

SUSQUEHANNA RIVER BASIN COMMISSION

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To fulfill its mission of managing water resources in the Susquehanna River Basin, the Susquehanna River Basin Commission must balance environmental protection with meeting the needs for adequate water supply and economic development.

In the early 1980s, the Commission conducted special studies of the groundwater resources of the basin, and in July 1993, the Commission adopted its first Groundwater Management Plan for the Susquehanna River Basin. The 1993 plan contained a general summary of the groundwater resources of the basin, as well as a description of the regulatory framework existing at that time within the basin, identified the appropriate regulatory role for the member jurisdictions and the Commission, and presented key groundwater-related issues in the basin, along with recommendations for proposed solutions and management actions.

In 2003, the Commission initiated a comprehensive revision of the 1993 plan. This publication is a summary of the current plan, which was finalized and adopted in June 2005.

The complete Groundwater Management Plan (Publication No. 236) is available on the Commission's web site at <http://www.srbc.net/groundwater-management.htm> or on CD-ROM or hard copy format. For a CD-ROM or hard copy, call (717) 238-0423 or e-mail srbc@srbc.net. For more information, contact: Paula B. Ballaron, P.G., Project Review & Compliance Section Chief, Water Resources Management Division

Groundwater Management Plan for the Susquehanna River Basin

June 2005
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Summary Report

PURPOSE

The Groundwater Management Plan for the Susquehanna River Basin was prepared to provide a framework for the Commission to effectively manage the basin's groundwater resources in cooperation with its member jurisdictions and other organizations. The vision reflected in the plan is for an organized and cooperative effort among the Commission, federal government, states, local jurisdictions, business and environmental interests, and the public to make sound decisions for the sustainable development, use, and protection of groundwater resources in the basin.

The plan will promote and serve as a catalyst for more effective management of groundwater, enhanced coordination, and improved knowledge of the resource and its use. This will be done by carefully considering a wide range of factors, including water resource sustainability, protection of existing users, actions to minimize or mitigate impacts, protection of high quality water from degradation, effective interagency coordination, and public understanding of groundwater issues.

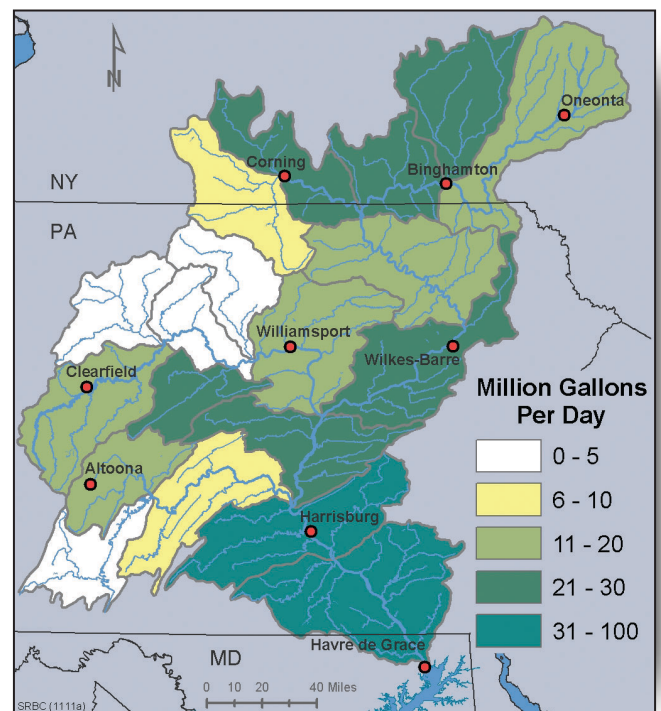
SCOPE

The Susquehanna River Basin is defined by the surface water drainage area. As shown on the map, the basin's groundwater is extensively used. The Groundwater Management Plan addresses a number of issues and problems concerning the interaction of groundwater and surface water resources, and, in particular, streamflow. Groundwater commonly supplies more than half of the total annual streamflow, and is the primary source

of water for streamflow during periods between surface water runoff events (rainfalls and snowmelts). During periods of low flow (i.e., normal summer conditions and droughts), virtually all of the water flowing in stream channels is supplied by groundwater.

The plan covers all groundwater activities that fall within the purview of the Commission. The plan also includes actions to be carried out by its member jurisdictions – New York, Pennsylvania, Maryland, and the federal government – and local jurisdictions, that are directly related to the Commission's program. The plan is broad-based and is not meant to be a detailed implementation document.

Preparation of the Groundwater Management Plan was accomplished under the general oversight of the Commission's Water Resources Management Advisory Committee (WRMAC). WRMAC is comprised of Commission staff and representatives of the four member jurisdictions.

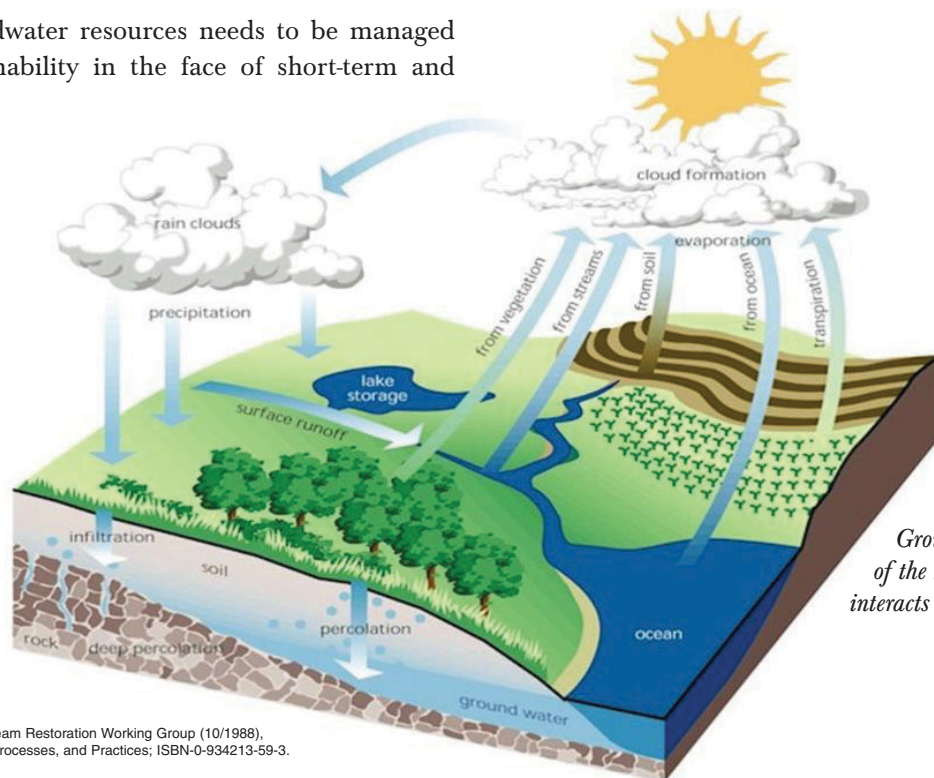


*Susquehanna River Basin groundwater use
by 8-digit hydrologic unit code*

MANAGEMENT PRINCIPLES

Certain principles form the foundation for management of the groundwater resources by the Commission. Many are basic facts or axioms – propositions that are universally recognized as indisputable – and are listed below as background for management discussions. Others are concepts adopted from the successes of a variety of existing and ongoing efforts. Overall, the principles serve to guide the Commission in its policy development and its actions to implement management goals.

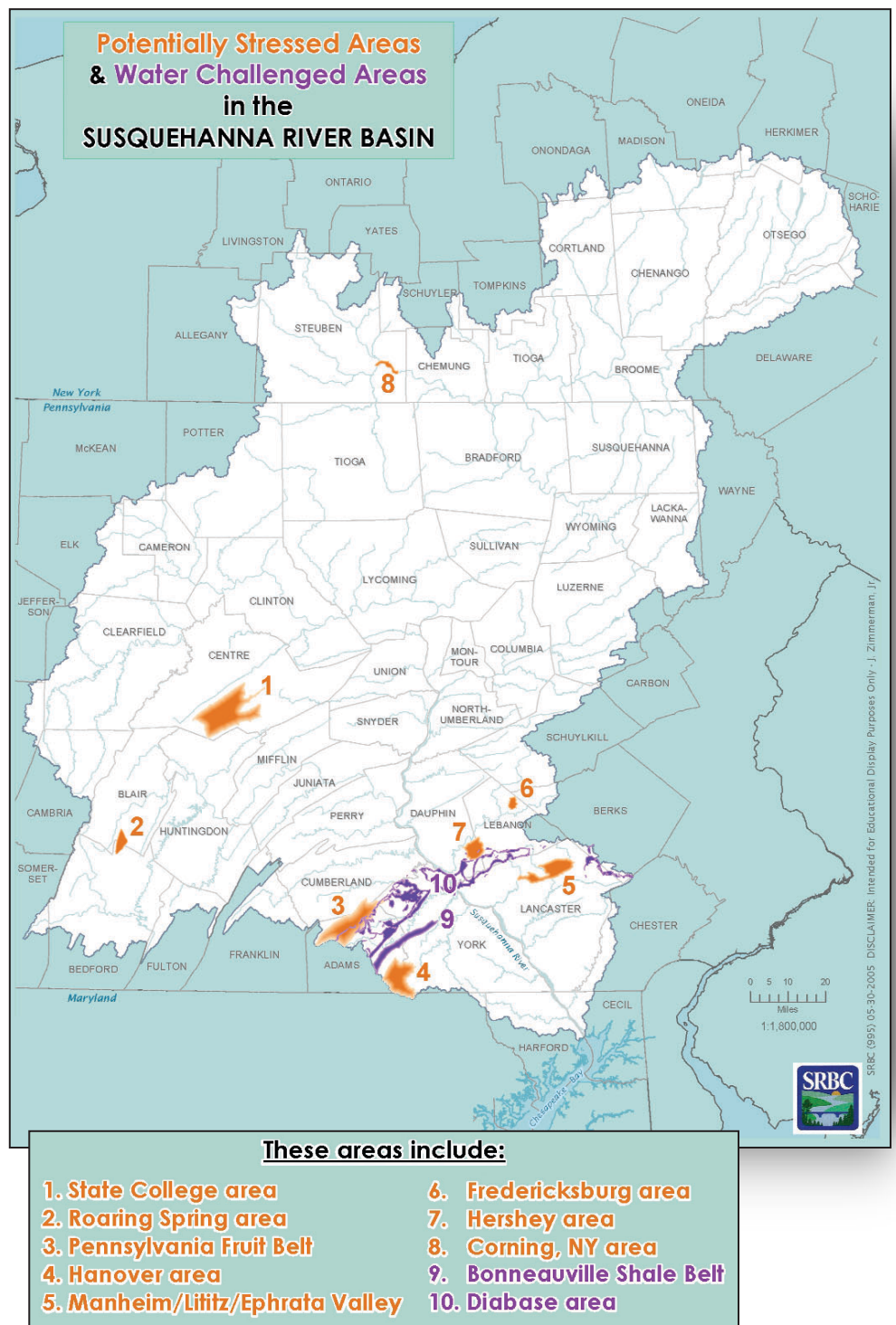
1. Water is a valuable asset and a finite natural resource; it is essential to all life.
2. Groundwater occurs almost everywhere beneath the land surface, but earth materials vary widely in their ability to store and transmit water. This causes a disparate distribution of groundwater resources in watersheds and poses a challenge for equitable allocation and use. Furthermore, the volumes of water pumped from a groundwater system must come from somewhere and must cause a change in the groundwater flow system.
3. From the standpoint of water use and water management, all groundwater is not equal – the quality of the water may make it unsuitable for some uses without treatment. Groundwater quality is a key consideration in developing water management strategies.
4. Groundwater management needs to be consistent with the objectives of the Susquehanna River Basin Compact to promote the “orderly, integrated and comprehensive development, use and conservation” of the basin’s waters and to secure and maintain “a proper balance among industrial, commercial, agricultural, water supply, residential, recreational, and other legitimate uses of the water resources of the basin.”
5. The use of groundwater resources needs to be managed to promote sustainability in the face of short-term and long-term growth.
6. Water resources management, and particularly groundwater resources management, requires an integrated approach whereby the Commission needs to consider all of the aspects of the water resource that are fundamentally interrelated in its decision-making.
7. Decision-making should be based on sound scientific principles, policies, and requirements in laws and regulations.
8. For proper management and protection, the Commission, as well as its member jurisdictions, should work to build long-term, local capability to foster critical “local stewardship” of water resources.
9. Prudent groundwater management requires that the Commission and its member jurisdictions recognize the likelihood of continuing limitations in fiscal and staffing resources, and focus on key issues where they can make a positive and substantial impact.
10. Coordination among member state and federal agencies and the Commission results in efficient data collection, planning, monitoring, and management of the basin’s groundwater resources.



GROUNDWATER RESOURCE ISSUES, PROBLEMS, AND RECOMMENDATIONS

Many groundwater problems have been brought about by human activities, either directly related to increasing demands for groundwater or indirectly related when development alters the natural flow regime in a non-beneficial manner. Other problems are related to water scarcity. Greater demand for groundwater has, at the same time, impacted the quantity and quality of those resources. An objective of the Commission's plan is to manage the use of water resources to promote sustainability in the face of short-term and long-term growth. The Commission, from a regulatory perspective, has defined the sustainable limit of water resource development as the average annual base flow (recharge) available in the "local" watershed during a 1-in-10-year average annual drought. The Commission has identified several Potentially Stressed Areas (PSAs) in the basin where existing or projected withdrawals and uses are anticipated to exceed long-term sustainability of the groundwater resource or cause conflicts among users. In addition, several Water Challenged Areas (WCAs) have been identified in locations where natural conditions severely limit the amount of groundwater resources available to support water resource development. As new information on PSAs and WCAs becomes available, the identification of these areas is subject to revision.

The significant groundwater resource issues, problems, and recommended actions are listed in the following pages.



RECOMMENDED ACTIONS

Using the available groundwater management tools, 39 recommended actions were identified to address groundwater issues and problems in the Susquehanna River Basin. The recommended actions in the plan were formulated with the goal of balancing economic development and environmental protection as a primary consideration. The current recommendations include significant additions, deletions, and modifications to the 1993 plan recommendations that were reconsidered as part of the current plan. The final Groundwater Management Plan has incorporated additional or revised information, as needed, to reflect changes in response to the comments received during the public review of the draft plan in June-September 2004.

The Commission adopted the management plan on June 8, 2005, to effectively address major groundwater resource issues in the basin that are within the Commission's purview. The Commission will monitor plan implementation and periodically review and update the plan.

Issue 1: Areas of Intensive Growth and Development, and Consequent Water Resource Development

Problem: Well interference.

Recommendation: Use groundwater modeling and/or water level monitoring to evaluate potential well interference. Mitigation may be necessary.

Problem: Exceedence of sustainable yield.

Recommendation: Require groundwater availability analyses for new projects and for areas where sustainable yield has been exceeded. Develop water budgets for all PSAs. Adjust withdrawal rates for sustainability, if needed.

Problem: Loss of aquifer recharge (see photo).

Recommendation: Base sustainable yields for wells on post-build-out conditions and encourage the use of best management practices (BMPs) to minimize loss of recharge.



Andrew Gavin

Issue 2: Intensive Water Use in Small Basins

Problem: Loss of base flow.

Recommendation: Educate the public and local officials about the need for protection and proper management of headwater areas to ensure sustainability.

Problem: Loss of perennial streamflow.

Recommendation: Evaluate headwater areas for the purpose of managing water quantity and quality.

Issue 3: Watershed “Transfers”

Problem: Wastewater is not returned to the watershed where it was withdrawn.

Recommendation: Educate professional groups about the value of keeping groundwater withdrawals and post-use discharges in the same watershed.

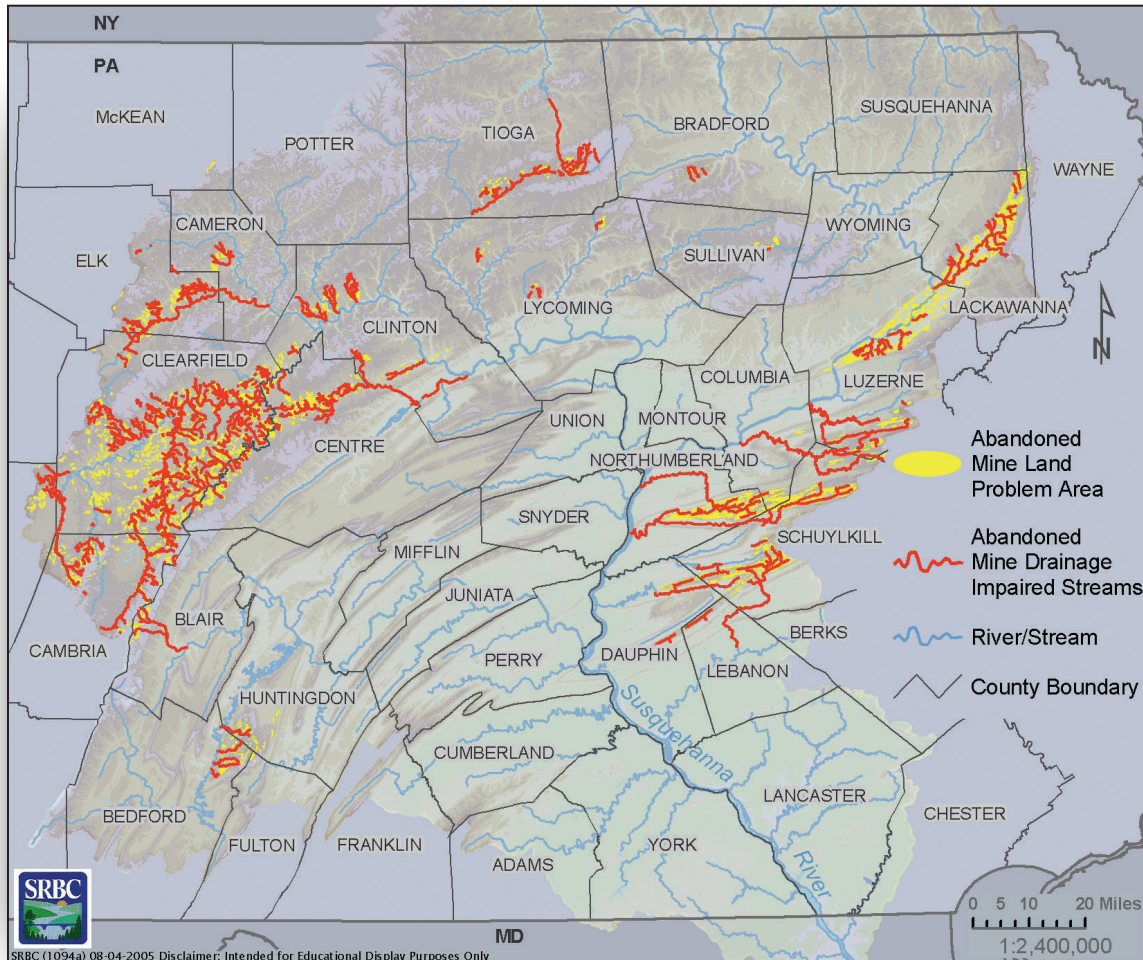
Issue 4: Loss of “Clean” Water Input to AMD-Impacted Streams

Problem: Degradation of stream quality.

Recommendation:

Evaluate cumulative impacts from consumptive water uses to downstream water quality in acid mine drainage (AMD)-impacted areas (see map below).

Subdivision development resulting in potential loss of recharge area



Abandoned mine land problem areas and abandoned mine drainage impaired streams in the Susquehanna River Basin

Issue 5: Unknown and Unregulated Groundwater Use

Problem: Data gaps can prevent evaluation of true sustainability and cumulative impact.

Recommendation: Collect information on currently unknown and unregulated withdrawals to improve evaluation for new projects.

Problem: Loss of base flow during the growing season.

Recommendation: Perform water budget and cumulative impact analyses, and manage groundwater withdrawals to address any adverse impacts.

Problem: Interference with existing water sources.

Recommendation: Perform water budget analyses and consider options to address overdraw.

Issue 6: Scarcity of Clean Water in Coal-Mined Areas

Problem: Preferential development of high quality groundwater sources.

Recommendation:

Manage quantity and quality in non-AMD-impacted watersheds (recognizing that water resources are necessary for the economic growth of mining-affected regions) by educating local officials and consultants, coordinating with state and federal agencies, and encouraging grayfields initiatives.

Issue 7: Drought Impact to Base Flow

Problem: Insufficient streamflow to sustain instream flow needs or downstream water supplies (see photo).

Recommendation: Educate local jurisdictions about stormwater management, critical aquifer recharge areas (CARAs), and BMPs for development, and improve scientific basis for instream use protection.

Issue 8: Impacts of Mining

Problem: The positive and beneficial use of water discharged from mining operations is underutilized as a resource.

Recommendation: Encourage cooperative efforts to develop reliable water supplies related to mining operations.

Problem: Extensive aquifer dewatering.

Recommendation: Delineate the area of influence and capture area for the mine withdrawal and identify the impacts and method of impact mitigation, when needed.

Problem: Exceedence of sustainable yield.

Recommendation: Reduce impacts of mine pumpage through the grouting of water inflow points if economically and technically feasible.

MANAGEMENT ISSUES AND RECOMMENDATIONS

Problems and issues related to the management of groundwater resources are listed below. Included are issues related to the Commission and other agencies that manage groundwater resources, and the Commission's interaction and coordination with those agencies.

Issue 1: Multi-Agency Coordination

Problem: Coordination among water resource agencies can be ineffective or incomplete.

Recommendation: Enhance the Commission's water resources procedures and project review coordination activities with involved agencies to avoid conflicting actions.

Issue 2: Changes to Water Resource Utilization Over Time

Problem: Water resource management programs can become less efficient with changes in technology and water use.

Recommendation:

Assess water resource utilization periodically and make appropriate changes in policies, procedures, and project review process.

Problem: Water supply sustainability and stream low flow conditions can be adversely impacted by lack of the best and most efficient use of groundwater resources.

Recommendation:

Strengthen water conservation requirements and encourage use of treated wastewater and conjunctive use.

Issue 3: Regulatory Duplication

Problem: Change in the regulatory programs of the member jurisdictions may make some of the Commission's regulatory program redundant, inefficient, or inappropriate.

Recommendation: Maintain close and effective coordination among the Commission, its member jurisdictions, and key agencies to include possible formal arrangements such as memoranda of understanding.

Issue 9: Flow Compensation for Consumptive Water Uses

Problem: Need for additional low flow augmentation to compensate for consumptive water uses.

Recommendation: Bring together key stakeholders to help promote use of groundwater stored in "artificial" aquifers to offset consumptive water uses and support instream flow needs.

Robert Pody



This stream reach is dry because of declining base flows as groundwater levels are reduced during drought conditions.

Issue 4: Increased Knowledge About Groundwater as a Resource

Problem: Useful information about groundwater occurrence, availability, transmissivity, and yield is collected by various government permitting agencies and others, but is not compiled and shared among agencies nor disseminated to the professional community, developers of policy, or local decision-makers.

Recommendation: Capture and compile groundwater data submitted to the Commission by project sponsors to allow its use by the Commission and others.

Problem: Lack of fundamental knowledge of groundwater resources by many policy/decision-makers at the local, municipality level and by their constituents, and at the corporate level of private businesses, has hindered the understanding of sound groundwater management practices.

Recommendation: Identify the constituency for an outreach and education program, and develop tools that can be used by them to make informed decisions.



SRBC held workshops in 2004 to explain its draft groundwater management plan and receive public comments.

Problem: Lack of consideration of factors important to groundwater protection and sustainability within the municipal planning process, resulting from limited knowledge of groundwater resources, has hindered implementation of sound groundwater management practices.

Recommendation: Encourage and assist local governments to include groundwater management concepts in planning and land use control.

Problem: There is the absence of an educational framework needed to present groundwater concepts and issues to a variety of audiences through several forms of media.

Recommendation: Incorporate a variety of methods into a multifaceted outreach and education program.



SRBC works with the media to help disseminate groundwater information to the public.

Issue 5: Plan Performance and Accountability

Problem: The management plan will not be productive unless the tasks identified are performed and accountability for accomplishing the tasks is established.

Recommendation: Provide periodic progress reports on implementation of the Groundwater Management Plan and new significant groundwater issues.

Issue 6: Review and Update of the Plan

Problem: The management plan needs to be reviewed and updated on a recurring basis in order to be current and of continuing value.

Recommendation: Conduct comprehensive reviews and revisions of this plan at intervals not to exceed 10 years.

Issue 7: Funding to Implement the Plan

Problem: Adequate long-term funding needs to be made available to implement the actions recommended in the plan.

Recommendation: Funding to implement the plan's recommended actions should be made available and/or proactively sought by the lead jurisdiction(s) for each action.

SUPPORT PROGRAMS AND RECOMMENDATIONS

There are a number of management and regulatory programs, primarily at the state and local level, that are applicable to many of the groundwater problems and groundwater management issues previously discussed.

The following are specific program areas, groundwater management issues, and recommendations for improvements.

Issue 1: Protection of Groundwater Sources of Supply and Aquifers

Problem: Contamination of groundwater resources from the affects of improper land use planning and zoning.

Recommendation: Encourage states and local jurisdictions to develop regulations and programs to protect groundwater from contamination.

Problem: Lack of comprehensive groundwater quality datasets showing the extent and severity of nonpoint source pollution affecting groundwater resources basinwide, and the lack of management plans necessary for improving conditions.

Recommendation: Continue and expand monitoring and research, in cooperation with states, related to nonpoint source contamination, and support the assessment and implementation of such actions, including total maximum daily loads (TMDLs), USEPA's 319 Nonpoint Source Program, and United States Department of Agriculture/Natural Resource Conservation Service (USDA/NRCS) water programs.

Problem: Degradation of water quality conditions in aquifers from point source discharges.

Recommendation: Support jurisdictions in their efforts to consider the effect of wastewater discharges on groundwater, including sensitive recharge areas, when issuing National Pollutant Discharge Elimination System (NPDES) or State Pollutant Discharge Elimination System (SPDES) permits.

Problem: Limited support for local development of source water protection plans.

Recommendation: Assist communities with groundwater source protection by utilizing existing source water assessment data and aquifer test data to provide educational and technical assistance in formulation of protection plans.

Issue 2: Water Use and Availability Information

Problem: Not all large volume withdrawals are registered (documented).

Recommendation: Require large volume groundwater users (>10,000 gallons per day [gpd]) to register (document) their use

and to re-register (update documentation) periodically. Coordinate with member states and others to maintain a vibrant data set.

Problem: Data on large volume users need to be available for management use.

Recommendation: Maintain a centralized database containing information on large users and make this data available to planners and managers throughout the basin, subject to security considerations.

Problem: Well information (water use) is not available to all agencies and local managers.

Recommendation: Maintain a centralized database containing well information, and make this data available to planners and managers throughout the basin, subject to security considerations.

Problem: Groundwater managers, planners, and decision-makers often do not have ready access to fundamentally important, basinwide information on groundwater.

Recommendation: The Commission should partner with appropriate agencies to develop the required information for the entire basin and make it available on-line.

Issue 3: Well Requirements

Problem: Improper well construction and abandonment procedures can cause aquifer contamination.

Recommendation: Support state and local programs for well abandonment and construction standards, and improved controls to provide pollution control.

Problem: Lack of certification program for drillers in Pennsylvania and the need for improving existing licensing/certification programs and well driller training in other basin states.

Recommendation: Support legislation that works toward the development of a well driller's certification program in Pennsylvania and support the improvement of programs that provide training and licensing/certification for all well drillers in the basin's states.

Problem: The observation well network does not have the capability to monitor the dynamic response of aquifers in the basin to changes in precipitation.

Recommendation: Provide effective maintenance to the observation well network by the USGS and work towards improvements for the basinwide observation well network with a goal of having real-time monitoring capability in each county in the basin.

Issue 4: Assessment of State/Federal Groundwater Programs and Program Coordination

Problem: State and federal agencies need to ensure their groundwater programs are current and responsive. In addition, these programs need to coordinate management activities to enhance program effectiveness and efficiency.

Recommendation: The Commission's member jurisdictions should continue periodic assessments of their groundwater programs to identify needed improvements and plan for their implementation.

“The Groundwater Management Plan sets forth 39 actions to address a variety of groundwater issues and problems.”

IMPLEMENTATION OF THE MANAGEMENT PLAN

The Groundwater Management Plan sets forth 39 actions to address a variety of groundwater issues and problems.

The Commission, its four member jurisdictions, local jurisdictions, and the private sector are to implement the plan. Each party's roles and responsibilities are presented in the detailed full plan, and each party is responsible for allocating the resources necessary to implement its elements of the plan, using a prioritized and phased approach, as needed. A rating system for prioritizing actions and assigning schedules was developed for the management plan to enhance implementation. This resulted in 10 actions being rated as top priority, 20 as high priority, and 9 as priority. In terms of scheduling, 12 actions were determined to be continuing efforts with 16 being short-term (within 2 years) and 11 being long-term efforts (2 to 5 years).

MANAGEMENT TOOLS

The development of the Groundwater Management Plan began with an assessment of available management tools and groundwater conditions in the basin.

Resource Evaluation

The Commission evaluates groundwater availability, utilization, and potential impacts to existing users and the environment using a number of different tools. In recent years, the number of groundwater withdrawals in some areas is causing well interference, and the total amount being withdrawn is at, or approaching, the sustainable limit, causing local depletion of groundwater and/or surface water resources. Areas having intense water resource utilization require

additional analysis to maintain a balance between groundwater withdrawals and aquifer recharge and prevent local resource depletion, environmental impacts, and water supply failure. There are a number of analytical methods and tools available to meet

this goal. These include water budget analyses, identification of critical aquifer recharge areas, water level monitoring, special studies and models, and an enhanced water resource management database.

Regulatory Program

The Commission's Regulatory Program is a key tool in managing groundwater resources in a sustainable manner. Key elements of the program include regulation of surface water and groundwater withdrawals, compliance monitoring and enforcement, authority to identify protected areas, development of standards and guidance, water conservation requirements, and support for water reuse, and conjunctive surface and groundwater use.

Public Outreach and Education

Public outreach and education on groundwater science and management concepts are important for managing the resource. Since most issues concerning availability and use hinge on land use planning and development decisions, local government and citizens are a critical audience for focusing efforts on outreach and education.

EXISTING CONDITIONS

Earth materials (rocks and unconsolidated materials) differ in their ability to store and transmit water in the subsurface. Aquifers in the Susquehanna River Basin are of one of three types: karst, fractured bedrock, and porous media. Each type possesses unique hydrogeologic properties. The aerial extents of these aquifers are commonly limited by the annual infusion of recharge by rainfall and snowmelt. A basinwide estimation of recharge to groundwater resources during average conditions is on the order of 13 inches. During periods of precipitation deficiencies, droughts occur and can impact portions of, or the entire, Susquehanna River Basin. The drought of 2002 is an example of a multiyear regional event that began in fall 2001 when precipitation deficits in the basin were as much as 10 inches from October 2001 to December 2002. Record and near record low levels at some observation wells in the basin indicated the severity of the 2002 drought.

Groundwater quality in the Susquehanna River Basin is typically good and, for the most part, influenced by geology and land use. Some portions of the basin have been particularly impacted by abandoned coal mine workings to the extent that the groundwater resource is largely unsuitable for most uses (see photo). Some of the discharges from abandoned mine lands result in the worst water quality conditions in the basin. Agricultural and residential/urban activities may also cause degradation of groundwater quality, particularly in the karst aquifers, due to pesticides, nitrate concentrations, and volatile organic contaminants. The diversion of stormwater runoff into sinkholes and karst conduits presents a substantial threat to groundwater quality. Such stormwater management practices direct any fluid on the roadways directly into the aquifer.

The use of groundwater resources within the basin is approximately 390 million gallons per day (mgd). Groundwater plays a critical role in supplying drinking water and maintaining economic viability. Outside of the major

population centers, drinking water supplies are heavily dependent on groundwater supply wells. General household use from private wells is also a significant portion of the basin's overall use. Business and industry dependent on the basin's groundwater resources employ thousands



Streams can be polluted by groundwater sources and vice-versa. This stream in Northeastern Pennsylvania is polluted by acid mine drainage that shoots up like a fountain from underground sources affected by abandoned mines.

of people and contribute billions of dollars to local/regional economies through payrolls, product distribution, and product sales. Examples of some of these industries include food, raw material, and chemical production.

The largest users of groundwater are public water suppliers (115 mgd), mining (90 mgd), domestic withdrawals (80 mgd), industrial (48 mgd), agriculture (42 mgd), and commercial (12 mgd).

The Commission's Compact recognizes the powers and duties of the states and the primary responsibility for managing the waters of the Susquehanna River Basin falls on the three states in the Commission – New York, Pennsylvania, and Maryland. The Commission addresses important groundwater management and regulatory gaps that exist among the states' programs. The principal elements of the Commission's water resources program are the Project Review Program (regulatory); groundwater

quality coordination; watershed studies, special studies and water budget analyses; protected areas; and the groundwater management plan.

There are long-standing and diverse authorities that require not only the Commission, but the federal government, states and local jurisdictions to manage, regulate, and protect various elements of groundwater resources. The key federal and state agencies with groundwater responsibilities are:

1. Federal Government –
United States Geological Survey,
United States Environmental
Protection Agency, United States
Army Corps of Engineers,
and United States Fish and
Wildlife Service.
2. New York State Department of
Environmental Conservation
and Department of Health.
3. Maryland Department of the
Environment and Department
of Natural Resources.
4. Pennsylvania Department of
Environmental Protection and
Department of Conservation
and Natural Resources.

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