

2005 Advisory Committee on the Management and Protection of the State's Water Resources

**Interim Report
July 2006**

**M. Gordon Wolman
Chairman**



**Robert L. Ehrlich, Jr.
Governor**

**Michael S. Steele
Lieutenant Governor**

Members of the Advisory Committee on the Management and Protection of the State's Resources

M. Gordon "Reds" Wolman, Ph.D.
Advisory Committee Chair
Department of Geography and
Environmental Engineering
The Johns Hopkins University
G. W. Whiting School of Engineering

The Honorable Betty Ballas, Mayor
Town of Federalsburg, Maryland

Alan Brench, Ph.D.
Division of Food Control
Maryland Department of Health and
Mental Hygiene

John Chlada, Vice President
Environmental Affairs
Perdue Farms, Inc.

The Honorable Galen Clagett
Maryland House of Delegates

The Honorable Roy P. Dyson
Maryland Senate

Larry Fogelson, Manager
Water and Sewer Planning
Maryland Department of Planning

James M. Gerhart, Director
MD – DE – DC Water Science Center
U.S. Geological Survey

David Goshorn, Ph.D., Director
Resource Assessment Service
Maryland Department of Natural
Resources

The Honorable Perry Jones,
Commissioner
Carroll County, Maryland

Louise Lawrence, Chief
Office of Resource Conservation
Maryland Department of Agriculture

J. Alan Roberson, Director
Security and Regulatory Affairs
American Water Works Association

Sarah J. Taylor Rogers, Ph.D.
Center for Agro-Ecology
University of Maryland

Robert M. Summers, Ph.D.
Director, Water Management
Administration
Maryland Department of Environment

C. Victoria Woodward, Esq.
Executive Director
Safe Waterways in Maryland

Study Contributors

Maryland Department of Environment

John Grace
Saeid Kasraei
Virginia Kearny
Barry O'Brien, P.E.
Janice Outen
Mat Pajerowski
Lyn Poorman
Jay Prager
Herbert Sachs
John Smith, P.E.

Maryland Department of Agriculture

Fred Samadani, P.E.

Maryland Department of Natural Resources

Emery Cleaves, Ph.D.
Ron Klauda
Margaret McGinty
Ken Miller

U.S. Geological Survey

Jonathan Dillow
Betzaida Reyes
Michael Wiczorek
Douglas Yeskis

Interstate Commission on the Potomac River Basin

Erik Hagen
Cherie Schultz

Delegate Galen Clagett's Office

Carol Krimm

Table of Contents

Executive Summary	1
Introduction and Background.....	5
Statewide and Regional Water Supply Issues	7
Water Supply Assessment and Planning Needs.....	22
Programmatic Changes	30
Funding	32
Summary of Recommendations	38

Appendices

- A. 2003 Committee
- B. Executive Order 01.01.2005.25
- C. Findings of the Interagency Technical Advisory Committee
- D. HB 1141
- E. Budget Projections

Executive Summary

It is a hot day in June, a few years from now. Precipitation has been at record low levels since the previous fall, with some areas of the State having annual rainfall deficits of five inches or more. Ground water levels and stream flows are beginning to reflect the lack of normal recharge. Now imagine that this condition continues into the summer and through the next fall, exacting its toll on wells in the Piedmont area of central Maryland, and on communities that depend on streamflow from small tributary streams that have ceased to flow. And suppose that this is not an isolated condition, but one that extends for a prolonged period as did the drought of the early 1930s. While this climatic occurrence is taking place, Maryland's population is steadily increasing, demanding more water each year. New water supply problems are being created, and existing ones are being exacerbated. How long could this situation be tolerated, and who would be held accountable for not anticipating the crisis and undertaking the necessary safeguards? Most assuredly, elected officials would hear from their constituencies, and would turn to government agencies for quick fixes that simply do not exist. This scenario presents a state of affairs that can only be avoided by adequate planning that begins long before such a situation develops. Maryland has the authority to properly address water resource planning needs, but tough management decisions will have to be made. This report describes the tools needed for carrying out this authority and recommends steps to prevent this hypothetical, but very possible, scenario from threatening the health, environment, and economy of the State and its citizens.

The droughts of 1999 and 2002 suggest what could occur, although growing demands for water are likely to mean that a future drought would be much more difficult to manage. During this period, hundreds of domestic wells failed, some public water systems' well yields were significantly reduced and public water systems using surface supplies without adequate reservoir storage were dangerously close to being unable to meet demands. Some systems installed emergency water intakes, some violated permit flow-by conditions, and some communities hauled water from other localities to meet their water needs. Citizens and businesses felt the economic and lifestyle pinch of water restrictions, and natural ecosystems were stressed as streambeds across the State went dry.

Even during periods of normal rainfall, some communities experience difficulties related to water supply. Some towns in the Piedmont region of the State, for example, have drilled numerous wells, and spent hundreds of thousands of dollars, without finding adequate sources for their communities. The deep, confined aquifers in the Coastal Plain region of the State have exhibited steadily declining water levels, and there are concerns about the ability of these aquifers to provide sustainable supplies of water to a steadily growing population.

As pressures on water resources increase, so does the potential for conflicts. Maryland has already experienced conflicts between farmers who want to ensure the best possible crop during a dry summer and their neighbors who rely on ground water for their domestic needs. Boaters and property owners don't want reservoirs to be lowered by water supply withdrawals. Whitewater rafters, fly fishers, and resource managers want to maintain stream flows in streams that others would use for water supply. The State's natural resources, including the Chesapeake Bay, depend on both good water quality and a sufficient quantity of water to maintain a healthy environment.

Water is vital to citizens, industry, agriculture, and the environment, and responsible management of water resources is essential to the future adequacy of water supplies; yet to date no entity in Maryland has been required to pay for withdrawing or using this valuable public resource. While other states charge water appropriation permit fees, legislative attempts to institute such a fee in Maryland have repeatedly failed.

The quality of water resources can be as much a limiting factor as quantity. Water treatment is very expensive, and contamination of the resource by either naturally-occurring contaminants or by human activities, can add greatly to the cost of treatment. Water management measures must make provisions for protecting good quality sources and remediating those that could not otherwise be used. The State spends considerable financial resources annually to restore and protect water quality in the Chesapeake Bay, primarily to safeguard its living resources. However, little attention has been given to the ground water and headwater streams that feed the rivers and Bay, while also providing drinking water to the State's citizens.

Land use decisions have a profound impact on water resources. In Maryland, local governments control land use, while water management is predominantly a State function. In some areas of the State, proposed development can proceed through the local government review and approval stages with little attention given to the availability of water until the State review process begins. The current development process is inefficient for developer and regulator alike, and needs to be revised so that water resource concerns are addressed early in the process.

While there is a real cost for these activities, there is an even larger potential cost for not conducting the appropriate water resources planning. Development, industry, and economic expansion are already constrained by water and sewerage limitations. Unlike electricity, one cannot generate more water, and streams and rivers have a finite capacity to assimilate wastewater discharges. Additionally, significant economic and social benefits are derived from appropriately planning for water resources needs. For example, helping local governments to consider water resource availability when developing their Comprehensive Plans will prevent developers from investing large amounts of capital into a project before realizing at a late stage that there is not enough water to support the proposed development. Proper planning will ensure that Maryland's natural flora and fauna, which are inherently dependent on water, remain viable. Many of the benefits of ensuring sustainable water supplies are not easily quantifiable, but the benefits of protecting public health, and upholding Maryland's unique natural and cultural environment, must not be ignored. Planning for water resource needs before a "crisis" situation occurs is the best way to implement efficient and effective programs to ensure a safe and reliable water supply for Maryland citizens.

Water is a finite resource. As Maryland continues to grow, very difficult decisions will have to be made about when, where, and how to develop, and when not to develop, in order to protect this most important natural resource. Clearly, the era when the availability of water could be taken for granted is over.

Based on recommendations of the 2003 Advisory Committee on the Management and Protection of the State's Water Resources and the 2005 Maryland General Assembly, Governor Robert L. Ehrlich, Jr. issued Executive Order 01.01.2005.25, forming a second Committee to complete and supplement the work of the 2003 Committee. This 2005

Committee was directed to submit a final report in July 2008, with an interim report due in July 2006. This document constitutes the required interim report.

The goal of the Committee is to ensure that Maryland has an adequate drinking water supply to protect public health, preserve the existing quality of life, sustain economic growth, and maintain and restore ecosystem integrity into the foreseeable future. The Committee will spend its remaining tenure evaluating the issues and water management needs for the State. This interim report, however, identifies several issues of significant importance that warrant immediate attention. The following recommendations for addressing these matters track closely with the subjects delineated for study and analysis in the Governor's Executive Order creating the Committee. For the convenience of the reader, the recommendations are grouped under the categories of planning, legislative needs, outreach, and funding.

RECOMMENDATIONS:

1. Develop a State Water Resources Management Plan within three years to provide guidance for the Maryland Department of Environment (MDE) in carrying out its water management responsibilities and for local governments developing the plans required under new legislation enacted in 2006.
 - a. Continue the comprehensive evaluation of the State's watersheds and aquifers to determine their adequacy in meeting expected demands. Expand ground and surface water monitoring networks to provide the data for this analysis and the continuing management of the State's water resources.
 - b. Identify and develop new water sources and make better use of existing resources.
 - c. Provide support for local water supply planning by providing information and technical assistance as required by HB1141 (codified as Chapter 381, 2006 Laws of Maryland) and implementing recommendations of the Interagency Technical Advisory Committee.
 - d. Establish regional planning initiatives to more fully integrate planning processes among State, county and municipal governments.
 - e. Avoid where possible, or minimize and appropriately mitigate the ecosystem impacts of any water resource management decision that changes or modifies natural conditions.

2. Enact legislation to:
 - a. Improve efficiency of the water appropriation permit process by eliminating the requirement to obtain a permit for withdrawals under 5,000 gallons per day.
 - b. Protect the sources of drinking water supplies to insure their long-term availability.
 - c. Enact an effective mechanism for enforcing appropriation permits to provide equity among users and the data needed for management purposes.
3. Develop an outreach program to educate Maryland citizens, the regulated community, and State and local officials regarding the importance of water resource management, water supply protection, and water conservation and efficiency practices.
4. Identify funding to support water resource management programs by initiating a dialogue with various stakeholders to evaluate funding alternatives.

Following submission of the interim report, the Committee is mandated by Executive Order to continue its work until July 2008. As these recommendations are initiated and the Committee continues its work over the next two years, other issues and additional recommendations are likely to develop.

Introduction and Background

Over the past several years, a number of water-related difficulties have served as a warning that better water resources planning and management are needed:

- Building moratoriums were imposed by several communities in central Maryland due to lack of adequate water supplies.
- Long-term monitoring of water levels in water supply aquifers indicates continuing water level declines in the confined aquifers of Southern Maryland, where significant growth is occurring.
- Drought conditions that impacted the State in 1999 and 2002 aroused widespread concern for the adequacy of the State's water resources to meet existing and future demand.
- Releases of gasoline constituents threaten private wells in many areas and these and other contaminants have also affected some municipal supplies.

The impact of the 1999 drought highlighted the concern that Maryland's water resources will face more severe challenges with recurring drought in the future. As a result of these concerns, in February 2002, 72 legislators joined forces to request a statewide assessment of laws, regulations, and governmental resources available for the protection, conservation, and management of water resources. As one of his first actions after taking office in 2003, Governor Robert L. Ehrlich, Jr. issued Executive Order 01.01.2003.08, which created the 2003 Advisory Committee on the Management and Protection of the State's Water Resources. The 2003 Committee found that projected increases in the State's population will result in an increase in total water demand of about 233 million gallons per day (mgd) by 2030, a 16% increase over the 1,447 mgd used in 2000. The 2003 Committee determined that additional evaluations, planning and resources are needed in order to ensure that the State's water resources remain sustainable into the foreseeable future. Seven specific recommendations were offered, which are described in Appendix A, along with a summary of activities undertaken as a result of the recommendations.

Based on recommendations of the 2003 Committee and the 2005 Maryland General Assembly, Governor Robert L. Ehrlich, Jr. issued Executive Order 01.01.2005.25 (Appendix B), forming a second Committee to complete and supplement the work of the 2003 Committee. This Committee is charged with reviewing the latest information on the State's water resources, assessing the adequacy of existing laws and regulations, and recommending comprehensive strategies for the development, management and protection of the State's water resources. This 2005 Committee was directed to submit a final report in July 2008, with an interim report due in July 2006. This document constitutes the required interim report.

The 2005 Committee met nine times since September 2005. The Committee reviewed the findings and recommendations of the 2003 Committee, and sought to gain additional insights into the State's water management issues by conducting more thorough reviews of existing laws, regulations, and policies, and evaluating several areas where conflicts have arisen and/or current laws, regulations and policies appear to be insufficient to protect the resource and ensure sustainability. These issues included:

- Water allocation, particularly the difficulties in the fractured rock areas of the State, where finding sufficient ground water to meet growing needs, and implementing the State's water balance criteria present challenges;
- Enforcement of water appropriation permits;
- The need for better understanding, at all levels of government and with the general public, of the importance of the availability of water;
- The need for improving the integration of planning processes across State and local government;
- Water rights on public and private lands; and
- Management of the Potomac River in light of the 2002 Supreme Court decision that granted Virginia equal authority with Maryland to manage withdrawals from the River;

This interim report explores these issues and provides the Committee's recommendation for improving the State's water management programs. The report is divided into four primary sections.

1. An overview of statewide and regional issues currently impacting water supply.
2. Water supply assessment and planning steps needed to address the various water supply concerns.
3. Specific programmatic changes needed to facilitate improved management of the resource.
4. Funding needs and financing options.

The report is intended to provide the Committee's initial findings and recommendations. The Committee will continue its effort over the next two years, and is likely to expand these recommendations in its July 2008 final report.

Statewide and Regional Water Supply Issues

Maryland is a geographically diverse state, with topography ranging from the relatively flat landscape of the Eastern Shore to the mountainous terrain of western Maryland. There are several distinct hydrogeologic regions, with the eastern and southern regions of the State consisting of sandy Coastal Plain aquifers while the central and western regions are composed of fractured rock aquifers. Climate across the State also differs, with annual precipitation varying from about 36 inches a year in Allegany County to almost 45 inches per year in Harford County.¹

Maryland's water resources also vary. In the central Baltimore and Washington metropolitan regions, and the large municipalities in central and western Maryland, most citizens receive their water from public water systems that rely on surface water sources. In the more rural areas of the State, including the Eastern Shore and southern Maryland, water supply is primarily ground water either from a public water system or from private residential wells.

Because of the variety of water sources, regional differences in climate and terrain, and the uneven distribution of demand for water, water supply issues differ from region to region, although some issues apply across the State. Water uses also vary across the State, as shown in the graphs of water withdrawals by region. The graphs depict total water withdrawals by category. It is important to note that not all water use is consumptive. Depending on the type of use, a substantial amount of the water withdrawn may be returned to the environment, either to the original source or to another water body, where it may be available for subsequent use. For this report, the State is divided into six regions based on hydrogeologic conditions, climate, water supply, and political boundaries. A summary of statewide and regional issues follows.

Maryland Water Supply Regions

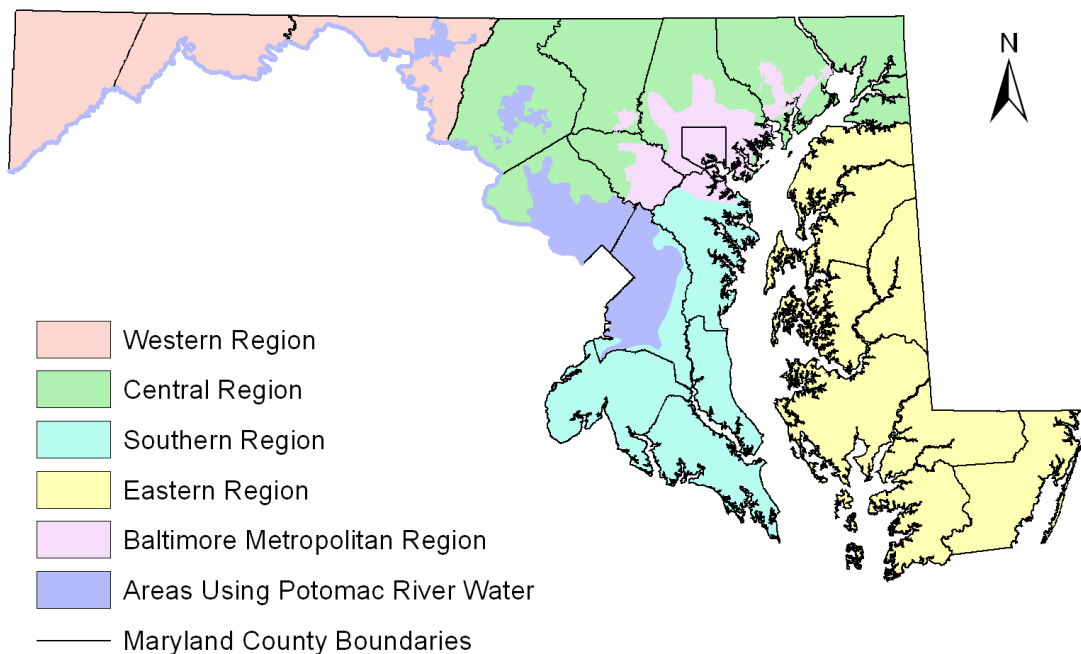


Figure 1

Statewide Issues

1. MDE's water management responsibilities include the allocation of water through an appropriation permit system. Although local governments are tasked with decision-making regarding land use and development, they often do not adequately integrate the availability or cost of providing water or sewerage service into their comprehensive planning processes. Better data on local water resource conditions are needed to enable local government officials to make rational, informed decisions about land use and development.

2. To strengthen the relationship between local comprehensive plans and the county water and sewerage plans, and in recognition of the need to better integrate water resource issues into the local comprehensive planning process, the 2006 General Assembly enacted legislation this year

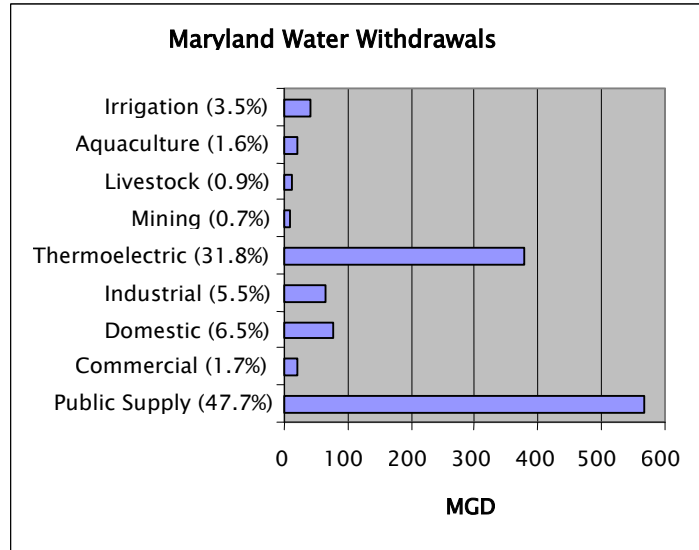


Figure 2

- (Chapter 381, 2006 Laws of Maryland) requiring all local governments with planning and zoning authority to include a water resources element in their comprehensive plans by 2009. MDE has the dual role of providing technical information to the local governments to be used in their plans and of reviewing the plans to assure consistency with the programs and goals of MDE. A State Water Resources Management Plan is needed to establish priorities, and water availability studies are needed to provide adequate information to inform decision-making. These efforts are a very high priority and must be adequately funded.
3. Appropriation permit decisions at the State level depend on accurate and comprehensive information about how much water is available, how much will be needed to meet future demands, and the impacts of use on natural resources. This information is not always available to allow State permit writers to make sound decisions regarding water withdrawal requests.
 4. There are a number of areas in the State where water supplies are not adequate to meet future needs. Several communities in the Piedmont region of the State are currently lacking water to support proposed development. Population growth and water use projections indicate this situation will become more widespread. Alternatives for increasing water supplies and pursuing strategies for making better use of existing resources is a high priority. Meeting federal and State regulatory requirements for protecting streams, wetlands, ground water aquifers, and other natural environments can present challenges to increasing supplies and/or developing adequate storage.

5. Additional studies are needed to better understand the complex nature of ground water supplies and the interaction between ground water supplies and surface water. More information is needed to assess the adequacy of current State allocation policies to protect stream biota and ecological functions in stream headwaters and adjoining watersheds. Current flow-by requirements for surface water withdrawals must be examined to assure protection of in-stream and terrestrial biota.
6. Local governments need effective strategies for ensuring that their visions for growth and development are consistent with providing safe and adequate water supplies for residents of their own or adjoining jurisdictions. Private wells in unconfined aquifers are particularly vulnerable to contamination as there is a direct connection between the ground surface and the aquifer. Furthermore, there is no routine monitoring of private wells after they are installed that could detect contamination. Drinking water watersheds that encompass multiple jurisdictions need cooperative approaches from many parties for effective protection. Community wellhead protection areas often overlap developed municipal areas and are at risk from a number of existing contaminant sources.
7. Current water appropriation permit requirements apply equally to both large and small withdrawals. As a result, a disproportionate amount of time is needed to process small withdrawals, which cumulatively have minimal impact on the resource. Withdrawals of less than 5,000 gallons per day represent 88% of the permits processed, and less than five percent of the water withdrawn.
8. Current laws do not allow the State to effectively enforce compliance with water appropriation permit requirements. Lack of compliance is unfair to users who are meeting legal requirements. Further, the data that is not being reported in accordance with permit requirements is essential to water management decision-making.
9. The State's drought monitoring and response plan provides for managing drought conditions on a regional basis. A regional assessment may not accurately reflect the potential for water shortages at individual water systems, however. Some communities, especially those with limited capabilities for storing water, may need to develop individualized plans for responding to drought based on their specific needs.
10. Public water systems need improved security and emergency responsiveness. Terrorist events have highlighted the need for increased security at water systems, but in addition, systems need to develop strategies to address a variety of unexpected events including power outages, water shortages, etc.
11. As the need for water supply capacity intensifies, it is becoming increasingly important for water suppliers to consider managing demand as a means for extending water supplies and delaying or eliminating the need to develop new sources. Policies should encourage water suppliers, commercial and residential users, and industry to utilize water conservation technologies, water reuse, and financial incentives to reduce demand.

- The general public, as well as many decision-makers at all levels of government, need to become more aware of the water management problems facing the State.

Western Region Issues

The Western Region consists of Allegany, Garrett, and Washington Counties. The largest community water systems use surface water sources. The ground water aquifers are unconfined, which makes them more susceptible to climatic influences and contamination from human activities. While Washington and Garrett Counties together are projected to grow by more than 30% by 2030, Allegany County is the only county in the State that is projected to have a declining population.² Most of the projected growth in Washington County centers around Hagerstown and would be served by the Hagerstown public water system, although other towns in the county are also facing significant growth. In Garrett County, growth is projected for the Deep Creek Lake area, which is served by a combination of public water and residential wells. Some small communities are served by water from the Potomac River basin.

- The State’s streamflow monitoring network currently includes 18 stream gages and the ground water level monitoring network has six monitoring wells in this region. The U.S. Geological Survey (USGS) and Maryland Geological Survey (MGS) have estimated that seven additional stream gages and 19 additional monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource.³

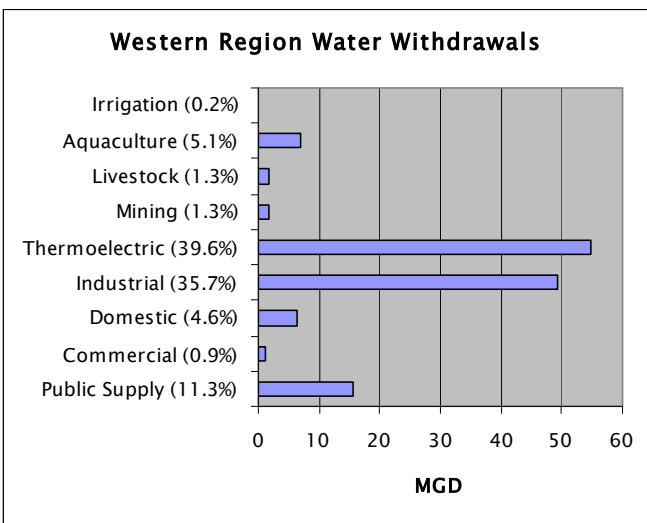


Figure 3

- Many community water systems in this region rely on surface water sources. Recent changes in standards for disinfection byproducts have resulted in a number of these systems exceeding the revised standards. Some may require significant capital investments in their treatment technologies in order to comply.

- Population growth and changing growth patterns are placing increased pressure on water resources in areas underlain by fractured-rock

aquifers in central and western Maryland. As additional development is proposed for communities dependent on ground water in this region, the application of MDE’s water balance criteria for assessing ground water availability has indicated insufficient water for some planned growth. In some cases, communities have been allocated less than what they need because the community did not have a large enough recharge area in the watershed to sustain the expected withdrawal during drought conditions. The water balance policy requires communities to set aside open space or acquire water rights from properties outside of the community in order to support the higher density development encouraged under the principles of

Smart Growth.⁴ Limited well yields can make development of adequate ground water supplies even more difficult. Communities, with the assistance of MDE, need to evaluate whether future growth plans are supportable by ground water alone.

4. Water supplies for some areas of this region are withdrawn from karst (limestone) aquifers, which are more vulnerable to surface water contamination than most other aquifers. As a result, ground water in many areas can be contaminated with pathogenic organisms from septic systems and animal waste. Public water systems served by these relatively unprotected ground water sources are required to meet certain treatment technique requirements, however private wells serving homes and small businesses are less able to meet the complex treatment requirements. Strategies must be developed to protect public health in these areas, including exploring options such as providing public water or limiting new development on private wells in affected areas.

Western Region

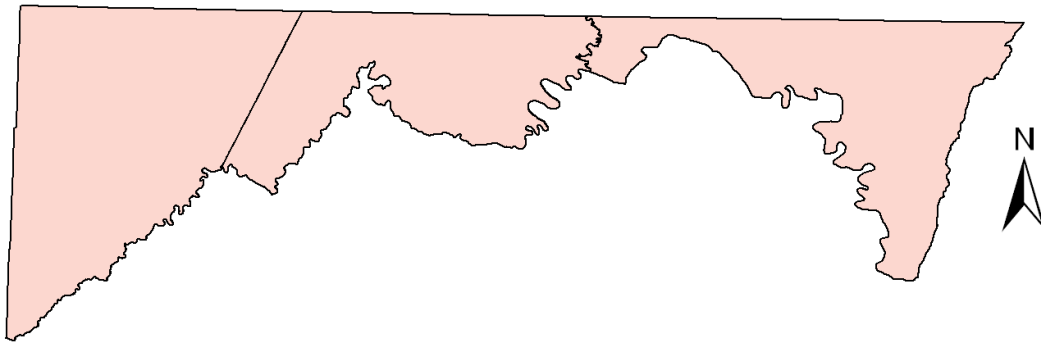


Figure 4 The Western Region consists of Allegany, Garrett, and Washington Counties

5. Areas that rely on the Potomac River as a source, or may need to use the Potomac in the future, need to be assured that the River is being responsibly and equitably managed for upstream users as well as for users in the metropolitan Washington area.

Central Region Issues

The central region consists of Baltimore, Carroll, Cecil, Frederick, Harford, Howard, and Montgomery Counties, except for areas served by the Baltimore City and Washington Suburban Sanitary Commission (WSSC) water systems. While many of the residents of these counties are served by public water systems, more than 400,000 rely on individual wells.⁵ Public water systems use both surface water and ground water. Reliance on the Potomac River is expected to increase. Population for this region, including areas served by Baltimore and WSSC systems, is expected to grow by about 18% by 2030.⁶

1. The State's streamflow monitoring network currently includes 38 stream gages and the ground water level monitoring network has 19 monitoring wells in this region. The USGS and MGS have estimated that an additional 24 stream gages and 22 monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource.⁷

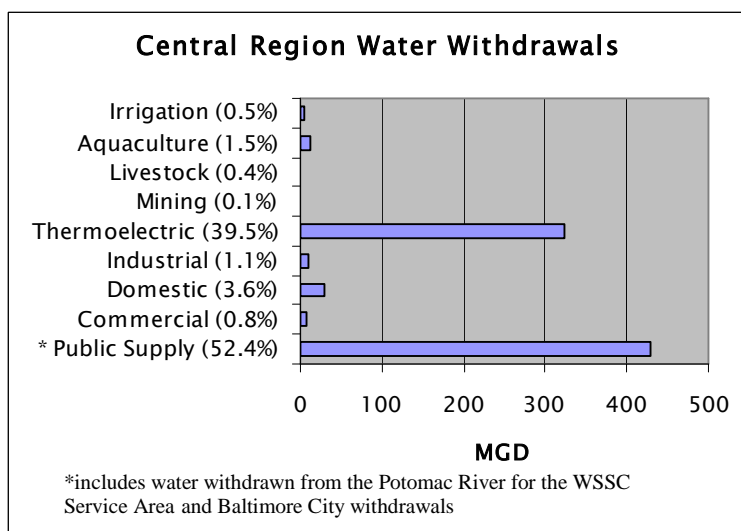


Figure 5

2. Population growth and changing growth patterns are placing increased pressure on water resources in areas underlain by fractured-rock aquifers in central and western Maryland. As additional development is proposed for communities dependent on ground water in this region, the application of MDE's water balance criteria for assessing ground water availability has indicated insufficient water for some planned growth. In some cases, communities have been allocated less than what they need because the community did not have a large enough recharge area in the watershed to sustain the expected withdrawal during drought conditions. The water balance policy requires communities to set aside open space or acquire water rights from properties outside of the community in order to support the higher density development encouraged under the principles of Smart Growth. Limited well yields can make development of adequate ground water supplies even more difficult. Communities, with the assistance of MDE, need to consider whether future growth is supportable by ground water alone.
3. Community water systems using reservoirs need to better protect their source watershed in order to reduce the water quality impacts of increased development and agricultural activities. Increased stormwater runoff, road salt in winter storm runoff, nutrient loadings, and the potential for contaminant spills all present challenges to managers of reservoir systems.
4. Community water systems using run-of-river intakes are particularly sensitive to rapid changes in source water quality (e.g. increased turbidity and increased fecal levels). Major highway, rail, and pipeline crossings upstream of some intakes make sources susceptible to spills.
5. Water supplies for some areas of this region are withdrawn from karst (limestone) aquifers, which are more vulnerable to surface water contamination than most other aquifers. As a result, ground water in many areas can be contaminated with pathogenic organisms from septic systems and animal waste. Public water systems served by these relatively unprotected ground water sources are required to meet certain treatment technique requirements, however private wells serving homes and

small businesses are less able to meet the complex treatment requirements. Strategies must be developed to protect public health in these areas, including exploring options such as providing public water or limiting new development.

6. All ground water sources in this region are vulnerable to contamination from man-made sources. A number of public water systems employ treatment due to contamination from nitrates, gasoline-related compounds, and chlorinated solvents.
7. Naturally-occurring radon, which may exceed new federal drinking water standards expected to be promulgated in 2006, is also found in this region.
8. Many community water systems in this region rely on surface water sources. Recent changes in standards for disinfection byproducts have resulted in a number of these systems exceeding the revised standards. Some may require significant capital investments in their treatment technologies in order to comply.

Central Region

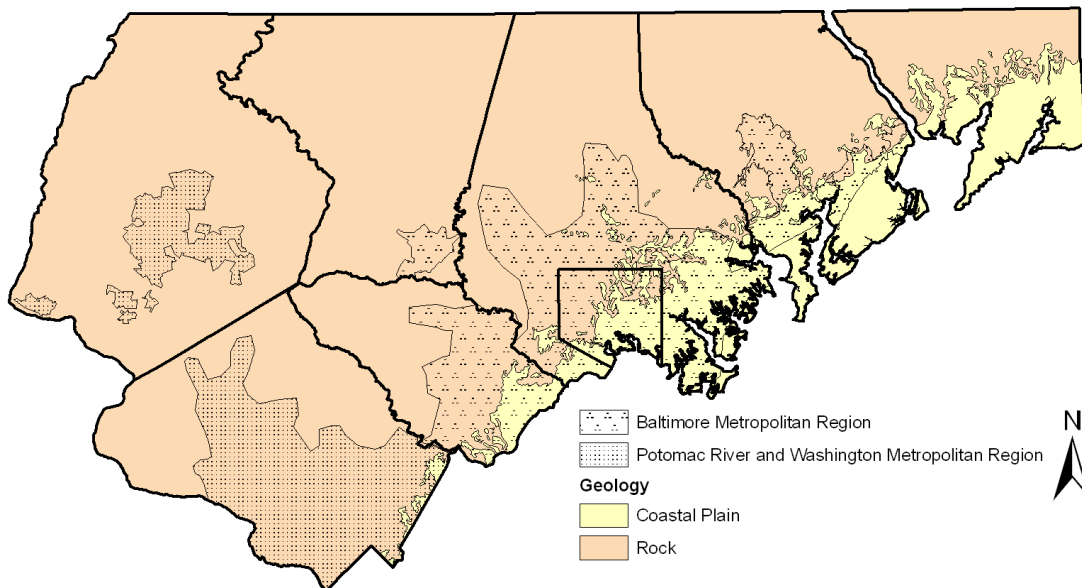


Figure 6

The Central Region includes Baltimore, Carroll, Cecil, Frederick, Harford, Howard, and Montgomery Counties

9. Residents of Harford and Cecil Counties who live in the vicinity of the Susquehanna River need assurance that the River will be responsibly and equitably managed so that water is available to them as these areas grow. Any proposed increases in use of water from the Susquehanna River will require approval by the Susquehanna River Basin Commission, which regulates appropriations from the entire watershed for the benefit of all jurisdictions, including headwaters in New York and all of central Pennsylvania.

10. Aquifer mapping and modeling of the Patapsco Aquifer system in Cecil County is inadequate to assess the impacts of some withdrawals.
11. Increased water use in Delaware places additional pressures on aquifers that extend beneath state lines, creating potential interstate competition for ground water resources shared by Maryland and Delaware.

Baltimore Metropolitan Region Issues

While geographically part of the central region, the Baltimore Metropolitan Region is discussed separately because it is served exclusively by the City of Baltimore's water supply system. The City provides treated water to Baltimore City, and to service areas in Baltimore and Howard Counties, as well as the northern and western portions of Anne Arundel County. Harford and Carroll Counties draw untreated water from the system. Three reservoirs located in Baltimore and Carroll Counties provide most of the water for the system, however during periods of low flow the reservoirs are supplemented by withdrawals from the Susquehanna River. The Baltimore City water system currently serves about 1.8 million people and provides about 265 million gallons of treated water per day.⁸

1. The State's streamflow monitoring network currently includes 24 stream gages and the ground water level monitoring network has seven monitoring wells in this region. The USGS and MGS have estimated that an additional three stream gages and three monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource.⁹
2. Better information and modeling are needed to predict the impacts of growth and changing land use on the water quality of the reservoirs. Controlling eutrophication in the City's reservoirs is the major water quality issue to ensure the long-term health of the reservoir system. Recent watershed protection agreements reflect the fact that the greatest impacts on reservoir quality result from development in Baltimore and Carroll Counties.
3. Continued population growth is expected to increase the system's reliance on Susquehanna River supplies. It is critical that the river be responsibly and equitably managed, and that Baltimore's right to withdraw sufficient amounts of Susquehanna River water is assured.
4. The City must ensure that the water supply system, including the reservoirs, has sufficient security measures in place to protect against and reduce vulnerabilities to potential terrorist attacks; to plan for and practice response to emergencies and incidents; and to apply new security technologies to detect and monitor contaminants and prevent security breaches.
5. Data indicate that sodium concentrations in the Baltimore City supply have increased substantially over the past three decades. Concentrations have repeatedly exceeded federal standards for water consumed by persons who have been placed on a sodium-restricted diet. Road and parking lot de-icing activities are most likely

the cause of this trend. In addition, a number of fish taken from City reservoirs have had elevated levels of mercury, and all three reservoirs have been placed on the 303(d) list of impaired waters for mercury. It is believed that most of the mercury is coming from non-local atmospheric pollution sources. The City needs to develop strategies for evaluating and addressing increasing sodium and mercury concentrations.

Potomac River and Washington Metropolitan Region Issues

This region is geographically included among the western, central, and southern regions, but because of its interstate aspects, it is discussed as a separate region. Maryland's Potomac River drainage is part of a larger interstate basin shared with Virginia, West Virginia, Pennsylvania and the District of Columbia (D.C.). The water utilities serving Prince George's and Montgomery Counties in Maryland, Fairfax County in Virginia, and the District of Columbia are the predominant users of the Potomac, however the upstream counties in both Maryland and Virginia are experiencing rapid growth and will continue to do so over the next 25 years. The non-tidal portion of the Potomac basin in Maryland encompasses 2700 square miles¹⁰ (28% of the State) and in 2000 had a population of 2.036 million (about 38% of the State). The Maryland portion of the basin is served by surface water supplies and, in areas outside of the Washington metropolitan area, ground water from unconfined aquifers. Population for the entire non-tidal watershed is projected to increase by nearly 1.6 million by 2030, which will require a 25% increase in water use.¹¹

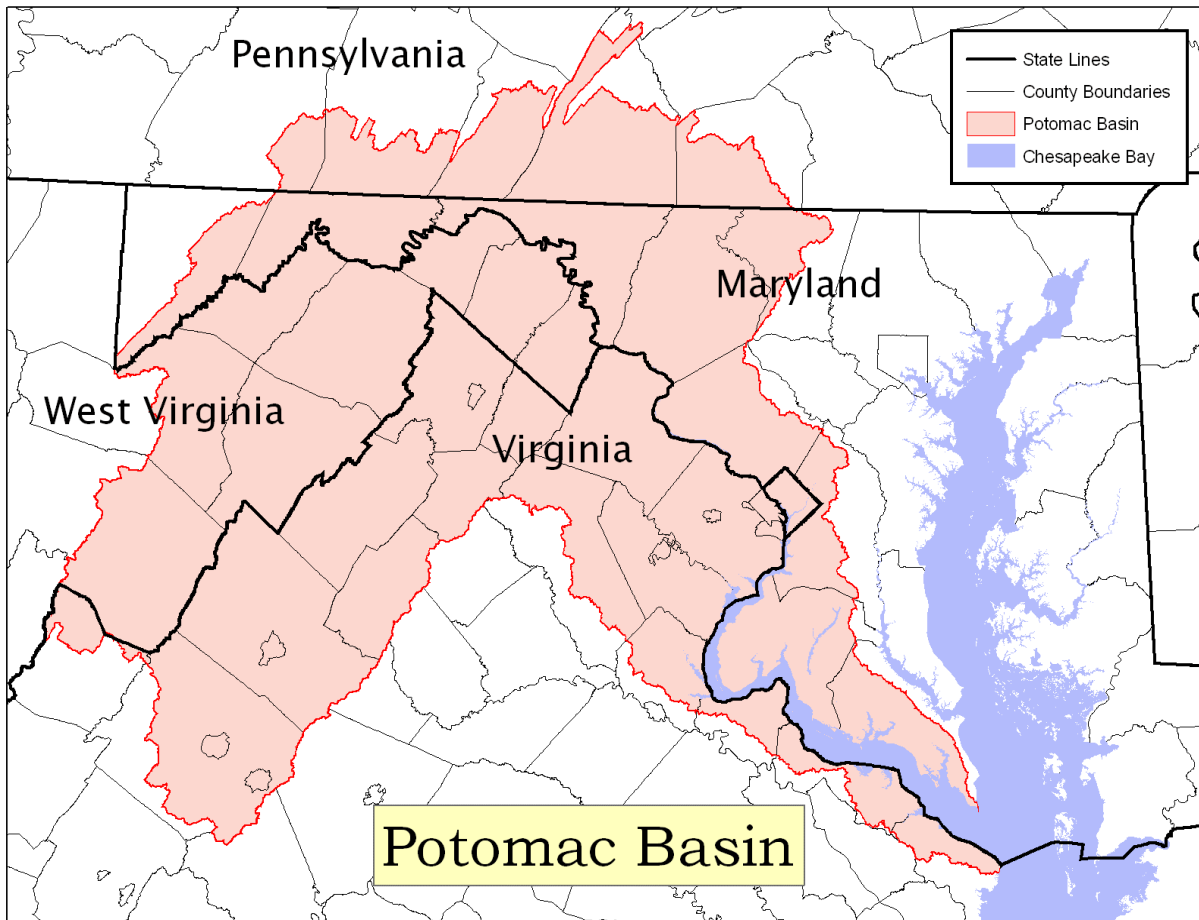


Figure 7

1. The State's streamflow monitoring network currently includes 24 stream gages and the ground water level monitoring network has eleven monitoring wells in this region. The USGS and MGS have estimated that one additional stream gage and seven monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource.¹²
2. A 2003 Supreme Court decision provided Virginia a co-equal right with Maryland to withdraw water from the Potomac River. To implement its new responsibility, Virginia is currently in the process of establishing water allocation procedures, which presumably will be compatible with those in Maryland. The two jurisdictions must then collaborate on a joint review process for considering new and revised permit requests. For watershed planning purposes, the process should not be limited to withdrawals from the mainstream Potomac, but should also include withdrawal requests from tributary streams.
3. There is a need to develop new water sources and increased water supply storage for this region in order to meet projected demand.
4. Population increase in the Potomac River Basin upstream of the major utilities' intakes creates the additional potential for increased pollutant loadings. This may result in water utilities having to spend additional resources for treatment, and/or wastewater utilities needing to increase the level of treatment. Increased stormwater runoff from newly developed areas has the potential for increasing stream bank erosion and nonpoint source contaminant loads.
5. The Potomac River Basin Drinking Water Source Protection Partnership, which includes numerous federal, state, regional and local agencies, counties, and municipalities in Maryland and Virginia, and water supply utilities serving the Washington Metropolitan Area, was established in 2004. In 2005 the Partnership established priorities and adopted A Strategic Plan for Source Water Protection in the Potomac River Basin.¹³ A regular source of funding from the States, federal government and utilities is needed in order to implement its strategic vision. An effective approach is needed for implementing source water protection strategies across the basin.
6. All of the major storage facilities in the basin are owned by the major water utilities, with low-flow allocation mechanisms for the area coordinated through the Interstate Commission on the Potomac River Basin (ICPRB). In anticipation of the projected growth in the area upstream of the Washington metropolitan area, additional storage and drought management strategies must be explored.
7. There is a need to establish who should "own" any additional storage that is developed for this region. Currently, all of the major storage facilities are owned by the Fairfax County, Washington Aqueduct, and Washington Suburban Sanitary Commission utilities. With more of the future demand expected to occur in the area upstream of the Washington metropolitan area, the needs of all users may be better met if the State of Maryland assumes a more active role.

8. Water suppliers in this region must ensure that their systems, including the reservoirs, have sufficient security measures in place to protect against and reduce vulnerabilities to potential terrorist attacks; to plan for and practice response to emergencies and incidents; and to apply new security technologies to detect and monitor contaminants and prevent security breaches.

Southern Region Issues

The Southern Region consists of Anne Arundel, Calvert, Charles, Prince George’s, and St. Mary’s Counties. Ground water is the principal source of drinking water for both public water systems and individual homes, except for certain areas of Anne Arundel County that are served by Baltimore City water, and much of Prince George’s County, which is served by the Washington Suburban Sanitary Commission. The major sources are deep confined aquifers that are protected from contamination found in surface water or from other contaminants at the land surface. Population for this region is expected to grow by about 20% by 2030.¹⁴

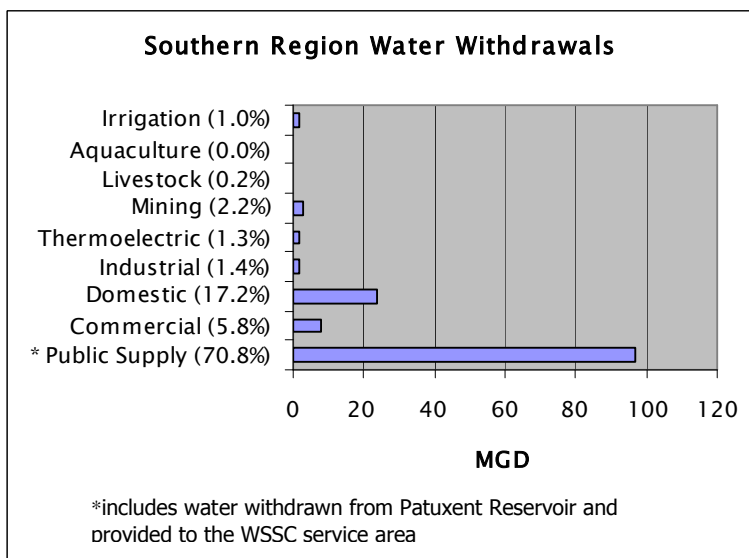


Figure 8

1. The State’s streamflow monitoring network currently includes seven stream gages and the ground water level monitoring network has 55 monitoring wells in this region. The USGS and MGS have estimated that an additional seven stream gages and 24 monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource.¹⁵

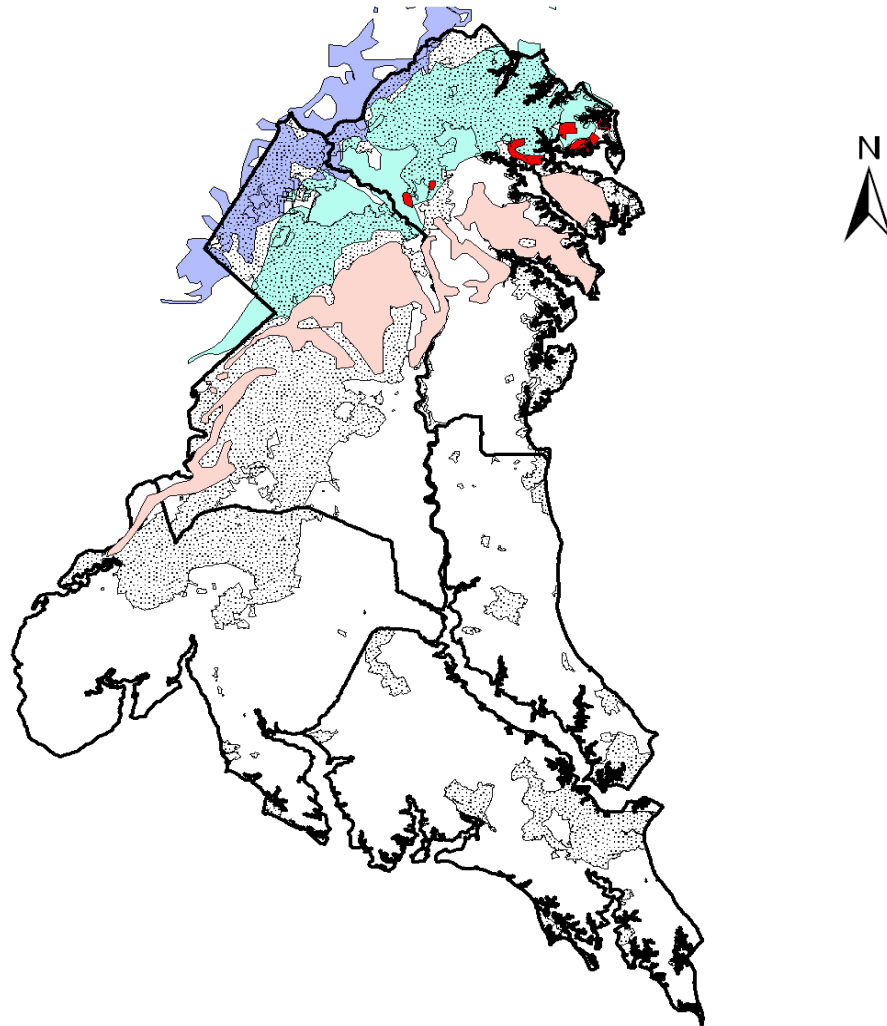
2. Water levels in the confined aquifers are declining at a significant rate, with the water

level in some confined aquifers being tens to hundreds of feet below their original levels. Ground water pumpage from the confined aquifers is expected to increase by 20% between 2000 and 2030.¹⁶ It is important to gain a better understanding of the aquifer system and the level of water usage that can be sustainably maintained. Although an assessment of the aquifers in Calvert, Charles, and St. Mary’s Counties was recently completed, continuing information and data will be needed to assess the impacts of withdrawals and the effectiveness of the 80% management level currently employed for evaluating water withdrawal requests.¹⁷

3. Stormwater management practices and increased impervious surfaces from development may have a significant impact on recharge rates in the outcrop areas of the major confined aquifers. Better data is needed to assess these impacts.

4. Little is known about the impacts of large withdrawals in areas where the confined aquifers are relatively shallow. Near the outcrop areas, there is little available

drawdown, making the 80% management level an inappropriate tool for managing ground water withdrawals. Better data and tools are needed to improve the management of these areas.



Southern Region

- Aquia Outcrop Area
- Magothy Outcrop Area
- Patapsco Outcrop Area
- Patuxent Outcrop Area
- Growth Areas of the Counties of the Southern Region

Figure 9

The Southern Region includes Anne Arundel, Calvert, Charles, Prince George's, and St. Mary's Counties. This map depicts the outcrop areas of the major aquifers serving this region. The outcrop areas, where most water for the aquifer systems is recharged, occur primarily in the more densely developed areas that coincide with major highways such as Interstate 95.

5. Water quality issues arise from both natural and anthropogenic causes. Elevated sodium levels in the western part of Charles County may be an early indicator of saltwater intrusion. Naturally-occurring arsenic at elevated levels is found in the Aquia and Piney Point Aquifers in Calvert, Charles, and St. Mary’s Counties. Elevated radionuclide levels from natural sources have been found in northern Anne Arundel County and some wells in Charles County.

Eastern Region Issues

The Eastern Region is comprised of the counties located on the Maryland Eastern Shore, including Caroline, Dorchester, Kent, Queen Anne’s, Somerset, Talbot, Wicomico, and Worcester Counties. For management purposes, Cecil County is considered in the Central Region, although some of the issues identified in the Eastern Region are also relevant to the southern part of Cecil County. Ground water is the principal source of drinking water for both private and public water supplies throughout this region. Use of unconfined and confined aquifers for public and residential wells varies across the region. Agricultural water use, which is mostly from streams and shallow unconfined aquifers, has been increasing and is expected to continue increasing. Population is projected to increase by almost 30% for the entire region by 2030, with concentrated growth centers in Salisbury, Ocean City, and Queen Anne’s County.¹⁸

1. The State’s streamflow monitoring network currently includes 13 stream gages and the ground water level monitoring network has 37 monitoring wells in this region. The USGS and MGS have estimated that an additional six stream gages and 27 monitoring wells are needed in this region to insure adequate assessment of water availability and the impacts of withdrawals on the resource¹⁹.

2. Water levels in the confined aquifers are declining, and it is important to gain a better understanding of the aquifer system and the level of water usage that can be sustainably maintained. Better data is needed to assess the impacts of withdrawals and the effectiveness of the 80% management level currently employed for evaluating water withdrawal requests.

3. There have been conflicts between agricultural users and municipal users in close proximity to one another due to impacts on neighboring wells of the large agricultural withdrawals.

4. Contamination by saltwater intrusion is a significant water quality issue, and may have a major impact on the ability of some aquifers to sustain heavy use. This has

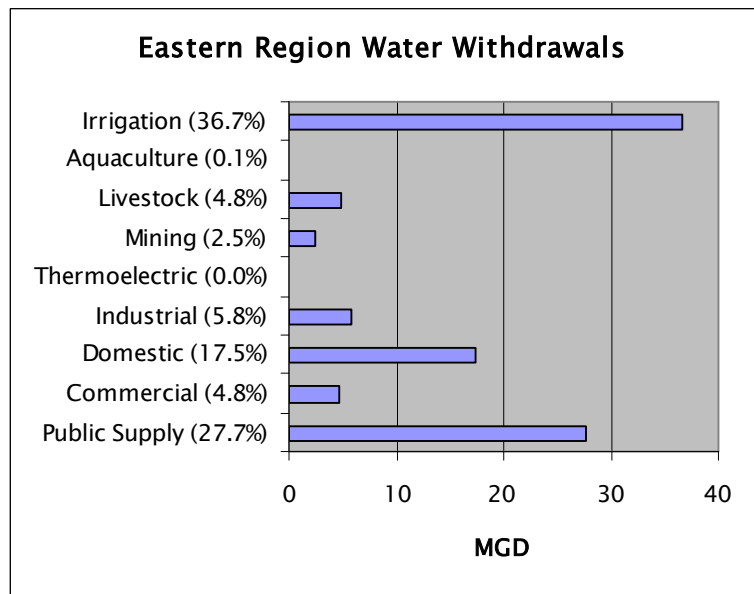
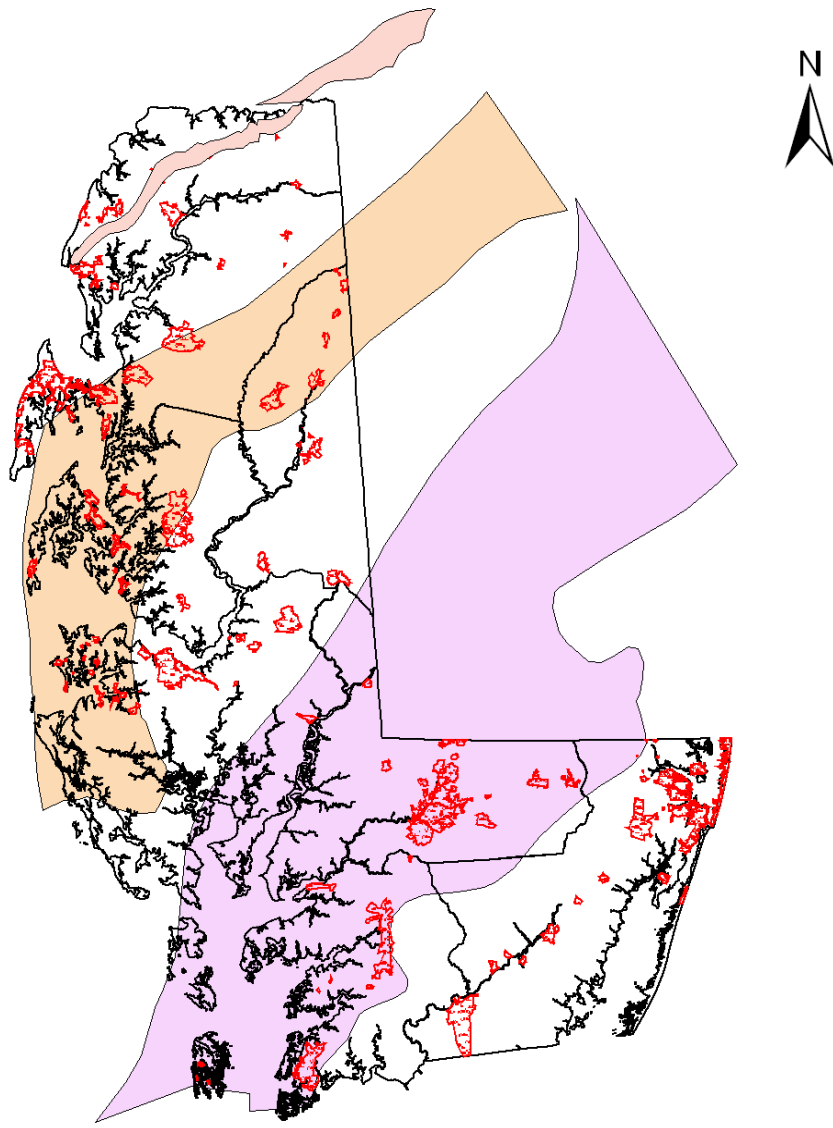


Figure 10

been a problem with the Aquia Aquifer on Kent Island in Queen Anne's County and the Manokin Aquifer in Ocean City in Worcester County. Current management strategies appear to be working in these areas to limit the intrusion of saltwater further into the aquifer systems. The potential for occurrence of saltwater in deep parts of the aquifer system is not well known because few data are available.

5. Elevated nutrients and agricultural chemicals, especially nitrates, are a concern for residences where the water supply source is an unconfined aquifer. Elevated nitrate levels from agriculture and onsite sewage disposal systems have already affected drinking water supplies in Kent, Worcester, and Wicomico Counties. In addition, elevated arsenic levels from natural sources have been found in the Aquia Aquifer in Queen Anne's, Talbot, Dorchester, and Caroline Counties.



Eastern Region

- Aquia Outcrop Area in Maryland and Delaware
- Subcrop of the Upper Chesapeake Aquifers in Maryland and Delaware
- Subcrop of the Lower Chesapeake Aquifers in Maryland and Delaware
- Growth Areas in the Eastern Region

Figure 11

The Eastern Region includes all of the Maryland counties on the Eastern Shore, except for Cecil County. This map depicts the outcrop and subcrop areas of the major aquifer systems. Outcrop areas are the part of an aquifer that appears at the land surface, and where aquifer recharge occurs. Subcrop areas are the outcrop of a formation that is covered by rock or sediment from a different formation. The Eastern Shore aquifers subcrop under the surficial Columbia Aquifer.

Water Supply Assessment and Planning Needs

Although Maryland is rich in water resources, some areas of the State do not have water supplies that are sufficient to support the multitude of human and environmental uses of this critical resource. While water supplies remain relatively abundant on a statewide basis, specific locations throughout the State have experienced conditions where water supplies are inadequate or water supply development has not kept pace with demand. Currently, water availability for specific projects is evaluated through the water appropriation permitting process, but is not considered as part of the local planning process. As a result, projects that have been through other approval processes and for which considerable investment has been made may be denied or delayed due to water availability issues. These situations, along with projections indicating that Maryland's population may grow by more than 1 million people by 2030,²⁰ underscore the necessity for improved water resource planning in the State.

Water supplies in Maryland are finite, and must be used wisely to meet a variety of important functions. Technically sound assessments of water resources coupled with integrated planning are critical for the most efficient use of this resource. Even the best assessments and planning, however, do not serve to create more water. It is important that Maryland realize, therefore, that as population grows, some areas of the State may face difficult decisions, including a decision not to develop.

In order to ensure the long-term sustainability of the State's water supplies to meet competing needs over the next 50 years, it is essential to take steps to obtain a better understanding and improve scientific management of the resource. Sound water resource management includes:

1. Assessing the adequacy of the resource to meet current and future human and environmental needs; and
2. Developing plans to ensure that existing supplies are used efficiently, sustainably, and in the best interest of Maryland citizens, and to ensure that adequate supplies are available in a timely manner to meet the needs of future generations.

Assessment of Maryland's Water Supply

Water Supply and Demand Analysis

Water supply and demand analyses provide the backbone for planning. Planners and decision-makers, at both the State and local levels, need accurate comprehensive information about how much water is available, how much will be needed to meet future demands, and the impacts of use on natural resources. Water supply and demand evaluations assess current water availability, projected population growth and economic development, land use plans, and the water quality and quantity requirements of aquatic and terrestrial living resources. In addition, the potential for reducing demand through water conservation technologies, appropriate pricing structures, water reuse, and other demand management techniques must be considered. These assessments will inform decision-makers about water supply

availability, facilitate long range planning at both the State and local level, and identify specific issues or vulnerabilities relative to the region of concern.

Baltimore City and the Interstate Commission on the Potomac River Basin have conducted evaluations of current and future supply and demand for the Baltimore and Washington metropolitan regions, respectively. This type of evaluation is still needed for regions of the State not served by the two large metropolitan water systems. Hydrologic units (i.e. watersheds or physiographic provinces) provide a useful framework for analyzing data and making management decisions related to water supply, however it is also important to consider the political boundaries that relate most closely to the governing bodies that make decisions affecting water resource use. This report identifies six physiographic water supply regions, which have similarities in geology, water source, and climate.

Water Resource Monitoring

In order to assess water availability, sufficient data must be available on the condition of surface and ground water supplies. The primary tool for monitoring water quantity is a statewide network of stream gages that measure surface flows, and monitoring wells that measure ground water levels. Funding for these statewide networks fluctuates from year to year, and it is critical that reliable funding become available to support these gages and wells with long-term records of water levels. In addition, there are many areas of the State where monitoring is insufficient to determine the impacts of withdrawals or proposed withdrawals on the water resource, and on the aquatic and terrestrial living resources that depend on adequate water quality and quantity. This Committee reiterates the 2003 Committee recommendation that a reliable and consistent funding source be identified to support the existing monitoring network and expand the network to areas of the State where more data are needed to adequately assess water conditions.

Modeling Studies

The 2003 Advisory Committee recommended that the State conduct an evaluation of the declining ground water levels in the Atlantic Coastal Plain of Maryland. In response to this recommendation, Governor Ehrlich directed MDE and the Maryland Department of Natural Resources (DNR) to work in cooperation with the USGS to initiate the first phase of the Coastal Plain monitoring and modeling project to evaluate the sustainability of the ground water resources in the seven major confined Coastal Plain aquifers. It is essential to complete this study and to initiate similar studies for the remaining areas of the State. These water availability modeling studies will provide critical data to assist permit writers in making sound decisions about water withdrawal requests, and will provide information to help local planners and decision-makers in developing their Comprehensive Plans and water and sewerage plans.

RECOMMENDATION:

Continue the comprehensive evaluation of the State's watersheds and aquifers to determine their adequacy in meeting expected demands.

Maryland Stream Gage Network

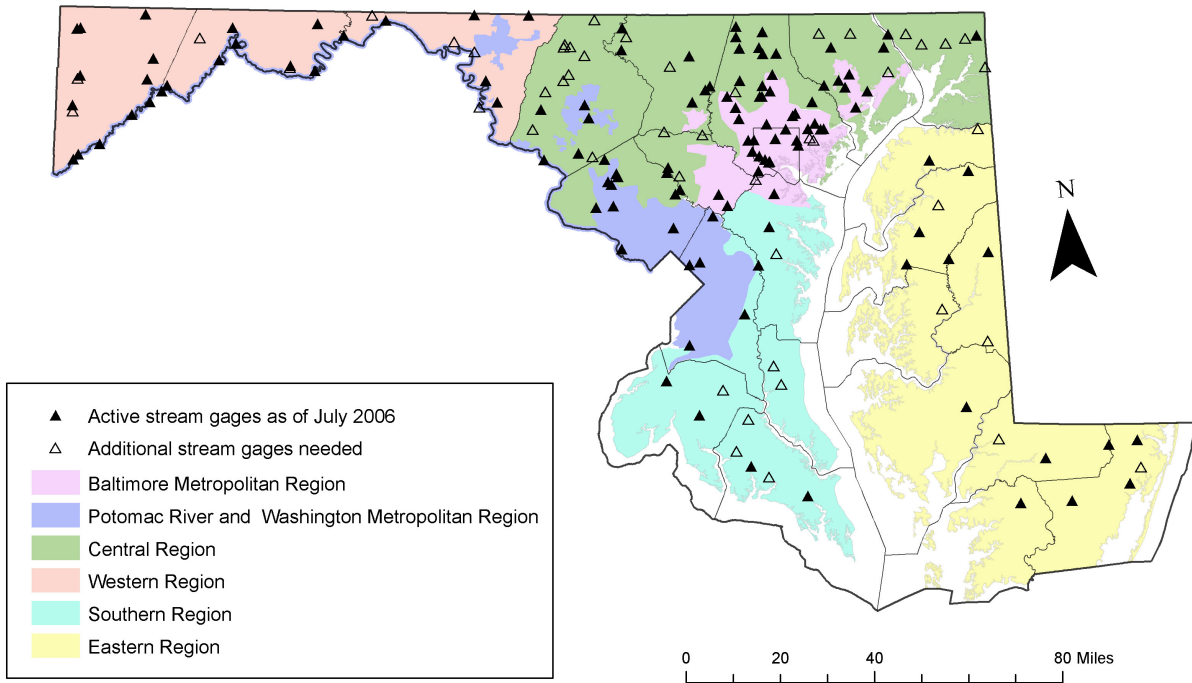


Figure 12

Maryland Observation Well Network

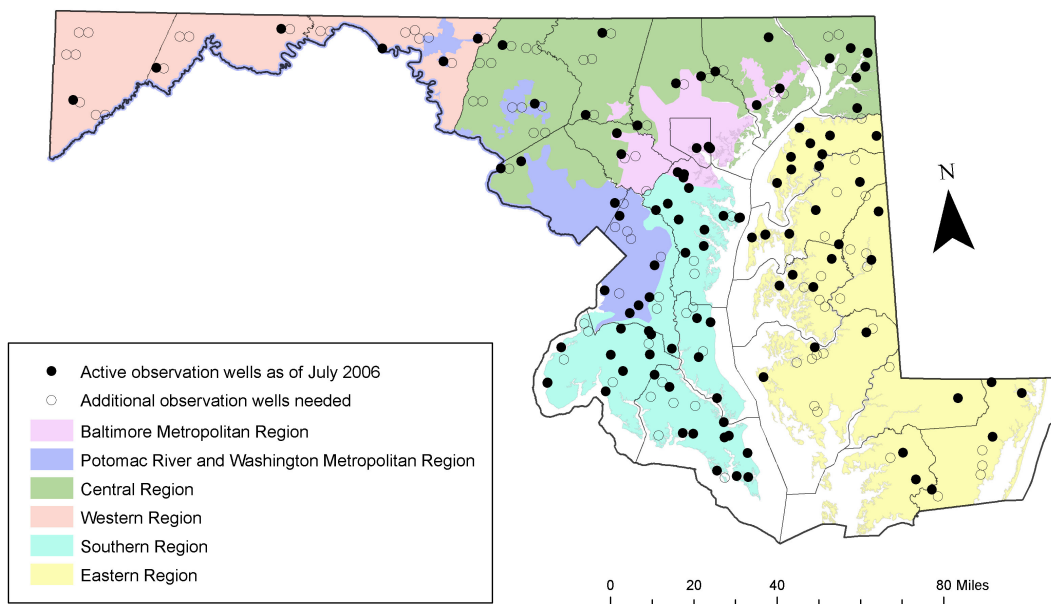


Figure 13

Planning for Maryland's Water Supply Needs

State Water Resources Management Plan

Adequate planning for water supply must include an understanding of both current and future supply and demand, an analysis of the impacts of withdrawals on the resource and aquatic environment, and the development of an appropriate management structure to ensure that the State's water resources remain sustainable. Good planning also requires identifying and evaluating alternatives for water supply demands in areas where demand is likely to exceed the available supply (including the possibility of limiting growth), and must define the infrastructure necessary to utilize these future sources of water.

Section 5-203 of the Environment Article of the Annotated Code of Maryland requires MDE to:

Develop a water resources program that contemplates proper conservation and development of the waters of the State, in a manner compatible with multiple purpose management on a watershed or aquifer basis, or any other appropriate geographical unit.

State and local agencies are empowered to plan and supervise the development and conservation of the waters of the State for the citizens' best interests and benefit. Most of the State's water resources program focuses on water quality (e.g. wastewater discharge permits, sediment and stormwater control, Total Maximum Daily Loads, etc.). Although MDE uses the water appropriation permitting process to manage water withdrawals, there is no statewide plan to ensure that adequate water resources will be available to meet future needs, or that water resources are being used in the most efficient manner. A State Water Resources Management Plan must be developed, in cooperation with local governments, to assess both human and environmental water supply needs throughout Maryland, and to evaluate and implement alternatives for developing new water supplies. The State Water Resources Management Plan should establish priorities and timeframes for the development of water supply infrastructure, and inform decision-making at the State and local levels regarding capital improvement programs. Inherent in this Plan should be the knowledge and recognition that water is a limited resource that cannot meet all needs. The Plan should provide a technically sound and open process for wise allocation of the resource.

The State Water Resources Management Plan should address water supply needs in Maryland for at least 50 years into the future. The plan should also evaluate developing water supply infrastructure on a regional basis, as cumulative impacts and opportunities can be better identified. Providing water services on a regional basis may be more efficient than on an individual jurisdiction basis, and regional systems can generate the funds necessary to provide for capital improvements at lower user rates. Regional systems can also generate funds to support the planning and engineering personnel necessary to effectively address water supply requirements and limitations.

Recognition of Ecosystem Impacts

Water is valuable for its direct human uses: drinking, waste disposal, commercial processes, and transportation. But water is also essential for ecosystem functions, which in turn benefit all Maryland citizens. The value of Maryland's ecosystem depends upon adequate quantities of good quality water. The challenge confronting management of the State's water resources is to ensure that ecosystem integrity is maintained and restored while also ensuring that adequate water supply and sewage disposal systems are available for Maryland's citizens.

Human activities that withdraw ground or surface water can have significant negative impacts on the State's natural resources. For example, headwater streams and wetlands rely on groundwater to maintain baseflow conditions, and are adversely impacted when ground water withdrawals exceed recharge. Extreme and highly variable stream temperatures and reduced habitat quantity and quality are two alterations related to low baseflow conditions that are detrimental to living resources. Any change in natural stream flow can have cascading impacts to downstream ecosystems. These changes result in habitat alteration that often leads to losses in commercially and recreationally valuable finfish stocks causing direct and indirect economic losses to the State.

Damming streams and rivers can have equally damaging effects if the environmental impacts of constructing and operating the dam are not adequately considered. Of utmost concern are changes in flow and temperature regimes, as well as impedance of fish migration. A significant change in water quality downstream from a dam can result from releases of oxygen-depleted water from the lower levels of deep reservoirs.

These concerns should not automatically rule out any consideration of building dams to create reservoirs. As an example, the construction of the Jennings Randolph reservoir on the North Branch of the Potomac River has facilitated the creation of a trophy trout stream in one of the most polluted rivers in Maryland. The dam was constructed so that releases can be made from varying depths of the reservoir to maximize water reoxygenation. Streamflow augmentation not only provides water to meet the needs of the downstream metropolitan area, but also has improved the water quality in the North Branch to allow the establishment of a trout fishery just below the dam. While additional water quality improvements are still needed in the North Branch, Jennings Randolph is nevertheless a good example of a project that has significantly improved local conditions in a stream by proactively addressing the potentially damaging impacts of dam construction and operation.

Maryland's water resources are also negatively impacted even without the direct withdrawal of water or damming of streams or rivers. Many studies have shown that land development results in higher water temperatures, more extreme and variable flows, altered channel structure, less retention of nutrients and sediments in upstream areas, higher rates of soil erosion, increased runoff of warm water and pollutants, lower biological integrity, a dominance of living resource communities by a few species that can tolerate and thrive in degraded conditions, and often the establishment of non-native invasive species that displace or significantly reduce the abundance of native species.

Maryland has several monitoring programs that can be used to assess the likely impacts of proposed water withdrawals, damming, or other development on our water resources, albeit with some enhancements. This information can also help to make sound decisions about water usage in the State, reduce conflicts related to water allocations, and maintain and restore ecosystem function.

As Maryland strives to meet the water needs of a growing population and dispose of the associated waste products, there is a significant potential to impact the State's aquatic and terrestrial living resources and change the ecosystems on which they, and humans, depend. The State needs to recognize these impacts and strive to balance human water needs with maintaining vital natural resources. The Committee plans to identify and explore critical ecosystem issues during the remainder of its tenure, so that improvements made for water supply also benefit the State's living resources.

Support for Local Water Supply Planning

Providing guidance to and improving State-mandated local planning programs is critical to the long-term success of the State Water Resources Management Plan. Local planning programs are the principle vehicle through which long term planning outputs are implemented as thousands of local decisions and actions. Local governments have been delegated full authority to manage and regulate their own land and development activities. The State has a responsibility to provide local governments with sufficient guidance to carry out this responsibility in a way that protects and makes wise use of water resources, and that benefits the entire State.

A review of the current set of county Water and Sewerage Plans and Comprehensive Plans found that there are wide disparities in how current they are, their quality, and their interrelatedness. This review did not consider the more than 100 municipalities that are also required to prepare and maintain Comprehensive Plans, but presumably many of the same problems exist.

Analysis of the adoption dates of county plans documented that there is no consistent relationship between the timing of the two plans. In some cases, the Water and Sewerage Plan predates the Comprehensive Plan, and in others the Comprehensive Plan is developed before the Water and Sewerage Plan. The duration of gaps between development of the two plans varies widely. Water and Sewer Plans are mandated to be updated every three years, while the Comprehensive Plans are mandated to be updated every six years. While some counties' plans are current, there are Water and Sewer Plans that have not been updated for as many as 15 years, and Comprehensive Plans that have not been updated for as many as 33 years.²¹

In the course of deliberations on this topic, major new legislation was enacted that bears strongly and directly on these issues. House Bill 1141 will significantly add to and transform the content of local Comprehensive Plans by 2009. These bills added major new elements including requiring county municipal annexation/growth area plans and agreements, agricultural preservation elements, and a water resources element. All of these have significant and direct relationships to water resources and water supply issues. The water resources element has the most direct impact on this Committee's work. This legislation increases the urgency of integrating and coordinating the work of MDE, DNR, and the Maryland Department of Planning (MDP), and dictates that the agencies start to work together to map out a program to guide local governments in their implementation.

Closely related to the subjects covered by the new legislation are the recommendations of the Interagency Technical Assistance Committee on Wastewater Treatment Systems (ITAC), listed below. The major components listed here are described in more detail in Appendix C:

- Ensure adequate water and wastewater system capacity;
- Fund water and sewerage planning;
- Provide guidance, technical assistance and training;
- Improve inter-jurisdictional cooperation;
- Integrate water resource objectives into water and sewerage planning;
- Strengthen the MDE's oversight role in water and sewerage planning;
- Revise the regulations for Water and Sewerage Plans; and
- Establish procedures to govern minor Water and Sewerage Plan amendments.

Planning for Future Water Supplies

There are a number of areas in the State, especially in the central and western regions, where it is already apparent that water supplies are not adequate to meet current or future needs. As soon as possible, it is necessary to take steps to make more efficient use of existing water supplies, as well as to identify and develop new water supplies. Although ground water is available in this area, it may be impractical to find ground water sources to meet demands that significantly exceed 500,000 gallons per day. All options should be fully explored, including building new reservoirs, expanding the interconnections between water systems to allow for increased transfer of water supplies from areas of relative abundance to areas of need, implementing water reuse technologies, instituting effective conservation measures, eliminating system leakage, and exploring the possible use of desalinization, or other innovative or alternative measures.

In order to meet anticipated water resource needs for the western and central regions of the State, it is imperative that planning be initiated as soon as possible. These regions should be the first priority for completion in the State Water Resources Management Plan. Finding appropriate locations for future reservoirs, building stakeholder support, and meeting stringent environmental requirements make constructing a reservoir a much more involved and complex matter than it was when plans for the Jennings Randolph reservoir were initiated. Planning for the Jennings Randolph reservoir began in the 1960s, and the reservoir did not become operational until 1982. In a more current example, the Virginia Corps of Engineers recently issued a permit for the King William Reservoir, a 12.2-billion gallon storage reservoir, which will provide water for the Virginia peninsula, New Kent County, and King William County. Planning for this reservoir began in 1987, and now, 18 years later, the design and implementation stage of the project is just beginning.²² System interconnections also require long planning periods and considerable efforts to build stakeholder support.

RECOMMENDATIONS:

Develop a State Water Resources Management Plan within three years to provide guidance for MDE in carrying out its water management responsibilities and for local governments developing the plans required under new legislation enacted in 2006.

Establish regional planning initiatives to more fully integrate planning processes among State, county and municipal governments. Resource management and land-use decision-making must be integrated to provide for orderly development while, at the same time, protecting the resources.

Avoid where possible, or minimize and appropriately mitigate the ecosystem impacts of any water resource management decision that changes or modifies natural conditions.

Provide support for local water supply planning by providing information and technical assistance as required by HB1141 (codified as Chapter 381, 2006 Laws of Maryland) and implementing recommendations of the Interagency Technical Advisory Committee.

Initiate a process to identify and develop new water sources and to expand upon means to make better use of existing resources. This recommendation acknowledges that adequacy problems already exist and more will follow with the projected increases in population and water use.

Programmatic Changes

The Committee identified two areas where programmatic changes will facilitate improved management of the State's water resources:

1. Make appropriate legislative changes; and
2. Initiate an outreach and education program

Legislative Changes

Exempting Small Appropriations from Permit Requirements

Approximately 9,800 (88%) of the 14,000 appropriation permits on record are for withdrawals less than 5,000 gallons per day (gpd), and these small permits represent less than five percent of total water withdrawals. While having very little individual or cumulative impact on the resource, they require a substantial amount of staff time to process. Eliminating the permit requirement would free two full-time employees at MDE to focus on the more complex permits for larger withdrawals. An amendment in law is required to accomplish this change. Even if small withdrawals are exempted from the permit requirements, the State will continue to require every well to obtain a well construction permit, which requires permittees to provide location information as well as well yield.

Protecting the Sources of Drinking Water Supplies

A Source Water Protection Area (SWPA) is the area that contributes water to a public water system. For surface water systems, it is the watershed of the river or stream upstream of the intake that supplies water to the system. For ground water systems, the SWPA is the wellhead protection area for the supply well. SWPAs have been delineated for all public water systems. In addition, some aquifers or regions that provide substantial water resources for individual residential wells are also vulnerable to contamination from human activities. While some local governments have taken steps to protect the SWPAs for their public water systems, there is no statewide program to protect the sources of drinking water. Legislation, regulations and/or new policies are needed to provide for protection of drinking water sources.

Providing an Effective Mechanism for Enforcing Compliance with Water Appropriation Permits

Currently, the State does not have an effective means for enforcing compliance with water appropriation permit requirements. The use of the existing criminal sanctions is much too cumbersome and may be excessively punitive for most of these violations. As a result, the State has little recourse where overuse occurs or when a user fails to obtain or renew a permit, or to report water use. Legislation is needed to provide civil and administrative remedies for enforcing water appropriation permits.

RECOMMENDATION:

Enact legislation or regulation to:

- a. Improve efficiency of the water appropriation permit process by eliminating the requirement to obtain a permit for withdrawals under 5,000 gallons per day.**
- b. Protect the sources of drinking water supplies to insure their long-term availability.**
- c. Enact an effective mechanism for enforcing appropriation permits to provide equity among users and the data needed for management purposes.**

Education/ Outreach Program

Both the earlier Advisory Committee report and this interim report express serious concern over the complacency of public officials and the general public alike for water supply issues. While many agencies and organizations work tirelessly to focus attention on water quality issues, particularly as they relate to the Chesapeake Bay, there is minimal attention paid to water supply. This is true despite the fact that water supply, including the protection of its quality, is of greater importance to public health and arguably of equal importance to the State's economy than preserving and protecting Chesapeake Bay resources. Yet, notwithstanding its importance, there are very few resources available at the State level for outreach and education programs pertaining to water supply.

As the State agency responsible for managing water supply programs, MDE needs to implement an educational program that can be adapted to various audiences, including elected officials, the media, advocacy groups, citizens, students, and others. The task involves determining what outreach efforts are needed for each targeted audience, creating educational and outreach materials, providing a method for disseminating the materials, and presenting information to the various audiences. Implementing an effective outreach and education program is a critical component of the State's water resource management efforts, and key to obtaining support for carrying out the recommendations of the Advisory Committee.

RECOMMENDATION:

Develop an outreach program to educate Maryland citizens, the regulated community, and State and local officials regarding the importance of water resource management, water supply protection, and water conservation and efficiency practices.

Funding

The Committee's recommendations cannot be implemented without identifying appropriate funding mechanisms and securing adequate long-term funding. A subcommittee, comprised of those members of the Committee representing private sector and local government organizations, reviewed funding needs and possible financing opportunities. The objective in identifying any potential funding source is to be as fair and equitable as possible across the different categories of water users, such as municipal, industrial, and agricultural. Each one of these sectors should pay their "fair share" for water resources planning and management activities, without placing any undue burden on a particular sector. Efforts to identify funding sources need to consider the cumulative impacts of various financing strategies.

As population growth continues, and changing settlement patterns shift the demand for services, development pressure is expected to be very high in Maryland. The planning activities recommended by the Committee are critical to accommodating this growth in existing and planned development areas that can be efficiently served by water and sewer utilities and other urban services. Providing adequate services within planned development areas is also important to reducing development pressure in rural areas in order to maintain the economic, environmental, cultural, and aesthetic integrity of those areas. Placing the bulk of the cost of resource analysis and planning activities with those who most directly benefit from the services (i.e. developers and public water suppliers) may be one way to ensure equity. Commercial and industrial development typically follow residential development, so those sectors will also need to pay their "fair share" for water resources planning. Additionally, there is a legitimate desire to keep agriculture viable by minimizing any potential adverse financial impacts.

While the benefits of implementing these programs are not easily quantified, they are very real, and it is important to keep in mind that there are also costs associated with not planning for future water supply needs. Failure to plan for Maryland's water needs could have serious economic and environmental results, at a cost that far outweighs the relatively small fiscal impact of this Committee's recommendations.

Funding Needs

The Committee estimated funding needs based on the issues identified in this report, and evaluated a number of different potential funding mechanisms to determine their suitability for supporting the recommended activities. It is important to keep in mind that the budget needs are preliminary, and intended to provide an estimate of the magnitude of need. Budget estimates may need to be adjusted based on the actual programs implemented and/or legislation adopted.

The budget proposal included in Appendix D details the increased budget needs for the next eight years (2007 – 2014). The budget needs are approximately \$5.6 million for 2007, \$7.0 million for 2008, \$8.2 million for 2009, \$9.7 million for 2010, \$8.1 million for 2011, \$7.7 million for 2012, and about \$5.9 million for 2013. Budget needs level out at about \$5.5 million per year for 2014 and beyond. The total for the eight year period is \$63.1 million. The identified budget needs represent statewide activities. Specific

responsibilities and associated resources would be distributed among several state agencies as appropriate. A brief summary of the expenditures follows.

1. Studies to evaluate water availability statewide

Providing high quality information on available water resources will allow State planners to make better decisions regarding requests to withdraw water, and will assist local planners in determining where and how much growth can be supported within their jurisdictions. Funding estimates include the Coastal Plain Aquifer study that was initiated in 2005 (as recommended by the 2003 Advisory Committee), as well as funding to conduct an analysis of water availability in the hard rock aquifers west of the Fall Line. The two assessments will be conducted collaboratively by MDE, DNR, and USGS.

The budget also includes one Water Resources Engineer to conduct in-house watershed assessments and oversee contracted efforts, as well as estimated costs for expanding the State's water monitoring programs, including the addition of 48 new stream gages and 102 new ground water wells, plus associated operation and maintenance costs. Funding for the monitoring networks should be added to existing monitoring network funding in DNR's Maryland Geological Survey.

2. Staffing and associated costs for development of the State Water Resources Management Plan, and implementation of House Bill 1141 (codified as Chapter 381, 2006 Laws of Maryland)

Included in this request are three Natural Resource Planners, two Water Resources Engineers, and an administrative support person for MDE, and three planners for MDP, who will implement the activities required under the bill. The proposed MDE staffing would provide three regional Natural Resource Planners, with a Water Resources Engineer to provide engineering support, a Water Resources Engineer to function as division leader, and administrative support. MDP planners are needed to carry out the GIS analysis associated with the outlined work, to maintain liaison with county and municipal planners to assist them to integrate the necessary elements into their plans, and to develop and oversee the State and local development and land use policy and program aspects associated with the State and regional water resource plans.

Obtaining adequate funding in the FY 2008 budget, followed by gearing up to prepare the State Water Resources Management Plan, will take 12 to 18 months. During this time, steps can be taken with existing staff and resources to lay the necessary groundwork for the full planning program. Implementing these steps will require the commitment, direction, and priority of involved state agencies at the Secretariat level to include the following:

- Improve day-to-day communication between agency staff with overlapping program responsibilities;
- Increase mutual understanding of differing missions, disciplines, and perspectives;
- Improve consistency between programs and actions of each agency;

- Assure that the State speaks with one voice to local government and the public; and
- Improve the foundation for working together on long-term planning issues.

3. Staffing and associated costs for outreach and education activities

The budget includes one Administrative Officer to develop and implement an outreach program, with associated costs for document publication and for MDE to conduct workshops with various stakeholder groups.

4. Staffing to enforce water appropriation permit requirements

The budget includes two Environmental Compliance Specialists to enforce water appropriation permit requirements, plus two vehicles. These additional staff will be needed if legislation is enacted to give Maryland civil and administrative authority for enforcing the water appropriation permit regulations. Costs for these staff are projected to begin in 2009.

5. Staffing and associated costs to support existing State programs

Additional staffing is proposed for improving existing MDE programs, including one Geologist and one Water Resources Engineer for evaluating permit requests, and two Natural Resources Planners to conduct Source Water Protection implementation activities. The budget also includes estimates for updating the Water Supply Program's antiquated data management system.

Additional staffing is also proposed to support DNR programs that assess biological resources and ecosystems in Maryland that may be impacted by water supply issues.

6. Funding for local government planning efforts

For integrated planning to be truly effective, local governments must have the resources to incorporate water resource management into their planning and operating programs. Much of this effort is a local responsibility, however providing financial incentives to local government will help to assure that local governments undertake responsibilities related to the local water and sewerage planning program. Local governments have the authority to assess fees for water and sewer, building permits, and other local initiatives. Local planning efforts will primarily be financed through these local fee programs or other locally-generated funds. Providing State matching grants could be one alternative for assisting local governments and encouraging their planning efforts. State financial assistance could be tied to performance standards for implementing local water resources planning and management responsibilities.

Financing Alternatives

The Committee reviewed a number of alternatives for providing an ongoing source of funding for the recommended activities. The most likely means for raising the needed funds is through some type of fee structure. In the past, various sectors including local

government entities and the agricultural community, have opposed fees that were proposed by MDE. In order to ensure that any fee or other means for raising funding remains fair and equitable for all impacted citizens, the Committee recommends soliciting input from affected stakeholders to review various fee structures and other funding alternatives. Educating the stakeholders about the benefits of the proposed recommendations as well as involving them in the development of an appropriate fee structure, should result in a financial strategy that raises a sufficient amount of funds without placing an undue burden on any one sector of water users.

A significant consideration is whether a source of funding would be one-time, for a limited time, or ongoing. A one-time fee limits the ability to conduct additional studies that may surface in the future. Most of the necessary effort (operation and maintenance of additional monitoring gages and additional staffing) would need to be supported with ongoing funding. The most likely source of long-term, reliable funding for these programs would be some combination of a water appropriations permit fee and/or a drinking water fee comparable to the State's Bay Restoration Fund.

Without sufficient funding, the recommendations of this Committee and the previous Committee cannot be effectively implemented. It is critical that a reliable source of funding be identified to support ongoing water resource management efforts, including resource evaluation, planning and outreach initiatives, permitting programs, and for identifying and developing new water sources to meet future needs. This process should be initiated as soon as possible to ensure that funding becomes available at the earliest possible time.

1. Water appropriation permit fee

Permits are currently required for all commercial, agricultural, institutional, industrial, or municipal activities, with some exceptions. Exceptions include agricultural uses under 10,000 gallons per day, temporary dewatering activities using less than 10,000 gallons per day with a duration of less than 30 days, residential subdivisions with ten or fewer lots, and extinguishing a fire.

MDE is the agency responsible for issuing water appropriation permits, and maintains control over slightly more than 14,000 water appropriations permits. Currently there is no fee associated with issuing the permits or withdrawing water in Maryland. The renewal cycle is 12 years, which means that the State reviews approximately 1,200 permits annually.

In 2002, legislation was introduced in Maryland that would have established fees ranging from \$500 to \$5,000 per permit, and would have raised approximately \$3.6 million dollars per year. The legislation was not passed. If similar legislation is again proposed, modifying the amount of the permit fees and/or the way the fees are applied could result in more or less income from the fees.

Many other states with similar programs have fees associated with permit issuance. States charge application fees for new or renewal permits, annual fees, or a combination of the two. Some states charge a flat fee, while other rate structures are based on the amount of water withdrawn. Permit fees may also provide the benefit of heightening awareness about the importance of water and, if based on the

amounts of water withdrawn may also provide incentive for permittees to take steps to eliminate waste and reduce water use.

Permit application fees may provide an equitable approach for the imposition of water withdrawal and use fees, however in the past opposition to such a fee has been strong. It is crucial to garner the support and input of affected parties in order to develop an equitable structure that raises sufficient funds to meet water resource management needs. The Committee recommends initiating a formal dialogue with stakeholders such as the Maryland Association of Counties, the Maryland Municipal League, the Farm Bureau, the State Soil Conservation Committee, the Agricultural Commission, public drinking water suppliers, and other potentially impacted groups. Involving stakeholders at an early stage in the development of legislation or other funding strategies will improve the potential for a successful outcome.

2. Require large permittees to fund stream gages and monitoring wells

Frequently, large permittees have a significant impact on the water resource, and large surface water permittees are currently required to meet a “flow-by” or minimum flow requirement in order to maintain the ecological integrity of the stream. In many cases, however, there is not adequate monitoring of the stream to evaluate the impacts of large withdrawals or the cumulative impacts of multiple withdrawals on the resource. Current law allows MDE to require permittees to fund gages as part of the permit requirements.

MDE is currently conducting an assessment to identify potential permittees that could be required to pay for surface water gages. A similar assessment could identify potential ground water permittees who could be required to pay for ground water monitoring wells or stream gages.

3. Statewide impact fees for water

In 2004, the Bay Restoration Act was signed into law, requiring each user of a wastewater treatment plant or onsite sewage disposal system to pay a fee. The fee assesses \$30 per year to each user, and raises more than \$60 million per year that is used to upgrade wastewater plants, finance improvements to onsite septic disposal systems, and implement a cover crop program for the State.²³

A similar fee could be imposed specifically for water. The fee could be assessed to individual users, to developers, or to public water suppliers, and based on the volume of water used, or a standard fee per connection (like the Bay Restoration fee). Associating an impact fee with development may be an appropriate method for funding water related planning needs. A drinking water fee at about one-tenth the amount of the flush fee would generate enough revenue to meet the budget needs discussed in this report.

4. State general funds

The support of both the Governor and the Maryland General Assembly could provide dedicated State general funds for use in funding planning positions and/or

specific activities such as the Coastal Plain project. This source is particularly appropriate for funding positions needed to fulfill the requirements of the recently passed HB 1141.

5. Other state funding sources

Critical Areas funding could be increased to supplement some planning activities. These funds go to local government, and may be available for coordinating planning activities between the county comprehensive zoning plans and the county water and sewerage plans. Sixteen counties and forty-four municipalities are eligible for Critical Areas funding.

6. Federal funding sources

Additional research needs to be conducted to investigate the possibility of obtaining funding through U.S. Department of Agriculture's Rural Utility Service, the Corps of Engineers Urban Studies, the Environmental Protection Agency, and any other potential federal sources. While funding for water supply programs is not currently of high priority at the federal level, new and innovative initiatives might well attract the interest and support of federal agencies.

7. Local water and sewer user fees

Local water utilities could impose user or other fees to fund local planning activities. User fees of local water and sewerage systems should be adequate to properly maintain and replace existing systems and to support the planning requirements associated with these systems, such as county water and sewerage planning programs.

RECOMMENDATION:

Identify funding to support water resource management programs by initiating a dialogue with various stakeholders to evaluate funding alternatives.

Summary of Recommendations

The Committee recommends the following initial actions as first steps toward the goal of ensuring long-term sustainability of the State's water resources.

RECOMMENDATIONS:

1. Develop a State Water Resources Management Plan within three years to provide guidance for MDE in carrying out its water management responsibilities and for local governments developing the plans required under new legislation enacted in 2006.
 - a. Continue the comprehensive evaluation of the State's watersheds and aquifers to determine their adequacy in meeting expected demands. Expand ground and surface water monitoring networks to provide the data for this analysis and the continuing management of the State's water resources.
 - b. Identify and develop new water sources and make better use of existing resources.
 - c. Provide support for local water supply planning by providing information and technical assistance as required by HB1141 (codified as Chapter 381, 2006 Laws of Maryland) and implementing recommendations of the Interagency Technical Advisory Committee.
 - d. Establish regional planning initiatives to more fully integrate planning processes among State, county and municipal governments.
 - e. Avoid where possible, or minimize and appropriately mitigate the ecosystem impacts of any water resource management decision that changes or modifies natural conditions.
2. Enact legislation or regulation to:
 - a. Improve efficiency of the water appropriation permit process by eliminating the requirement to obtain a permit for withdrawals under 5,000 gallons per day.
 - b. Protect the sources of drinking water supplies to insure their long-term availability.
 - c. Enact an effective mechanism for enforcing appropriation permits to provide equity among users and the data needed for management purposes.
3. Develop an outreach program to educate Maryland citizens, the regulated community, and State and local officials regarding the importance of water resource management, water supply protection, and water conservation and efficiency practices.

4. Identify funding to support water resource management programs by initiating a dialogue with various stakeholders to evaluate funding alternatives.

Following submission of this interim report, the Committee is mandated by Executive Order to continue its work until July 2008. As these recommendations are initiated and the Committee continues its work over the next two years, other issues may be identified which will likely result in additional recommendations.

The Committee's work is far from complete. The Committee intends to continue studying the various issues related to water management in Maryland and to oversee the implementation of ongoing and future activities including the Coastal Plain Aquifer study and any other water assessment studies that are undertaken. Additional issues that may be addressed include the impact of water quality on water supply, demand management as a possible means for extending current supplies, and interstate and other coordination issues relative to the management of the Potomac and Susquehanna River basins.

-
- ¹ Maryland Department of Environment. Normal Monthly Precipitation Totals (in Inches) for Maryland Counties. <http://www.mde.state.md.us/Programs/WaterPrograms/Water_Conservation/Previous_Conditions/normalprecip_new.asp> June 20, 2006
 - ² Maryland Department of Planning. Historical and Projected Total Population for Maryland's Jurisdictions. September 2005 Revisions. Planning Data Services. September 2005.
 - ³ Gerhart, James. U.S. Geological Survey. Personal correspondence. May and June 2006.
 - ⁴ Maryland Department of Environment. 'Water Supply Conflicts in Areas with Fractured Rock Aquifers'. 2006.
 - ⁵ Wheeler, Judy. Unpublished U.S. Geological Survey data, 2003. Personal correspondence. March 16, 2005.
 - ⁶ Maryland Department of Planning. 'Historical and Projected Total Population for Maryland's Jurisdictions'. September 2005 Revisions. Planning Data Services. September 2005.
 - ⁷ Gerhart. 2006.
 - ⁸ Baltimore City. Bureau of Water and Wastewater Fact Sheet. Department of Public Works. <<http://www.baltimorecity.gov/government/dpw/wwwfacts.html>> June 20, 2006.
 - ⁹ Gerhart. 2006.
 - ¹⁰ Maryland State Planning Department. Maryland Water Supply and Demand Study. Part 1, Volume 3, Potomac River Basin. December 1967.
 - ¹¹ Steiner, Roland C., Erik R. Hagen, and Jan Ducnuigeen. Water Supply Demands and Resources Analysis in the Potomac River Basin. Interstate Commission on the Potomac River Basin. ICPRB Report No. 00-5. November, 2000.
 - ¹² Gerhart. 2006.
 - ¹³ Potomac River Basin Drinking Water Source Protection Partnership. 2005 Annual Report. 2005.
 - ¹⁴ Maryland Department of Planning. 2005.
 - ¹⁵ Gerhart. 2006.
 - ¹⁶ U.S. Geological Survey. Sustainability of the Ground-Water Resources in the Atlantic Coastal Plain of Maryland. USGS Fact Sheet FS 2006-3009. 2006.
 - ¹⁷ Drummond, D. Maryland Geological Survey. 'Water Supply Potential of the Coastal Plain Aquifers in Calvert, Charles, and St. Mary's Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers'. 2005.
 - ¹⁸ Maryland Department of Planning. 2005
 - ¹⁹ Gerhart. 2006.
 - ²⁰ Maryland Department of Planning. 2005.
 - ²¹ Fogelson. 2006.
 - ²² Official website of the King William Reservoir Project. <<http://www.kwreservoir.com>> June 20, 2006.
 - ²³ Khuman, Jag. Maryland Department of Environment. Personal correspondence. June 12, 2006.

Appendix A

2003 Committee

Follow up for Recommendations of the 2003 Advisory Committee on the Management and Protection of the State's Water Resources.

The 2003 committee found that the State's population is projected to increase by 1.1 million people by 2030, resulting in an increase in total water demand of about 233 million gallons per day. The committee determined that additional evaluations, planning and resources are needed in order to ensure that the State's water resources remain sustainable into the foreseeable future. The committee made seven specific recommendations. While resource limitations have precluded more substantive efforts, a number of activities have occurred to implement the first committee's recommendations:

1. Continue the comprehensive evaluation of watersheds and aquifers that are significant sources of water supply. Continue an Advisory Committee to provide guidance in implementing the recommendations.

Following the May 2004 report, the Maryland Department of Environment (MDE) conducted an inventory of watersheds in Maryland and determined a priority ranking for conducting supply and demand evaluations by watershed. The Water Supply Program has evaluated the Catoctin Creek watershed in Frederick County, and produced a report with findings and recommendations.

In addition, the Governor has provided support and funding to initiate a study of the complex Coastal Plain aquifer system. The U.S. Geological Survey, Maryland Geological Survey, and MDE have initiated the first phase of the three-phase project. A copy of the fact sheet describing the project is included in Appendix A.

2. Restore Funding for observation wells and stream gages deleted from the FY 2005 budget. Expand monitoring networks as funding becomes available.

Following the recommendations of the committee, funding for existing monitoring stations was restored for the FY 2005 budget cycle.

3. Improve coordination between Maryland and Virginia regarding water allocations from the Potomac River.

MDE has held cabinet-level meetings with the Virginia Department of Environmental Quality (VA DEQ), and has met with and held several conference calls with VA DEQ staff regarding management and technical issues. Maryland shared its regulations and policies with VA DEQ staff, and drafted a Memorandum of Understanding (MOU) establishing a coordinated review and comment process between the States. The states have agreed to the MOU in concept. In addition, Virginia proposed regulations in February 2006 establishing permit requirements for surface water systems.

4. Support water and sewer planning at the State and local government levels. Restore staff support at the State level. Restore financial assistance for counties.

Consider changes, such as adding source protection plans and water availability assessments.

MDE reassigned one full time employee to assist with plan review. In addition, Water Supply Program employees' responsibilities now include assisting with plan review.

MDE staff also participated in a Technical Advisory Committee that reviewed the existing water and sewerage planning process and made a series of recommendations to improve the process. A summary of the TAC's findings is included in Appendix A.

5. Implement an outreach program to inform the public about water supply issues and the importance of conservation.

During 2005, the secretaries of MDE and the Maryland Department of Planning presented information about land use planning and environmental concerns to the Maryland Association of Counties and the Maryland Municipal League. In addition, the two agencies conducted a series of workshops throughout the State aimed at helping local government planners and decision makers better understand the issues related to water supply and other water management concerns.

In April 2006, the Maryland State Lottery (MSLA) launched a scratch-off ticket aimed at educating Maryland citizens about water conservation. The ticket was developed in a unique collaborative effort between MDE and MSLA, with each ticket including one of sixteen water conservation tips.

6. Exempt withdrawals below a minimum threshold in the appropriation permit law.

House Bill 612 was submitted in the 2005 session of the Maryland General Assembly. The bill was not enacted. A copy of the bill is included in Appendix A.

7. Review laws, regulations, funding resources, and State laboratory capacity.

A bill was drafted and submitted which would have provided MDE with administrative penalty authority to enforce water appropriation permit violations. The bill was not enacted.

MDE also drafted guidance for public water systems on developing capacity management plans. MDE accepted comments from various stakeholders and is currently revising the guidance document. Final guidance should be available in 2006.

Appendix B

EXECUTIVE ORDER 01.01.2005.25

(Rescinds Executive Orders 01.01.2002 .05 and 01.01.2003.08)

Advisory Committee on the Management and Protection of the State's Water Resources

WHEREAS, The Water Resources Management Advisory Committee was established by Executive Order 01.01.2002.05, and later amended by Executive Order 01.01.2003.08, to provide advice to the State on policies and programs relating to the management, development, conservation, and protection of the State's water resources;

WHEREAS, The Advisory Committee submitted a Final Report of its findings to the Governor on May 28, 2004;

WHEREAS, The Advisory Committee found that the population of Maryland is projected to increase by 1.1 million people by 2030, and the demand for water is projected to increase by 233 million gallons per day by 2030;

WHEREAS, The Advisory Committee found that the availability of water resources to meet projected needs is not certain in all parts of the State where water demand is expected to increase;

WHEREAS, The Advisory Committee found that assessments of water resource availability throughout the State should be conducted on a continuing basis;

WHEREAS, The Advisory Committee recommended the establishment of a successor Committee to advise the State in implementing programs for the long-term sustainable use and protection of the State's water resources; and

WHEREAS, The Administration concurs with the recommendation of the Advisory Committee to establish a successor Committee.

NOW, THEREFORE, I, ROBERT L. EHRLICH, JR., GOVERNOR OF THE STATE OF MARYLAND, BY VIRTUE OF THE AUTHORITY VESTED IN ME BY THE CONSTITUTION AND THE LAWS OF MARYLAND, HEREBY RESCIND EXECUTIVE ORDERS 01.01.2002.05 AND 01.01.2003.08 AND PROCLAIM THE FOLLOWING EXECUTIVE ORDER, EFFECTIVE IMMEDIATELY:

- A. Established. An Advisory Committee on the Management and Protection of the State's Water Resources is established to advise the State in implementing programs and policies relating to the management, development, conservation and protection of the State's water resources.
- B. Membership and Procedures.
 1. Membership. The Advisory Committee shall consist of up to 15 members, including:
 - a. A member of the House of Delegates, appointed by the Speaker of the House;
 - b. A member of the Senate of Maryland, appointed by the President of the Senate;
 - c. The Secretary of the Department of the Environment or a designee;
 - d. The Secretary of the Department of Health and Mental Hygiene or a designee;
 - e. The Secretary of the Department of Agriculture or a designee;
 - f. The Secretary of the Department of Natural Resources or a designee;
 - g. The Secretary of the Department of Planning or a designee; and
 - h. Up to 8 members appointed by the Governor to include representatives of local government, the environmental, agricultural, and business communities, and other individuals from the general public with relevant interest or expertise.
 2. Members appointed by the Governor shall serve at his pleasure.
 3. The Governor shall designate the chairperson of the Advisory Committee.
 4. A member may not receive compensation for serving on the Advisory Committee, but is entitled to reimbursement for expenses under the Standard State Travel Regulations as provide in the State budget.
- C. Duties. The Committee shall perform the following duties:
 1. Review the latest information from State, local and federal agencies concerning assessments of the quality and quantity of the State's ground and surface water resources;
 2. Review local, State and federal laws, regulations and policies related to the management, development, conservation and protection of ground and surface water resources;

3. Assess the adequacy of existing governmental resources, regulatory enforcement and monitoring programs that are available for the management, development, conservation and protection of the State's ground and surface water resources;
 4. Identify alternatives for additional sources of water supply, such as storage, reservoirs, water system interconnections, inter-basin water transfers, or other means that may be necessary to meet future water demand;
 5. Recommend additional actions, studies, policies, regulations or laws necessary to assure that the management and protection of the State's surface and ground water resources is conducted in a manner consistent with their long-term sustainable use and protection;
 6. Identify appropriate State, federal and local government and private funding mechanisms to ensure that the actions, studies, policies, regulations or laws recommended by the Committee may be appropriately implemented; and
 7. Develop and recommend a comprehensive strategy, including the above elements and any other elements the Committee believes are necessary to ensure the adequacy of the State's water resources to meet the current and projected demand for water through 2030.
- D. Staffing. Staff support to the Advisory Committee shall be provided by the Maryland Department of the Environment.
- E. Meetings. The Advisory Committee shall meet on a quarterly basis or more often if necessary.
- F. Report. The Advisory Committee shall report its interim findings and recommendations to the Governor by July 1, 2006, and its final findings and recommendations by July 1, 2008.

GIVEN Under My Hand and the Great Seal of the State of Maryland, in the City of Annapolis, this 16 th Day of May, 2005.



Robert L. Ehrlich, Jr.
Robert L. Ehrlich, Jr.
Governor

Attest:

R. Karl Aumann
R. Karl Aumann
Secretary of State

Final Report of the Interagency Technical Assistance Committee on Wastewater Treatment Systems

prepared for the

Water Security and Sewerage Systems Advisory Council

EXECUTIVE SUMMARY

January 2006

**Stephen R. McHenry, Chair
Interagency Technical Assistance Committee**

**C. Victoria Woodward, Chair
Advisory Council**



**ROBERT L. EHRLICH, JR.
GOVERNOR**

**MICHAEL S. STEELE
LIEUTENANT GOVERNOR**

**This Report and the Preliminary Report of the ITAC are available
at MDE's web page under the heading of "More Publications":**

www.mde.state.md.us

Executive Summary

INTRODUCTION

Elected officials, planners, scientists, environmentalists, developers, community activists and just about anyone else who lives in Maryland has an opinion about growth and development as well as its effects on the environment and the quality of life in this beautiful State. One effect is clear: enormous development pressures test the ability of Maryland's State and local agencies to provide the public facilities needed to serve the growing population. Over one million new residents are expected to live in Maryland by the year 2020. To protect the public health, it is necessary to provide safe and adequate wastewater treatment facilities. In addition, to restore the Chesapeake Bay and its tributaries, it is necessary to improve the quality of the effluent from these wastewater facilities.

Local governments must meet these population growth and water quality pressures in several ways. The managers of wastewater systems must have strong financial policies and procedures in place in order to have self-supporting systems and to ensure the long-term operational and environmental performance of these systems. Local governments must also have County Water and Sewerage Plans in place that describe where, when and how wastewater systems will be developed to meet the demands of the growing population. Such plans must include demographic information, inventories of existing infrastructure, financing mechanisms, and plans for capital improvements. Unfortunately, many local governments are not able to keep pace with growth. Many smaller jurisdictions have difficulty maintaining existing wastewater facilities due to limited population, revenues, and funding options. In addition, local governments face new federal and State environmental laws and regulations that are expensive and difficult to implement.

In response to these needs, the Maryland General Assembly enacted House Bill 659 in 2002. This bill was a combination of three bills pending in the General Assembly during the 2002 session that called for the study of a wide variety of water security and wastewater systems topics. House Bill 659 created the Advisory Council on Water Security and Sewerage Systems and the Interagency Technical Advisory Committee on Wastewater Treatment Systems (ITAC). The Advisory Council was tasked to study multiple issues including water and wastewater security; funding for water and wastewater plant upgrades; water and sewer plans; and the safety of using chlorine as a disinfectant. The Advisory Council reported its findings and recommendations to the General Assembly on December 1, 2004. The Interagency Technical Assistance Committee on Wastewater Treatment Systems was charged with implementing a recommendation of the Governor's 2001 Task Force on Upgrading Sewerage Systems to advise local jurisdictions on the efficient operation and financial management of wastewater treatment systems.

The Interagency Technical Advisory Committee formed two subcommittees: the Financial Management Subcommittee and the Water and Sewerage Subcommittee. The two Subcommittees prepared the findings and recommendations that are presented in this Report. This Report addresses some of the obstacles to good financial management and wastewater planning by identifying training opportunities, suggesting better coordination among funding agencies, and proposing ways to improve the water and sewerage planning process.

FINANCIAL MANAGEMENT OF WASTEWATER SYSTEMS

The Financial Management Subcommittee of the Interagency Technical Assistance Committee (ITAC) prepared the Financial Management Section of this Report in response to recommendations in the *Task Force Report on Upgrading Sewerage Systems* (2001) and the *Final Report of the Water Security and Wastewater Systems Advisory Council* (2004). The Subcommittee identified its current tasks pursuant to the 2001 and 2004 Reports as the identification and recommendation of additional enhancements to local wastewater treatment system efficiencies as follows:

- Examine the potential for mandatory minimum training requirements for local, non-technical system personnel;
- Determine the feasibility of a statewide review committee to improve and expedite the application and selection processes for financial assistance; and
- Examine the potential for establishing a statewide database of wastewater system rates.

Local governments, especially small and medium-sized ones, face technical, managerial, training, and financial challenges in operating and maintaining water and wastewater systems. In particular, the Subcommittee recognized that training of local elected officials in the technical, financial, and managerial aspects of water and wastewater systems is critical.

The Subcommittee also recognized that it would be desirable to improve coordination of the various State and federal agencies providing financial assistance to local governments for water and wastewater capital improvements in regard to funding priorities, joint funding decisions, and the provision of information to prospective financial applicants.

The Subcommittee recommends that current levels of State capital grant funding for wastewater treatment systems, of approximately \$10 to \$20 million per year, be maintained in the future. Even as Biological Nutrient Removal projects are completed, there will be an ongoing need for financial assistance to some local governments to keep needed upgrades affordable to all citizens of Maryland. Without grant assistance, these systems may fall out of compliance, thereby reversing the environmental benefits of wastewater system improvements.

Finally, the Subcommittee evaluated the creation and maintenance of a database for wastewater user rates. While the Subcommittee acknowledged that rates should not be compared without detailed knowledge of the particular systems, such a database would be helpful to address affordability issues.

RECOMMENDATIONS: FINANCIAL MANAGEMENT OF WASTEWATER SYSTEMS

Provide a Consolidated List of Training Opportunities

The Maryland Department of the Environment (MDE) should work with training providers to develop a list of training opportunities on technical wastewater topics to assist local wastewater system staff.

Provide Training for Local Officials

- a) MDE and other stakeholders should prepare and widely circulate a short presentation to introduce local officials to their responsibilities for managing their wastewater systems and to inform them of relevant training opportunities. (The 20-minute CD on Wastewater Utility Management included in the Appendix of this Report provides an introduction to the type of training needed.)
- b) MDE and other stakeholders should identify appropriate training sessions on management and finance topics relevant to local responsibilities for wastewater systems and encourage local officials to attend these training sessions.
- c) MDE, the Department of Housing and Community Development (DHCD), and the U.S. Department of Agriculture - Rural Development (USDA) should require local officials and local system personnel to attend a minimum four-hour training course on their wastewater system responsibilities as a condition of receiving grant or loan assistance.

Coordinate Funding Agencies

- a) A statewide committee of wastewater funding program representatives should be established to serve as an information sharing and funding coordination body.
- b) MDE, DHCD, USDA and the Maryland Department of Planning should execute a Memorandum of Understanding that specifies funding goals, establishes a process to coordinate funding priorities, and streamlines procedures for the review of projects.
- c) State capital grant funds for wastewater treatment systems of approximately \$10 to \$20 million per year should continue to be available even after completion of current Biological Nutrient Removal improvements.

Create a Database of Wastewater System User Rates

MDE should create a database of wastewater system user rate structures to help funding agencies and managers of wastewater systems.

WATER AND SEWERAGE PLANS

House Bill 659 (2002) directed a review of the effectiveness of Water and Sewerage Plans. The Water and Sewerage Subcommittee of the Interagency Technical Assistance Committee (ITAC) evaluated this issue and prepared eight categories of findings and recommendations to improve the effectiveness of Water and Sewerage Plans.

Many communities in Maryland are undergoing growth, and some are experiencing unprecedented rapid growth. The water and sewerage planning process is a critical early step in the development process. Each community must provide adequate water and sewer systems to serve current needs, new development, and redevelopment in a manner consistent with the local comprehensive plan. Adequate water and sewer systems are necessary in order to support economic development and Smart Growth, and to protect public health and water quality. The Water and Sewerage Plan is the plan for water and wastewater infrastructure in a local jurisdiction.

At the State level, the work force dedicated to managing the Water and Sewerage Planning Program has been reduced over the years as other pressing issues have been given higher priority. Local jurisdictions now face a myriad of environmental priorities that also compete for funding with infrastructure planning. Adequate funds are needed to properly manage the County Water and Sewerage Plan process to ensure that safe and adequate facilities will be available to support local Comprehensive Plans and economic development in ways that support Smart Growth.

The members of the Subcommittee used their expertise and the results of a recent MDE survey on the tracking and allocation of water and wastewater capacity to develop a series of findings and recommendations for this Report. Several other work groups in addition to the ITAC were also examining issues that were relevant to this Subcommittee. These groups evaluated issues such as Total Maximum Daily Load (TMDL) implementation, Tributary Strategy implementation, annexation policy and procedures, and system capacity management. All of these issues factor into water and sewerage planning. The Subcommittee considered relevant water and wastewater planning issues in a systematic manner and prepared comprehensive recommendations, which are as follow:

RECOMMENDATIONS: WATER AND SEWERAGE PLANS

Ensure Adequate Water and Wastewater System Capacity

Local jurisdictions should enact ordinances (such as Adequate Public Facilities Ordinances) and implement management procedures to ensure that adequate water supply and sewerage facilities are available to meet projected needs, consistent with County and Municipal Comprehensive Plans.

Fund Water and Sewerage Planning

- a) MDE and the Maryland Department of Planning (MDP), in cooperation with the Maryland Association of Counties (MACO), the Maryland Municipal League (MML), and other stakeholders, should identify ways to fund State and local water and sewerage planning programs.
- b) MDE and MDP, in cooperation with MACO, MML, regional planning councils, and other stakeholders, should identify ways to develop information technology capabilities to improve the effectiveness and efficiency of the water and sewerage planning programs.
- c) When appropriate, the State Revolving Fund should be used to provide funding for the preparation and review of local Water and Sewerage Plans and amendments.

Provide Guidance, Technical Assistance, and Training

- a) MDE, MDP, and other agencies as appropriate, should provide necessary State data, technology, and technical assistance to local governments for preparing Water and Sewerage Plans.
- b) MDE should provide training for local elected officials and staff for preparing Water and Sewerage Plans.

Improve Inter-jurisdictional Cooperation

- a) MDE, DBED and MDP, in cooperation with MACO, MML, regional planning councils, and other relevant State and interstate agencies, should encourage inter-jurisdictional and regional cooperation for water supply and wastewater facilities.
- b) MDE, DBED and MDP, in cooperation with MACO, MML, and regional planning councils, should develop mechanisms to resolve county/municipal disagreements concerning water supply and wastewater systems.
- c) The Annotated Code of Maryland should be revised to establish a process and a time period for a county to act on proposed Water and Sewerage Plans and amendments submitted by municipal governing bodies. After the period expires, the municipality should be able to follow the new process and submit its Plan or amendment to MDE.

Integrate Water Resource Objectives into Water and Sewerage Planning

MDE and MDP, in cooperation with MACO and MML, should hold technical and policy meetings with stakeholders to integrate multiple water resource management objectives into the comprehensive planning process and the water and sewerage planning process.

Strengthen MDE's Oversight Role in Water and Sewerage Planning

- a) MDE should continue to provide oversight and guidance to those water and wastewater systems at critical capacity levels to ensure that necessary capital improvements are planned and constructed.
- b) All local jurisdictions should prepare Water Supply Capacity Management Plans and Wastewater Capacity Management Plans to ensure that there is adequate capacity in their water supply and wastewater systems. Each local jurisdiction must use and present consistent data in its Capacity Management Plans and its Water and Sewerage Plan.

Revise the Regulations for Water and Sewerage Plans

- a) MDE and MDP, with input from all stakeholders, should review and update the regulations pertaining to Water and Sewerage Plans.
- b) In order to receive State guidance and assistance in a timely manner, the counties should submit draft Water and Sewerage Plan updates and amendments to MDE and receive State comments before initiating formal plan-adoption procedures.

Establish Procedures to Govern Minor Water and Sewerage Plan Amendments

MDE should establish procedures to govern minor amendments to Water and Sewerage Plans to ensure consistency with the State law.

Appendix D

Appendix D available on the Maryland General Assembly website at <http://mlis.state.md.us/2006rs/billfile/hb1141.htm>

Water Resource Advisory Committee

FFY 2007 - 2014 Budget Detail

Personnel	2007	2008	2009	2010	2011	2012	2013	2014
Assistance to Local Government (MDE)								
Natural Resources Planner III (3)	\$108,585.00	\$113,579.91	\$118,804.59	\$124,269.60	\$129,986.00	\$135,965.35	\$142,219.76	\$148,761.87
Water Resources Engineer III (1)	\$41,126.00	\$43,017.80	\$44,996.61	\$47,066.46	\$49,231.52	\$51,496.17	\$53,864.99	\$56,342.78
Water Resources Engineer V (1)	\$46,773.00	\$48,924.56	\$51,175.09	\$53,529.14	\$55,991.48	\$58,567.09	\$61,261.18	\$64,079.19
Assistance to Local Government (MDP)								
Natural Resources Planner III (3)	\$108,585.00	\$113,579.91	\$118,804.59	\$124,269.60	\$129,986.00	\$135,965.35	\$142,219.76	\$148,761.87
Watershed Assessments (MDE)								
Water Resources Engineer III (2)	\$41,126.00	\$43,017.80	\$89,993.23	\$94,132.92	\$98,463.03	\$102,992.33	\$107,729.98	\$112,685.56
Assessment of Ecosystem Impacts (DNR)								
Natural Resources Biologist (2)	\$69,740.00	\$72,948.04	\$152,607.30	\$159,627.24	\$166,970.09	\$174,650.71	\$182,684.65	\$191,088.14
Potomac River/Jennings Randolph (MDE)								
Natural Resources Planner III (1)			\$39,601.53	\$41,423.20	\$43,328.67	\$45,321.79	\$47,406.59	\$49,587.29
Outreach/Education (MDE)								
Administrative Officer II (1)	\$33,970.00	\$35,532.62	\$37,167.12	\$38,876.81	\$40,665.14	\$42,535.74	\$44,492.38	\$46,539.03
Enforcement of Appropriation Permits (MDE)								
Environmental Compliance Specialist I (2)			\$69,778.34	\$72,988.14	\$76,345.60	\$79,857.50	\$83,530.94	\$87,373.36
Permit Writers (MDE)								
Geologist III (1)			\$39,601.53	\$41,423.20	\$43,328.67	\$45,321.79	\$47,406.59	\$49,587.29
Water Resources Engineer III (1)			\$44,996.61	\$47,066.45	\$49,231.51	\$51,496.16	\$53,864.98	\$56,342.77
Source Water Protection Implementation								
Natural Resources Planner III (2)			\$79,203.06	\$82,846.40	\$86,657.34	\$90,643.57	\$94,813.18	\$99,174.58
Support Staff								
Office Secretary III (1)	\$26,429.00	\$27,644.73	\$28,916.39	\$30,246.55	\$31,637.89	\$33,093.23	\$34,615.52	\$36,207.83
Data Entry Operator II (1)	\$21,971.00	\$22,981.67	\$24,038.82	\$25,144.61	\$26,301.26	\$27,511.12	\$28,776.63	\$30,100.35
Total Personnel	\$498,305.00	\$521,227.03	\$939,684.81	\$982,910.31	\$1,028,124.18	\$1,075,417.90	\$1,124,887.12	\$1,176,631.93

Fringe	2007	2008	2009	2010	2011	2012	2013	2014
30% of total salary cost	\$149,491.50	\$156,368.11	\$281,905.44	\$294,873.09	\$308,437.25	\$322,625.37	\$337,466.14	\$352,989.58
Total Fringe	\$149,491.50	\$156,368.11	\$281,905.44	\$294,873.09	\$308,437.25	\$322,625.37	\$337,466.14	\$352,989.58
Travel								
Motor vehicle operation and maintenance	\$8,000.00	\$8,000.00	\$13,500.00	\$13,500.00	\$13,500.00	\$13,500.00	\$13,500.00	\$13,500.00
Instate Travel (to meetings and inspections) meals \$39/diem x 150 days accommodations \$75/diem x 100 days parking & tolls \$10/diem x 75 days	\$12,450.00	\$12,450.00	\$18,550.00	\$18,550.00	\$18,550.00	\$18,550.00	\$18,550.00	\$18,550.00
Out of State travel	\$3,000.00	\$3,000.00	\$5,750.00	\$5,750.00	\$5,750.00	\$5,750.00	\$5,750.00	\$5,750.00
Total Travel	\$23,450.00	\$23,450.00	\$37,800.00	\$37,800.00	\$37,800.00	\$37,800.00	\$37,800.00	\$37,800.00
Equipment								
Vehicles (2)			\$39,756.00					
Electrofisher	\$5,000.00			\$5,000.00				
Block-nets, dip nets, D-nets	\$1,500.00			\$1,500.00				
Multi-meter water quality instrument	\$6,000.00			\$6,000.00				
Total Equipment	\$12,500.00		\$39,756.00	\$12,500.00				
Supplies								
7 Replacement Computers @ \$1,755 each	\$12,285.00				\$12,285.00			
10 Replacement Computers @ \$1,151 each	\$3,453.00		\$8,057.00		\$3,453.00		\$8,057.00	
Software	\$1,600.00				\$1,600.00			
Office, Library, Audio Visual, Data	\$3,000.00	\$3,000.00	\$1,500.00	\$1,500.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00
Total Supplies	\$20,338.00	\$3,000.00	\$9,557.00	\$1,500.00	\$20,338.00	\$3,000.00	\$11,057.00	\$3,000.00

Contractual	2007	2008	2009	2010	2011	2012	2013	2014
Coastal Plain aquifer study	\$700,000.00	\$1,600,000.00	\$1,700,000.00	\$3,000,000.00	\$2,300,000.00	\$1,800,000.00	\$500,000.00	
Piedmont/Valley/Appalachian aquifer study		\$600,000.00	\$600,000.00	\$600,000.00	\$600,000.00	\$600,000.00		
Stream gages*	\$145,000.00	\$320,000.00	\$510,000.00	\$560,000.00	\$570,000.00	\$587,000.00	\$605,000.00	\$623,000.00
Ground water monitoring**	\$950,000.00	\$1,100,000.00	\$1,250,000.00	\$1,400,000.00	\$340,000.00	\$350,200	\$360,706	\$371,527
Printing of brochures/manuals	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00
Workshops	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00	\$5,000.00
Database Upgrade	\$500,000.00	\$127,018.33	\$125,961.18	\$124,855.39	\$123,698.74	\$122,488.88	\$121,223.37	\$119,899.65
Grants to Local Government (\$100K/yr/jurisdiction)	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00	\$2,400,000.00
Total Contractual	\$4,703,000.00	\$6,155,018.33	\$6,593,961.18	\$8,092,855.39	\$6,341,698.74	\$5,867,688.88	\$3,994,929.37	\$3,522,426.83
Other								
Freight and Postage	\$5,232.00	\$5,232.00	\$3,000.00	\$3,000.00	\$5,232.00	\$5,232.00	\$5,232.00	\$5,232.00
Photocopying	\$3,040.00	\$3,040.00	\$3,040.00	\$3,040.00	\$3,040.00	\$3,040.00	\$3,040.00	\$3,040.00
Training	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00	\$3,000.00
Total Other	\$11,272.00	\$11,272.00	\$9,040.00	\$9,040.00	\$11,272.00	\$11,272.00	\$11,272.00	\$11,272.00
Indirect Costs								
Indirect costs @ 24.27% of salary + fringe	\$157,220.21	\$164,452.34	\$296,479.95	\$310,118.03	\$324,383.46	\$339,305.10	\$354,913.13	\$371,239.14
Total Indirect Costs	\$157,220.21	\$164,452.34	\$296,479.95	\$310,118.03	\$324,383.46	\$339,305.10	\$354,913.13	\$371,239.14
Total	\$5,575,576.71	\$7,034,787.81	\$8,208,184.38	\$9,741,596.82	\$8,072,053.64	\$7,657,109.25	\$5,872,324.76	\$5,475,359.47

Total for 7 year period \$57,636,992.84

8th year \$5,475,359.47

Total for 8 year period \$63,112,352.31

*Based on adding 16 gages per year for 3 years. Cost estimates include installation plus operation and maintenance

** Based on adding 25 wells per year for 4 years. Cost estimates include well construction plus operation and maintenance