# A WATER QUALITY STUDY

# OF THE

# PISCATAWAY CREEK WATERSHED

August 1968



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# CHAPTER I

## PREFACE

The Washington, D. C., metropolitan complex is a rapidly growing area, changing not only the character of the land use of the upper Potomac Estuary Drainage Basin, but also placing increasing demands upon the water resources of the River and its Estuary. Since 1960, the population of the metropolitan area has grown from about 2,100,000 to the present estimated population of approximately 2,900,000.

Eight major municipal wastewater treatment facilities discharge to the Potomac Estuary. The treated discharges have a biochemical oxygen demand (BOD) of 100,000 pounds per day, equivalent to the untreated sewage from 600,000 people. This loading is about six times the natural capacity of the Estuary to assimilate oxygen demanding wastes and maintain a dissolved oxygen (DO) average of five milligrams per liter (mg/l).

The facility at Blue Plains discharges directly into the Potomac River and is the largest, serving the District of Columbia and large areas in Montgomery and Prince Georges Counties, Maryland. The remaining seven discharges are to embayments of the Potomac Estuary. The relative advantages of conveying treated wastewater directly into the Potomac Estuary instead of into the small embayments had not been previously investigated.

In recent months, public interest in the operation and effects of the Piscataway Wastewater Treatment Plant on Piscataway Creek

water quality caused considerable attention to be given to this area. The problem is twofold: first, the limited assimilative capacity of this small embayment and, second, provision of suitable "fail-safe" mechanisms and operating procedures in the wastewater treatment facilities to eliminate discharge of untreated sewage.

# CHAPTER II

# INTRODUCTION

## A. Purpose and Scope

As part of the Chesapeake Bay-Susquehanna River Basins Project, the Chesapeake Field Station (CFS), Middle Atlantic Region, Federal Water Pollution Control Administration (FWPCA) has undertaken a comprehensive water quality management study of the Potomac River Basin. Important phases of this study are determination of the effects of wastewater discharges on water quality in the Potomac Estuary and recommendation of a program to achieve the approved water quality standards for this interstate river.

In recent months there has been considerable public interest in the operation of the Piscataway Wastewater Treatment Plant (PWTP) of the Washington Suburban Sanitary Commission (WSSC) and the effect of plant effluent on the water quality of Piscataway Creek. A series of field surveys was conducted by CFS on the efficiency of the PWTP and on water quality in Piscataway Creek.

This report contains the findings of the CFS studies to date. The purposes of this report are:

1. To provide information on:
    a. Efficiency of PWTP
    b. Effects of the discharge on the water quality in Piscataway Creek and the Potomac River
    c. General operation of the PWTP

2. To investigate and recommend alternative locations for the effluent discharge point from the PWTP.

Although the scope of this report is primarily limited to the Piscataway Creek and the adjacent reaches of the Potomac Estuary, other embayments in the area were investigated in order to compare the Piscataway results with similar embayments including three not receiving treated water discharges. In the future, the rapid growth of the area will require construction of additional wastewater treatment facilities in the lower embayments, such as Mattawoman Creek, and may result in similar problems in this and other embayments of the Potomac Estuary.

## B. Authority

This survey was conducted and the report prepared under the provisions of the Federal Water Pollution Control Act as amended (33 U.S.C. 466 et seq.) which directs the Secretary of the Interior to prepare or develop programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary condition of surface and underground waters, in cooperation with State water pollution control agencies and with the municipalities and industries involved.

## C. Acknowledgments

The assistance and the cooperation of the Washington Suburban Sanitary Commission, Maryland State Department of Health (MSDH),

Maryland Department of Water Resources (MDWR), and the Prince Georges County Cheverly Laboratory, enabled the CFG to collect, assemble, and evaluate the necessary data in a much shorter time than would otherwise have been required.

# CHAPTER III

## SUMMARY AND RECOMMENDATIONS

Intensive field investigations, sampling surveys, and data analyses have been conducted to determine the conditions in the Piscataway Creek and adjacent water by CFS, including the operations of the Piscataway Wastewater Treatment Plant of WSSC. A summary of the findings of these investigations, surveys, and analyses follows:

1. The Piscataway Creek Watershed, which is a Sub-Basin of the lower Potomac River below Washington, D. C., has a drainage area of about 80 square miles.
2. The Piscataway Basin is rapidly being developed into suburban residential areas with no major industrial development in the area. Andrews Air Force Base is located in the headwaters of the Basin.
3. The waters of the Piscataway Basin, including the embayment, are used for commercial and sport fishing. In the lower portion of the embayment near the Potomac Estuary there is a marina and a national park.
4. There are six municipal wastewater treatment facilities in the Piscataway Basin discharging, after secondary treatment, about 780 pounds of 5-day BOD into the waters of the Basin.

5. The Piscataway Wastewater Treatment Plant, which also serves parts of Prince Georges County outside of the Watershed, contributes about 80 percent of the domestic wastewater loading. The current population of the service area is about 110,000, with a projected population of over 600,000.

6. The Piscataway Wastewater Treatment Plant has a nominal design capacity of 5.0 million gallons per day (mgd). This facility was placed in operation in late 1967 and has a temporary discharge to the Piscataway embayment.

7. Since the Piscataway plant was placed into operation, the following have occurred.

   a. Flow exceeded nominal design capacity. For example, in June 1968, the average flow to the plant was 6.54 mgd.

   b. Untreated sewage has been by-passed to the Piscataway embayment, resulting in numerous complaints by local residents.

   c. Operational difficulties occurred at the treatment facility, resulting from power failures and inexperienced personnel.

8. Evidence of water quality degradation has been observed in the embayment near the pumping station and near the wastewater outfall. Chemical analysis of the water also

indicates high nutrient (phosphorus and nitrogen) concentration in these two areas.

9. Due to the very limited fresh water inflow and excessive weed growth, the water movement is restricted and thus reduces the overall effect of the periodic tidal flushing of the embayment in the vicinity of the pumping station and the temporary outfall.

10. During low tide, the water depth in the embayment near the discharge point is less than a foot. The effluent from the wastewater plant flows within 100 feet of the shoreline of a residential area downstream from the outfall.

11. In the lower Piscataway embayment near the Potomac Estuary and in the Estuary itself, extensive algal blooms have been occurring in recent years, apparently as a result of the wastewater discharges from the Washington metropolitan area. The dissolved oxygen in the upper Potomac Estuary below Washington often falls below 3.0 mg/l in the summer months.

After investigations following a series of complaints by residents in the area adjacent to the wastewater treatment plant, the Maryland State Department of Health directed that WSSC take the following actions:

1. Limit the flow into the plant to an average daily flow of 5.0 mgd;

2. Install an alarm system which would be activated during periods of by-passing of flows; and
3. Upgrade the general operating conditions of the plant, including training personnel.

WSSC has complied with this directive.

Since mid-July of 1968, analyses of the efficiency of the wastewater treatment plant by WSSC, MSDH, FWPCA's advanced waste treatment group, and CFS indicate that the efficiency is of very good quality.

As part of the water quality management program for the Potomac River, including Piscataway Creek, the following specific recommendations are presented for the WSSC facility:

1. As originally proposed by WSSC and approved by Maryland State Department of Health and FWPCA, an outfall should be constructed to the main channel of the Potomac Estuary.

2. An investigation should be made and appropriate action taken by WSSC to eliminate by-passing of untreated sewage to the Piscataway embayment.

3. To provide for better dispersion of the wastewater in marshy areas of the embayment, pending completion of the Potomac outfall, a channel should be excavated or temporary pipeline laid to convey the final effluent out to the southerly stream channel.

As guidelines for long-range planning, the following general recommendations have been developed as a result of the Piscataway investigation and the previous studies of the entire Potomac Estuary by CFS:

1. No new discharges of wastewater to the Estuary or to its embayments, temporary or permanent, should be approved until an engineering study has been made on the assimilative capacity of the receiving water and a plan developed to eliminate discharge of untreated wastes.
2. Inspections and efficiency studies should be made on all treatment facilities at least four times a year to insure high quality operation and to provide an opportunity for discussion of any operational problems with the plant personnel.

# CHAPTER IV

# DESCRIPTION OF AREA, WATER RESOURCES, AND WATER QUALITY STANDARDS

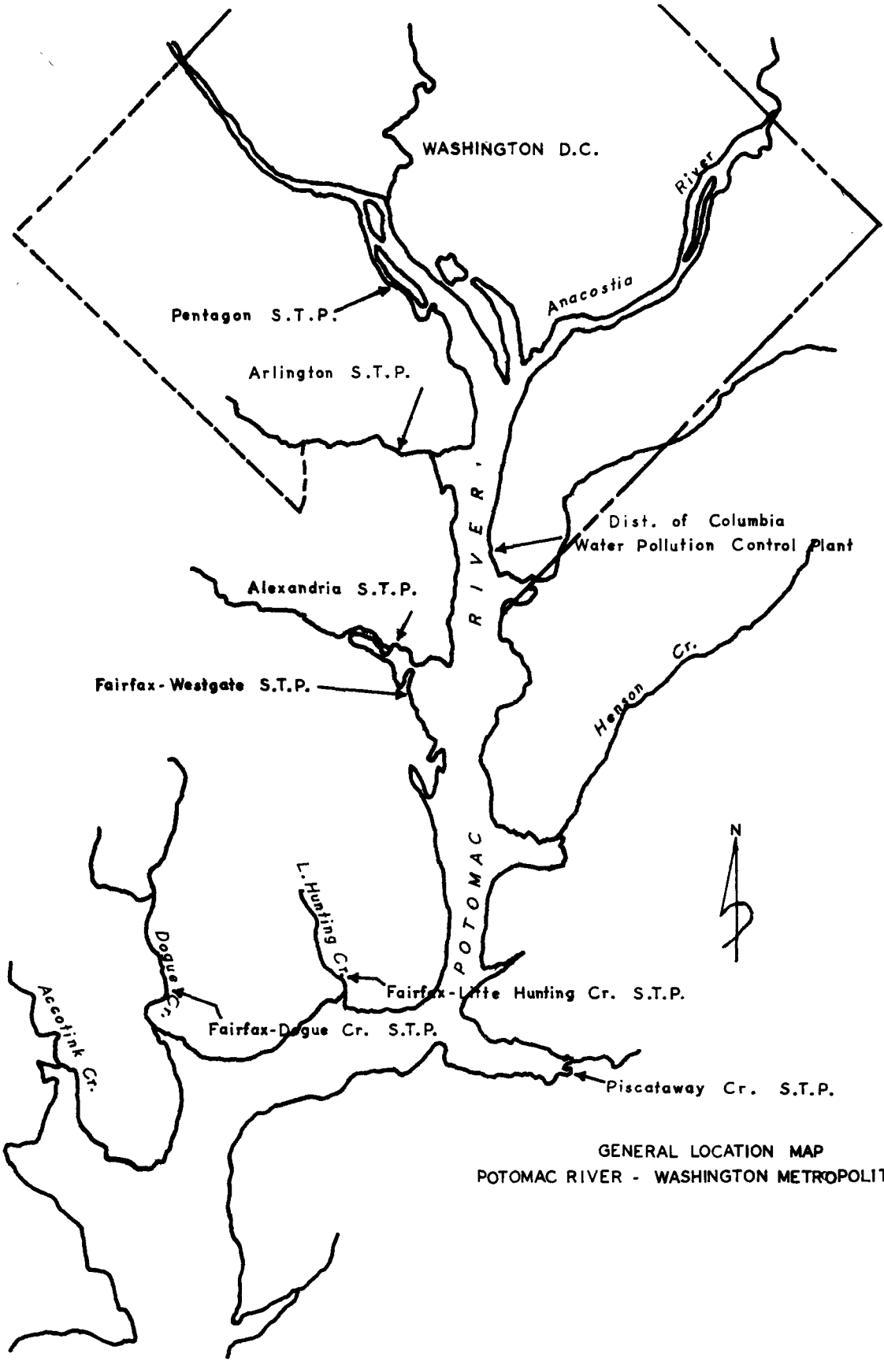
## A. General

The Piscataway Creek Watershed has a drainage area of 81.5 square miles and is located about 12 miles southeast of the center of Washington, D. C. (see Figure IV-1). The Creek, which flows in a westerly direction, enters the upper Potomac Estuary about 98 miles upstream from the Chesapeake Bay.

Since it is located in the Washington metropolitan area, the Watershed is rapidly being developed into a suburban residential area. Housing for employees of Andrews Air Force Base, which is located partly in the upper portion of the Piscataway Sub-Basin, has also added to the urban development of the Basin.

There are no major industries in the Watershed. The only industrial discharges are from sand and gravel operations in the non-tidal portions of the Watershed.

Except for the embayment segment of Piscataway Creek, the Stream is small, sluggish, and, in the headwaters, the stream flow is intermittent. The maximum, mean, and minimum flows from a stream gaging station established near Piscataway, Maryland, in 1965, were 328, 19.7, and 0.0 cubic feet per second (cfs), respectively. Using the longer term records of Henson Creek, which has an average yield of 1.10 cfs per square mile, the average annual flow from the entire




GENERAL LOCATION MAP
POTOMAC RIVER - WASHINGTON METROPOLITAN AREA

FIGURE IV-1

Piscataway Creek Watershed is estimated to be about 90 cfs. The upper part of the embayment is a swamp with abundant growths of submerged and emergent aquatic plants. Tentative identification of the noted aquatic growths indicates that the majority of the emergent plants are reed grass, Phyragmites and Pontederia cordata. The submerged growths appear to be mostly coontails, Cereatophyllerm. The center and lower embayment is about four to six feet deep and has little or no submerged and emergent plants.

B. Water and Land Related Resources

The waters of Piscataway Creek are used for both tidal and non-tidal fishing. According to the Annotated Code of Maryland, the waters of Piscataway Creek above Maryland Route 224 are considered non-tidal.

Although sport fishing is not widely practiced due to the limited access to embayment waters, local residents have made catches of catfish, carp, perch, and rockfish in Piscataway Creek. During a CFS sampling survey, a local resident who has fished the Piscataway for the past 20 years stated that he had not noticed any great change in the fish population. He did indicate that there had been an increase in commercial fishing for carp and catfish in the swampy area of the embayment in recent years. Also, during many of the surveys, numerous species of fish were observed, especially in the marshy area of the embayment.

During the spring spawning period, herring are netted from the waters of Piscataway Creek. Larger catches are obtained near Indian Head Highway and other shallow portions of the upper embayment. According to a game warden of the Maryland Department of Game and Inland Fish, the 1968 herring run in Piscataway Creek was considered to have been good.

After long periods of hot, dry weather, crabs are often seen in the Piscataway Creek embayment. However, the crabs observed are too small in size and in number to have any sport or commercial significance.

There is a marina on the northern shore of Piscataway Creek near the confluence with the Potomac River. The marina provides slips for approximately 450 boats, 30 of which are covered.

Also on the northern shore of Piscataway Creek embayment and continuing along the shoreline of the Potomac River is the Fort Washington National Park. Historically, since the early 1800's this Fort had been the key defense position for the City of Washington, D. C. Since World War II, however, the Fort has been made into a National Park. This Park, which is operated by the U. S. National Park Service, had 413,000 visitors in 1967.

The remaining portion of the embayment, including the southern shore, has been developed for residential use and includes several small, private recreational areas and marinas.

C. Water Quality Standards and Implementation Plan

In 1967, the State of Maryland*

> ". . . in order to provide for the enhancement of the water quality where such quality has deteriorated or is deteriorating, for the conservation of water quality where such quality is good or satisfactory, and for the protection of lawful and reasonable uses . . ."

established both general and specific water quality standards for both inter and intrastate waters. A plan for implementation and enforcement of the water quality standards for all of Maryland's waters was also established. The standards and the implementation plan for the interstate waters were approved and adopted by the U. S. Department of the Interior in August 1967.

1. Water Uses

The uses of waters of the Potomac Estuary were grouped into six categories as follows:

"I - Shellfish harvesting

"II - Public or municipal water supply

"III - Water contact recreation

"IV - Propagation of fish and other aquatic life and wildlife

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* Water Resources Regulation 4.8, General Water Quality Criteria and Specific Water Quality Standards for all Maryland Waters, Water Resources Commission and Department of Water Resources, Maryland State Office Building, Annapolis, Maryland 21401.

"V - Agricultural water supply

"VI - Industrial water supply"

For each of the water uses categories, bacteriological, dissolved oxygen, pH, and temperature standards were specified. The designated uses of applicable water zones of the Piscataway Creek watershed are presented below:

| Waste of Water Zone | Water Use to be Protected |
|---|---|
| Piscataway Creek and Tributaries (Headwaters to Md. Rt. 224) | III, IV, V, VI |
| Piscataway Creek and Tributaries of Potomac River (From Md. Rt. 224 to Mouth) | III, IV |

2. Water Quality Standards

Dissolved Oxygen (DO) is the parameter most indicative of water quality in a free-flowing stream or estuary of this type. Wastewater treatment requirements and/or flow regulation needs were determined using a mean monthly DO level of 5.0 mg/l with a minimum level of 4.0 mg/l. This is the approved standard for the waters of the Piscataway Creek in the study area. (See Water Resources Regulation 4.8 of the State of Maryland for other specific bacteriological, temperature, and pH standards.)

# CHAPTER V

# WASTEWATER TREATMENT FACILITIES

In the Piscataway Creek Basin there are seven wastewater discharges. One of the discharges is mineral, and the remaining six are organic in nature.

## A. Andrews AFB Wastewater Treatment Facilities

Andrews Air Force Base has two wastewater discharges in the Basin. Plant Number 1, which discharges into Meetinghouse Branch of Piscataway Creek about 13 miles upstream from the Potomac, has an average flow of 0.65 mgd with a biochemical oxygen demand (BOD) loading to the River of 90 pounds per day. The Number 4 plant, which has an average flow of 0.06 mgd and BOD loading after treatment of 10 pounds per day, discharges into Paynes Branch of Piscataway Creek about 13 miles upstream from the Potomac River.

Both facilities consist of Imhoff tanks, trickling filters, secondary sedimentation, and chlorination. BOD removal efficiency of 89 percent and 83 percent for plants Nos. 1 and 4, respectively, is obtained. A summary of the water quality below the two discharges is given in Chapter VI.

## B. Piscataway Creek Wastewater Treatment Facility

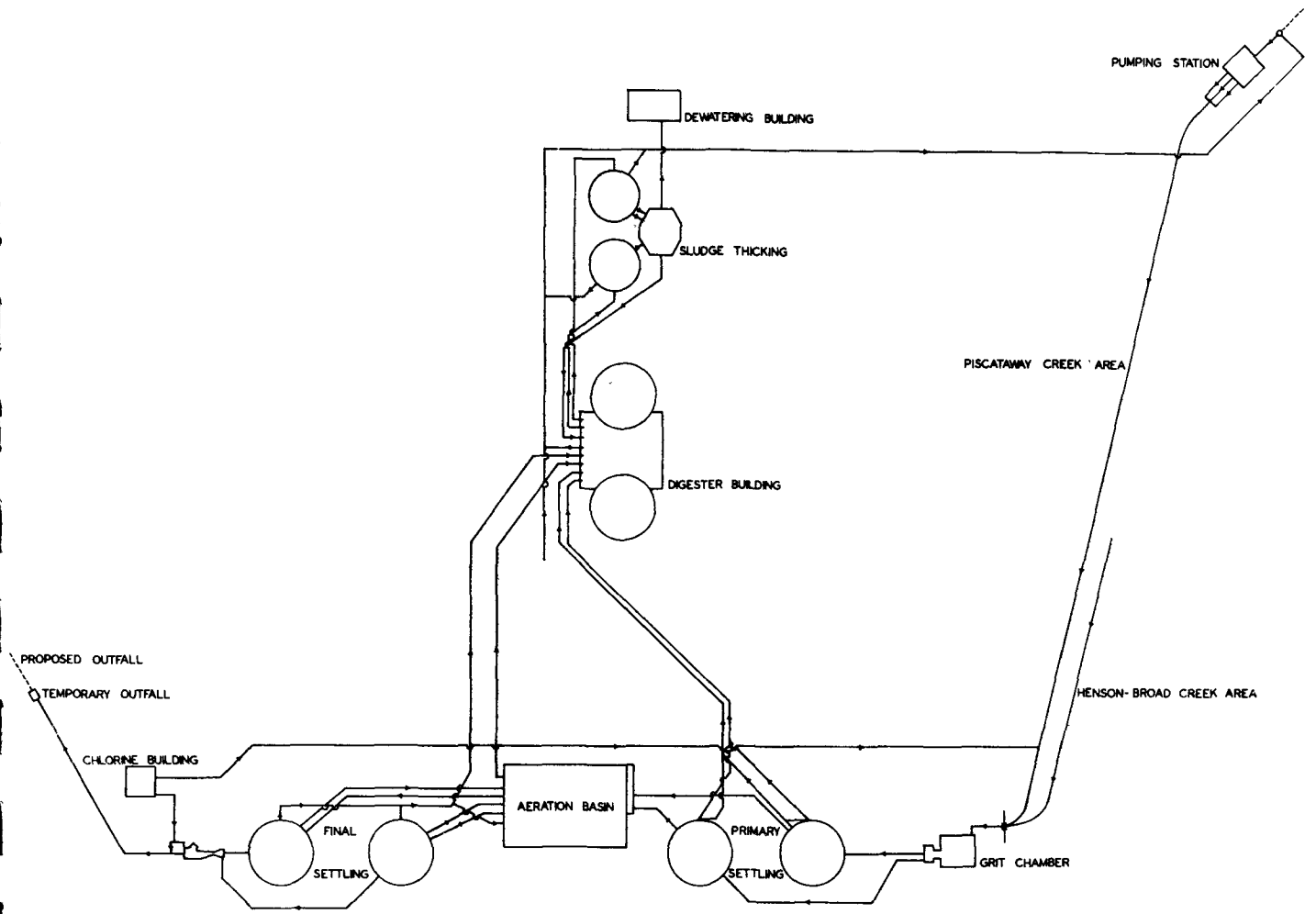
The treatment facility was placed in operation in late 1967 and has a design capacity of 5.0 mgd at a 5-day BOD removal efficiency of 90 percent. Flows above this capacity can be treated at a reduced

BOD removal efficiency. Provisions have been made on the site to expand plant capacity to 30 mgd.

The sewage is brought to the facility by two force mains, one from the Henson Creek area and the other serving the adjacent Piscataway Creek area. The plant provides activated sludge treatment with sludge digestion, conditioning and vacuum filtration. The effluent is chlorinated and discharged into a partly lined channel which flows into a marsh area of the embayment. A schematic diagram of the plant is given in Figure V-1. In an agreement recently signed with FWPCA, the WSSC is to design and build a 4.0 mgd advanced wastewater treatment (AWT) pilot plant consisting of lime precipitation and sedimentation, filtration, and carbon adsorption.

The major factors influencing effective utilization of the Piscataway Creek facility include operating problems, presence of a bypass, location of the temporary outfall, and high flows to the plant. In the first six months of the year, except for January, there were days during which the average daily flows were from 6.0 to 9.0 mgd. As can be seen in Table V-1, the average daily flows for the months of April, May, and June were above the nominal design capacity of the plant.

While the reported plant efficiencies in terms of BOD and suspended solids removal are high, these figures are misleading, since the influent figures were not representative of the untreated sewage. Nevertheless, excluding the times when the average flow was greater




SCHEMATIC OF PISCATAWAY WASTEWATER TREATMENT PLANT

FIGURE IX-1

TABLE V-1

PISCATAWAY WASTEWATER TREATMENT DATA

January - June 1968

As Reported by WSSC Personnel

| Month | Flow | | | BOD | | | Suspended Solids | | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. (mgd) | Avg. (mgd) | Max. (mgd) | Untreat.* (mg/l) | Treat. (mg/l) | Removal (%) | Untreat.* (mg/l) | Treat. (mg/l) | Removal (%) |
| January | 0.00 | 1.58 | 4.23 | 98 | 15 | 84 | 138 | 19 | 79 |
| February | 0.70 | 3.72 | 6.05 | 143 | 23 | 85 | 152 | 17 | 89 |
| March | 0.90 | 4.24 | 6.50 | 205 | 18 | 91 | 364 | 19 | 88 |
| April | 3.30 | 5.36 | 7.13 | 359 | 33 | 91 | 785 | 27 | 96 |
| May | 5.10 | 5.89 | 9.10 | 362 | 38 | 90 | 799 | 29 | 96 |
| June | 4.27 | 6.54 | 9.10 | 496 | 45 | 91 | 1,921 | 53 | 97 |

* Untreated samples include some overflow from digesters, therefore not a good measure of the untreated wastewater.

than 5.0 mgd, as given in Table V-1, the plant is capable of providing 90 percent BOD removal.

Plans for the Piscataway Wastewater Treatment Plant, as originally approved by the Maryland State Department of Health, provided for an effluent lime some three miles long discharging the treated wastes into the main channel of the Potomac River. The plans and specifications as submitted were reviewed and approved for a construction grant by FWPCA.

When some difficulty developed in obtaining a right of way for an outfall to the Potomac, WSSC submitted plans and specifications for a temporary outfall to discharge into the head of the Piscataway embayment in July 1967. This was approved by MSDH.

Operational problems occurred in sludge handling, screen cleaning equipment jammed, and pumping stations were subject to power failures. No emergency stand-by power was provided in the original design, nor was there any alarm system to indicate failure of equipment in the system.

During the first six months of 1968, power failures and operational problems resulted in the discharge or raw or partially treated sewage into Piscataway Creek. The limited transport and assimilative capacity of the embayment obviously caused a degradation in its water quality far more than a similar accidental discharge would have caused in the Potomac River.

The discharge of untreated sewage and, to some extent, the overloading of the treatment plant suggest these three general needs which should be studied to identify actions which should be taken to prevent water quality degradation in all embayments of the Potomac Estuary in the future:

1. More frequent surveillance of the wastewater treatment facility by the appropriate State and County health agencies.
2. Incorporation into the design of the wastewater facility a "fail-safe" warning or stand-by system which will minimize uncontrolled discharges of untreated wastes.
3. Specialized engineering studies in the design and the selection of discharge points for the wastewater effluents. The study should also incorporate the affects of possible discharges.

The latter of the three needs is the primary area of concern in the surveys which were subsequently conducted by CFS.

C. Other Discharges

The remaining organic wastewater loadings into Piscataway Creek, about seven percent of the total, come from three sources, Cheltenham Boys Village, U. S. Naval Communications Station, and the Country Club Cleaners. These three, which have a total BOD

loading to the Piscataway Creek of 50 pounds per day, will probably be connected to the WSSC system in the near future as the sewer system is expanded. In Table V-2 is presented a complete listing of wastewater discharges into the Piscataway Creek Watershed.

TABLE V-2

WASTEWATER DISCHARGE

Piscataway Creek Basin

| Name | Type of Waste | Design Capacity (mgd) | Volume of Waste (mgd) | BOD Untreat. (#/day) | BOD Treat. (#/day) | BOD Removal (%) | Receiving Stream | Remarks |
|---|---|---|---|---|---|---|---|---|
| Andrews AFB #1 | San. | 0.913 | 0.645 | 830 | 90 | 89 | Meetinghouse Br. | |
| Inland Materials, Inc. (Clinton, Md.) | Silt | --- | --- | --- | --- | --- | Paynes Br. | Silt Ponds |
| Andrews AFB #4 | San. | 0.125 | 0.060 | 66 | 10 | 83 | Paynes Br. | |
| County Club Cleaners | Laundry | Unk | 0.015 | 25 | 4 | 84 | Paynes Br. | |
| Piscataway Wastewater Plant | San. | 5.000 | 5.000 | 4,000 | 635 | 84 | Piscataway Bay | New Facility |
| Cheltenham Village (State of Md.) | San. | 0.060 | 0.121 | 333 | 34 | 90 | T. Piscataway Cr. | Overloaded |
| U. S. Naval Communications Station (Cheltenham, Md.) | San. | 0.050 | 0.056 | 200 | 10 | 95 | T. Piscataway Cr. | Loaded to Capacity |

# CHAPTER VI

# EXISTING WATER QUALITY

## A. Potomac River Near Piscataway Creek

### 1. Water Quality Monitoring Programs

Water quality in the Potomac River in the Washington, D. C., area has been monitored since the early 1930's by the Department of Sanitary Engineering, District of Columbia Government. Since the late 1950's, originally the U. S. Public Health Service and presently the Federal Water Pollution Control Administration has also conducted numerous water quality surveys in the upper Potomac Estuary. An automatic water quality monitor at Fort Washington was added to the existing system in the Potomac Estuary in 1964.

### 2. Water Quality in the Upper Potomac Estuary Near Piscataway Creek

The water quality in the Upper Potomac Estuary near Piscataway Creek is greatly affected by the wastewater discharges, as shown in Figure VI-1. Approximately 100,000 pounds of 5-day BOD and 136,000 pounds of suspended solids are discharged into the upper Estuary above Piscataway Creek each day.

As can be seen in Figure VI-1, BOD loading during the low flow months of June, July, August, and September, depresses the DO in the main channel of the Potomac Estuary below the State Standard of 5.0 mg/l. BOD data from the 1968 survey, as given in Table VI-1, exhibit similar effects on water quality.

BOD, DO and TEMPERATURE *

POTOMAC RIVER
near
PISCATAWAY CREEK
1967

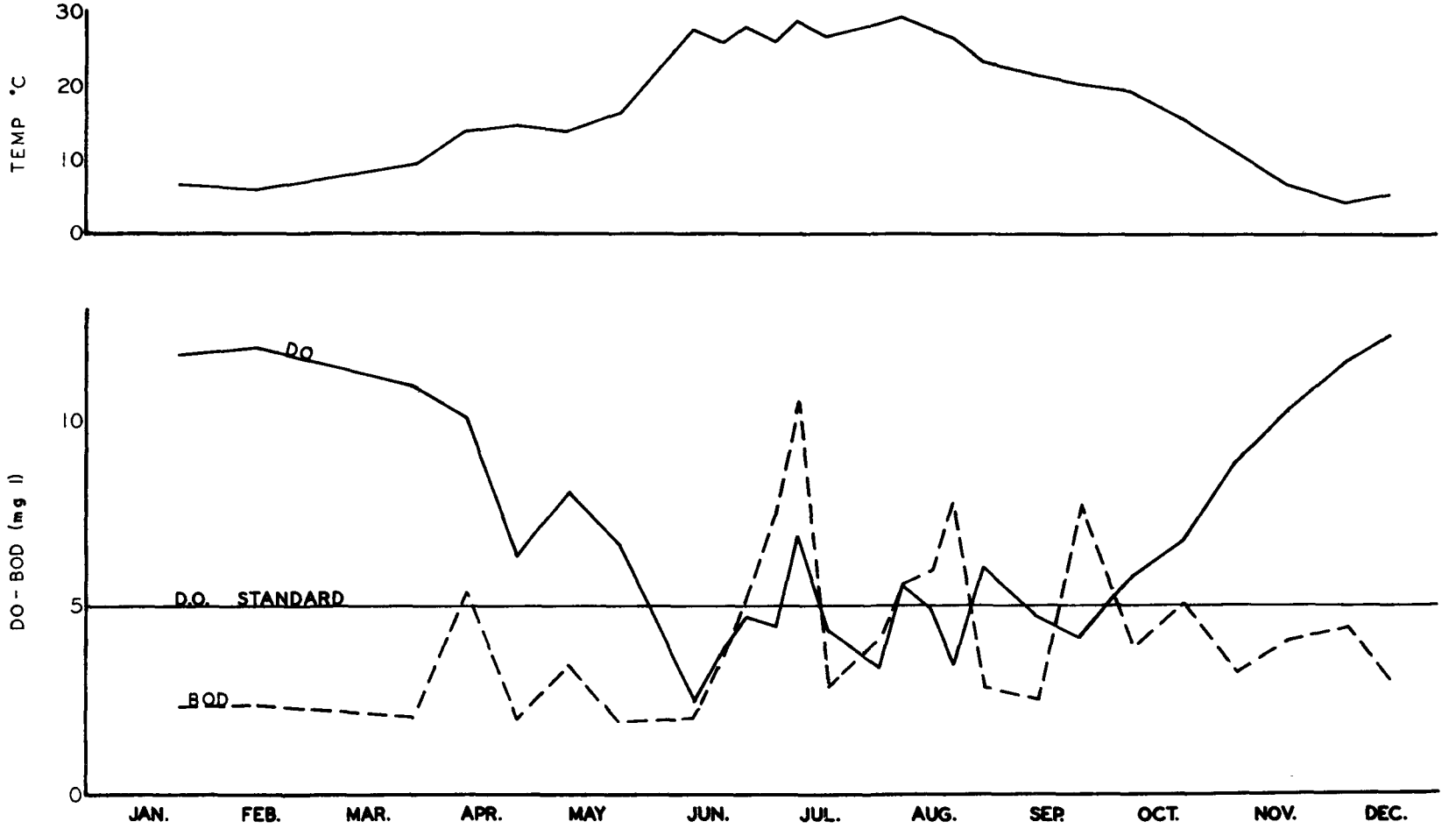



FIGURE VI-1

* Sampled by D.C. Water Pollution Control Plant

TABLE VI-1

WATER QUALITY DATA

Potomac Estuary near Piscataway Creek 1968

| Date | Temp. (°C) | DO (mg/l) | BOD (mg/l) | T. $PO_4$ as $PO_4$ (mg/l) | TKN as N (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (µg/l) |
|---|---|---|---|---|---|---|---|
| 5-15-68 | 19.5 | 1.5 | 3.8 | 1.51 | 2.27 | 0.34 | 18.0 |
| 6-10-68 | 26.6 | 6.9 | 3.8 | 0.59 | LA | 0.55 | 81.7 |
| 6-24-68 | 27.1 | 5.3 | 4.6 | 1.12 | 1.80 | LA | 4.5 |
| 7-08-68 | 28.7 | 4.2 | ND | 1.02 | 2.50 | 0.47 | 28.5 |
| 7-11-68 | 27.0 | 4.2 | 10.6 | 0.88 | ND | 0.99 | 78.8 |
| 7-22-68 | 30.4 | 3.4 | 4.6 | 0.78 | 1.76 | 1.62 | ND |
| 8-05-68 | 29.5 | 5.0 | 12.1 | 1.47 | 1.29 | 1.75 | 148.5 |
| 8-14-68 | 26.0 | 5.4 | 9.3 | 1.06 | 1.89 | 0.99 | 199.5 |

LA = Lab Accident

ND = Not Determined

A nutrient load is also associated with the large BOD and suspended solids loadings in all the wastewater discharges in the upper Potomac Estuary. Based upon current wastewater volumes, approximately 66,000 pounds per day of total phosphorus as $PO_4$ and 50,000 pounds per day of total Kjeldahl nitrogen (TKN) as nitrogen are discharged into the estuary.

During the past five years, extensive algal blooms have been observed in the upper Potomac Estuary. The blooms, consisting principally of Anacystis sp., Oscillatoria sp., and Chlamydomonas sp. occur in areas which are high in nutrient content.

As presented in Table VI-1, the nutrient concentrations for the Potomac Estuary for 1968 indicate a high concentration of phosphorus and nitrogen near the confluence with Piscataway Creek. For the months of May, June, July, and August, the average concentration of $PO_4$, TKN, and $NO_2$-$NO_3$ were 1.06, 1.89, and 0.99, respectively.

Associated with these high nutrient concentrations were high chlorophyll* levels in the Potomac Estuary near Piscataway Creek. As can be seen in Table VI-1, the chlorophyll levels for the latter part of July and for August were above 50 µg/l. During August, there was an extensive algal bloom in the entire upper Potomac Estuary.

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* Chlorophyll is a gross measure of algal concentrations or "standing crop." A chlorophyll level of 50 µg/l is considered to be a "bloom."

B. Upper Piscataway Area Watershed

Water quality in the upper Piscataway Creek has been monitored by personnel of Andrews Air Force Base above and below the discharge points of their waste treatment plants since 1967. A summary of the weekly sampling program is presented in Tables VI-2 and VI-3 for the Meetinghouse and Paynes Branch facilities, respectively.

As can be seen in these Tables, the effects of the wastewater discharges on DO and BOD in Paynes and Meetinghouse Branches are insignificant. The BOD below the two discharges is usually less than 0.5 mg/l larger than above the facilities, with the DO essentially the same above and below the discharges.

The water quality standard for DO, which is 5.0 mg/l monthly average, was met in Paynes Branch except for October of 1967. However, the DO above the discharge point at the same time was also below 5.0 mg/l. In general, the water quality in the headwaters of Piscataway Creek appear to meet the approved quality standards.

C. Piscataway Creek Embayment

A series of stream and wastewater treatment plant surveys was conducted by CFS in order to determine the effects of wastewater discharges on water quality in the Piscataway Creek embayment, especially those discharges in the Piscataway Basin and in the Potomac Estuary, and including land runoff. Sampling stations in the Piscataway Creek embayment are shown in Figure VI-2. The

TABLE VI-2

MONTHLY SUMMARIES OF BOD AND DO DATA*

Meetinghouse Branch STP

Piscataway Creek

| | | 800 Feet Above Outfall | | 2 Miles Below Outfall | |
|---|---|---|---|---|---|
| Year | Month | BOD (mg/l) | DO (mg/l) | BOD (mg/l) | DO (mg/l) |
| 67 | January | 1.5 | 10.3 | 2.3 | 10.0 |
| 67 | February | 5.0 | 9.5 | 4.6 | 10.3 |
| 67 | March | 1.7 | 10.2 | 2.5 | 10.1 |
| 67 | April | 2.5 | 9.1 | 1.6 | 10.6 |
| 67 | May | 1.5 | 8.6 | 0.8 | 7.3 |
| 67 | June | 2.4 | 7.3 | 1.7 | 5.3 |
| 67 | July | 2.4 | 7.3 | 1.7 | 5.3 |
| 67 | August | 1.3 | 6.4 | 1.6 | 6.8 |
| 67 | September | 1.9 | 6.6 | 1.5 | 5.6 |
| 67 | October | | | | |
| 67 | November | 2.5 | 6.7 | 1.9 | 5.9 |
| 67 | December | 2.0 | 8.3 | 2.3 | 8.0 |
| 68 | January | 2.2 | 10.4 | 2.8 | 9.7 |
| 68 | February | 2.4 | 11.9 | 4.2 | 10.6 |
| 68 | March | 1.6 | 8.6 | 2.4 | 7.6 |
| 68 | April | 2.7 | 8.5 | 2.9 | 7.3 |
| 68 | May | 4.0 | 7.0 | 5.0 | 7.2 |
| 68 | June | 3.1 | 6.9 | 2.9 | 6.0 |
| 68 | July | 3.0 | 6.0 | 2.5 | 6.2 |

* Analysis made by Andrews AFB personnel four times per week.

TABLE VI-3

MONTHLY SUMMARIES OF BOD AND DO DATA*

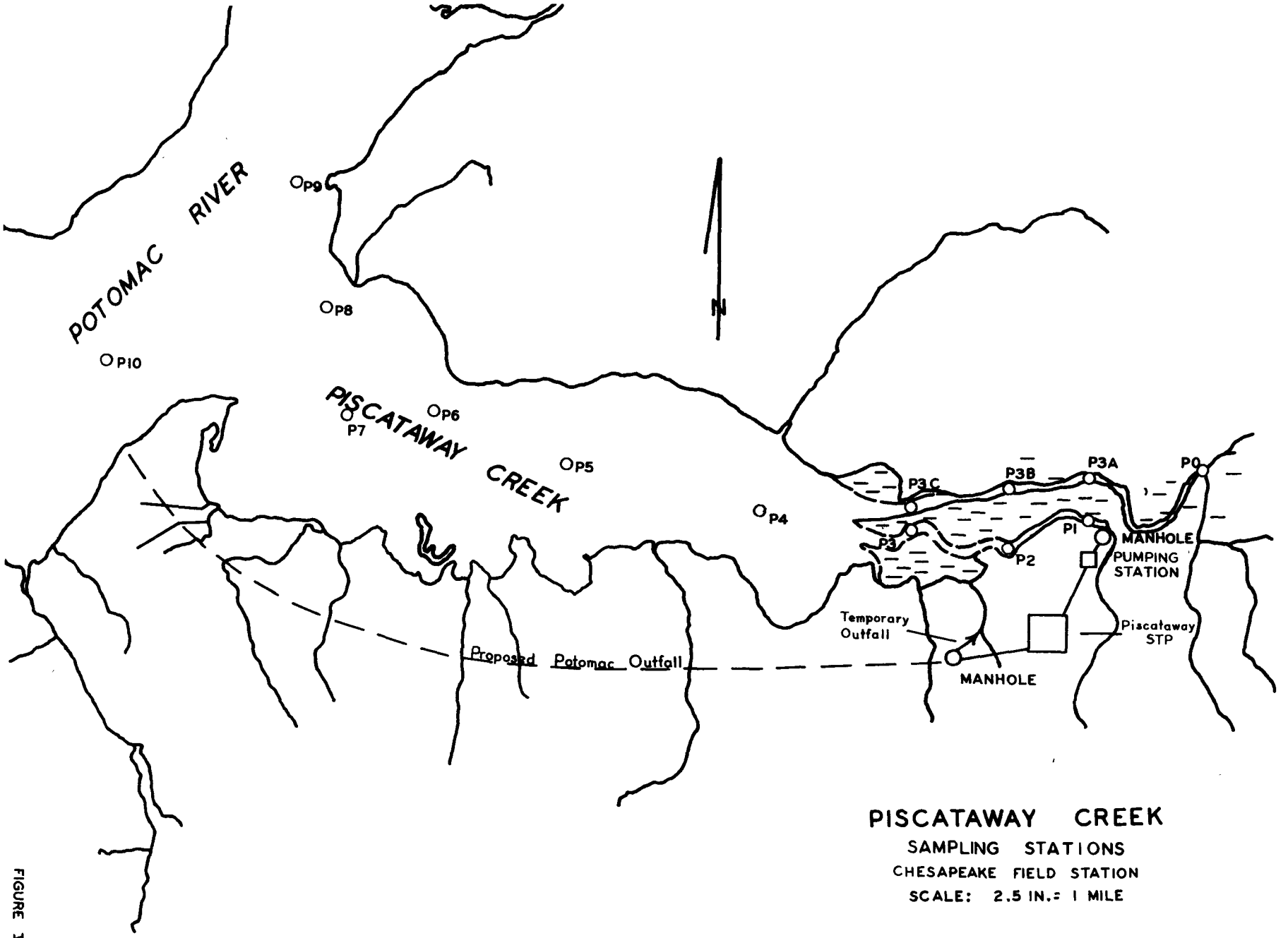
Payne Branch STP

Andrews Air Force Base

Piscataway Creek

| | | 800 Feet Above Outfall | | 2 Miles Below Outfall | |
|---|---|---|---|---|---|
| Year | Month | BOD (mg/l) | DO (mg/l) | BOD (mg/l) | DO (mg/l) |
| 67 | January | 2.9 | 6.5 | 2.2 | 6.4 |
| 67 | February | 3.2 | 8.9 | 3.9 | 10.4 |
| 67 | March | 1.0 | 9.6 | 4.5 | 11.0 |
| 67 | April | 0.6 | 7.2 | 1.6 | 9.5 |
| 67 | May | 1.2 | 7.0 | 2.1 | 7.4 |
| 67 | June | 1.3 | 6.3 | 2.0 | 6.3 |
| 67 | July | 1.8 | 6.3 | 2.0 | 6.3 |
| 67 | August | 1.6 | 6.3 | 1.4 | 6.4 |
| 67 | September | 2.3 | 5.3 | 2.0 | 5.5 |
| 67 | October | 2.9 | 4.9 | 2.7 | 4.4 |
| 67 | November | 2.1 | 6.1 | 2.6 | 6.3 |
| 67 | December | 1.9 | 8.4 | 1.4 | 8.2 |
| 68 | January | 1.5 | 8.7 | 1.4 | 8.6 |
| 68 | February | 2.4 | 11.2 | 2.8 | 10.1 |
| 68 | March | 1.9 | 8.8 | 2.7 | 8.4 |
| 68 | April | 2.0 | 8.2 | 2.6 | 7.3 |
| 68 | May | 3.9 | 6.3 | 2.0 | 6.8 |
| 68 | June | 1.9 | 7.4 | 3.3 | 5.9 |
| 68 | July | 3.2 | 6.0 | 3.3 | 5.9 |

* Analysis made by Andrews AFB personnel four times per week.




PISCATAWAY CREEK
SAMPLING STATIONS
CHESAPEAKE FIELD STATION
SCALE: 2.5 IN.= 1 MILE

FIGURE XI-2

surveys were incorporated into the larger program of the upper Potomac Estuary from the Washington, D. C., area to 301 Bridge near Morgantown, Maryland.*

1. Survey of July 11, 1968

Data from the embayment and waste treatment plant surveys are presented in Tables VI-4 and VI-5, respectively. The survey was conducted during high tide.

As can be seen in Figure VI-3, there was a pronounced algal bloom in the embayment during the survey. The algal concentration in the Potomac Estuary was about one-half of that in the Piscataway embayment.

The phosphorus values in the vicinity of the waste treatment facility were about twice those in the Potomac Estuary or in Piscataway Creek as it flowed into the embayment. The nitrite-nitrate ($NO_2$-$NO_3$) concentrations decreased with distance from the treatment plant, suggesting that denitrification was occurring. Since TKN data was not taken, no nitrogen balance was attempted.

The BOD in the embayment near the treatment facility was only slightly higher than in the Potomac Estuary (Figure VI-3). However, the BOD of Piscataway Creek at Indian Head Highway was less than 5.0 mg/l, suggesting that BOD in the embayment is coming from both the Potomac Estuary and the PWTP.

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* The data from this survey will be presented in a separate report by CFS.

TABLE VI-4

PISCATAWAY WASTEWATER TREATMENT PLANT DATA

July 11, 1968

Chesapeake Field Station

| Parameter | Influent* | Effluent** |
|---|---|---|
| Average Flow (mgd) | 4.20 | 4.20 |
| Maximum Flow (mgd) | 5.00 | 5.00 |
| BOD (mg/l) | 91.50 | 32.40 |
| TKN as N (mg/l) | 10.50 | 16.30 |
| $NH_3$ as N (mg/l) | 6.90 | 10.50 |
| $NO_2$-$NO_3$ as N (mg/l) | 1.79 | 0.08 |
| T. $PO_4$ as $PO_4$ (mg/l) | 9.65 | 15.71 |

* Based on a three-hour composite, 9:00 a.m. to 12:00 noon, on July 11, 1968, of the incoming wastewater from the Piscataway area only, and therefore is not a good measure of incoming characteristics.

** Based on a 24-hour composite, 8:00 a.m. on July 10, 1968, to 8:00 a.m. on July 11, 1968.

Table VI-5

PISCATAWAY CREEK SURVEY

July 11, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | T. $PO_4$ as $PO_4$ (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (µg/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/ 100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indianhead Hwy. Bridge | P-0 | 1225 | 21.5 | - | .972 | 1.540 | 3.00 | 4.56 | 7.65 | ND | ND |
| Pumping Sta. - Above Discharge | P-1 | 0930 | 23.0 | 6 | 2.510 | .317 | 84.00 | 14.32 | 3.18 | 230 | 43,000 |
| First Bend - Above Discharge | P-2 | 0955 | 24.5 | 8 | 2.261 | .372 | 173.20 | 15.10 | 5.66 | 230 | 7,500 |
| Near White Barrels Next to first home | P-3 | 1000 | 25.0 | 8 | 1.886 | .350 | 220.50 | 14.52 | 8.09 | 93 | 23,000 |
| Farmington Lodge Pt. - in Bay | P-4 | 1010 | 26.0 | 8 | 1.168 | .419 | 201.00 | 12.62 | 12.05 | 15 | 230 |
| In Bay - Out from Marina | P-5 | 1020 | 26.5 | 14 | 1.214 | .667 | 72.00 | 11.90 | 4.50 | 210 | 750 |
| Point - Below Marina in Channel | P-6 | 1030 | 26.5 | 18 | .968 | .774 | 43.50 | 11.54 | 5.05 | 230 | 430 |
| Mid - Bay, Off First Two channel markers | P-7 | 1035 | 26.5 | 24 | .934 | .971 | 78.00 | 11.74 | 4.82 | 43 | 230 |
| Confluence With Potomac Mid channel at marina | P-8 | 1040 | 26.5 | 24 | .838 | 1.160 | 76.50 | 10.58 | 4.21 | 75 | 390 |
| Off Monitor Sta. Buoy Potomac River | P-9 | 1045 | 27.0 | 23 | .883 | .992 | 78.75 | 10.60 | 4.18 | 93 | 230 |
| Buoy 76 in Potomac River | P-10 | - | 26.5 | 24 | .822 | 1.232 | 76.50 | 10.30 | 4.21 | 43 | 430 |

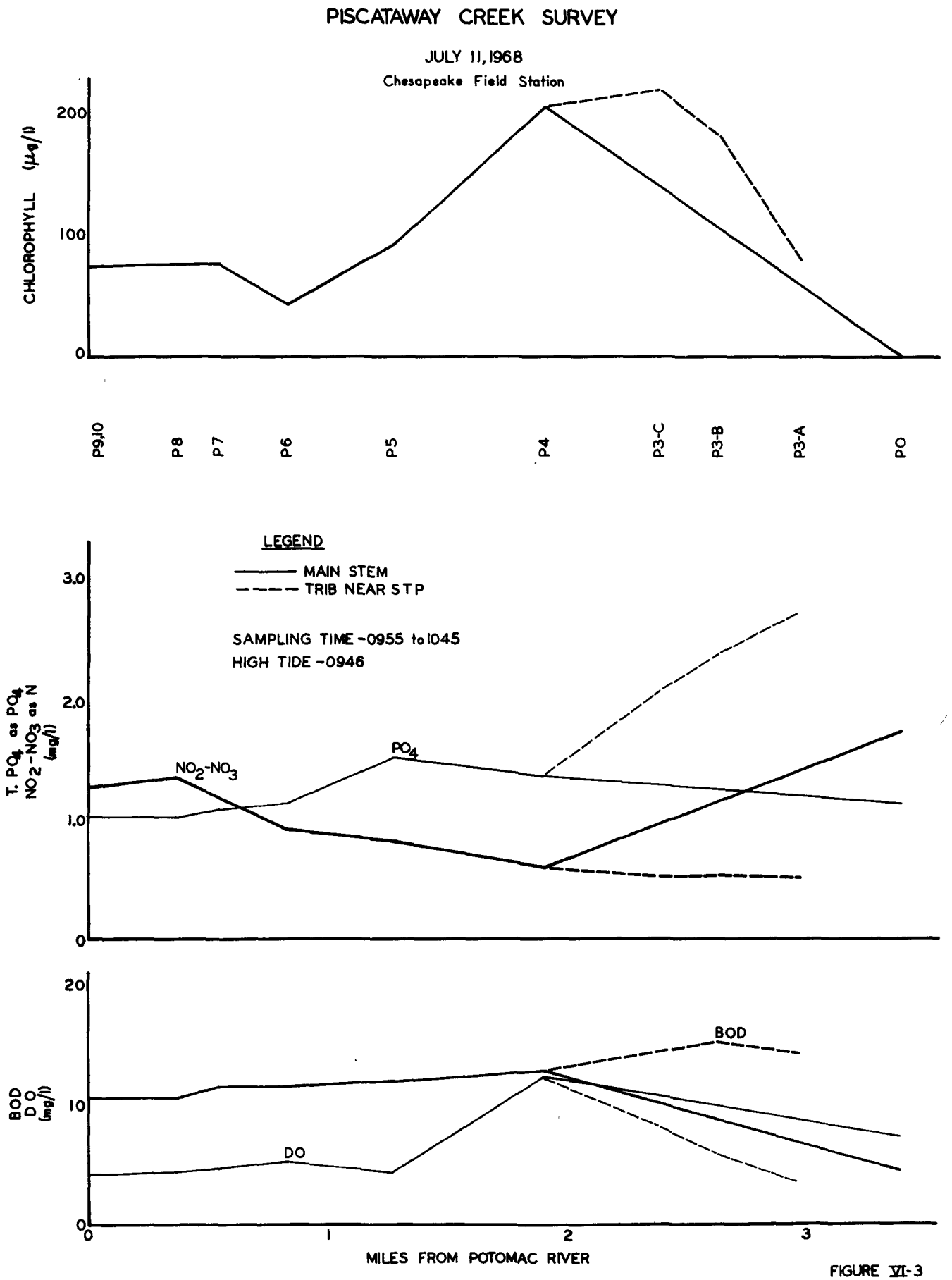
PISCATAWAY CREEK SURVEY
JULY 11, 1968
Chesapeake Field Station
CHLOROPHYLL (µg/l)
200
100
0
P9,10
P8
P7
P6
P5
P4
P3-C
P3-B
P3-A
PO
LEGEND
MAIN STEM
TRIB NEAR STP
SAMPLING TIME -0955 to 1045
HIGH TIDE -0946
T. PO4 as PO4
NO2-NO3 as N
(mg/l)
3.0
2.0
1.0
0
NO2-NO3
PO4
BOD
DO
(mg/l)
20
10
0
BOD
DO
0
1
2
3
MILES FROM POTOMAC RIVER

FIGURE VI-3

At stations P-1, P-2, and P-3 in the southerly channel, coliform concentrations were the highest. The concentration of fecal coliforms, which is an indicator of human waste, was higher at stations P-1, P-2, P-5, and P-6 than at the remaining stations.

In the embayment and in the Potomac Estuary, DO concentrations below 5.0 mg/l were observed. As presented in Figure VI-1, a total of five stations had DO levels less than the adopted standards. The high concentration in the middle of the embayment was probably due to the oxygen production of the standing crop of algae.

While sampling the Piscataway embayment, numerous gas bubbles in the tributary near the wastewater plant were observed near the stations P-1 and P-2 by CFS personnel. Gas bubbles emanating from sluggish waters in marsh areas are common and, therefore, no special significance can be attached as to their causes.

During the survey, an analysis of the influents and effluents of the PWTP was made as given in Table VI-4. Although the influent sampling point was not representative of all the untreated wastewater, the data indicate that the facility was then producing a 5-day BOD removal efficiency of about 65 percent.

2. Investigation of August 6, 1968

As a result of an odor complaint, an investigation was made of the water quality conditions in the Piscataway Creek

embayment. During a reconnaissance of the area, no odor was detected. However, in a visit to PWTP later the same day, it was learned that there had been some operational difficulty at the treatment facility during the week-end of August 3-4, 1968, resulting in discharge of a poor quality effluent.

3. Intensive Surveys of August 14-16, 1968

To further define the effects of the wastewater effluent on the Piscataway embayment, a three-day intensive survey was conducted. Three surveys were made during ebb tide, as contrasted to flood tide for the July survey. The data for the three surveys are presented in Tables VI-6, VI-7, VI-8, and VI-9.

As can be seen in Figures VI-4, VI-5, and VI-6, the chlorophyll level for the embayment and the Potomac Estuary are indications of an extremely extensive algal bloom. In Piscataway Creek near Maryland 210 Highway, the chlorophyll drops off considerably.

The phosphorus and TKN concentrations were higher in the tributary near the facility, especially for the surveys on August 15 and 16. (See Figures VI-5 and VI-6.) The phosphorus and TKN in the main or northerly channel which flows on the opposite side of the embayment were relatively lower, as can be seen in Figures VI-4 and VI-6.

Nutrient data for the August 16, 1968, survey as presented in Figure VI-6 shows large nutrient concentrations in the Piscataway embayment near the confluence with the Potomac Estuary. These

Table VI-6

PISCATAWAY CREEK SURVEY

August 14, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | T.$PO_4$ as $PO_4$ (mg/l) | TKN (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (ug/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indian Head Hwy. Bridge Rt. 210 | P-0 | 0930 | 22.2 | - | 1.165 | .544 | .130 | 2.25 | 3.04 | 7.54 | 4,300 | 9,300 |
| Pumping Sta. - Above Discharge | P-1 | 1000 | 23.0 | 14 | .845 | 2.589 | .188 | 43.50 | 6.84 | 2.31 | 930 | 46,000 |
| First Bend - Above Discharge | P-2 | 1005 | 23.0 | 10 | 1.193 | LA | .170 | 72.75 | 8.36 | 1.96 | 430 | 46,000 |
| Near White Barrels Next to first home | P-3 | 1020 | 23.5 | 6 | 1.198 | 3.203 | .217 | 132.00 | 3.44 | 6.52 | 230 | 24,000 |
| On trib. Opposite Plant near posts channel | P-3A | 1040 | 21.5 | 5 | .879 | .937 | .642 | 43.50 | 6.98 | 6.59 | 2,300 | 15,000 |
| On trib. Opposite Plant near channel to road | P-3B | 1048 | 23.5 | 5 | .990 | 2.291 | .177 | 130.50 | 9.78 | 6.78 | 230 | 15,000 |
| Near end of Cattails in Opposite trib. | P-3C | 1055 | 24.0 | 4 | 1.023 | 2.633 | .031 | 207.75 | 9.32 | 10.92 | 230 | 2,300 |
| Farmington Lodge Pt. in Bay | P-4 | 1100 | 25.0 | 5 | 1.004 | 2.475 | .244 | 209.25 | 7.56 | 12.38 | 39 | 150 |
| In Bay - Out from Marina | P-5 | 1110 | 25.5 | 10 | .918 | 1.899 | .970 | 146.25 | 8.54 | 7.93 | 93 | 2,300 |
| Off Point- Below Marina in Channel | P-6 | 1115 | 26.0 | 12 | .967 | 1.987 | 1.022 | 162.75 | 8.00 | 6.20 | 430 | 4,300 |
| Mid-Bay, Off First Two Channel markers | P-7 | 1120 | 26.0 | 12 | .976 | 1.785 | 1.190 | 111.75 | 9.06 | 5.68 | 930 | 2,300 |
| Confluence with Potomac Mid channel at markers | P-8 | 1130 | 26.0 | 12 | .918 | 2.348 | 1.600 | 184.50 | 8.90 | 6.88 | 430 | 930 |

Table VI-6 (cont.)

PISCATAWAY CREEK SURVEY

August 14, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | $T.PO_4$ as $PO_4$ (mg/l) | TKN (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (ug/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Off Monitor Sta. Buoy Potomac River | P-9 | 1130 | 26.0 | 14 | 1.130 | 1.728 | 1.240 | 199.50 | 9.28 | 5.38 | 930 | 4,300 |
| Buoy 76 in Potomac River | P-10 | 1150 | 26.0 | 12 | 1.179 | 2.405 | 3.210 | 192.00 | 11.60 | 5.27 | 43 | 9,300 |

Table VI-7

PISCATAWAY CREEK SURVEY

August 15, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | T.$PO_4$ as $PO_4$ (mg/l) | TKN (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (µg/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indian Head Hwy. Bridge Rt. 210 | P-0 | 1225 | 22.0 | - | 1.078 | .911 | 1.360 | 4.50 | 3.02 | 8.12 | | |
| First Bend - Above Discharge | P-2 | 1032 | 23.0 | 14 | 2.466 | 3.321 | .232 | 57.50 | 9.80 | 3.25 | | |
| Near White Barrels Next to first home | P-3 | 1045 | 24.2 | 11 | 3.628 | 5.645 | .343 | 7.50 | 11.04 | 6.57 | | |
| Farmington Lodge Pt. in Bay | P-4 | 1100 | 25.0 | 10 | 2.006 | 3.003 | .163 | 154.50 | 14.90 | 12.90 | | |
| In Bay - Out from Marina | P-5 | 1115 | 25.5 | 4 | 1.350 | 2.563 | .169 | 173.25 | 11.82 | 10.88 | | |
| Off Point - Below Marina in Channel | P-6 | 1120 | 26.0 | 10 | 1.416 | 2.440 | 1.110 | 137.25 | 12.50 | 6.53 | | |
| Mid-Bay, off first two Channel markers | P-7 | 1124 | 26.0 | 10 | 1.688 | 2.165 | 1.360 | 9.00 | 11.34 | 5.39 | | |
| Confluence with Potomac Mid Channel at markers | P-8 | 1126 | 26.5 | 12 | 1.397 | 2.593 | 1.250 | 135.15 | 14.58 | 8.24 | | |
| Off Monitor Sta. Buoy Potomac River | P-9 | 1135 | 26.5 | 14 | 1.200 | 2.024 | 1.390 | 113.25 | 9.24 | 4.86 | | |
| Buoy 76 in Potomac River | P-10 | 1145 | 26.0 | - | 1.191 | 2.171 | 1.410 | 116.25 | 9.04 | 5.66 | | |

Table VI-8

PISCATAWAY CREEK SURVEY

August 16, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | T.$PO_4$ as $PO_4$ (mg/l) | TKN (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (ug/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indian Head Hwy. Bridge Rt. 210 | P-0 | 1215 | 23.0 | - | 1.108 | .482 | 1.318 | 4.50 | 3.94 | 7.62 | | |
| Pumping Sta. - Above Discharge | P-1 | 1140 | 23.0 | 10 | 3.437 | 4.723 | .194 | 3.25 | 12.80 | 4.02 | | |
| First Bend - Above Discharge | P-2 | 1135 | 24.5 | 12 | 4.017 | 5.759 | .273 | 133.50 | 13.74 | 3.78 | | |
| Near White Barrels Next to first home | P-3 | 1125 | 24.5 | 4 | 2.553 | 3.277 | .317 | 123.00 | 8.74 | 6.52 | | |
| On trib. Opposite Plant near posts channel | P-3A | 1055 | 23.5 | 4 | 1.169 | 1.867 | .628 | 82.50 | 7.36 | 7.01 | | |
| On trib. Opposite Plant near channel to road | P-3B | 1105 | 22.5 | 4 | 1.424 | .717 | 1.195 | 18.00 | 3.96 | 6.04 | | |
| Near end of Cattails in Opposite trib. | P-3C | 1110 | 23.0 | 6 | .864 | .518 | 1.273 | 195.75 | 3.74 | 6.87 | | |
| Farmington Lodge Pt. in Bay | P-4 | 1040 | 25.0 | 6 | 1.475 | 3.102 | .180 | 279.75 | 9.64 | 9.57 | | |
| In Bay - Out from Marina | P-5 | 1030 | 25.5 | 11 | 1.037 | 2.813 | .108 | 171.00 | 11.20 | 12.88 | | |
| Off Point - Below Marina in Channel | P-6 | 1020 | 26.0 | 11 | 1.007 | LA | .473 | 173.25 | 10.72 | 8.69 | | |
| Mid-Bay, Off First Two Channel markers | P-7 | 1010 | 26.0 | 14 | 5.898 | 8.325 | .807 | 180.00 | 16.52 | 6.06 | | |
| Confluence with Potomac Mid channel at markers | P-8 | 1000 | 26.0 | 14 | 1.078 | 1.771 | 1.136 | 138.00 | 10.42 | 5.35 | | |

Table VI-8 (cont.)

PISCATAWAY CREEK SURVEY

August 16, 1968

Chesapeake Field Station

| Station | Sta. No. | Sample Time | Water Temp. (°C) | Secchi Disk (Inches) | T.$PO_4$ as $PO_4$ (mg/l) | TKN (mg/l) | $NO_2$-$NO_3$ as N (mg/l) | Chlorophyll (ug/l) | BOD (mg/l) | DO (mg/l) | Fecal Coliform (MPN/100 ml) | Coliform (MPN/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Off Monitor Sta. Buoy Potomac River | P-9 | 0935 | 26.0 | 15 | .976 | 1.633 | 1.363 | 303.00 | 8.62 | 3.08 | | |
| Buoy 76 in Potomac River | P-10 | 0.950 | 26.0 | 15 | 1.525 | 4.434 | 1.246 | 130.50 | 12.32 | 3.68 | | |

TABLE VI-9

WASTEWATER DATA*

Piscataway Wastewater Treatment Plant

August 14, 1968

| Parameter | Influent | Effluent | Reduction (%) |
|---|---|---|---|
| Flow (mgd) | 5.2 | 5.2 | - |
| BOD (mg/l) | 93.5** | 17.5 | 82 |
| S. Solids (mg/l) | - | 8.0 | - |
| T. $PO_4$ as $PO_4$ (mg/l) | 11.0 | 8.6 | 22 |
| TKN as N (mg/l) | 11.2 | 9.6 | 14 |
| $NH_3$ as N (mg/l) | 12.7 | 7.7 | 39 |
| $NO_2$-$NO_3$ as N (mg/l) | 0.5 | 1.2 | -140 |

* Based on a 24-hour composite.

** Based on an average of 3 analyses of the 24-hour composite.

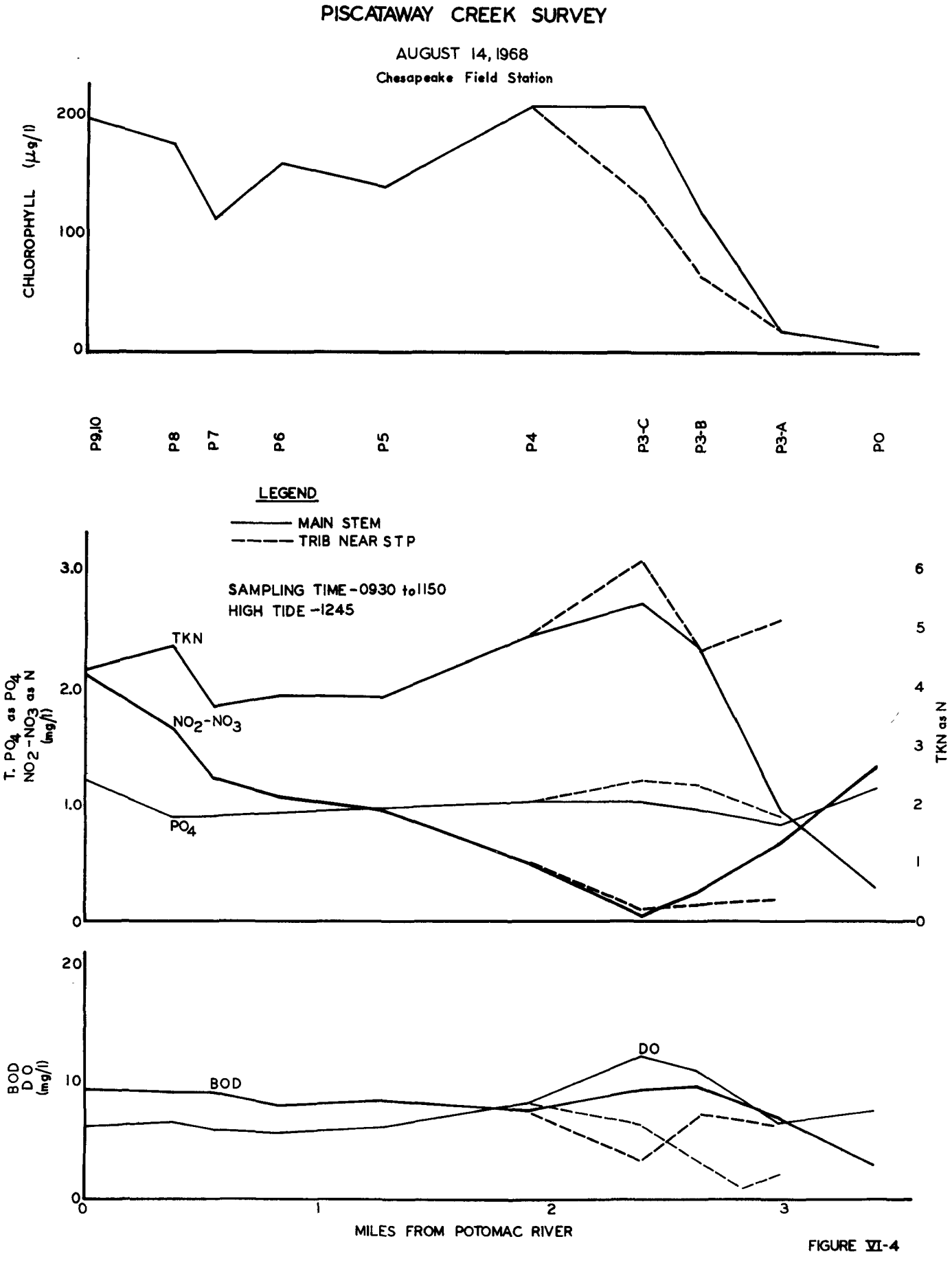
PISCATAWAY CREEK SURVEY
AUGUST 14, 1968
Chesapeake Field Station
CHLOROPHYLL (µg/l)
200
100
0
P9,10
P8
P7
P6
P5
P4
P3-C
P3-B
P3-A
PO
LEGEND
MAIN STEM
TRIB NEAR STP
SAMPLING TIME - 0930 to 1150
HIGH TIDE - 1245
T. PO4 as PO4
NO2-NO3 as N
(mg/l)
3.0
2.0
1.0
0
TKN
NO2-NO3
PO4
6
5
4
3
2
1
0
TKN as N
BOD
DO
(mg/l)
20
10
0
DO
BOD
0
1
2
3
MILES FROM POTOMAC RIVER

FIGURE VI-4

# PISCATAWAY CREEK SURVEY

AUGUST 15, 1968

Chesapeake Field Station

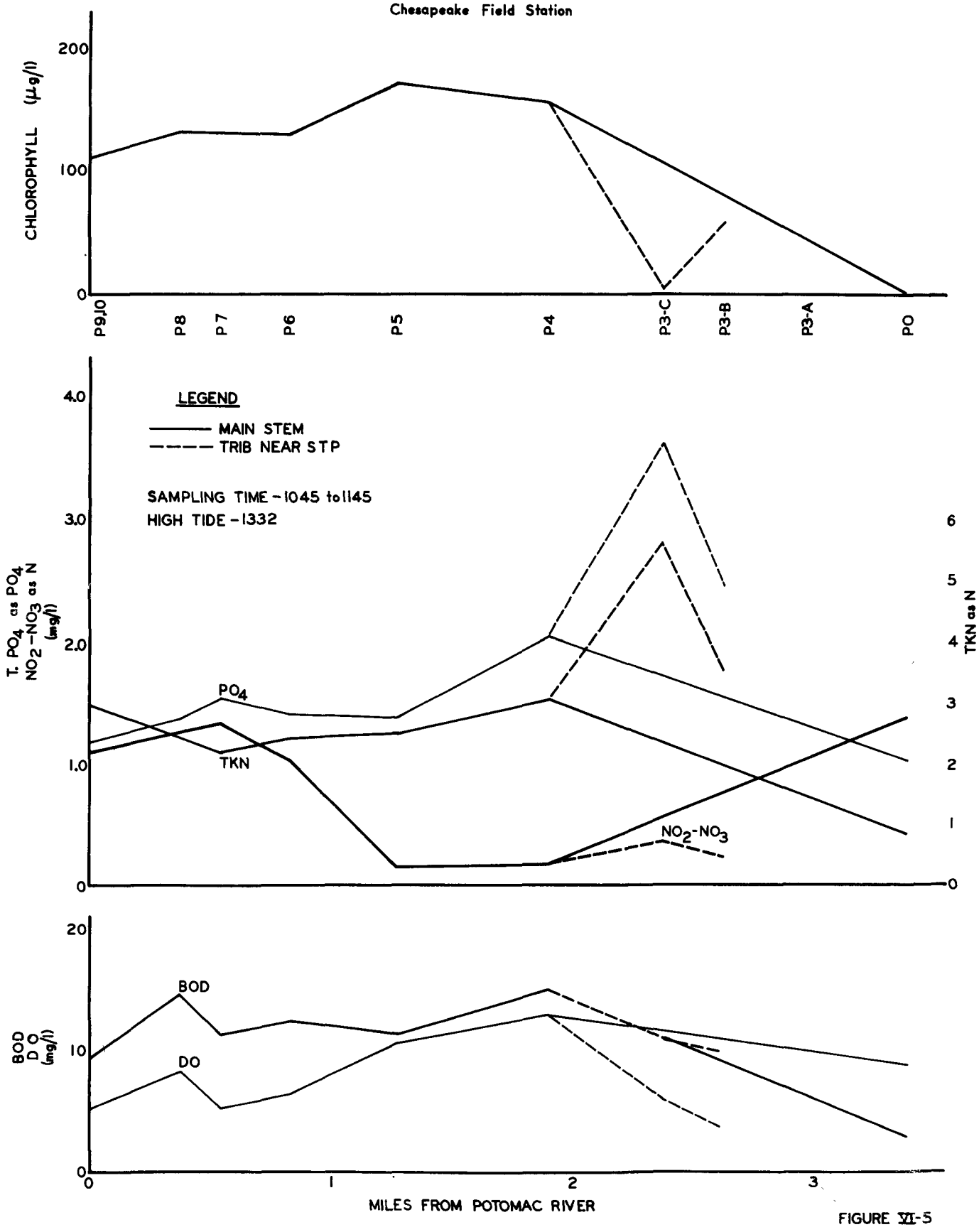


FIGURE VI-5

# PISCATAWAY CREEK SURVEY

AUGUST 16, 1968

Chesapeake Field Station

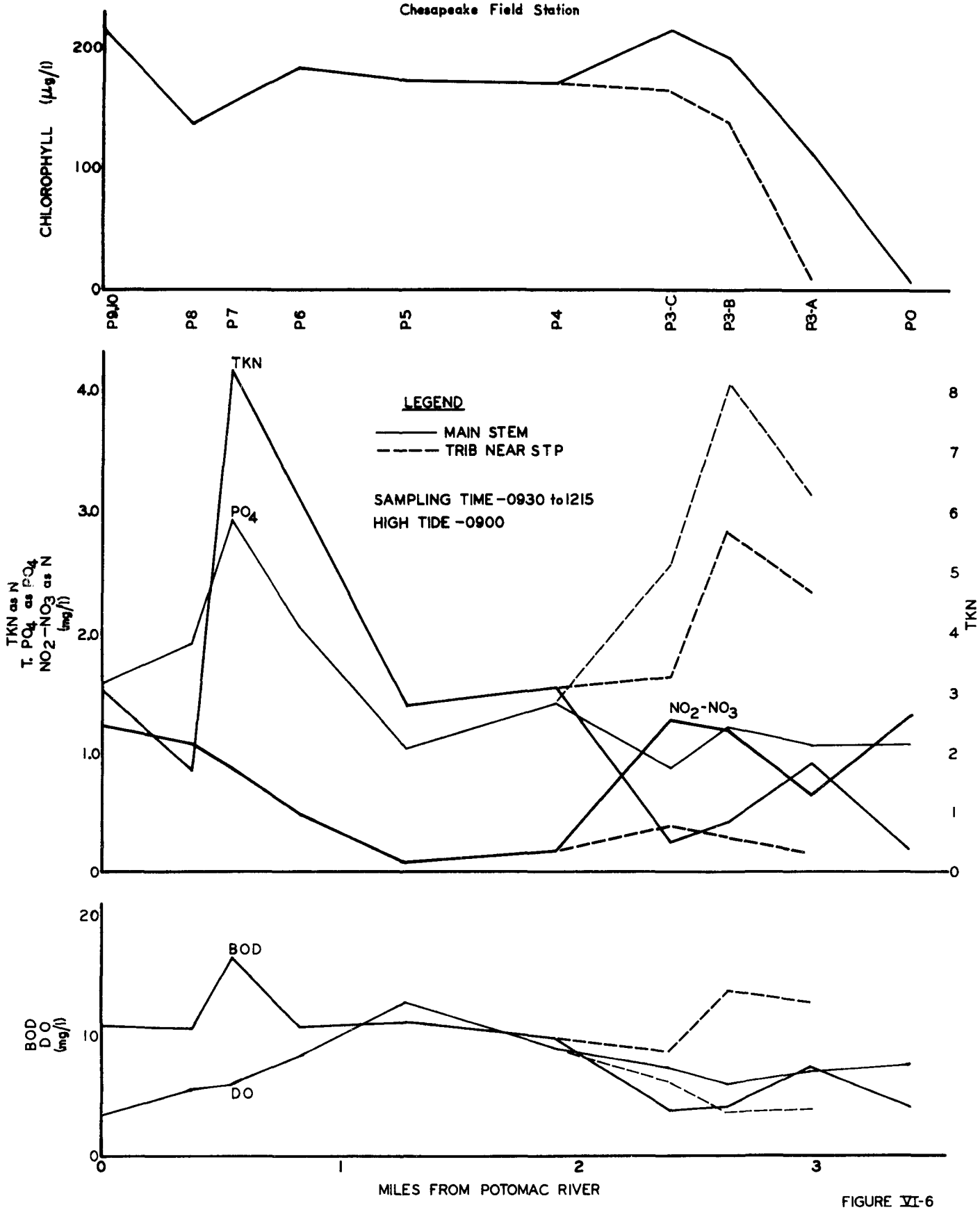


FIGURE VI-6

higher concentrations, which were observed at low tide, are probably the result of tidal flushing of the wastewater discharge.*

The BOD and DO determinations of the three surveys exhibit similar characteristics in the nutrient data, as also given in Figures VI-4, VI-5, and VI-6. However, the concentrations near the pumping stations near the manholes were not much different from the stations on the main channel.

In general, the BOD in the Potomac Estuary near Piscataway Creek was about 10 mg/l. The BOD in the Piscataway embayment was also about 10 mg/l, thus suggesting that BOD in Piscataway embayment is related more directly to BOD in the Potomac than to the Creek itself.

Using a tidal height prism of 2.4 feet and a surface area of 5.53 million square feet, it was determined that about 17,000 pounds per day of BOD enter and leave the Piscataway embayment from the Potomac Estuary. This compares to less than 1,000 pounds per day coming from wastewater effluents and the fresh water flow into Piscataway Creek.

Although the data required for determining exchange rates are not currently available for Piscataway embayment, it can readily be seen from the above calculations that organic loading, including

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* In later investigations it was determined that effluent does "hug" the southern shore, thus confirming the interpretation of the August 16 data.

the nutrients in the middle and lower Piscataway embayment, is controlled primarily by the quality of the Potomac Estuary. Nevertheless, it can also be seen in Figures VI-4, VI-5, and VI-6 that the effluent from the Piscataway Wastewater Treatment Plant does affect effluent and water quality in the embayment, especially in the small tributary on the southern shore.

Coliform concentrations of over 9,000 MPN/100 ml were observed in the upper portions of the southerly and northerly channels. The highest counts, over 24,000, were detected in the southerly channel near the manhole by the pumping station. As can be seen in Table VI-5, the highest fecal coliform counts are for the two uppermost stations in the main or northerly channel. Urban runoff from a recent rainfall may have been the probable source of these high fecal counts.

Results of the efficiency study of the wastewater treatment facility, as given in Table VI-9, indicates that the effluent leaving the plant is of very good quality. The BOD and suspended solids were 17.5 and 8.0 mg/l, respectively, for the 24-hour composite sample.

The influent to the plant appears to be very weak for a domestic sewage. The incoming wastewater ranges from about 70 to 120 mg/l of 5-day BOD, with an average of about 95 mg/l. Similar BOD concentrations for the influent were observed by MSDH and WSSC personnel.

4. Investigation of August 23, 1968

A complete inspection of the Piscataway area wastewater treatment plant and adjacent area was made by CFS personnel on August 23, 1968. During the inspection of the plant, the following were observed.

a. The plant was operating efficiently.

b. The effluent, which was being monitored continuously by FWPCA, indicated that BOD was between 10 and 20 mg/l, with the suspended solids concentrations ranging from 4 to 17 mg/l.

c. An alarm system, which had been installed recently, appeared to be working satisfactorily. A log of each alarm activation is being kept by WSSC personnel.

d. Since the plant was placed into operation, no solids from the digester have been wasted. Start-up seed was being brought to the plant from the Laurel-Parkway facility of WSSC to aid in establishing the proper bacteriological cultures.

e. No evidence of recent by-passing or accidental spills was observed.

f. A maintenance crew was filling a gully formed by the effluent near the present terminal end of the discharge interceptor. As a result of this filling operation, a high silt load was picked up by the effluent stream.

An inspection at low tide was also made of the Calvert Manor area which is downstream from and adjacent to the WSSC facility. The combination of low tide and the large quantities of silt in the effluent clearly showed that effluent from the wastewater plant was flowing along the shore, near the site of the original Lord Calvert grant.* Under these conditions, the water is less than one foot deep, and the only discernable flow was the wastewater discharge.

The "tagging" of the effluent by silt particles clearly showed the course of the effluent. This confirms the reports of local residents of Calvert Manor that an accident or malfunction at the plant would readily be noticeable from the shoreline as, for example, during the early August breakdown when the area near the shoreline was reported to be an "open sewer" under low tidal conditions.

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* This historical site is currently being restored by the Claggett family.

# CHAPTER VII

# CORRECTIVE MEASURES

## A. Existing Wastewater Treatment Facilities

As indicated in Chapter V, there are seven wastewater discharges in the Piscataway Watershed discharging about 5.8 mgd with a 5-day BOD loading of 780 pounds per day. All of the treatment facilities are currently providing secondary treatment with a BOD removal efficiency of 83 percent and greater.

Since August 1, 1968, as directed by the Maryland State Department of Health, the following actions have been taken by WSSC at the PWTP.

1. The flow into the plant has been limited to average daily flow of 5.0 mgd.
2. An alarm system has been intalled to indicate pumping or other mechanical difficulties which could result in by-passing untreated sewage.
3. General upgrading of plant operation.

The above actions by the Maryland State Department of Health and WSSC are endorsed in this report.

A major deficiency at the existing plant appears to be failure to provide stand-by electric power. If a power failure occurs, the incoming wastewater will be by-passed from a manhole near the plant's pumping station serving the Piscataway area or from the Broad Creek pumping station for the remaining service area.

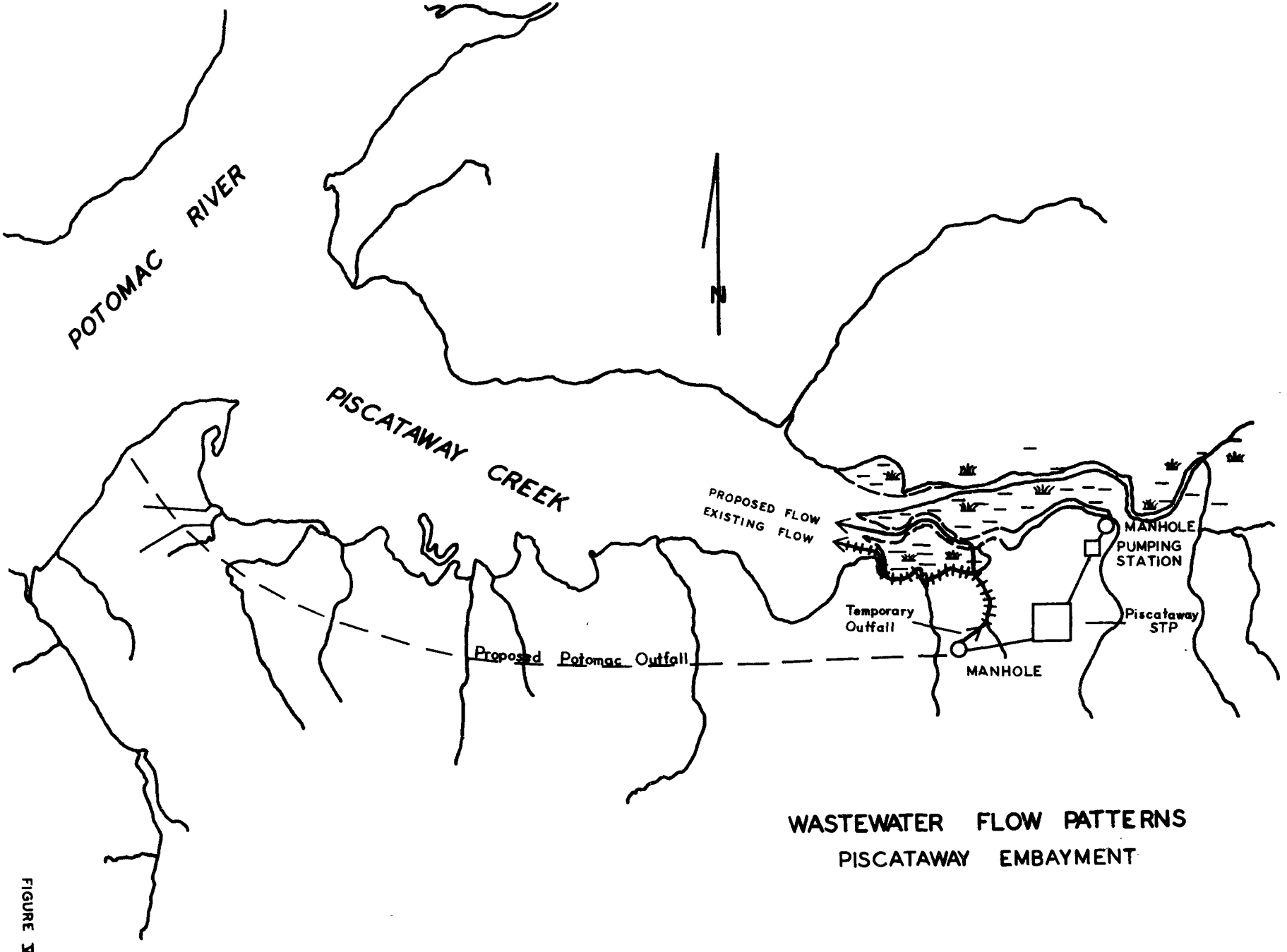
To eliminate or significantly reduce the incidence of overflows which have occurred in both service areas, it is recommended that stand-by power be provided at all pumping stations. As a precautionary measure, in case of dual failure, a plan for diverting or storing of the wastewater should be developed to prevent discharge of untreated sewage.

B. Existing Temporary Discharge Location of the Piscataway Wastewater Treatment Plant

As indicated in the previous chapter and as shown in Figure VII-1, the existing discharge location results in a wastewater flow pattern in the Piscataway embayment which flows along the shoreline. To eliminate this condition and to provide for better dilution and dispersion of the wastewater, it is recommended that the final effluent be conveyed to the southerly channel as shown in Figure VII-1.

The conveyance, which could be by an excavated channel or via a temporary pipeline, would provide a vehicle for continuous wastewater flow and prevent stagnant conditions. If a channel is excavated, a program to maintain the channel, including weed control, as required should also be initiated.

Since the current assimilative capacity of the Piscataway embayment is being exceeded by present wastewater loadings, it is recommended that the effluent outfall, as originally proposed by WSSC, be constructed as soon as possible. In addition, provision should be made to eliminate the discharge of untreated wastes.




WASTEWATER FLOW PATTERNS
PISCATAWAY EMBAYMENT

FIGURE VII

C. Expansion of the Piscataway Wastewater Treatment Facility and Potomac Interceptor

According to the 1969-1973 Sewerage Program of WSSC, the existing plant is to be expanded by 25.0 mgd. It has been estimated by WSSC that wastewater flow in the service area by 1980 will be about 30 mgd. Associated with the expansion program will be a 4.0 mgd advanced wastewater treatment plant.

Preliminary studies by CFS have indicated that the wastewater treatment level for all discharges into the Potomac Estuary will have to be provided as given below to meet established water quality standards.

| Parameter | Percent Reduction |
|---|---|
| 5-day BOD (Biochemical Oxygen Demand) | 95 |
| TKN (Total Kjeldahl Nitrogen) | 85 |
| $PO_4$ (Phosphates) | 95 |

Using the projected population and current loading averages for the entire Potomac Estuary, this will result in the wastewater loadings from the 30 mgd Piscataway facility as follows:

| Parameter | Current Treated Loading (#/day) | Projected Treated Loading* (#/day) |
|---|---|---|
| 5-day BOD | 635 | 1,500 |
| TKN | 400 | 750 |
| $PO_4$ | 390 | 500 |

* Treated loadings based on 95, 89, and 95 percent BOD, TKN, and $PO_4$ removal efficiency, respectively.

As can be seen when the projected and current loadings are compared, the projected loadings to the Piscataway embayment, even with addition of AWT, will be higher than from the existing 5.0 mgd facility.

Therefore, it is recommended that the effluent from the existing plant and the proposed expansion be conveyed to the Potomac Estuary.