CRITICAL AREAS IN THE POTOMAC RIVER BASIN

A Mid-1977 Review of Water Pollution Control

by Keith M. Brooks

Interstate Commission on the Potomac River Basin
4350 East West Highway
Bethesda, Maryland 20014

Technical Publication 77-3

December 1977

THE AUTHOR

Keith M. Brooks is employed by the Interstate Commission on the Potomac River Basin as an Environmental Analyst. Mr. Brooks received his Bachelor of Science degree in Biology from the Pennsylvania State University and his Master of Regional Planning degree from the University of Pennsylvania.

ACKNOWLEDGEMENTS

Many sources were consulted in the preparation of this updated report. By far, the most information was supplied by the state water resources agencies in the Potomac basin. They include:

DISTRICT OF COLUMBIA
Department of Environmental Services
415 12th Street, N.W.
Washington, D.C. 20004

MARYLAND
Water Resources Administration

D-2 Tawes State Office Building
Annapolis, Md. 21401

Cumberland Regional Office
Naves Crossroads
Cumberland, Md. 21502

PENNSYLVANIA
Department of Environmental Resources
P.O. Box 2063
Harrisburg, Pa. 17120

VIRGINIA
Virginia State Water Control Board

Northern Virginia Office
5515 Cherokee Street
Alexandria, Va. 22312

Valley Regional Office
P.O. Box 268
Bridgewater, Va. 22812

WEST VIRGINIA
Department of Natural Resources
District II
Box 506
Romney W. Va. 26757

UNITED STATES
Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

Region III
6th and Walnut Streets
Phila., Pa. 19106

Some of the above agencies reviewed drafts of this report and supplied information on water quality, effluent data and enforcement procedures, but the author is solely responsible for the report's findings and conclusions.

Staff members of the Interstate Commission on the Potomac River Basin who contributed to this report by reviewing the manuscript and offering suggestions include: William McCaw, Environmental Engineer; Kevin C. Flynn, Public Information Officer; Anne Blackburn, Public Education Specialist; James Rasin, Aquatic Biologist; Wendy Goodwin, Editorial Assistant; and Paul W. Eastman, Executive Director. Sandy Sayers and Joan Bing typed the manuscript in its many revisions. The editing and suggestions, in addition to the encouragement of the Staff were most appreciated.

This publication has been prepared by the staff of the Interstate Commission on the Potomac River Basin. Funds for this publication are provided by the United States government, the United States Environmental Protection Agency, and the signatory bodies to the Interstate Commission on the Potomac River Basin: District of Columbia, Maryland, Pennsylvania, Virginia and West Virginia. The opinions expressed are those of the authors and should not be construed as representing the opinions or policy of the United States government or any of its agencies, the several states, or the Commissioners of the Interstate Commission on the Potomac River Basin.

On the cover Photo of construction of the Upper Occoquan Sewage Authority plant near Centreville, VA (see Critical Area 18.)

CONTENTS

INTRODUCTION

This report constitutes the first update of the 1975 ICPRB publication entitled Critical Areas in the Potomac River Basin. That report, authored by Richard N. Palmer, identified 18 "critical" areas which were not meeting water quality standards at the time the Potomac states prepared their 1975 Water Quality Reports under Section 305(b) of Public Law 92-500, the Federal Water Pollution Contol Act Amendments of 1972.

In the preparation of this report, water quality data and water quality improvement programs implemented during 1975 and 1976 were examined to determine whether progress has occurred in the Critical Areas, and to check the progress of the Potomac basin in meeting the goals of P.L. 92-500. This Act, which was the most ambitious and far-reaching water pollution law in the history of the United States, has two major goals:

- By July 1, 1983, wherever possible, to have water that is clean enough for fish, shellfish, and wildlife propagation and provides for recreation in and on the water;

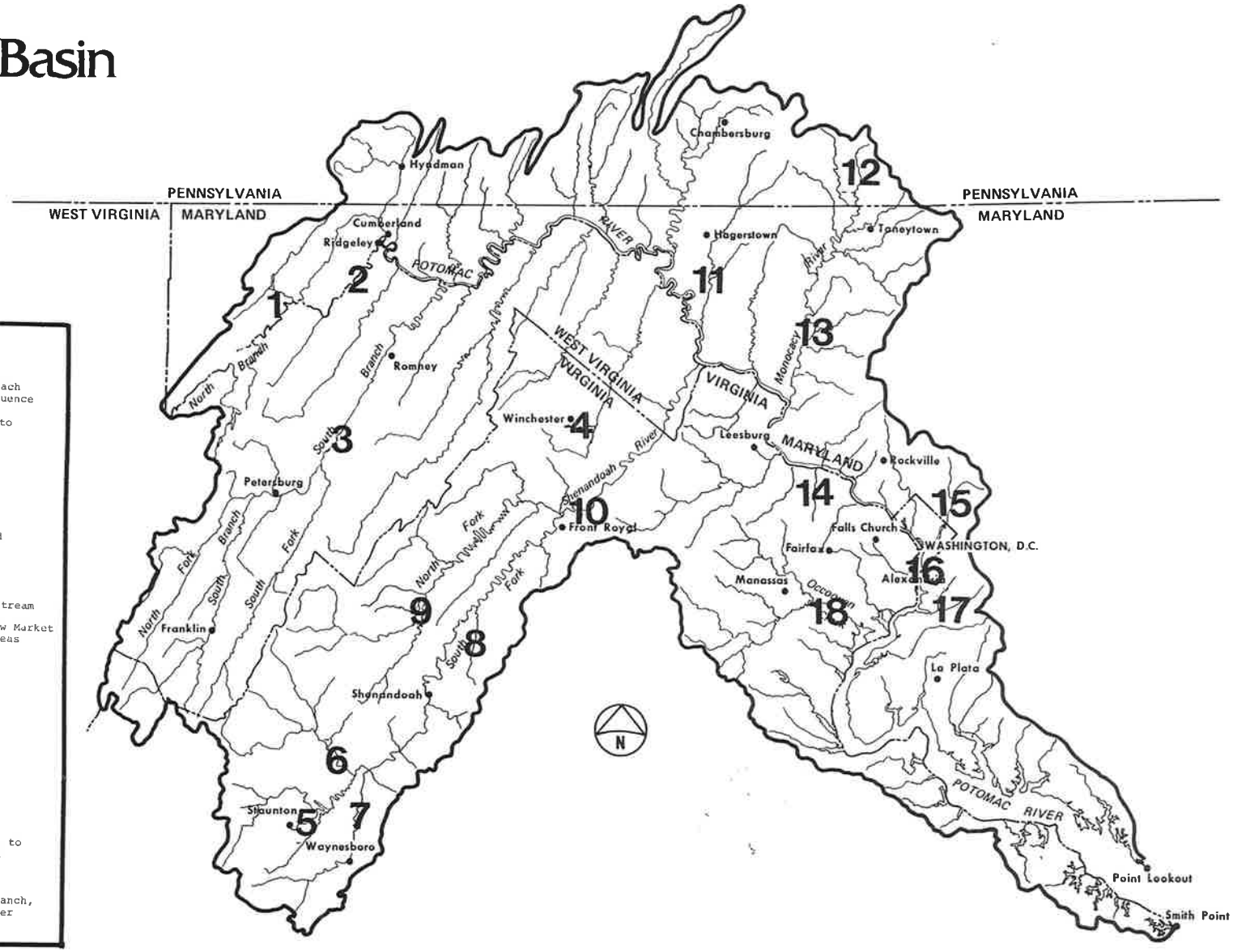
- And by 1985, to eliminate the discharge of pollutants into the nation's waters. In the five years since passage of P.L. 92-500, it has become apparent that the first goal is enforceable under the provisions of the Act having to do with water quality-related effluent limitations, but the second is not.

Sections 201 and 402 of P.L. 92-500 are the most relevant to municipal and industrial water pollution control. Section 201 is important to the improvement of the Critical Areas because it assists in the development and implementation of municipal waste treatment management plans in order to achieve the goals of the Act. Under this section, municipalities have the opportunity to apply for a series of grants from the U.S. Environmental Protection Agency which will pay for 75 percent of the planning and construction costs of eligible pollution control facilities necessary for compliance with the Act. The grant program consists of three stages: Step I is the facilities plan and feasibility study, Step II is the completion of the plant design for the alternative which proved to be cost-effective and Step III is the actual construction phase of the treatment facility.

Section 402 prohibits the discharge of pollutants from any point source into the waters of the United States, unless the discharger has applied for and received a National Pollutant Discharge Elimination System (NPDES) permit. In the Potomac River basin, NPDES permits are issued by the U.S. EPA in West Virginia, Pennsylvania and

Potomac River Basin Critical Areas

	STREAM NAME	LOCATION
1	North Branch and Georges Creek	Headwater of each to their confluence
2	North Branch	Georges Creek to South Branch
3	South Branch	Downstream of Moorefield
4	Abrams Creek	Entire length
5	Lewis Creek	Entire length
6	North River	Bridgewater and downstream
7	South River	Waynesboro and downstream
8	Hawksbill Creek	Luray and downstream
9	North Fork Shenandoah River	Timberville, New Market and Broadway areas
10	Shenandoah River	Front Royal and downstream
11	Antietam Creek	Entire length
12	Rock Creek	Gettysburg and downstream
13	Monocacy River	Frederick and downstream
14	Sugarland Run	Herndon and downstream
15	Anacostia River	Entire length
16	Potomac Estuary and embayments	Washington, D.C. to Piscataway Creek
17	Piscataway Creek	Entire length
18	Bull Run drainage basin and Occoquan Reservoir	Cub Run, Flat Branch, Bull Run and Lower Occoquan



the District of Columbia. In Maryland and Virginia, EPA has granted approval to the state water pollution control agencies to issue permits and enforce the law. Each permit specifies which pollutants may be discharged and their monthly averages and maximum daily limits. If a discharger is not able to comply with his permit, firm targets are set in order to achieve the requirements. This law also encourages areawide waste treatment management, reclamation and recycling of water, other techniques for eliminating the discharge of pollutants, and open space preservation.

NATIONAL ABATEMENT EFFORTS

On July 1, 1977, as this report was being written, a major milestone was passed under P.L. 92-500. This date marked the time by which industries were required to use the Best Practicable Technology (BPT) to control water pollution, and municipalities required to provide at least secondary treatment for their sewage wastes. By 1983, the next major milestone, industrial dischargers are required to employ the Best Available Technology (BAT), and municipalities to utilize the Best Practicable Technology. In every case, dischargers must control effluents to avoid violation of federally-approved receiving water quality standards established by the states. Amendments to P.L. 92-500 which have been passed in the 1977 session of Congress will modify the BAT requirements. They will also allow for case-by-case extension of some of the deadlines in the Act under certain specified conditions.

Nationwide, significant progress has been made in cleaning up industrial water pollution. According to the EPA, the agency responsible for implementation of P.L. 92-500, all but 600 of the 4,000 major industrial polluters in the nation met this deadline, an 85 percent success rate. The progress made by major municipal dischargers has been slower, with only about one-half of the 4,300 dischargers, nationally, in compliance. The reasons for the failures include the magnitude of investment required from municipalities, the fact that federal grants have not been available in all cases, the substantial time involved in completing construction, and the difficulty of translating a national act into language and action which can be implemented by local officials and planners.

In the Critical Areas, industrial dischargers have failed to meet their compliance schedules in only four instances of the eighteen plants analyzed (a 78 percent success rate). Fourteen of the thirty-one muncipal dischargers failed to meet the July 1 deadline (a 55 percent success rate). Many of the major municipal dischargers in the Potomac basin require advanced waste treatment (AWT). EPA has projected that all major municipal dischargers will be able to comply with the AWT limitations by 1983.

EPA's enforcement policy has been stated as one of "penalizing the recalcitrant by taking firm and timely action against noncompliers." This policy was formulated in June and July of 1977 and is being initiated at the time of this report. The EPA Office of Enforcement reportedly plans on concentrating their efforts on what they consider the "big polluters." These dischargers have the most impact on water quality and action against them will result in the greatest possible improvement.

In industrial violation cases, policy directs enforcement efforts toward prosecuting judicial actions against the big polluters that have neglected to build or install the needed treatment equipment. "Substantial" penalties can be imposed on those industries which failed to comply with the 1977 deadline. Section 309(d) of the Federal Water Pollution Control Act sets a maximum civil penalty of $10,000 per day of violation. The most important criterion in determining an appropriate judgment, according to EPA, may be an analysis of the "economic benefit that accrued to the discharger as a result of the noncompliance." Other factors affecting the monetary settlement may be the degree of harm to the public, the willfulness of the violation, the ability of the defendant to pay the penalities, and the necessity of vindicating the authority of the EPA.

In the municipal violation cases, those that are not moving expeditiously to build the needed treatment could be subjected to judicial and administrative actions. In those instances of municipalities proceeding in bad faith, despite the availability of federal funding, judicial action could be taken to enforce the compliance schedule and separate penalties could be invoked for violating the schedule. In those cases where the municipality has not acted in obvious bad faith, the use of administrative enforcement may be considered. This would require the municipality to undertake a specific action for an identified problem. First priority for enforcement actions logically would be those facilities identified as not taking the necessary steps. The enforcement of the municipal violators will be more difficult, especially due to the various reasons for the failure to comply.

In both the municipal and industrial cases, enforcement has two objectives: getting the greatest possible cleanup by speeding compliance with the Act's requirements and maintaining the integrity of EPA's entire cleanup program by making noncompliance less attractive than compliance. Enforcement judgments will take time, but the deadline of July 1, 1977 has passed and those in violation face the consequences of their failure to comply with the law. In those states which have the permit issuing and enforcing power (Virginia and Maryland in the Potomac River basin), the state will generally employ similar priorities and seek similar remedies as outlined for the EPA regional offices.

However, under Section 309, EPA may use its enforcement authority if the state action is insufficient.

President Carter's May 1977 environmental message called for vigorous initiatives in the administration of existing environmental programs. These enforcement policies are seen by many as a positive step in that direction.

THE POTOMAC BASIN

The Potomac River has a drainage area of 14,669 square miles and includes portions of Maryland (3,820 square miles), Virginia (5,720 square miles), West Virginia (3,490 square miles), Pennsylvania (1,570 square miles), and the District of Columbia (69 square miles). The river originates in the Allegheny Plateau of West Virginia, and flows northeast, then southeast, as it slowly changes from a small stream into a major estuary prior to its flow into the Chesapeake Bay. The Potomac River ranks 25th in length, 26th in discharge, and 21st in drainage area among U.S. rivers. The river is navigable for 108 miles from the mouth at the Chesapeake Bay to just above the District of Columbia. Land use remains essentially rural with approximately 55 percent forested, 40 percent agricultural, and 5 percent urban.

The only large metropolitan center in the basin is the region including the District of Columbia and its suburbs. Employment here has concentrated in public administration and related services and little industry has developed. Industrial development has occurred primarily in the North Branch between Luke and Cumberland, Maryland, and along the South Fork of the Shenandoah River in Virginia.

The U.S. Environmental Protection Agency estimates that there are 827 municipal and industrial dischargers in the basin. These have been classified as either major or minor according to the significance and quantity of pollutants discharged. Fifty-five municipal and 52 industrial dischargers have been identified as major. EPA classifies a major industrial discharger as one whose effluent contains toxic substances, or whose flow is greater than 50,000 gallons per day. A major municipal discharger is considered one which serves 10,000 or more people or has a discharge of greater than one million gallons per day (1 mgd). This flow for municipalities was previously 0.5 mgd, with the definition amended by EPA in 1977.

KEY CONCEPTS AND TERMINOLOGY

Because of the highly complex phenomena and interrelationships which are involved, the identification of the

causes of water pollution is difficult. Since pollution frequently is the result of numerous conditions, the term encompasses many types of degradation. The 1972 Federal Water Pollution Control Act defines a pollutant as "any dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural wastes discharged into the water." With such an inclusive definition of what determines a pollutant, the parameters used for determining the severity of the pollution necessarily vary. Water pollution problems are attributable to a variety of sources, as indicated above. The sources are considered in two general categories: point and nonpoint sources. A point source is a source of pollution that is transported by a confined and discrete conveyance, such as a pipe, tunnel or channel. A nonpoint source is a source of pollution that is diffuse with the constituents originating over a large area and usually transported to the receiving waters by storm runoff.

Water quality standards are established to insure that a given stream segment will be of a desired quality. Standards are fixed and not flexible. The states in the Potomac River basin, with the exception of Pennsylvania, define standards as definite, legally binding rules, principles or measures. Criteria, on the other hand, are informative in nature and are not legally binding. Standards may be supported by criteria. Pennsylvania's water quality standards include specific numerical water quality criteria. Rather than being supportive of the standards, the criteria are the determinants. A detailed listing of all the states' standards was published by the Interstate Commission on the Potomac River Basin (ICPRB) in 1977 (Mason, et al.). From these standards, stream quality may be considered in two categories: water quality limited and effluent limited. Water quality limited is a segment of a stream in which the water quality does not meet applicable state standards, and will not meet them even after application of pollution discharge limitations. Effluent limited is a stream segment in which water quality is meeting the standards or will meet them after the application of discharge limitations.

Dissolved oxygen, fecal coliform, and pH standards have been set for all the states in the basin. The dissolved oxygen standard for those streams discussed in this report is a minimum of 4.0 mg/l and the daily average must be greater than 5.0 mg/l. Fecal coliform counts are reported as a log MPN (most probable number) per 100 ml, a geometric mean. The standards vary greatly from a geometric mean of 70 MPN/100 ml for shellfish waters to 1,000 MPN/100 ml for secondary recreation in the District of Columbia. The permissable pH is generally set between a range of 6.0-8.5.

Each state has established standards for other parameters and these regulations should be consulted by individuals desiring further information. The parameters and terminology used in this report include:

BOD_5 (the five-day biochemical oxygen demand) is a measure of the amount of dissolved oxygen which is required for the biological oxidation of carbonaceous materials. When waste containing BOD_5 is discharged into a stream, oxygen is removed from the stream as the material is consumed by aquatic organisms and oxidized. If enough of the waste is discharged, the oxygen demand of the material may be sufficient to cause an oxygen depletion which is detrimental to the receiving waters, particularly the fish and other aquatic life. The discharge of BOD_5 is usually reported in the metric system as milligrams per liter (mg/l) and the English system as pounds per day (lbs/day). It should be noted that the conversion between these two systems is simple. If one knows the flow of the discharger in million gallons per day (mgd) and the concentration of the discharge in mg/l, the number of pounds of BOD_5 being discharged per day is equal to the concentration times the flow times 8.34 (a conversion factor).

Dissolved Oxygen is the weight of oxygen in water expressed in mg/l or in percent of saturation under existing ambient conditions. Generally, dissolved oxygen less than 4 mg/l for extended periods is not adequate to support most aquatic life.

pH is a measure of the degree of acidity or alkalinity in a stream. A pH value of 7 is considered neutral, any value less than 7 is considered acidic, and any value above that is considered basic or alkaline. Both plant and fish populations are affected by pH levels, with a generally acceptable level ranging from 6 to 8.5.

Nutrients are elements or compounds essential as raw materials for organism growth and development. Nitrogen and phosphate are of most interest in water pollution. Both of these nutrients occur not only in their elemental form in the environment, but also in a variety of organic and inorganic states. These two nutrients can join with other elements commonly found in streams to promote extensive algae and rooted aquatic plant growth. A certain level of nutrients is needed to promote a healthy environment in a stream, but an over-abundance of nutrients can result in a condition known as eutrophication--a condition characterized by a nuisance level of aquatic plants and wide daily fluctuations in the dissolved oxygen level of the stream due to plant photosynthesis and decay. As with BOD_5 and suspended solids, nutrients are reported in mg/l and pounds/day.

Fecal coliform is a type of bacteria found in large amounts

in the gastrointestinal tract and feces of warm blooded animals and man. Although these organisms are themselves not dangerous, they are used as an indicator of the potential presence of pathogenic organisms which are more difficult to detect. Fecal coliforms are reported as the most probable number per 100 milliliters (MPN/100 ml). This value represents the expected number of fecal coliform organisms one would find in a sample of 100 milliliters.

Suspended solids are particles physically held in suspension in water by agitation or the flow of the water itself. After being discharged from a waste treatment facility, these particles often begin to settle and accumulate on the bed of the stream into which they are discharged. If enough solids collect, they can adversely affect the biological activities that occur on the stream bed. As was the case with BOD_5, suspended solids are often reported in mg/l and in pounds/day. The conversion between the two systems is the same as with BOD_5.

Flow is the volume of water passing a point in a given time interval, usually measured in cubic feet per second (cfs) or million gallons per day (mgd) (1 cfs = .65 mgd).

Turbidity is a measure of the light transmitting properties of water--that is, how clear the water appears. Turbidity is reported in Jackson Turbidity Units (JTU), a numerical measure of the cloudiness of water. The greater the JTU of water, the more difficult it is for light to pass through it. Research suggests that in water with an average turbidity of over 130 JTU, fish productivity will be reduced, and that very little aquatic life can exist in turbidities consistently above 200 JTU.

COD (chemical oxygen demand) is a measure of the amount of oxygen which is required for the chemical oxidation of a waste. Values of COD for a given waste are greater than the sum of that waste's BOD and NOD. This is because COD not only measures oxidation that would occur naturally, but measures all possible oxidation. COD is reported in mg/l or pounds/day.

NOD (nitrogenous oxygen demand) is a measure of the amount of oxygen which is required for the biological oxidation of organic nitrogen compounds in a waste. When this value is added to the BOD of a waste, the "total oxygen demand" is obtained. The NOD of a waste is often exerted more slowly than the BOD and most often after the BOD. NOD is reported in mg/l and pounds/day.

Eutrophication is the normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestial state and disappears. During eutrophication the lake becomes so rich in nutritive compounds, especially nitrogen and phosphorous, that algae

and other microscopic plant life become super-abundant, thereby "choking" the lake, and causing it eventually to dry up. Excessive nutrients from runoff or discharges from sewage treatment plants accelerate the aging process.

FORMAT

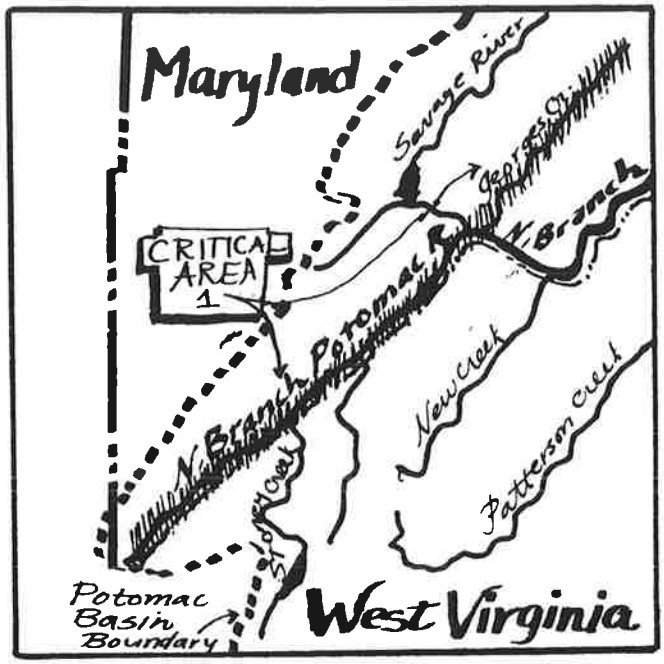
In this report, water quality is reported for the months of April through September (4/1-9/30). This has been done to maintain consistency with the reporting of the Commission's Baseline Water Quality Monitoring Network (BWQMN). The first Critical Areas Report used yearly data, so differences between the 1975 values in these two publications may be due to the change in reporting periods from twelve months to six months.

Each Critical Area will be discussed in detail. First there will be descriptive terms relating geographic location, unique attributes, and special concerns. Secondly, water quality data for selected parameters will be provided for 1976 and 1975 including the station location and STORET number, where available. Next will be a description of the 1976 principal dischargers including the 1976 effluent values and how these dischargers have complied with the July 1, 1977 deadline. The final discussion will attempt to summarize the previously mentioned information and to provide some projections for the future of each area of concern.

There has been no attempt to rank the Critical Areas in terms of severity. They are listed from upstream to downstream for convenience in locating specific areas within the report.

CRITICAL AREA ONE

North Branch Potomac River and Georges Creek, Maryland and West Virginia



Critical Area One is located in the headwaters of the Potomac River and includes the first 40 miles of the North Branch and Georges Creek. Water quality is degraded by the discharge of untreated sewage and acid mine drainage. Raw sewage is discharged in some small communities and failing septic tanks contribute to poor water quality. However, this problem is overshadowed by the more serious mine drainage from active and inactive coal mines. Discharges are characterized by a high concentration of acidity and iron and sulfur compounds. The coal mine drainage affects water quality by (1) lowering the pH, (2) reducing the natural alkalinity, (3) increasing total hardness, and (4) adding undesirable amounts of iron, manganese, aluminum, and sulfates.

WATER QUALITY

Coal mine drainage pollution begins with the exposure of iron sulfide minerals associated with coal to the atmosphere during the mining operation. The exposed, relatively insoluble sulfide minerals are converted by oxidation to soluble sulfuric acid, sulfates, and to iron compounds. These sulfuric acids may, in turn, dissolve other minerals, such as manganese, aluminum and calcium. The sulfuric acid, iron, and other minerals in mine drainage affect water use in various ways, including: (1) mortality of fish and other aquatic life, except the most tolerant species, and (2) affecting the use of water for municipal and industrial supply by increasing the costs for equipment and water treatment. Virtually no natural biological communities exist upstream of Kitzmiller, Maryland on the North Branch, and the absence of a healthy aquatic ecosystem may be observed as far downstream as Oldtown, Maryland.

In addition, many of the streams have a ferric hydroxide slime (known as "yellow-boy") covering the stream

beds, which further impedes improvement.

For several years, the Baltimore District of the Army Corps of Engineers has been conducting a study of the Potomac's North Branch to develop feasibility plans for control of acid mine drainage from abandoned mines. (Active mines are subject to control under the P.L.92-500 NPDES permit program.) The Corps developed a plan for the North Branch which consisted of five tasks: (1) collection of existing data, (2) updating with new data, (3) data analysis and definition of the base conditions, (4) formulation of specific plans, and (5) an objective ranking process to select the top ranking abatement alternatives and to establish the individual watershed reclamation and abatement priorities. In 1977, a draft final report on Tasks 1 through 3, entitled "North Branch Potomac River: The Mine Drainage Study," was submitted to the Baltimore District by the consulting firm of Skelly & Loy. The 1976 base conditions, using recent water data and a simulation model developed by Water Resources Engineers, Inc., showed that the most adversely affected streams by mine drainage were Deakin Run (with a pH of 6.2; pre-1976 pH value = 3.6), Laurel Run (with a pH of 4.7; pre-1976 value = 3.5), Buffalo Creek (with a pH of 4.6; pre-1976 value = 3.3), Stony River (with a pH of 5.4; pre-1976 value = 3.5), Abrams Creek (with a pH of 5.1; pre-1976 value = 3.5), Three Forks Run (with a pH of 5.0; pre-1976 value = 3.6), and Bloomington Dam (with a pH of 4.9; pre-1976 base condition 4.0). Other water quality parameters generally used in determining water quality are unimportant, relative to the overshadowing influence of the acid conditions.

PRINCIPAL DISCHARGERS

The sources of acid mine drainage include both active and inactive surface and deep mines. In West Virginia, a substantial portion of the degradation of the streams is associated with recent, but inactive mines. In Maryland, the acid problems arise from inactive mines, of early extractions. Active mining should pose little or no threat of serious pollution, since their discharges must be in compliance with stringent state and federal NPDES effluent controls and mine reclamation procedures. In the past, three deep mines were the major polluters of the North Branch: Alpine Mine, North Branch Mine and Laurel Run Mine, all owned by the Island Creek Coal Company. Treatment systems have been installed in all these mines and, according to West Virginia officials, the discharge of these operations is now of excellent quality.

DISCUSSION

In the North Branch of the Potomac River, the greatest opportunity for income growth is in the mining sector. With the renewed interest in coal production and national energy

independence, the West Virginia coal mines appear to be in a very promising situation. According to Professor William H. Miernyk, a prominent Appalachian planner and economist, "The combination of good location, resource base, and improving transportation facilities support the projection of slow, but steady progress in the Upper Potomac River basin for the rest of this century." (Economic Alternatives for the Upper Potomac River Basin, ICPRB General Publication 76-1).

According to the previously mentioned consultant report to the Corps of Engineers, water quality in the North Branch and its tributaries has improved significantly in recent years due to controls on active mines. The drainage from abandoned mines remains a problem. The Corps' consultant in its 1977 study report recommended that each watershed be assigned a priority in the North Branch basin and those with the highest priorities be given primary consideration for development of specific abatement plans. In 1977, the Corps was scheduled to contract for preparation of specific plans in high-priority watersheds. However, they terminated the study because, according to the District Engineer, the Corps' work would be a duplication of work by the states and the U.S. Department of Interior under the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87). State agencies and ICPRB have protested the Corps' termination of the study because implementation of Title IV, the abandoned mine reclamation provisions of the new law, will not begin for one to two years. Title IV provides for the federal collection of a fee of 35 cents per ton of strip-mined coal and 15 cents for deep-mined coal to cover the restoration costs of areas damaged by coal mining. Nationally, the fee is expected to generate $30 million annually for the Abandoned Mine Reclamation Fund administered by the U.S. Department of Interior. At least 50 percent of the reclamation fund revenues are to be returned to the states where the coal was extracted. In the Potomac basin, Maryland expects to receive about $900,000 and West Virginia about $3,000,000 each year from the fund. The first allocations to the states from the fund, however, will not occur until late 1978. If a state's allocation is not used within three years, it will be available for expenditure in any area, as determined by the Secretary of Interior. The Surface Mining Control and Reclamation Act will help decrease the severity of the acid mine drainage problem in the North Branch, but the delay due to the interruption of the site-specific study on abandoned mine drainage control in the North Branch and transition to the broader reclamation program is unfortunate.

The States of Maryland and West Virginia have been attempting to attack the problem of abandoned mines, but the costs appear to be prohibitive. If the Corps does not resume its study and contingent upon available funding, especially from the Abandoned Mine Reclamation Fund established by P.L. 95-87, it is recommended that West

Virginia and Maryland initiate coordinated and detailed feasibility investigations on their own. In Maryland, implementation of the state's Abandoned Mine Drainage Control Act has been hampered by insufficient funding and legal difficulties concerning land aquisition. The problem of orphan mines will not be solved immediately, but the coordination of state, federal, and private concerns will make the solution more attainable.

CRITICAL AREA TWO

North Branch Potomac River, Maryland

Critical Area Two is located between Luke and Oldtown, Maryland, on a fifty-mile stretch of the North Branch. Upstream of Luke, the water quality has already been degraded by acid mine drainage from abandoned mines. At the City of Luke, Westvaco Corporation and the Upper Potomac River Commission's (UPRC) wastewater treatment facility discharge into the river. Farther downstream, near Cumberland, Maryland, the river receives discharges from a variety of industries including Celanese Fibers, Kelly-Springfield Tire Corporation, PPG Industries, and the City of Cumberland's treatment plant. The cumulative effect of these discharges, in addition to the acidic conditions from upstream, has been to produce poor water quality.

WATER QUALITY

Monitoring Stations:

NBP0534, Bloomington, Md.
Rt. 134 Bridge
NBP0326, Pinto, Md.
Rt. 28 Bridge

The two monitoring stations selected in this segment have been chosen in order to reflect the changes which occur in water quality above and below the area of the major dischargers, Westvaco and UPRC. The station located upstream of the UPRC/Westvaco complex had a dissolved oxygen concentration in 1976 which averaged 8.3 mg/l (1975 value = 9.7 mg/l). The pH was low due to the addition of mine drainage to the watercourse and averaged 4.5 (1975 value = 4.3). Nitrate and nitrite averaged .44 mg/l as nitrogen (1975 value = .37 mg/l). Total phosphorous averaged .02 mg/l (1975 value = .10 mg/l). The fecal coliform concentration averaged 10 MPN/100 ml (1975 value = 3 MPN/100 ml); however, only three samples were analyzed and this is insufficient for comparison purposes.

The second monitoring station is located 25 miles downstream from the previous station and is immediately upstream from Cresaptown, Maryland. The dissolved oxygen at this station averaged 6.5 mg/l in 1976 (1975 value = 8.1 mg/l), pH was 6.9 in 1976 (1975 value = 6.6), nitrate and nitrite as nitrogen averaged .30 mg/l (1975 value = .35 mg/l), total phosphorous averaged .07 mg/l (1975 value = .15 mg/l), fecal coliform averaged 556 MPN/100 ml in 1976 (1975 value = 126 MPN/100), but again only three samples were taken.

PRINCIPAL DISCHARGERS

Westvaco — Luke, Md.

Westvaco Corporation's Luke Mill is located on the North Branch of the Potomac River at Luke, Maryland, and is a producer of fine paper products, including magazines and cigarette paper. The mill has grown to be one of the largest industries in the entire Potomac basin, employing over 1,800 people. In addition to being one of the largest industrial employers in the basin, Westvaco is also the largest industrial polluter. In its early years, raw waste was discharged from many pipes directly into the Potomac, but in recent years, over $30 million has been invested in pollution abatement equipment at the Luke Mill. Most of the plant's process wastewater is treated at the nearby UPRC municipal treatment plant in Westernport. There are five outfalls discharging, four of which are cooling water and one process water. Cooling waters are discharged directly into the North Branch. The process water from one of the outfalls (#005) is used for ash sluicing and is pumped across the river to a lagoon where the ash is settled out and then discharged to the North Branch of the Potomac River. This ash lagoon project does not meet permit requirements and current upgrading should be completed by January 1978.

Westvaco has experienced a series of problems with its water treatment system and fly ash lagoon in the past. In 1976, a notice of Civil Penalties hearing was mailed from the Department of Natural Resources in Annapolis ordering Westvaco to appear for a hearing in court. Currently, Westvaco is in violation of its compliance schedule with EPA's July 1, 1977 deadline. The most recent violation occurred in February of 1977, and EPA has placed Westvaco on the list of dischargers which are in violation and will be subject to enforcement. Maryland's DNR Cumberland Regional Office, however, does not list Westvaco on its "bad faith" list. Westvaco has been attempting to clean up its discharge and has spent much time, energy and money.

Upper Potomac River Commission — Westernport, Md.

The UPRC facility treats the wastewater of Westvaco and the towns of Westernport, Luke, and Piedmont. The facility

was constructed in 1960, with Westvaco paying 96 percent of the construction and operating costs. The plant was designed to treat 21.6 mgd of which 20.8 was expected to flow from Westvaco. In 1972 and 1977 renovations occurred to enable the plant to meet permit requirements. Improvements have included a primary clarifier, major modification in the municipal sewage handling system, a new aeration system, a cooling tower, a disc screen, a hydrosieve, and a chlorinator. On August 17, 1977, all new modifications were reported on line and the facility had achieved compliance with its schedule. The NPDES permit allows the facility to discharge 14,261 lbs/day of BOD_5 and 51,341 lbs/day of suspended solids. In 1976, the UPRC discharge averaged 20.2 mgd containing 10,287 lbs/day of BOD_5 and 25,793 lbs/day of suspended solids. In the summer of 1976, the state reported that the effluent was better than it had ever been.

Cumberland

The sewage treatment plant of the City of Cumberland is designed to treat 10 mgd, using prechlorination, grit removal, primary settling, and final chlorination. This facility is the largest domestic wastewater treatment plant in the upper portion of the Potomac basin. In May 1977, the city had in progress an infiltration and interconnections study to quantify the flows and their specific locations. Once the study is completed, elimination of the problems which the plant faces will start with construction set for June 1978. In 1976, the Cumberland treatment plant discharged an average flow of 8.93 mgd containing 1885 lbs/day BOD_5 and 1711 lbs/day of suspended solids. The NPDES permit allows 9100 lbs/day of BOD_5 and 4250 lbs/day of suspended solids. The sewage treatment plant of the City of Cumberland was upgraded to secondary treatment in 1976 (activated sludge process). Capacity was increased from 10 mgd to 15 mgd. The upgrading of the facility substantially improved the effluent discharged to the Potomac River. On the average, the plant met its permit requirements for all parameters, excepting chlorine residual, which was constantly violated due to an overdesigned chlorinator. However, during rainfall periods, six overflow points throughout the system still create water quality problems. This periodic violation should be analyzed in the infiltration/interconnection (I/I) study and some solutions presented. Chlorination difficulties are being examined in the study, and the most economical method of achieving the required disinfection level in conjunction with the maximum chlorine effluent limitation will be recommended.

The Cumberland plant was cited in May 1977 as being one of the two facilities in the North Branch area of Maryland not in compliance with their permits. The noncompliance was due to the presence of the six overflow points which bypass the plant. The improvement of this facility will require implementing the conclusions of the I/I report. After this,

the facility should be able to meet the permit requirements even during periods of rainfall and runoff.

PPG Industries — Cumberland, Md.

Pittsburgh Plate Glass Industries is a manufacturer of plate and flat glass. The facility is near Cumberland, Maryland, and discharges to the North Branch of the Potomac River. In 1976, with only nine months of data available, the flow was only .02 mgd, substantially reduced from 1975 (.14 mgd). The average temperature of the water discharged was 60.6° F., but data for summer months was lacking. In May of 1977, production was scheduled to increase. No violations occurred for total suspended solids or total phosphorous, and one violation occurred for oil and grease, which was caused by a leak and quickly repaired. The NPDES permit requirements were easily met and this plant should remain within acceptable standards even with the expected increased production. Since the facility has met the permit requirements in 1975 and 1976, this is one of the dischargers which may be removed from the discharger list in the Critical Areas in the future.

Celanese Fibers Inc. — Amcelle, Md.

Celanese Fibers Inc. produces cellulose acetate and tri-acetate for a variety of purposes and discharges its treated wastewater to the North Branch of the Potomac River. The NPDES permit allows a discharge of 420 lbs/day of BOD_5 and 500 lbs/day of suspended solids. In 1976 the plant used approximately 12.4 mgd for cooling water and .61 mgd for process water, and the discharge contained 18 lbs/day of BOD_5 and 63 lbs/day of suspended solids. It should be noted that Celanese was meeting its NPDES permit requirements for all parameters. The method of treatment consists of secondary treatment by activated sludge. This facility is one which may be removed from the principal discharger list of the Critical Areas in the future.

Kelly-Springfield Tire Company — Cumberland, Md.

Kelly-Springfield Tire Company is a manufacturer of truck and passenger car tires. The plant starts from basic materials, such as synthetic rubber, petroleum products, and other compounds. These materials are made into different types of rubber needed for tires, and are then assembled and vulcanized into the final products.

Kelly-Springfield has chosen to pretreat a portion of its waste by vibratory separation and settling, and will then send it to the Cumberland treatment plant for final treatment. In addition to the portion sent to the municipal plant, Kelly-Springfield has in-house treatment with three outfalls to the Potomac River for cooling water, boiler blowdown, and steam release. All of the design was

completed in July 1977, but some of the installation of equipment will not occur until the latter months of 1977.

DISCUSSION

Critical Area Two may be considered one of the foremost areas of concern in the Potomac River basin. The cumulative effects of acid drainage from upstream orphan mines and the discharge of oxygen-demanding substances in this region account for a seriously degraded water quality. Although the principal dischargers are either meeting or expecting to meet their permit requirements, the current allowances enable large quantities of oxygen-demanding substances to be discharged, thereby degrading the water quality. To achieve the goals of 1983, the permits will be made more stringent and the principal dischargers will be required to make major efforts to comply and substantially improve the water in this area. To complicate the situation, the abatement efforts of Westvaco have ironically worsened the pH content of the waters in the vicinity of the plant. In the past, the highly alkaline effluent from Westvaco, to some extent, neutralized the very acidic waters.

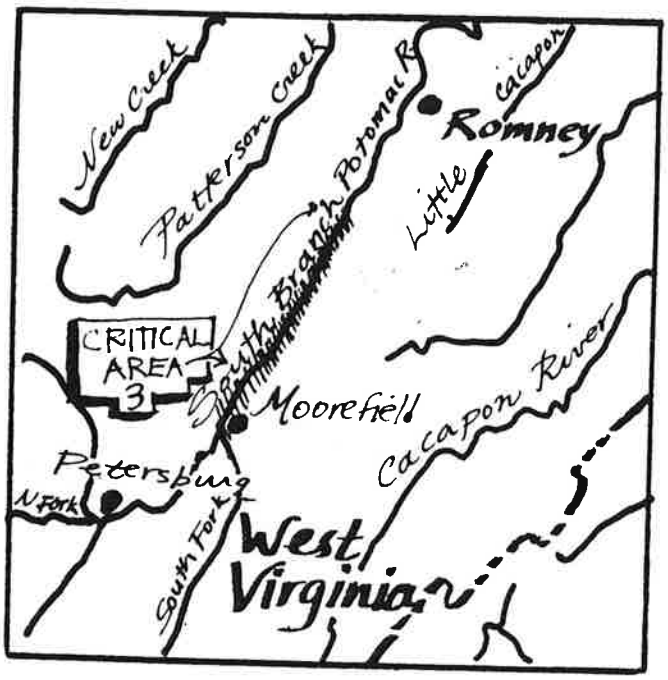
A positive development in this area is the ongoing construction of Bloomington Dam, expected to be completed in late 1981. This dam will be located twenty miles upstream from Westvaco in Garrett County, Maryland and Mineral County, West Virginia. It has been designed to provide water quality control, reduction of flood damage, water supply, and recreation. Low flow releases of the dam will increase the dependable flow of the river at Luke from the present 93 cubic feet second (cfs) to 305 cfs, a substantial increase. The dam, when operational, can be expected to make pH levels and dissolved oxygen more consistent throughout the year.

Water problems have existed in this area for many years and dramatic improvements are not expected in the near future. The acid mine drainage is derived from abandoned mines, and no one assumes responsibility for the degradation and the necessary abatement measures. The Westvaco facility has made great advances in treatment of its wastewater, but it still is in violation of the permit and the July 1, 1977 deadline. Cumberland, the other violator, similarly is acting in reasonably good faith and is in a fact-finding and recommendation stage at present in order to solve its infiltration and interconnection dilemma. If the State of Maryland decides that these two facilities have acted in good faith, they may be granted extensions in order to achieve the targets of the 1972 Act.

CRITICAL AREA THREE

South Branch Potomac River, West Virginia

Critical Area Three is located near the confluence of the North and South Forks of the South Branch of the Potomac River. The area of concern begins at Moorefield, West Virginia, and extends several miles downstream. Two major dischargers account for the water quality problems attributable to point sources and nonpoint sources supply the remainder of the pollutants. The river below Moorefield is slow-moving and numerous pools exist.



WATER QUALITY

No 1976 data was available for this portion of the Potomac River because there were no water quality monitoring stations located there. Data is available starting with September 1977 and will be available in the future. The STORET number assigned to the new station, located at River Mile 285-45, is 550843. In the past, water quality data was descriptive only. Nutrients, from both point and nonpoint sources, accumulate in the sluggish areas of the river and algal proliferation has been observed.

PRINCIPAL DISCHARGERS

Rockingham Poultry Marketing Co-Op — Moorefield, W.Va.

Rockingham Poultry Marketing Co-Op is the largest discharger in the South Branch of the Potomac River. Prior to 1973, it was also designated as one of the largest polluters in the entire Potomac River basin. In 1973, the establishment added a Griffith-style aerated lagoon and a chlorinator. Since that time, the discharge of this facility has been of excellent quality according to West Virginia officials. The NPDES permit allows 82 lbs/day of BOD_5 and 124 lbs/day of suspended solids. In 1977, from January to June, the flow averaged .43 mgd containing 134 lbs/day of BOD_5 and 98 lbs/day of suspended solids. The fecal coliform, a problematic parameter in the past, was 70

MPN/100 ml, indicating a high and efficient level of treatment. The BOD_5 level was in excess of this permit, but the EPA has determined that Rockingham Poultry has been acting in good faith and the BOD_5 levels may be reduced with careful operation of the facility.

Moorefield

The town of Moorefield's sewage treatment plant serves approximately 1500 individuals. Treatment is primary with upgrading to secondary treatment in progress. Step II of the upgrading has been completed and the town is awaiting the decision on the construction phase. This construction phase is scheduled to begin by the spring of 1978, but construction will probably start later than that. The NPDES permit for this facility allows a discharge of .2 mgd containing 50 lbs/day of BOD_5 and suspended solids. In 1976, with limited data, the flow averaged .13 mgd containing 320 lbs/day of BOD_5 and 117 lbs/day of suspended solids. Fecal coliform was 17,325 MPN/100 ml. The extremely high levels of BOD_5 and fecal coliform indicate the inefficiency of the primary facility for adequately treating the wastes of the town. Moorefield has a new Sewage Plant Committee which is addressing the problems and is waiting for the Step III decisions from EPA.

DISCUSSION

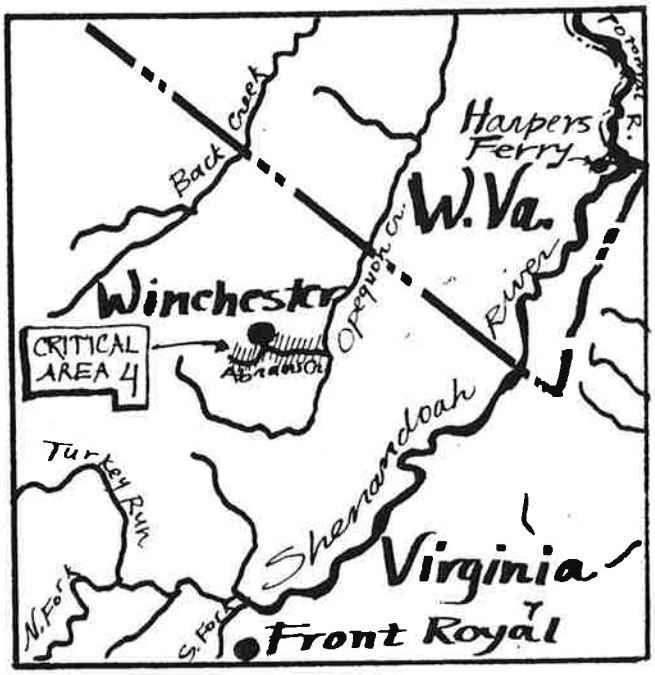
With the improvement of Rockingham Poultry Marketing Co-Op, the major polluter on this portion of the South Branch is now the small municipal treatment plant at Moorefield. The flow is relatively minor, but due to the slow-moving river and its poor assimilative capacity, water quality is degraded. The addition of the nutrients to the pools, as zones of accumulation, compounds the problem. When the Moorefield treatment plant is upgraded to secondary treatment, in 1978 or 1979, the nutrient concentrations added to the river may be reduced.

The runoff of soil, animal wastes, and other nonpoint sources of pollution may continue to create water quality problems in the slow-moving South Branch. A comprehensive plan to manage the land resource more effectively will be necessary in order for substantial improvements to be manifested in the water quality of the Moorefield area. The Moorefield treatment plant, due to its designation as a minor discharger, has not been placed high on the enforcement list by EPA for failure to achieve the goals of the July 1, 1977 deadline. Additionally, the town has acted in good faith by processing its application and is now awaiting a decision by EPA.

CRITICAL AREA FOUR

Abrams Creek, Virginia

Critical Area Four is located on Abrams Creek at Winchester and extends into Opequon Creek. In the past, the water quality violations in this region have been the result of low dissolved oxygen levels and high coliform concentrations. The Commonwealth of Virginia classifies this creek as Water Quality Limited. The major dischargers' impacts are felt throughout Abrams Creek, as well as into the Opequon.



WATER QUALITY

Monitoring Station:
1AABR002.73, Rt. 656 Bridge

In 1976, dissolved oxygen in Abrams Creek averaged 7.1 mg/l (1975 value = 7.2 mg/l). The BOD_5 level averaged 5.8 mg/l (1975 value = 3.7 mg/l). Nutrient levels were 7.3 mg/l for total nitrogen (1975 value = 5.4 mg/l), and total phosphate averaged 1.1 mg/l (1975 value = .55 mg/l). Fecal coliform, a persistent problem in this stream segment, was a log mean of 5417 MPN/100 ml (1975 value = 4106 MPN/100 ml). In 1976, total nitrogen, fecal coliform, and BOD_5 levels increased, indicating a problem with sewage treatment in the area.

PRINCIPAL DISCHARGERS

Winchester — Winchester, Va.

The Winchester sewage treatment plant began operation in December of 1949. The facility serves approximately 21,000 individuals in the City of Winchester and Frederick County, treating municipal and industrial wastes. The flow of the industrial dischargers is relatively small compared with the municipal wastes, but makes up over 60 percent of the organic loading of the plant. The largest single contributor to the organic load is the National Fruit Product Company, Inc. Treatment consists of primary settling, chemical addition of polymers, trickling filtration, and secondary settling. The sludge produced is

treated by anaerobic digestion, drying beds, and vacuum filtering. During the fruit processing season, the plant is subjected to large amounts of organic wastes requiring treatment.

The permit issued for this facility allows a flow of 5.4 mgd containing 803 lbs/day of BOD_5 and suspended solids. The average flow in 1976 was 3.9 mgd. The BOD_5 and suspended solids discharged into Abrams Creek were 911 lbs/day and 515 lbs/day, respectively. The plant is not overloaded except in its capacity to treat the high quantities of organic material. This organic load contributes to the violations of the BOD_5 level. By February of 1977, construction had been completed on a new chlorinating unit. With this installation, the discharge was meeting its NPDES permit and was removed from the list of facilities in noncompliance. The future requirements, however, will not be met with the present treatment system and advanced treatment may be necessary for the high organic loading problem. The Step I grant has been received and the Step II application is currently being prepared for a regional plant.

Abrams Creek

This sewage treatment facility began serving the Winchester area in June of 1977. The NPDES permit allows a flow of .5 mgd containing 42 lbs/day of BOD_5 and suspended solids. Treatment consists of standard activated sludge with ferric chloride addition.

O'Sullivan Corporation Winchester, Va.

The O'Sullivan Corporation processes natural and synthetic polymers to vulcanize and finish shoe products. Resins are manufactured into extruded film and sheeting. Wastewater from the facility consists of in-plant oil sumps and spent cooling water and is discharged into Abrams Creek. The current permit allows the maximum daily average concentration for suspended solids, BOD_5, and oil and grease to be equal to 10 mg/l. Total phosphorous permissable is 15 mg/l. This permit for O'Sullivan was not written in units of pounds per day. Since the Commonwealth of Virginia does not include flow requirements in industrial permits, conversion from concentrations to pounds/day is not possible for this discharger. In 1976, the flow averaged 1.5 mgd with concentrations of 3.62 mg/l for BOD_5, and suspended solids equal to 5.82 mg/l. For all five outfalls, the permit requirements for every parameter were achieved. The O'Sullivan Corporation seems to have met the water pollution abatement goals and may be removed from the next Critical Areas report.

DISCUSSION

In 1976, Critical Area Four met all major water quality standards with the exception of fecal coliform. Total nitrogen was quite high for a stream in this area. The source of these pollutants is presumably the Winchester sewage treatment plant, with additional degradation by nonpoint sources. This area is described as a Water Quality Limited segment and there exists the possibility of water quality violations during periods of low flow.

Of greatest concern to this stream segment is the proliferation of nuisance aquatic plants. The uncontrolled growth is due directly to the increased nutrients supplied to the creek by point and nonpoint sources. Water Quality will not appreciably improve until the design and construction phases of the regional treatment plant at Winchester are completed. The impact of nonpoint sources will then be more easily evaluated. There is the possibility that the stream will remain in a degraded state due to the nutrient rich nonpoint sources. If this becomes the case, management of the land resource will have to be improved in order to substantially improve the quality of the water resource.

CRITICAL AREA FIVE

Christians and Lewis Creeks, Virginia

Critical Area Five consists of two small creeks which discharge into the Middle River: Lewis and Christians Creeks. Lewis Creek has in the past experienced water quality degradation, particularly low dissolved oxygen, high nutrient values, and high coliform concentrations. Christians Creek has been historically within water quality standards. The major discharger to Lewis Creek is the sewage treatment plant of the City of Staunton. Non-point sources are also thought to have some deleterious effects on water quality. Due to Lewis Creek's extremely small flow, any pollution that reaches the water body is significant.

WATER QUALITY

Monitoring Stations:

1BLEW005.40 Below Sewage Discharge, Augusta Co.
1BCST006.43 Rt. 254 Bridge, Augusta Co.

The dissolved oxygen concentration in Lewis Creek during 1976 averaged 7.6 mg/l (1975 value = 9.1 mg/l). The other parameters of interest for water quality of Lewis Creek were pH equal to 8.5 (1975 value = 8.7); total nitrogen averaged 8.3 mg/l (1975 value = 6.7 mg/l); total phosphate was 1.9 mg/l (1975 value = 1.4 mg/l); and fecal coliform averaged 1735 MPN/100 ml (1975 value = 1152 MPN/100 ml). The nutrient levels for nitrogen, phosphorous, and coliform were extremely high indicating inadequate sewage treatment or a combination of such a problem with nonpoint sources.

The dissolved oxygen during 1976 in Christians Creek averaged 8.7 mg/l (1975 value = 10.2 mg/l). Other parameters of interest for Christians Creek were pH equal to 8.9 (1975 value = 8.9); total nitrogen averaged 1.7 (1975 value = 1.6 mg/l); total phosphate was equal to .30 (1975

value = .27 mg/l) and fecal coliform levels were 126 MPN/100 (1975 value = 191 MPN/100). These values indicate excellent quality for Christians Creek.

PRINCIPAL DISCHARGERS

Staunton

The sewage treatment facility of the City of Staunton discharges to Lewis Creek, a tributary of the Middle River, which flows to the South Fork of the Shenandoah River. The plant serves approximately 25,000 individuals. This secondary treatment facility consists of a barminuter, grit removal, primary settling, two high-rate trickling filters, final clarification, and chlorination. The treated effluent adversely affects water quality and the level of treatment is not at Best Practicable Technology (BPT). The solution to the system's shortcomings is either advanced waste treatment or a pipe to discharge the effluent into the Middle River which could assimilate the wastes better than does the smaller Lewis Creek. The NPDES permit allows a flow of 4.5 mgd containing 937 lbs of BOD_5/day and 901 lbs/day of suspended solids. In 1976, the flow averaged 1.8 mgd containing 337 lbs/day of BOD_5 and 296 lbs/day of suspended solids. The Staunton treatment facility had frequent violations of the chlorine residual values. Step I has been completed for upgrading and the Step II has recently been started. The plant is scheduled to relocate its discharge to the Middle River in the 1980's.

Fishersville

The Fishersville regional sewage treatment plant is a new facility which operated during the entire year of 1976. The NPDES permit allows a flow of 2.0 mgd, and a BOD_5 and suspended solids discharge of 400 lbs/day. In 1976, the flow averaged only .2 mgd. The BOD load was 9 lbs/day and the suspended solids value was 12 lbs/day. The reason for such low values in BOD and suspended solids is easily attributed to the very small flow. Since the flow was an order of magnitude smaller than permissible, the resultant lbs/day value would be less since the lbs/day is computed by flow multiplied by concentration and by 8.34. In five months of 1976, pH violations occurred, with a low of 3.9 occurring in June. The chlorine residual values were exceeded in each month of the year. In no month was any minimum or maximum acceptable to the standard. The difficulties with the chlorine may be the result of improper attention or the fact that in an underloaded condition the operators are having problems reacting to demand. The Virginia State Water Control Board (SWCB) has cited this problem frequently.

DISCUSSION

The low flows of Lewis Creek make it less than an

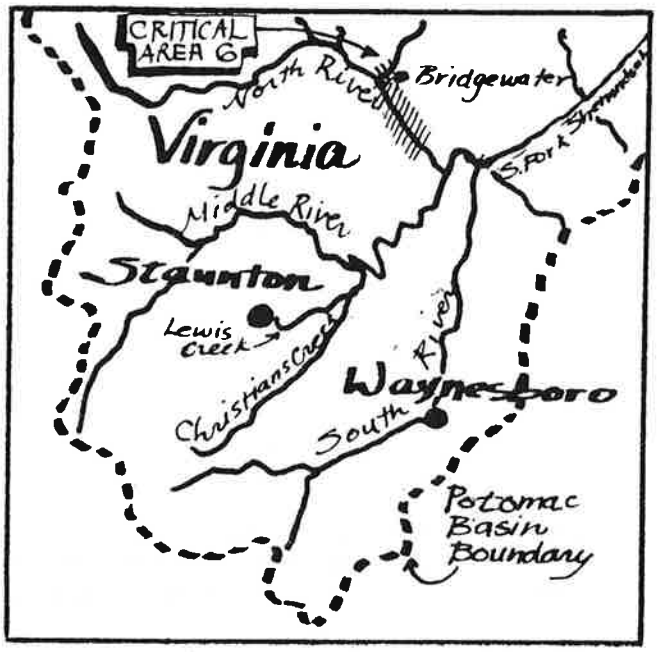
optimum choice as the receiving water body for the Staunton facility. The Staunton plant is in the Step II stage now, and the movement of the discharge pipe to the Middle River may be the solution to improve the quality of the creek, as suggested in the plant's design phase.

The impact of the new Fishersville regional plant on the historically good Christians Creek cannot be ascertained in a year's time. The STP has eliminated smaller, less sophisticated treatment plants and should have a relatively minor effect on the creek, while providing service for the 15,000 individuals in its service area.

CRITICAL AREA SIX

North River, Virginia

Critical Area Six includes the North River downstream of the town of Bridgewater and three of its tributaries: Black's Run, Cook's Creek, and Muddy Creek. The area has historically experienced low dissolved oxygen and high coliform levels. Pollution impacts are more dramatic on the smaller tributaries due to their low flows.



WATER QUALITY

Monitoring Stations:
1BNTH020.40 North River
1BMDD001.65 Muddy Creek
1BBLK000.57 Black's Run
1BCKS001.03 Cook's Creek

In 1976, the North River averaged 8 mg/l for dissolved oxygen (1975 value = 10.7 mg/l). Fecal coliform levels were 390 MPN/100 ml (1975 value = 236 MPN/100 ml). Nutrients included total nitrogen equal to 1.4 mg/l (1975 value = 1.2 mg/l) and total phosphate was .15 mg/l (1975 value = .12 mg/l). Water quality in the North River is far superior to that exhibited in the tributaries, attributable to the greater flow and subsequent higher assimilative capability of the river.

Muddy Creek, in 1976, had a dissolved oxygen average of 8.2 mg/l (1975 value = 8.6 mg/l), with a minimum of 3.0 mg/l. Fecal coliform was 976 MPN/100 ml (1975 value = 493 MPN/100 ml). Nutrient levels included total nitrogen equal to 2.2 mg/l (1975 value = 3.8 mg/l) and total phosphate was equal to .27 mg/l (1975 value = .27 mg/l).

In 1976, in Black's Run, dissolved oxygen averaged 5.4 mg/l (1975 value = 7.0 mg/l). The minimum recorded was an extremely depressed reading of 1.8 mg/l. Fecal coliform averaged 2,441 MPN/100 ml (1975 value = 1,123 MPN/100 ml). Nutrient levels were high with total nitrogen equal to 8.24 mg/l (1975 value = 14.8 mg/l) and total phosphate equal to 2.7 (1975 value = 3.2 mg/l).

In Cook's Creek, the dissolved oxygen averaged 5.1 mg/l (1975 value = 7.6 mg/l). The minimum recorded was a

depressed 1.5 mg/l. Fecal coliform averaged 2528 MPN/100 ml (1975 value = 367 MPN/100 ml). Nutrient levels included total nitrogen equal to 6.5 mg/l (1975 value = 7.1 mg/l) and total phosphate equal to 1.3 mg/l (1975 value = 1.3 mg/l).

PRINCIPAL DISCHARGERS

Harrisonburg-Rockingham Regional Sewer Authority

In August of 1976, as scheduled, the Harrisonburg-Rockingham regional STP came on line and took over the service areas of three smaller and less efficient plants: Dayton, Harrisonburg, and Bridgewater. The NPDES permit for the regional STP allows a flow of 8.0 mgd, and discharges of 1201 lbs/day of BOD_5 and suspended solids. This secondary treatment plant utilizes an activated sludge process. Discharge is into the North River four miles downstream from the abandoned Bridgewater plant. In the five months of operation in 1976, the flow averaged 4.9 mgd, containing a BOD_5 average of 550 lbs/day and suspended solids equal to 436 lbs/day. The chlorine residual limitation was exceeded in each month of operation in 1976. The chlorinator which had been originally installed was too large for the facility and was replaced in November of 1976. Problems should be reduced as the operators become more experienced with this new regional plant's equipment.

Wampler Foods, Inc. Hinton, Va.

Wampler Foods, a processor of poultry, discharges into War Branch, a tributary of Muddy Creek which is a tributary of the North River. Wastewater treatment is accomplished with screening, primary settling, chemical coagulation, flotation, trickling filtration, biodisk, clarification, and chlorination. The NPDES permit allowed a discharge of BOD_5 of 654 lbs/day and suspended solids equal to 547 lbs/day, until June 30, 1977. In 1976, the plant had an average flow of .1 mgd, BOD_5 equal to 263 lbs/day and average suspended solids equal to 325 lbs/day. In January of 1977, the addition of the biodisk, as a polishing treatment for the organic load, was initiated. By mid-1977, the equipment was functional and Wampler Foods, Inc. was operating at BPT.

DISCUSSION

With the start up of the more efficient regional plant, and the removal of three chronic polluters, the water quality should improve substantially in the future. In addition, the one major industrial discharger added an additional level of treatment and has met its compliance schedule. Not enough time has passed to check what improvements may be attributable to the new plant or the added technologies at Wampler Foods, but in the future, changes should become apparent.

CRITICAL AREA SEVEN

South River, Virginia

Critical Area Seven is located on the South River at Waynesboro and extends to a point seven miles upstream from the confluence with the North River. Above Grottoes, the South River joins with the South Fork of the Shenandoah River. In the past, water quality has been excellent but, more recently, there have been high organic loadings and abnormally high fecal coliform levels. In addition to these water quality problems, mercury was discovered in the sediments of the South River in 1976. The South River has been identified as a water quality limited segment by the Commonwealth of Virginia.

WATER QUALITY

Monitoring Station: 1BSTH014.49 Crimora, Va.

In 1976, dissolved oxygen downstream of Waynesboro was 7.8 mg/l (1975 value = 7.3 mg/l). Fecal coliform averaged 333 MPN/100 ml (1975 value = 138 MPN/100 ml). Nutrient values were average for this type of stream with total nitrogen equal to 3.8 mg/l (1975 value = 3.3 mg/l) and total phosphate equal to .20 mg/l (1975 value = .22 mg/l).

PRINCIPAL DISCHARGERS

Waynesboro

The City of Waynesboro's sewage treatment plant discharges to the South River, a tributary of the South Fork of the Shenandoah River. Current facilities include screening, comminution, grit removal, primary settling, high-rate trickling filtration, clarification, and chlorination. Sludge is digested, vacuum filtered, dried on sand beds and then transported to final disposal. The NPDES permit allows a flow of 4.0 mgd containing 1101 lbs/day of BOD_5 and 1268 lbs/day of suspended solids. The plant is operating within its permit, but will have to upgrade the facility to meet water standards. The consulting engineers to the City of

Waynesboro have recommended a biodisk for advanced treatment. Step I has been initiated and the Step II grant procedures are undergoing review. In 1976, the Waynesboro treatment plant frequently experienced chlorine residual violations which have been cited by the SWCB.

Crompton-Shenandoah — Waynesboro, Va.

Crompton-Shenandoah is a dyer and finisher of pile fabrics. The plant uses both natural and synthetic fibers in the production process. Wastes from this plant include waxes, dyes, bleaches, and other fabric processing by-products. Present wastewater treatment includes a one-million-gallon equalization basin, and a six-million-gallon aerated lagoon employing biological treatment and final clarification. The treatment process has been chosen by EPA as a model facility and the BPT standards for the pile fabrics industry were based on this specific operation. Water quality standards have been met, and this facility's effluent is currently exceeding BPT. The NPDES permit for Crompton-Shenandoah allows a daily flow of 2.0 mgd containing 60 lbs/day of BOD_5 and 449 lbs/day of suspended solids. In 1976, the average flow was 1.5 mgd and contained 44 lbs/day of BOD_5 and 292 lbs/day of suspended solids. However, the BOD_5 value permissable was exceeded in two months of 1976, and Crompton-Shenandoah continues to experience difficulties in complying with BOD_5, suspended solids and chemical oxygen demand limits for 1977. In October 1977, Crompton-Shenandoah was cited for violations of these limits by EPA. The company was ordered to immediately comply with the limits established in the permit.

E. I. du Pont de Nemours — Waynesboro, Va.

DuPont is a manufacturer of synthetic fibers and resins, including cellulose acetate, Orlon acrylic, and Lycra Spandex. Treatment of wastewater, with a discharge into the South River, includes neutralization, blending, pre-aeration, cooling, activated sludge, clarification, extended aeration, and dual media filtration. The plant has three discharges, two of which are for cooling waters. The NPDES permit, which expired on June 30, 1977, allowed a discharge of 600 lbs/day of BOD_5 and a discharge of 6,085 lbs/day of suspended solids. In 1976, the flow averaged 7.7 mgd and contained 428 lbs/day of suspended solids. The permit was scheduled to be reissued by July 1, 1977 to incorporate final limits for ammonia and organic nitrogen, determined by water quality modeling of the South River. The original permit contained limits for ammonia and organic nitrogen which were contested by DuPont. The permit was issued with a condition requiring the company to survey and model the South River with special interest regarding nitrogen loads and assimilative capacity. The original limits were to be attained in 1979, according to the permit; however, the Attorney General of the Commonwealth of Virginia ruled that a 1979 compliance date was not

consistent with the mandate of P.L. 92-500 to meet water quality standards by July 1, 1977. As a result, upon expiration of the original permit on June 30, 1977, DuPont was in violation of the July 1, 1977 deadline and was so cited by EPA. In May 1977, a meeting was held in Philadelphia with EPA, DuPont, and the SWCB, to make final determinations on the appropriate nitrogen limits for inclusion in the new permit. This meeting produced a tentative agreement which would set limits on ammonia in a two-tiered system: 50 lbs/day for a daily average in the months of June through October and 200 lbs/day in the months of November through May, the months of greatest flow. The permit is expected to be reissued by early 1978. In the summer of 1977, DuPont closed the acetate fiber plant, reducing total production and the resulting discharge. A new nylon plant is in the final construction stages; however no target date has been set for start-up of the operation.

DISCUSSION

The South River downstream of Waynesboro has had a history of water quality problems attributable, in part, to wastewater discharges of E. I. du Pont, Crompton-Shenandoah, and the Waynesboro sewage treatment plant. Recent abatement efforts have been effective in reducing the BOD_5 levels in the stream. Nitrogen levels have remained an issue of some controversy among EPA, DuPont and the Commonwealth of Virginia, but compliance is expected within a reasonable amount of time.

Overshadowing the current water quality problems and progress has been the discovery, in September 1976, of mercury contamination in the sediment and fish of the South River and South Fork. Following a report by DuPont of high levels of mercury, the SWCB investigated and found high levels of mercury near the DuPont plant, and levels in smallmouth bass exceeding current Food and Drug Administration guidelines as far away as Front Royal, more than 130 miles away. Mercury was used by DuPont in manufacturing at Waynesboro, but the use of this element in the process was curtailed twenty-seven years ago in 1950.

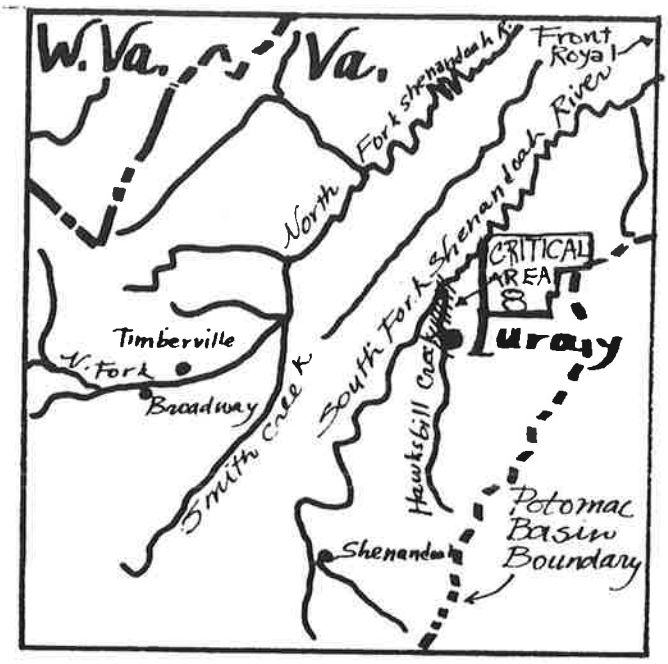
On June 6, 1977, Governor Mills Godwin of Virginia announced the closing of the South River below Waynesboro and the entire South Fork to the taking of fish for eating, due to mercury contamination. Apparently, a relatively small amount of mercury has contaminated the sediment of one of the Potomac basin's most renowned fishing areas, and the contamination is likely to persist for many years.

With this recent discovery, the future quality of this Critical Area, despite improved treatment of present discharges, is very uncertain.

CRITICAL AREA EIGHT

Hawksbill Creek, Virginia

Critical Area Eight is located near the town of Luray on Hawksbill Creek and continues downstream to the creek's confluence with the South Fork of the Shenandoah River. The creek experiences low dissolved oxygen, high fecal coliform levels, high total solids, and a high nutrient level during the summer. The magnitude of these problems is aggravated by the prevalence of nonpoint source pollution, in addition to two major point dischargers.



WATER QUALITY

Monitoring Station:
1BHKS006.04, Luray, below STP

In 1976, fecal coliform counts in the Hawksbill Creek near Luray averaged 6000 MPN/100 ml (1975 value = 2564 MPN/100 ml). The dissolved oxygen level was 8.6 mg/l (1975 value = 10 mg/l). Total nitrogen in 1976 was 5.34 mg/l (1975 value = 3.35 mg/l). Total phosphate averaged 1.62 mg/l (1975 value = 1.55 mg/l). Reports of the creek running a deep brown color have been periodically received in the past, but the monitoring system did not show this in 1976.

PRINCIPAL DISCHARGERS

Luray

The treatment facility of the town of Luray treats the wastes of approximately 5,000 residents and some industrial dischargers. The facility discharges into Hawksbill Creek and is scheduled to be abandoned in the future. A Step II grant has been completed and is under review for a new regional-type facility located in Luray. The new treatment plant is expected to have a capacity of .80 mgd and have advanced treatment capability. The Luray facility currently operating has an NPDES permit which allows a flow of .65 mgd, a BOD_5 discharge of 846 lbs/day and suspended solids of 651 lbs/day. The 1976 discharge from the Luray plant

included flow equal to .488 mgd, with BOD equal to 317 lbs/day, and suspended solids equal to 384 lbs/day. The plant was originally designed to treat only .335 mgd, however the permit was amended in 1976 allowing an increased flow of .65 mgd. Infiltration and inflow have been recognized as major problems of this facility. The I/I difficulties plus concentrated wastes from the industrial dischargers have produced a situation in which the plant has not violated its NPDES permit, but will not be able to meet more stringent future permit requirements. The chlorine residual value was the only parameter which was regularly in violation of the current permit allowances.

Virginia Oak Tannery — Luray, Va.

Virginia Oak Tannery, a manufacturer of leather goods, also discharges into Hawksbill Creek, a tributary of the South Fork of the Shenandoah River. The current treatment consists of flow equalization, neutralization, settling, biological treatment in three aerated lagoons, final clarification and chlorination. The original NPDES permit allowed a BOD_5 load of 700 lbs/day and suspended solids of 3,400 lbs/day. Oil and grease were given limits due to the nature of the industry. In 1976, the BOD_5 discharge was 397 lbs/day, the suspended solids equaled 1553 lbs/day, and the flow averaged .33 mgd. Fecal coliform values were regularly in great excess of 400 MPN/100 ml. The yearly average for fecal coliform was approximately 140,000 MPN/100 ml. BOD_5 and bacteria violations were common for this facility.

Virginia Oak Tannery has been placed by EPA on the list of facilities violating the compliance schedules of the July 1, 1977 deadline. The company's permit was recently reissued and compliance is currently being maintained for all parameters except fecal coliform.

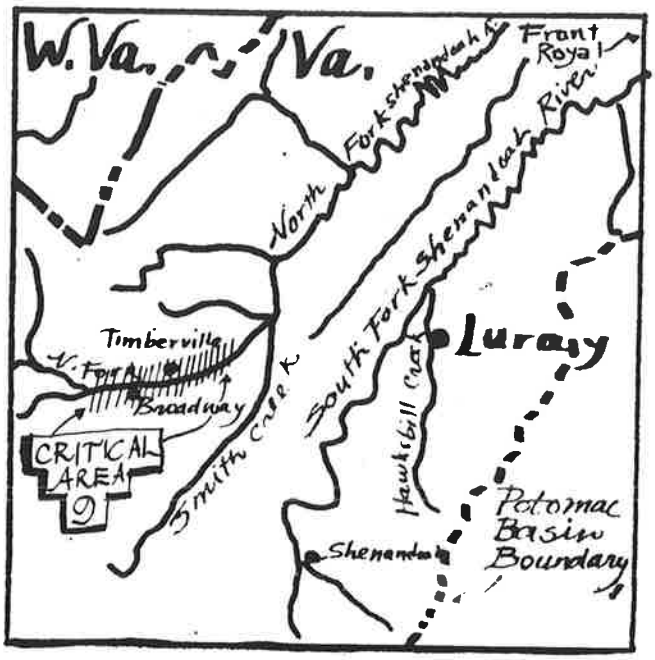
DISCUSSION

The two principal dischargers to Hawksbill Creek are utilizing a stream which has insufficient assimilative capacity for their present wasteloads. The future construction of the regional advanced wastewater treatment plant should aid the recovery of this area. Virginia Oak Tannery has been issued a new permit and enforcement proceedings have been initiated by the SWCB for failure to comply with the fecal coliform limits.

CRITICAL AREA NINE

North Fork Shenandoah River, Virginia

Critical Area Nine is located on the North Fork of the Shenandoah River near the town of Broadway and extends downstream for approximately ten miles. Municipal and industrial dischargers have caused severe water quality problems for many years. The most conspicuous examples of pollution are low dissolved oxygen levels, high fecal coliform, and visible scum, as well as occasional floating debris in the water body. This area has been described as one of the most polluted areas in the entire Potomac basin, but water quality is improving.



WATER QUALITY

Monitoring Station: 1BNFS088.00 Rockingham County

In 1976, the dissolved oxygen in the North Fork in this segment averaged 7.6 mg/l (1975 value = 8.1 mg/l). Fecal coliform levels in 1976 were high, averaging 722 MPN/100 ml (1975 value = 1850 MPN/100 ml). Nutrient levels consisted of total nitrogen equaling 4.5 mg/l (1975 value = 2.3 mg/l) and total phosphate equal to .60 mg/l (1975 value = .13 mg/l). Water quality for the North Fork, in 1976, indicated that although some major problems persist the area has improved from the period when severe pollution frequently was reported.

PRINCIPAL DISCHARGERS

New Market

The town of New Market operates a sewage treatment facility that serves approximately 1500 individuals and treats the wastes from a Holly Farms chicken processing plant. Treatment includes a Griffith activated sludge process and is designed for .28 mgd. Although the treatment is not designated as a major discharger by EPA due to its small capacity, the facility is often overloaded and the

effluent discharged is of poor quality. The NPDES permit allows a flow of .375 mgd containing 688 lbs/day of BOD_5 and suspended solids equal to 547 lbs/day. In 1976, the flow averaged .248 mgd with 344 lbs/day of BOD_5, and suspended solids averaged 211 lbs/day. Although the treatment facility met its NPDES requirements in all measured parameters, except the chlorine residual which was violated in every month, the permit allows extremely high concentrations of BOD_5 and suspended solids (220 mg/l and 175 mg/l respectively) to enter the river and degrade its quality. To meet future requirements, however, the plant will have to be upgraded. The Step I application is in revision and awaiting the new policy of the Virginia State Water Control Board regarding sewage treatment plants and their funding.

Timberville

The treatment facility of the town of Timberville has bar screens, primary settling, activated sludge for secondary treatment, and chlorination. The NPDES permit allows a flow of .103 mgd, a BOD_5 load of 20.6 lbs/day, and suspended solids equal to 20.6 lbs/day. In 1976, the Timberville facility had an average flow of .07 mgd, BOD_5 equal to 13 lbs/day, and suspended solids equal to 10 lbs/day. The Timberville upgrading is on the Virginia Fiscal Year 1977 priority list for Step I.

The 1976 values on the average were within the standards, but violations in BOD_5 occurred in four months and suspended solids violations in two. The maximum chlorine residual limitation was exceeded in most months of 1976. The Timberville facility is not labeled as a major discharger by the EPA.

Broadway

The town of Broadway utilizes a series of two ponds for treatment of the town's wastes. The ponds were designed to treat approximately .1 mgd. The NPDES permit originally allowed a flow of .10 mgd containing 40 lbs/day of BOD_5 and suspended solids. In July 1976, the permit was amended to allow a flow of .31 mgd containing 194 lbs/day of BOD_5 and 465 lbs/day of suspended solids. In 1976, the flow averaged .18 mgd, and contained 85 lbs/day of BOD_5 and 77 lbs/day of suspended solids. The chlorine residual limits were frequently violated. After the initial permit requirements were relaxed, the plant was in compliance. The upgrading of the Broadway facility, necessary to meet the more stringent future requirements, had been added to the state priority list for Step I funding for Fiscal Year 1977.

National Fruit Product Company Timberville, Va.

The National Fruit Product Company, Inc. produces canned fruit items. The plant discharges two types of waste

from two outfalls--one waste heat and the other process water. Wastewater is screened before it is discharged into a series of lagoons with capacities ranging from 600,000 gallons to two million gallons. The NPDES permit allows a discharge of 37 lbs/day of BOD_5 and 52 lbs/day of suspended solids.

In 1976, the flow averaged .02 mgd during the five months when there was a discharge. The BOD_5 averaged 19 lbs/day and suspended solids were 20 lbs/day. This facility is considered to be better than BPT and will require no further upgrading. The heated water never exceeded the permissible levels during 1976.

Rockingham Poultry Marketing Cooperative Broadway, Va.

The Rockingham Poultry plant discharges to the North Fork of the Shenandoah River. The Broadway plant of Rockingham Poultry is a poultry processor and a rendering operation. The treatment of wastes previously consisted of grease and solids separators, two anaerobic lagoons, and a mechanically aerated lagoon. The plant completed installation of enhanced secondary treatment plus chlorination to meet BPT on June 30, 1977. The NPDES permit originally allowed a discharge of 2270 lbs/day of BOD_5 and 1630 lbs/day of suspended solids. Current effluent limitations for BOD_5 and total suspended solids are 112 lbs/day amd 155 lbs/day, respectively. In 1976, Rockingham Poultry had an average flow of 1.0 mgd containing 1635 lbs/day of BOD_5 and 747 lbs/day of suspended solids. The upgrading of this treatment plant was necessary in order to meet the more stringent effluent limitations.

In November of 1976, Rockingham Poultry requested an extension of its effluent limitation schedule. The request was denied by the Commonwealth of Virginia and the company was directed by the State Water Control Board to comply with the permit requirements by June 30, 1977. A hearing for Rockingham Poultry has been scheduled in December 1977 for the failure of the new treatment facility to meet the NPDES permit effluent limitations.

Shen Valley Meat Packers, Inc. Timberville, Va.

Shen Valley Meat Packers, Inc. processes hogs and beef livestock. Treatment consists of fat and scum skimming, anaerobic digestion, aeration, final settling, polishing, and chlorination. The permit issued to Shen Valley allows it to discharge 57 lbs/day of BOD_5, 91 lbs/day of suspended solids, and a concentration of 400 MPN/100 ml of fecal coliform. Future effluent limitations reduce the limit of BOD_5 to 45 lbs/day and the suspended solids to 60 lbs/day. In 1976, Shen Valley's flow averaged .13 mgd, the BOD_5 averaged 26 lbs/day, and suspended solids were 25 lbs/day. The discharge from this plant is operating within the limits

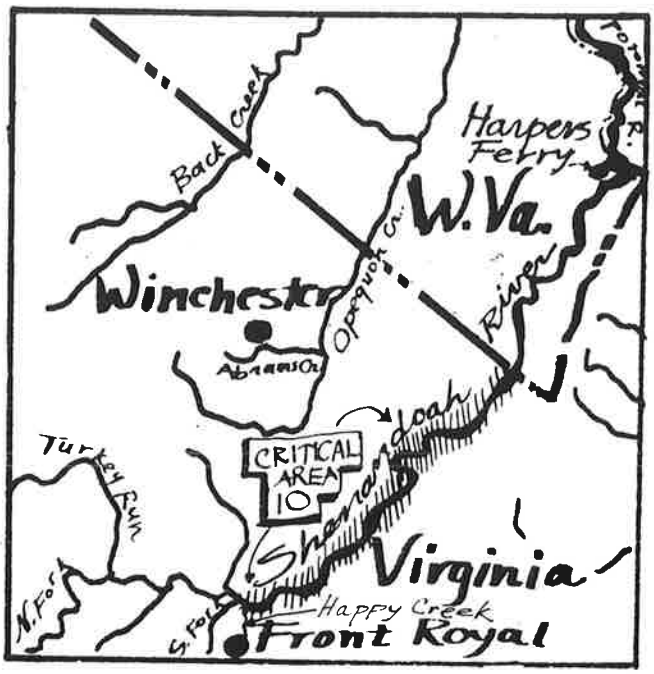
of future effluent requirements and no more upgrading will be necessary. Increased maintenance will allow the plant to remain within the standards of water quality and BPT.

DISCUSSION

As previously mentioned, this seqment of the Shenandoah River has historically been infamous for poor water quality. With the current status of Shen Valley Meat Packers, Inc. and National Fruit, Inc. at BPT, and the expected compliance by Rockingham Poultry, the industrial offenders of the past should be affecting water quality to a much lesser extent. The three minor municipal sewage treatment plants are expected to undergo upgrading and expansion, and this will further improve the waters of the North Fork.

CRITICAL AREA TEN

Shenandoah River and Happy Creek, Virginia



Critical Area Ten is located on the Shenandoah River downstream of Front Royal and includes Happy Creek, which is the receiving water for the treatment facility of the town. The area has suffered from high organic loadings and excessive coliform levels. In addition, a low water dam downstream of Front Royal lowers the reaeration rate of the river during low flow periods, and one of the industrial discharger's effluent contains zinc, further aggravating the water quality. During the periods of high flow, the area around Front Royal generally experiences few water quality violations. The South Fork upstream of Front Royal was recently closed to fishing by the State Water Control Board because of mercury contamination (See Critical Area Seven).

WATER QUALITY

Monitoring Stations:	1BHPY000.10	Riverton Junction
	1BSHN022.63	Berryville, Va.

The dissolved oxygen in the Shenandoah River below Front Royal in 1976 averaged 8.8 mg/l (1975 value = 10.8 mg/l). Fecal coliform levels averaged 147 MPN/100 ml (1975 value = 164 MPN/100 ml). Nutrient levels included total nitrogen equal to .59 mg/l (1975 value = 1.57 mg/l) and total phosphate equal to .09 mg/l (1975 value = .1 mg/l). Happy Creek in 1976, below the Front Royal STP, had dissolved oxygen levels of 4.2 mg/l (1975 value = 6.8 mg/l) with a minimum of 1.5 mg/l. Fecal coliform levels in Happy Creek have historically been high due to the impact of the STP. In 1976, fecal coliform levels seemed improved with a mean count of 518 MPN/100 ml (1975 value = 1322 MPN/100 ml). The nutrient levels in Happy Creek included total nitrogen equal to 5.81 mg/l (1975 value = 4.36 mg/l), and total phosphate was equal to 1.52 mg/l in 1976 (1975 value = 1.07 mg/l). The Shenandoah River water quality near Front Royal has been reasonably good in the past few years, but the

degradation of the STP is easily seen on the small, low flow Happy Creek.

PRINCIPAL DISCHARGERS

Front Royal

The town of Front Royal discharges to Happy Creek, a tributary of the South Fork of the Shenandoah River. Current facilities include screening, primary settling, and chlorination. The NPDES permit allows a flow of 1.5 mgd containing 1626 lbs/day of BOD_5 and suspended solids equal to 1251 lbs/day. In 1976, the flow averaged 1.02 mgd with a BOD_5 value of 700 lbs/day and suspended solids equal to 597 lbs/day. The plant is meeting its effluent limitations, but will require upgrading to secondary treatment in order to meet future permit conditions. A proposal for Front Royal's future, included in the Virginia State Water Control Board 303(e) Plan for 1976, consists of replacement of the present plant by a regional sewage treatment plant with a capacity of 1.83 mgd, to be increased to 2.68 mgd. The discharge of the new plant will be into the Shenandoah River, rather than to the smaller Happy Creek. The design is almost completed for this facility, but the construction phase remains some years away.

Avtex (formerly FMC Corporation) Front Royal, Va.

This company is a manufacturer of rayon and polyester fibers, with a discharge into the South Fork of the Shenandoah River. Wastewater is treated by an activated sludge process. There are four discharges, including two fly ash retention basins, storm runoff and cooling waters, and treated process water. The NPDES permit allows a discharge of 3098 lbs/day of BOD_5, 5565 lbs/day of suspended solids, 336 lbs/day of zinc. In 1976 the flow averaged 8.5 mgd and contained 1375 lbs/day of BOD_5, 1489 lbs/day of suspended solids, 137 lbs/day of zinc, and 9223 lbs/day of COD. In 1977, these limits will become more stringent with the zinc allowance reduced to 204 lbs/day. Avtex has been in compliance since April 1977 according to the SWCB.

Old Virginia Front Royal, Va.

Old Virginia is a fruit processor which discharges into the South Fork of the Shenandoah River. Peak productions occur during the months of October and November, when fruit is being processed. Old Virginia currently has a permit which allows BOD_5 of 386 lbs/day daily average and suspended solids equal to 108 lbs/day. There is no future effluent limit since the processor should be included in the new Front Royal regional STP. In 1976, the average flow was .032 mgd; the BOD_5 discharge was 322 lbs/day; and suspended solids equaled 59 lbs/day. The current permit allows the concentrated wastewater with high BOD_5 to be discharged to

the stream.

Allied Chemical — Front Royal, Va.

Allied Chemical of Front Royal, Virginia, produces sulfuric acid from sulfur. The effluent from the plant includes purge water from acid cooling systems. Wastewater is transferred to a lagoon, neutralized, and settled before discharge into the Shenandoah River. The plant is meeting BPT and the waste discharged has little impact on water quality. In 1976, flow averaged .041 mgd and temperature never exceeded 88° F.

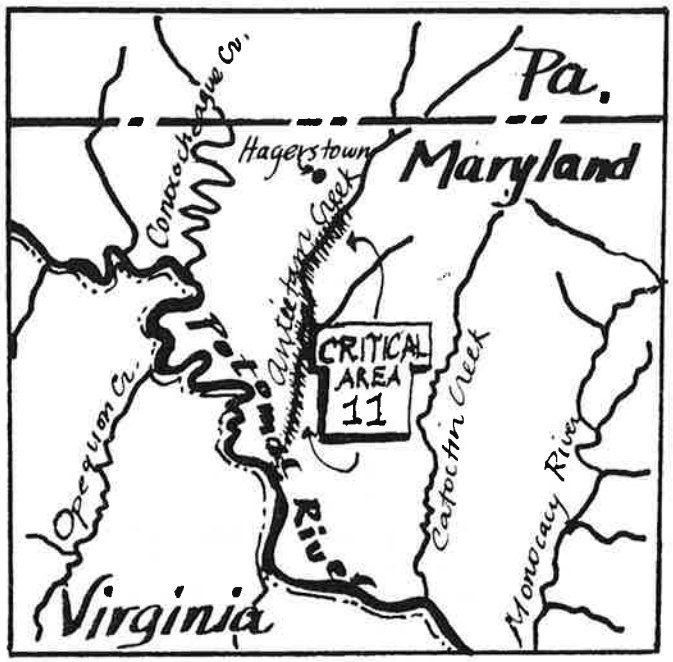
DISCUSSION

This segment of the Shenandoah River had reasonably good water quality during 1976. The industrial dischargers are doing quite well in meeting or complying with schedules to meet BPT. The Avtex incorporation of zinc removal will allow much less of this metal to enter the watercourse. When the expanded regional Front Royal sewage treatment plant is completed, water quality should improve markedly. The removal of Front Royal's primary treatment plant effluent from Happy Creek and the transfer of the Old Virginia discharge to the new regional plant should also reduce the high organic loadings which frequently occur.

CRITICAL AREA ELEVEN

Antietam Creek, Maryland

Critical Area Eleven is located on Antietam Creek at Hagerstown and extends to the main stem of the Potomac River. Although the entire Antietam Creek watershed is designated as either natural or recreational trout waters, the segment below Hagerstown imposes restrictions on aquatic life due to agricultural, urban and suburban runoff, and occasional industrial discharge violations.



WATER QUALITY

Monitoring Stations:
ANT0044, Sharpsburg, Md. at Rt. 34
ANT0203, Funkstown, Md. at Poffenberger Rd.

The entire Antietam Creek watershed experiences violations of state water standards for fecal coliform. In 1976, the two stations analyzed for this stream segment were below the Hagerstown dischargers and downstream at the Antietam National Battlefield. The fecal coliform average for the station directly south of Hagerstown was 4,385 MPN/100 ml (1975 value = 529 MPN/100 ml). The Antietam Battlefield area reported a fecal coliform average of 3,073 MPN/100 ml in 1976 (1975 value = 391 MPN/100 ml). Dissolved oxygen below Hagerstown in 1976 averaged 6.8 mg/l (1975 value = 9.4 mg/l). Nutrient levels for the area below Hagerstown were nitrate-nitrogen equal to 3.2 mg/l (1975 value = 2.44), and total phosphorous at .08 in 1976 (1975 value = .32 mg/l). All ambient water quality standards were met during 1976 in the Hagerstown area, except the gross violations of the fecal coliform standard. Antietam Creek supplies poor bacterial water quality to the Potomac River.

In June of 1976, Antietam Creek became the focus of attention due to the disclosure during Congressional hearings that the U.S. Geological Survey (USGS), in its routine sampling, discovered polychlorinated biphenyls (PCB's) in the sediment of the creek in 1972. The ambient sediment

concentrations of PCB's are usually only 50 parts per billion. In the survey of Antietam Creek, the USGS found levels in excess of 1,000 ppb. A survey conducted in June 1976 by the Maryland Water Resources Administration, with laboratory support by the Environmental Protection Agency, indicated that the abnormally high levels of PCB's no longer existed in Antietam Creek.

PRINCIPAL DISCHARGERS

Hagerstown

The major discharger to Antietam Creek in this Critical Area is the Hagerstown sewage treatment plant. Treatment consists of bar screening, grit removal, secondary treatment using activated sludge, secondary clarification, and chlorination. The sludge produced is treated by anaerobic digestion, with some dried and used as soil conditioner, and the remainder disposed of in liquid form on farmland according to a state-approved program. The facility is designed to treat 8 mgd of wastewater and currently serves some 35,500 people. During heavy rainfalls, the facility is subjected to an excessive amount of infiltration and inflow. At these times, the plant bypasses all flows greater than 10 mgd. These limitations, due to the present design, are being addressed in the 201 facilities plan, which is now in its final stages. The NPDES permit allows 1175 lbs/day of BOD_5 and 3525 lbs/day of suspended solids. In 1976, the Hagerstown plant treated an average of 5.9 mgd discharging 627 lbs/day of BOD_5 and 1254 lbs/day of suspended solids. The fecal coliform limitation was exceeded in nine months of 1976.

In addition to the infiltration and inflow problems, several areas around Hagerstown experience water quality difficulties from failing septic systems. The septic systems used in this area are prone to fail since they have been installed with too little filterable material surrounding the effluent tile fields. The soils found in the Hagerstown area are not well suited for septic systems. This inability to have properly working, efficient systems leads to some minor surface water contamination, and perhaps to the more serious contamination of the ground water supply.

INDUSTRIAL DISCHARGERS

The major industrial dischargers in this portion of Antietam Creek include Doubleday and Company, Metal Finishing Inc., Mack Truck Inc., Marine Electronics and the Western Maryland Railroad. They have all had some difficulty in the past with waste disposal, but are now in compliance with their NPDES permits, with one exception. Metal Finishing Inc. has been placed on the "bad faith" list of the State of Maryland for failing to reply to an official state "14 day letter." A hearing was set for the company in

September 1977. However, because Metal Finishing Inc. is not classified as a major discharger by EPA, it was not included in the interim report for those facilities in violation of the July 1 deadline.

DISCUSSION

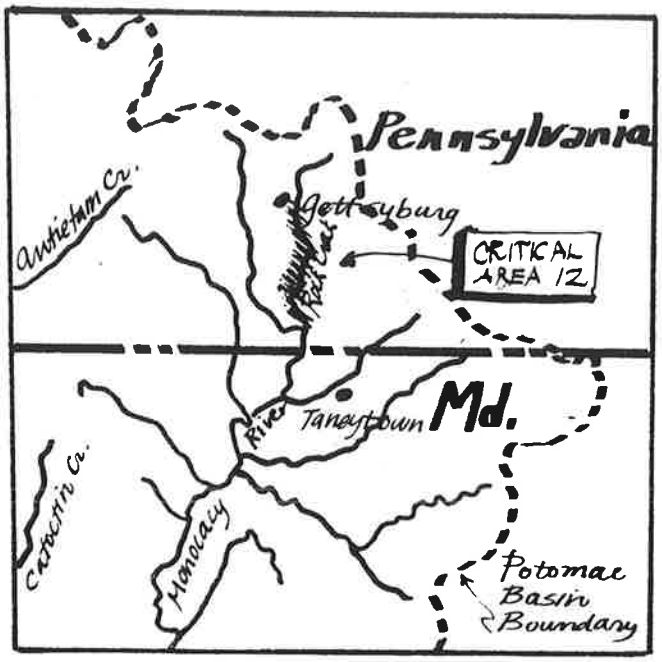
Nonpoint sources in this area are believed to contribute, in addition to other pollutants, three principal types of contaminants to Antietam Creek: bacteria, sediment, and nutrients. The contaminants are transported from urban and agricultural lands and then deposited in the creek. In 1976, detailed planning for nonpoint sources of pollution was begun during Phase II of the River Basin Planning Program in Maryland. This program is mandated by PL 92-500 to investigate the sources of nonpoint pollution and plan for effective measures to control sediment, bacteria, and other problems. Phase II also includes an identification of areas where septic systems are failing. After the area has been studied, priorities for the extension of sewer lines from central sewerage systems, or alternate forms of wastewater disposal, can be more adequately determined.

When the Hagerstown treatment plant is upgraded, the effects on water quality improvement may be minimal. Bacterial violations are the result of a combination of point and nonpoint sources. Despite the removal of the major point source contributor, violations may still occur. Steps must be taken toward land management and developers and farmers should be encouraged to improve stream quality by decreasing the omnipresent nonpoint pollution in the Antietam Creek basin.

CRITICAL AREA TWELVE

Rock Creek, Pennsylvania

Critical Area Twelve is located on Rock Creek below the City of Gettysburg. The creek serves as a major tributary to the Monocacy River in Maryland. The discharge of the Gettysburg sewage treatment plant has caused water quality degradation in the past, including low dissolved oxygen values, high fecal coliform counts, and excessive growth of nuisance aquatic plants.



WATER QUALITY

Monitoring Station:
WQN0503, Gettysburg

In 1976, more data was available for water quality analysis in Rock Creek than in previous years. Data was reported for five of the six months between April and September. Dissolved oxygen values averaged 7.6 mg/l (1975 value = 6.3 mg/l), with a minimum of 3.6 mg/l. BOD_5 averaged 6.5 mg/l (1975 value = 2.9 mg/l), representing a substantial increase in this parameter. Total nitrogen averaged 6.94 mg/l (1975 value = 2.99 mg/l). Total phosphate averaged 2.54 mg/l (1975 value = 1.29 mg/l). The fecal coliform concentration averaged 172 MPN/100 ml (1975 value = unreported), with a maximum of 2100 MPN/100 ml reported. The increased values of nitrogen, BOD_5, and phosphate indicate a significant impact on water quality by the only major discharger on Rock Creek, the Gettysburg sewage treatment plant.

PRINCIPAL DISCHARGERS

Gettysburg Sewage Treatment Plant

The Gettysburg sewage treatment facility is a secondary plant designed to treat 1.0 mgd of wastewater. The plant utilizes primary settling, trickling filters, secondary settling, and chlorination. The daily average flow to the facility often exceeds the design capacity because of excessive infiltration and inflow during runoff periods.

problem is severe enough to cause the periodic bypassing of sewage around the plant. For 1976, the daily flow averaged 1.25 mgd. The NPDES permit allows a flow of 1.0 mgd containing 500 lbs/day of BOD_5 and suspended solids. This permit was an interim permit written with the intention that the facility would be upgraded in the near future. The effluent in 1976 contained 417 lbs/day of BOD_5 and 209 lbs/day of suspended solids. No NPDES permit has been issued for the future, since the facility has been in noncompliance since August 28, 1975. The noncompliance is not seen in the averages, but the inability of the plant to treat wastes during periods of infiltration creates the water quality problems. Gettysburg has been placed on the EPA list of violating facilities as of July 1, 1977. Enforcement action will be undertaken using the policies outlined by EPA in June 1977 (described in this report's introduction).

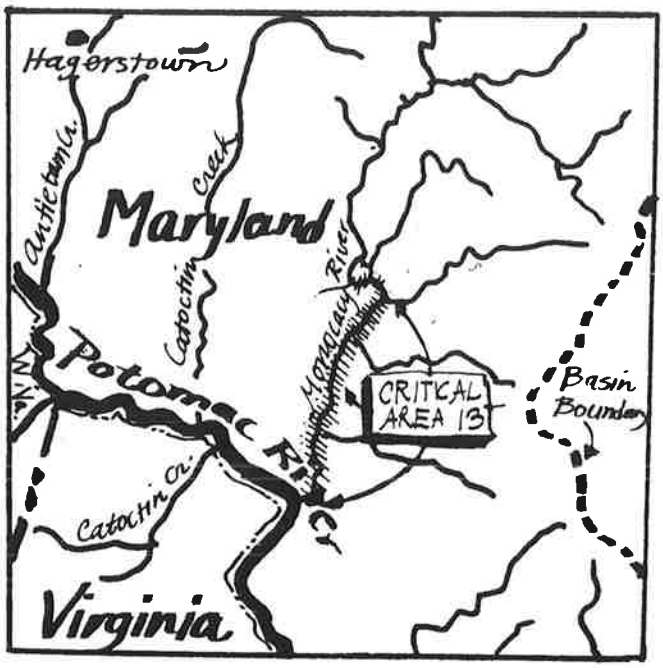
DISCUSSION

Besides the Gettysburg wastewater treatment facility on Rock Creek, two minor dischargers are the Bonneville and Cumberland Township treatment plants. Both of these are relatively small facilities and are operating efficiently. The Gettysburg facility, however, is of prime concern regarding water quality problems in Rock Creek. As a result of the Step I feasibility study it was concluded that advanced waste treatment will be necessary to maintain the water quality of Rock Creek.

The Gettysburg facility has been placed high on the priority list of the Enforcement Division of EPA and will be subject to enforcement actions. Enforcement for municipalities will attempt to move the delayed facilities toward the water quality goals of P.L. 92-500. When the enforcement policy is carried through and the treatment plant is either upgraded or abandoned for a regional facility, the quality of Rock Creek should improve dramatically.

CRITICAL AREA THIRTEEN

Monocacy River, Maryland



Critical Area Thirteen lies on the Monocacy River below Frederick, Maryland, and extends to the main stem of the Potomac River. The river drains rich farmland, including dairy and cattle farms. The soils in this region are highly susceptible to erosion resulting in the loss of valuable topsoil from the basin. In the past, the sediment load provided by the Monocacy to the Potomac River has been as high as 25 percent of the total load. The dissolved oxygen levels have often violated stream standards below the City of Frederick due to the poor operation of the city's sewage treatment plant. In recent years, operation of this plant has improved significantly and the dissolved oxygen violations have been dramatically reduced. The major problems facing the Monocacy are high fecal coliform levels and the suspended sediments from agricultural practices and urban-suburban runoff. Urbanization and rapid growth are projected for the vicinity of Frederick in the near future.

WATER QUALITY

Monitoring Station: MONO167, Below Frederick, Md. U.S. Rt. 40 West

During 1976, only three months were monitored by the Maryland Water Resources Administration(WRA) during the April through September period. The dissolved oxygen averaged 7.4 mg/l (1975 value = 8.9 mg/l). Total nitrogen averaged 2.45 mg/l (1975 value = 2.0 mg/l), and total phosphorous averaged .16 mg/l (1975 value = .12 mg/l). The fecal coliform levels were consistently in excess of water quality standards averaging 11,811 MPN/100 ml (1975 value = 2,540 MPN/100 ml). Eutrophic conditions may have existed during various times of the year, but the combination of turbidity and flow of the river precluded the growth of dense algal populations. Turbidity and suspended solids

were reported on occasions at levels which were detrimental to desirable aquatic organisms.

PRINCIPAL DISCHARGERS

Frederick

The largest discharger to the Monocacy River is the sewage treatment facility of the City of Frederick. This plant began operation in 1936 and currently includes a grit chamber, comminutor, primary and secondary clarifier, trickling filters, and chlorinator. The plant was designed to treat 7.0 mgd and presently serves approximately 30,000 people. The plant lies in the flood plain of the Monocacy at the confluence with Carroll Creek. Industrial development in the Frederick region discharges almost totally into the STP. These discharges contribute only about .5 mgd but contain high concentrations of wastes. To mitigate the problem of strong industrial wastes, the City of Frederick passed an ordinance in 1971 which set standards for the quality of waste that would be acceptable at the municipal plant.

In 1976, the Frederick sewage treatment plant discharged 4.18 mgd with an average BOD_5 of 2,023 lbs/day and 865 lbs/day suspended solids. The discharge permit for this facility was issued on March 8, 1976 and expires July 1, 1980. The permit allowed the discharge of 5,755 lbs/day of BOD_5 and 2,502 lbs/day of suspended solids. The final limitations require the discharge to be reduced to 584 lbs/day for BOD_5 and suspended solids. The permit was modified in March of 1977, changing the chlorine residual minimum from 1.4 to 4.0 mg/l. The Frederick plant was in violation of the limits of its permit for the parameters of dissolved oxygen and coliform, with an average coliform level of 7228 MPN/100 ml, and dissolved oxygen average of 1.9 mg/l. The dissolved oxygen is expected to improve, and the levels in the latter months of 1976 showed this trend.

However, the treatment plant is not meeting its limitations for the July 1, 1977 deadline, and the State of Maryland will be taking action in the coming year. A study completed in July 1977, prepared by MCA Engineering, has recommended that the City of Frederick and the county join together to expand the city treatment facility. There has been considerable controversy about Frederick's sewer problems among the city, state, and county. The city and county must show the State of Maryland that they have agreed on a cost-effective plan for supplying future area sewerage needs. With the consultants's report advocating an improved city STP, the City and County of Frederick will most likely present their cost-effective proposal to the state officials for approval.

Ballenger Creek

This facility is an unopened county facility which will discharge into the Monocacy River below Frederick. The plant is designed to be a 2 mgd enhanced activated sludge facility. The permit issued for this treatment plant allows it to discharge up to 2 mgd containing 250 lbs/day of BOD_5 and suspended solids. The Ballenger Creek treatment plant will probably operate at less than full capacity for several years. Although Frederick County is one of the fastest growing areas in Maryland, the time for development and population movement with future tie-ins remains some years away. Subdivision of the land must be completed before the plant will realize its full potential. There have been questions raised concerning the wisdom of building this plant, since it is too large for present use and too small to enable the County and City of Frederick to adapt it for treatment of their overloads.

DISCUSSION

The greatest pollution problems concerning the Monocacy River arise from nonpoint sources. With highly erodible soils, the river is periodically subjected to extreme pressures of sedimentation. The Monocacy River carries significantly more sediment per unit volume of water than any other nonurban stream in the Potomac basin where sediment is monitored. According to a recent publication by the Interstate Commission on the Potomac River Basin (McCaw and Gambell, 1977), of the 36 basin counties analyzed, Frederick County was ranked last because of its inability to meet the conservation needs on agricultural and forest lands. The combination of erodible soils, lack of adequate conservation practices, and increased urban-suburban development creates a serious water quality problem. The runoff of nutrients from the land increases the concentration of algae and other aquatic plants. This nutrient input causes nuisance conditions in the Monocacy, as well as the Potomac and the estuary downstream. After arriving at an equitable solution of the Frederick city/county issue on sewage treatment facilities, the major issue for this critical area will be to focus on methods to control or alleviate the nonpoint sources. The River Basin plan for Maryland, administered by the Water Resources Administration, will investigate the nonpoint source problem with assistance provided by the Soil Conservation Service and the Agricultural Extension Service.

The problems of the Monocacy River Critical Area probably will become more uniform throughout the drainage basin after the STP issue is solved. Nonpoint pollution has been a problem throughout the entire watershed and the reduction of pollutants in the Frederick sewage treatment discharge may have only minimal benefits for overall water

quality. River basin planning and watershed management will be the keys to the control of the insidious sources of pollution.

CRITICAL AREA FOURTEEN

Folly Lick and Sugarland Run, Virginia

Critical Area Fourteen is located downstream of the Herndon sewage treatment Plant on Folly Lick Branch and extends into Sugarland Run. Both Folly Lick and Sugarland Run have small flows and in the past water quality has been good. In 1975, the area was placed on the Critical Area list due to mismanagement of the sewage treatment plant at Herndon and the subsequent deterioration of water quality.

WATER QUALITY

Monitoring Station:
1ASUG004.42 Sugarland Run

No monthly data exists for Folly Lick in 1976, but Sugarland Run is monitored by the Virginia State Water Control Board. The water quality of Sugarland Run is quite good. Dissolved oxygen values averaged 7.8 mg/l (1975 value = 7.2 mg/l), with a BOD_5 value of 4.2 (1975 value = 3.6 mg/l). Fecal coliform averaged 238 MPN/100 ml (1975 value = 184 MPN/100 ml). Nutrient levels included total phosphates 1.1 mg/l (1975 value = .38 mg/l), and total nitrogen averaged 2.85 mg/l (1975 value = 1.91). A number of stream surveys were done which indicated a great deal of organic pollution in Folly Lick during the Herndon STP difficulties in 1975 and 1976, but the problems are not reflected in the data for Sugarland Run.

PRINCIPAL DISCHARGERS

Herndon

The sole reason for this stream segment being labeled critical was due to the Herndon sewage treatment plant and its failure to properly treat its wastes. Herndon's plant was scheduled to close in June of 1975 and to have its flows directed to the Potomac Interceptor, a trunk sewer from Dulles International Airport in Virginia to the treatment facility at Blue Plains. The time between June 1975 and the time of interceptor hookup was the period of water quality

problems in Folly Lick and Sugarland Run. In January of 1977, the Herndon sewage treatment facility went off line with the connection into the Dulles Interceptor.

DISCUSSION

The connection that was planned for the Herndon sewage system in June 1975 did not occur as scheduled due to a moratorium imposed by Fairfax County on connections to the Potomac Interceptor. In 1976, a consulting firm was retained to make interim repairs and allow treatment until the connection was possible. The revised schedule date for connection to the Blue Plains regional treatment plant was December 31, 1976, so the actual connection occurred nearly as scheduled. With the removal of this source of water pollution problems, Critical Area Fourteen should re-establish its previous good quality.

CRITICAL AREA FIFTEEN

Anacostia River, Maryland and
District of Columbia

The Anacostia watershed drains most of the suburban area located northeast of the District of Columbia. Major land uses are categorized as 20 percent heavily urbanized, 60 percent suburban development, and 20 percent as wooded/agricultural. The Montgomery County, Maryland, portion includes Northwest Branch, Sligo Creek, and the upper portion of Paint Branch. Tributaries in Prince George's County include the Northwest Branch, Indian Creek, Little Paint Branch, and Beaverdam Creek. Approximately nine miles of the Anacostia River are within the District of Columbia. The upper portion of the Anacostia is free-flowing. The last four miles of its length are tidal and are therefore affected by the water quality of the Potomac estuary. The most significant impact on water quality is due to nonpoint sources of pollution, particularly sewer overflows and storm water runoff. The major discharger located on the Anacostia is the Potomac Electric Power Company (PEPCO).

WATER QUALITY

Monitoring Stations:

101031 Bladensburg Rd.
101013 D.C. Line
101016 Pennsylvania Ave.

In 1976, the most serious pollution problems in the Anacostia basin were associated with violations of the fecal coliform levels. These excesses were due to nonpoint sources and sewer overflows. In 1976, dissolved oxygen averaged 8.8 mg/l (1975 value = 7.9 mg/l) at Bladensburg Road and fecal coliform averaged 1239 MPN/100 ml (1975 value = 851 MPN/100 ml). At the District of Columbia line, the dissolved oxygen averaged 7.5 mg/l (1975 value = 6.4 mg/l), fecal coliform was 1,968 MPN/100 ml (1975 value = 2,664 MPN/100 ml), total phosphorous averaged .2 mg/l (1975 value

= .26 mg/l), and total nitrogen was equal to 2.4 mg/l (1975 value = 3.11 mg/l). The third monitoring station at Pennsylvania Avenue reported in 1976 average dissolved oxygen equal to 5.8 mg/l (1975 value = 4.2 mg/l). Fecal coliform averaged 1,600 MPN/100 ml (1975 value = 3548 MPN/100 ml). Total phosphorous averaged .50 mg/l (1975 value = .37 mg/l), and total nitrogen averaged 3.4 mg/l (1975 value = 3.3 mg/l).

PRINCIPAL DISCHARGERS

PEPCO — District of Columbia

The one major point source which affects the Anacostia's water quality is the Potomac Electric Power Company (PEPCO). Over 1,000 mgd of cooling water is discharged from the operation of PEPCO's two electric generating stations, Benning Road and Buzzard Point. With this discharge of cooling water, the temperatures of the Anacostia are raised during the summer months to almost 86° F. (30° C.). This elevated temperature has a profound effect on the aquatic ecosystem. In addition to the PEPCO plants, there are other industrial users of the Anacostia River, such as sand and gravel operations, the Naval Ordnance Laboratory, and the Mineral Pigment Corporation. The impacts of these industrial users are minor relative to PEPCO's effects.

Junction Chamber Overflow — Bladensburg, Md.

Raw sewage overflows in the lower Anacostia have resulted from inadequate interceptor capacity. Four large trunk lines are joined into one sewer line that is too small to handle the load of the other four in times of high flow. This inadequacy is complicated by infiltration/inflow shortcomings of the system. It has been estimated that in the past, the peak flow periods experienced infiltration/ inflow rates as great as 63.5 mgd and raw sewage overflow rates of about 50 mgd. The Washington Suburban Sanitary Commission (WSSC) has expanded the capacity to 120 mgd. The total capacity could be greater, but is limited by the pumping capabilties and the amount of waste that the Blue Plains treatment plant will accept. With the recent construction in 1977 including more sewer lines, a pumping station and a force main, the occurence of overflows from the Junction Chamber should be substantially eliminated, except under extreme wet weather conditons.

The problems facing the Anacostia basin will further be alleviated with the startup of operation in September 1977 of the Lower Anacostia Interim Wastewater Treatment facility at Tuxedo, Maryland. The NPDES permit allows a discharge of 133 lbs/day of BOD_5 and suspended solids. The interim plant is designed for approximately 2.0 mgd.

DISCUSSION

With the expansion of the Anacostia interceptor and operation of the interim facility, the occurrence of overflows from the Junction Chamber should be eliminated, except under the most severe circumstances. However, problems may persist in the lower Anacostia area due to septic system failures and erosion and sediment runoff in the upper watershed. Septic problem areas are located throughout the basin, but the upper reaches of Northwest Branch and Paint Branch have been the worst offenders in the past. Extensive residential construction centered in the upper watershed has resulted in massive stream bank erosion and runoff during periods of rainfall. Land use in the Northeast Branch of the watershed includes well managed forest and farmlands owned by the United States Department of Agriculture. The larger northeast section provides less sediment than the smaller, but heavily urbanized, northwestern area. The sediment and nutrient loading of the Anacostia River will continue to be a matter of concern.

In addition to its own watershed, the lower Anacostia is influenced by the quality of the Potomac estuary. Improvements in the Potomac will also aid the recovery of the tidal segment of the Anacostia River.

CRITICAL AREA SIXTEEN

The Potomac Estuary, District of Columbia and Maryland

Critical Area Sixteen is located along a fifteen mile segment of the Potomac River from the District of Columbia to Piscataway Creek in Maryland. This portion of the Potomac River shows the effects of a growing population in proximity to a major water body. In this small stretch, the Potomac is subjected to the treated wastes of three million people and severe urban runoff problems.

WATER QUALITY

Monitoring Stations:

POT1184	Little Falls Dam
101001	Fletcher's Boathouse
101007	Hains Point
101011	Below Blue Plains Treatment Plant

This portion of the Potomac has long suffered from water pollution problems. The severity of the problem was recognized as long ago as 1925, when the U.S. Public Health Service concluded that no section of the river adjacent to the District of Columbia "could be considered free enough from pollution with sewage to permit its use for bathing without a potential danger to such bathers of contracting sewage borne diseases." In 1932, when the raw sewage of nearly 600,000 people was being discharged into the Potomac, the situation was termed critical. In 1937, 18 years after the public Health Service first suggested treatment for sewage in the metropolitan area, the Blue Plains sewage treatment plant was constructed to supply the wastes with primary treatment. But within six years, because of continued population growth, the organic load reaching the Potomac was a third greater than that in 1932, before any treatment was available. Beginning in 1949, the primary plant was expanded to 175 mgd and serious planning for upgrading to secondary treatment was under way. In 1958, expeditious completion of the secondary treatment was recommended to improve a river that had become degraded by

excessively low dissolved oxygen levels, foul odors, noxious floating debris, and bacterial contamination that had closed the river to bathers from Three Sisters Island to Hallowing Point. Expanded and upgraded treatment facilties at Blue Plains, providing a low degree of secondary treatment(a capacity of 240 mgd with BOD_5 and suspended solids removal of 75 percent and chlorination), began operation in 1959.

However, prior to 1959, as well as subsequently, evidence of a trend toward eutrophication in the estuary was noted. An invasion of water chestnut occurred, especially in the tributaries of the upper estuary, beginning in the 1930's. It was alleviated by a Corps of Engineers program of physically removing each and every plant. An extensive invasion of water milfoil followed in the 1940's and 50's, impairing both the surface usefulness of the water for small boats and creating oxygen depletion in creeks and embayments. These growths disappeared in the late 1950's by some unexplained natural means. Subsequently, during the 1960's, the estuary was characterized by massive and persistent blue-green algae blooms in the tidal freshwater portions, which at times resulted in ugly, malodorous algal mats and oxygen depletions as the algae died and decayed. Although concern over bacterial pollution and high organic loadings continued, in the late 1960's and early 1970's eutrophication also had become a major concern. Visual observations by even the most casual passer-by indicated that excessive aquatic plants and algae were a problem in the Potomac and scientific research in the Potomac reinforced these casual observations. Studies indicated that at least one of the nutrients being discharged to the Potomac which encouraged algal growth would have to be limited to stop the steady decline of the Potomac. The nutrient most often mentioned was phosphorous. Federal and state representatives at a Washington Metropolitan Area Potomac Enforcement Conference in 1969 recommended that all sewage treatment facilities in the area be required to remove 96 percent of their BOD_5 and phosphorous load and 85 percent of their nitrogen load. These recommendations have since been used by the states and federal government as guidelines for writing NPDES permits in the Washington Metropolitan Area.

The Potomac River is muddy and brown during and after storms, the result of erosion from construction and other land-disturbing activities primarily in the metropolitan area. Suspended solids, turbidity, and color tests were not run in 1976; however, visual analysis would indicate that runoff is, indeed, a problem for the Potomac estuary. Water quality has been improving in the past few years. In 1976, nutrients continued their downward trend from the high levels recorded during the algal blooms of the 1960's. Four sampling stations were chosen for this area of the river for comparison of upstream and downstream points.

In 1976, the dissolved oxygen recorded at Little Falls

Dam averaged 9.6 mg/l (1975 value = 9.3 mg/l), nutrient levels were .78 mg/l for nitrate-nitrogen (1975 value = .58 mg/l), and total phosphate was equal to .06 mg/l (1975 value = .07 mg/l). Fecal coliform in 1976 was 256 MPN/100 (1975 value = 430 MPN/100).

Three stations were located within the District of Columbia limits. Fletcher's Boathouse had a dissolved oxygen value of 10.1 mg/l, nutrient values of 1.7 mg/l for total nitrogen (1975 value = 2.4 mg/l), and total phosphate equal to .16 mg/l (1975 value = .25 mg/l). Hains Point had a dissolved oxygen value equal to 10.0 mg/l, nutrient levels included total nitrogen equal to 1.9 mg/l (1975 value = 2.5 mg/l), and total phosphate equal to .12 mg/l (1975 value = .11 mg/l). Below the Blue Plains sewage treatment plant, the dissolved oxygen was 8.0 mg/l, nutrient values were 2.9 mg/l for total nitrogen (1975 value = 3.1 mg/l), and .23 mg/l for total phosphate (1975 value = .24 mg/l). In 1976, of 364 measurements in the District of Columbia, only seven were in violation of the dissolved oxygen minimum of 4.0 mg/l. The improvement is significant because, historically, the major water quality problem in the Potomac estuary has been severe oxygen deficits. The other problem which has plagued the Potomac has been fecal coliform bacteria violations. In 1976, fecal coliform counts did not meet water quality standards for recreation. Excessive fecal coliforms will probably continue due to storm discharges from combined sewers.

PRINCIPAL DISCHARGERS

In the Washington Metropolitan Area, there are 13 municipal dischargers with flows of one mgd or greater. Described below will be the major discharger to the Potomac, the Blue Plains Sewage Treatment Plant, and a proposed plant at Dickerson, Maryland, which has been the subject of much controversy. The controversy regarding the Dickerson facility will be discussed in some detail in the section following the listing of the major dischargers, since the Dickerson decision will have a substantial impact on the regional wastewater treatment crisis.

Blue Plains Sewage Treatment Plant

The dominant water pollution control facility located along the Potomac River main stem is the Blue Plains Wastewater Treatment Plant in the District of Columbia. The District of Columbia's flow share of the 309 mgd design capacity is 135 mgd (43.7 percent), suburban Maryland's share is 153.3 mgd (49.6 percent), and the Virginia suburbs is 20.7 mgd (6.7 percent). The treatment system currently completed or under construction includes primary clarification, modified aeration activated sludge secondary treatment, and tertiary treatment by dual addition of alum and/or ferric chloride for phosphorous removal, biological nitrification(oxidation of organic nitrogen and ammonia to

reduce nitrogenous oxygen demand), multi-media filtration, and disinfection with chlorine gas. In February of 1975, EPA deferred the requirement for construction of the denitrification facilities until water quality improvements could be evaluated.

The District of Columbia is constructing a full-scale raw sludge composting facility in the Oxon Cove area near the Blue Plains plant. When this composting process is in full operation in 1978, disposal of raw and digested sludge directly on land will be discontinued. Other composting sites are being evaluated for use when the sludge volume exceeds the capacity of the Oxon Cove site. Current proposals call for the use of incineration as a back-up process only. Thus, Blue Plains will be the first major facility in the nation to use composting as a primary sludge handling method.

The NPDES interim permit allows a flow of 309 mgd containing 77,312 lbs/day of BOD_5 and suspended solids. In 1976, the flow averaged 294 mgd and contained 82,000 lbs/day of BOD_5 and 74,917 lbs/day of suspended solids. In mid-September of 1976, the full secondary capacity came on-line and the plant met its interim requirements.

The District of Columbia's Department of Environmental Services reported that the schedule of contract completions should enable the plant to meet the final effluent requirements of the NPDES permit by mid-1979. Blue Plains was placed on the EPA list of facilities in violation of the July 1, 1977 milestone date, due to a tardy compliance status report for April 1977.

Dickerson

A proposed treatment facililty in western Montgomery County, Maryland, is currently under review by EPA, the State of Maryland and the Counties of Montgomery and Prince George's. In 1975, the preliminary design for an advanced wastewater treatment facility (AWT) was completed. The plant was designed to process 60 mgd of sewage. The proposed treatment would include screening, grit removal, complete mix activated sludge, secondary clarification, lime coagulation, flocculation, chemical clarification, two-stage recarbonation, breakpoint chlorination, filtration, granular carbon adsorption, and disinfection. The design incorporated the latest proven technology to ensure a high level of protection for public health and the environment. The current status of this proposed treatment facility will be discussed in the following section.

The proposed Dickerson Plant, although it would not discharge directly to the Potomac estuary, would have profound effects on the quality of the estuary by processing much of the suburban Maryland sewage to a very high level of

treatment.

DISCUSSION

The Washington Metropolitan Area is undertaking an enormous program for pollution control, and advanced waste treatment facilities should greatly reduce the level of pollution attributed to sewage. The Dickerson Plant proposed for western Montgomery County has been a center of much controversy during the past two years. In 1975, Montgomery County, Maryland, and the Washington Suburban Sanitary Commision (WSSC) completed the final design for a regional advanced wastewater treatment facility at Dickerson, Maryland, to relieve a sewer capacity crisis which began back in May of 1970. The Dickerson site was selected after study of 17 alternative locations in an open public process marked by much controversy. Following this process, EPA stated that no upstream discharge point closer to the metropolitan D.C. water supply intakes than Dickerson would be accepted. Dickerson was proposed as superior to all other alternatives, with respect to location and the proposed treatment process. Additionally, the Dickerson facility was expected to include capacity for suburban Fairfax County, Virginia, and the District of Columbia. These jurisdictions would pay for capacity at Dickerson, but would actually use an equivalent amount of Montgomery County's existing capacity at the Blue Plains treatment plant. The Dickerson location was reviewed and approved by the State of Maryland, and subsequently included in the state's Potomac metropolitan area basin water quality management plan, which was approved by EPA in April 1975.

In mid-1976, EPA Region III returned the WSSC application which had been certified by the state for a construction grant under P.L. 92-500. EPA 's reasons included the contention that the proposed plant was oversized, too costly, and needed capacity could be provided by alternate means. The State of Maryland, Montgomery and Prince George's counties, and WSSC subsequently sued EPA in U.S. District Court. The District of Columbia later joined the plaintiffs in the suit. In September 1977, Judge John L. Smith instructed the parties to reach a compromise that would permit Montgomery County to build a regional sewage treatment plant. These negotiations were still under way at the time this report was written.

In the meantime, a study by consultants for WSSC explored several possible approaches for land treatment of sewage and identified a number of preliminary sites in Montgomery County for further investigation. This finding now makes it possible for Montgomery County to further consider the feasibility of land treatment, along with other mid-term alternatives in the facilities planning process. The application for a Step I grant from EPA to study ways of meeting Montgomery County mid-term local needs, as

contrasted with the longer-term regional needs for which the Dickerson plant is proposed, was pending with EPA Region III in November 1977.

With expected future advances in point source pollution abatement, concern will soon be redirected to the nonpoint sources. These pollutants will continue to enter the Potomac River and adversely effect the water quality. The discharges of combined sewer overflows and storm water runoff will continue to burden the Potomac estuary with high fecal coliform levels, limiting potential water uses. Sediment will be transported from sites upstream as well as from the urban environment of the capital area. The goals of fishable and swimmable waters for the Potomac estuary, as defined by present criteria, may be difficult to achieve, but improvements have occurred and the trend will probably continue.

CRITICAL AREA SEVENTEEN

Piscataway Creek, Maryland

Critical Area Seventeen is located south of the District of Columbia on Piscataway Creek in Prince George's County. The Piscataway Creek drains approximately 80 square miles and discharges into the Potomac estuary. Due to its proximity to the employment centers of the Metropolitan Washington Area, this drainage basin is being developed extensively as a suburban residential area. The effect of freshwater inflow on the general water quality of the tidal portion of Piscataway Creek is minimal. About three miles before the confluence with the Potomac, the creek broadens significantly to a width of three quarters of a mile. In this tidal area, quality of the water is affected by the quality of the upper portion of the creek and its land uses.

WATER QUALITY

Monitoring Station: PIS033 S. Piscataway, Md. Rt. 210 Bridge

Only limited sampling has been done by the Maryland WRA in the Piscataway Creek since 1970, when a comprehensive study was performed. In 1976, only one month (June) was sampled during the April though September period, and in 1975 only two months were sampled, making water quality evaluation uncertain and perhaps misleading. Dissolved oxygen averaged 10.1 mg/l (1975 value = 10.2 mg/l), and pH was 6.6 (1975 value = 7.5). Nutrient levels of nitrate-nitrogen averaged 1.82 mg/l (1975 value = .57 mg/l). Total phosphorous was .81 mg/l (1975 value = .08mg/l). Fecal coliform in 1976 averaged 230 MPN/100 ml (1975 value = 994 MPN/100 ml).

The best statement that can be made concerning water quality in the Piscataway Creek is from the Maryland 1977

305(b) report which states that "no signficant changes were noted and the limited sampling did not reveal any major violations of standards. Eutrophic conditions were observed, however, during most of the year."

PRINCIPAL DISCHARGERS

Piscataway Sewage Treatment Plant

The largest discharge to Piscataway Creek comes from the Piscataway sewage treatment plant located where the creek begins to widen to the ultimate 3/4 mile width at its mouth. The Piscataway plant has primary and secondary facilities capable of handling 30 mgd. The NPDES permit allows it to discharge 1418 lbs/day of BOD_5 and suspended solids to the Piscataway embayment. A second NPDES permit issued in 1975 allows a discharge of 2500 lbs/day of suspended solids and BOD_5 to be discharged through an outfall into the Potomac estuary. This outfall was not in service in 1976 since the construction was not yet completed. In 1976, the embayment discharge was 15.2 mgd containing 632 lbs/day of BOD_5 and 637 lbs/day of suspended solids.

In November of 1975, a $27-million contract was awarded to add advanced wastewater treatment at Piscataway. The addition will include biological nitrification, mixed-media filtration, and post-aeration. Once completed, this project will enable Piscataway to handle its full capacity of 30 mgd. In 1977, the State of Maryland approved the Prince George's County Ten-Year Water and Sewerage Plan which included a 30 mgd addition to the Piscataway plant. Capacity would then be at a total of 60 mgd with a Potomac discharge. The Piscataway plant will receive Montgomery County sewage from the Anacostia basin.

The project to relocate the outfall of the sewage treatment plant from the embayment to the Potomac estuary is still under way. The discharge permit for Piscataway did not impose effluent limitations after June 30, 1977 for the embayment outfall, since the plant was expected to be abandoned before that date. The Maryland Water Resources Administration has recognized the construction delays in the project and has modified the permit to allow discharge through the embayment outfall until November 5, 1979. This action occurred in July 1977.

Andrews Air Force Base

Andrews Air Force Base, the only other major discharger to Piscataway Creek, has diverted its discharge from Piscataway Creek into the WSSC system for treatment at the Piscataway plant.

DISCUSSION

The relocation of the Piscataway discharge from the embayment to the Potomac main channel should decrease the annual nutrient load which reaches the creek and causes increased biological production. There are few industrial discharges and after the Piscataway outfall is relocated, no major dischargers should remain in the Piscataway Creek.

The future of the treatment plant is in question due to the Dickerson controversy, mentioned previously in this report. An alternative to Dickerson proposed by EPA is a further addition to Piscataway, enabling it to expand eventually from the planned 60 mgd to 95 mgd. This expansion would make the Piscataway treatment facility the second largest in the metropolitan region, after Blue Plains. A more complete analysis of this alternative will require a decision on Dickerson. Officials in Prince George's County and their constitutents have voiced strong opposition to such a plan.

For the future, Piscataway Creek should experience improved water quality. Point sources will effectively be eliminated by 1979 and then only the remaining nonpoint pollutants will detrimentally affect stream quality.

CRITICAL AREA EIGHTEEN

Bull Run Drainage Basin and the Occoquan Reservoir

Critical Area Eighteen lies in the Bull Run watershed (including Cub Run, Flat Branch, and Bull Run) and extends into the Occoquan Reservoir. This area in Prince William and Fairfax Counties, Virginia, receives the discharges of 11 major municipal facilities and various nonpoint sources. The Occoquan Reservoir, a major water supply source for the densely populated Northern Virginia area, has been the topic of numerous studies and in-depth monitoring programs. A policy for wastewater management for the Occoquan watershed was adopted by SWCB in 1971.

WATER QUALITY

Monitoring Stations:

51ST40	Bull Run near Clifton, Va.
51ST50	Cub Run near Bull Run
51ST10	Occoquan Creek near Manassas, Va.
1AFLB000.64	Flat Branch Manassas, Va.

In 1976, dissolved oxygen averaged 9.0 mg/l (1975 value = 8.5 mg/l) in Bull Run. BOD_5 values averaged 2.1 mg/l (1975 value = 2.2 mg/l). Total Kjeldahl Nitrogen (TKN = organic nitrogen plus ammonia) averaged 2.0 in 1976 (1975 value = 2.5 mg/l).

Dissolved oxygen in Cub Run averaged 8.9 mg/l (1975 value = 8.6 mg/l). BOD_5 averaged 2.8 mg/l (1975 value = 2.3 mg/l), and TKN averaged 1.46 mg/l (1975 value = 2.25 mg/l).

Dissolved oxygen in Occoquan Creek averaged 9 mg/l in 1976 (1975 value = 8.6 mg/l), and BOD_5 averaged 2 mg/l (1975 value = 2.9). TKN averaged 1.06 mg/l (1975 value = 1.79

mg/l).

Dissolved oxygen in Flat Branch averaged 7.2 mg/l (1975 value = 6.1 mg/l), and BOD_5 was extremely high with a mean of 10.5 mg/l (1975 value = 5.0 mg/l). The data was insufficient for this station in 1976, with only three reports, and a high reading of 16.0 mg/l influenced the mean. Total nitrogen averaged 14.2 mg/l (1975 value = 9.0 mg/l), and total phosphate averaged 3.3 mg/l (1975 value = 3.4 mg/l). Fecal coliform levels were a bit higher in 1976 with an average of 274 MPN/100 ml (1975 value = 73 MPN/100 ml).

Water problems generally arise in the Occoquan during the summer months when the lower portion of the reservoir becomes oxygen deficient and algal blooms cause serious taste and odor problems in the finished water. The concentrations of plant nutrients are generally higher, and algal blooms occur more often in the Bull Run arm of the reservoir than in the Occoquan Creek arm. The summer is especially serious because the nutrient concentrations are high and the dissolved oxygen concentrations are low.

PRINCIPAL DISCHARGERS

Greenbriar

The Greenbriar plant discharges into the headwaters of Big Rocky Run. The plant treats the wastes of some 7,000 individuals. The facility employs a comminutor followed by parallel activated sludge package units, in addition to two holding ponds for treatment, and enhancement by chemical addition. The NPDES permit allows a discharge of .8 mgd containing 133 lbs/day of BOD_5 and suspended solids. In 1976, the flow averaged .71 mgd with BOD_5 averaging 21.4 lbs/day and suspended solids averaging 37 lbs/day. The fecal coliform values for the year averaged only 1.5 MPN/100 ml. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Big Rocky Run

The Big Rocky Run treatment plant discharges into Big Rocky Run, treating the wastes of 2,500 persons. Treatment consists of a packaged stabilization unit that includes a raw sewage comminutor, an aerated grit chamber, chlorinator, and a holding pond. The NPDES permit allows a discharge of .25 mgd containing 29 lbs/day of BOD_5 and suspended solids. In 1976, the average flow was .20 mgd and contained 14 lbs/day of BOD_5 and 14 lbs/day of suspended solids. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters. The fecal coliform average was 3.4 MPN/100 ml.

Upper Cub Run

The Upper Cub Run sewage treatment plant discharges into Cub Run. The treatment, for approximately 2,000 individuals, consists of activated sludge with contact stabilization. Enhancement is accomplished by the addition of ferric chloride, and then the effluent is chlorinated. The NPDES permit allows a discharge of .25 mgd containing 31 lbs/day of BOD_5 and suspended solids. In 1976, the discharge of .18 mgd averaged 7.4 lbs/day for BOD_5 and 8.8 lbs/day for suspended solids. The fecal coliform average was 4.3 MPN/100 ml.

Middle Cub Run

The Middle Cub Run treatment plant discharges into Cub Run four miles downstream of the Upper Cub Run discharge. The plant treats the wastes of 6,000 individuals using contact stabilization, ferric chloride addition, lagoons and chlorination. The NPDES permit allows a discharge of .6 mgd containing 100 lbs/day of BOD_5 and suspended solids. In 1976, the flow averaged .57 mgd and contained 33 lbs/day of BOD_5 and 47.5 lbs/day of suspended solids. The fecal coliform average was 2.2 MPN/100 ml. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Flatlick

The Flatlick sewage treatment plant discharges into Flatlick Run, approximately three miles before its confluence with Cub Run. Treatment consists of primary settling tanks, activated sludge with alum addition, holding ponds, and chlorination. The NPDES permit allows a discharge of .5 mgd containing 62.6 lbs/day of BOD_5 and suspended solids. In 1976, the average flow was .36 mgd containing 24 lbs/day of BOD_5 and 30 lbs/day of suspended solids. The fecal coliform mean was 5.3 MPN/100 ml. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Manassas-Liberia

The Manassas-Liberia sewage treatment facility is located on Flat Branch. The treatment is a Griffith process which consists of bar screens, primary clarification, primary aeration, secondary clarification, secondary aeration, final settling, 30-day detention, and chlorination. The NPDES permit allows a discharge of .34 mgd containing 62 lbs/day of BOD_5 and 65 lbs/day of suspended solids. In 1976, the flow averaged .32 mgd, but exceeded the permit level in two months. The BOD_5 average was 34 lbs/day and suspended solids averaged 54.5 lbs/day. Fecal coliform

averaged 169 MPN/100 ml with three months of the year violating the allowed level. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Manassas-Northside

The Northside sewage treatment plant is located on Flat Branch. The NPDES permit allows a discharge of .872 mgd containing 160 lbs/day of BOD_5 and 167 lbs/day of suspended solids. In 1976, the flow averaged .75 mgd and contained 72 lbs/day of BOD_5 and 99 lbs/day of suspended solids. The fecal coliform mean was 26 MPN/100 ml. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Greater Manassas Sanitary District

The Greater Manassas Sanitary District operates two sewage treatment plants, Westgate and Old Centreville Road, which discharge into Bull Run. The Westgate facility has been abandoned and is currently pumping its waste to the Old Centreville Road sewage treatment plant. This treatment plant uses chemical addition, along with primary settling, activated sludge, secondary settling, and chlorination. The permit for Old Centreville allows a discharge of 2.34 mgd containing 175.6 lbs/day of BOD_5 and suspended solids. In 1976, the plant averaged a flow of 2.4 mgd, exceeding its permit, and contained 95.7 lbs/day of BOD_5 and 97.7 lbs/day of suspended solids. The fecal coliform mean was 5 MPN/100 ml. Values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

Manassas Park I and II

The City of Manassas Park operates two treatment facilities which discharge into Flat Branch. Both plants have NPDES permits which allow a discharge of .344 mgd containing 28.7 lbs/day of BOD_5 and suspended solids. Both plants utilize the Griffith process for treatment and Manassas Park II has an additional finishing pond.

In 1976, Manassas Park I had an average flow of .27 mgd containing 12.4 lbs/day of BOD_5 and 12.9 lbs/day of suspended solids. The fecal coliform average was 7 MPN/100 ml. Manassas Park II had an average flow of .21 mgd in 1976, containing 7.3 lbs/day of BOD_5 and 8.3 lbs/day of suspended solids. The fecal coliform mean was 6.4 MPN/100 ml. Both these facilities reported values for the chlorine residual in most months were below the minimum needed for disinfection and at other times above the maximum permissible for receiving waters.

DISCUSSION

The Occoquan Reservoir is a major water supply source for the Northern Virginia area and has been the subject of much study. In September of 1977, the levels of the Occoquan hit record lows after a severely dry summer. The Occoquan serves 612,000 residents who use as much as 65 million gallons per day. In 1970, a study was completed by the consulting firm of Metcalf and Eddy which indicated that there were very serious water quality problems in the reservoir, largely attributable to the discharge of nutrient-rich sewage wastes. After this report was issued, the State Water Control Board prepared its "Long Range Policy for Wastewater Treatment in the Occoquan Watershed." This comprehensive policy recommended the construction of two or three regional plants with advanced waste treatment. The Upper Occoquan Sewage Authority (UOSA) Plant has a completion date schedule of March 1978. This advanced waste treatment plant is very similar to the successful facility used at Lake Tahoe, California. The UOSA facility will be an activated sludge plant which will include both physical and chemical treatment. Nitrogen removal will be accomplished by ion exchange and a sludge composting site will be on the premises. The UOSA plant will have an initial design flow of 10 mgd, with expansion to 25 mgd by the year 2020, and final effluent requirements removing in excess of 96 percent of BOD_5, COD, suspended solids, nitrogen, phosphorous, and fecal coliform.

After this plant is completed, all the dischargers listed in the previous section will hook into the regional facility. When the facility begins operation, the water quality should improve, due to the phasing out of the less sophisticated plants which are the major point source contributors in this area.

In addition to these sources which have caused degradation of water quality, the Occoquan area is subject to the effects of nonpoint sources. Nutrients in the runoff from agriculture, forest and urban lands increase the rate of eutrophication in the Occoquan Reservoir. Of the two major tributaries to the reservoir, Occoquan Creek receives no major waste discharges, yet it experiences severe water quality problems. From a water quality aspect, the amount of nutrients and sediment from nonpoint sources must be limited in order to prolong the useful life of this vital water supply. In addition to water quality, the sediment may create a water quantity problem as well. It is possible for the sediment to settle in the quiescent regions of the reservoir and displace water, thereby reducing its storage capacity. Although this problem is less serious than the water quality issue, it becomes important in long-range planning for water supply.

All of the four counties in the Occoquan Watershed have

erosion control ordinances and programs, yet agricultural operations are exempt from control. This absence of control contributes nutrients and sediment to the receiving water bodies. Limiting sediment only from active construction areas will not, alone, alleviate nonpoint pollution.

MAJOR DISCHARGERS IN THE CRITICAL AREAS

AREA/DISCHARGER	FLOW (mgd)			BOD_5 (lbs/day)*			SUSPENDED SOLIDS (lbs/day)*		
	Permit	1976	1975	Permit	1976	1975	Permit	1976	1975
2/UPRC	(A)	20.21	20.10	14,261	10,287	11,475	51,341	25,793	36,192
2/Cumberland	(A)	8.93	8.70	9,100	1,885	6,398	4,250	1,711	3,913
2/Celanese Fibers Company	(A)	.61	1.00	420	18	83	500	63	115
3/Rockingham Poultry	(A)	.43	.33	82	134	78	124	98	(D)
3/Moorefield	.20	.13	(D)	50	320	(D)	50	117	(D)
4/Winchester	5.35	3.86	4.80	803	911	1,065	803	516	734
4/Abrams Creek	.50	(B)	(B)	42	(B)	(B)	42	(B)	(B)
4/O'Sullivan Corporation	(A)	1.48	2.60	(C)	(C)	(C)	(C)	(C)	(C)
5/Staunton	4.50	1.79	2.30	937	337	338	901	296	406
5/Fishersville	2.00	.21	(B)	400	9	(B)	400	12	(B)
6/Harrisonburg-Rockingham	8.00	4.90	(B)	1,201	551	(B)	1,201	436	(B)
6/Wampler Foods	(A)	.16	.22	654	263	320	547	325	370
7/Waynesboro	4.00	2.78	3.30	1,101	546	511	1,268	570	675
7/Crompton-Shenandoah	(A)	1.54	1.54	60	44	59	449	292	388
7/E.I. duPont de Nemours	(A)	7.73	7.46	600	428	526	6,085	2,335	2,543
8/Luray	.65	.49	.60	846	317	477	651	384	422
8/Virginia Oak Tannery	(A)	.33	.41	700	397	450	3,400	1,553	2,838
9/New Market	.38	.25	.29	688	344	486	547	211	318
9/Timberville	.10	.07	.08	21	13	18	21	10	17
9/Broadway	.31	.18	.18	194	85	93	465	77	138
9/National Fruit Product Company	(A)	.02	.03	37	19	28	52	20	42
9/Rockingham Poultry	(A)	1.00	.91	2,270	1,635	1,670	1,630	747	888
9/Shen Valley Meat Packers	(A)	.13	.13	57	26	36	91	25	24
10/Front Royal	1.50	1.02	1.10	1,626	700	697	1,251	597	550
10/Avtex	(A)	8.52	8.50	3,098	1,375	894	5,565	1,489	1,580
10/Old Virginia	(A)	.03	.02	386	322	190	108	59	28
10/Allied Chemical	(A)	.04	.40	(E)	(E)	(E)	(E)	(E)	(E)
11/Hagerstown	8.00	5.90	8.08	1,175	627	750	3,525	1,254	1,306
12/Gettysburg	1.00	1.25	1.50	500	417	475	500	209	288
13/Frederick	(A)	4.18	4.42	5,755	2,023	2,761	2,502	865	1,252
13/Ballenger Creek	2.00	(B)	(B)	250	(B)	(B)	250	(B)	(B)
15/PEPCO	(A)	1,000.00	1,138.00	(E)	(E)	(E)	(E)	(E)	(E)
16/Blue Plains	309.00	294.17	292.00	77,312	82,000	92,820	77,312	74,917	93,360
17/Piscataway	30.00	15.20	15.70	1,418	632	502	1,418	637	662
18/Greenbriar	.80	.71	.70	133	21	46	133	37	642
18/Big Rocky Run	.25	.20	.21	29	14	16	29	14	19
18/Upper Cub Run	.25	.18	.19	31	7	8	31	9	11
18/Middle Cub Run	.60	.57	.58	100	33	34	100	48	58
18/Flatlick	.50	.36	.36	63	24	18	63	30	15
18/Manassas-Liberia	.34	.32	.33	62	34	21	65	55	34
18/Manassas-Northside	.87	.75	.89	160	72	618	167	99	92
18/Greater Manassas	2.34	2.39	(D)	176	96	(D)	176	98	(D)
18/Manassas Park I	.34	.27	.26	29	12	17	29	12	17
18/Manassas Park II	.34	.21	.20	29	7	7	29	8	15

* NPDES permits vary widely in their requirements and how data is reported. Daily loads determined by the conversion formula, described in the introduction, have been rounded off to the nearest integer.

(A) The state does not include limitations for flow in the National Pollution Discharge Elimination(NPDES) permit.

(B) Not in service.

(C) Reported only in concentration(mg/l). Permit requirements were not written in pounds/day.

(D) This water is for cooling purposes only.

GLOSSARY

ACTIVATED SLUDGE--Sludge floc produced in raw or settled wastewater by the growth of zoological bacteria and other organisms in the presence of dissolved oxygen and accumulated in sufficient concentration by returning settled floc previously formed.

ACTIVATED SLUDGE PROCESS--A biological wastewater treatment process in which a mixture of wastewater and activated sludge is agitated and aerated. The activated sludge is subsequently separated from the the liquid portion (mixed liquor) by sedimentation and digested or returned to the process as needed.

ADSORPTION--The tendency exhibited by all solids to exert a molecular attraction for other solids or compunds in wastewater, which are held to their surface until removed and physically or chemically degraded. Activated carbon removes organic matter from wastewater using this property.

AERATION--The bringing about of intimate contact between air and a liquid by one or more of the following methods: (a) spraying the liquid in the air, (b) bubbling air through the liquid, (c) agitating the liquid to promote surface absorption of air.

AEROBIC DIGESTION--Digestion of suspended organic matter by means of aeration.

ANAEROBIC DIGESTION--The degradation of organic matter brought about through the action of microorganisms in the absence of elemental oxygen.

BAR SCREENING--A wastewater treatment process during which the largest particulate matter is separated from the sewage by passing the sewage through coarse screens. This often is the first treatment received by waste.

BIODISK--A relatively new treatment process which consists of a series of flat, parallel disks which are rotated while partially immersed in the waste being treated. Biological slime covers the surface of the disks and adsorbs and absorbs colloidal and dissolved organic matter present in the wastewater. This process is quite effective for treating wastes which are highly concentrated.

BIOLOGICAL WASTEWATER TREATMENT--Forms of wastewater treatment in which bacterial or biochemical action is intensified to stabilize, oxidize, and nitrify the unstable organic matter present. Biodisks, contact beds, trickling filters, and activated sludge processes are examples.

BLOWDOWN--The water discharged from a boiler or cooling tower to dispose of accumulated salts.

CHEMICAL COAGULATION--The destabilization and initial aggregation of colloidal and finely divided suspended matter by the addition of a floc-forming chemical.

CHLORINATION--The application of chlorine to water or wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.

CHLOROPHYLL a--A primary plant pigment which functions in the process of photosynthesis, used as an indicator of plant biomass in water.

CLARIFICATION--Any process or combination of processes the primary purpose of which is to reduce the concentration of suspended matter in a liquid.

CLARIGESTER--A treatment process in which clarification and aerobic digestion occurs in the same tank.

COAGULATION--In water and wastewater treatment, the stabilization and initial aggregation of colloidal and finely divided suspended matter by the addition of a floc-forming chemical or by biological processes.

COMMINUTOR--A device which is often used with, or in place of, bar screens. Instead of removing large particles, comminutors are designed to grind them into smaller particles which are then removed by other processes.

CONTACT STABILIZATION PROCESS--A modification of the activated sludge process in which raw wastewater is aerated with a high concentration of activated sludge for a short period, usually less than 60 minutes, to obtain BOD removal by adsorption. The solids are subsequently removed by sedimentation and transferred to a stabilization tank where aeration is continued further to oxidize and condition them before their reintroduction to the raw wastewater flow.

DIGESTER--A tank in which sludge is placed to permit digestion to occur. Also called sludge digestion tank.

DIGESTION--The biological decomposition of organic matter in sludge, resulting in partial gasification, liquefaction, and mineralization.

DISSOLVED AIR FLOATATION--A process designed to separate solids and liquids. This is accomplished by bubbling air through the liquid, which increases the buoyancy of the solids and lifts them to the surface of the liquid where they can be removed.

EFFLUENT--Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof.

ELUTRIATION--A process of sludge conditioning whereby the sludge is washed with either fresh water or plant effluent to reduce the demand for conditioning chemicals and to improve settling or filtering characteristics of the solids. Excessive alkalinity is removed in this process.

EQUALIZATION--The collection of sewage in a storage area to reduce large fluctuations in either its strength or flow.

FILTRATION--The process of passing a liquid through a filtering medium (which may consist of granular material, such as sand, magnetite, diatomaceous earth, finely woven cloth, unglazed porcelain, or specially prepared paper) for the removal of suspended or colloidal matter.

FLOCCULATION--In water and wastewater treatment, the agglomeration of colloidal and finely divided suspended matter after coagulation by gentle stirring by either mechanical or hydraulic means. In biological wastewater treatment where coagulation is not used, agglomeration may be accomplished biologically.

GRIT--The heavy suspended mineral matter present in water or wastewater, such as sand, gravel, or cinders.

GRIT CHAMBER--A detention chamber or an enlargement of a sewer designed to reduce the velocity of flow of the liquid to permit the separation of mineral from organic solids by differential settling.

HYDRAULICALLY OVERLOADED--A condition in which the quantity of flow through a treatment plant is greater than that for which it is designed, which often results in the decrease in operational efficiency of the plant.

INCINERATION--Consists of burning the sludge to remove the water and reduce the remaining residues to a safe, non-burnable ash. The ash can be disposed of safely on land, in some waters, or into caves or other underground locations.

INFILTRATION--The quantity of groundwater that leaks into a pipe through joints, porous walls, or breaks.

INTERCEPTOR--A sewer that receives dry-weather flow from a number of transverse sewers or outlets and frequently additional predetermined quantities of storm water (if from a combined system), and conducts such waters to a point for treatment or disposal.

LAGOON--A pond containing raw or partially treated wastewater in which aerobic or anaerobic stabilization occurs.

LAND APPLICATION--The discharge of raw or treated wastewater onto the ground for treatment or reuse. The wastewater penetrates into the ground where the natural filtering and straining action

of the soil removes most of the pollutants. Three techniques are used: spray irrigation, rapid infiltration and overland flow.

MICROSTRAINING--The filtration of a fluid through a specially created media designed to remove essentially all of the fluid's suspended solids and colloidal material.

NEUTRALIZATION--The adjustment of the pH of acidic or basic fluids.

NITRIFICATION--A treatment process which involves the conversion of ammonia nitrogen into nitrate and nitrite nitrogen.

ORGANICALLY OVERLOADED--A condition in which the poundage of organic wastes entering a sewage treatment plant is greater than that for which it is designed. As with hydraulic overloading, this often results in a decrease in the operational efficiency of the plant.

POLISHING--The final treatment stages, such as in a polishing pond, where the effluent receives a final treatment before being discharged.

PRIMARY TREATMENT--The first major (sometimes the only) treatment process in a wastewater treatment works. The removal of a substantial amount of settleable matter but little or no collodial and dissolved matter.

RECEIVING WATERS--Rivers, lakes, oceans, or other water courses that receive treated or untreated wastewaters.

SANITARY SEWER--A pipe that carries liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with varying quantities of groundwater and storm water that are not admitted intentionally.

SECONDARY WASTEWATER TREATMENT--The treatment of wastewater by biological methods after primary treatment by sedimentation.

SEDIMENTATION--The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material. Also called settling.

SEPTIC TANK--An on-site system used for domestic wastes when a sewer line is not available to carry them to a treatment plant. The wastes are piped to underground tanks directly from the home or homes. Bacteria in the wastes decompose the organic matter and the sludge settles on the bottom of the tank. The effluent flows out of the tank into the ground through a system of drainage pipes. The sludge should be pumped out of the tanks at regular intervals.

SLUDGE--The accumulated solids separated from liquids, such as

water or wastewater, during processing, or deposits on bottoms of streams or other bodies of water. The precipitate resulting from chemical treatment, coagulation, or sedimentation of water or wastewater.

TRICKLING FILTER--A filter consisting of an artificial bed of coarse material, such as broken stone, clinkers, slate, slats, brush, or plastic materials, over which wastewater is distributed or applied in drops, films, or spray from troughs, drippers, moving distributors, or fixed nozzles, and through which it trickles to the underdrains, giving opportunity for the formation of zoological slimes which remove dissolved organic matter from the wastewater and reduce the BOD_5.

VACUUM FILTER--A filter consisting of a cylindrical drum mounted on a horizontal axis, covered with a filter cloth, and revolving with partial submergence in the liquid to be treated. A vacuum is maintained under the cloth for the larger part of a revolution to draw the liquid through the filter cloth. Solids accumulate on the exterior of the drum as "cake" which is scraped off continuously.

WASTE STABILIZATION PONDS--The oxidation of waste in ponds by sedimentation, the removal of settleable solids and the decomposition of this resulting sediment by microorganims. The sludge is converted to inert residues and soluble organic substances. Decomposition of organic matter is the work of microorganisms, either aerobic or anaerobic. It is desirable to maintain aerobic conditions, since aerobic microorganisms cause the most complete oxidation of organic matter. Also referred to as lagooning or polishing, after previous treatment.

REFERENCES

District of Columbia Department of Environmental Services and the Interstate Commission on the Potomac River Basin. 305(b) Report--District of Columbia, 1977. (Unpublished).

Interstate Commission on the Potomac River Basin. Economic Alternatives for the Upper Potomac River Basin. Bethesda, Md. General Publication 76-1. July, 1976.

Maryland, State of. Maryland Water Quality 1975. Prepared Jointly by the Water Resources Administration, Environmental Health Administration and Maryland Environmental Service. Annapolis, Md. November, 1975.

Maryland Department of Natural Resources. 305(b) Report Maryland--1976. Maryland Water Resources Administration. Annapolis, Md. 1976.

Maryland Department of Natural Resources. 305(b) Report Maryland--1977. (unpublished).

Maryland Department of Natural Resources. Response to the Tentative U.S. Environmental Protection Agency Report on Advanced Wastewater Treatment Plant. Maryland Water Resources Administration. Annapolis, Md. May, 1976.

Mason, William T. et al. Potomac River Basin Water Quality Monitoring Network. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 77-1. June, 1977.

Mason, William T. Potomac River Basin Water Quality-1974. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 76-3. June, 1977.

Mason, William T., and Kevin C. Flynn. Editors. The Potomac Estuary: Biological Resources, Trends and Options. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 76-2. April, 1976.

McCaw, William J. and Ernest L. Gambell. Conserving The Potomac's Soil and Water Resources. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 77-2. September, 1977.

Montgomery County, Maryland. Wastewater Treatment Study--An Element of the Regional Water Resources Management Effort. Prepared by Cornell, Howland, Hayes & Merryfield-Clair A. Hill and Associates. Reston, Va. November, 1972.

Palmer, Richard N. Critical Areas in the Potomac River Basin. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 76-4. June, 1977.

Palmer, Richard N. Non-Point Pollution in the Potomac River Basin. Interstate Commission on the Potomac River Basin. Bethesda, Md. Technical Publication 75-2. June, 1975.

Pennsylvania Department of Environmental Resources. Commonwealth of Pennsylvania 1976 Water Quality Inventory. Bureau of Water Quality Management. Harrisburg, Pa. Publication No. 42. April, 1976.

United States Army Corps of Engineers. Mine Drainage Study: North Branch Potomac River. Prepared by Skelly & Loy. Harrisburg, Pa. January, 1977.

U.S. 94th Congress. Hearings and Markup on the State of the Potomac River, 1976. U.S. Government Printing Office. Washington, D.C. Serial No. 94-20. 1977.

United States Department of the Interior. Stream Pollution by Coal Mine Drainage in Appalachia. U.S. Government Printing Office. Washington, D.C. 1969.

United States Environmental Protection Agency. A Primer on Wastewater Treatment. U.S. Government Printing Office. Washington, D.C. 1976.

United States Environmental Protection Agency. Quarterly Reports and Interim List for Violators of Compliance Schedule. U.S. Government Printing Office. Washington, D.C. 1976, 1977.

United States Environmental Protection Agency. Toward Cleaner Water--The New Permit Program to Control Water Pollution. U.S. Government Printing Office. No. 546-312/40. Washington, D.C. 1973.

U.S. Public Law 92-500. The Federal Water Pollution Control Act Amendments of 1972.

U.S. Public Law 95-87. The Surface Mining Control and Reclamation Act of 1977.

Virginia State Water Quality Control Board. Water Quality Inventory, 305(b) Reports--1975, 1976. Richmond, Va. Information Bulletin 509. April 1975, 1976.

Virginia State Water Control Board. Plan Summary--Potomac-Shenandoah River Basin Water Quality Management Plan, Section 303(e). Richmond, Va. December 1976.

West Virginia Department of Natural Resources. 305(b) Report--1976. Division of Water Resources. Charleston, W. Va. 1976.