	00.0	0	17.6			1641	B	15					P01B	422
18/10/69	08.0		CYR1		37-31.6	76-48.2	8.5						05	02.0	0	18.9			1641	B	16						422
18/10/69	08.0		CYR1		37-31.6	76-48.2	8.5						05	04.0	0	18.9			1641	B	15						422
18/10/69	08.0		CYR1		37-31.6	76-48.2	8.5						05	06.0	0	19.1			1641	B	15						422
18/10/69	08.0		CYR1		37-31.6	76-48.2	8.5						05	08.0	0	19.1	R	9.48	1641	B	16			B	5.84		422
18/10/69	09.0		CYR1		37-31.6	76-48.2	8.5						05	00.0	0	18.5	R	8.15	1626							P01B	422
18/10/69	09.0		CYR1		37-31.6	76-48.2	8.5						05	02.0	0	18.6	R	8.04	1626					B	5.20		422
18/10/69	09.0		CYR1		37-31.6	76-48.2	8.5						05	04.0	0	18.6	R	8.86	1626								422
18/10/69	09.0		CYR1		37-31.6	76-48.2	8.5						05	06.0	0	18.6	R	8.26	1626								422
18/10/69	09.0		CYR1		37-31.6	76-48.2	8.5						05	08.0	0	18.6	R	8.83	1626					B	5.00		422

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	22.7		CYR1		37-31.6	76-48.2	9.C					C5	0C.C	C	19.1	R	9.61	1635	B	16					P01B	422
17/10/69	22.7		CYR1		37-31.6	76-48.2	9.C					C5	C2.C	C	19.2	R	9.63	1635	B	16			B	3.95		422
17/10/69	22.7		CYR1		37-31.6	76-48.2	9.C					C5	C4.C	C	19.3	R	9.74	1635	B	15						422
17/10/69	22.7		CYR1		37-31.6	76-48.2	9.C					C5	C6.C	C	19.3	R	9.77	1635	B	16						422
17/10/69	22.7		CYR1		37-31.6	76-48.2	9.C					C5	C8.C	C	19.3	R	9.76	1635	B	15						422
17/10/69	23.7		CYR1		37-31.6	76-48.2	9.C					C5	CC.C	C	19.2	R	8.73	1636	B	16					P01B	422
17/10/69	23.7		CYR1		37-31.6	76-48.2	9.C					C5	C2.C	C	19.2	R	8.98	1636	B	15			B	3.05		422
17/10/69	23.7		CYR1		37-31.6	76-48.2	9.C					C5	C4.C	C	19.2	R	9.22	1636	B	17						422
17/10/69	23.7		CYR1		37-31.6	76-48.2	9.C					C5	C6.C	C	19.2	R	9.34	1636	B	16						422
17/10/69	23.7		CYR1		37-31.6	76-48.2	9.C					C5	C8.C	C	19.2	R	9.63	1636	B	18						422
18/10/69	C3.2		CYR1		37-31.6	76-48.2	9.C					C5	CC.C	C	18.6	R	9.34	1637	B	C1					P01B	422
18/10/69	C3.2		CYR1		37-31.6	76-48.2	9.C					C5	C2.C	C	18.4	R	1C.C9	1637	B	34			B	4.29		422
18/10/69	C3.2		CYR1		37-31.6	76-48.2	9.C					C5	C4.C	C	18.5	R	10.56	1637	B	34						422
18/10/69	C3.2		CYR1		37-31.6	76-48.2	9.C					C5	C6.C	C	18.9	R	11.26	1637	B	33						422
18/10/69	C3.2		CYR1		37-31.6	76-48.2	9.C					C5	C8.C	C	18.8	R	11.28	1637	B	34						422
18/10/69	C4.4		CYR1		37-31.6	76-48.2	9.C					C5	CC.C	C	17.7	R	1C.18	1638	B	35					P01B	422
18/10/69	C4.4		CYR1		37-31.6	76-48.2	9.C					C5	C2.C	C	18.7	R	4.82	1638	B	35			B	6.24		422
18/10/69	C4.4		CYR1		37-31.6	76-48.2	9.C					C5	C4.C	C	19.C	R	5.11	1638	B	34						422
18/10/69	C4.4		CYR1		37-31.6	76-48.2	9.C					C5	C6.C	C	19.C	R	5.68	1638	B	35						422
18/10/69	C4.4		CYR1		37-31.6	76-48.2	9.C					C5	C8.C	C	19.1	R	5.76	1638	B	34						422

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
17/10/69	16.0		CYR1		37-31.6	76-48.2	9.0					05	00.0	0	19.4	R	9.52	1631	B	35					P01B	422
17/10/69	16.0		CYR1		37-31.6	76-48.2	9.0					05	02.0	0	19.4	R	9.50	1631	B	35			B	7.07		422
17/10/69	16.0		CYR1		37-31.6	76-48.2	9.0					05	04.0	0	19.3	R	11.16	1631	B	35						422
17/10/69	16.0		CYR1		37-31.6	76-48.2	9.0					05	06.0	0	19.3	R	11.25	1631	B	36						422
17/10/69	16.0		CYR1		37-31.6	76-48.2	9.0					05	08.0	0	19.3	R	9.62	1631	B	36						422
17/10/69	19.0		CYR1		37-31.6	76-48.2	9.0					05	00.0	0	19.2	R	11.21	1632	B	16					P01B	422
17/10/69	19.0		CYR1		37-31.6	76-48.2	9.0					05	02.0	0	19.3	R	11.54	1632	B	16			B	6.02		422
17/10/69	19.0		CYR1		37-31.6	76-48.2	9.0					05	04.0	0	19.4	R	12.30	1632	B	16						422
17/10/69	19.0		CYR1		37-31.6	76-48.2	9.0					05	06.0	0	19.4	R	12.24	1632	B	16						422
17/10/69	19.0		CYR1		37-31.6	76-48.2	9.0					05	08.0	0	19.5	R	12.79	1632	B	15						422
17/10/69	20.7		CYR1		37-31.6	76-48.2	9.0					05	00.0	0	19.1	R	10.66	1633	B	14					P01B	422
17/10/69	20.7		CYR1		37-31.6	76-48.2	9.0					05	02.0	0	19.3	R	10.93	1633	B	15			B	3.17		422
17/10/69	20.7		CYR1		37-31.6	76-48.2	9.0					05	04.0	0	19.3	R	11.37	1633	B	16						422
17/10/69	20.7		CYR1		37-31.6	76-48.2	9.0					05	06.0			R	11.42	1633								422
17/10/69	20.7		CYR1		37-31.6	76-48.2	9.0					05	08.0			R	11.38	1633								422
17/10/69	21.7		CYR1		37-31.6	76-48.2	9.0					05	00.0	0	19.1	R	10.14	1634	B	16					P01B	422
17/10/69	21.7		CYR1		37-31.6	76-48.2	9.0					05	02.0	0	19.2	R	10.30	1634	B	16			B	3.39		422
17/10/69	21.7		CYR1		37-31.6	76-48.2	9.0					05	04.0	0	19.3	R	10.40	1634	B	16						422
17/10/69	21.7		CYR1		37-31.6	76-48.2	9.0					05	06.0	0	19.3	R	10.46	1634	B	17						422
17/10/69	21.7		CYR1		37-31.6	76-48.2	9.0					05	08.0	0	19.3	R	10.55	1634	B	17						422

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NO	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
18/10/69	00.2		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.2	R	8.45	1621	B	16					P01A	421
18/10/69	00.2		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.2	R	8.87	1621	B	16			B	3.31		421
18/10/69	00.2		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.3	R	9.24	1621	B	16						421
18/10/69	00.2		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.3	R	9.20	1621	B	19			B	2.07		421
18/10/69	00.7		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	18.4	R	9.66	1622							P01A	421
18/10/69	00.7		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.1	R	8.87	1622					B	5.79		421
18/10/69	00.7		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.1	R	11.18	1622								421
18/10/69	00.7		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.1	R	11.22	1622					B	6.00		421
18/10/69	05.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	18.1	R	6.95	1623							P01A	421
18/10/69	05.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	18.5	R	6.65	1623					B	6.24		421
18/10/69	05.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	18.9	R	7.27	1623								421
18/10/69	05.0		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.2	R	7.10	1623					B	6.00		421
17/10/69	14.0		CYR1		37-31.6	76-48.2	9.0						05	00.0	0	19.6	R	9.43	1629	B	36					P01B	422
17/10/69	14.0		CYR1		37-31.6	76-48.2	9.0						05	02.0	0	19.4	R	9.55	1629	B	36			B	4.07		422
17/10/69	14.0		CYR1		37-31.6	76-48.2	9.0						05	04.0	0	19.4	R	9.44	1629	B	35						422
17/10/69	14.0		CYR1		37-31.6	76-48.2	9.0						05	06.0	0	19.3	R	9.53	1629	B	35						422
17/10/69	14.0		CYR1		37-31.6	76-48.2	9.0						05	08.0	0	19.3	R	9.50	1629	B	35						422
17/10/69	15.0		CYR1		37-31.6	76-48.2	9.0						05	00.0	0	19.6	R	9.57	1630	B	36					P01B	422
17/10/69	15.0		CYR1		37-31.6	76-48.2	9.0						05	02.0	0	19.3	R	9.44	1630	B	35			B	4.40		422
17/10/69	15.0		CYR1		37-31.6	76-48.2	9.0						05	04.0	0	19.3	R	9.57	1630	B	35						422
17/10/69	15.0		CYR1		37-31.6	76-48.2	9.0						05	06.0	0	19.3	R	9.58	1630	B	35						422
17/10/69	15.0		CYR1		37-31.6	76-48.2	9.0						05	08.0	0	19.3	R	9.45	1630	B	35						422

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NO DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
17/10/69	18.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.2	R	9.53	1616	B	16					P01A	421
17/10/69	18.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.4	R	11.49	1616	B	12			B	6.34		421
17/10/69	18.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.4	R	12.79	1616	B	08						421
17/10/69	18.0		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.4	R	12.82	1616	B	08						421
17/10/69	20.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.1	R	11.30	1617	B	15					P01A	421
17/10/69	20.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.4	R	11.60	1617	B	16			B	3.43		421
17/10/69	20.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.4	R	12.05	1617	B	16						421
17/10/69	20.0		CYR1		37-31.7	76-48.1	7.0						04	05.0	0	19.4	R	12.28	1617	B	17			B	3.19		421
17/10/69	21.2		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.2	R	10.50	1618	B	15					P01A	421
17/10/69	21.2		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.3	R	11.04	1618	B	16			B	2.99		421
17/10/69	21.2		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.4	R	11.35	1618	B	15						421
17/10/69	21.2		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.4	R	11.46	1618	B	16			B	2.98		421
17/10/69	22.2		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.1	R	9.82	1619	B	16					P01A	421
17/10/69	22.2		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.2	R	10.24	1619	B	15			B	3.27		421
17/10/69	22.2		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.3	R	10.52	1619	B	16						421
17/10/69	22.2		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.3	R	10.55	1619	B	17			B	3.15		421
17/10/69	23.3		CYR1		37-31.7	76-48.1	7.0						04	00.0	0	19.2	R	9.15	1620	B	14					P01A	421
17/10/69	23.3		CYR1		37-31.7	76-48.1	7.0						04	02.0	0	19.2	R	9.51	1620	B	16			B	3.43		421
17/10/69	23.3		CYR1		37-31.7	76-48.1	7.0						04	04.0	0	19.2	R	9.73	1620	B	16						421
17/10/69	23.3		CYR1		37-31.7	76-48.1	7.0						04	06.0	0	19.2	R	9.86	1620	B	16			B	2.98		421

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCD	I	DR	I	VEL	I	DO	COL	STA
18/10/69	12.5		CYR1		37-32.3	76-48.7	5.3						03	00.0	J	18.9	R	6.23	1611	C	16	C	0.39			P02C	413
18/10/69	12.5		CYR1		37-32.3	76-48.7	5.3						03	02.0	J	18.9	R	6.91	1611	C	16	C	0.09	B	5.26		413
18/10/69	12.5		CYR1		37-32.3	76-48.7	5.3						03	04.0	J	18.9	R	7.16	1611	C	17	C	0.04				413
18/10/69	13.5		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	19.1	R	5.79	1612	C	16	C	0.11			P02C	413
18/10/69	13.5		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.0	R	6.63	1612	C	06	C	0.05	B	5.62		413
18/10/69	13.5		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.0	R	7.38	1612	C	04	C	0.18				413
17/10/69	14.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	C	19.6	R	8.37	1613	B	36					P01A	421
17/10/69	14.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	C	19.5	R	9.37	1613	B	34			B	3.25		421
17/10/69	14.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	C	19.5	R	9.39	1613	B	34						421
17/10/69	14.0		CYR1		37-31.7	76-48.1	7.0						04	06.0	C	19.4	R	9.40	1613	B	34			B	3.13		421
17/10/69	15.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	C	19.6	R	9.45	1614	B	36					P01A	421
17/10/69	15.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	C	10.4	R	9.52	1614	B	35			B	3.97		421
17/10/69	15.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	C	10.4	R	9.52	1614	B	35						421
17/10/69	15.0		CYR1		37-31.7	76-48.1	7.0						04	06.0	C	10.4	R	9.45	1614	B	35			B	4.56		421
17/10/69	16.0		CYR1		37-31.7	76-48.1	7.0						04	00.0	C	19.4	R	9.52	1615	B	01					P01A	421
17/10/69	16.0		CYR1		37-31.7	76-48.1	7.0						04	02.0	C	19.4	R	9.57	1615	B	35			B	5.36		421
17/10/69	16.0		CYR1		37-31.7	76-48.1	7.0						04	04.0	C	19.3	R	9.51	1615	B	34						421
17/10/69	16.0		CYR1		37-31.7	76-48.1	7.0						04	06.0	C	19.3	R	9.59	1615	B	35			B	2.62		421

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCD I DR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA
18/10/69	06.5		CYR1		37-32.3	76-48.7	5.3						03	00.0	J	16.8			1605	C	09	C	0.08			P02C	413
18/10/69	06.5		CYR1		37-32.3	76-48.7	5.3						03	02.0	J	18.8			1605	C	01	C	0.04				413
18/10/69	06.5		CYR1		37-32.3	76-48.7	5.3						03	04.0	J	18.7			1605	C	01	C	0.03				413
18/10/69	07.5		CYR1		37-32.3	76-48.7	5.7						04	00.0	J	17.5	R	9.42	1606	C	15	C	0.37			P02C	413
18/10/69	07.5		CYR1		37-32.3	76-48.7	5.7						04	02.0	J	18.2	R	10.49	1606	C	15	C	0.21	B	5.73		413
18/10/69	07.5		CYR1		37-32.3	76-48.7	5.7						04	04.0	J	18.6	R	11.07	1606	C	17	C	0.15				413
18/10/69	07.5		CYR1		37-32.3	76-48.7	5.7						04	05.7			R	11.32	1606								413
18/10/69	08.4		CYR1		37-32.3	76-48.7	5.7						04	00.0	J	18.4	R	8.26	1607	C	17	C	0.71			P02C	413
18/10/69	08.4		CYR1		37-32.3	76-48.7	5.7						04	02.0	J	18.6	R	10.19	1607	C	17	C	0.41	B	5.49		413
18/10/69	08.4		CYR1		37-32.3	76-48.7	5.7						04	04.0	J	18.6	R	10.41	1607	C	16	C	0.23				413
18/10/69	08.4		CYR1		37-32.3	76-48.7	5.7						04	05.7			R	10.71	1607								413
18/10/69	09.5		CYR1		37-32.3	76-48.7	5.6						03	00.0	J	18.5	R	8.30	1608	C	16	C	0.85			P02C	413
18/10/69	09.5		CYR1		37-32.3	76-48.7	5.6						03	02.0	J	18.7			1608	C	16	C	0.54	B	4.10		413
18/10/69	09.5		CYR1		37-32.3	76-48.7	5.6						03	04.0	J	18.7	R	9.85	1608	C	16	C	0.33				413
18/10/69	10.5		CYR1		37-32.3	76-48.7	5.6						03	00.0	J	18.8	R	7.53	1609	C	16	C	0.72			P02C	413
18/10/69	10.5		CYR1		37-32.3	76-48.7	5.6						03	02.0	J	18.8	R	8.07	1609	C	17	C	0.44	B	4.80		413
18/10/69	10.5		CYR1		37-32.3	76-48.7	5.6						03	04.0	J	18.8	R	8.24	1609	C	16	C	0.27				413
18/10/69	11.4		CYR1		37-32.3	76-48.7	5.3						03	00.0	J	18.9	R	6.95	1610	C	17	C	0.66			P02C	413
18/10/69	11.4		CYR1		37-32.3	76-48.7	5.3						03	02.0	J	18.9	R	7.35	1610	C	16	C	0.42	B	5.28		413
18/10/69	11.4		CYR1		37-32.3	76-48.7	5.3						03	04.0	J	18.9	R	7.61	1610	C	16	C	0.27				413

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I CR I VEL I DO COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
18/10/69	C1.3		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	18.8	R	7.C8	16C0	C	17	C	C.1C			P02C	413
18/10/69	C1.3		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.C	R	7.12	16C0	C	14	C	C.C3	B	4.82		413
18/10/69	C1.3		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.2	R	7.67	16C0	C	35	C	C.15				413
18/10/69	C1.3		CYR1		37-32.3	76-48.7	6.C					C4	C6.C			R	8.1C	16C0								413
18/10/69	C2.3		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	18.6	R	8.C6	16C1	C	02	C	C.15			P02C	413
18/10/69	C2.3		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	18.9	R	7.C9	16C1	C	36	C	0.25	B	4.84		413
18/10/69	C2.3		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.2	R	7.5C	16C1	C	35	C	C.33				413
18/10/69	C2.3		CYR1		37-32.3	76-48.7	6.C					C4	C6.C			R	8.74	16C1								413
18/10/69	C3.4		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	19.2	R	7.8C	16C2	C	36	C	C.58			P02C	413
18/10/69	C3.4		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.C	R	7.89	16C2	C	35	C	C.6C	B	4.86		413
18/1C/69	C3.4		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	18.7	R	9.52	16C2	C	35	C	C.5C				413
18/1C/69	C3.4		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	18.7	R	9.76	16C2	C	35	C	C.35				413
18/10/69	C4.4		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	18.4	R	8.49	16C3	C	36	C	C.55			P02C	413
18/10/69	C4.4		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	18.4	R	8.51	16C3	C	35	C	C.55	B	5.C8		413
18/10/69	C4.4		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	18.6	R	1C.48	16C3	C	35	C	C.45				413
18/1C/69	C4.4		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	18.6	R	1C.65	16C3	C	35	C	C.35				413
18/10/69	C5.7		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	17.3	R	9.61	16C4	C	C2	C	C.C5			P02C	413
18/10/69	C5.7		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	18.3	R	1C.48	16C4	C	35	C	C.24	B	5.73		413
18/10/69	C5.7		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	18.8	R	11.2C	16C4	C	35	C	C.13				413
18/1C/69	C5.7		CYR1		37-32.3	76-48.7	6.C					C4	C5.C	J	18.8			16C4	C	36	C	C.11				413

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DO	COL	STA
17/10/69	19.3		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	18.9	R	11.01	1594	C	17	C	0.50			P02C	413
17/10/69	19.3		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.2	R	11.07	1594	C	16	C	0.38	B	6.32		413
17/10/69	19.3		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.3	R	11.58	1594	C	18	C	0.34				413
17/10/69	20.3		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	19.1	R	9.06	1595	C	17	C	0.70			P02C	413
17/10/69	20.3		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.3	R	11.20	1595	C	17	C	0.50	B	6.02		413
17/10/69	20.3		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.4	R	11.51	1595	C	16	C	0.35				413
17/10/69	21.3		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	18.8	R	9.80	1596	C	18	C	0.80			P02C	413
17/10/69	21.3		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.2	R	10.02	1596	C	17	C	0.63	B	5.49		413
17/10/69	21.3		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.3	R	10.40	1596	C	16	C	0.43				413
17/10/69	22.3		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	19.0	R	9.26	1597	C	17	C	0.65			P02C	413
17/10/69	22.3		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.3	R	9.37	1597	C	17	C	0.50	B	5.10		413
17/10/69	22.3		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.3	R	9.60	1597	C	16	C	0.33				413
17/10/69	23.3		CYR1		37-32.3	76-48.7	5.5						03	00.0	J	18.9	R	8.06	1598	C	17	C	0.60			P02C	413
17/10/69	23.3		CYR1		37-32.3	76-48.7	5.5						03	02.0	J	19.2	R	8.41	1598	C	17	C	0.37	B	4.82		413
17/10/69	23.3		CYR1		37-32.3	76-48.7	5.5						03	04.0	J	19.3	R	8.76	1598	C	16	C	0.22				413
18/10/69	00.3		CYR1		37-32.3	76-48.7	6.0						04	00.0	J	19.1	R	7.49	1599	C	16	C	0.34			P02C	413
18/10/69	00.3		CYR1		37-32.3	76-48.7	6.0						04	02.0	J	19.2	R	7.92	1599	C	16	C	0.20	B	4.44		413
18/10/69	00.3		CYR1		37-32.3	76-48.7	6.0						04	04.0	J	19.2	R	8.10	1599	C	15	C	0.08				413
18/10/69	00.3		CYR1		37-32.3	76-48.7	6.0						04	06.0			R	8.18	1599								413

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DO COL STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DO	COL	STA
17/10/69	14.2		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	19.5	R	8.79	1589	C	35	C	C.65			PO2C	413
17/10/69	14.2		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.5	R	9.45	1589	C	35	C	C.75	B	6.05		413
17/10/69	14.2		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.5	R	1C.48	1589	C	35	C	C.65				413
17/1C/69	14.2		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	19.5	R	1C.78	1589	C	35	C	C.55				413
17/10/69	15.4		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	19.4	R	1C.52	1590	C	36	C	C.55			PO2C	413
17/10/69	15.4		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.5	R	1C.63	159C	C	36	C	C.65	B	6.67		413
17/10/69	15.4		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.5	R	11.22	1590	C	35	C	C.65				413
17/10/69	15.4		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	19.6	R	11.2C	1590	C	35	C	C.65				413
17/1C/69	16.3		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	19.2	R	11.28	1591	C	36	C	C.37			PO2C	413
17/10/69	16.3		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.2	R	11.3C	1591	C	36	C	C.41	B	6.63		413
17/1C/69	16.3		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.4	R	11.5C	1591	C	35	C	C.48				413
17/1C/69	16.3		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	19.4	R	11.87	1591	C	35	C	C.44				413
17/10/69	17.4		CYR1		37-32.3	76-48.7	6.C					C4	CC.C	J	19.C	R	11.44	1592	C	36	C	C.11			PO2C	413
17/1C/69	17.4		CYR1		37-32.3	76-48.7	6.C					C4	C2.C	J	19.2	R	11.25	1592	C	36	C	C.17	B	6.65		413
17/10/69	17.4		CYR1		37-32.3	76-48.7	6.C					C4	C4.C	J	19.4	R	12.44	1592	C	34	C	C.15				413
17/1C/69	17.4		CYR1		37-32.3	76-48.7	6.C					C4	C6.C	J	19.4	R	12.27	1592	C	32	C	C.C8				413
17/10/69	18.4		CYR1		37-32.3	76-48.7	6.C					C5	CC.C	J	18.7	R	9.8C	1593	C	16	C	C.34			PO2C	413
17/10/69	18.4		CYR1		37-32.3	76-48.7	6.C					C5	C2.C	J	19.C	R	11.37	1593	C	18	C	C.14	B	6.79		413
17/10/69	18.4		CYR1		37-32.3	76-48.7	6.C					C5	C4.C	J	19.3	R	12.C1	1593	C	16	C	C.17				413
17/10/69	18.4		CYR1		37-32.3	76-48.7	6.C					C5	C5.C					1593					B	7.1C		413
17/1C/69	18.4		CYR1		37-32.3	76-48.7	6.C					C5	C6.C	J	18.4	R	12.47	1593	C	17	C	C.C4				413

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV CV NC DPT I TEMP I SALN CCCC I CR I VEL I DO COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
18/10/69	08.2		CYR1		37-32.3	76-48.6	5.4						04	00.0	J	18.4	R	8.56	1583	C	16	C	0.61			P02B	412
18/10/69	08.2		CYR1		37-32.3	76-48.6	5.4						04	02.0	J	18.7	R	9.99	1583	C	16	C	0.33	B	5.43		412
18/10/69	08.2		CYR1		37-32.3	76-48.6	5.4						04	04.0	J	18.7	R	11.09	1583	C	16	C	0.17				412
18/10/69	08.2		CYR1		37-32.3	76-48.6	5.4						04	04.5					1583					B	5.95		412
18/10/69	09.2		CYR1		37-32.3	76-48.6	5.1						03	00.0	J	18.2	R	8.18	1584	C	17	C	0.91			P02B	412
18/10/69	09.2		CYR1		37-32.3	76-48.6	5.1						03	02.0	J	18.6	R	8.18	1584	C	16	C	0.53	B	5.30		412
18/10/69	09.2		CYR1		37-32.3	76-48.6	5.1						03	04.0	J	18.7	R	10.71	1584	C	16	C	0.26	B	5.30		412
18/10/69	10.2		CYR1		37-32.3	76-48.6	5.0						03	00.0	J	18.6	R	7.60	1585	C	15	C	0.83			P02B	412
18/10/69	10.2		CYR1		37-32.3	76-48.6	5.0						03	02.0	J	18.8	R	8.81	1585	C	16	C	0.48	B	4.66		412
18/10/69	10.2		CYR1		37-32.3	76-48.6	5.0						03	04.0	J	18.8	R	9.79	1585	C	17	C	0.22	B	5.18		412
18/10/69	11.2		CYR1		37-32.3	76-48.6	5.1						03	00.0	J	18.9	R	7.02	1586	C	16	C	0.70			P02B	412
18/10/69	11.2		CYR1		37-32.3	76-48.6	5.1						03	02.0	J	18.8	R	7.68	1586	C	16	C	0.41	B	5.84		412
18/10/69	11.2		CYR1		37-32.3	76-48.6	5.1						03	04.0	J	18.9	R	8.45	1586	C	17	C	0.18	B	4.90		412
18/10/69	12.2		CYR1		37-32.3	76-48.6	5.1						03	00.0	J	18.9	R	6.23	1587	C	16	C	0.53			P02B	412
18/10/69	12.2		CYR1		37-32.3	76-48.6	5.1						03	02.0	J	18.9			1587	C	15	C	0.24	B	5.10		412
18/10/69	12.2		CYR1		37-32.3	76-48.6	5.1						03	04.0	J	18.9	R	7.57	1587	C	17	C	0.03	B	5.08		412
18/10/69	13.2		CYR1		37-32.3	76-48.6	5.1						03	00.0	J	19.1	R	5.77	1588	C	17	C	0.23			P02B	412
18/10/69	13.2		CYR1		37-32.3	76-48.6	5.1						03	02.0	J	18.9	R	6.45	1588	C	23	C	0.03	B	5.28		412
18/10/69	13.2		CYR1		37-32.3	76-48.6	5.1						03	04.0	J	18.9	R	6.81	1588	C	15	C	0.15	B	5.50		412
DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	CV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD	T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	DR	I	VEL	I	DC	COL	STA
18/10/69	03.2		CYR1		37-32.3	76-48.6	6.0						05	00.0	J	18.5	R	7.54	1578	C	36	C	0.39			P02B	412
18/10/69	03.2		CYR1		37-32.3	76-48.6	6.0						05	02.0	J	19.1	R	7.60	1578	C	35	C	0.58	B	4.82		412
18/10/69	03.2		CYR1		37-32.3	76-48.6	6.0						05	04.0	J	19.1	R	8.94	1578	C	36	C	0.58				412
18/10/69	03.2		CYR1		37-32.3	76-48.6	6.0						05	05.0					1578					B	4.78		412
18/10/69	03.2		CYR1		37-32.3	76-48.6	6.0						05	06.0			R	9.77	1578								412
18/10/69	04.2		CYR1		37-32.3	76-48.6	6.0						04	00.0	J	18.3	R	8.82	1579	C	36	C	0.60			P02B	412
18/10/69	04.2		CYR1		37-32.3	76-48.6	6.0						04	02.0	J	18.6	R	9.05	1579	C	35	C	0.58	B	5.04		412
18/10/69	04.2		CYR1		37-32.3	76-48.6	6.0						04	04.0	J	18.7	R	9.70	1579	C	34	C	0.55				412
18/10/69	04.2		CYR1		37-32.3	76-48.6	6.0						04	06.0			R	10.41	1579	C	35	C	0.40				412
18/10/69	05.2		CYR1		37-32.3	76-48.6	6.0						05	00.0	J	18.3	R	10.13	1580	C	36	C	0.43			P02B	412
18/10/69	05.2		CYR1		37-32.3	76-48.6	6.0						05	02.0	J	18.7	R	10.45	1580	C	36	C	0.43	B	5.67		412
18/10/69	05.2		CYR1		37-32.3	76-48.6	6.0						05	04.0	J	18.8	R	11.12	1580	C	36	C	0.37				412
18/10/69	05.2		CYR1		37-32.3	76-48.6	6.0						05	05.0					1580					B	5.93		412
18/10/69	05.2		CYR1		37-32.3	76-48.6	6.0						05	06.0	J	18.9	R	9.92	1580	C	36	C	0.24				412
18/10/69	06.2		CYR1		37-32.3	76-48.6	5.7						04	00.0	J	18.7	R	10.35	1581	C	36	C	0.16			P02B	412
18/10/69	06.2		CYR1		37-32.3	76-48.6	5.7						04	02.0	J	18.7	R	10.52	1581	C	35	C	0.20	B	5.95		412
18/10/69	06.2		CYR1		37-32.3	76-48.6	5.7						04	04.0	J	18.9	R	11.31	1581	C	33	C	0.12				412
18/10/69	06.2		CYR1		37-32.3	76-48.6	5.7						04	04.7					1581					B	5.71		412
18/10/69	07.2		CYR1		37-32.3	76-48.6	5.4						04	00.0	J	17.5	R	9.78	1582	C	16	C	0.17			P02B	412
18/10/69	07.2		CYR1		37-32.3	76-48.6	5.4						04	02.0	J	18.3	R	10.67	1582	C	18	C	0.17	B	5.73		412
18/10/69	07.2		CYR1		37-32.3	76-48.6	5.4						04	04.0	J	18.8	R	11.32	1582	C	17	C	0.11				412
18/10/69	07.2		CYR1		37-32.3	76-48.6	5.4						04	04.4					1582					B	5.95		412

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I DR I VEL I DC COL STA

DA/MO/YR	TIM	VS	DNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	DC	COL	STA
17/10/69	21.2		CYR1		37-32.3	76-48.6	5.0					03	00.0	J	18.7	R	9.71	1572	0	17	0	0.85			P02B	412
17/10/69	21.2		CYR1		37-32.3	76-48.6	5.0					03	02.0	J	19.2	R	10.00	1572	0	17	0	0.68	B	6.94		412
17/10/69	21.2		CYR1		37-32.3	76-48.6	5.0					03	04.0	J	19.4	R	10.51	1572	0	17	0	0.40	B	5.81		412
17/10/69	22.2		CYR1		37-32.3	76-48.6	5.0					03	00.0	J	19.0	R	9.29	1573	0	17	0	0.70			P02B	412
17/10/69	22.2		CYR1		37-32.3	76-48.6	5.0					03	02.0	J	19.2	R	9.36	1573	0	17	0	0.60	B	5.26		412
17/10/69	22.2		CYR1		37-32.3	76-48.6	5.0					03	04.0	J	19.3	R	9.62	1573	0	16	0	0.31	B	5.10		412
17/10/69	23.2		CYR1		37-32.3	76-48.6	5.5					03	00.0	J	18.9	R	8.22	1574	0	16	0	0.60			P02B	412
17/10/69	23.2		CYR1		37-32.3	76-48.6	5.5					03	02.0	J	19.2	R	8.41	1574	0	17	0	0.41	B	4.75		412
17/10/69	23.2		CYR1		37-32.3	76-48.6	5.5					03	04.0	J	19.3	R	8.82	1574	0	16	0	0.20	B	4.72		412
18/10/69	00.2		CYR1		37-32.3	76-48.6	5.0					03	00.0	J	18.9	R	7.39	1575	0	16	0	0.41			P02B	412
18/10/69	00.2		CYR1		37-32.3	76-48.6	5.0					03	02.0	J	19.2	R	7.78	1575	0	16	0	0.19	B	4.72		412
18/10/69	00.2		CYR1		37-32.3	76-48.6	5.0					03	04.0	J	19.2	R	8.32	1575	0	16	0	0.05	B	4.78		412
18/10/69	01.2		CYR1		37-32.3	76-48.6	5.5					03	00.0	J	18.9	R	7.02	1576	0	17	0	0.13			P02B	412
18/10/69	01.2		CYR1		37-32.3	76-48.6	5.5					03	02.0	J	19.1	R	7.38	1576	0	20	0	0.03	B	4.72		412
18/10/69	01.2		CYR1		37-32.3	76-48.6	5.5					03	04.0	J	19.2	R	7.90	1576	0	36	0	0.09	B	4.92		412
18/10/69	02.2		CYR1		37-32.3	76-48.6	5.5					03	00.0	J	18.7	R	8.18	1577	0	35	0	0.14			P02B	412
18/10/69	02.2		CYR1		37-32.3	76-48.6	5.5					03	02.0	J	19.1	R	7.08	1577	0	36	0	0.20	B	4.60		412
18/10/69	02.2		CYR1		37-32.3	76-48.6	5.5					03	04.0	J	19.2	R	7.29	1577	0	35	0	0.25	B	4.88		412

DA/MO/YR TIM VS DNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCC I CR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT WC WV CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/10/69	16.2		CYR1		37-32.3	76-48.6	6.C		C4	CC.C	J	19.2	R	11.C9	1567	C	C4	C	C.55			P02B	412
17/10/69	16.2		CYR1		37-32.3	76-48.6	6.C		C4	C2.C	J	19.4	R	11.11	1567	C	36	C	C.55	B	6.59		412
17/10/69	16.2		CYR1		37-32.3	76-48.6	6.C		C4	C4.C	J	19.4	R	11.43	1567	C	35	C	C.55				412
17/10/69	16.2		CYR1		37-32.3	76-48.6	6.C		C4	C6.C	J	19.4	R	11.7C	1567	C	35	C	C.42	B	6.15		412
17/10/69	17.1		CYR1		37-32.3	76-48.6	6.C		C4	CC.C	J	19.2	R	1C.97	1568	C	02	C	0.2C			P02B	412
17/10/69	17.1		CYR1		37-32.3	76-48.6	6.C		C4	C2.C	J	19.2	R	11.36	1568	C	02	C	C.22	B	6.77		412
17/10/69	17.1		CYR1		37-32.3	76-48.6	6.C		C4	C4.C	J	19.4	R	11.7C	1568	C	35	C	C.22				412
17/10/69	17.1		CYR1		37-32.3	76-48.6	6.C		C4	C6.C	J	19.4	R	12.21	1568	C	35	C	C.29	B	6.39		412
17/10/69	18.2		CYR1		37-32.3	76-48.6	6.C		C5	CC.C	J	19.C	R	11.25	1569	C	16	C	C.11			P02B	412
17/1C/69	18.2		CYR1		37-32.3	76-48.6	6.C		C5	C2.C	J	19.2	R	11.54	1569	C	16	C	C.C3	B	7.24		412
17/10/69	18.2		CYR1		37-32.3	76-48.6	6.C		C5	C4.C	J	19.3	R	12.13	1569	C	34	C	C.C1				412
17/10/69	18.2		CYR1		37-32.3	76-48.6	6.C		C5	C5.C					1569					B	6.49		412
17/10/69	18.2		CYR1		37-32.3	76-48.6	6.C		C5	C6.C	J	19.4	R	12.45	1569	C	21	C	C.CO				412
17/1C/69	19.2		CYR1		37-32.3	76-48.6	5.5		C3	CC.C	J	19.2	R	11.C1	1570	C	16	C	C.5C			P02B	412
17/1C/69	19.2		CYR1		37-32.3	76-48.6	5.5		C3	C2.C	J	19.4	R	11.16	157C	C	17	C	C.C4	B	6.32		412
17/10/69	19.2		CYR1		37-32.3	76-48.6	5.5		C3	C4.C	J	19.4	R	11.95	157C	C	17	C	C.2C	B	6.47		412
17/10/69	2C.2		CYR1		37-32.3	76-48.6	5.5		C3	CC.C	J	19.3	R	9.34	1571	C	17	C	C.75			P02B	412
17/10/69	2C.2		CYR1		37-32.3	76-48.6	5.5		C3	C2.C	J	19.4	R	1C.9C	1571	C	17	C	C.55	B	5.96		412
17/1C/69	2C.2		CYR1		37-32.3	76-48.6	5.5		C3	C4.C	J	19.4	R	11.62	1571	C	17	C	C.35	B	6.26		412

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA
18/10/69	1C.C		CYR1		37-32.4	76-48.5	5.1						C3	CC.C	J	18.6	R	7.88	1561	C	16	C	C.82			P02A	411
18/1C/69	1C.C		CYR1		37-32.4	76-48.5	5.1						C3	C2.C	J	18.7	R	8.46	1561	C	17	C	C.51	B	5.CC		411
18/1C/69	1C.C		CYR1		37-32.4	76-48.5	5.1						C3	C4.C	J	18.7	R	9.57	1561	C	17	C	C.21	B	4.9C		411
18/10/69	11.C		CYR1		37-32.4	76-48.5	5.1						C3	CC.C	J	18.8	R	7.15	1562	C	16	C	C.68			P02A	411
18/1C/69	11.C		CYR1		37-32.4	76-48.5	5.1						C3	C2.C	J	18.8	R	7.62	1562	C	16	C	C.5C	B	5.48		411
18/1C/69	11.C		CYR1		37-32.4	76-48.5	5.1						C3	C4.C	J	18.9	R	8.36	1562	C	17	C	C.2C	B	4.68		411
18/1C/69	12.C		CYR1		37-32.4	76-48.5	5.1						C3	CC.C	J	18.9	R	6.66	1563	C	15	C	C.54			P02A	411
18/10/69	12.C		CYR1		37-32.4	76-48.5	5.1						C3	C2.C	J	18.9	R	7.C7	1563	C	17	C	C.31	B	5.78		411
18/10/69	12.C		CYR1		37-32.4	76-48.5	5.1						C3	C4.C	J	18.9	R	7.64	1563	C	16	C	C.1C	B	4.9C		411
18/10/69	13.C		CYR1		37-32.4	76-48.5	5.C						C3	CC.C	J	19.C	R	5.7C	1564	C	16	C	C.35			P02A	411
18/10/69	13.C		CYR1		37-32.4	76-48.5	5.C						C3	C2.C	J	18.9	R	6.60	1564	C	22	C	C.C3	B	5.5C		411
18/1C/69	13.C		CYR1		37-32.4	76-48.5	5.C						C3	C4.C	J	18.9	R	7.43	1564	C	35	C	C.11	B	5.12		411
17/1C/69	14.2		CYR1		37-32.3	76-48.6	6.C						C4	CC.C	J	19.1	R	9.49	1565	C	C3	C	C.75			P02B	412
17/1C/69	14.2		CYR1		37-32.3	76-48.6	6.C						C4	C2.C	J	19.2	R	9.27	1565	C	36	C	C.75	B	5.77		412
17/10/69	14.2		CYR1		37-32.3	76-48.6	6.C						C4	C4.C	J	19.6	R	1C.41	1565	C	35	C	C.75				412
17/10/69	14.2		CYR1		37-32.3	76-48.6	6.C						C4	C6.C	J	19.6	R	1C.4C	1565	C	35	C	C.65	B	5.63		412
17/1C/69	15.2		CYR1		37-32.3	76-48.6	6.C						C4	CC.C	J	19.C	R	1C.71	1566	C	35	C	C.75			P02B	412
17/10/69	15.2		CYR1		37-32.3	76-48.6	6.C						C4	C2.C	J	19.4	R	1C.84	1566	C	35	C	C.75	B	6.57		412
17/10/69	15.2		CYR1		37-32.3	76-48.6	6.C						C4	C4.C	J	19.4	R	1C.92	1566	C	35	C	C.65				412
17/10/69	15.2		CYR1		37-32.3	76-48.6	6.C						C4	C6.C	J	19.5	R	1C.57	1566	C	35	C	C.65	B	6.67		412
CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA

DA/MO/YR	TIM	VS	CNC	ARA	DG-MIN	DG-MIN	WD T	AT	WD	WV	DV	NC	DPT	I	TEMP	I	SALN	CCCD	I	DR	I	VEL	I	DC	COL	STA
18/10/69	05.0		CYR1		37-32.4	76-48.5	6.0					05	00.0	J	18.1	R	9.67	1556	0	35	0	0.44			P02A	411
18/10/69	05.0		CYR1		37-32.4	76-48.5	6.0					05	02.0	J	18.8	R	10.24	1556	0	35	0	0.39	B	5.49		411
18/10/69	05.0		CYR1		37-32.4	76-48.5	6.0					05	04.0	J	18.9	R	10.71	1556	0	35	0	0.33				411
18/10/69	05.0		CYR1		37-32.4	76-48.5	6.0					05	05.0					1556					B	5.63		411
18/10/69	05.0		CYR1		37-32.4	76-48.5	6.0					05	06.0	J	19.0	R	10.70	1556	0	36	0	0.21				411
18/10/69	06.0		CYR1		37-32.4	76-48.5	5.5					04	00.0	J	18.6	R	10.69	1557	0	32	0	0.13			P02A	411
18/10/69	06.0		CYR1		37-32.4	76-48.5	5.5					04	02.0	J	19.0	R	11.11	1557	0	36	0	0.19	B	5.79		411
18/10/69	06.0		CYR1		37-32.4	76-48.5	5.5					04	04.0	J	19.1	R	11.27	1557	0	10	0	0.07				411
18/10/69	06.0		CYR1		37-32.4	76-48.5	5.5					04	04.5					1557					B	5.97		411
18/10/69	07.0		CYR1		37-32.4	76-48.5	5.1					03	00.0	J	18.6	R	10.65	1558	0	15	0	0.17			P02A	411
18/10/69	07.0		CYR1		37-32.4	76-48.5	5.1					03	02.0	J	19.0	R	10.91	1558	0	17	0	0.12	B	5.59		411
18/10/69	07.0		CYR1		37-32.4	76-48.5	5.1					03	04.0	J	19.1	R	10.36	1558	0	18	0	0.10	B	5.89		411
18/10/69	08.0		CYR1		37-32.4	76-48.5	5.1					03	00.0	J	18.2	R	9.40	1559	0	17	0	0.16			P02A	411
18/10/69	08.0		CYR1		37-32.4	76-48.5	5.1					03	02.0	J	18.6	R	10.19	1559	0	16	0	0.38	B	5.33		411
18/10/69	08.0		CYR1		37-32.4	76-48.5	5.1					03	04.0	J	18.9	R	10.95	1559	0	17	0	0.14	B	5.69		411
18/10/69	09.0		CYR1		37-32.4	76-48.5	5.1					03	00.0	J	18.4	R	7.97	1560	0	16	0	0.85			P02A	411
18/10/69	09.0		CYR1		37-32.4	76-48.5	5.1					03	02.0	J	18.7	R	10.07	1560	0	16	0	0.53	B	5.59		411
18/10/69	09.0		CYR1		37-32.4	76-48.5	5.1					03	04.0	J	18.8	R	10.66	1560	0	16	0	0.24	B	5.83		411

DA/MO/YR TIM VS CNC ARA DG-MIN DG-MIN WD T AT WD WV DV NC DPT I TEMP I SALN CCCD I DR I VEL I DC COL STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	CCL	STA
17/10/69	23.C		CYR1		37-32.4	76-48.5	5.C						C3	CC.C	J	19.2	R	6.84	1550	C	16	C	C.58			P02A	411
17/10/69	23.C		CYR1		37-32.4	76-48.5	5.C						C3	C2.C	J	19.2	R	8.56	1550	C	17	C	C.42	B	4.9C		411
17/10/69	23.C		CYR1		37-32.4	76-48.5	5.C						C3	C4.C	J	19.2	R	8.7C	155C	C	17	C	C.21	B	5.CC		411
18/10/69	CC.C		CYR1		37-32.4	76-48.5	5.5						C3	CC.C	J	18.8	R	7.58	1551	C	17	C	C.39			P02A	411
18/10/69	CC.C		CYR1		37-32.4	76-48.5	5.5						C3	C2.C	J	19.1	R	7.7C	1551	C	17	C	C.21	B	4.84		411
18/10/69	CC.C		CYR1		37-32.4	76-48.5	5.5						C3	C4.C	J	19.2	R	8.29	1551	C	16	C	C.C9	B	4.82		411
18/10/69	C1.C		CYR1		37-32.4	76-48.5	5.5						C3	CC.C	J	19.C	R	7.12	1552	C	17	C	C.16			P02A	411
18/10/69	C1.C		CYR1		37-32.4	76-48.5	5.5						C3	C2.C	J	19.1	R	7.33	1552	C	18	C	C.C1	B	4.92		411
18/10/69	C1.C		CYR1		37-32.4	76-48.5	5.5						C3	C4.C			R	8.1C	1552	C	1C	C	C.1C	B	4.82		411
18/10/69	C2.C		CYR1		37-32.4	76-48.5	5.5						C3	CC.C	J	18.1	R	8.61	1553	C	C7	C	C.C4			P02A	411
18/10/69	C2.C		CYR1		37-32.4	76-48.5	5.5						C3	C2.C	J	19.C	R	7.C6	1553	C	C2	C	C.17	B	4.62		411
18/10/69	C2.C		CYR1		37-32.4	76-48.5	5.5						C3	C4.C	J	19.3	R	7.25	1553	C	36	C	C.16	B	4.86		411
18/10/69	C3.C		CYR1		37-32.4	76-48.5	6.C						C4	CC.C	J	18.C	R	6.75	1554	C	36	C	C.36			P02A	411
18/10/69	C3.C		CYR1		37-32.4	76-48.5	6.C						C4	C2.C	J	19.1	R	7.99	1554	C	36	C	C.5C	B	4.44		411
18/10/69	C3.C		CYR1		37-32.4	76-48.5	6.C						C4	C4.C	J	19.1	R	9.39	1554	C	35	C	C.45	B	4.62		411
18/10/69	C3.C		CYR1		37-32.4	76-48.5	6.C						C4	C6.C			R	9.7C	1554								411
18/10/69	C4.C		CYR1		37-32.4	76-48.5	6.C						C5	CC.C	J	18.2	R	8.C4	1555	C	36	C	C.6C			P02A	411
18/10/69	C4.C		CYR1		37-32.4	76-48.5	6.C						C5	C2.C	J	18.7	R	9.21	1555	C	35	C	C.58	B	5.18		411
18/10/69	C4.C		CYR1		37-32.4	76-48.5	6.C						C5	C4.C	J	18.8	R	9.97	1555	C	35	C	C.4C				411
18/10/69	C4.C		CYR1		37-32.4	76-48.5	6.C						C5	C5.C					1555					B	5.49		411
18/10/69	C4.C		CYR1		37-32.4	76-48.5	6.C						C5	C6.C	J	18.9	R	1C.C1	1555	C	35	C	C.27				411
CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC	T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA

CA/MC/YR	TIM	VS	CNC	ARA	CG-MIN	CG-MIN	WC T	AT	WC	WV	CV	NC	CPT	I	TEMP	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA
17/1C/69	17.C		CYR1		37-32.4	76-48.5	6.C					C4	CC.C	J	19.8	R	1C.61	1544	C	36	C	C.23			PO2A	411
17/1C/69	17.C		CYR1		37-32.4	76-48.5	6.C					C4	C2.C	J	19.8	R	11.63	1544	C	35	C	C.26	B	5.79		411
17/1C/69	17.C		CYR1		37-32.4	76-48.5	6.C					C4	C4.C	J	19.5	R	11.86	1544	C	35	C	C.27				411
17/1C/69	17.C		CYR1		37-32.4	76-48.5	6.C					C4	C6.C	J	19.5	R	11.82	1544	C	35	C	C.21	B	6.57		411
17/10/69	18.C		CYR1		37-32.4	76-48.5	5.5					C4	CC.C	J	19.5	R	11.C7	1545	C	15	C	C.16	B	6.13	PO2A	411
17/10/69	18.C		CYR1		37-32.4	76-48.5	5.5					C4	C2.C	J	19.4	R	11.31	1545	C	16	C	C.C7				411
17/1C/69	18.C		CYR1		37-32.4	76-48.5	5.5					C4	C4.C	J	19.4	R	12.25	1545	C	17	C	C.C2				411
17/10/69	18.C		CYR1		37-32.4	76-48.5	5.5					C4	C5.C			R	12.5C	1545					B	5.53		411
17/10/69	19.C		CYR1		37-32.4	76-48.5	5.C					C3	CC.C	J	19.2	R	11.27	1546	C	16	C	C.47			PO2A	411
17/1C/69	19.C		CYR1		37-32.4	76-48.5	5.C					C3	C2.C	J	19.4	R	11.33	1546	C	16	C	C.41	B	6.2C		411
17/10/69	19.C		CYR1		37-32.4	76-48.5	5.C					C3	C4.C			R	12.1C	1546	C	17	C	C.22	B	6.36		411
17/1C/69	2C.C		CYR1		37-32.4	76-48.5	5.5					C3	CC.C	J	19.4	R	9.91	1547	C	17	C	C.75			PO2A	411
17/1C/69	2C.C		CYR1		37-32.4	76-48.5	5.5					C3	C2.C	J	19.4	R	1C.94	1547	C	18	C	C.6C	B	5.92		411
17/10/69	2C.C		CYR1		37-32.4	76-48.5	5.5					C3	C4.C	J	19.4	R	11.51	1547	C	16	C	C.35	B	6.C6		411
17/10/69	21.C		CYR1		37-32.4	76-48.5	5.5					C3	CC.C	J	19.1	R	9.99	1548	C	17	C	C.75			PO2A	411
17/1C/69	21.C		CYR1		37-32.4	76-48.5	5.5					C3	C2.C	J	19.3	R	1C.2C	1548	C	17	C	C.6C	B	5.16		411
17/1C/69	21.C		CYR1		37-32.4	76-48.5	5.5					C3	C4.C	J	19.3	R	1C.55	1548	C	17	C	C.35	B	6.87		411
17/1C/69	22.C		CYR1		37-32.4	76-48.5	5.C					C3	CC.C	J	19.2	R	9.44	1549	C	16	C	C.7C			PO2A	411
17/1C/69	22.C		CYR1		37-32.4	76-48.5	5.C					C3	C2.C	J	19.2	R	9.45	1549	C	17	C	C.6C	B	5.32		411
17/1C/69	22.C		CYR1		37-32.4	76-48.5	5.C					C3	C4.C	J	19.2	R	9.63	1549	C	17	C	C.32	B	5.38		411

CA/MC/YR TIM VS CNC ARA CG-MIN CG-MIN WC T AT WC WV CV NC CPT I TEMP I SALN CCCC I CR I VEL I CC COL STA

17/1C/69	14.C	CYR1	37-32.4	76-48.5	6.C	C4	CC.C	J	19.9	R	8.21	1541	C	35	C	C.65			P02A	411
17/10/69	14.C	CYR1	37-32.4	76-48.5	6.C	C4	C2.C	J	19.9	R	8.5C	1541	C	35	C	C.65	B	5.23		411
17/1C/69	14.C	CYR1	37-32.4	76-48.5	6.C	C4	C4.C	J	19.1	R	1C.C1	1541	C	35	C	C.65				411
17/1C/69	14.C	CYR1	37-32.4	76-48.5	6.C	C4	C6.C	J	19.1	R	9.98	1541	C	35	C	C.43	B	5.85		411
17/1C/69	15.C	CYR1	37-32.4	76-48.5	6.C	C4	CC.C	J	19.5	R	1C.29	1542	C	36	C	C.65			P02A	411
17/1C/69	15.C	CYR1	37-32.4	76-48.5	6.C	C4	C2.C	J	19.5	R	1C.25	1542	C	35	C	C.65	B	5.99		411
17/10/69	15.C	CYR1	37-32.4	76-48.5	6.C	C4	C4.C	J	19.5	R	1C.69	1542	C	35	C	C.55				411
17/10/69	15.C	CYR1	37-32.4	76-48.5	6.C	C4	C6.C	J	19.5	R	1C.67	1542	C	35	C	C.55	B	5.73		411
17/1C/69	16.C	CYR1	37-32.4	76-48.5	6.C	C4	CC.C	J	19.1	R	1C.72	1543	C	36	C	C.55			P02A	411
17/10/69	16.C	CYR1	37-32.4	76-48.5	6.C	C4	C2.C	J	19.3	R	1C.62	1543	C	35	C	C.65	B	6.53		411
17/10/69	16.C	CYR1	37-32.4	76-48.5	6.C	C4	C4.C	J	19.4	R	1C.89	1543	C	35	C	C.55				411
17/1C/69	16.C	CYR1	37-32.4	76-48.5	6.C	C4	C6.C	J	19.5	R	1C.79	1543	C	35	C	C.36	B	6.75		411
CA/MC/YR	TIM	VS CNC	ARA CG-MIN	CG-MIN	WC T	AT WC WV CV NC	CPT	I	TEMF	I	SALN	CCCC	I	CR	I	VEL	I	CC	COL	STA

APPENDIX D

LISTING OF COMPUTER PROGRAM FOR THE MATHEMATICAL MODEL OF DISSOLVED OXYGEN IN THE PAMUNKEY-YORK ESTUARIES, TOGETHER WITH INPUT DATA.

```
//OYRFANG  JOB (0165,MV03,15,3),'FANG',MSGLEVEL=(1,1),CLASS=C
// EXEC FORTGCLG
//FORT.SYSIN  DD  *
C      DATA  ARRAYS CF CONSTANT  SIZE
       REAL  K1(1),K2(1),K3(1)
       DIMENSION  DTR(1),DWQP(1),DTP(1),QTP(1),EDC(1),UAV(1),
      1     BODT(1),BCNT(1),DOT(1),ALFA(1),BET(1),TO(1),CS(1),
      2     QTR(1),BOCP(1),BONP(1)
C     *         *         *         *         *
C     IN THE FOLLOWING ARRAYS IN COMMON, THE FIRST SUBSCRIPT EQUALS  THE
C       MAXIMUM  ALLCWABLE  NUMBER OF  ITEMS  OF A  PARTICULAR  TYPE
C     SAME  DIMENSION  MUST  BE  USED  IN  SUBROUTINE  INPUT
C     *         *         *         *         *
       COMMCN IR,IW,NTR,NH ,NTP,NOS,INOU,INOP,DUP,QUP,BODU,DOU,XO,DXMAX,
      1     DIV,IP,BASE,NG(11),TITLE(35),NWQP
       COMMON  NATR(2,8),TR(2,5),DH(30),AH(30),BH(30),WQP(30,9),
      1     RQ(30),KSL(5),KPT(5),KK(5),NAP(3,8),PLANT(5,4),TPVAL(12,4)
       EQUIVALENCE (CTR(1),TR(1,1)),(BODT(1),TR(1,4)), (QTR(1),TR(1,2)),
      1    (DTP(1),PLANT(1,1)),(DOT(1),TR(1,3)),(BONP(1),PLANT(1,4)),
      2    (BONT(1),TR(1,5)),(K1(1),WQP(1,1)),(K2(1),WQP(1,2)),
      3    (K3(1),WQP(1,3)),(ALFA(1),WQP(1,4)),(BET(1),WQP(1,5)),
      4    (TO(1),WQP(1,6)),(CS(1),WQP(1,7)),(EDC(1),WQP(1,8)),
      5    (UAV(1),WQP(1,9 )),(QTP(1),PLANT(1,2)),(BODP(1),PLANT(1,3))
2      FORMAT(1H1)
4      FORMAT(20X,6F10.2)
6      FORMAT(/1X,8A2/)
8      FORMAT(1X,'GRCUP',I2)
10     FORMAT(20X,35A2//)
12     FORMAT(1X,20('*'),'SUMMARY OF RESULTS',20('*')//1X,
      1 'REACH   FROM  TO  QUALI','TY  CLASSIFICATION      COMPUTED MINIMU
      2M DISSOLVED OXYGEN'/21X,'DESIRED                 LOCATION  D.O.   CS
      3     BOD'/54X,'MILE   MG/L   MG/L   MG/L')
15     FORMAT(/1X,I3,F9.2,F7.2,13X,F15.2,3(2X,F8.3))
       DO 41 I=1,11
41     NG(I)=1
       IR=5
       IW=6
       BASE=10
       DIV=2.302
       INOU=1
       INOP=1
       NTR=1
       NTP=1
       DXMAX=3.
       IP=6
50     CALL INPDA
       TU=0.
       DU=DUP
       QU=QUP
       BODUP=BODU
```

```
      DOUP=DOU
C     FIND  INITIAL VALUES OF CURRENT INDICES
      LTC=NOCC(DTR,NTR,DU)
      LHC=NOCC(DH,NH ,DU)
      LPC=NOCC(DTP,NTP,DU)
      CSU=CS(LHC)
      IPRIN=0
      NLINE=60
      CALL PAGE(IW,IP,1,NLINE,TITLE )
      WRITE(IW,4) DU,TU,DOUP,CSU,BODU,QU





C    *         *         *         *
C     FIND  NEXT  CHANGE  POINT
56    IT  =4
      XC=XO
      CALL  CMAX(3,IT  ,LPC,PLANT,XC,DU,I3)
      CALL  CMAX(2,IT  ,LHC,DH,XC,DU,I2)
      CALL  CMAX(1,IT  ,LTC,TR,XC,DU,I1)
      DX=DU-XC
      IF(DX-0.0001)60,60,92
C     MORE  THAN  ONE  CHANGE AT A POINT
60    IF(IT  -1)61,65,61
61    IF(IT  -2)63,65,63
63    IF(IT  -3)68,65,68
65    IPRIN=1
68    GO TO  (70,80,81,90),IT
C     TRIBUTARY
70    LTC=I1
      BOD=FTBOD(TO(LTC),BODT(LTC),BONT(LTC))
      BOD=0.185*BOD/QTR(LTC)
      CALL  CONJ(DOUP,BODUP,QU,DOT(LTC),BOD,QTR(LTC))
      IF(INOP)56,56,75
75    CALL  PAGE(IW,IP,3,NLINE,TITLE)
      WRITE(IW,6)(NATR(LTC,I),I=1,8)
      GO TO 56
C     HYDRAULIC
80    LHC=I2
      QU= RQ(I2)
      GO TO 90
C     TREATMENT  PLANT
81    LPC=I3
      K=KSL(LPC)+KPT(LPC)-1
      Q=1.55*QTP(LPC)
      BOD=FTBOD(TO(LPC),(1.-TPVAL(K,1))*BODP(LPC),(1.-TPVAL(K,2))*
     1    BONP(LPC))
      BOD=0.185*BOD/Q
      CALL CONJ(DOUP,BODUP,QU,TPVAL(K,3),BOD,Q)
```

```
      IF(INOP)56,56,83
83    CALL PAGE(IW,IP,3,NLINE,TITLE)
      WRITE(IW,6)(NAP(LPC,I),I=1,8)
      GO TO 56
90    CALL PAGE(IW,IP,1,NLINE,TITLE)
      WRITE(IW,8)IT
      GO TO 56
92    IF(IPRIN*INOP)95,95,93
93    CALL PAGE(IW,IP,1,NLINE,TITLE)
      CSU=CS(LHC)
      WRITE(IW,4)DU,TU,DOUP,CSU,BODUP,QU
95    IPRIN=0
C     COMPUTE  TERMS IN  CAMP'S  EQUATIONS
      C1=K1(LHC)*2.71**(0.046*(TO(LHC)-20.))
      C2=K2(LHC)*1.0241**(TO(LHC)-20.)
      C3=K3(LHC)
      V=AH(LHC)*QU**BH(LHC)
      DODU=CS(LHC)-DOUP
      CP4=BET(LHC)/(DIV*(C1+C3))
      CP3=BODUP-CP4
      CP1=C1*CP3/(C2-C1-C3)
      CP2=C1*(BET(LHC)/(C1+C3)-ALFA(LHC)/C1)/(DIV*C2)
      C4=UAV(LHC)/(2.*EDC(LHC))
      E1=.434*(C4-SQRT(C4*C4+DIV*(C1+C3)/EDC(LHC)))
      E2=.434*(C4-SQRT(C4*C4+DIV*C2/EDC(LHC)))
```



```
      IF(CP3)96,96,98
96    TC=-1
      GO TO 100
98    FAC=(CP1+CP2-DODU)/CP1
      IF(FAC)96,96,99
C     COMPUTE  CRITICAL  DEFICIT
C    *         *        *         *
99    TC=ALOG10(C2*FAC/(C1+C3))/(C2-C1-C3)
100   XD=DU
      DXC=1.E+10
      IF(TC)103,103,101
101   IF(TC-DX/V)102,103,103
102   DXC=TC*V
103   IX=XD-DXMAX+0.95
      DXM=DU-IX
      DXU=AMIN1(DX,DXC,DXM)
      T1=BASE**(E1*DXU)
      T2=BASE**(E2*DXU)
      XD=DU-DXU
      TD=TU+DXU/V
      DOD=CS(LHC)-CP1*(T1-T2)-CP2*(1.-T2)-DODU*T2
```

```
      BODD=CP3*T1+CP4
      IF(ABS(DXU-DXC)-0.0001)105,105,106
105   DXC=1.F+10
106   IF(INOP)110,110,107
107   CALL  PAGE(IW,IP,1,NLINE,TITLE)
      CSU=CS(LHC)
      WRITE(IW,4)XD,TD,DOD,CSU,BODD,QU
110   IF(ABS(DXU-DX)-0.0001)111,111,103
111   IF(IT  -4)112, 50,112
112   DU=XD
      TU=TD
      DOUP=DOD
      BODUP=BODD
      GO TO 60
      END
      FUNCTION  FTBCD(T,BODC,BODN)
      FTBOD=BODC*2.718**(0.02*(T-20.))/(1.-10.**(-0.5))+BODN
      RETURN
      END
      SUBROUTINE  CCNJ(DOU,BODU,QU,DOIN,BODIN,QIN)
      QUP=QU-QIN
      DOU=(DOU*QUP+DOIN*QIN)/QU
      BODU=(BODU*QUP+BODIN*QIN)/QU
      RETURN
      END
      FUNCTION  NOCC(A,N,X)
C    FIND  INITIAL  VALUES OF CURRENT  INDICES
      DIMENSION A(1)
      I=N
1     IF(A(I)-X)3,2,2
2     I=I-1
      GO TO 1
3     NOCC=I+1
      RETURN
      END
      SUBROUTINE  CMAX(I,J,K,X,Y,Z,L)
      DIMENSION X(1)
      L=K-1
      IF(L)5,5,1
1     IF(Y-X(L)-0.0001)2,2,5
2     J=I
      Y=X(L)
5     RETURN
      END
      SUBROUTINE   PAGE(I,J,K,L,T)
      DIMENSION T(35)
```

```
      IF(I-J)21,2,21
2     M=(L+K)/58
      IF(M)20,20,4
4     WRITE(I,5)
5     FORMAT(1H1)
      WRITE(I,7) (T(II),II=1,35)
7     FORMAT(5X,35A2)
      WRITE(J,9)
9     FORMAT(/1X,'DESCRIPTION',10X,'LOCATION    TIME     D.O.      DO.SA
     1T.      BOD  DISCHARGE'/20X,'RIVER MILE    DAYS     MG/L         MG
     2/L      MG/L        CFS')
      L=3+K
      GO TO 21
20    L=L+K
21    RETURN
      END
      SUBROUTINE  INPDA
C     SUBROUTINE  INPDA =INPUT  OF  DATA
      DIMENSION NAME (30)
      COMMON IR,IW,NTR,NH ,NTP,NOS,INOU,INOP,DUP,QUP,BODU,DOU,XO,DXMAX,
     1    DIV,IP,BASE,NG(11),TITLE(35),NWQP
      COMMON  NATR(2,8),TR(2,5),DH(30),AH(30),BH(30),WQP(30,9),
     1    RQ(30),KSL(5),KPT(5),KK(5),NAP(3,8),PLANT(5,4),TPVAL(12,4)
C    *         *         *
1     FORMAT(1H1)
2     FORMAT(2I5,30A2)
3     FORMAT (1X,35A2)
6     FORMAT(7F10.0)
13    FORMAT(I2,'INPUT  DATA  GROUP',I5,10X,30A2)
14    FORMAT(10X,'SUBGROUP  DATA',I5,10X,30A2)
15    FORMAT(3(8A2,4X))
16    FORMAT(/1X,15('*'),5X,'TRIBUTARIES',5X,15('*')/25X,'RIVER MILES
     1DISCHARGE          DO      BOD(5C)     BOD(N)')
18    FORMAT(1X,I3,2X,8A2,4X,5F10.2)
19    FORMAT(7E10.4)
21    FORMAT(/1X,20('*'),'HYDRAULIC REACHES',20('*')/6X,
     1'UPSTREAM  EXPONENTIAL CONSTANT')
23    FORMAT(1X,I5,F9.3,3X,E11.4,F11.4)
5     FORMAT(9E13.4)
27    FORMAT(/1X,20('*'),'RIVER DISCHARGE',20('*')/
     1 1X,'UPPER  END  DISCHARGE')
28    FORMAT(6F12.3)
29    FORMAT(/1X,20('*'),'TREATMENT, ALTERNATIVES',20('*')/25X,'REMOVAL
     1EFFICIENCIES         DO'/29X,'BOD(C)   BOD(N)')
30    FORMAT(/5X,8A2/(25X,3F10.3))
31    FORMAT(A2,8X,2F10.0)
```

-D5-

```
34     FORMAT(/1X,'DATA GROUP ',I2,'IS MISSING')
35     FORMAT(3X,'DUP=',F11.2,'QUP=',F11.2,'BODU=',F11.2,'DOU=',F11.2,
      1    'XO=',F11.2/)
36     FORMAT(3X,'DXMAX=',F12.2/)
37     FORMAT (14I5)
39     READ(IR,3)TITLE
       WRITE(IW,1)
       WRITE(IW,3)TITLE




40     READ (IR,2) NDG,NS,NAME
46     WRITE(IW,13)INOU,NDG,NAME
C     NDG=NO. OF DATA GROUP, NS=NO. OF SUBGROUP
       IF(NDG-99)49,200,200
49     IF(NDG-10)55,55,50
50     CALL EXIT
55     GO TO (61,81, 91,111,121,141,151,155,     165,181),NDG
C     TRIBUTARIES
C     *           *          *
61     NG(1)=0
63     READ(IR,2)NDG,NS,NAME
       IF(NDG)65,65,70
65     WRITE(IW,14)NS,NAME
       IF(NS-1)66,66,69
66     READ(IR,15)((NATR(I,J),J=1,8),I=1,NTR)
       GO TO 63
69     K=NS-1
       READ(IR,6)(TR  (I,K),I=1,NTR)
       GO TO 63
70     IF(INOU)46,46,71
71     WRITE(IW,16)
       DO 73 I=1,NTR
73     WRITE(IW,18)I,(NATR(I,J),J=1,8),(TR  (I,J),J=1,5)
       GO TO 46
C     *           *          *          *
81     NG(2)=0
       NH=NS
       READ(IR,6)(DH(I),I=1,NH)
       READ(IR,19)(AH(I),I=1,NH)
       READ(IR,6)(BH(I),I=1,NH)
       IF(INOU)40,40,83
83     WRITE(IW,21)
       WRITE(IW,23)(I,DH(I),AH(I),BH(I),I=1,NH)
       GO TO 40
C     *           *          *          *
C      WATER  QUALITY  PARAMETERS
91     IF (NG(3))95,95,92
92     NWQP=NS
```

```
      NG(3)=0.
      DO 93 I=1,NS
      WQP(I,1)=1.
      WQP(I,2)=.1
      WQP(I,3)=.15
      WQP(I,4)=0.
      WQP(I,5)=0.
      WQP(I,6)=20.
      WQP(I,7)=8.5
      WQP(I,8)=5.
93    WQP(I,9)=0.01
95    READ(IR,2)NDG,NS,NAME
      IF(NDG)107,107, 46
107   WRITE(IW,14)NS,NAME
      READ(IR,6)(WQP(I,NS),I=1,NWQP)
      IF(INOU)46,46,108
 108  WRITE(IW,5)(WCP(I,NS),I=1,NWQP)
      GO TO 95
C    *          *          *          *
C     RIVER  DISCHARGE
111   NG(4)=0
112   READ(IR,2)NDG,NS,NAME
```



```
      IF(NDG)119,119,46
119   WRITE(IW,14)NS,NAME
      READ(IR,6) (RC(I),I=1,NH )
      IF(INOU)46,46,120
 120  WRITE(IW,28) (RQ(I),I=1,NH)
      GO TO 112
C    *          *          *          *
C     TREATMENT  PLANTS
121   NG(5)=0
      NTP=NS
122   READ(IR,2) NDG,NS,NAME
      IF(NDG)124,124,46
124   WRITE(IW,14)NS,NAME
      IF(NS-1)125,125,127
125   READ(IR,15) ((NAP  (I,J),J=1,8),I=1,NTP)
      GO TO 122
127   IF(NS-6)128,130,130
128   K=NS-1
      READ(IR,6)(PLANT(I,K),I=1,NTP)
      GO TO 122
C    *          *          *          *          *
C     ALTERNATIVES AT EACH  PLANT
130   IB=0
      IF(INOU)133,133,131
```

```
131   WRITE(IW,29)
133   DO 139 I=1,NTP
      READ(IR,2)ID,N
      KB=IB+1
      KE=IB+N
      KPT(I)=KB
      KK  (I)=KE
      IB=KE
      DO 135 K=KB,KE
135   READ(IR,6)(TPVAL(K,L),L=1,3)
      IF(INOU)139,139,136
136   WRITE(IW,30)(NAP  (I,J),J=1,8),((TPVAL(K,L),L=1,3),K=KB,KE)
139   CONTINUE
      GO TO 122
C     *          *          *          *
C     INITIAL  CONDITIONS, AND  STARTING  LOCATION
141   NG(6)=0
      READ(IR,6)DUP,QUP,BODU ,DOU ,XO
      IF(INOU)40,40,142
142   WRITE(IW,35) CUP,QUP,BODU,DOU,XO
      GO TO 40
C     *          *          *          *          *
C     MAXIMUM  DISTANCE  INCREMENT
151   NG(7)=0
      READ(IR,6)DXMAX
      IF(INOU)40,40,152
152   WRITE(IW,36) CXMAX
      GO TO 40
C     *          *          *          *          *
C     OUTPUT  OPTIONS
155   NG(8)=0
      READ (IR,37) INOU,INOP
      IF(INOU)40,40,157
157   WRITE(IW,37) INOU,INOP
      GO TC 40
C     *          *          *          *          *
C     BASE  FOR  OXYGEN  SAG EQUATION



165   NG(9)=0
      READ(IR,6) BASE
      IF(BASE-5.)174,174,172
C     BASE=10.
172   DIV=2.302
      IF(INOU)40,40,173
 173  WRITE(IW,19) BASE,DIV
      GO TO 40
C     BASE=E
```

```
174   DIV=1.
      IF(INOU)40,40,175
 175  WRITE(IW,19) BASE,DIV
      GO TO 40
C     *          *          *          *          *
C    TREATMENT PLANT  SELECTION
181   NG(10)=0
      READ (IR,37)(KSL(I),I=1,NTP)
      IF(INOU)40,40,182
 182  WRITE(IW,37)(KSL(I),I=1,NTP)
      GO TO 40
C     CHECK  FOR  SUFFICIENT  DATA
200   IND=0
      DO 210 I=1,9
      IF(NG(I))210,210,203
203   IND=I
      WRITE(IW,34) IND
210   CONTINUE
      IF (NG(10))218,218,215
215   DO 216 I=1,NTP
216   KSL(I)=1.
218   DO 219 I=1,NWQP
      TO=WQP(I,6)
      SO=WQP(I,7)
219   WQP(I,7)=14.6244-0.367134*TO+.0044972*TO*TO-.0966*SO+.00205*SO*TO
     1  +0.0002739*SO*SO
      WRITE(IW,1)
      RETURN
      END
//GO.SYSIN    DD  *
 OXYGEN BALANCE SIMULATION ANALYSIS    PAMUNKEY AS MAIN  RIVER
    1     1 TRIBUTARIES
          1 NAMES
MATTAPONI RIVER
          2 LOCATIONS  (RIVER MILES)
33.88
          3 DISCHARGE  (CFS)
100.
          4 DISSOLVED  OXYGEN (MG/L)
6.72
          5 BOD(5)
150.
          6 BOD(N) (ALL ZERO)
30.
    2    22 HYDRAULIC REACHES (VELOCITY)
32.64     33.88     35.05     35.62     37.87     40.37     42.87
45.37     43.16     49.71     52.82     55.28     57.33     59.19
```

```
62.91     61.26     71.22     73.39     77.11     81.70     84.38
88.3
.38187    .42113    .97198    .87446    .66119    .55748    .601        BP1
.66119    .90465    .74302    .85012    .8052     .90027    .8921       BP2




.87101    .92056    .66119    .58024    .37586    .39665    .42998      BP3
.35363                                                                  BP4
.06103    .04271    .00268    .00443    .02006    .04572    .033        AP1
.02204    .00602    .00646    .00702    .00528    .00665    .00717      AP2
.00866    .01104    .07026    .12999    .60432    .57621    .49523      AP3
.97668                                                                  AP4
    3   22  PARAMETERS
         1  K1  VALUES
0.25       0.25       0.50     0.5      0.45      0.4       0.4
0.4       0.4       0.40      0.40      0.30      0.25      0.25
.25       .25        .25       .25       .25       .25       .25
.15        .15       .15       .15      .15       .15        .15
         2 K2  VALUES
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
         3  K3  VALUES
0.25      0.90      2.95      2.95      2.75      2.65      2.5
2.25      2.00      1.75      1.5       1.25      1.0       0.75
.25       .25        .25       .25       .2       .2         .2
.15        .15       .15       .15      .15       .15        .15
         4  ALPHA
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
.1        .1        .1         .1        .1        .1        .1
         5  P VALUES
0.40      0.50      0.75      0.95      0.85      0.75      0.5
.25       .25        .25       .25       .25       .25       .25
0.25      0.25      0.25      .20       .20       .20       .20
.20        .20       .20       .20      .20       .20       .20
         6  TEMPERATURE (DEGREES IN C)
27.       27.       27.       27.       27.       27.       27.
27.       27.       27.       27.       27.       27.       27.
27.       27.       27.       27.       27.       27.       27.
27.       27.       27.       27.       27.       27.       27.
         7  SALINITY IN PPM
13.       12.5      12.       11.       10.       9.        8.
7.        6.        5.        4.        3.        2.        1.
0.
0.
```

```
         8  DISPERSION COEFF
3.4        3.4        3.3        3.3        3.2        4.6        3.8
2.5        1.6        0.9        1.3        1.4        1.7        1.6
2.3        1.6        1.1        .75        .5         .3          .2
.2
         9   VELOCITY
.25        .25         .25        .25        .25        .25        .25
.25        .25         .25        .25        .25        .25        .25
.25        .25         .25        .25         .25        .20        .20
.20        .10         .10
    4   22  RIVER  DISCHARGE
         2  DISCHARGE (CFS)
 400.       400.       300.       294.       285.       281.       275.
268.       255.       241.       223.       218.       206.       196.
187.       160.       151.       126.       114.        96.        73.
 60.
    5    1   WASTEWATER EFFLUENT
         1  NAMES
CHESAPEAKE INC.


         2  LOCATIONS  (RIVER MILE)
35.05
         3  DISCHARGE  (MGD)
14.
         4  BOD(5-DAY, 20 DEGREES C.) (LB/DAY)
30000.
         5  BOD(ULTIMATE NITROGENOUS) (LB/DAY)

         6  TREATMENT ALTERNATIVES
         4  CHESAPEAKE INC.
0.         0.         1.
.3         0.05       2.
0.85       0.3        4.
0.99       1.         4.
    6      INITIAL CONDITIONS
62.00      233.       3.         6.         25.
    7      MAXIMUM DISTANCE INCREMENT
1.
    8      OUTPUT  OPTIONS
    1      1
    9      BASE  FOR OXYGEN  SAG  EQUATION
10.
   10      OPTIMAL COMBINATION OF TREATMENT PLANTS,DATA SET 1
    1
   99
  RIVER  DISCHARGE  DATA  GROUP  5
    4   22  DISCHARGE
         2  DISCHARGE
350.       350.       250.       230.       210.       195.       185.
175.       165.       155.       145.       135.       125.       115.
105.        95.        85.       75.        65.        60.        55.
50.
    6      INITIAL CONDITIONS
52.81      140.       3.         6.         30.
   99
  SIMULATION OF OPTIMAL SOLUTION OBTAINED PRIMARY TREATMENT
   10      DATA SET 2
    2
```

```
   99
  SIMULATION OF OPTIMAL SOLUTION OBTAINED FOR SECONDARY TREATMENT
   10      DATA SET  3
    3
   99      END OF DATA,
//
```

APPENDIX E

LISTING OF COMPUTER OUTPUT FOR THE PROGRAM AND INPUT DATA OF APPENDIX D.

OXYGEN BALANCE SIMULATION ANALYSIS   PAMUNKEY AS MAIN RIVER

1INPUT DATA GROUP 1   TRIBUTARIES

SUBGROUP	DATA	1	NAMES
SUBGROUP	DATA	2	LOCATIONS (RIVER MILES)
SUBGROUP	DATA	3	DISCHARGE (CFS)
SUBGROUP	DATA	4	DISSOLVED OXYGEN (MG/L)
SUBGROUP	DATA	5	BOD(5)
SUBGROUP	DATA	6	BOD(N) (ALL ZERO)

*************** TRIBUTARIES ***************

		RIVER MILES	DISCHARGE	DO	BOD(5C)	BOD(N)
1	MATTAPONI RIVER	33.88	100.00	6.72	150.00	30.00

1INPUT DATA GROUP 2   HYDRAULIC REACHES (VELOCITY)

*******************HYDRAULIC REACHES*******************

	UPSTREAM	EXPONENTIAL	CONSTANT
1	32.640	0.3819E 00	0.0610
2	33.880	0.4211E 00	0.0427
3	35.050	0.9720E 00	0.0027
4	35.620	0.8745E 00	0.0044
5	37.870	0.6612E 00	0.0201
6	40.370	0.5575E 00	0.0457
7	42.870	0.6010E 00	0.0330
8	45.370	0.6612E 00	0.0220
9	43.160	0.9046E 00	0.0060
10	49.710	0.7430E 00	0.0065
11	52.820	0.8501E 00	0.0070
12	55.280	0.8052E 00	0.0053
13	57.330	0.9003E 00	0.0066
14	59.190	0.8921E 00	0.0072
15	62.910	0.8710E 00	0.0087
16	61.260	0.9206E 00	0.0110
17	71.220	0.6612E 00	0.0703
18	73.390	0.5802E 00	0.1300
19	77.110	0.3759E 00	0.6043
20	81.700	0.3966E 00	0.5762
21	84.380	0.4300E 00	0.4952
22	88.300	0.3536E 00	0.9767

```
1INPUT  DATA  GROUP    3              PARAMETERS
        SUBGROUP  DATA     1              K1  VALUES
  0.2500E 00   0.2500E 00   0.5000E 00   0.5000E 00   0.4500E 00   0.4000E 00   0.4000E 00   0.4000E 00   0.4000E 00
  0.4000E 00   0.4000E 00   0.3000E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00
  0.2500E 00   0.2500E 00   0.2500E 00   0.1500E 00
        SUBGROUP  DATA     2              K2  VALUES
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00
        SUBGROUP  DATA     3              K3  VALUES
  0.2500E 00   0.9000E 00   0.2950E 01   0.2950E 01   0.2750E 01   0.2650E 01   0.2500E 01   0.2250E 01   0.2000E 01
  0.1750E 01   0.1500E 01   0.1250E 01   0.1000E 01   0.7500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00
  0.2000E 00   0.2000E 00   0.2000E 00   0.1500E 00
        SUBGROUP  DATA     4              ALPHA
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000F 00   0.1000E 00   0.1000E 00
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00
  0.1000E 00   0.1000E 00   0.1000E 00   0.1000E 00
        SUBGROUP  DATA     5              P VALUES
  0.4000E 00   0.5000E 00   0.7500E 00   0.9500E 00   0.8500E 00   0.7500E 00   0.5000E 00   0.2500E 00   0.2500E 00
  0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2000E 00
  0.2000E 00   0.2000E 00   0.2000E 00   0.2000E 00
        SUBGROUP  DATA     6              TEMPERATURE (DEGREES IN C)




  0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02
  0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02
  0.2700E 02   0.2700E 02   0.2700E 02   0.2700E 02
        SUBGROUP  DATA     7              SALINITY IN PPM
  0.1300E 02   0.1250E 02   0.1200E 02   0.1100E 02   0.1000E 02   0.9000E 01   0.8000E 01   0.7000E 01   0.6000E 01
  0.5000E 01   0.4000E 01   0.3000E 01   0.2000E 01   0.1000E 01   0.0          0.0          0.0          0.0
  0.0          0.0          0.0          0.0
        SUBGROUP  DATA     8              DISPERSION COEFF
  0.3400E 01   0.3400E 01   0.3300E 01   0.3300E 01   0.3200E 01   0.4600E 01   0.3800E 01   0.2500E 01   0.1600E 01
  0.9000E 00   0.1300E 01   0.1400E 01   0.1700E 01   0.1600E 01   0.2300E 01   0.1600E 01   0.1100E 01   0.7500E 00
  0.5000E 00   0.3000E 00   0.2000E 00   0.2000E 00
        SUBGROUP  DATA     9              VELOCITY
  0.2500E 00   0.2500F 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00
  0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00   0.2500E 00
  0.2500E 00   0.2000E 00   0.2000E 00   0.2000E 00
1INPUT  DATA  GROUP    4              RIVER  DISCHARGE
        SUBGROUP  DATA     2              DISCHARGE (CFS)
    400.000      400.000      300.000     294.000      285.000      281.000
    275.000      268.000      255.000     241.000      223.000      218.000
    206.000      196.000      187.000     160.000      151.000      126.000
    114.000       96.000       73.000      60.000
1INPUT  DATA  GROUP    5              WASTEWATER EFFLUENT
        SUBGROUP  DATA     1              NAMES
        SUBGROUP  DATA     2              LOCATIONS  (RIVER MILE)
        SUBGROUP  DATA     3              DISCHARGE  (MGD)
        SUBGROUP  DATA     4              BOD(5-DAY, 20 DEGREES C.) (LB/DAY)
        SUBGROUP  DATA     5              BOD(ULTIMATE NITROGENOUS) (LB/DAY)
        SUBGROUP  DATA     6              TREATMENT ALTERNATIVES
```

```
*******************TREATMENT, ALTERNATIVES*******************
                         REMOVAL EFFICIENCIES        DO
                             BOD(C)    BOD(N)

    CHESAPEAKE INC.
                              0.0       0.0       1.000
                              0.300     0.050     2.000
                              0.850     0.300     4.000
                              0.990     1.000     4.000
1INPUT  DATA  GROUP    6          INITIAL CONDITIONS
  DUP=      62.00QUP=     233.00BODU=      3.00DOU=       6.00XO=       25.00

1INPUT  DATA  GROUP    7         MAXIMUM DISTANCE INCREMENT
  DXMAX=        1.00

1INPUT  DATA  GROUP    8         OUTPUT  OPTIONS
   1    1
1INPUT  DATA  GROUP    9         BASE  FOR OXYGEN  SAG  EQUATION

.1000E 020.2302E 01
1INPUT  DATA  GROUP   10         OPTIMAL COMBINATION OF TREATMENT PLANTS,DATA SET 1
   1
1INPUT  DATA  GROUP   99
```

RIVER DISCHARGE CATA GROUP 5

DESCRIPTION	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	52.81	0.0	6.00	7.68	3.00	140.00
	52.47	0.38	5.93	7.68	1.65	140.00
	52.00	0.92	6.04	7.68	0.73	140.00
	51.00	2.06	6.48	7.68	0.16	140.00
	50.00	3.19	6.88	7.68	0.07	140.00
	49.71	3.52	6.97	7.68	0.06	140.00
GROUP 2						
	49.71	3.52	6.97	7.69	0.06	155.00
	49.00	4.45	7.19	7.69	0.05	155.00
	48.00	5.75	7.42	7.69	0.05	155.00
	47.00	7.05	7.56	7.69	0.05	155.00
	46.00	8.36	7.66	7.69	0.05	155.00
	45.00	9.66	7.72	7.69	0.05	155.00
	44.00	10.96	7.76	7.69	0.05	155.00
	43.16	12.06	7.78	7.69	0.05	155.00
GROUP 2						
GROUP 2						
	43.16	12.06	7.78	7.69	0.05	175.00
	43.00	12.27	7.78	7.69	0.05	175.00
	42.87	12.45	7.79	7.69	0.04	175.00
GROUP 2						
	42.87	12.45	7.79	7.69	0.04	185.00
	42.00	13.66	7.78	7.69	0.06	185.00
	41.00	15.07	7.77	7.69	0.07	185.00
	40.37	15.95	7.76	7.69	0.07	185.00
GROUP 2						
	40.37	15.95	7.76	7.69	0.07	195.00
	40.00	16.47	7.75	7.69	0.08	195.00
	39.00	17.88	7.72	7.69	0.10	195.00
	38.00	19.29	7.69	7.69	0.10	195.00
	37.87	19.47	7.69	7.69	0.10	195.00
GROUP 2						
	37.87	19.47	7.69	7.69	0.10	210.00
	37.00	20.65	7.65	7.69	0.11	210.00
	36.00	22.01	7.61	7.69	0.11	210.00
	35.62	22.53	7.60	7.69	0.11	210.00
GROUP 2						
	35.62	22.53	7.60	7.69	0.11	230.00
	35.05	23.16	7.58	7.69	0.11	230.00
GROUP 2						
CHESAPEAKE INC.						
	35.05	23.16	7.00	7.69	37.45	250.00
	34.64	23.58	4.33	7.69	19.89	250.00
	34.00	24.23	2.94	7.69	7.39	250.00
	33.88	24.35	2.88	7.69	6.15	250.00
MATTAPONI RIVER						
GROUP 2						
	33.88	24.35	4.41	7.70	3.90	350.00
	33.66	24.75	4.44	7.70	3.25	350.00
	33.00	25.98	4.64	7.70	1.89	350.00

OXYGEN BALANCE SIMULATION ANALYSIS   PAMUNKEY AS MAIN RIVER

DESCRIPTION	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	39.00	27.98	7.76	7.64	0.10	281.00
	38.00	29.37	7.72	7.64	0.10	281.00
	37.87	29.55	7.71	7.64	0.10	281.00
GROUP 2						
	37.87	29.55	7.71	7.61	0.10	285.00
	37.00	30.72	7.65	7.61	0.11	285.00
	36.00	32.07	7.59	7.61	0.11	285.00
	35.62	32.59	7.58	7.61	0.11	285.00
GROUP 2						
	35.62	32.59	7.58	7.57	0.11	294.00
	35.05	33.22	7.54	7.57	0.11	294.00
GROUP 2						
CHESAPEAKE INC.						
	35.05	33.22	7.06	7.53	31.22	300.00
	34.64	33.64	4.82	7.53	16.52	300.00
	34.00	34.29	3.65	7.53	6.17	300.00
	33.88	34.41	3.59	7.53	5.14	300.00
MATTAPONI RIVER						
GROUP 2						
	33.88	34.41	4.63	7.52	3.60	400.00
	33.66	34.82	4.65	7.52	2.99	400.00
	33.00	36.03	4.81	7.52	1.75	400.00
	32.64	36.69	4.94	7.52	1.32	400.00
GROUP 2						
	32.64	36.69	4.94	7.50	1.32	400.00
	32.50	36.95	4.98	7.50	1.24	400.00
	32.00	37.85	5.12	7.50	0.99	400.00
	31.00	39.67	5.42	7.50	0.68	400.00
	30.00	41.48	5.71	7.50	0.50	400.00
	29.00	43.30	5.96	7.50	0.41	400.00
	28.00	45.12	6.17	7.50	0.36	400.00
	27.00	46.93	6.35	7.50	0.33	400.00
	26.00	48.75	6.49	7.50	0.31	400.00
	25.00	50.57	6.60	7.50	0.30	400.00

```
 RIVER  DISCHARGE  CATA  GROUP  5
1INPUT  DATA  GROUP    4              DISCHARGE
      SUBGROUP  CATA    2                 DISCHARGE
   350.000     350.000     250.000     230.000     210.000     195.000
   185.000     175.000     165.000     155.000     145.000     135.000
   125.000     115.000     105.000      95.000      85.000      75.000
    65.000      60.000      55.000      50.000
1INPUT  DATA  GROUP    6            INITIAL CONDITIONS
  DUP=       52.81QUP=      140.00BODU=        3.00DOU=        6.00XO=       30.00
```

SIMULATION OF CPTIMAL SOLUTION OBTAINED PRIMARY TREATMENT

DESCRIPTICN	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	52.81	0.0	6.00	7.69	3.00	140.00
	52.47	0.38	5.93	7.69	1.65	140.00
	52.00	0.92	6.04	7.69	0.73	140.00
	51.00	2.06	6.49	7.69	0.16	140.00
	50.00	3.19	6.88	7.69	0.07	140.00
	49.71	3.52	6.97	7.69	0.06	140.00
GROUP 2						
	49.71	3.52	6.97	7.69	0.06	155.00
	49.00	4.45	7.20	7.69	0.05	155.00
	48.00	5.75	7.42	7.69	0.05	155.00
	47.00	7.05	7.56	7.69	0.05	155.00
	46.00	8.36	7.66	7.69	0.05	155.00
	45.00	9.66	7.72	7.69	0.05	155.00
	44.00	10.96	7.76	7.69	0.05	155.00
	43.16	12.06	7.78	7.69	0.05	155.00
GROUP 2						
GROUP 2						
	43.16	12.06	7.78	7.69	0.05	175.00
	43.00	12.27	7.79	7.69	0.05	175.00
	42.87	12.45	7.79	7.69	0.04	175.00
GROUP 2						
	42.87	12.45	7.79	7.69	0.04	185.00
	42.00	13.66	7.78	7.69	0.06	185.00
	41.00	15.07	7.77	7.69	0.07	185.00
	40.37	15.95	7.76	7.69	0.07	185.00
GROUP 2						
	40.37	15.95	7.76	7.69	0.07	195.00
	40.00	16.47	7.75	7.69	0.08	195.00
	39.00	17.88	7.72	7.69	0.10	195.00
	38.00	19.29	7.69	7.69	0.10	195.00
	37.87	19.47	7.69	7.69	0.10	195.00
GROUP 2						
	37.87	19.47	7.69	7.69	0.10	210.00
	37.00	20.65	7.65	7.69	0.11	210.00
	36.00	22.01	7.61	7.69	0.11	210.00
	35.62	22.53	7.60	7.69	0.11	210.00
GROUP 2						
	35.62	22.53	7.60	7.69	0.11	230.00
	35.05	23.16	7.57	7.69	0.11	230.00
GROUP 2						
CHESAPEAKE INC.						
	35.05	23.16	7.09	7.69	26.24	250.00
	34.64	23.58	5.23	7.69	13.98	250.00
	34.00	24.23	4.26	7.69	5.20	250.00
	33.88	24.35	4.22	7.69	4.33	250.00
MATTAPONI RIVER						
GROUP 2						
	33.88	24.35	5.22	7.69	2.81	350.00
	33.67	24.73	5.24	7.69	2.37	350.00
	33.00	25.98	5.40	7.69	1.39	350.00

RIVER DISCHARGE DATA GROUP 5

DESCRIPTION	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	32.64	26.64	4.79	7.70	1.42	350.00
GROUP 2						
	32.64	26.64	4.79	7.70	1.42	350.00
	32.52	26.86	4.83	7.70	1.34	350.00
	32.00	27.82	5.01	7.70	1.06	350.00
	31.00	29.65	5.36	7.70	0.72	350.00
	30.00	31.48	5.70	7.70	0.53	350.00

OXYGEN BALANCE SIMULATION ANALYSIS   PAMUNKEY AS MAIN RIVER

DESCRIPTION	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	62.00	0.0	6.00	7.99	3.00	233.00
	61.26	0.76	5.91	7.99	1.52	233.00
GROUP 2						
GROUP 2						
	61.26	0.76	5.91	7.99	1.52	187.00
	61.00	1.05	5.96	7.99	1.29	187.00
	60.82	1.24	6.00	7.99	1.16	187.00
	60.00	2.15	6.23	7.99	0.72	187.00
	59.19	3.03	6.47	7.99	0.48	187.00
GROUP 2						
	59.19	3.03	6.47	7.95	0.48	196.00
	59.00	3.24	6.55	7.95	0.41	196.00
	58.00	4.32	6.94	7.95	0.19	196.00
	57.33	5.04	7.15	7.95	0.14	196.00
GROUP 2						
	57.33	5.04	7.15	7.91	0.14	206.00
	57.00	5.40	7.24	7.91	0.12	206.00
	56.00	6.47	7.46	7.91	0.09	206.00
	55.28	7.24	7.58	7.91	0.09	206.00
GROUP 2						
	55.28	7.24	7.58	7.87	0.09	218.00
	55.00	7.58	7.62	7.87	0.08	218.00
	54.00	8.78	7.74	7.87	0.07	218.00
	53.00	9.99	7.82	7.87	0.07	218.00
	52.82	10.21	7.83	7.87	0.07	218.00
GROUP 2						
	52.82	10.21	7.83	7.83	0.07	223.00
	52.00	11.14	7.86	7.83	0.06	223.00
	51.00	12.27	7.89	7.83	0.05	223.00
	50.00	13.40	7.91	7.83	0.05	223.00
	49.71	13.73	7.91	7.83	0.05	223.00
GROUP 2						
	49.71	13.73	7.91	7.79	0.05	241.00
	49.71	13.73	7.91	7.79	0.05	241.00
	49.00	14.65	7.92	7.79	0.05	241.00
	48.00	15.95	7.92	7.79	0.05	241.00
	47.00	17.25	7.93	7.79	0.05	241.00
	46.00	18.55	7.93	7.79	0.05	241.00
	45.00	19.85	7.93	7.79	0.05	241.00
	44.00	21.15	7.94	7.79	0.05	241.00
	43.16	22.24	7.94	7.79	0.05	241.00
GROUP 2						
GROUP 2						
	43.16	22.24	7.94	7.71	0.05	268.00
	43.00	22.45	7.93	7.71	0.05	268.00
	42.87	22.63	7.93	7.71	0.04	268.00
GROUP 2						
	42.87	22.63	7.93	7.68	0.04	275.00
	42.00	23.83	7.89	7.68	0.06	275.00
	41.00	25.21	7.86	7.68	0.07	275.00
	40.37	26.08	7.84	7.68	0.07	275.00
GROUP 2						
	40.37	26.08	7.84	7.64	0.07	281.00
	40.00	26.60	7.82	7.64	0.08	281.00

SIMULATION OF OPTIMAL SOLUTION OBTAINED PRIMARY TREATMENT

DESCRIPTION	LOCATION RIVER MILE	TIME DAYS	D.O. MG/L	DO.SAT. MG/L	BOD MG/L	DISCHARGE CFS
	32.64	26.64	5.51	7.69	1.06	350.00
GROUP 2						
	32.64	26.64	5.51	7.69	1.06	350.00
	32.53	26.84	5.54	7.69	1.01	350.00
	32.00	27.82	5.67	7.69	0.81	350.00
	31.00	29.65	5.92	7.69	0.58	350.00
	30.00	31.48	6.15	7.69	0.45	350.00