THE 1991 RE-EVALUATION OF THE CHESAPEAKE BAY NUTRIENT REDUCTION STRATEGY

A Summary Prepared by the 1991 Re-Evaluation Workgroup

June, 1991

I. Introduction

In December of 1987, the Governors of Maryland, Virginia and Pennsylvania, the Mayor of the District of Columbia, the chairman of the Chesapeake Bay Commission, and the administrator of the Environmental Protection Agency signed the "1987 Bay Agreement". One of the most dramatic and challenging commitments contained within this document was 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." This reduction of nutrient loadings was projected to result in an appreciable improvement in the levels of dissolved oxygen and chlorophyll (algae) in the Bay's mainstem (Fig. 1) The signatories also agreed "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.

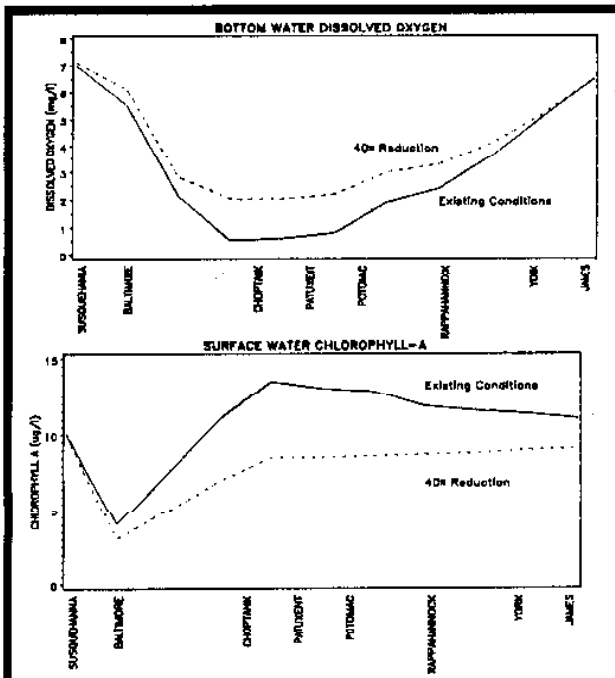

Fig. 1. Longitudinal plots of mainstem dissolved oxygen and chlorophyll "a" as projected by the 1987 2-dimensional model. The solid line represents the model calibration for 1985 water quality conditions. The dashed line represents the model projection of water quality resulting from a 40% reduction in nutrient loads.

In July of 1988, a detailed strategy was developed to implement this commitment in each of the jurisdictions. A phased approach was adopted as follows:

Phase I: From benchmark loading year of 1985 to signing of agreement in 1987.

Phase II: From 1987 to Re-Evaluation in 1991.

Phase III: From 1991 to the year 2000.

The plans of each jurisdiction were apportioned among the various phases. The Bay-wide loading projections to the year 2000 and progress for point and nonpoint sources through 1989 are shown in Figures 2 and 3.

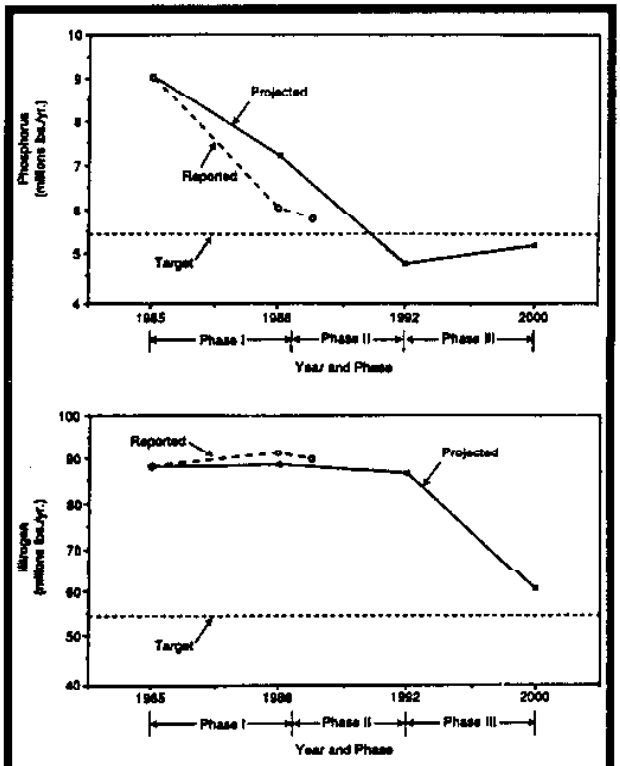

Fig. 2. Projected and reported point source phosphorus and nitrogen loads to Chesapeake Bay.

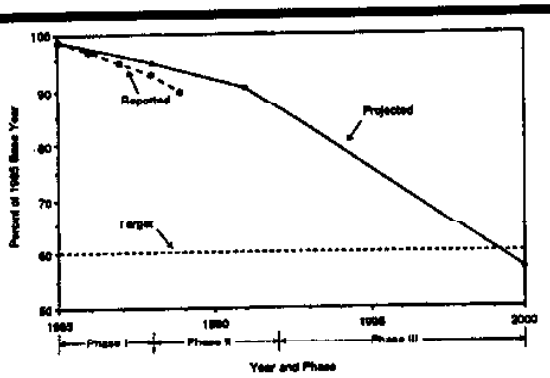

Fig. 3. A.Projected and reported nonpoint source nutrient (both phosphorus and nitrogen) loads to Chesapeake Bay.

In 1989, the Bay Program Implementation Committee formed a "1991 Re-Evaluation Workgroup" to coordinate the Re-Evaluation. This Workgroup under the leadership of Bob Perciasepe, Secretary of the Maryland Department of the Environment, has been assigned the challenging task of assembling the results of the latest technical studies and melding them with social and economic factors to fulfill the Re-Evaluation commitment made in the 1987 Bay Agreement.

II. Major Objectives of the 1991 Re-Evaluation

The major objectives of the Re-Evaluation are as follows:

1. Re-evaluate the appropriateness of the 40% nutrient reduction commitment based on available monitoring, modeling and research information.

2. Refine nutrient reduction commitments as appropriate, based upon a careful evaluation of the cost effectiveness, implementability, and living resources benefits.

3. Provide a refined overall Bay-wide nutrient reduction commitment including basin-specific nutrient reduction targets.

4. Based on the work and analysis completed, provide guidance to the signatories with regard to living resources, water quality and nutrient load characterization to aid in revising the basin strategies most effectively.

The basin-specific nutrient reduction targets would be evaluated, as called for in objective 3, for the basins identified in figure 4.

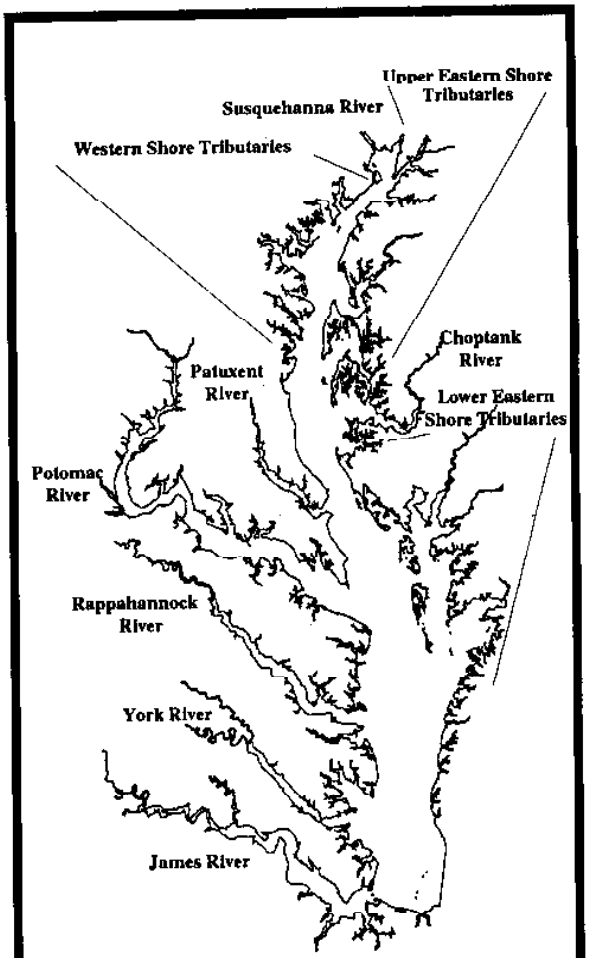

Fig. 4. Map of major Chesapeake Bay basins included in the 1991 Re-Evaluation.

III. Information to be Used in the Re-Evaluation

The signatories to the Bay Agreement of 1987 recognized that more precise and current information from monitoring, modeling and research would be available in 1991 to refine the Baslnwide Nutrient Reduction Strategy. As one of it's first tasks, the 1991 Re-Evaluation Workgroup formulated a reporting strategy that would bring the appropriate information together in a form that would be usable for the decisions

that need to be made. This basic strategy is depicted in the report sequence shown below:

1991 Re-Evaluation Reports

Quantification & Characterization:

- **Nonpoint Source Load Inventory**
- **Point Source Load Inventory**
- **Water Quality Characterzation**
- **Living Resources Characterization**

Interpretation & Progress:

- **Nutrient Load Reduction Progress Report**
- **Water Quality Restoration Priorities for Living Resources**

Nutrient Control Effectiveness & Cost:

- **Technology Effectiveness: Point Source Controls**
- **Technology Effectiveness: Nonpoint Source**
- **Financial Cost Effectiveness**

Strategy Evaluation:

- **Development and Evaluation of Alternative Management Scenarios**

Final Product :

- **Revised Nutrient Reduction Strategy for Executive Council Review**

Nutrient Loads:

One of the first tasks of the Re-Evaluation is to re-calculate the point and nonpoint source nutrient loads of 1985, the baseline year, and to estimate progress in reducing loads since then. This will help to establish how successful management actions have been during Phases I and II of the Nutrient Reduction Strategy. Point source load estimates are reasonably precise and are available for all of the Bay's major basins. Because of significant actions, such as wastewater treatment plant upgrades and phosphate detergent bans, point source nutrient loads are expected to demonstrate considerable progress for phosphorus since 1985 (see Fig. 2 for progress through 1989). The initiation in 1985 of enhanced monitoring of rivers entering the Chesapeake Bay and the completion of the watershed model will greatly improve our estimates of nonpoint source nutrient loads. Estimates of nonpoint source load improvements based upon the installation of best management practices through 1989 is provided in Fig. 3.

Research:

Much of the research that is being used in the Re-Evaluation focuses on establishing water quality goals that will insure adequate habitat conditions for important Bay species. Two areas that have been targeted are water quality conditions necessary to support the growth and survival of submerged aquatic vegetation (SAV) and the dissolved oxygen requirements of several key species of fish and shellfish. The water quality conditions that are specified by this research, and that are responsive to nutrient control measures, will be used in the identification of water quality problems in the tributaries and the mainstem. Furthermore, these conditions can also be used to evaluate the benefits of various nutrient control scenarios.

Another area of useful research is the investigation of the role of bottom sediments in regulating Bay water quality. Much of the recent research has suggested that the release of nutrients from bottom sediments, especially during periods of anoxia, can have significant water quality consequences. The lack of sufficient information was identified during the last mathematical modeling effort. Considerable monitoring and experimental data has since been collected which has allowed a sediment "sub-model" to be constructed as part of the latest Bay model. This model will allow us to better quantify the influence of sediments as nutrient loadings are reduced.

The effectiveness of best management practices for nonpoint source nutrient controls and biological nutrient removal for wastewater treatment plants have also been areas of active research. This information, along with the cost-effectiveness of these nutrient control options forms a crucial base of information for developing a revised nutrient control strategy.

Monitoring:

Our ability to judge actual progress in cleaning up the Bay depends upon a multifaceted monitoring program that was initiated in 1984. This information on chemical and biological aspects of water quality and on living resources provides the "bottom line" for our management actions. In the 1991 Re-Evaluation this information will be used to:

1. identify, diagnose and prioritize areas in the mainstem and tributaries with water quality and living resource problems.
2. determine the effectiveness of currently implemented point and nonpoint source nutrient reduction programs by measuring progress to date.
3. supply the data required to develop mathematical models of the Bay.

The Bay monitoring programs have already yielded signs of significant progress in the Potomac and Patuxent Estuaries. There are also early indications that phosphorus levels are declining in some portions of the mainstem.

Modelling:

In all recent management strategies for Chesapeake Bay, mathematical models have been a major technical justification for the chosen strategy. The strength of the models is in their ability to simulate the very complex physical, chemical and biological interactions that occur in the Bay ecosystem and thereby provide a tool for projecting the Bay's response to alternative nutrient reduction strategies. There will actually be 4 model components used in the 1991 Re-Evaluation. A watershed model will principally be used to identify nonpoint source nutrient loadings and provide information on the controllability of these loads. A hydrodynamic model will simulate the complex water movements including tides and the mixing of fresh and ocean waters. A sediment model will simulate the interactions between the Bay's bottom sediments and the overlying water column. And, finally, a water quality model will interact with the three other models to predict the response of chemical and biological aspects of water quality to different nutrient reduction strategies.

The models were designed for and will be used to determine:

1. Relationships between nutrient loading and anoxia in the Bay.
2. Critical nutrient(s) in control of eutrophication and anoxia.
3. Whether both point and nonpoint sources should be controlled.
4. The degree of control needed.
5. For greatest impact, where controls should be implemented first.
6. The length of time it will take for Bay water quality to improve once controls are implemented.

Cost and Effectiveness of Nutrient Controls

Finally, when specific nutrient reduction strategies are being formulated, those working on the 1991 Re-Evaluation will consider the cost and effectiveness of nutrient removal from various sources, including point and nonpoint. This information will be assembled from past experiences as well as new studies on point (e.g. biological nutrient removal) and nonpoint (e.g. nutrient management; sediment and erosion control) source nutrient controls . This information will be used interactively with the technical information described above to derive the most cost-effective and achievable solutions for each major basin.

IV. Final Product and Future Work

By Dec. 31, 1991 the Re-evaluation is scheduled to be presented to the Executive Council (EC) in final draft form. Leading up to this point, in parallel with efforts to assemble the Re-Evaluation, will be a series of milestones to insure adequate input from the public. An additional public comment period will follow in early 1992. Final approval by the EC could be expected by June, 1992. A schedule for this process is presented in the box below.

SCHEDULE FOR 1991 RE-EVALUATION

RE-EVALUATION	PUBLIC PARTICIPATION
SPRING, 1991	
Quantification and Characterization Reports	Distribution of Summary Document Describing Re-Evaluation
SUMMER, 1991	
Interpretation and Progress Reports	Articles by the Alliance for Chesapeake Bay on Re-Evaluation Progress
Nutrient Control Effectiveness and Cost Reports	
Strategy Evaluation Reports	
FALL/WINTER, 1991	
Development of Revised Nutrient Reduction Strategy	Public Meeting
Review by Bay Program Committee	Development and Distribution of Summary Literature
Presentation to Executive Council	
WINTER, 1992	
	Public Comment
SPRING, 1992	
Executive Council Approval	
SUMMER/FALL, 1992	
Development of Jurisdiction-Specific Nutrient Reduction Plans	

It is anticipated that the Re-Evaluation will be a significant advance over current plans in its targeting of nutrient load reductions for the greatest benefit to the Bay. However, aspects such as the actual tributary-based nutrient reduction strategies, will need to be developed by each signatory as a next step after the Re-evaluation. This process of developing more detailed plans is similar to the process that followed the 1987 Bay Agreement. Fulfillment of the fourth objective of the Re-Evaluation will provide a solid foundation of new information that the various jurisdictions can draw upon in formulating the revisions and refinements to their existing strategies.