STATUS REPORT OF THE
STATE WATER CONTROL BOARD
AND
DEPARTMENT OF CONSERVATION
AND HISTORIC RESOURCES ON

The Development of a Nutrient Management Strategy

(As requested by SJR 165, 1987)

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

Senate Document No. 3

COMMONWEALTH OF VIRGINIA
RICHMOND
1989

TABLE OF CONTENTS

APPENDICES

I. Introduction

The 1987 Virginia General Assembly approved Senate Joint Resolution No. 165 which requests the State Water Control Board and the Department of Conservation and Historic Resources' Division of Soil and Water Conservation to cooperatively develop and implement a comprehensive nutrient limitation strategy by July 1, 1988. The resolution stated that this strategy shall include the following:

(1) A nutrient standard or standards for the waters of the Commonwealth including the watershed of the Chesapeake Bay;

(2) Suggested target loads for the main Bay and each of its tributaries from point and non-point sources resulting from application of the water quality standard;

(3) Suggested regulations, guidelines, and budget projections as appropriate or necessary to implement the nutrient management strategy; and

(4) Recommendations for short-term and long-term data gathering, analysis, and research needed to fine tune the nutrient limitation strategy in future

years to provide the most effective, equitable and cost-effective approach to controlling nutrient enrichment in the Bay and its tributaries.

This resolution recognizes the Water Control Board as having primary responsibility for regulating point source discharges of nutrients and the Division of Soil and Water Conservation as having primary responsibility for managing non-point source control programs. The resolution requests that these two agencies work together to cooperatively develop and implement a comprehensive nutrient management strategy for the Commonwealth. A copy of SJR 165 may be found in Appendix A.

The remainder of this status report presents the progress to date toward the development of a Virginia Nutrient Management Strategy.

II. Water Quality Standards for Nutrient Enriched Waters

Pursuant to SJR 165, the Nutrient Management Strategy is to include appropriate water quality standards that will address the Commonwealth's nutrient enrichment problems.

Section 62.1-44.15(3) of the Code of Virginia authorizes the State Water Control Board to establish water quality standards and policies for any State waters consistent with the purpose and general policy of the State Water Control Law, and to modify, amend, or cancel any such standards or policies established. Such standards shall be adopted only after a hearing is held and the Board takes into consideration the economic and social costs and benefits which can reasonably be expected to be obtained as a result of the standards as adopted, modified or cancelled.

At its June 1986 meeting, the Board authorized the development of water quality standards to protect the Chesapeake Bay, its tributaries, and the remaining waters of the Commonwealth from nutrient enrichment problems. The Board also authorized the staff to hold public meetings on the development of the nutrient standards and to proceed with a two year workplan for their development.

The development process for the standards included the following activities:

- Two public meetings were held in September and October 1986 to receive comments on the proposed development of water quality standards and the alternative types of standards which should be considered.

- Board staff conducted special water quality monitoring at selected stations throughout the Commonwealth to better determine the levels of both nutrients and algae present. Water quality monitoring data from this special monitoring project, as well as from the routine Chesapeake Bay mainstem and tributary monitoring programs, were compiled for detailed analysis.

- A Technical Advisory Committee, consisting of nineteen scientists from five Virginia universities, several out of state universities, and the federal government, was established to provide technical advice to the Board staff. A two day workshop was held in May 1987 with the committee to develop a consensus on issues related to developing nutrient control standards.

- At its June 1987 planning session the Board received a status report on the progress towards

development of the standards. The Board also concurred with the approach of developing a nutrient water quality standard and an implementation strategy regulation for point sources.

At its September 1987 meeting the Water Control Board approved for public hearing a Water Quality Standard for Nutrient Enriched Waters and a Point Source Policy for Nutrient Enriched Waters. Three public hearings were held in January 1988 which resulted in several revisions to the proposed Standard and Policy. The Board approved the Standard and Policy at its March 1988 meeting.

The approved Water Quality Standard for designating as "Nutrient Enriched Waters" those waters of the Commonwealth showing evidence of degradation attributable to the presence of excessive amounts of nutrients. Based on a review of historical water quality records, the Board has approved the following waters of the State for designation as "Nutrient Enriched Waters":

- Lake Chesdin
- Rivanna Reservoir
- Smith Mountain Lake

- Peak Creek tributary to Claytor Lake

- Nine embayments or tributaries to the Potomac River (Aquia Creek, Fourmile Run, Hunting Creek, Little

  Hunting Creek, Guntson Cove, Belmont Bay, Potomac Creek, and Neabsco Creek from their headwaters to the state line; and Williams Creek from its headwaters to its confluence with Lower Machodoc Creek).

- The Chesapeake Bay from the Virginia state line to the mouth of the Bay (a line from Cape Henry drawn through Buoys 3 and 8 to Fisherman's Island), and all its tributaries to a point five miles above the fall line, if any, but excluding the Potomac tributaries, the Mattaponi upstream of Clifton, and the Pamunkey upstream of Sweet Hall Landing.

Average seasonal concentrations of chlorophyll a exceeding 20-25 micrograms/liter (ug/l), dissolved oxygen fluctuation, and high water column concentrations of total phosphorus were the indicators utilized in the evaluation of the historical data for the purpose of

identifying those waters affected by the presence of excessive nutrients. These parameters were recommended as appropriate indicators of nutrient enrichment by the Technical Advisory Committee. Chlorophyll a, a pigment found in all plants, was the primary indicator since it is a means of assessing the quantity of algal growth.

All the water bodies designated as "nutrient enriched" have a historical record of chlorophyll a measurements in the visible range sufficient to discolor the water. Several, such as the Potomac Embayments, have had severe algal bloom problems. On the other hand, the Chesapeake Bay mainstem was included due to slight to moderate enriched conditions which are beginning to become evident. Management programs are needed to prevent further degradation of this valuable resource.

A copy of the approved water quality standard may be found in Appendix B.

III. Point Source Policy for Nutrient Enriched Waters

Along with the approved water quality standard, the Board has also approved a Point Source Policy for Nutrient Enriched Waters. Appendix C contains a copy of the approved Policy.

As a part of the Nutrient Management Strategy, the Water Control Board staff has proposed a phased approach to control the nutrients discharged from point sources. Given the complexity of the nutrient enrichment process in both fresh and estuarine waters, and the uncertainty of the final nutrient removal requirements that will ultimately be needed, a phased approach that allows for incremental steps in point source nutrient reductions offers a favorable balance between environmental progress and economic impact. Once a management action is taken, ongoing and intensive monitoring, modeling, and research programs will be relied upon to evaluate progress and aid in identifying subsequent phases in point source nutrient control.

The 1987 Virginia General Assembly initiated the first step in this phased approach to point source nutrient management by approving a ban on phosphate detergents in Virginia which became effective January 1, 1988. The anticipated results of the ban are as follows:

- In the short term the ban will provide a modest reduction (25-30%) in the amount of phosphorus

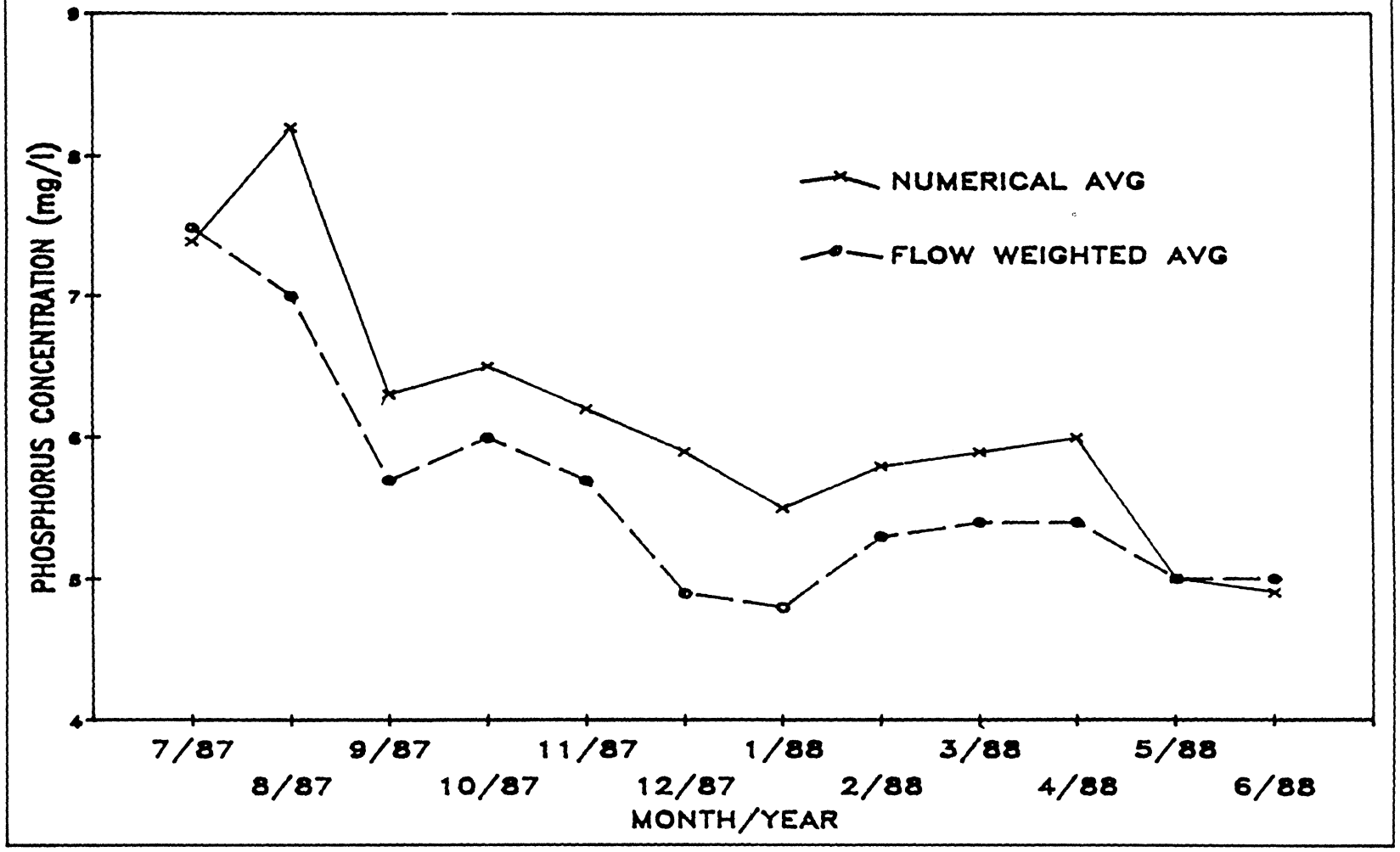
discharged to state waters from sewage treatment facilities. This will ensure that enrichment problems resulting from excessive phosphorus will not become worse during the period while more extensive phosphorus removal actions are taken.

- In the long term, the ban will provide benefits to treatment plant operators in the form of cost savings and reduced sludge production where chemicals are used for phosphorus removal. In addition, the ban is expected to allow for improved treatment where biological nutrient removal is practiced.

Experience in other ban states indicates that detergent suppliers began substituting non-phosphate detergents for the phosphate detergents prior to the effective date of the ban. Thus, reductions in phosphorus were evident several months prior to the ban. It appears that similar actions have been taken in preparation for the effective date of the Virginia phosphate detergent ban. Figure 1 presents average phosphorus data from 33 Virginia municipal treatment plants participating in a Voluntary Nutrient Monitoring Program.

Data from these plants indicates a general decreasing trend in the influent phosphorus levels at these facilities since the fall of

FIGURE 1: AVERAGE INFLUENT PHOSPHORUS CONCENTRATION
(MUNICIPAL STPs IN VNMP)



1987 (using either a straight numerical average or flow weighted average comparison). Since seasonal changes may account for some part of this decrease, a full evaluation of the benefits of the ban will require at least a year's worth of data. However, all indications are that the Virginia phosphate detergent ban will result in the expected phosphorus reductions.

The approved Policy, which is the next step in the phased nutrient management strategy for point sources, will require certain discharges to meet a monthly average total phosphorus effluent limitation of 2 mg/l. Each discharger will have to comply with this requirement within three years from the modification of his permit. This phase of the nutrient management strategy focuses on phosphorus for the following reasons:

1. **Precedent for point source phosphorus control.**

   Throughout the country, nutrient enrichment problems have been successfully addressed through application of phosphorus controls at point sources. For example, an extensive phosphorus removal program at wastewater treatment plants in the mid-west has resulted in a marked improvement in the water quality of the Great Lakes.

   Within Virginia, nutrient enrichment problems in Smith Mountain Lake, the Occoquan Reservoir, the Potomac

Embayments and the Chickahominy Watershed are all being addressed by controlling point source discharges of phosphorus.

Within the Chesapeake Bay basin, point source phosphorus controls are required in both Pennsylvania and Maryland by the Upper Chesapeake Bay Policy. Special phosphorus removal requirements also exist for discharges into the Patuxent River in Maryland and the Potomac River in Maryland and Washington, D.C.

2. **Water quality models for Virginia tidal fresh rivers.**

Extensive water quality modeling work has recently been completed within the Potomac embayments below Washington and the James River between Richmond and the Chickahominy River. Projections developed from these models indicate that phosphorus removal from point sources will benefit water quality.

3. **Estuarine portions of Virginia's rivers are phosphorus limited during the spring bloom.**

The estuarine portions of Virginia's major tributaries to the Chesapeake Bay have been designated as nutrient

enriched waters primarily due to algae bloom conditions during the spring. Results from Virginia's Tributary Monitoring Program indicate that the tidal rivers are phosphorus limited during a major part of the year. Research conducted at VIMS using nutrient microcosm studies, although indicating nitrogen limitation in mid-salinity waters during much of the year, also indicates phosphorus limitation during the late winter/early spring algae bloom period.

4. **Cost effective biological phosphorus removal technology has been successfully demonstrated.**

Three full scale nutrient removal demonstration projects have successfully demonstrated that cost effective options are available for phosphorus removal. Appendix D contains a status report on these projects.

It is the contention of the Board staff that either simple chemical addition or biological phosphorus removal, supplemented with chemical addition where necessary, would be available options for meeting the requirements of the proposed Policy.

The concentration of 2 mg/l was selected based upon the following criteria:

A. This limit is readily achievable by chemical addition processes as demonstrated by experiences in other parts of the country; and,

B. This is the effluent limit suggested for biological phosphorus removal (BPR) contained in the report, "Assessment of Cost and Effectiveness of Biological Dual Nutrient Removal Technologies in the Chesapeake Bay Basin", September, 1987, prepared by J.M. Smith and Associates for the U.S. EPA. Dr. Clifford Randall, Professor of Civil Engineering, VPI & SU, also confirms this as an achievable effluent concentration for the BPR process supplemented with chemical addition.

C. This limit represents a substantial reduction in the amount of phosphorus discharged by wastewater treatment facilities. The 40% phosphorus reduction target contained in the 1987 Chesapeake Bay Agreement will be achieved for point sources with a 2 mg/l phosphorus limit.

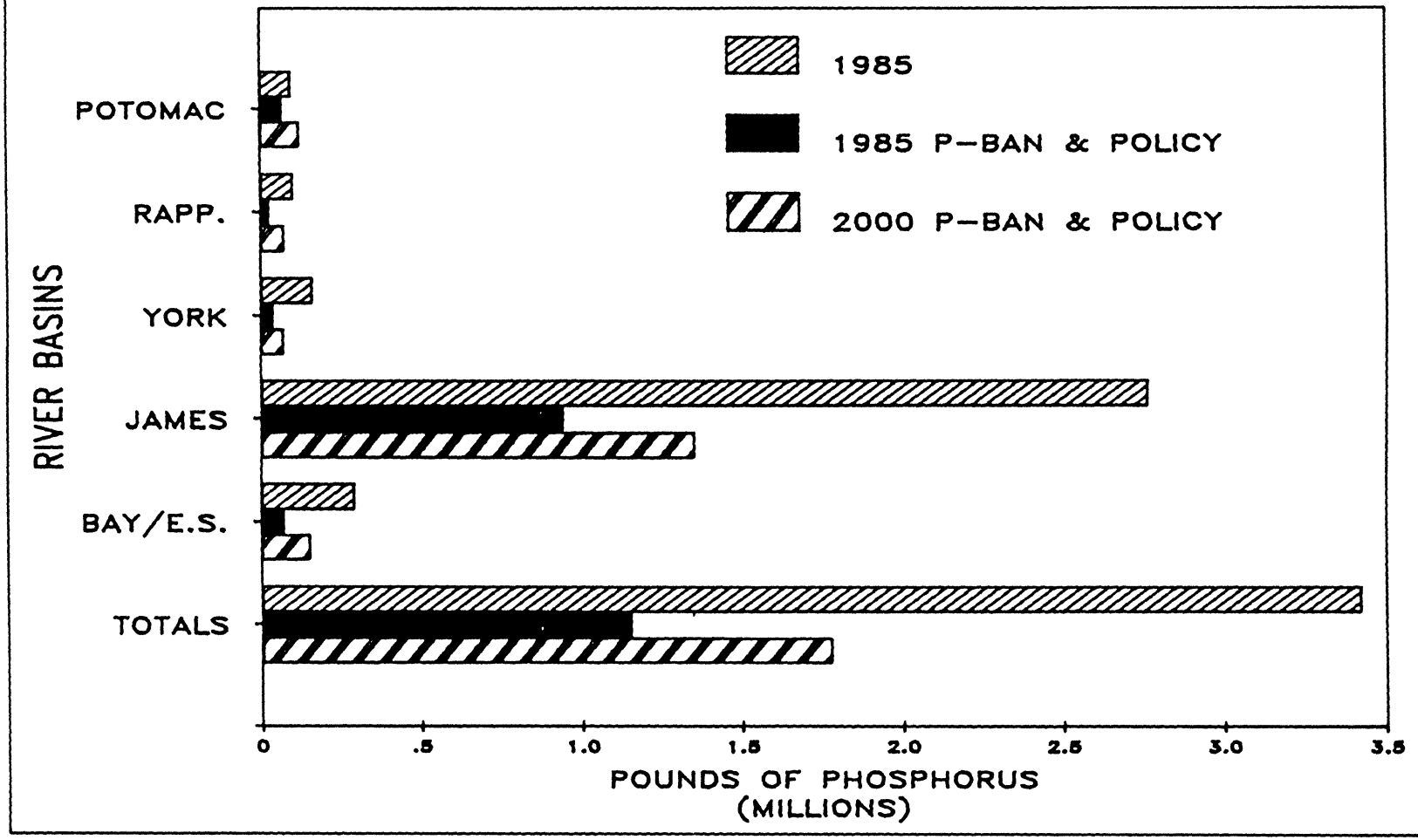
Experience in other areas indicates that such

reductions in the discharge of phosphorus have led to improved water quality conditions. All indications are that similar improvements should occur in Virginia's waters. For example, using a recently completed water quality model of the James river between Richmond and the Chickahominy river indicates that the 2 mg/l limit will aid in reducing the currently unacceptable peak chlorophyll levels experienced during drought flow conditions down to more acceptable levels (from about 70 ug/l down to 40 ug/l). Further monitoring and modeling will indicate if further phosphorus reductions are needed.

Phosphorus Loading Reductions Due to Proposed Policy

Figure 2 presents the changes in phosphorus loadings due to the ban and the approved Policy for the municipal treatment facilities below the fall line. These are the facilities directly impacted by the Policy. Using the 1985 plant flows, the reduction in phosphorus loading is 66% due to the ban and proposed Policy. With the increase in treatment plant flows by the year 2000, the projected year 2000 loadings under the ban and proposed Policy would be 48% lower than the 1985 loadings. (The year 2000 flow projections use the design flow of the plants and therefore is a conservative estimate. Thus, the actual loadings in the year 2000 will most likely be lower than shown, and the percentage reductions compared to the 1985 loadings will be higher than shown.)

FIGURE 2
CHESAPEAKE BAY TRIBUTARY
ANNUAL MUNICIPAL PHOSPHORUS LOADS
(DISCHARGED BELOW THE FALL LINE)



If all of the point source loadings are factored into the percentage reduction analysis, the projected year 2000 loadings would be 44% lower than the 1985 loadings. Thus, implementation of the current Policy is projected to exceed the 40% commitment in the 1987 Bay Agreement for point sources.

Capital Costs Of Point Source Policy

The Point Source Policy will initially impact 20 municipal and 5 industrial discharges at an estimated construction cost of $27.5 million to $228 million, depending upon the type of phosphorus removal technology selected. Costs of phosphorus removal were estimated by the Board staff for three treatment technologies:

1. Biological phosphorus removal - $16.5 million plus an additional $7 to $11 million for license fees.

2. Simultaneous chemical precipitation - $89 million

3. Post chemical precipitation - $228 million

Each affected treatment plant owner will have to evaluate the most suitable technology to use given the condition and type of the

existing treatment plant, site constraints, and size. Operation and maintenance costs have not been estimated because of the varying conditions at each facility related to chemical feed rate, aeration requirements, solids handling, and final disposal. These costs will also impact the type of treatment technology selected.

An engineering study co-sponsored by twelve wastewater treatment plant owners indicated the most cost effective approach to meeting the requirements of the Policy was biological phosphorus removal followed by chemical polishing. The estimated capital cost for the 16 facilities included in the study that must upgrade is $21 million which is very close to the Board's estimated costs.

Voluntary Nitrogen Removal

The approved Policy contains the option of allowing an additional year to comply with the Policy requirements if a discharger voluntarily accepts a permit to require the installation and operation of nitrogen removal facilities to meet a total nitrogen concentration of 10 mg/l during the months of April through October.

Nitrogen removal is not included as a requirement at this time due to questions regarding the extent of nitrogen removal for water quality protection and the capability and cost of nitrogen removal technology for point sources.

Nitrogen removal is not widely practiced in the country due to the extremely high capital and operating costs, and the complexity of conventional nitrogen removal technologies. Biological nitrogen removal may offer a viable option, but has not yet been fully demonstrated in Virginia. In addition, the cost of retrofitting this technology is open to much uncertainty.

Therefore, the Board has received, as part of the FY'88-90 Virginia Chesapeake Bay Initiatives, funds to allow continuation of demonstration projects for biological nitrogen removal. Additional funds have been allotted to determine the feasibility of using the biological nutrient removal technology and to develop preliminary cost estimates for retrofitting this new technology at selected major Virginia treatment facilities.

Questions over the appropriate water quality requirements also make development of effluent limits for nitrogen difficult. Nitrification and denitrification processes within estuarine waters raise the question of the need for only seasonal nitrogen reductions.

In addition, the federal/state Chesapeake Bay Program has initiated an extensive, highly sophisticated modeling effort within the Bay and its tributaries. This time variable, three dimensional (3D) model of the Bay will incorporate hydrodynamic, water quality, and sediment models into a management tool that could give Bay

managers a predictive capability for assessing future nutrient control actions that has not existed previously. It is anticipated that this model will be available in the early 1990's.

Under the Policy, owners may select to incorporate nitrogen removal at this time if it fits into their individual plans and schedules for upgrading and expanding their wastewater treatment facilities.

Future Phases of the Point Source Policy for Nutrient Enriched Waters

As stated in Paragraph E of the approved Policy:

> "The Board anticipates that, following implementation of the foregoing requirements and evaluation of effects of this policy and of the results of the non-point source control programs, further limitations on discharges of phosphorus or of other nutrients may be necessary to control undesirable growths of aquatic plants."

Although not specified in the approved Policy, there are a number of future possible steps that may be taken in the area of point source nutrient control. Alternatives include the following (not listed in any special order):

- Require existing, smaller discharges (under 1 MGD) within the nutrient enriched waters designation area to meet the phosphorus limitation.

- Require discharges above the fall line to meet the phosphorus limitation.

- Require more stringent effluent limits for phosphorus.

- Require nitrogen removal for new and/or existing discharges where and when applicable.

As outlined in Chapter V, the 1987 Chesapeake Bay Agreement established a target of reducing the amount of phosphorus and nitrogen entering the Bay by 40% by the year 2000. As stated above the Policy requirement for phosphorus will achieve a 40% reduction by the year 2000 of phosphorus discharged by Virginia's point sources. In order to reduce nitrogen by 40% the Board will have to amend the Policy to require point source nitrogen removal. The Board is committed to taking this step, but is currently awaiting the establishment of the scientific basis for adopting a regulation to require nitrogen removal. The 3D model of the Chesapeake Bay and its major tributaries will provide the appropriate basis for taking this action.

Finally, as point source programs are implemented, non-point control programs will also begin to show positive results in water quality. These benefits must also be factored into future phases of the Nutrient Management Strategy to help determine the equitable share of the nutrient reduction efforts that must be implemented in the point source and non-point source areas.

IV. Non-point Source Strategy for Nutrient Enriched Waters and Other Waters

Nonpoint source (NPS) pollution control strategies for nutrient enriched waters involve the overall coordination by the Division of Soil and Water Conservation (DSWC) of activities being carried out by the USDA agencies (Soil Conservation Service, Agricultural Stabilization and the Cooperative Extension Service), the Virginia Department of Forestry, the Department of Mines, Minerals and Energy and the Virginia Water Control Board among others.

The control strategy is as follows:

1. Pollutant source identification, i.e. cropland, urban area, forested area, etc.

2. Development of appropriate management strategies or best management practices (BMPs).

3. Targeted implementation of these practices.

Implementation of any of these BMPs is a combination of education, technical assistance and financial incentives.

The Chesapeake Bay Research study published in 1983 determined that as much as 39% of the phosphorus and 67% of the nitrogen in an

average rainfall year is contributed by agricultural sources, primarily cropland and animal manures. The study also concluded that as much as 50% of sediment delivery is a direct result of shoreline erosion. Urban sources contribute only 6-8% of the nutrient and sediment load but deliver surprising amounts of heavy metals such as zinc, iron and lead along with petroleum products. The Division of Soil and Water Conservation operates programs for pollution abatement in each of these source areas, but expects that the most dramatic impacts will result from agricultural strategies, followed by urban strategies. These strategies will be discussed in further detail below.

Specific to agriculture, the overriding driving force is the 1985 Farm Bill and its provision for conservation compliance. Conservation plans must be developed and approved by local Soil and Water Conservation Districts (SWCDs) for all highly erodible land by January 1, 1990. These plans must be implemented no later than January 1, 1995 in order to maintain eligibility for USDA benefits such as farm loans and commodity price supports. This highly erodible land amounts to about 430,000 acres of cropland in the Chesapeake Bay drainage basin. The Division of Soil and Water Conservation is working very closely with the USDA-SCS to bring this state cropland under an erosion rate of "T" by 1995.

The remainder of our ongoing program and its future refinements are described in the following eight primary elements:

* Agricultural Demonstration/Research Projects
* Agricultural Education Program
* Technical/Administrative Assistance to SWCDs
* Agricultural Pollution Source Identification Data Base
* Agricultural Best Management Practice Cost-Sharing
* Nutrient Management Program
* Urban Education Program
* Urban BMP Demonstration Projects

Each of these program elements has been refined annually to better target the efforts needed to achieve the overall program goal of improving water quality in the Chesapeake Bay basin by reducing the influx of nonpoint pollutants. The program elements being utilized to meet these goals are discussed below.

Agricultural Demonstration/Research Projects

The nonpoint source pollution control strategy has since its inception included the support and funding of demonstration and research projects aimed at better understanding NPS problems and methods of controlling NPS pollution. During 1985-1986 twenty-six innovative BMP methods were funded statewide to research and field test new BMP technologies. These research efforts provided important field performance data and also became important educational tools for all parties concerned. One ongoing research demonstration project is a rainfall simulator demonstration project which is utilized statewide to educate farmers and others concerned as to the

relative importance and success of BMPs in reducing erosion and related problems caused by rainfall events. Six sites were demonstrated during the summer of 1987 to coincide with existing tours and field days to maximize public exposure to the demonstrations.

Two other major ongoing research projects involve the monitoring of two watersheds over a 10 year study period to address the issue of the effects of BMP usage on downstream water quality. One watershed was selected for study since it was representative of a watershed dominated by cropland land use and the absence of point source discharges which could affect water quality. A second watershed was chosen because it contained a large percentage of livestock operations representative of a watershed where livestock management BMPs could be utilized. Information from these projects will be critically important in verifying water quality changes due to BMP implementation.

Agricultural Education Program

The state BMP cost-share program by itself will probably not result in sufficient implementation of BMPs to reduce agricultural pollutant loads to desired levels because there is no guarantee that farmers would implement the estimated $170 million needed in BMPs under a voluntary program even if cost-sharing were available. With only limited cost-share funding of approximately $1.6 million a year, the critical nature of education is evident to the success of the

agricultural BMP program. The education program is vital not only to sell the benefits of BMP implementation to farmers to encourage their participation in the cost-share program but also to encourage their voluntary implementation of BMPs.

Many of the BMPs that are being promoted for their water quality benefits are also economically beneficial to the farmer. The challenge is to convince farmers to try BMPs so that they can evaluate their performance for themselves. It is hoped that a substantial number of farmers can be convinced to implement BMPs through education, thus reducing reliance upon a cost-share program. A primary objective of the education program is to reach farmers who normally do not participate in local conservation programs.

The DSWC is working closely through a contract with the Virginia Cooperative Extension Service to conduct an intensive educational program in the Chesapeake Bay basin. This program coordinates the educational activities of county extension agents to promote the NPS control programs at the local level through farm visits, educational meetings, news articles, radio programs and similar methods.

Many other educational activities are ongoing to promote BMP usage and NPS controls statewide including the prevention of shoreline erosion. These include promotion of the cost-share program, a clean water farm farmer recognition program, promotion of research activities, promotion of BMP usage related activities

through talks and speeches at interested groups, displays at fairs, publication of promotional literature, distribution of news releases and many similar activities.

Technical/Administrative Assistance to Soil and Water Conservation Districts

The DSWC provides extensive technical and administrative assistance to soil and water conservation districts within the Bay basin and statewide. This assistance includes, as an example, guidance and training in operating the BMP cost-share programs within the Bay basin. This assistance included the funding assistance for computer systems for Bay districts for cost-share tracking and management. Other assistance is provided in the form of financial management assistance, information and guidance on other DSWC programs such as the erosion and sedimentation control program and keeping the districts up-to-date on ongoing federal and state programs affecting local soil and water conservation activities. Primary assistance to the soil and water conservation districts is provided by six field specialists serving various portions of the state supervised by a district operations chief in Richmond.

In addition to the assistance provided by the DSWC, the extent of the nonpoint source programs, particularly within the Bay basin has resulted in the need for additional technical and administrative assistance within the soil and water conservation districts. All 25

districts in the Bay basin receive some personnel assistance support through the DSWC. In 1986 this support amounted to a total of 34 man-years for the basin. Of the 34 man-years, 27 man-years were for technical positions with the remainder providing administrative assistance. The majority of the technical positions provide assistance in agricultural programs. Several of the technical positions, however are specifically designated for assistance in urban programs.

Agricultural Pollution Source Identification Data Base

One of the greatest challenges of implementing a large scale agricultural nonpoint source pollution control program is to identify areas of greatest pollution potential. This is necessary in order to target limited available resources to areas where it will do the most good. With approximately 24,000 farms containing about 3.5 million acres of crop and pastureland in the Chesapeake Bay drainage basin, this is no small task.

The Virginia Geographic Information System (VirGIS) project was initiated in the fall of 1985 through a contract with VPI&SU to create a cost effective database designed to identify and prioritize areas with the greatest relative potential to be nonpoint source pollution problems. A secondary use intended for the VirGIS database is to supply base line information for computer based mathematical models. These models can be used to access the relative

effectiveness and accomplishments of BMPs to reduce sediment delivery and nutrient losses. The VirGIS database consists of six basic computerized data layers that are spatially referenced to the Universal Transverse Mercator (UTM) coordinate system. The six basic layers include elevation, soil types, water bodies, land use, watershed boundaries and county boundaries. These basic layers can be manipulated and combined to generate additional working data layers or maps such as Erodibility Index (EI), Water Quality Index (WQI) and many other maps that can be used as technical management tools.

Potential sediment loadings (PSL) were calculated during phase I (85-86) of the project for 19 counties in the York and Rappahannock drainage area. The PSLs were grouped into categories representing high, moderate and low NPS pollution potential. Maps displayed on clear mylar overlays and sized to fit USGS 7 1/2 minute quadrangles were generated and distributed to the SWCDs for use in prioritizing critical NPS pollution areas.

Phase II (86-87) and phase III (87-88) of the VirGIS project have continued the development of the database beyond the York and Rappahannock drainage basins. A total of 38 counties covering approximately 8 million acres in the Bay area are scheduled to be in the database by the end of phase III. Methods of prioritizing potential nonpoint source pollution areas have been refined to include the Erodibility Index (EI) and the Water Quality Index (WQI)

maps. The maps have also been found very useful in identifying land areas eligible for the USDA conservation reserve program.

Work is continuing on refining and improving VirGIS capabilities. Databases for soil type, elevation, land use, waterbodies, watersheds and counties will be developed for 6 additional counties during phase III of the project. A pilot study is being conducted to develop procedures for identifying areas with high nonpoint source pollution potential in the absence of a county soil survey. A land use data layer will be added to the 19 counties in the phase I area. Routines will be developed to access soils interpretation data from which suitability maps can be generated for a variety of scenarios that relate to soils (i.e., septic drain fields, specific crop yields, etc.). A user-friendly database management system is also under development to enable the DSWC to address both in-house and remote user needs. Work is being conducted to interface VirGIS with SCS CAMPS and farm plan algorithms for incorporating water quality goals in farm plans. An investigation will also be initiated to assist the DSWC in evaluating alternative nonpoint in-stream nutrient control strategies using VirGIS, existing W.Q. data and models.

Agricultural Best Management Practice Cost-Sharing

The Virginia Agricultural Best Management Practice (BMP) Program is a DSWC project to improve water quality in the State's streams, rivers and the Chesapeake Bay. The program is funded with state and

federal monies through local soil and water conservation districts. The districts, in turn, administer a cost-share and incentive program to encourage farmers and landowners to apply needed BMPs to their land to better control sediment and nutrient loss and transportation into our waters from excessive surface flow, erosion and inadequate animal waste management.

The districts receive their funding allocation based on need as determined from an analysis of major agricultural factors that influence water quality such as intensive cropland cultivation, erosive soil conditions and animal unit numbers. The district then distributes assistance to voluntary applicants whose requests have been evaluated to have the highest cost effectiveness potential for water quality improvement. This targeting of funds based on the cost-effectiveness of water quality improvement is utilized rather than a first-served payment or other distribution method to achieve the maximum benefits per dollar spent.

Although resource based problems affecting water quality occur on all land uses, this program emphasizes efforts for corrective action on agricultural and forested lands only, and offers cost-share assistance as an incentive to carry out construction or implementation of selected BMPs. Beginning in 1983, state cost-share funds were only available for the Chowan basin. The program was expanded in 1984 to include the Chesapeake Bay Basin through funds provided under the EPA Chesapeake Bay program. Since 1986 the General Assembly has provided funds for cost-sharing BMP installation statewide.

Nutrient Management Program

The nutrient management program basically evolved out of educational and research programs as a necessary program area requiring greater emphasis. The program is based upon a concentrated educational effort combined with the provision of technical services to farmers to ensure the proper utilization and application of animal wastes and commercial fertilizers. This program is considered to have the greatest potential impact on the reduction of nitrogen inputs to the overall nonpoint source pollution problem.

The program consists of an ongoing educational program primarily through county extension agents and other extension personnel under contract to the DSWC to promote the development and use of fertilizer and animal waste plans for farms throughout the state. Demonstration plots have also been established yearly throughout the state demonstrating comparable yields grown on cropland receiving optimized and normally reduced levels of fertilizer and animal waste applied at optimum periods for plant growth. These demonstration plots have been widely advertised and been very effective in demonstrating the benefits of optimum fertilizer and animal waste application. Technical services are provided through this program through free animal waste nutrient analyses, plant tissue testing for nutrient levels and soil testing, as well as in the development of fertilizer and animal waste management plans. A computer program has been developed to assist county extension agents in the development of animal waste plans. All county agents have been trained in its usage.

This program is projected for significant expansion in the future. Greater staff resources are projected to provide more intensive assistance statewide to better ensure the proper utilization of fertilizer and animal wastes. Such assistance will include but not be limited to more staff time devoted to development of fertilizer and animal waste utilization plans, more demonstration and research efforts, greater one to one contact with farmers to include hands-on technical assistance in proper fertilizer and animal waste utilization and in tissue, soil and animal waste sampling and greater training and educational efforts for all concerned parties.

Urban Education Program

In order to provide technical assistance to localities implementing the Virginia Erosion and Sediment Control (ESC) Law the DSWC provides continuing education and technical assistance relative to urban NPS controls. The Division has routinely offered a seminar in four regional locations each year to teach implementation of and compliance with the ESC Law. Another four regional seminars teach compliance with the stormwater management aspects of the ESC Program. The first of these two seminars has recently been condensed from two days to one day and the DSWC plans to offer it in eight to ten regional locations each year.

Education is also provided through presentations, seminars and similar events to other parties involved or interested in erosion and

sediment control, stormwater management and other areas of urban NPS management. Consideration is currently being given to the development of a course in Virginia's Community College System to teach technical aspects of erosion and sediment control.

New legislation passed in 1988 will require certification for local erosion and sediment control inspectors by the DSWC. This requirement will provide additional educational opportunities and increase the competency and consistency of local officials. Other new legislation in 1988 established clear authority for DSWC oversight of local erosion and sediment control programs. This will require DSWC to perform periodic reviews of local programs to ensure compliance with implementation of the erosion and sediment control law and provide a further educational link for implementation of the program. The legislature also adopted other changes to strengthen the erosion and sediment control law and improve implementation of the overall program.

Urban BMP Demonstration Projects

While urban nonpoint source pollution of the Bay is not as significant as agricultural sources at this time, it is a growing problem. Land in Virginia is being converted to urban uses at a rate of about 20 square miles per year (1979 reference). This development is largely confined to the fringes of certain urban centers, most of which are in the Chesapeake Bay drainage basin. These include the

Northern Virginia, Richmond, Tidewater, Charlottesville and Fredericksburg areas.

There are currently no state regulations in Virginia dealing with the quality of urban stormwater. A few localities have adopted their own local stormwater management regulations, but like the State Erosion and Sediment Control Law, most of these deal with the quantity rather than the quality of stormwater runoff. One reason for the absence of a state program is a lack of conclusive data concerning the effectiveness and practicability of certain identified urban BMPs and stormwater management criteria. To learn more about urban BMPs and to communicate the data effectively to land developers and local officials, the DSWC has established an Urban BMP Research and Demonstration Program under the State Chesapeake Bay Initiative.

Under this program local officials, land developers, academicians and engineering consultants in urbanizing jurisdictions have been given an opportunity to submit proposals for cost-sharing assistance on urban BMP research and demonstration projects. Projects have been selected on the basis of innovativeness, water quality improvement potential and participation by local project sponsors. Ten projects have been funded to date and include a wide variety of urban practices and water quality research. These projects include funding assistance in the porous asphalt parking lots, two of which are being monitored; monitoring of an extended-detention dry pond; creation and monitoring of an urban

marsh; creation and evaluation of a predictive stormwater management model for PC-type computers and a demonstration of soil bioengineering techniques in stabilizing severely eroding streambanks.

A recent consultant study focused on the various stormwater management enabling laws in the Code of Virginia and identified gaps in local authority to manage runoff effectively. The study recommended combining the existing authorities with additional ones into a single, comprehensive stormwater management law for the Commonwealth. Specific recommendations were made regarding the general format provisions and criteria of such a law, and the DSWC was identified as the most logical administering agency. Whether or not the General Assembly acts upon those recommendations remains to be seen.

Future research will probably be focused upon a method of effectively targeting urban resources at the greatest problem areas.

Progress Indicators

The ultimate goal of the agricultural nonpoint source control program is to improve water quality through soil conservation practices and wise land use management decisions. Measuring the impacts of this program are difficult considering the many factors influencing water quality and the imprecise and evolving science of

monitoring nonpoint source impacts. The DSWC is placing a major effort in the development of the VirGIS system to dramatically improve our capabilities for targeting nonpoint source problem areas and for monitoring progress.

Under the 1987 Chesapeake Bay agreement, Virginia is committed to reducing the flow of nutrients to the Bay from all sources by 40% by the year 2000. As part of the commitment to this goal, estimates have been developed on nutrient reductions achieved and achievable under the agricultural nonpoint source program. These reductions have been calculated for three program phases and compared against the total nonpoint source load reduction target loads. Phase I covers reductions achieved to date between the years 1985-1988. Phase II projects reductions for the period 1988-1991, when the 40% reduction goal is to be re-evaluated. The final phase, Phase III, projects reductions to the year 2000. The projected nutrient reductions are summarized by river basin in Tables 1 and 2.

The reductions shown in these tables evaluate projects achieved under the state cost-share program, the USDA-ASCS agricultural conservation program and conservation reserve program and projected reductions to be achieved under the Food Security Act of 1985 (Farm Bill). The Farm Bill requires that conservation plans must be developed and approved by 1990 and implemented by 1995 on all cropland on highly erodible land to reduce levels of erosion to

acceptable levels ("T" values). Approximately 25% or 430,000 of Virginia's cropland will be impacted. Failure to comply with the Farm Bill provisions will make the farmland ineligible for USDA farm subsidy programs. Obviously this program will be critical to the overall success of agricultural nonpoint source program.

TABLE 1

Nitrogen Reduction Due to Agricultural Nonpoint Source Programs

RIVER BASIN	1985 BASELOAD (LBS/YR)	40% REDUCTION TARGET LOAD	PHASE I LBS %	PHASE II LBS %	PHASE III LBS %
Potomac	17,688,748	10,613,249	16,849,735 4.7%	16,274,957 8.0%	13,274,026 25.0%
Rappahannock	925,143	555,086	811,056 12.3%	755,853 18.3%	379,590 59.0%
York	2,108,036	1,264,822	1,938,786 8.0%	1,901,246 9.8%	1,511,428 28.3%
James	8,389,838	5,033,903	7,915,476 5.7%	7,779,527 7.3%	6,572,305 21.7%
Coastal	569,340	341,604	556,940 2.2%	556,414 2.3%	502,605 11.7%

TABLE 2

Phosphorous Reduction Due to Agricultural Nonpoint Source Programs

RIVER BASIN	1985 BASELOAD (LBS/YR)	40% REDUCTION TARGET LOAD	PHASE I LBS %	PHASE II LBS %	PHASE III LBS %
Potomac	4,134,938	2,480,963	3,943,821 4.6%	3,812,496 7.8%	3,126,840 24.4%
Rappahannock	156,046	93,628	134,624 13.7%	124,812 20.0%	56,114 64.0%
York	201,013	120,608	184,807 8.1%	181,263 9.8%	143,559 28.6%
James	1,023,608	614,165	964,513 5.8%	949,613 7.2%	801,293 21.7%
Coastal	84,488	50,693	80,776 4.4%	80,562 4.6%	65,561 22.4%

It is apparent from Tables 1 and 2 that Virginia is making significant progress toward the 40% nutrient nonpoint source reduction target by accounting for agricultural programs alone. In fact, for the Rappahannock basin, agricultural program controls are estimated to reduce total nonpoint nutrient loads by 59.0% for nitrogen and 64.0% for phosphorous by the year 2000. Other basin nutrient reductions for the year 2000 range from a low of 21.7% for nitrogen from agricultural programs in the James basin to a high of 28.6% for both nutrients in the York basin and 25.1% for the Chesapeake basin as a whole. The achievable reduction percentages are greatly influenced by the fraction of the cropland/pastureland components of the nonpoint load in the 5 river basins which ranges from 14% in the Potomac to 48% in the Rappahannock. Similarly, animal waste contributions range from 24% in the James to 47% in the Potomac. Present program targeting emphasizes cropland/pastureland practices in the Rappahannock, York and lower Potomac and animal waste practices in the Upper Potomac. The progress in the Potomac basin can only be evaluated by summing the results of all 4 jurisdictions draining to this basin, but this data reconfirms the existing targeting strategy. Further success in the James and Coastal basins may be achievable through the provision of additional funds for cropland/pastureland and animal waste practices.

Beyond these traditional agricultural controls, it appears that new emphasis needs to be placed upon better identification and characterization of the full range of loads in the designated nonpoint source component of each river basin. Loads not subject to

agricultural BMP controls (including urban and natural background) range from 12% in the Rappahannock to 53% in the Coastal basin. Upgraded fall line and ambient monitoring is underway and will provide useful information for decision making in 1991. As this data is collected, on-going programs in urban erosion and sediment control, forestry BMPs, landfill and septic tank regulation and shoreline erosion, as examples, need to be evaluated concerning their impact in reduction of the nonpoint source load.

Targeting and tracking of all of these programs will be continuously improved by the use of the VirGIS system. By July 1988, 38 of the 62 counties in the Bay drainage will have been taken into the system with incremental addition in each year thereafter. This system will potentially be useful in combination with the revised watershed model for the Bay system to greatly improve our decision making capabilities in 1988 on a river basin basis.

The data presented herein are useful for developing program management and targeting strategies and for providing a relative indicator of progress achieved. We will continue to diligently work toward the collection of more accurate and comprehensive data and to improve the estimates on a continuing basis.

Future Strategies

The future nonpoint source control strategies for nutrient enriched waters and other waters will be reflective of a continuation

and expansion of the above discussed programs as well as strategies to meet the commitments of the Chesapeake Bay Agreement signed in December 1987 and of recent revisions made to the Clean Water Act in 1987.

A major emphasis in the program is being placed upon the development of reliable baseload figures upon which to further evaluate nonpoint source pollutant reductions through the use of VirGIS. Within the next year it is expected that the DSWC will be in a much better position to project existing loadings and progress made towards reducing these loadings with the VirGIS system. Additionally, work and research is continuing on the development of a model to evaluate the impact on surface water nitrogen delivery of BMP installation. The objective is to establish a procedure to provide a reasonable assessment of trends that can be tied into VirGIS. Improved methods of estimating pollutant load reductions and tracking BMP implementation statewide are other major areas of future program emphasis.

As part of recent revisions under Section 319 of the Clean Water Act, Virginia is required to develop an assessment as to the nature and sources of nonpoint source (NPS) pollution affecting the attainment of water quality standards statewide. This effort is being jointly shared by the State Water Control Board and the Division of Soil and Water Conservation. The result of this effort will be the identification of specific waters in the state adversely affected by nonpoint pollution and an estimation of the sources and

causes of the nonpoint pollution. The initial assessment was completed on April 1, 1988.

While the Chesapeake Bay basin is already targeted as an area affected by NPS pollution the assessment identifies other areas of the state also affected by NPS problems. This effort is an important step towards prioritizing limited resources and funds to the most significant NPS problem areas. The existing commitment to the reduction of NPS nutrient loadings to the Chesapeake Bay along with the identification of all tributaries to the Bay as nutrient enriched waters under the proposed water quality standard will continue to make this area the highest priority for NPS control efforts.

The revisions to the Clean Water Act also require Virginia and all other states to prepare a NPS management plan by August 4, 1988. This plan will outline a four-year program designed to identify the best management practices (BMPs) which will be utilized to correct known sources of NPS pollution addressed in the assessment plan as well as an identification of needed implementation programs required to manage NPS pollution problems. In addition, annual milestones will be developed outlining the annual progress in BMP implementation and program implementation (i.e., training/technical assistance, enforcement, etc.) necessary to achieve the program's goals of improving water quality in NPS impacted areas.

Virginia's NPS management program will further define the NPS control strategies to be utilized for improving the quality of

nutrient enriched waters and other NPS impacted waters within the state. For the Bay and its tributaries the management strategies will be developed jointly between the State Water Control Board and Division of Soil and Water Conservation as part of the basinwide nutrient control strategy development, ongoing as part of the Chesapeake Bay Agreement and SJR 165.

V. Chesapeake Bay Agreement - Basinwide Nutrient Control Strategy

Governor Baliles became chairman of the Chesapeake Executive Council during 1987. One of the major steps he took was to call a 'Summer Summit' of Bay leaders which was held in Norfolk during early August. A draft of a revised Chesapeake Bay Agreement was issued at that meeting, containing major goals, objectives and commitments to guide the federal/state cooperative Chesapeake Bay Program into the future. Following extensive public debate on the draft Agreement the 1987 Chesapeake Bay Agreement was signed on December 15, 1987 by the Governors of Virginia, Maryland, and Pennsylvania, the mayor of Washington D.C., the EPA Administrator, and the chairman of the Chesapeake Bay Commission. Appendix E contains a copy of the 1987 Chesapeake Bay Agreement.

The Water Quality section of the Agreement contains the following commitments concerning nutrients:

- **By July 1988, to develop, adopt, and begin implementation of a basin-wide strategy to equitably achieve by the year 2000 at least a 40 percent reduction of nitrogen and phosphorus entering the mainstem of the Chesapeake Bay. The strategy should be based on agreed upon 1985 point source loads and on nonpoint loads in a average rainfall year.**

- **By December 1991, to re-evaluate the 40 percent reduction target based on the results of modeling, research, monitoring and other information available at that time.**

In response to the new Agreement, the federal and state participants have begun to draft the Basinwide Nutrient Strategy. The State Water Control Board and the Division of Soil and Water Conservation are representing the Commonwealth during the drafting process for the Basinwide Strategy.

The Virginia Nutrient Strategy, requested by SJR 165, and the Basinwide Nutrient Strategy, being drafted in response to the Bay Agreement, each have July 1988 as their scheduled completion date. In addition, both SJR 165 and the Bay Agreement are to outline how the Commonwealth plans to address nutrient enrichment problems within the Bay and its tributaries.

The Board and the Division anticipate that the contents of the Basinwide Strategy will address all of the issues raised by SJR 165. Since the process of developing the final Basinwide Strategy also includes an extensive public review, the proposals by the Board and the Division for future nutrient management within the Commonwealth will benefit from public review and comment prior to any final decisions.

It has been suggested that a Basinwide Nutrient Strategy Progress Report be produced on an annual basis by the principal signatories to the Bay Agreement. This report will provide members of the Virginia General Assembly, as well as the rest of the citizens of the Commonwealth, with an annual update on the progress achieved as well as any new information that will aid in improving the approaches being used in the nutrient reduction programs.

AEP:NUTSTRAT:jmv

APPENDIX A

(SJR 165)

1987 SESSION

LD5767118

SENATE JOINT RESOLUTION NO. 165

Offered January 27, 1987

Requesting the State Water Control Board and the Department of Conservation and Historic Resources' Division of Soil and Water Conservation to develop a coordinated point and nonpoint nutrient control strategy for the Chesapeake Bay and its tributaries.

Patron--Gartlan

Referred to the Committee on Rules

WHEREAS, the Chesapeake Bay is a valuable natural resource which provides a variety of recreational and economic opportunities as well as serving as a habitat for fish and waterfowl; and

WHEREAS, studies undertaken by the Commonwealth, EPA, and others have shown that the living resources of the Bay and its tributaries have declined in recent years; and

WHEREAS, these studies have shown that one of the factors causing this decline is a deterioration of the quality of water entering the Bay and its tributaries; and

WHEREAS, this deterioration has resulted in part from the point source discharges of wastewater treatment plants and the nonpoint runoff from agricultural, forestal, and urban areas; and

WHEREAS, these sources have generated excessive amounts of such nutrients as phosphorus and nitrogen which may stimulate excessive algae growth, which increases water turbidity and reduces the amount of dissolved oxygen essential for the survival of fish and other living organisms; and

WHEREAS, control strategies are necessary to reduce and otherwise limit the input of these nutrients; and

WHEREAS, a sound enforceable strategy involves the establishment of a water quality based nutrient standard or standards; and

WHEREAS, the subcommittee established by Senate Joint Resolution No. 116 (1985) recommended that the State Water Control Board establish nutrient standards for the waters of the Commonwealth by 1988; and

WHEREAS, the subcommittee continuing its study under Senate Joint Resolution No. 65 (1986) has encouraged the State Water Control Board to adopt nutrient control strategies and regulations for point sources discharges; and

WHEREAS, this same subcommittee believes management control strategies are also needed by the Department of Conservation and Historic Resources' Division of Soil and Water Conservation to address nonpoint source nutrient runoff; and

WHEREAS, the Division of Soil and Water Conservation provides education, technical assistance, and financial incentives to effectively implement a nonpoint runoff control program on a voluntary basis with farm and forest operators; and

WHEREAS, the United States Food Security Act of 1985 (also known as the 1985 Farm Bill) requires farmers to conserve highly erodible land and associated nutrients through the use of approved soil management practices to retain their eligibility in most United States Department of Agriculture programs; now, therefore, be it

RESOLVED by the Senate, the House of Delegates concurring, That the State Water Control Board and the Department of Conservation and Historic Resources' Division of Soil and Water Conservation are requested to cooperatively develop and implement a comprehensive nutrient limitation strategy by July 1, 1988; and, be it

RESOLVED FURTHER, That the strategy shall include:

(1) a nutrient standard or standards for the waters of the Commonwealth including the watershed of the Chesapeake Bay;

(2) suggested target loads for the main Bay stem and each of its tributaries from point and nonpoint sources resulting from application of the water quality standard;

(3) suggested regulations, quidelines, and budget projections as appropriate or necessary to implement nutrient management strategy; and

(4) recommendations for short-term and long-term data gathering, analysis, and research needed to fine tune the nutrient limitation strategy in future years to provide the most effective, equitable and cost-effective approach to controlling nutrient enrichment in the Bay and its tributaries; and, be it

RESOLVED FURTHER, That the Secretaries of Natural Resources and of Health and Human Services are requested to work with representatives of the jurisdictions participating in the Chesapeake Executive Council to ensure that Virginia's strategies and those of the other jurisdictions are consistent with a baywide nutrient control strategy and incorporated into the Chesapeake Bay Restoration and Protection Plan by July 1, 1989; and, be it

RESOLVED FINALLY, That the State Water Control Board and the Department of Conservation and Historic Resources are requested to report to the 1988 Session of the General Assembly on the status of the strategy, recommendations for its implementation, and any impediments to its implementation.

A True Copy, Teste:

C. R. Sheperson

Clerk of the Senate

Official Use By Clerks	
Agreed to By The Senate	**Agreed to By The House of Delegates**
without amendment ☐	without amendment ☐
with amendment ☐	with amendment ☐
substitute ☐	substitute ☐
substitute w/amdt ☐	substitute w/amdt ☐
Date: _____	Date: _____
Clerk of the Senate	Clerk of the House of Delegates

APPENDIX B

(Approved Water Quality Standard)

VR680-21-07 SPECIAL STANDARDS AND DESIGNATIONS

VR680-21-07.03 Nutrient Enriched Waters

A. Purpose

The Board recognizes that nutrients are contributing to undesirable growths of aquatic plant life in surface waters of the Commonwealth. This standard establishes a designation of "nutrient enriched waters". Designations of surface waters of the Commonwealth as "nutrient enriched waters" are determined by the Board based upon an evaluation of the historical water quality data for one or more of the following indicators of nutrient enrichment: chlorophyll "a" concentrations, dissolved oxygen fluctuations, and concentrations of total phosphorus.

B. Authority

This standard is adopted under the authority of Sections 62.1-44.15(3) and 62.1-44.15(10) of the Code of Virginia.

C. Designation of Nutrient Enriched Waters

The following State waters are hereby designated as "nutrient enriched waters":

1. Smith Mountain Lake and all tributaries* of the impoundment upstream to their headwaters.

2. Lake Chesdin from its dam upstream to where the Route 360 bridge (Goodes Bridge) crosses the Appomattox River, including all tributaries to their headwaters that enter between the dam and the Route 360 bridge.

3. South Fork Rivanna Reservoir and all tributaries of the impoundment upstream to their headwaters.

4. Peak Creek from its headwaters to its mouth (confluence with Claytor Lake), including all tributaries to their headwaters.

5. Aquia Creek from its headwaters to the State line.

6. Fourmile Run from its headwaters to the State line.

7. Hunting Creek from its headwaters to the State line.

8. Little Hunting Creek from its headwaters to the State line.

9. Gunston Cove from its headwaters to the State line.

10. Belmont and Occoquan Bays from their headwaters to the State line.

11. Potomac Creek from its headwaters to the State line.

12. Neabsco Creek from its headwaters to the State line.

13. Williams Creek from its headwaters to its confluence with Lower Machodoc Creek.

14. Tidal freshwater Rappahannock River from the fall line to Buoy 44, near Leedstown, Virginia, including all tributaries to their headwaters that enter the tidal freshwater Rappahannock River.

15. Estuarine portion of the Rappahannock River from Buoy 44, near Leedstown, Virginia, to the mouth of the Rappahannock River (Buoy 6), including all tributaries to their headwaters that enter the estuarine portion of the Rappahannock River.

16. Estuarine portion of the Mattaponi River from Clifton, Virginia, and estuarine portion of the Pamunkey River from Sweet Hall Landing, Virginia to West Point, Virginia, and the York River from West Point, Virginia, to the mouth of the York River (Tue Marsh Light) including all tributaries to their headwaters that enter the estuarine portions of the Mattaponi River, the Pamunkey River and the York River.

17. Tidal freshwater James River from the fall line to the confluence of the Chickahominy River (Buoy 70) including all tributaries to a distance five river miles above their fall lines that enter the tidal freshwater James River.

18. Estuarine portion of the James River from its confluence with the Chickahominy River (Buoy 70) to the mouth of the James River (Buoy 25), including all tributaries to their headwaters.

19. Chesapeake Bay and its small coastal basins from the Virginia State line to the mouth of the Bay (a line from Cape Henry drawn through Buoys 3 and 8 to Fishermans Island), and its tidal tributaries,

excluding the Potomac tributaries, those tributaries listed above, and the Mattaponi River upstream of Clifton, Virginia, and the Pamunkey River upstream of Sweet Hall Landing, Virginia.

*When the word "tributaries" is used in this standard, it does not refer to the mainstem of the water body that has been named.

D. Whenever any water body is designated as "nutrient enriched waters", the Board shall modify the NPDES permits of point source dischargers into the "nutrient enriched waters" as provided in the Board's Policy for Nutrient Enriched Waters (VR-680-14-02).

APPENDIX C

(Approved Policy For Nutrient Enriched Waters)

VR680-14-02 POLICY FOR NUTRIENT ENRICHED WATERS

A. Purpose

This policy provides for the control of discharges of nutrients from point sources affecting state waters that have been designated "nutrient enriched waters" in VR 680-21-07.03.

B. Authority

The Board has adopted this policy under the authority of Sections 62.1-44.15(3), 62.1-44.15(10) and 62.1-44.15(14) of the Code of Virginia.

C. Strategy for "Nutrient Enriched Waters"

As specified herein, the Board shall reopen the NPDES permits of certain point source dischargers to "nutrient enriched waters" and shall impose effluent limitations on nutrients in the discharges authorized by those permits and certain new permits.

1. a. All dischargers authorized by NPDES permits issued on or before July 1, 1988, to discharge 1 MGD or more to "nutrient enriched waters" shall be required to meet a monthly average total

phosphorus effluent limitation of 2 mg/l as quickly as possible and in any event within 3 years following modification of the NPDES permit.

b. At the time of modification of the NPDES permit, any discharger who voluntarily accepts a permit to require installation and operation of nitrogen removal facilities to meet a monthly average total nitrogen effluent limitation of 10 mg/l for the months of April through October shall be allowed an additional year to meet the phosphorus effluent limitation in Paragraph C.1.a.

2. All new source dischargers as defined in Regulation 6 with a permit issued after July 1, 1988 and a design flow greater than or equal to 0.05 MGD who propose to discharge to "nutrient enriched waters" shall be required to meet a monthly average total phosphorus effluent limitation of 2 mg/l.

3. All dischargers to nutrient enriched waters who at the time of designation of the "nutrient enriched waters" are subject to effluent limitations more stringent than 2 mg/liter monthly average total phosphorus shall be required to continue to meet the more stringent phosphorus limitation. This policy shall not be construed to relax any effluent limitation concerning

a nutrient that is imposed under any other requirement of state or federal law. No time extensions outlined in Subsection C.1.b. for installation and operation of nitrogen removal facilities shall be granted to a discharger if such an effluent limitation or a time extension is already imposed under any other requirement of state or federal law or regulation.

D. A discharge of phosphorus to surface waters of the Commonwealth may be deemed to pose a threat to the environment pursuant to section 6.51 (d) (4) of Regulation No. 6. Whenever the Board determines that a permittee has the potential for discharging monthly average total phosphorus concentrations greater than or equal to 2 mg/l or monthly average total nitrogen concentrations greater than or equal to 10 mg/l to "nutrient enriched waters," the Board may reopen the NPDES permit to impose monitoring requirements for nutrients in the discharge.

E. The Board anticipates that, following implementation of the foregoing requirements and evaluation of effects of this policy and of the results of the non-point source control programs, further limitations on discharges of phosphorus or of other nutrients may be necessary to control undesirable growths of aquatic plants.

F. The Board may entertain petitions from adjoining states to consider rulemakings to control nutrients entering

tributaries to "nutrient enriched waters" of the adjoining state.

APPENDIX D

(Status Report - Nutrient Removal Demonstrations)

STATUS REPORT:

VIRGINIA NUTRIENT REMOVAL DEMONSTRATION PROJECTS

CHESAPEAKE BAY OFFICE

VIRGINIA WATER CONTROL BOARD

APRIL 1988

HRSD-YORK RIVER STP: BIOLOGICAL NUTRIENT REMOVAL

The Hampton Roads Sanitation District (HRSD) received a $187,961 grant in April 1986 to demonstrate the effectiveness of Biological Nutrient Removal (BNR) at their York River Sewage Treatment Plant (STP). HRSD selected a dual nutrient removal process patented by Air Products, Inc., called A^2/O (Anaerobic/Anoxic/Oxic). HRSD personnel retrofitted the STP with temporary baffle walls, which partitioned two of the plant's six aeration basins into zones providing the correct environmental conditions for removal of both phosphorus and nitrogen. Mixers were added to stir the wastewater, and recirculation lines were installed to route the flow through the proper pattern (see attached Figure 1 for flow diagram). The HRSD-York STP has a design capacity of 15 million gallons per day (MGD), and is presently treating an average of about 7.5 MGD, with all of the flow receiving BNR treatment.

Biological phosphorus removal (BPR) alone was examined during the first phase of the project, which began in August 1986. Phosphorus removal rates approaching 70% were achieved within three weeks, with effluent concentrations near 4 mg/l. The effluent phosphorus level throughout the fall of 1986 averaged about 3.7 mg/l.

During the 1986 winter quarter, influent flow to the plant increased dramatically, from 6 MGD to 11-12 MGD due to wet weather I/I and growth in the service area. The efficiency of the BPR system was impacted by these high flows, resulting in only a 53% average removal rate. However, partly due to the weaker influent strength, the average effluent phosphorus concentration remained near 3.6 mg/l for this period. Also, due to the short hydraulic detention time and cold temperatures, nitrification could not be established as planned. This is an integral part of the nitrogen removal system, and start-up of this phase of the project was delayed several months.

During the 1987 spring quarter, HRSD diverted some of the excess flow to their Boat Harbor STP and drier weather arrived, bringing the average plant flow at York STP down to 8.7 MGD for the period. HRSD staff continued trying to establish nitrification, but were unsuccessful. A one month study was conducted on chemical addition to the sludge being processed by the belt filter. This was done to reduce the phosphorus level of the filtrate, which is pumped back to the head of the STP. Because the plant uses anaerobic digestion to stabilize the sludge, much of the phosphorus (removed in sludge settled out after treatment) can be released in the digester. Recycling this phosphorus through the STP, without final removal and disposal at some point, has the potential to build up the influent phosphorus level to a point that the BPR system cannot function properly. Several types of chemicals were investigated with inconclusive results, although there were periods when substantial phosphorus removal from the filtrate was accomplished.

Nitrification was finally established in early summer 1987 and the denitrification stage added in August 1987. The major finding from this operational period was that nitrogen removal is fairly easy to optimize and maintain once established. Nitrogen removal rates approaching 80% were observed (effluent total nitrogen concentrations of 5.7 mg/l), with only a modest decrease in the BPR rate.

HRSD-YORK RIVER STP: BIOLOGICAL NUTRIENT REMOVAL (cont.)

BPR efficiency did suffer while the nitrogen removal system was being stabilized, but effluent phosphorus concentrations averaged again near 3.5 mg/l with dual nutrient removal operating. The most interesting discovery during this phase was that effluent phosphorus values seemed to stay in a range from 3-4 mg/l, regardless of the influent strength. This supports some of the findings of the HRSD-Lamberts Point pilot study, where effluent values remained fairly constant even when the influent was spiked with phosphorus, as high as 12 mg/l. Effluent levels then remained fairly constant when influent phosphorus concentrations dropped.

The operational phase of this demonstration was scheduled to end in August 1987. The study has been extended to measure:

1. How the phosphate detergent ban affects phosphorus removal; and,

2. The affect of cold weather on the nitrogen removal system.

A contract has been executed with VPI&SU (Dr. Clifford Randall) to conduct sample analyses and data compilation through August 1988. Additional funds have been provided in the FY 1988-90 biennium budget to continue this demonstration project. HRSD has further modified the BNR system at York STP to evaluate full scale operation of the nutrient removal system that was developed on a small scale for the Virginia Initiative Plant (VIP - the upgraded/expanded Lamberts Point facility).

The attached Figure 2 presents influent and effluent total phosphorus concentrations at the York STP, for the period from July 1986 to October 1987. Air Products has reviewed the data generated by the York STP demonstration to date, and it is their contention that the BNR system is capable of achieving a monthly average effluent phosphorus concentration of 2.0 mg/l. They state that this can be achieved if a modification is made to the operating scheme at York STP. This change involves altering the rate of return sludge pumping from the settling tanks to coincide with the diurnal influent flow variations (peak flows during daytime, low flows at night). HRSD currently operates the return sludge pumping at a constant rate, and Air Products feels that if a "solids inventory" is maintained (a constant ratio of biodegradable organics to microorganisms) in the BNR units, then the phosphorus removal rates will improve. Air Products states that this mode of operation has successfully improved the efficiency of the BNR system at other plants in the country.

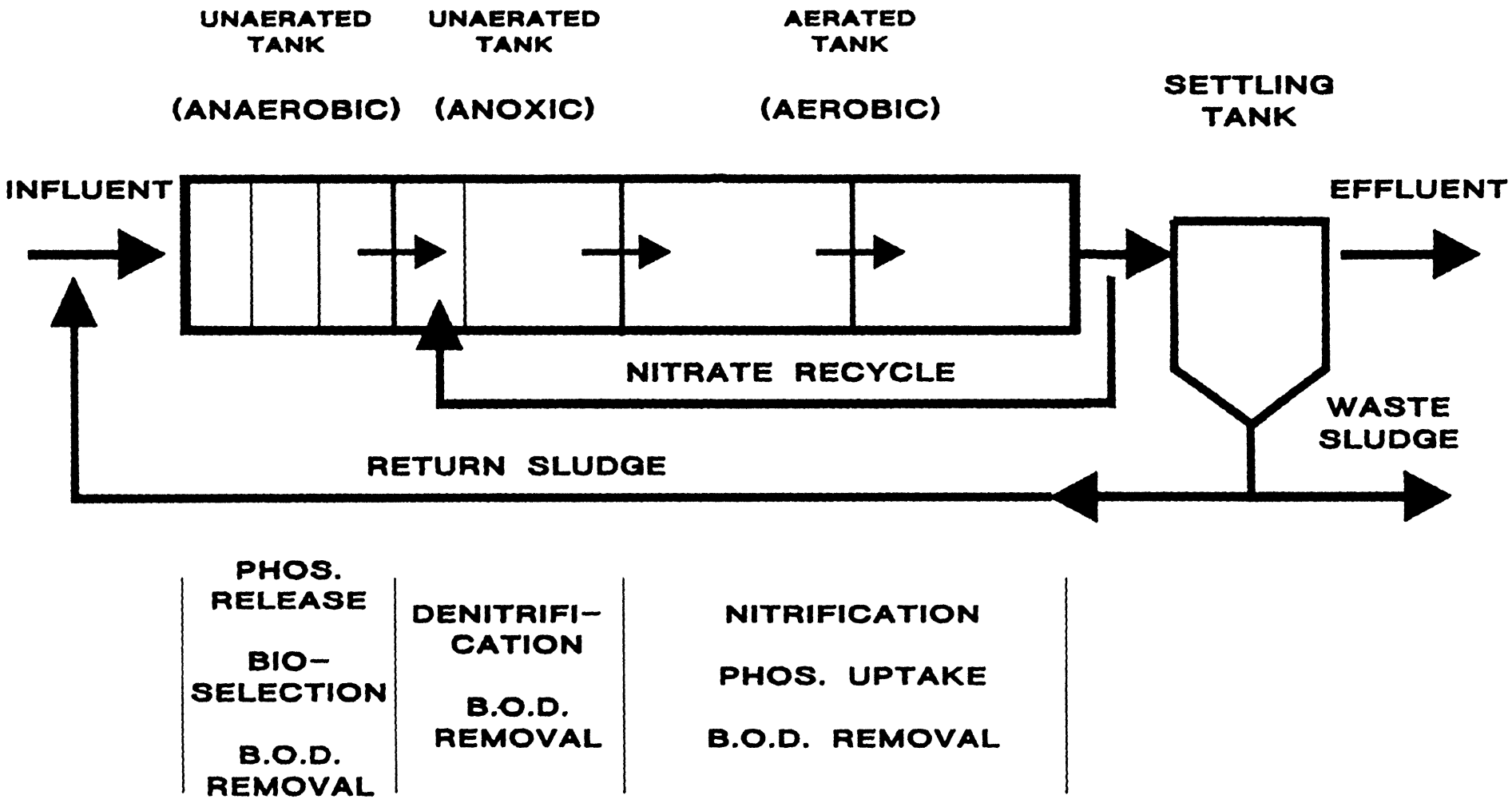
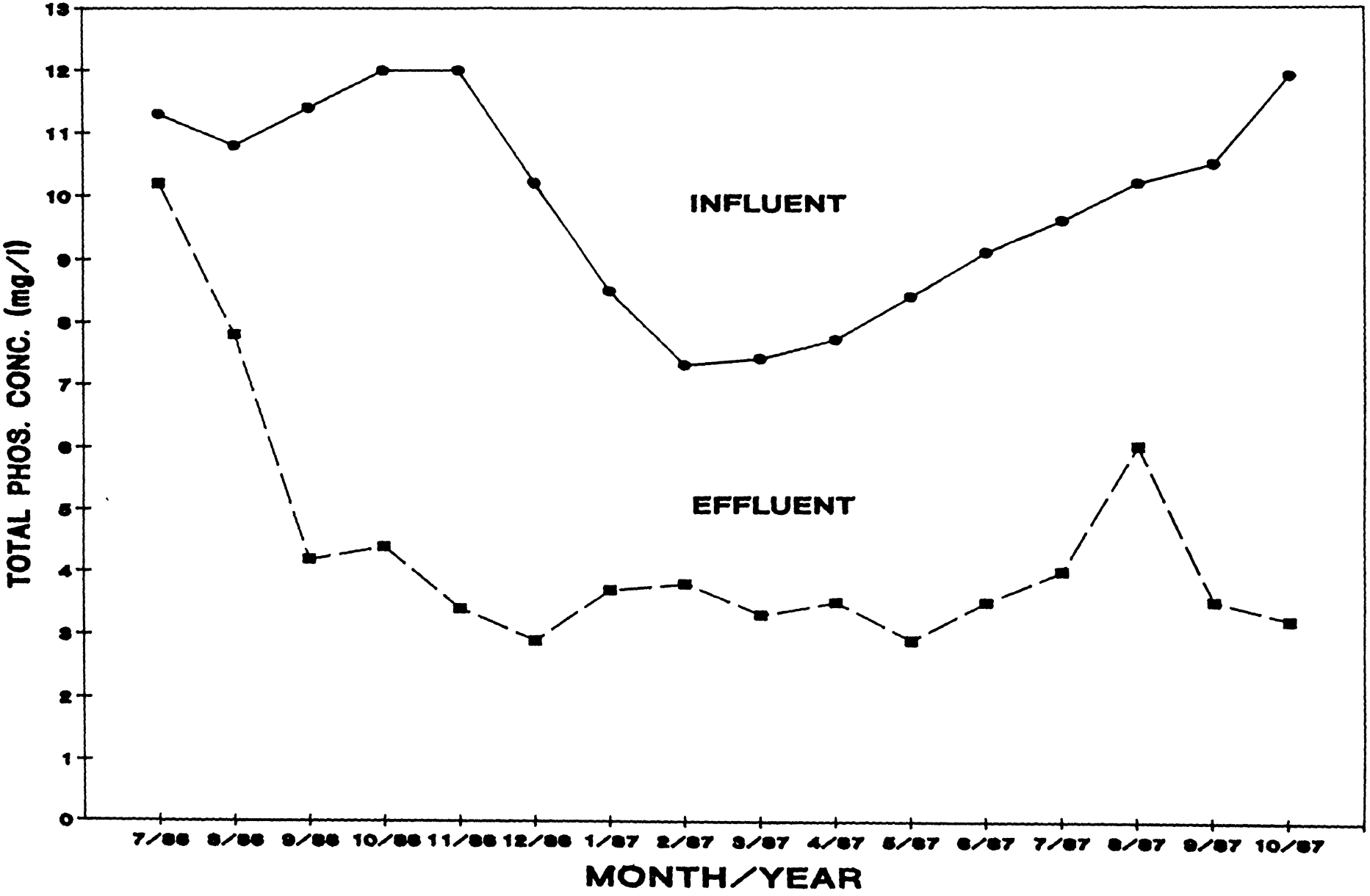


FIGURE 1: BIOLOGICAL NUTRIENT REMOVAL

(PHOSPHORUS AND NITROGEN)

FIGURE 2: BIOLOGICAL NUTRIENT REMOVAL

HRSD-YORK STP



TOWN OF KILMARNOCK - BIOLOGICAL PHOSPHORUS REMOVAL

The Town of Kilmarnock received a $160,189 grant in April 1986 to demonstrate the effectiveness of Biological Phosphorus Removal (BPR) at their sewage treatment plant (STP). The Town used a BPR process patented by Air Products, Inc., called A/O (Anaerobic/Oxic). The STP was retrofitted with temporary baffle walls, which partitioned one of the plant's two extended aeration basins into zones providing the correct environmental conditions for the operation of BPR. Mixers were added to stir the wastewater in the anaerobic zone, and flexible polyester curtains routed the flow through the aerobic zone (see attached Figure 3 for flow diagram). The Kilmarnock STP has a design capacity of 200,000 gallons per day (GPD), and is presently treating an average of about 100,000 GPD. During the demonstration, half of the flow through the plant was treated by the A/O system, and half received conventional treatment, which acted as the study control unit for comparison.

Since the Town had to use an outside contractor for the plant retrofit work, BPR start-up did not occur until February 1987. Unlike the HRSD-York River project, achieving BPR operation was not as easily done in Kilmarnock. Several severe storms occurred right after start-up, increasing I/I to the point of washing out the plant's aeration basins. Also, the STP could not handle excessive amounts of sand and grit properly, which caused problems for the submersible mixing pumps in the BPR unit. During April 1987, the process of BPR was partially established, although the effluent phosphorus levels did not decrease. Total plant flows during the period averaged approximately 110,000 gpd.

During the first quarter of BPR operation, only modest phosphorus removal rates were achieved. The average effluent phosphorus concentrations were 4.9 mg/l (total) and 4.6 mg/l (soluble); the removal rates being only 35% and 30%, respectively. System performance improved over time, and the project investigators determined that steady state operating conditions were achieved near the end of July 1987. At that time they began optimizing the system to attain the highest removal efficiency. Total plant flows during this period averaged about 100,000 gpd.

Removal rates, during the period when the BPR system was considered stabilized, were 57% for total phosphorus (effluent = 2.9 mg/l) and 66% for soluble phosphorus (effluent = 1.9 mg/l). By comparison, no BPR was observed in the unmodified treatment unit. It appeared that some incidental nitrogen removal was also occurring in the BPR unit. This was because nitrification occurred in the aerated zone, with denitrification taking place in the clarifier and the digester sections of the unit. Nitrification was also observed in the unmodified unit, but denitrification did not take place. Since the primary focus of this study was BPR operation, the nitrogen removal system was never optimized, nor was there a major effort to maintain the conditions necessary to achieve nitrogen removal on a consistent basis.

TOWN OF KILMARNOCK - BIOLOGICAL PHOSPHORUS REMOVAL (cont.)

The operational phase of this project terminated at the end of January 1988. If feasible, the Town would like to keep the BPR system on-line because they feel it has improved their plant's performance. The decision to maintain BPR will depend on several factors, including the ability of the temporary retrofit to stay in service, and the issue of the license fee for use of a patented system.

One of the major conclusions made by the principal investigators for the project was the ability to install and operate a BPR system in a facility like Kilmarnock's STP had been successfully demonstrated. They further state that under the correct operating conditions, effluent phosphorus concentrations of 2.0 mg/l (total-P) and 1.2 mg/l (soluable-P) can be achieved over a 30-day average.

Other observations made from the demonstration work were:

1. Successful BPR operation resulted in an increase in sludge production, on the order of 25% above the unmodified unit. However, the additional sludge generated had good settling and dewatering characteristics.

2. A reliable mixing device is needed for plants like Kilmarnock STP, that can tolerate large amounts of solids and grit;

3. An accurate means of controlling the return sludge rate under varying flow conditions is necessary, especially during the night hours; and,

4. Removal of excessive I/I flows in the collection system is required, in order to prevent hydraulic overloading of the BPR system.

The attached Figure 4 presents influent and effluent total phosphorus concentrations at the Kilmarnock STP (modified treatment unit), for the period from March 1987 to January 1988.

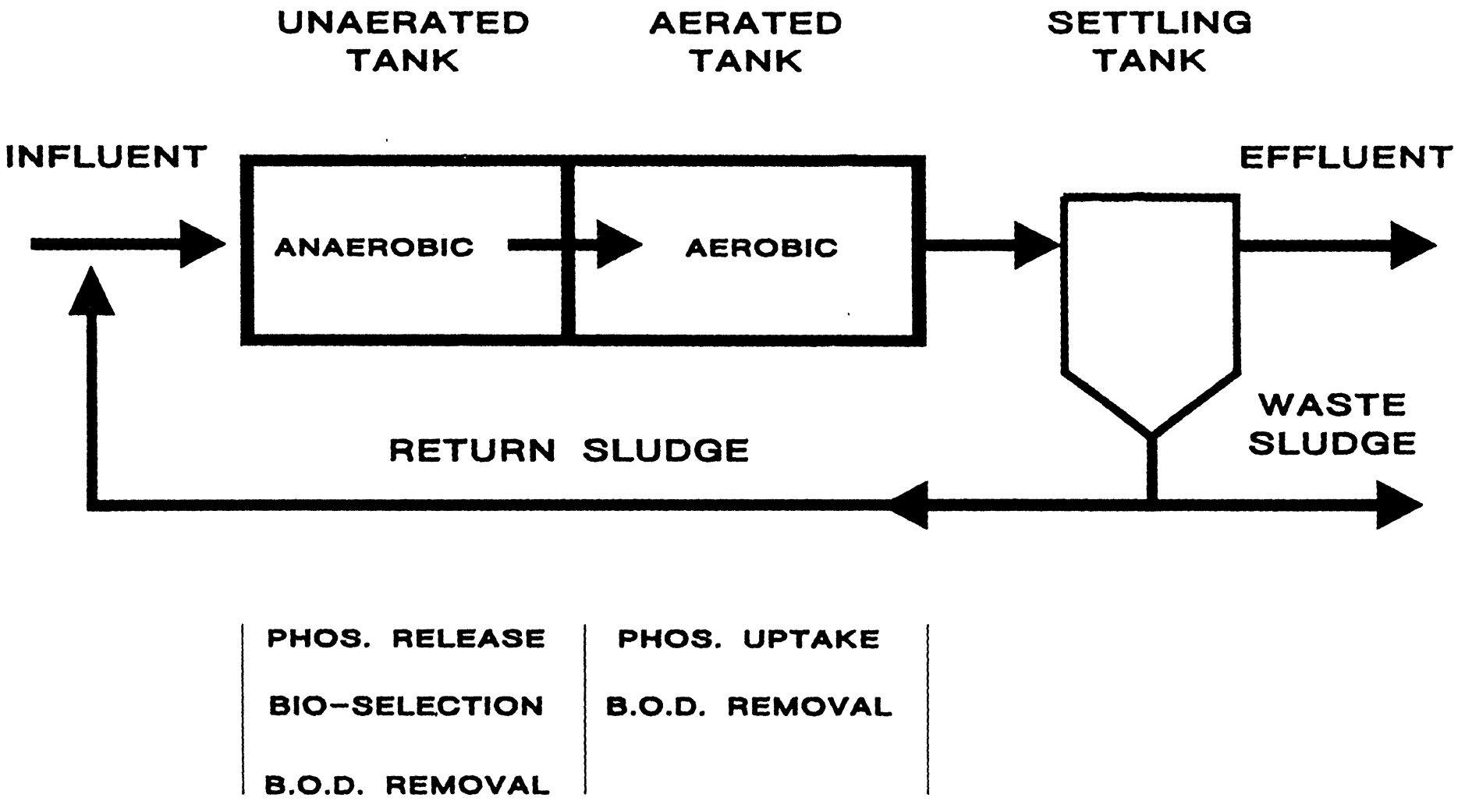
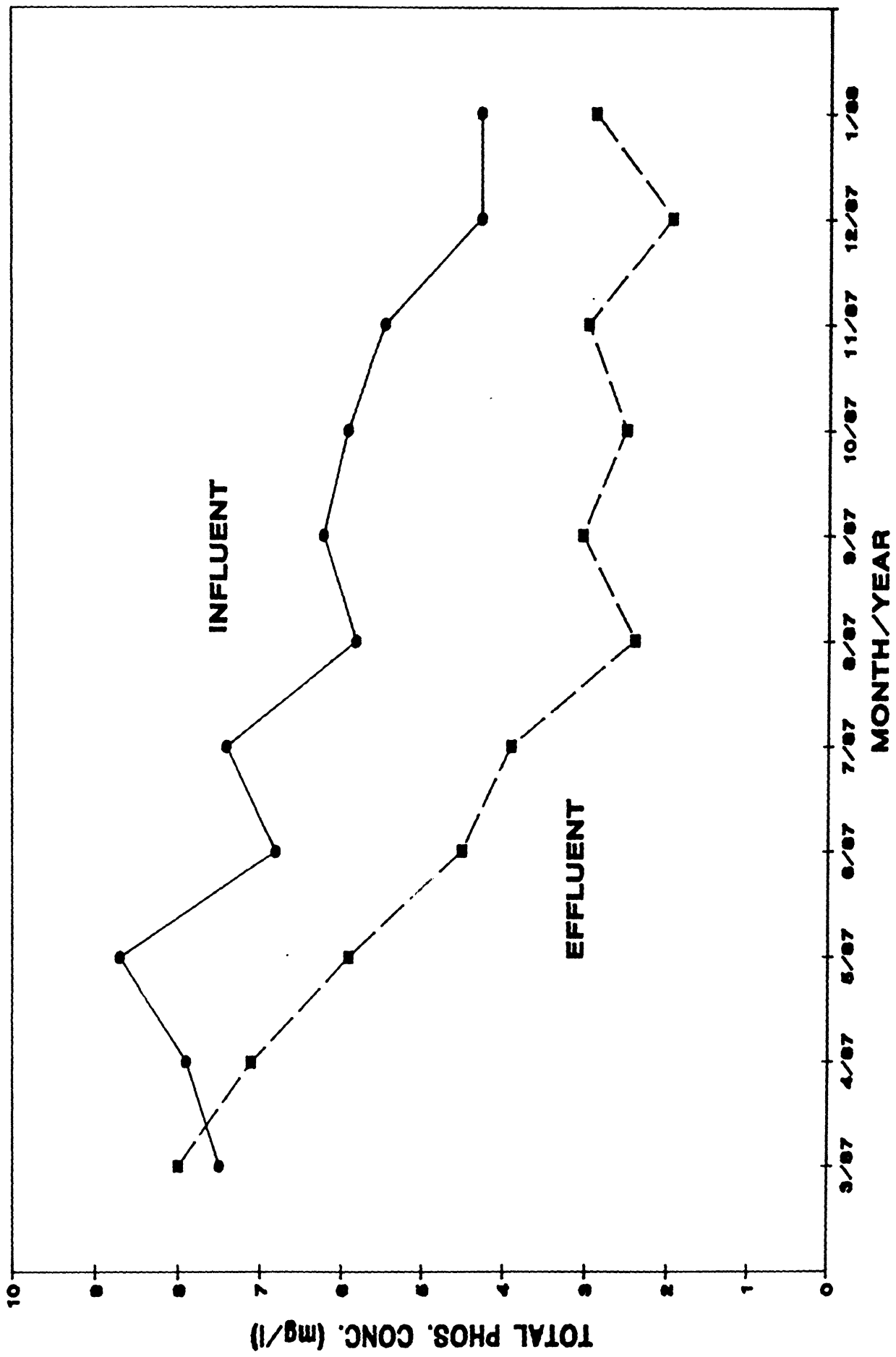


FIGURE 3: BIOLOGICAL PHOSPHORUS REMOVAL

FIGURE 4: BIOLOGICAL PHOSPHORUS REMOVAL

KILMARNOCK STP



FREDERICKSBURG - PHOSPHORUS REMOVAL BY SIMPLE CHEMICAL ADDITION (SIMULTANEOUS PRECIPITATION)

The City of Fredericksburg received an $11,850 grant in March 1986 to evaluate the phosphorus removal capability of a simple chemical addition system at their sewage treatment plant (STP). The City operates a trickling filter STP with a design capacity (per their discharge permit) of 1.49 million gallons per day (MGD). Between November 1986 and March 1987, performance data was collected at this STP to determine the levels of "casual" phosphorus removal attainable using chemicals primarily for BOD_5 and total suspended solids removal, and with unsophisticated process controls. No special efforts were made to modify the treatment facility or its operational procedures to enhance phosphorus removal during the study period. The Fredericksburg STP increases BOD_5 and total suspended solids removal with chemical addition of alum and polymer upstream from the primary settling tanks (see attached Figure 5 for flow diagram).

The average phosphorus removal rate during the study was 63%, with an average effluent phosphorus concentration of 2.5 mg/l. For short periods when wastewater flows were not influenced by I/I and influent wastewater strength was considered "normal", phosphorus removal rates in the 70% to 80% range were observed. By comparison, during an unrelated study (June - July 1986) when no chemicals were added to the system, phosphorus removal rates averaged only 19%.

The project investigators estimated that if a 60% overall phosphorus removal requirement were imposed on a facility like this STP, the capital cost to modify the plant would be about $36,000, and annual operating costs would be approximately $136,000. This plant would not be a likely candidate for biological phosphorus removal, because it is a "fixed growth" system.

The City provided chemical feed data along with the phosphorus removal information in their final project report. The alum dosage to phosphorus removal ratio ranged between 1.29 to 1.66 pounds of alum for each pound of phosphorus removed. The literature value for the alum dosage needed to achieve 75% phosphorus reduction in primary settling facilities ranges from 1.25 to 1.5 pounds of alum per pound of phosphorus removed, with an average value of 1.4:1. Therefore, there was a reasonable correlation between the demonstration project results and previously conducted research.

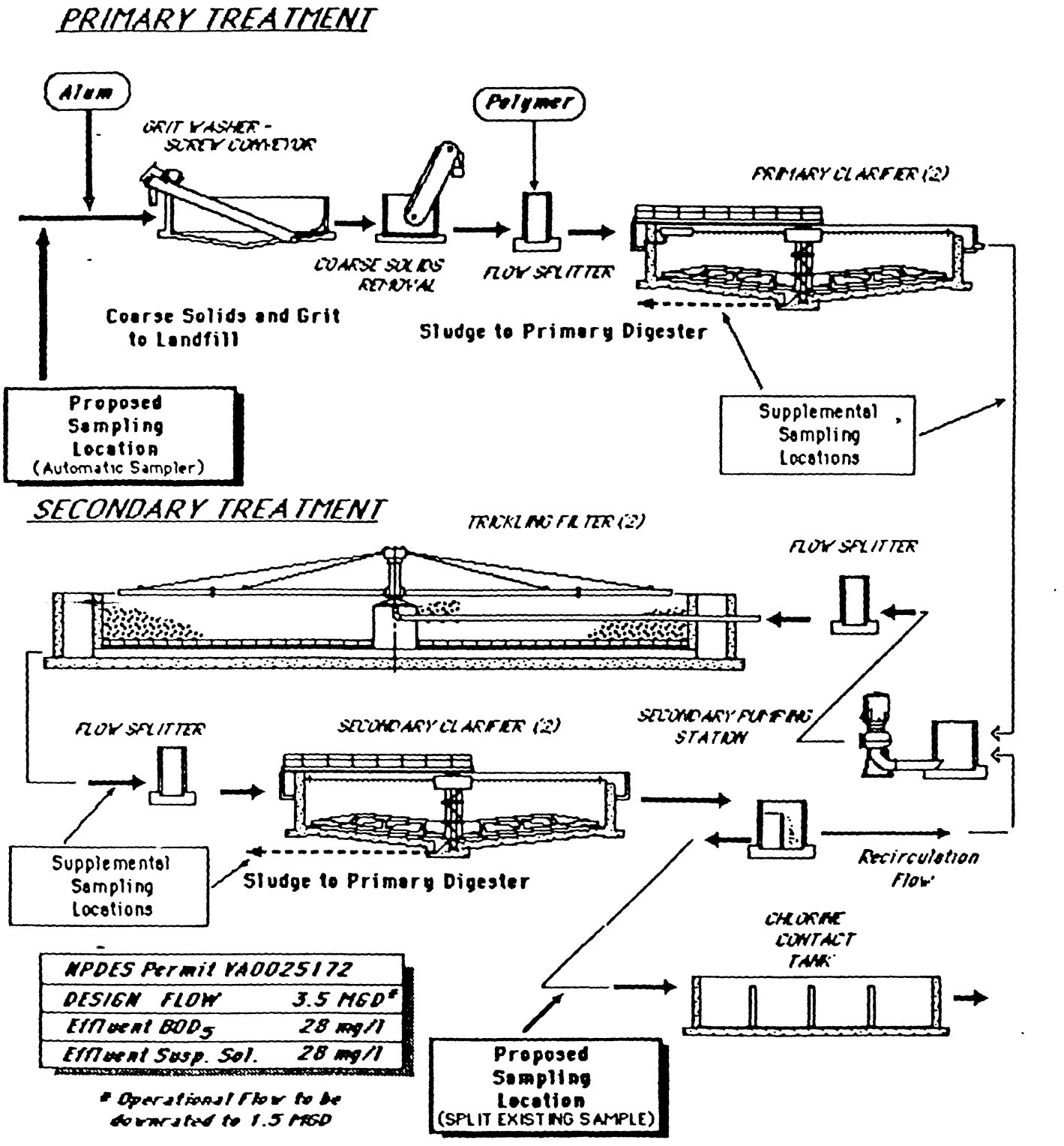


FIGURE 5: CITY OF FREDERICKSBURG
WASTEWATER TREATMENT PLANT PROCESS SCHEMATIC

APPENDIX E

(1987 Chesapeake Bay Agreement)

THE CHESAPEAKE BAY IS A NATIONAL TREASURE and a resource of worldwide significance. Its ecological, economic, and cultural importance are felt far beyond its waters and the communities that line its shores. Man's use and abuse of its bounty, however, together with the continued growth and development of population in its watershed, have taken a toll on the Bay system. In recent decades, the Bay has suffered serious declines in quality and productivity. ◊ *REPRESENTING* the Federal government and the States which surround the Chesapeake Bay, we acknowledge our stake in the resources of the Bay and accept our share of responsibility for its current condition. We are determined that this decline will be reversed. In response, all of our jurisdictions have embarked on ambitious programs to protect our shared resource and restore it to a more productive state. ◊ *IN* 1980, the legislatures of Virginia and Maryland established the Chesapeake Bay Commission to coordinate interstate planning and programs from a legislative perspective. In 1985, Pennsylvania joined the Commission. And, in 1983, Virginia, Maryland, Pennsylvania, the District of Columbia, the U.S. Environmental Protection Agency and the Chesapeake Bay Commission formally agreed to a cooperative approach to this undertaking and established specific mechanisms for its coordination. Since 1983, our joint commitment has carried us to new levels of governmental cooperation and scientific understanding. It has formed a firm base for the future success of this long-term program. The extent and complexity of our task now call for an expanded and refined agreement to guide our efforts toward the twenty-first century. ◊ *RECOGNIZING* that the Chesapeake Bay's importance transcends regional boundaries, we commit to managing the Chesapeake Bay as an integrated ecosystem and pledge our best efforts to achieve the goals in this Agreement. We propose a series of objectives that will establish a policy and institutional framework for continued cooperative efforts to restore and protect Chesapeake Bay. We further commit to specific actions to achieve those objectives. The implementation of these commitments will be reviewed annually and additional commitments developed as needed.

GOALS AND PRIORITY COMMITMENTS

THIS NEW AGREEMENT CONTAINS Goals and Priority Commitments for Living Resources; Water Quality; Population Growth and Development; Public Information, Education and Participation; Public Access; and Governance. ◊ The parties to this 1987 Agreement are the U.S. Environmental Protection Agency representing the Federal government, the District of Columbia, the State of Maryland and the Commonwealths of Pennsylvania and Virginia (hereinafter the "States") and the Chesapeake Bay Commission. This Agreement may be amended and attachments added in the future by unanimous action of the Chesapeake Executive Council.

LIVING RESOURCES

GOAL: *PROVIDE FOR THE RESTORATION AND PROTECTION OF THE LIVING RESOURCES, THEIR HABITATS AND ECOLOGICAL RELATIONSHIPS.* The productivity, diversity and abundance of living resources are the best ultimate measures of the Chesapeake Bay's condition. These living resources are the main focus of the restoration and protection effort. Some species of shellfish and finfish are of immense commercial and recreational value to man. Others are valuable because they are part of the vast array of plant and animal life that make up the Chesapeake Bay ecosystem on which all species depend. We recognize that the entire natural system must be healthy and productive. We will determine the essential elements of habitat and environmental quality necessary to support living resources and will see that these conditions are attained and maintained. We will also manage the harvest of and monitor populations of commercially, recreationally and ecologically valuable species to ensure sustained, viable stocks. We recognize that to be successful, these actions must be carried out in an integrated and coordinated manner across the whole Bay system.

OBJECTIVES:

- ◊ Restore, enhance, protect and manage submerged aquatic vegetation.
- ◊ Protect, enhance and restore wetlands, coastal sand dunes, forest buffers and other shoreline and riverline systems important to water quality and habitat.
- ◊ Conserve soil resources and reduce erosion and sedimentation to protect Bay habitat.
- ◊ Maintain freshwater flow regimes necessary to sustain estuarine habitats, including, where appropriate, establishing minimum in-stream flows.
- ◊ Develop compatible Bay-wide stock assessment programs.
- ◊ Develop Bay-wide fisheries management strategies and develop complementary state programs and plans to protect and restore the finfish and shellfish stocks of the Bay, especially the freshwater and estuarine spawners.
- ◊ Provide for the restoration of shellfish stocks in the Bay, especially the abundance of commercially important species.
- ◊ Restore, enhance and protect waterfowl and wildlife.

COMMITMENT

TO ACHIEVE THIS GOAL WE AGREE:

- ◊ by *January 1988*, to develop and adopt guidelines for the protection of water quality and habitat conditions necessary to support the living resources found in the Chesapeake Bay system, and to use these guidelines in the implementation of water quality and habitat protection programs.
- ◊ by *July 1988*, to develop, adopt and begin to implement a Bay-wide plan for the assessment of commercially, recreationally and selected ecologically valuable species.
- ◊ by *July 1988*, to adopt a schedule for the development of Bay-wide resource management strategies for commercially, recreationally and selected ecologically valuable species.
- ◊ by *July 1989*, to develop, adopt and begin to implement Bay-wide management plans for oysters, blue crabs and American Shad. Plans for other major commercially, recreationally and ecologically valuable species should be initiated by 1990.
- ◊ by *December 1988*, to develop a Bay-wide policy for the protection of tidal and non-tidal wetlands.
- ◊ Provide for fish passage at dams, and remove stream blockages wherever necessary to restore natural passage for migratory fish.

WATER QUALITY

GOAL *REDUCE AND CONTROL POINT AND NONPOINT SOURCES OF POLLUTION TO ATTAIN THE WATER QUALITY CONDITION NECESSARY TO SUPPORT THE LIVING RESOURCES OF THE BAY.* The improvement and maintenance of water quality are the single most critical elements in the overall restoration and protection of the Chesapeake Bay. Water is the medium in which all living resources of the bay live, and their ability to survive and flourish is directly dependent on it. ◇ To ensure the productivity of the living resources of the Bay, we must clearly establish the water quality conditions they require and must then attain and maintain those conditions. Foremost, we must improve or maintain dissolved oxygen concentrations in the Bay and its tributaries through a continued and expanded commitment to the reduction of nutrients from both point and nonpoint sources. We must do the same for toxics and conventional pollutants. To be effective, we will develop basin-wide implementation plans for the control and reduction of pollutants which are based on our best understanding (including that derived from modeling) of the Bay and its tributaries as an integrated system.

OBJECTIVES

- ◇ Provide timely construction and maintenance of public and private sewerage facilities to assure control of pollutant discharges.
- ◇ Reduce the discharge of untreated or inadequately treated sewage into Bay waters from such sources as combined sewer overflows, leaking sewage systems, and failing septic systems.
- ◇ Evaluate and institute, where appropriate, alternative technologies for point source pollution control, such as biological nutrient removal and land application of effluent to reduce pollution loads in a cost-effective manner.
- ◇ Establish and enforce pollutant limitations to ensure compliance with water quality laws.
- ◇ Reduce the levels of nonpoint sources of pollution.
- ◇ Reduce sedimentation by strengthening enforcement of existing control regulations.
- ◇ Eliminate pollutant discharges from recreational boats.
- ◇ Identify and control toxic discharges to the Bay system, including metals and toxic organics, to protect water quality, aquatic resources and human health through implementation and enforcement of the states National Pollutant Discharge Elimination System permit programs and other programs.
- ◇ Reduce chlorine discharges in critical finfish and shellfish areas. Minimize water pollution incidents and provide adequate response to pollutant spills.
- ◇ Manage sewage sludge, dredged spoil and hazardous wastes to protect the Bay system.
- ◇ Manage groundwater to protect the water quality of the Bay.
- ◇ Quantify the impacts and identify the sources of atmospheric inputs on the Bay system.

COMMITMENT

TO ACHIEVE THIS GOAL WE AGREE:

- ◇ by *July 1988*, to develop, adopt and begin implementation of a basin-wide strategy to equitably achieve by the year 2000 at least a 40 percent reduction of nitrogen and phosphorus entering the main stem of the Chesapeake Bay. The strategy should be based on agreed upon 1985 point source loads and on nonpoint loads in an average rainfall year.
- ◇ by *December 1991*, to re-evaluate the 40 percent reduction target based on the results of modeling, research, monitoring and other information available at that time.
- ◇ by *December 1988*, to develop, adopt and begin implementation of a basin-wide strategy to achieve a reduction of toxics consistent with the Water Quality Act of 1987 which will ensure protection of human health and living resources. The strategy will cover both point and nonpoint sources, monitoring protocols, enforcement of pretreatment regulations and methods for dealing with in-place toxic sediments where necessary.
- ◇ by *July 1988*, to develop and adopt, as required by the Water Quality Act of 1987, a basin-wide implementation strategy for the management and control of conventional pollutants entering the Chesapeake Bay system from point and nonpoint sources.
- ◇ by *July 1988*, the Environmental Protection Agency, acting for the federal government, will develop, adopt and begin implementation of a strategy for the control and reduction of point and nonpoint sources of nutrient, toxic and conventional pollution from all federal facilities.

POPULATION GROWTH AND DEVELOPMENT

GOAL *PLAN FOR AND MANAGE THE ADVERSE ENVIRONMENTAL EFFECTS OF HUMAN POPULATION GROWTH AND LAND DEVELOPMENT IN THE CHESAPEAKE BAY WATERSHED.* There is a clear correlation between population growth and associated development and environmental degradation in the Chesapeake Bay system. Enhancing, or even maintaining, the quality of the Bay while accommodating growth will frequently involve difficult decisions and restrictions and will require continued and enhanced commitment to proper development standards. The states and the federal government will assert the full measure of their authority to mitigate the potential adverse effects of continued growth. ◊ Local jurisdictions have been delegated authority over many decisions regarding growth and development which have both direct and indirect effects on the Chesapeake Bay system and its living resources. The role of local governments in the restoration and protection effort will be given proper recognition and support through state and federal resources. ◊ States will engage in an active partnership with local governments to establish policy guidelines to manage growth and development.

OBJECTIVES

- ◊ Designate a state-level office responsible for ensuring consistency with this Agreement among the agencies responsible for comprehensive oversight of development activity, including infrastructure planning, capital budgets, land preservation and waste management activities.
- ◊ Provide local governments with financial and technical assistance to continue and expand their management efforts.
- ◊ Consult with local government representatives in the development of Chesapeake Bay restoration and protection plans and programs.
- ◊ Identify and give public recognition to innovative and otherwise noteworthy examples of local government restoration and protection-related programs.
- ◊ Assure that government development projects meet all environmental requirements.
- ◊ Promote, among local, state and federal governments, and the private sector, the use of innovative techniques to avoid and, where necessary, mitigate the adverse impacts of growth.

COMMITMENT

TO ACHIEVE THIS GOAL WE AGREE:

- ◊ to commission a panel of experts to report, by *December 1988*, on anticipated population growth and land development patterns in the Bay region through the year 2020, the infrastructure requirements necessary to serve growth and development, environmental programs needed to improve Bay resources while accommodating growth, alternative means of managing and directing growth and alternative mechanisms for financing governmental services and environmental controls. The panel of experts will consist of twelve members: three each from Virginia, Maryland and Pennsylvania, and one each from the District of Columbia, Environmental Protection Agency and the Chesapeake Bay Commission.
- ◊ by *January 1989*, to adopt development policies and guidelines designed to reduce adverse impacts on the water quality and living resources of the Bay, including minimum best management practices for development and to cooperatively assist local governments in evaluating land-use and development decisions within their purview, consistent with the policies and guidelines.
- ◊ to evaluate state and federal development projects in light of their potential impacts on the water quality and living resources of the Chesapeake Bay, and design and carry out each state and federal development project so as to serve as a model for the private sector in terms of land-use practices.
- ◊ by *December 1988*, to develop a strategy to provide incentives, technical assistance and guidance to local governments to actively encourage them to incorporate protection of tidal and non-tidal wetlands and fragile natural areas in their land-use planning, water and sewer planning, construction and other growth-related management processes.

PUBLIC INFORMATION EDUCATION AND PARTICIPATION

GOAL *PROMOTE GREATER UNDERSTANDING AMONG CITIZENS ABOUT THE CHESAPEAKE BAY SYSTEM, THE PROBLEMS FACING IT AND POLICIES AND PROGRAMS DESIGNED TO HELP IT, AND TO FOSTER INDIVIDUAL RESPONSIBILITY AND STEWARDSHIP OF THE BAY'S RESOURCES.*

GOAL *PROVIDE INCREASED OPPORTUNITIES FOR CITIZENS TO PARTICIPATE IN DECISIONS AND PROGRAMS AFFECTING THE BAY.* The understanding and support of the general public and interest groups are essential to sustaining the long-term commitment to the restoration and protection of the Chesapeake Bay system and its living resources. Citizens must have opportunities to learn about that system and associated management policies and programs and must be given opportunities to contribute ideas about how best to manage that natural system.

OBJECTIVES

- ◊ Provide timely information on the progress of the restoration program.
- ◊ Assure a continuing process of public input and participation in policy decisions affecting the Bay.
- ◊ Enhance Bay-oriented education opportunities to increase public awareness and understanding of the Bay system.
- ◊ Provide curricula and field experiences for students.
- ◊ Promote opportunities to involve citizens directly in Bay restoration efforts.
- ◊ Coordinate the production and distribution of Bay information and education materials.

COMMITMENT

TO ACHIEVE THESE GOALS WE AGREE:

- ◊ to conduct coordinated education and information programs to inform the general public, local governments, business, students, community associations and others of their roles, responsibilities and opportunities in the restoration and protection effort, and to promote public involvement in the management and decision-making process.
- ◊ to provide for public review and comment on all implementation plans developed pursuant to this agreement.
- ◊ by *March 1988*, to develop state and federal communication plans for public information, education and participation, and *1988*, to develop a unified, Bay-wide communication plan.
- ◊ to promote Chesapeake Bay restoration efforts by establishing an annual Bay-wide series of Chesapeake Bay Watershed Awareness events, to include a Governor's Cup Fishing Tournament.

PUBLIC ACCESS

GOAL *PROMOTE INCREASED OPPORTUNITIES FOR PUBLIC APPRECIATION AND ENJOYMENT OF THE BAY AND ITS TRIBUTARIES.* Interest in and commitment to the Chesapeake Bay and its tributaries are greatly affected by personal contact with that natural system. Consequently, improved opportunities for access to the shores and waters of the system are essential if public awareness and support are to be maintained and increased.

OBJECTIVES

- ◊ Improve and maintain access to the Bay including public beaches, parks and forested lands.
- ◊ Improve opportunities for recreational and commercial fishing.
- ◊ Secure shoreline acreage to maintain open space and provide opportunities for passive recreation.
- ◊ Secure necessary acreage to protect unique habitat and environmentally sensitive areas.

COMMITMENT

TO ACHIEVE THIS GOAL WE AGREE:

- ◊ to intensify our efforts to improve and expand public access opportunities being made available by the federal government, the states, and local governments, by developing a strategy, which includes an inventory of current access opportunities by *July 1988*, which targets state and federal actions to secure additional tidal shorefront acres by *December 1990* along the Bay and its tributaries.
- ◊ by *December 1988*, to prepare a comprehensive guide to access facilities and the natural resource system for the tidal Chesapeake Bay.

GOVERNANCE

GOAL: *SUPPORT AND ENHANCE THE PRESENT COMPREHENSIVE, COOPERATIVE AND COORDINATED APPROACH TOWARD MANAGEMENT OF THE CHESAPEAKE BAY SYSTEM.*

GOAL: *PROVIDE FOR CONTINUITY OF MANAGEMENT EFFORTS AND PERPETUATION OF COMMITMENTS NECESSARY TO ENSURE LONG-TERM RESULTS.*

The cooperation necessary to sustain an effective Chesapeake Bay restoration and protection effort requires a formal working arrangement involving the states and the federal government. That institutional arrangement must allow for and promote voluntary individual actions coordinated within a well-defined context of the individual responsibilities and authorities of each state and the federal government. It must also ensure that actions which require a concerted, Bay-wide approach be addressed in common and without duplication. One of the principal functions of the coordinating institution is to develop strategic plans and oversee their implementation, based on advice from the public, from the scientific community and from user groups. ◊ In addition, the coordinating body must exert leadership to marshal public support, and it must be accountable for progress made under the terms of this agreement. The coordinating body will continue to be called the Chesapeake Executive Council. The Chesapeake Executive Council shall be comprised of the Governors, the Mayor of the District of Columbia, the Administrator of the Environmental Protection Agency and the Chairman of the Chesapeake Bay Commission. The chairmanship of the Council shall rotate annually as determined by the Council. The term of the Chairman shall be one year. The Administrator of the Environmental Protection Agency shall represent the federal government and the Chairman of the Chesapeake Bay Commission shall represent its members.

OBJECTIVES.

- ◊ Continue to demonstrate strong, regional leadership by convening an annual public meeting of the Chesapeake Executive Council.
- ◊ Continue to support the Chesapeake Executive Council and provide for technical and public policy advice by maintaining strong advisory committees.
- ◊ Coordinate Bay management activities and develop and maintain effective mechanisms for accountability.
- ◊ The Chesapeake Bay Liaison Office shall provide staff support to the Chesapeake Executive Council by providing analyses and data management, and by generating reports related to the overall program. The Implementation Committee shall provide guidance to the CBLO Director in all matters relating to support for the Council and their supporting committees, subcommittees and work groups including the development of all plans and other documents associated with the Council.
- ◊ Examine the feasibility of joint funding support of the Chesapeake Bay Liaison Office.
- ◊ Track and evaluate activities which may affect estuarine water quality and resources and report at least annually.
- ◊ Develop and maintain a coordinated Chesapeake Bay data management system.
- ◊ Continue to implement a coordinated Bay-wide monitoring system and to develop a Bay-wide living resources monitoring system.
- ◊ Develop and implement a coordinated Bay-wide research program.

COMMITMENT.

TO ACHIEVE THESE GOALS WE AGREE:

- ◊ to develop an annual Chesapeake Bay work plan endorsed by the Chesapeake Executive Council.
- ◊ to continue to support Bay-wide environmental monitoring and research to provide the technical and scientific information necessary to support management decisions.
- ◊ to strengthen the Chesapeake Bay Liaison Office by assigning, as appropriate, staff persons from each jurisdiction and from participating federal agencies to assist with the technical support functions of that office.
- ◊ by *July 1988*, to develop and adopt a comprehensive research plan to be evaluated and updated annually to address the technical needs of the Chesapeake Bay Program.
- ◊ by *July 1988*, develop a Bay-wide monitoring plan for selected commercially, recreationally and ecologically valuable species.
- ◊ by *March 1988*, to establish a local government advisory committee to the Chesapeake Executive Council and charge that committee to develop a strategy for local government participation in the Bay program.
- ◊ to consider and review the feasibility of establishing an independent Chesapeake Bay Executive Board.
- ◊ by *July 1988*, the Environmental Protection Agency, acting for the federal government, will develop, a coordinated, federal agency workplan which identifies specific federal programs to be integrated into a coordinated federal effort to support the restoration of the Chesapeake Bay.

BY THIS AGREEMENT, we reaffirm our commitment to restore and protect the ecological integrity, productivity and beneficial uses of the Chesapeake Bay system. We agree to report in *January 1989* on progress made in fulfilling the commitments in this agreement, and to consider at that time additional commitments. The implementation strategies which will be developed pursuant to this agreement will be appended as annexes, and annual reports will include an accounting of progress made on each strategy.

December 15, 1987
(Date)

FOR THE COMMONWEALTH OF VIRGINIA

FOR THE STATE OF MARYLAND

FOR THE COMMONWEALTH OF PENNSYLVANIA

FOR THE UNITED STATES OF AMERICA

FOR THE DISTRICT OF COLUMBIA

, Mayor

FOR THE CHESAPEAKE BAY COMMISSION

ACKNOWLEDGEMENTS

Anonymous / Baltimore Storage Company, Agents for Mayflower Van Lines / Bell Nursery and Crestone Plantings / Elizabeth Bellitty - Cantler's Restaurant / The Chesapeake Bay Foundation / Citizens Program For The Chesapeake Bay - Crown Central Petroleum Corporation - Fadley's Seafood / A. M. Fleming Company - First National Bank of Maryland / Harbour Court Hotel / Homewood Gardens / Hyatt Regency Hotel / KRS Remote Sensing (A Kodak Company) / The Maryland Watermen's Association, Inc. - Naval Academy Band Commercial Unit - Nick's Seafood / The Ward Foundation - F. E. Worthington, Inc.

Document printing sponsored by First National Bank of Maryland. Dissemination jointly sponsored by Crown Central Petroleum Corporation and by Bell Nursery and Crestone Plantings