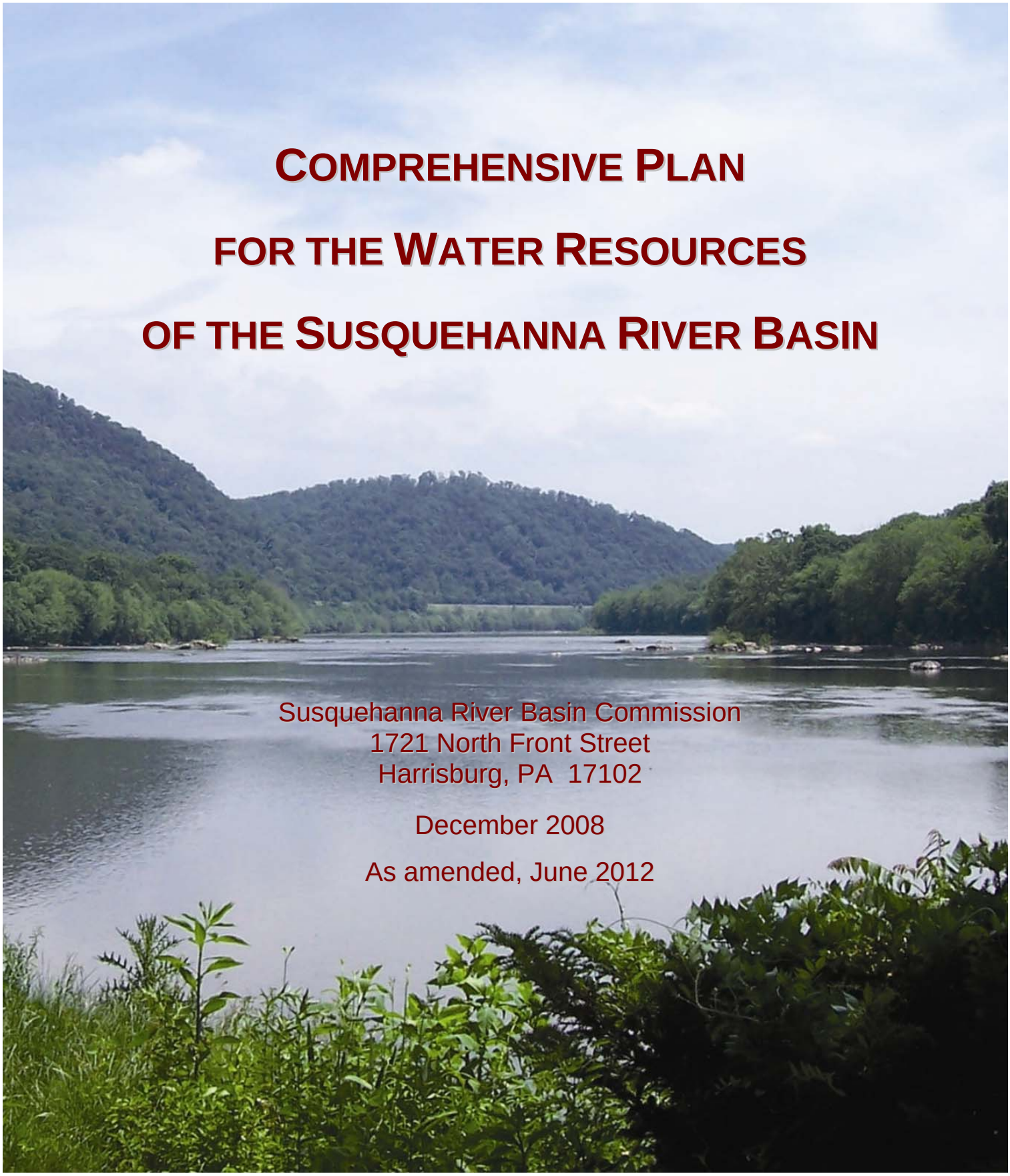


COMPREHENSIVE PLAN FOR THE WATER RESOURCES OF THE SUSQUEHANNA RIVER BASIN

Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102

December 2008

As amended, June 2012

SUSQUEHANNA RIVER BASIN COMMISSION

In 1971, the Susquehanna River Basin Commission was created as an independent agency by a federal-interstate compact* among the states of Maryland, New York, and the Commonwealth of Pennsylvania, and the federal government. In creating the Commission, the Congress and state legislatures formally recognized the water resources of the Susquehanna River Basin as a regional asset vested with local, state, and national interests for which all the parties share responsibility. As the single federal-interstate water resources agency with basinwide authority, the Commission's goal is to coordinate the planning, conservation, management, utilization, development and control of the basin's water resources among the public and private sectors.

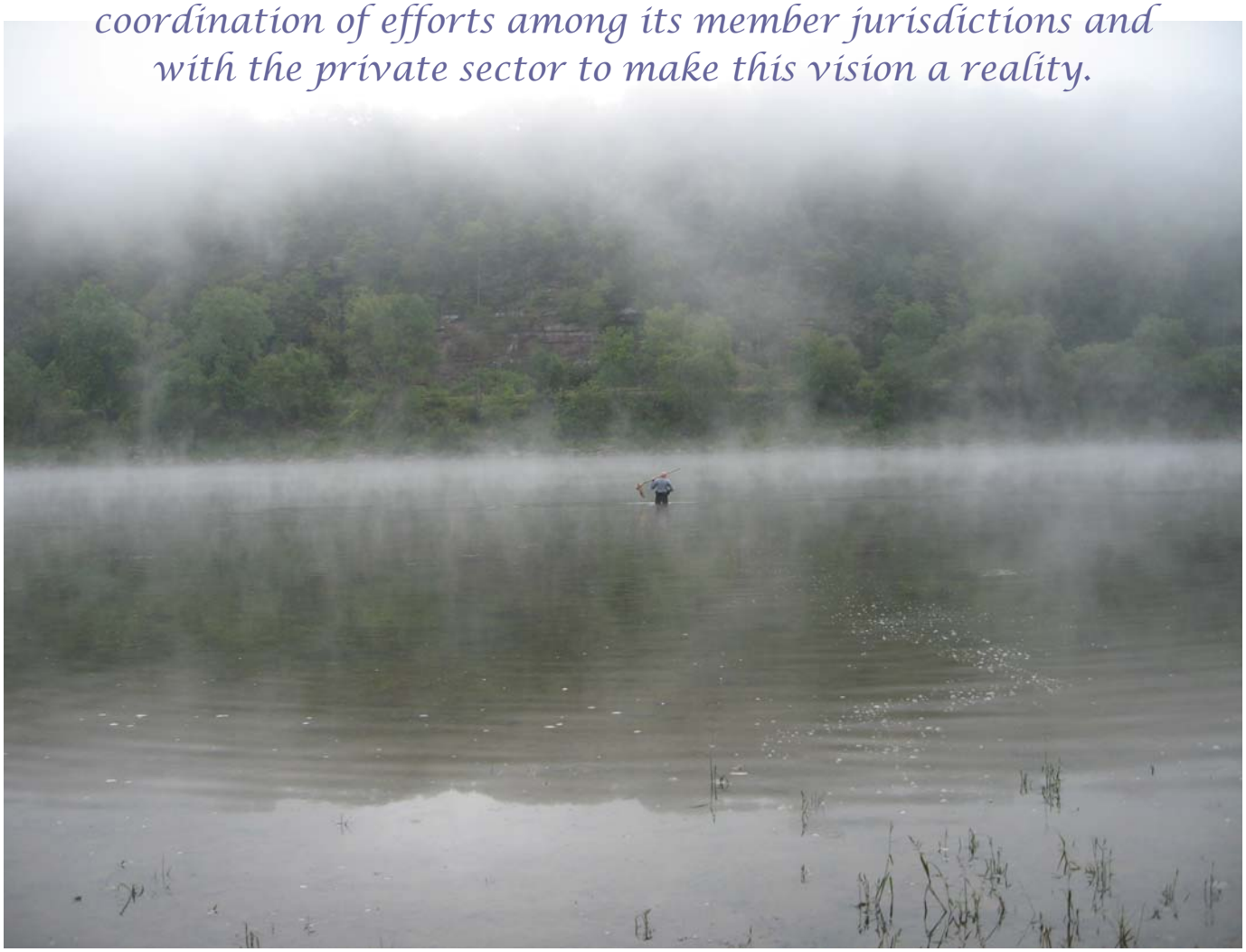
**Statutory Citations: Federal - Pub. L. 91-575, 84 Stat. 1509 (December 1970); Maryland - Natural Resources Sec. 8-301 (Michie 1974); New York - ECL Sec. 21-1301 (McKinney 1973); and Pennsylvania - 32 P.S. 820.1 (Supp. 1976).*

Cover photo: Juniata River south of Newport, Perry County, Pa.

This report is available on our web site at www.srbc.net/planning/compplanfiles.asp. The Commission also has a limited supply of hard copies. For a hard copy, contact the Susquehanna River Basin Commission, 1721 N. Front Street, Harrisburg, Pa. 17102-2391, (717) 238-0423, FAX (717) 238-2436, E-mail srbc@srbc.net. For more information concerning the Commission, visit our web site: www.srbc.net.

Vision Statement

The Commission's vision for the Susquehanna River Basin is healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply to support abundant and diverse populations of aquatic, riparian, and terrestrial organisms, as well as human uses and enjoyment. Through enlightened planning for and management of the basin's water resources, the health, safety and welfare of its citizens are safeguarded during times of flooding and drought, a vibrant economy is sustained, the Chesapeake Bay's water quality and living resources are improved, and an informed public is involved in resolving water resource issues. The Commission provides the necessary leadership and coordination of efforts among its member jurisdictions and with the private sector to make this vision a reality.



RESOLUTION NO. 2008-08

A RESOLUTION of the Susquehanna River Basin Commission adopting a revised *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*.

WHEREAS, under Article 3, Section 3.3 (1) and Article 14, Section 14.1 of the Susquehanna River Basin Compact, Pub. L. 91-575, (the "Compact"), the Susquehanna River Basin Commission (the "Commission") is directed to "develop and adopt, and from time to time review and revise, a comprehensive plan for the immediate and long range development and use of the water resources of the basin;" and

WHEREAS, the Commission has maintained such a comprehensive plan since first adopting it in 1973, and has revised its contents from time to time thereafter; and

WHEREAS, under Section 14.2 of the Compact, the Commission also adopts an annual water resources program based upon the comprehensive plan, which consists of the projects and facilities that the Commission proposes to be undertaken by the Commission and its member jurisdictions over the ensuing six-year time period or such other reasonably foreseeable period as the Commission may determine; and

WHEREAS, the current comprehensive plan has not undergone a complete revision since 1987; and

WHEREAS, there is now a need to extensively revise and update the comprehensive plan to make it more timely, improve its quality, and ensure its relevance as a guide to the management and development of the basin's water resources; and

WHEREAS, staff has produced and presented this day to the Commission a revised comprehensive plan dated December 4, 2008; and

WHEREAS, a draft of the plan was the subject of three public hearings held in July 2008 at Owego, New York; Danville, Pennsylvania; and Lancaster, Pennsylvania, respectively; and

WHEREAS, the Commission also accepted written comments on the draft plan during a 90-day comment period ending August 18, 2008; and

WHEREAS, the Commission has carefully considered the comments offered at the public hearings and in writing, and has modified the contents of the proposed plan.

NOW THEREFORE BE IT RESOLVED THAT:

1. The Commission hereby adopts a revised *Comprehensive Plan for the Water Resources of the Susquehanna River Basin* as presented by staff, dated December 4, 2008.

2. The annual water resources program prepared by the Commission shall hereinafter implement and be based upon this revised comprehensive plan, and shall be incorporated into the plan annually.

3. The staff is directed to distribute copies of the plan in printed or electronic form to interested parties and government officials, and to make the contents of the plan available on the Commission's website.

4. The staff is further directed to:

a. assess progress toward meeting goals set forth in the plan on an annual basis;

b. incorporate new approved water resources projects and plans into the comprehensive plan annually; and

c. conduct periodic review of the plan and propose appropriate revisions to the Commission to ensure its continued timeliness and relevance and to maintain its quality and utility.

5. This resolution incorporates the provisions of any and all previous resolutions or actions of the Commission regarding its comprehensive plan, unless such provisions conflict with the contents of this revised comprehensive plan, in which case they shall be superseded.

6. This resolution shall be effective immediately.

Dated: December 4, 2008

Dr. Robert M. Summers, Chairman
Maryland

Brig. Gen. Todd T. Semonite, Vice-Chairman
U.S. Government

Kenneth P. Lynch
New York

Cathleen C. Myers
Pennsylvania

Paul O. Swartz
Executive Director

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TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

EXECUTIVE SUMMARY

The Susquehanna River Basin Compact (Compact) was enacted in December 1970 as Public Law 91-575 and joined the federal government and the states of New York, Pennsylvania, and Maryland as equal partners for a period of 100 years to manage the Susquehanna basin's water resources through proper planning, development and regulation. The Compact created the Susquehanna River Basin Commission (Commission) as the single administrative agency to develop, effectuate, coordinate and adopt plans, policies, and programs related to water resources of the basin. In January 1971, the Compact took effect and the Commission was officially established. As equal partners, the member jurisdictions each appoint a commissioner who serves as the spokesperson for the jurisdiction that he represents. Under the leadership of the Executive Director, technical, administrative, and public information personnel support the daily operations of the Commission.

The mission of the Susquehanna River Basin Commission is to enhance public welfare through comprehensive planning, water supply allocation, and management of the basin's water resources. As a federal-interstate compact body, its jurisdiction is defined by the natural boundaries of the river basin rather than the political boundaries of the member states. As such, the Commission serves as a forum to provide coordinated management, promote communication among its members, and resolve water resource issues and controversies within the basin. The Commission's leadership role in basin water resource planning and management is also exercised through its regulatory function, which fills in the regulatory gaps that exist in each state's water resource management program. The Commission regulates ground and surface water withdrawals, consumptive water uses and out-of-basin diversions, when any of these reach certain quantity thresholds, and all in-basin diversions.

The Compact authorizes and requires the Commission to formulate and adopt a comprehensive plan for the immediate and long-range development and use of the water resources of the basin. This *Comprehensive Plan for the Water Resources of the Susquehanna River Basin* (Comprehensive Plan or the Plan) provides an overarching framework for the Commission to manage and develop the basin's water resources and serves as a guide for all Commission programs and activities. The Plan supports the goals set forth in the Compact and provides a basis for achieving desired results, meeting goals, and taking actions. It is further intended to be a useful resource for the Commission's member jurisdictions, water resource managers, private sector interests and others in the basin. This updated Comprehensive Plan replaces the previous plan adopted in 1987. The Commission actively sought public input to the current Plan by releasing a draft for public review and comment, and holding three public hearings. All comments received were considered and many resulted in changes that were incorporated into this final Plan.

The Susquehanna River Basin has more than 49,000 miles of waterways and drains 27,510 square miles spread over parts of New York, Pennsylvania, and Maryland. The population of the basin was nearly 4 million people in 2000. The Susquehanna River is the largest river lying entirely in the United States that drains to the Atlantic Ocean. The river is the largest tributary of the Chesapeake Bay and provides nearly one-half of the freshwater flow to the Bay.

Major water resource problems include flooding, droughts and poor water quality in some areas. The basin is one of the most flood prone areas in the nation with recorded major devastating floods occurring nine times since 1889. Significant droughts have occurred in portions of the basin 13 times since 1900, with drought emergencies declared for the more recent events. Poor water quality is present in 6,000 miles of impaired streams in the basin with abandoned mine drainage (AMD), agriculture, and urbanization being key sources of impairment.

There are many important existing projects and programs that address various aspects of water resources in the Susquehanna River Basin. These measures deal with flood damage reduction, water supply, wastewater treatment, recreation, energy production, migratory fish passage and abandoned mine drainage. Actions taken over a number of years by many entities to address water resource issues or use of the resources in the basin include

implementation of multipurpose reservoirs, local flood protection projects, water supply systems, wastewater treatment plants, recreation facilities, power plants, water diversions, migratory fish restoration projects, and AMD projects.

While recognizing the beneficial impact of numerous existing projects and programs, a series of six broad water resource needs have been identified based on the particular water management challenges present in the basin. The six categories of needs identified in this updated Comprehensive Plan fall within the programs and responsibilities of the Commission and they are: (1) water supply; (2) water quality; (3) flooding; (4) ecosystems; (5) Chesapeake Bay; and (6) coordination, cooperation, and public information. To assess the needs and determine potential actions necessary to address them, a set of criteria was developed to provide a management and legal framework for the work. The criteria include general principles, project guidance, and project standards.

A vision statement of future conditions is included in the Comprehensive Plan and is based on the belief that water resource management in the basin will be effective and successful. The vision statement serves as a focused objective for the Commission's efforts in addressing the needs and meeting desired results over the long term. The Commission's vision for the Susquehanna River Basin includes: (1) healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply; (2) enlightened planning for and management of the basin's water resources to safeguard the health, safety and welfare of its citizens during floods and droughts, to sustain a vibrant economy, to improve the Chesapeake Bay's water quality and living resources, and to inform the public; and (3) leadership and coordination of efforts by the Commission among its member jurisdictions and with the private sector necessary to make this vision a reality.

By virtue of the Compact, the Commission has powers and authorities to act on a broad range of water resource issues. Over the years, the Commission has chosen to focus on and prioritize its resources within management areas that effectively allow the Commission to accomplish its mission and meet its responsibilities. The Commission carefully considers its actions to give deference to the member jurisdictions' responsibilities and to avoid duplicating actions of the existing offices and agencies of its member jurisdictions. For the purposes of this Comprehensive Plan, the Commission has grouped its focused management responsibilities into the six key water resource needs and has identified them as "priority management areas"; they are (1) water supply; (2) water quality; (3) flooding; (4) ecosystems; (5) Chesapeake Bay; and (6) coordination, cooperation, and public information.

Each of the six priority management areas covers desired results, goals, ongoing Commission activities and the actions needed to meet the goals. In total, 30 goals have been established with 74 actions identified as being necessary to meet the goals. The Commission has lead responsibility for many of the actions. Some of the actions are to be taken by member jurisdictions and other groups and organizations, with the Commission providing support, assistance or encouragement. In these cases, the other entities have the responsibility to lead and manage the work, with the Commission working collaboratively with them in a spirit of full cooperation. Achieving the goals and taking the actions are, of course, dependent on the resources available to the Commission and others over the long term. Part IV, Priority Management Areas, discusses the desired results, goals, ongoing Commission activities and actions in detail.

While the priority management areas – with their goals and actions – serve as the primary vehicle for meeting the basin's water resource needs, the Commission also recognized the benefits of highlighting other important water resource topics. These selected topics were designated as "areas of special interest" by the Commission, and they are a mix of both long-standing and emerging programs and problems of interest to many sectors in the Susquehanna basin. Unlike the priority management areas, the areas of special interest do not have specific Commission goals and actions, but they are discussed in terms of their impact on water resources and initiatives underway or needed to address them. The 12 areas of special interest are: (1) abandoned mine drainage; (2) climate change; (3) consumptive use mitigation; (4) drought coordination; (5) economic development, recreation and other public values; (6) emerging contaminants; (7) energy production; (8) flood forecast and warning; (9) invasive species; (10) migratory fish restoration; (11) potentially stressed areas and water challenged areas; and (12) water

and wastewater infrastructure. The Commission believes these areas of special interest need to be addressed by the combined efforts of all levels of government, the private sector and the Commission.

It is important that the actions identified in Part IV, Priority Management Areas, be taken by the Commission and others in order to progress toward the goals set. The Commission's ongoing activities will require continuing emphasis to ensure they remain viable and productive. New actions will require integration into the Commission's work program with appropriate resources and priorities assigned. The process to implement the identified actions begins with approval of the Comprehensive Plan by the commissioners. Some of the identified actions, such as the incorporation of certain existing projects and plans and a basin-wide flood forecast and warning system into the Comprehensive Plan, will be taken upon that approval of the Plan.

The existing projects include: (1) the system of 13 U.S. Army Corps of Engineers' (USACE) multipurpose reservoirs, (2) 20 local flood protection projects constructed by the USACE, (3) 20 major electric power plants, (4) four fish passage facilities on the lower Susquehanna River, and (5) numerous water use projects approved by the Commission since 1971. The plans include the *Groundwater Management Plan for the Susquehanna River Basin*, the *Consumptive Use Mitigation Plan for the Susquehanna River Basin*, and the *Susquehanna River Basin Drought Coordination Plan*. The system is the Susquehanna Flood Forecast and Warning System, including the associated *Strategic Plan for Flood Forecast and Warning-Susquehanna Improvements Program*. Appendix 2 contains a list of the projects and other items that will be incorporated.

The Compact requires the Commission to adopt an annual water resources program, based upon the Comprehensive Plan, and consisting of the projects and facilities to be undertaken by the Commission and others during the ensuing six years or other reasonably foreseeable period. Accordingly, the Commission's annual Water Resources Program (WRP) is to serve as the implementation document for the actions identified in this Comprehensive Plan. The time period considered for actions in the WRP is two to three years in order to have a "reasonably foreseeable" forecast of needs, workload, priorities, project schedules and resource availability. The WRP is addressed in Appendix 3 and it will be updated as annual revisions are made.

The true value of this Comprehensive Plan will be measured by the degree to which its goals are met through the combination of ongoing Commission activities and taking the identified actions. An annual assessment of progress in meeting goals will be made by the Commission when preparing its annual Water Resources Program. Also annually, the Plan will incorporate new approved projects, plans and other actions (see Appendix 2) and the current version of the Water Resources Program (see Appendix 3). Updates to the full Comprehensive Plan will be made every five years to help ensure the Plan is current and of long term value and usefulness. A complete revision of the Plan will be made every 15 years.

The Comprehensive Plan was amended in December 2009 by incorporating the following items approved by the Commission in 2009: the Low Flow Monitoring Plan for the Susquehanna River Basin (see Appendix 2, Table 2-2), various water use projects (see Appendix 2, Table 2-3), and the Water Resources Program for Fiscal Year 2010-2011.

The Comprehensive Plan was amended in June 2011 by incorporating the following items approved by the Commission from January 2010 through June 2011: the Migratory Fish Management and Restoration Plan for the Susquehanna River Basin (see Appendix 2, Table 2-2), various water use projects (see Appendix 2, Table 2-3), and the Water Resources Program for Fiscal Years 2012-2013.

The Comprehensive Plan was amended in June 2012 by incorporating the following items approved by the Commission from January 2011 through June 2012: various water use projects (see Appendix 2, Table 2-3), and the Water Resources Program for Fiscal Years 2013-2014 (see Appendix 3).

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PART I - INTRODUCTION

A. The Susquehanna River Basin Commission

1. History

In the early 1960s, citizen concern regarding water resource problems in the Susquehanna River Basin – flooding, drought, and water pollution – stimulated the formation of the Susquehanna River Basin Association, a citizens' organization. This association and other groups, including all levels of government, expressed the need for comprehensive river basin studies to develop solutions to water resource problems in the basin. In addition, it was considered desirable that a regional government institution be created to deal with water resource problems and implement management measures on a basinwide basis.

The Congress of the United States recognized a national interest in the Susquehanna River Basin and, in 1962, authorized a comprehensive study of the water resources of the basin. The U.S. Army Corps of Engineers led this study, which was completed in 1970. In 1963, citizen and state activities led to the creation of an Interstate Advisory Committee for the Susquehanna River Basin, with membership derived from New York, Pennsylvania and Maryland. This Committee concluded that a regional approach to development issues of the basin was advisable, feasible and urgently needed. The Committee drafted a federal-interstate Compact for the comprehensive planning, management, development, use and conservation of the water resources of the basin, and recommended that the Compact be adopted by the member states and the federal government.

The President of the United States signed the Susquehanna River Basin Compact (Compact) into law (P.L. 91-575) on December 24, 1970, subsequent to its approval by Congress and the prior approval of the three states. It joined the federal government and the three states as equal partners for a period of 100 years to manage the Susquehanna basin's water resources through proper planning, development and regulation. The Compact created the Susquehanna River Basin Commission (Commission) as the single administrative agency to develop, effectuate, coordinate and adopt plans, policies, and programs related to water resources of the basin. In January 1971, the Compact took effect and the Commission was officially established.

2. Membership


First commissioners

As equal partners, the member jurisdictions of New York, Pennsylvania, Maryland and the federal government each appoint a commissioner to the Commission who serves as the spokesperson for the jurisdiction that he represents. The commissioners from the member states are the governors or their designees. The governor of New York also appoints an alternate commissioner(s) while the Pennsylvania and Maryland commissioners appoint their alternates.

In the case of the federal government, the U.S. Army Corps of Engineers is designated by law (Public Law 105-18, the FY 1997 Omnibus Appropriations Act) as the federal representative, with the North Atlantic Division Commander as the commissioner and an alternate(s) appointed by him. Under the leadership of the Executive Director, technical, administrative, and clerical personnel support the daily operations of the Commission.

3. Mission

The Commission's mission, which is defined in the Compact, is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin. To accomplish this mission, the Commission works to: reduce damages caused by floods; provide for the reasonable and sustained development and use of surface and ground water for municipal, agricultural, recreational, commercial and industrial purposes; protect and restore fisheries, wetlands and aquatic habitat; protect water quality and instream uses; and ensure future availability of flows to the Chesapeake Bay. The Commission strives to fulfill its commitments in the manner reflected in its mission statement, its motto "Protecting Your Watershed for Today and Tomorrow", and its values of teamwork, professionalism, and quality. This *Comprehensive Plan for the Water Resources of the Susquehanna River Basin* (Comprehensive Plan or the Plan) is formulated in accordance with these guiding commitments.

The Commission is uniquely qualified to carry out its mission. As a federal-interstate compact body, its jurisdiction is defined by the natural boundaries of the river basin rather than the political boundaries of the member states. As such, the Commission serves as a forum to provide coordinated management, promote communication among its members, and resolve water resource issues and controversies within the basin.

Inherent in this process is the coordination of planning and management efforts of others affecting water resources, stimulation of public awareness, and implementation of related action programs. The Commission serves as an agent for water resource project development, management and operation, as it determines necessary. Also, as the need is demonstrated, it coordinates and manages the funding and conduct of public works programs and projects in the basin. The Commission seeks to integrate planning done at the federal, state and local levels of government with that done by the private sector. It also provides opportunities for all interested groups to express their views and to reconcile differences when possible.

The Commission's leadership role in basin water resource planning and management is also exercised through its regulatory function, which fills in the regulatory gaps that exist in each state's water resource management program. There is an ongoing interface between the Commission and state regulatory programs to ensure each meets its objectives with no duplication of work or inconsistencies. The Commission regulates ground and surface water withdrawals of 100,000 gallons per day or more (peak 30-day average), consumptive water uses and out-of-basin diversions of 20,000 gallons per day or more (peak 30-day average), and all in-basin diversions. The main purposes of the regulations are to:

- Avoid conflict among water users
- Protect public health, safety and welfare
- Manage and protect stream quality
- Consider economic development factors
- Protect fisheries and aquatic habitat
- Protect the Chesapeake Bay

Projects and proposals for development, use and management of the water resources of the basin are evaluated in terms of their compatibility with the objectives, goals, standards and criteria set forth in the Comprehensive Plan, and on the basis of public input regarding project impacts. Public input is sought through public hearings, informal contacts, and through views formally expressed to the Commission.

The role of the Commission in any given endeavor varies according to the extent others act to meet water resource management needs within the basin. Where the Commission determines that existing programs of others do not meet identified needs, it first encourages the appropriate member or members to take actions needed. If justified, the Commission also acts directly to meet needs through the exercise of powers granted it by the Compact.

4. Duties and Powers

The duties of the Commission, as set forth in the Compact, are to:

a. Develop and effectuate plans, policies, and projects relating to water resources; adopt, promote, and coordinate policies and standards for water resource conservation, control, utilization, and management; and promote and implement the planning, development, and financing of water resource projects.

b. Undertake investigations, studies, and surveys, and acquire, construct, operate, and maintain projects and facilities relating to the water resources of the basin whenever it is deemed necessary to do so to achieve any of the provisions of the Compact.

c. Administer, manage, and control water resources in all matters determined by the Commission to be interstate in nature or to have a significant effect on the basin's water resources and their management.

d. Assume jurisdiction in any matter affecting water resources whenever it determines, after investigation and public hearing upon due notice given, that the Comprehensive Plan or the Compact so requires. If the Commission finds upon subsequent hearing requested by an affected signatory party that the party will take the necessary action, the Commission may relinquish jurisdiction.

e. Investigate and determine if the requirements of the Compact or the rules and regulations of the Commission are complied with. If non-compliance is found or if satisfactory progress has not been made, the Commission may institute an action or actions in its own name in any state or federal court of competent jurisdiction to compel compliance with any and all Compact provisions or any of the Commission rules and regulations adopted pursuant to the Compact.

The necessary authority to act on these duties is delegated to the Commission by the Compact signatories, as are such other and different powers which are necessary or convenient to carry out its express purposes, or purposes which may be reasonably implied from the Compact. The Compact clearly states that the authority granted the Commission is conditioned to preserve and utilize the functions, powers and duties of existing offices and agencies of the signatory parties to the extent consistent with the Compact.

5. Goals

The goals of the Commission are (as defined in the Commission’s 1993 Mission Statement):

a. To be responsive to water resource management needs of the Commission’s signatory members;

b. To provide excellent service to the public;

c. To coordinate management of interstate water resources and serve as an effective forum for resolution of water resource issues and controversies within the basin;

d. To be a leader in issues concerning the conservation, utilization, allocation, development, and management of water resources within the Susquehanna River Basin;

e. To encourage excellence in Commission staff by affording opportunities for professional growth and development and by providing a stimulating work environment for all Commission employees; and

f. To provide public information and education about the water resources of the basin.

B. The Comprehensive Plan

1. Authority

Sections 3.3 and 14.1 of the Compact authorize and require the Commission to formulate and adopt a Comprehensive Plan for the immediate and long-range development and use of the water resources of the basin. The Commission may adopt a Comprehensive Plan or any revision thereof in such parts as it deems appropriate. This authority is conditioned to require consultation with water users, interested public bodies and public utilities. Also the Commission must, prior to adoption or revision of the plan or any part thereof, conduct public hearings, and consider and give due regard to the findings and recommendations of the signatory parties and interested groups.

2. 1973 and 1987 Comprehensive Plans

After the Compact went into effect in January 1971, the Commission organized a staff and, in compliance with the terms of the Compact, made the adoption of a comprehensive plan a top priority. There was a strong belief among the Commission members that the Comprehensive Plan would form the foundation upon which the Commission would carry out all of its water management responsibilities. At the monthly meetings during 1972 and 1973, the staff regularly reported to the Commission on the progress made in completing the plan.

After a series of basinwide hearings, the Commission adopted its first *Comprehensive Plan for the Water Resources of the Susquehanna River Basin* on December 13, 1973. The plan consisted of three parts: Part I - Introduction; Part II - The Plan; and Part III - General Information.

Part II - The Plan - formed the heart of the 1973 Comprehensive Plan. A set of planning objectives was established for the use and development of the basin's water resources. The objectives included careful consideration of national economic development, environmental quality, social well being and regional development, with reasoned choices made among them when they conflict. The public trust responsibilities of the Commission and its member jurisdictions over the water resources of the basin were also emphasized. Program objectives and goals for water resource management were established for: (1) Flood Plain Management and Protection; (2) Water Supply; (3) Water Quality; (4) Recreation, Fish and Wildlife; (5) Watershed Protection and Management; and (6) Cultural, Visual and Other Amenities. The objectives and goals were reinforced by a set of "Guidelines and Criteria" that outlined "a sound basis for rational, well-considered decisions among alternatives or competing uses of basin water resources." Indeed, the Commission has relied heavily on the water management principles set forth in the "Guidelines and Criteria" in carrying out its regulatory functions. Finally, Part II set forth an "Early Action Program" to provide a five-year perspective on priority programs and projects to meet the needs and demands identified in the program objectives. It also identified responsibilities of both the Commission and its member jurisdictions.

In 1987, the Commission approved an overall revision of the 1973 Comprehensive Plan. This revision retained the basic structure and content of the 1973 plan. However, many changes and updates were made to the text, and items that had been adopted piecemeal by the Commission since 1973 were added. This included such things as the goals for restoration of migratory fish to the river system and the commitment to acquire water storage and release facilities. The "Guidelines and Criteria" Section of Part II was also expanded from 23 entries to 32 entries, with the language of several of the entries also being strengthened. A separate appendix was added for projects that had been included in the plan and completed, as opposed to projects in the early action program that awaited completion.

3. Current Comprehensive Plan

a. Purpose

The Comprehensive Plan provides an overarching framework for the Commission in regard to management and development of the water resources of the Susquehanna River Basin, and serves as a guide for all Commission programs and activities, thus facilitating the achievement of its mission to enhance the public welfare through comprehensive planning, water supply allocation, and management of the water resources of the basin. The plan supports the broad goals set forth in the Compact and provides a basis for achieving desired results, meeting specific goals, and taking actions necessary to meet the goals. The plan is further intended to be a useful resource for the Commission's member jurisdictions, water resource managers in the basin, private sector interests, and others. It can serve as a guide for water resource planning done by local interests and the states.

b. Scope

The Comprehensive Plan includes the following key elements: (1) an assessment of water resource needs in the basin; (2) principles, guidance, and standards necessary to effectively and efficiently execute the Commission's responsibilities; (3) desired results, goals, ongoing Commission activities and actions for the Commission's priority management areas; (4) recognition of water resource areas of special interest to the Commission; and (5) documentation of projects incorporated into the plan which are required, in the judgment of the Commission, for the optimum planning, development, conservation, utilization, management and control of the water resources of the basin to meet present and future needs. The Plan incorporates the provisions of any and all previous resolutions or actions of the Commission regarding its comprehensive plan, unless such provisions conflict with the contents of this Plan, in which case they shall be superseded. The Plan is envisioned to be a dynamic document that includes effective use of GIS products. Annually, the Plan will incorporate new approved projects, plans and other actions (Appendix 2) and include the current version of the Water Resources Program (Appendix 3). An update of the full Plan will be made every five years with a complete revision of the Plan made every 15 years to ensure its usefulness and applicability.

c. Public Input

The Commission actively sought public input to the current Comprehensive Plan through several means. In May 2008, the draft Plan was released for a 90-day public review and comment period that was announced through press releases, e-mails, and the Commission's website. Press releases were issued to more than 85 media outlets throughout the basin and nearly 2,000 e-mails were sent to citizens, groups, and agencies. The draft plan was made available for downloading on the Commission's website and was available in hard copy form upon request. Three public hearings were held in July 2008 in Owego, N.Y., and Danville and Lancaster, Pa., to allow the public to hear presentations on the draft plan, ask questions and receive answers, and provide comments. Approximately 150 comments were received by the Commission as a result of the public review. All comments were considered and many resulted in changes that were incorporated in the final plan. In addition, at the request of the Commission's federal member, a coordination meeting was held with representatives of eight federal agencies in March 2008. This meeting resulted in a number of changes that were included in the May 2008 draft plan released for public review.

C. The Susquehanna Basin

1. General Description

The Susquehanna River is the largest river lying entirely in the United States that drains into the Atlantic Ocean. The Susquehanna and its hundreds of tributaries constitute more than 49,000 miles of waterways and drain 27,510 square miles, an area nearly the size of Massachusetts, Vermont, Delaware and New Jersey combined spread over parts of New York, Pennsylvania, and Maryland. The river flows 444 miles from its origin at the outlet of Otsego Lake at Cooperstown, N.Y., until it empties into the Chesapeake Bay at Havre de Grace, Md. See Figure 1 for a map of the basin, major subbasins, and population centers, and Figures 2 through 7 for more detailed maps of each major subbasin. Table 1 includes drainage area information for the basin and the six major subbasins.

Table 1. Major Subbasins

Subbasin	Drainage Area (Sq. Mi.)
1 - Upper Susquehanna	4,944
2 - Chemung	2,604
3 - Middle Susquehanna	3,755
4 - West Branch Susquehanna	6,992
5 - Juniata	3,406
6 - Lower Susquehanna	5,809
Total Susquehanna River Basin	**27,510**

Other basin and river information includes:

- The Susquehanna River Basin covers half the land area of Pennsylvania, portions of New York and Maryland and includes all or portions of 67 counties.
- The basin comprises 43 percent of the Chesapeake Bay's drainage area and the river provides nearly one-half of the freshwater flow to the Bay, with an average flow of 18 million gallons per minute at Havre de Grace.
- The Susquehanna River Basin has more than 49,000 miles of waterways – rivers, streams, creeks, brooks, runs, etc. *(data source: National Hydrography Dataset)*
- The basin is made up of 69 percent forest lands. *(data source: Chesapeake Bay 2000 land use)*
- The Susquehanna basin has a population of approximately 4 million.
- The river is almost a mile wide at Harrisburg, Pa. and flows about 20 miles on an average summer day.
- The river is the nation's longest, commercially non-navigable waterway.
- The basin is one of the most flood prone areas in the nation, with a major devastating flood occurring every 13 years on the average.

Figure 1. Susquehanna River Basin

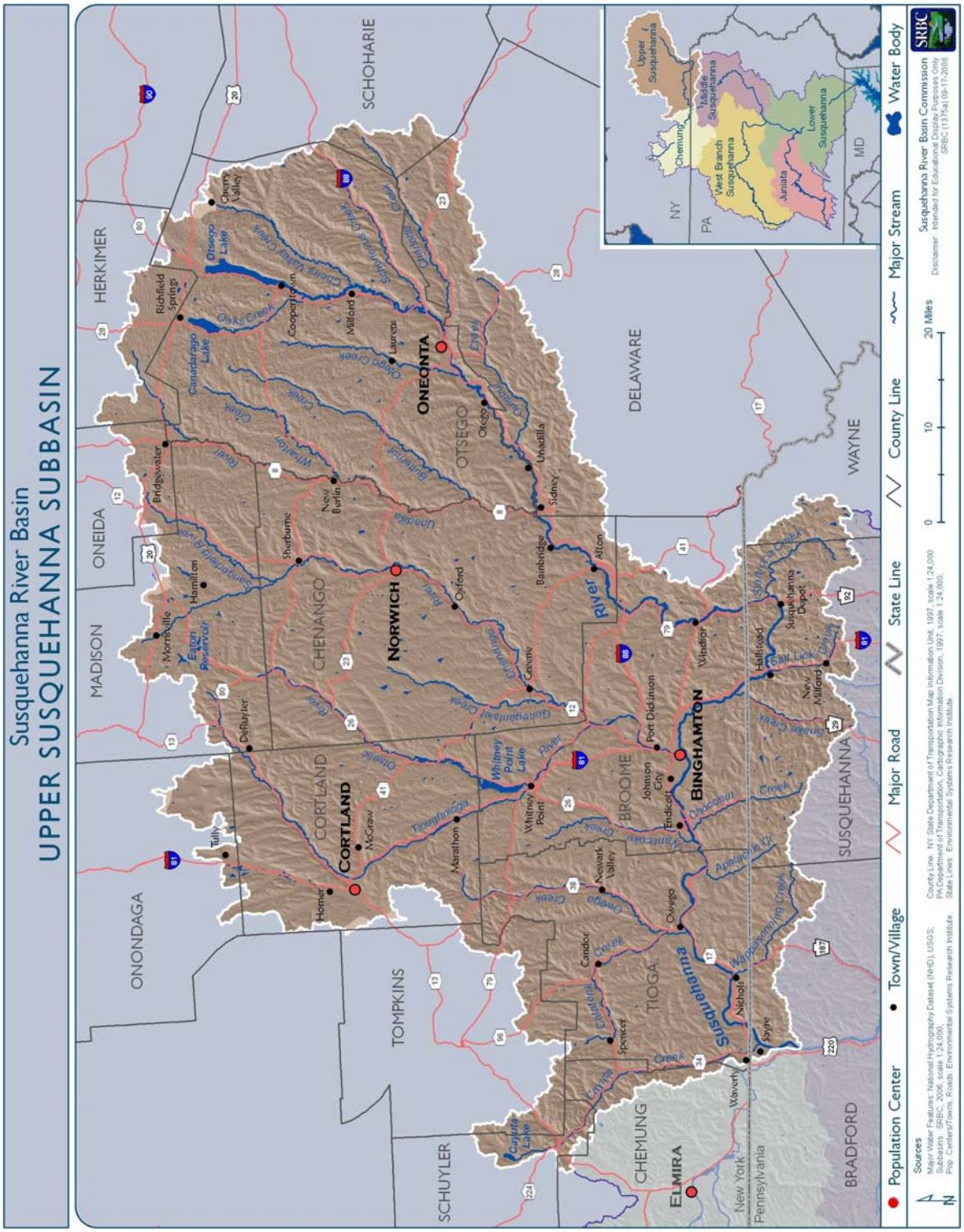


Figure 2. Upper Susquehanna Subbasin

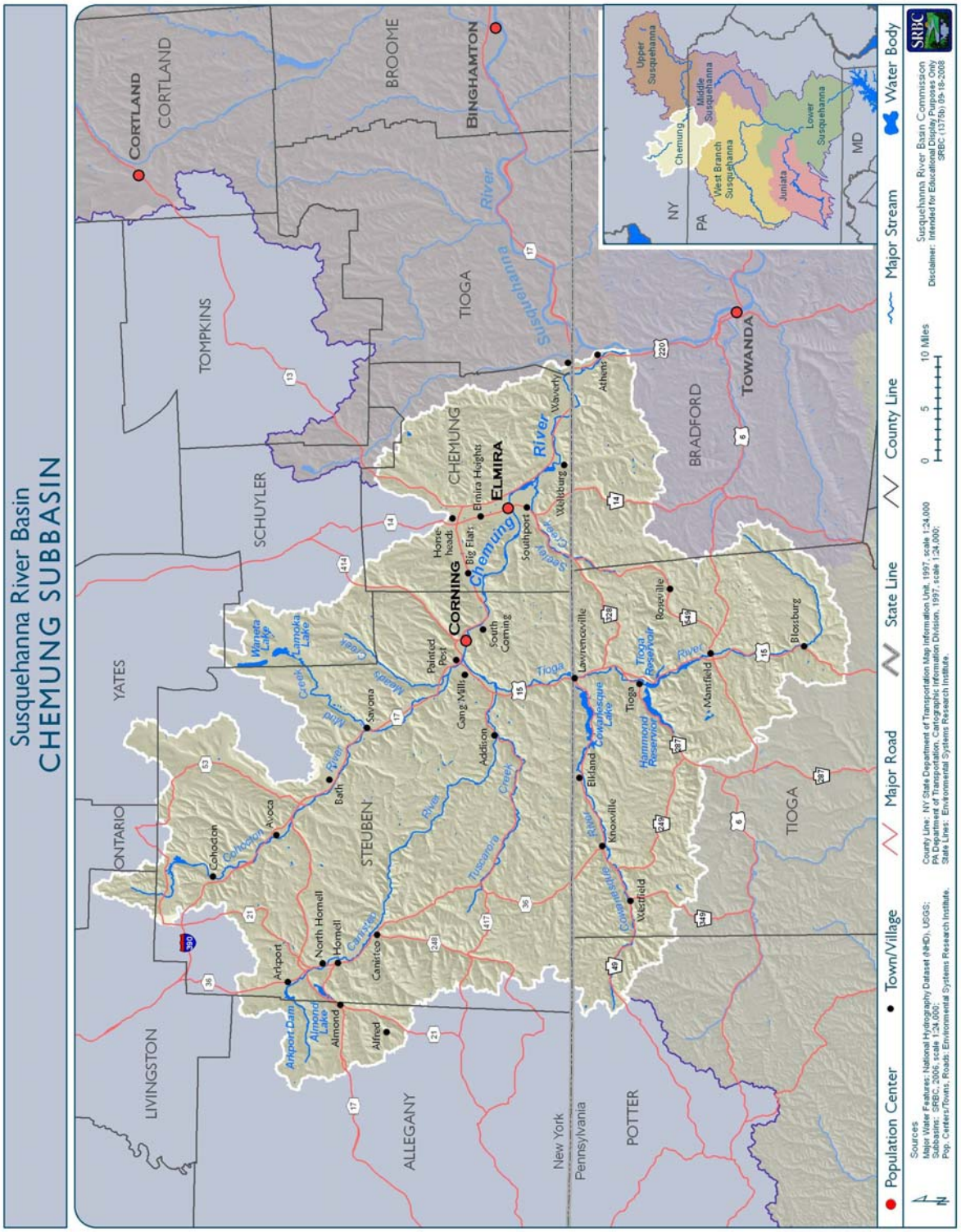


Figure 3. Chemung Subbasin

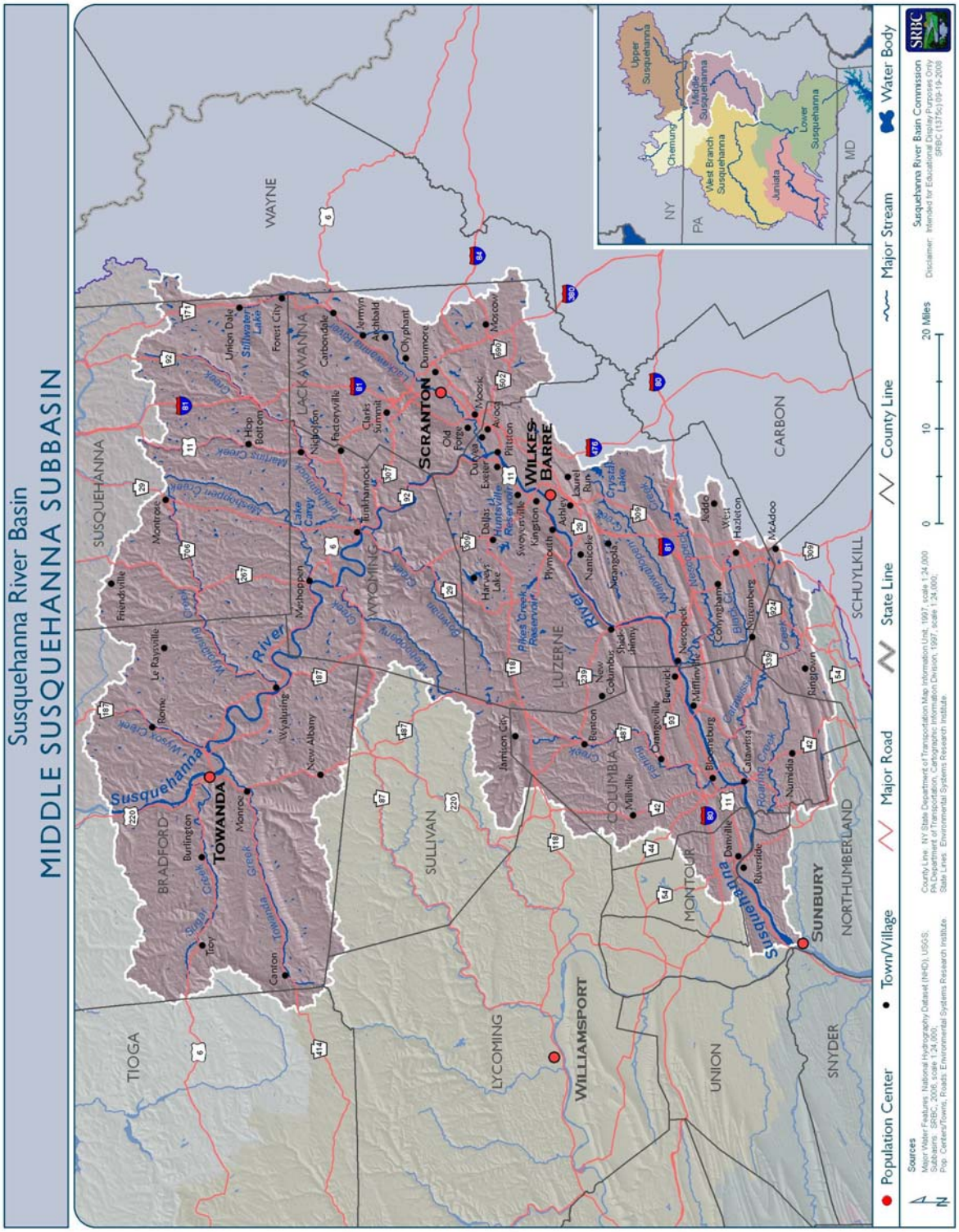


Figure 4. Middle Susquehanna Subbasin

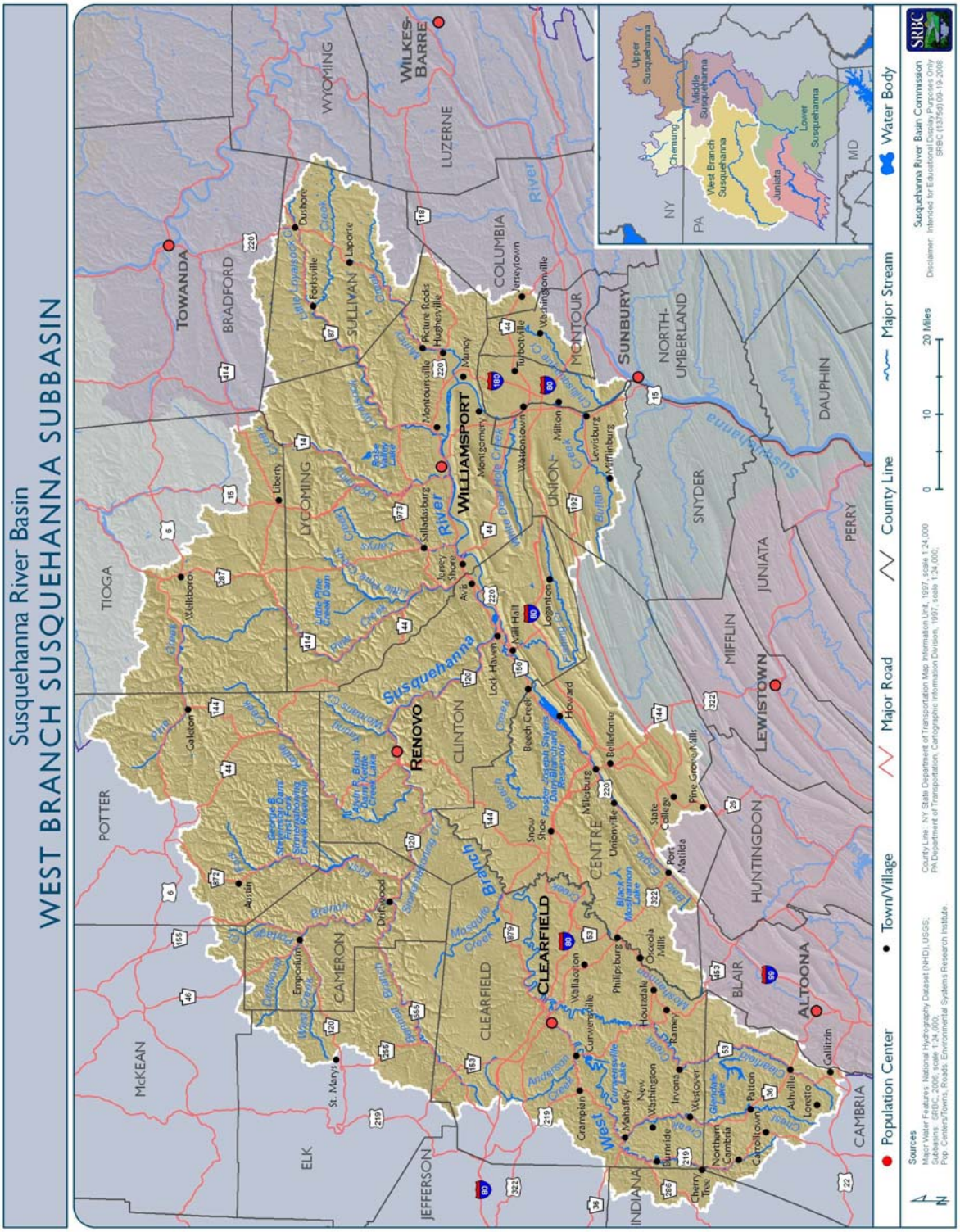


Figure 5. West Branch Susquehanna Subbasin

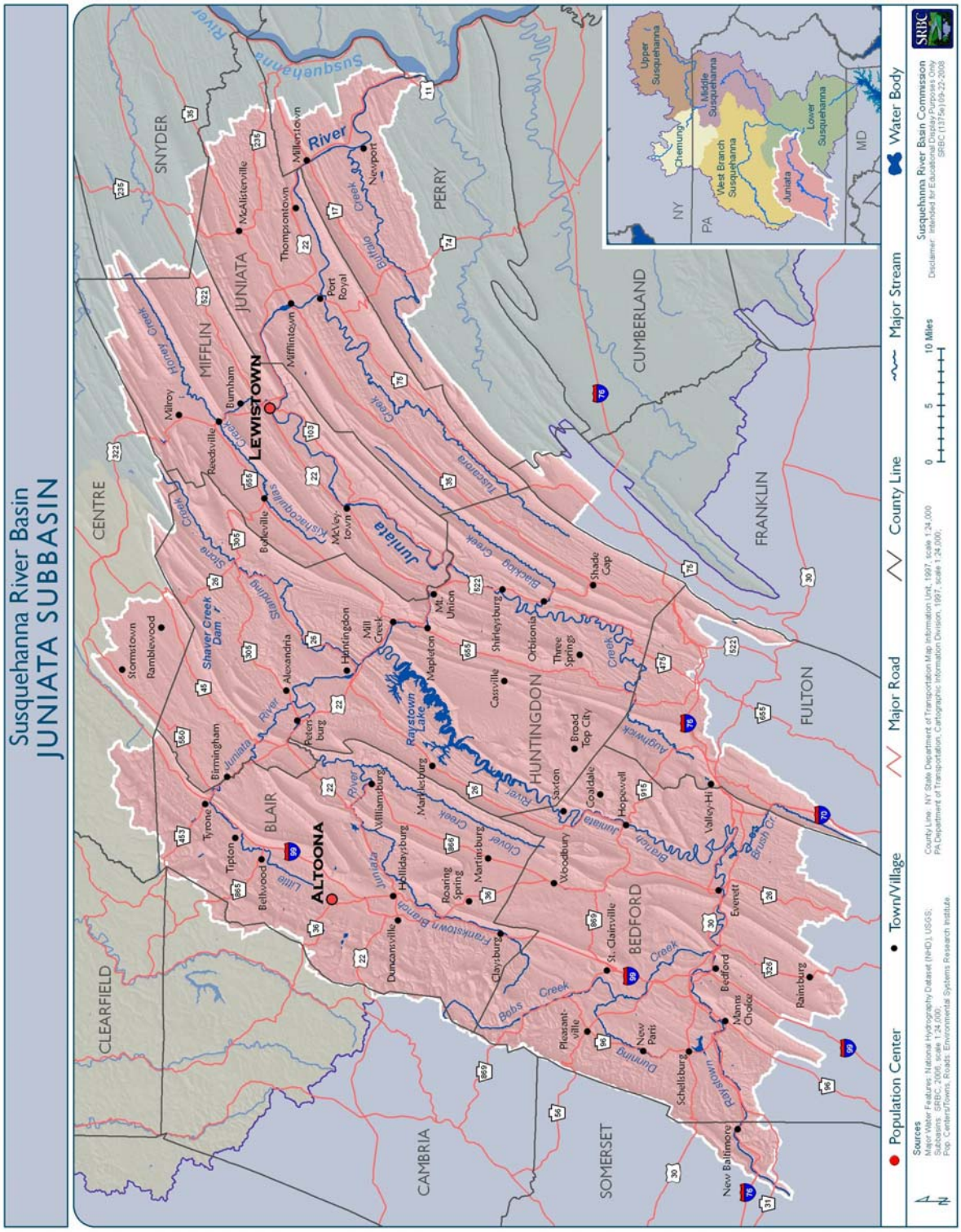


Figure 6. Juniata Subbasin

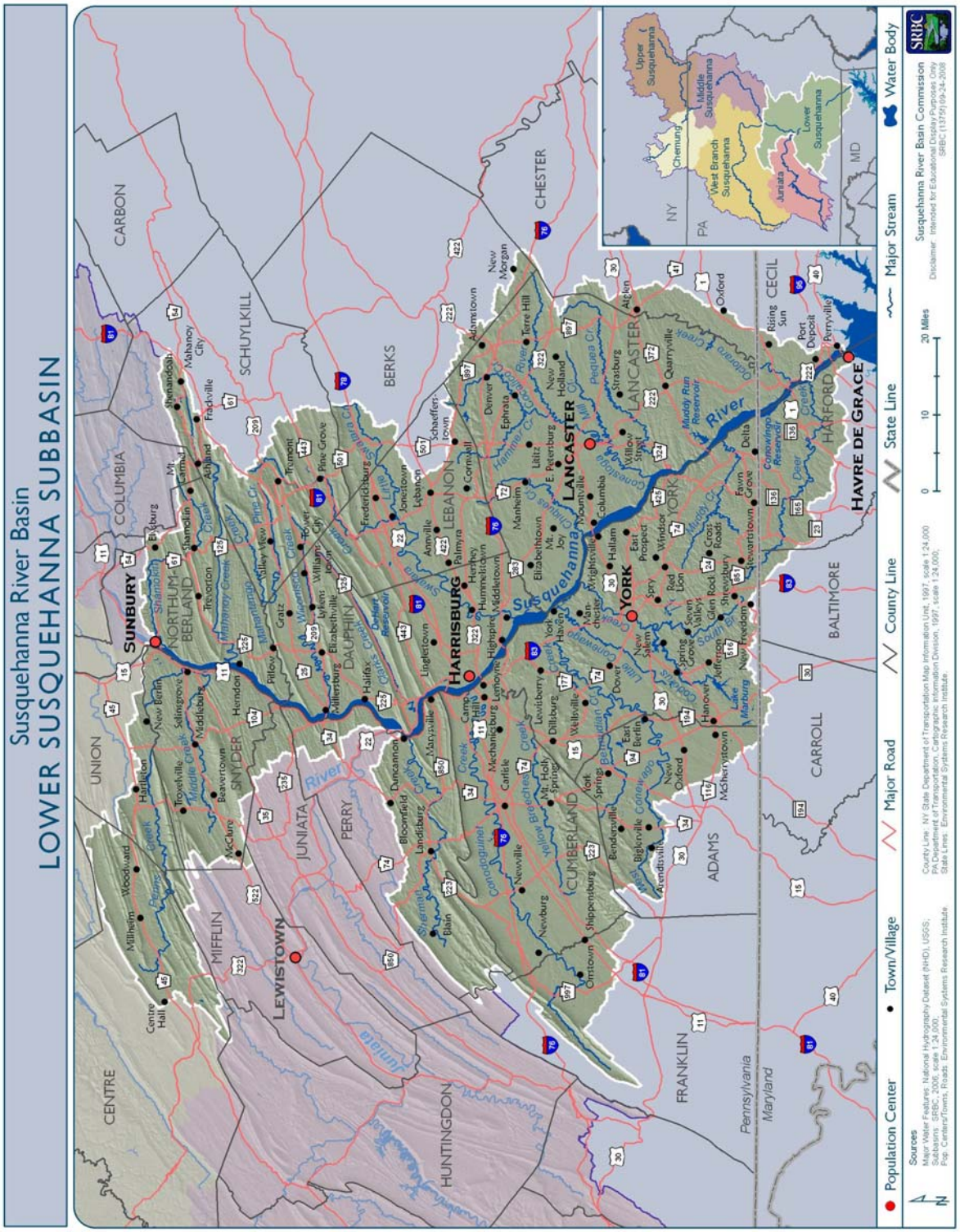
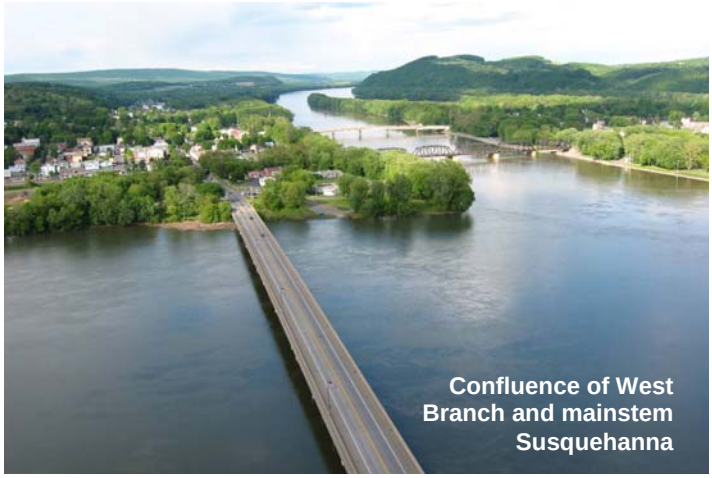


Figure 7. Lower Susquehanna Subbasin

2. Rivers in the Basin

The Susquehanna River starts as a small stream flowing from Otsego Lake and continues southward into Pennsylvania around the "Great Bend" and back into New York, then westward through Binghamton to be joined by the Chemung River at Athens, Pa. From this point, the river meanders southeastward into Pennsylvania until it is met by the Lackawanna River near Wilkes-Barre, where it turns southwestward to its confluence with the West Branch Susquehanna River at Sunbury.


Confluence of West Branch and mainstem Susquehanna

The Chemung River is formed by the confluence of the Cohocton and Tioga Rivers west of Corning, N.Y. The West Branch of the Susquehanna rises in the western part of the basin and flows north then east past Williamsport, where it turns south to its junction with the Susquehanna River at Sunbury. The Juniata River joins the Susquehanna at Duncannon, 38 miles downstream from Sunbury.

Below its junction with the Juniata, the Susquehanna becomes an impressive river nearly a mile wide. Just below Harrisburg, it flows through a series of gorges now dammed by hydroelectric power facilities. From the Maryland-Pennsylvania border, the river continues southeastward for 14 miles, passing one more major dam, until it mingles its waters with the tidal Chesapeake Bay at Havre de Grace.


Susquehanna River near Marietta, Pa.

SRBC Map and Data Atlas

The Commission has developed a Geographic Information Systems (GIS)-based Map and Data Atlas as a resource for water resource professionals and the public to access a wide variety of maps and datasets for the Susquehanna River Basin. The atlas provides a wealth of information on existing conditions in the basin and is periodically updated. Examples of the information in the atlas include watersheds, land use, average annual precipitation, toxic release inventory, flood insurance coverage, public lands and boat access points, and specific water resource projects. The Map and Data Atlas is available on the Commission's website at http://www.srbc.net.

3. Physiography

The Susquehanna River Basin includes three major physiographic provinces: the Appalachian Plateau, the Valley and Ridge, and the Piedmont Provinces. A very small part of the Blue Ridge Province also extends into the basin. Differences in topography and geology form a basis for these natural subdivisions, although the whole area has a similar geologic history and related geological features. These differences form a basis, too, for the settlement patterns of the basin (see Figure 8).

- Appalachian Plateau Province. This province occupies 56 percent of the Susquehanna drainage area in New York and Pennsylvania. This region is characterized by high, flat-topped hills and deep valleys cut by the Susquehanna and its tributaries.
- Valley and Ridge Province. This province is a mountainous region that covers approximately 37 percent of the basin and contains ridges, which rise from 500 to 1,600 feet above the surrounding valleys. In the eastern part, the folding of the rocks created the distinctive anthracite coal fields of the Lackawanna and Wyoming Valleys. Transportation routes and settlement have followed the valleys and the gaps in the ridges.
- Piedmont and Blue Ridge Provinces. About 7 percent of the basin is in the Piedmont and Blue Ridge Provinces. Maximum relief in the Piedmont Province ranges from 400 to 600 feet, with the Blue Ridge Province having a somewhat greater relief. This comparatively low relief allows a denser and more even population distribution than in the more mountainous parts of the basin.

4. The Climate of the Basin

The Susquehanna River Basin has a continental type of climate, modified somewhat by the moisture periodically entering the area from the Gulf of Mexico and the Atlantic Ocean. As a result, precipitation is greater and temperature less extreme than would otherwise be the case.

The average annual temperature in the basin ranges from about 44 degrees in the northern part of the basin to about 53 degrees in the southern part. Average January temperatures range from 20 to 30 degrees and average July temperatures range from 65 to 76 degrees. Extreme high temperatures of 107 degrees and low temperature of 39 degrees below zero have been recorded in the basin.

Average annual precipitation is about 40 inches over the entire basin and ranges from 33 inches in the northern part of the basin to 46 inches in the southern part. In the extreme years, more than 50 inches of rainfall have been recorded in various places, and in 1972 a record total of 59.2 inches of rainfall was recorded at Harrisburg. Drought years have seldom recorded less than 25 inches at any station.

Climate change has the potential to affect the basin’s temperature range and annual precipitation. More information on climate change is contained in Part V, Section B, of the Plan.

5. Hydrology

Since the average annual rainfall in the basin is about 40 inches per year, this means that more than 50 billion gallons of water per day, on the average, falls in the basin. An average of 26 billion gallons of water per day flows from the mouth of the Susquehanna into the Chesapeake Bay. Naturally, this flow varies from day-to-day and from year-to-year. Of particular interest are the extreme low flows and high flows, the droughts and the floods, and the flows that can be depended upon most of the time. Since the Susquehanna River experiences considerable variations in flow over periods of years and during any one year, resource management for the best utilization of the basin's water is a challenging task.

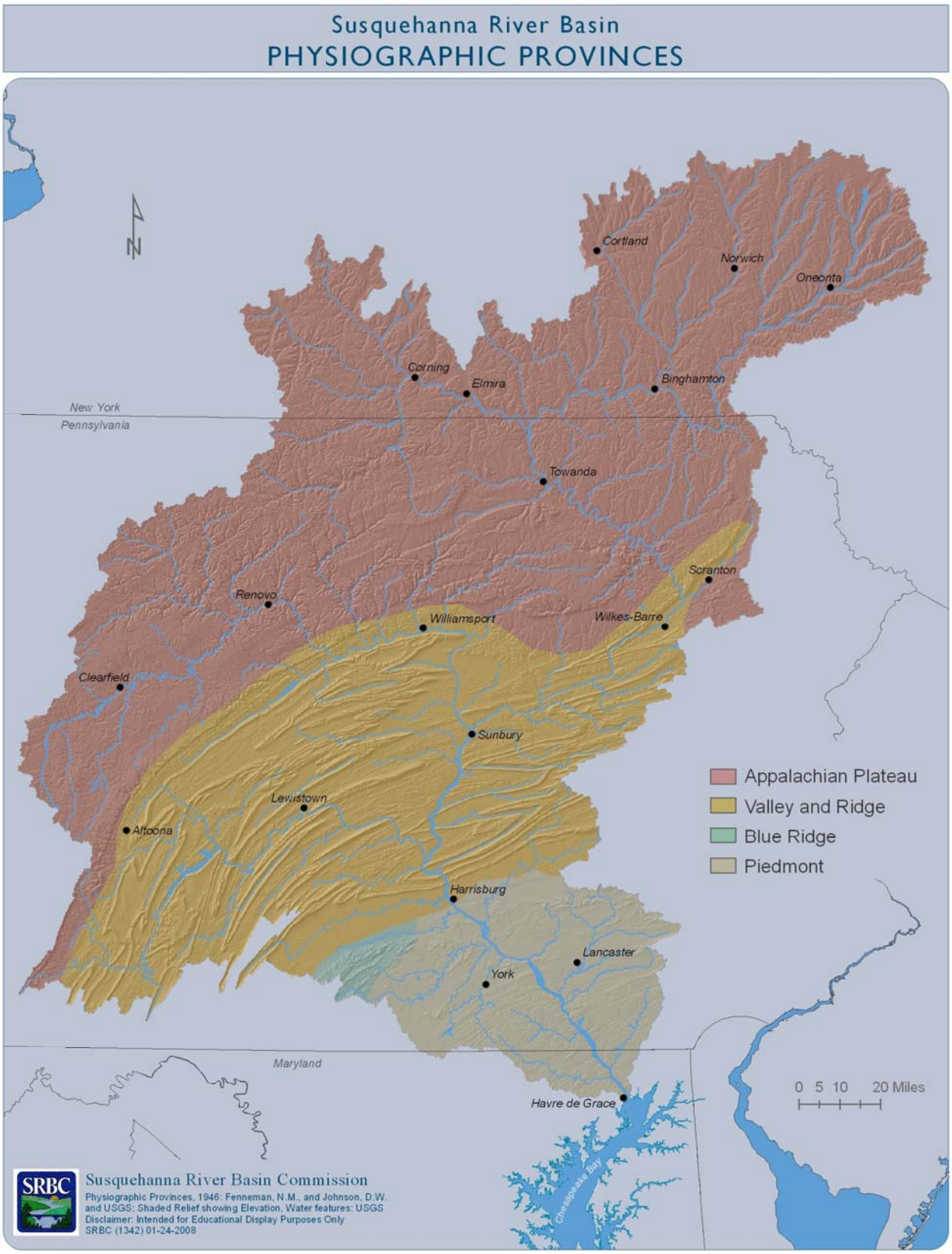


Figure 8. Physiographic Provinces

Total runoff varies from year-to-year and from location-to-location. Average yearly precipitation rates generally result in 52 percent of the total water being lost to evapotranspiration and 48 percent resulting in surface water runoff and ground water infiltration. Land use, soil, and the type of vegetative cover affect surface runoff and evapotranspiration rates. For instance, in urban areas with large portions of their areas paved or covered with buildings, surface runoff can approach 100 percent; in heavily forested areas, surface runoff is much lower and evapotranspiration is correspondingly higher.

In terms of seasonal variations in average stream flow, virtually all the major streams experience their highest flows in March, April, and May, when melting snows combine with spring rains. These three months account for about one-half of the yearly runoff. Flows are lowest in these streams during the summer and early fall months, with most streams hitting their lowest levels in September. Figure 9 shows a typical flow pattern for the basin as recorded, from 1890 to the present, for the Susquehanna River at Harrisburg, Pa. with a peak day flow of 954,000 cubic feet per second (cfs) in June 1972 and a minimum low flow of 1,700 cfs in September 1964. The average daily flows at Harrisburg range from 11,970 cfs in August to 217,000 cfs in April.

Average flow data are collected over long periods of time for locations throughout the basin. The data, however, does not reveal periods of drought when, for a year or more, rainfall and runoff were below these averages; and it does not reveal floods that occurred on the major streams after severe regional storms, or flooding of small tributaries because of local storms. It is possible for one portion of the basin to be flooded while another is experiencing a drought.

Climate change may have a significant effect on the basin's hydrology, particularly in terms of flow extremes and seasonal variations in flow. More information on the potential impacts of climate change is contained in Part V-B of the Plan.

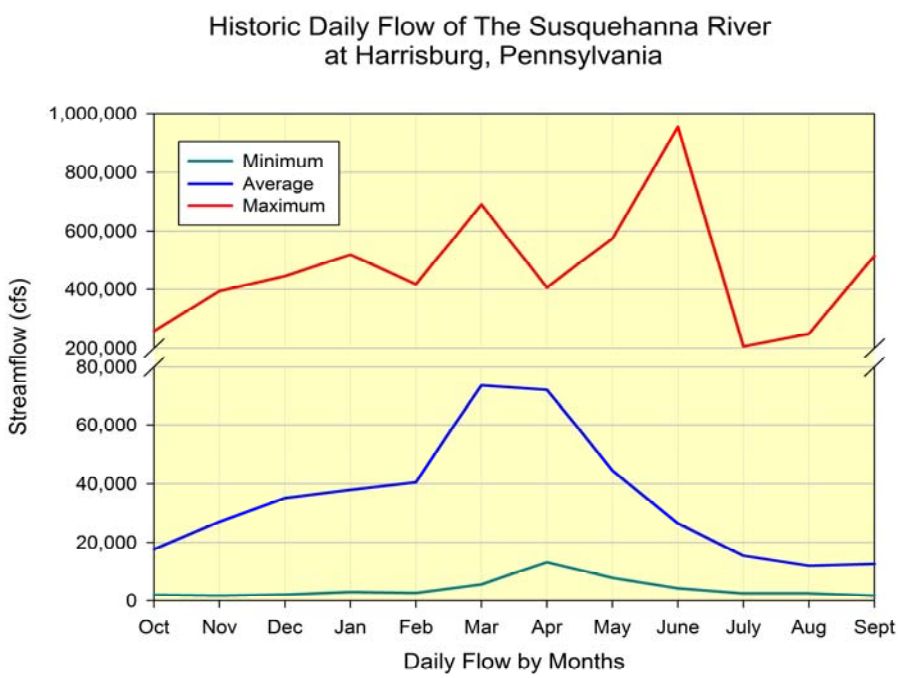


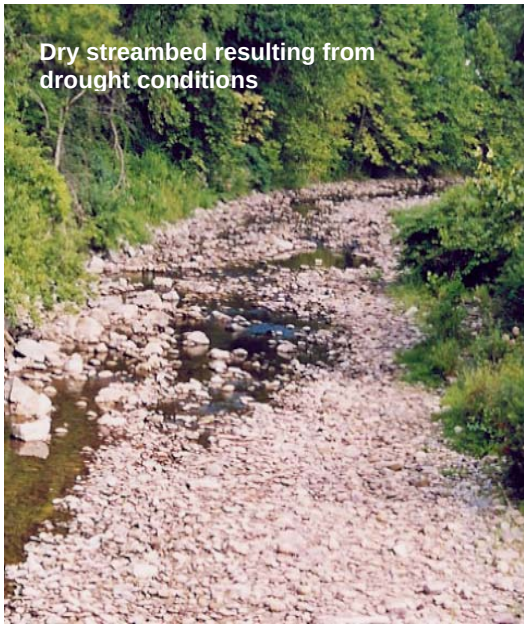
Figure 9. Typical flow pattern for the basin as recorded for the Susquehanna River at Harrisburg, Pa.

6. Floods

With more than 49,000 miles of waterways, the Susquehanna River Basin is one of the country's most flood prone areas. Generally, floods occur each year somewhere in the basin, and major floods can occur in all seasons of the year. The more frequent flooding, however, occurs in early spring, usually in March. Major floods have occurred as the result of heavy rainfall on top of heavy snowfall and as a result of heavy rainfall on previously saturated ground. Occasionally, local flooding is caused by ice jams. Flooding from high intensity summer storms is often aggravated by saturated ground conditions from previous storms, and flash flooding over small drainage areas also results from thunderstorms during the summer months. Hurricanes, or their remnants, passing through the basin have caused major floods. Record floods have occurred at most localities in the Susquehanna River Basin on one or more of the following dates: June 1889, July 1935, March 1936, May 1946, June 1972, September 1975, January 1996, September 2004, and June 2006.

7. Droughts

While many droughts have occurred in parts of the basin at different times, the two most severe occurred in the 1930-1934 period and the 1962-1965 period. The drought of the 1930s left many streams dry, and water for domestic use had to be transported to many places. The drought of the 1960s was even more severe, in terms of intensity and greater demands on water resources. Agriculture suffered, municipalities had to restrict water use drastically, and many streams were dry or were left with poor quality water. A measure of drought conditions is the occurrence of "Q7-10," which is the low flow statistically expected to occur for a seven-day duration once in ten years. An indication of the severity of the 1930s and 1960s droughts is the fact that more than 70 percent of the daily occurrences of flows below "Q7-10" at Harrisburg, from 1890 to 2007, took place during those two events. Significant droughts have also occurred in portions of the basin in 1900, 1908, 1910, 1913, 1941, 1980, 1991-1992, 1995, 1999, and 2002, with drought emergencies declared for the more recent events.



8. Groundwater

The surface water and groundwater resources of the Susquehanna River Basin are interrelated and must be considered jointly. Existing groundwater conditions in the basin result from a number of factors, including climate, physiography, land use, groundwater quality, and groundwater use. Groundwater maintains the base flow of perennial streams during periods of little or no precipitation and constitutes an average of 50 percent of the flow of most streams at other times. When groundwater is withdrawn and used consumptively (not returned), stream flows may be reduced.

The use of groundwater resources within the basin is extensive. In particular, 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 wells. For use as water supply, groundwater is sometimes preferable to surface water because of its relatively uniform temperature, quantity, and quality throughout the year. In addition, groundwater often requires fewer resources for treatment. Approximately 20 percent of the basin population is served by public water suppliers that use groundwater as a source.

9. Soils

Soil types in the basin vary largely within the predominant physiographic provinces. In the glaciated portion of the Appalachian Plateau Province, the deep soils on the sloping uplands are developed in glacial till and are moderately well to poorly drained. Most of the soils contain considerable amounts of coarse fragments, frequently have stones on the surface, and are in woodland. The stream valleys contain deep deposits of glacial valley fill materials and are predominantly deep and well drained (sand and gravel deposits) or poorly drained (finely textured deposits). In the unglaciated part of the plateau, soils formed in materials weathered from sandstone and shale are deep and well to poorly drained.

In the Valley and Ridge Province, soils of the ridges are mostly moderately deep to deep, well drained, and very stony. Soils of the shale valleys are mostly moderately deep to shallow, well to moderately well drained, and feature moderate to steep slopes. Soils of the limestone valleys are predominantly deep, well drained, productive, and often in cropland.

Soils of the Piedmont Province are formed in parent materials weathered from a wide variety of rocks, including red shale, schist, gneiss, quartzite, diabase, and greenstone. The ridge soils are mostly deep, well drained, and very stony. Soils formed over shales and other softer rocks are moderately deep to deep, well to poorly drained, and generally very fertile.

10. Mineral Resources

Coal has been, and continues to be, a significant mineral resource in the Susquehanna basin. There are nearly 1,000 active coal mines in the basin and over 2,500 square miles (surface area) of coal fields. Some of the towns and cities in the basin were built for the single purpose of coal mining. While coal provided a livelihood for thousands over many decades, the operators worked without regard to environmental impacts until the 1970s. The land was stripped, deep mine wastes were left in enormous piles, and mine drainage flowed into waterways and groundwater. Since the 1970s, many of the previously mined areas have been either abandoned or reclaimed. See Parts I-D8 and V-A of the Comprehensive Plan for more detailed information on the effects of abandoned mine drainage and actions taken to manage and mitigate these effects. Another very significant mineral resource in the basin is the natural gas captured in certain shale formations. See Part V-G, Energy Production, for more detailed information on natural gas extraction in the basin. Large reserves of both coal and natural gas are present in the basin and will be important sources of energy production for decades. Other important mineral resources of the basin include glass sand, lime, clay, trap rock (an aggregate deposit also known as “Diabase” that is a very hard durable material), sand and gravel and stone.

D. Water Resource Projects and Programs in the Basin

There are many important projects and programs that address various aspects of water resources in the Susquehanna River Basin. This part of the Comprehensive Plan provides an overview of existing projects and programs that deal with flood damage reduction, water supply, wastewater treatment, recreation, electric power production, water diversions, migratory fish passage and abandoned mine drainage. Also discussed are the projects, plans and other actions that the Commission has incorporated into the Comprehensive Plan. The overview is meant to provide an insight to existing conditions in the basin, but it does not attempt to address all existing projects or ongoing activities.

1. Flood Damage Reduction

The existing federal, state and local flood damage reduction projects in the basin have provided significant benefits for many years. The projects include reservoirs, local flood protection projects (levees, floodwalls, channel modifications, pumping stations), and flood forecast and warning systems. Without these valuable projects, damages in the flood prone areas of the basin would be much higher than what actually occurs.

The U.S. Army Corps of Engineers (USACE) operates and maintains a system of 13 dams and multipurpose reservoirs which are located in all six major subbasins. For the purpose of flood damage reduction, USACE also regulates the operation of a Commonwealth of Pennsylvania reservoir (George B. Stevenson) in the West Branch Susquehanna Subbasin. These 14 projects provide most of the floodwater storage in the basin, with over 940,000 acre-feet of storage available for reducing flood damages. Table 2 contains a listing of the 13 USACE reservoirs. The federal Natural Resources Conservation Service and the Commonwealth of Pennsylvania have constructed other reservoirs in the basin that reduce flood damages. These projects are generally smaller in scale than most of the USACE reservoirs, but provide important local benefits.

There are approximately 100 local flood protection projects in the basin that were constructed by federal and state agencies and local interests. These projects are well distributed throughout the basin and provide varying levels of protection, depending on the flow or flood level used for design purposes. The operation and maintenance responsibilities for the projects are typically at the local level. An example of an effective local program is the Sunbury, Pa. Municipal Authority's operation and maintenance of the federally constructed local flood protection project at Sunbury. Figure 10 is a basin map showing the locations of the major flood damage reduction projects discussed above. The map provides a visual display of the distribution of these projects throughout the basin.

The Susquehanna Flood Forecast and Warning System (SFFWS) is a comprehensive system that is of very significant value to basin residents, communities, and businesses in reducing flood damages. The SFFWS is an automated state-of-the-art system utilizing advanced technology, including radar and streamflow and rainfall gages, to provide data used by the National Weather Service to forecast stream levels and issue timely and accurate early warnings. The early warnings allow all flood-prone interests to secure their property and move people and property to a safe location. The SFFWS is

overseen by a federal and state interagency committee coordinated by the Commission. There are also locally-operated flood warning systems, such as the one in Lycoming County, Pa., that complement the basinwide system with more specific watershed and local warning information. Figure 10 also shows the locations of the river forecast points used under the SFFWS. The map provides a visual display of the distribution of these forecast points throughout the basin.

The National Flood Insurance Program and effective floodplain management at the state and local level have also played important roles in reducing long term flood damages.

Table 2. U.S. Army Corps of Engineers Reservoirs

Reservoir or Dam Name	Subbasin Location	County and State
Almond Lake	Chemung	Steuben, N.Y.
Arkport Dam	Chemung	Steuben, N.Y.
Aylesworth Lake	Middle Susquehanna	Lackawanna, Pa.
Alvin R. Bush Dam	West Branch Susquehanna	Clinton, Pa.
Cowanesque Lake	Chemung	Tioga, Pa.
Curwensville Lake	West Branch Susquehanna	Clearfield, Pa.
East Sidney Lake	Upper Susquehanna	Delaware, N.Y.
Indian Rock Dam	Lower Susquehanna	York, Pa.
Raystown Lake	Juniata	Huntingdon, Pa.
Foster J. Sayers Dam	West Branch Susquehanna	Centre, Pa.
Stillwater Lake	Middle Susquehanna	Susquehanna, Pa.
Whitney Point Lake	Upper Susquehanna	Broome, N.Y.
Tioga-Hammond Lakes	Chemung	Tioga, Pa.

2. Water Supply

More than 1,100 public water supply systems currently exist in the basin, including municipal and commercial (e.g., trailer park) facilities. Of this total, 335, 823, and 7 public systems are in the New York, Pennsylvania and Maryland portions of the basin, respectively. The water supplies for the public systems include more than 340 surface water intakes and 7,500 groundwater wells.

In addition to the public systems, there are many self-supplied water supply sources in the basin. It is estimated that more than 1.2 million of the basin's residents and 1,200 industries depend on self-supplied sources for their water.

The Commission has approved surface or groundwater withdrawals and/or consumptive water use for more than 500 individual facilities under its regulatory authority. The types of water supply users include commercial, industrial, and municipal interests. The Commission also owns more than 29,000 acre-feet of water storage at Cowanesque and Curwensville Lakes. This storage provides mitigation (i.e., low flow augmentation) for a portion of the consumptive water use in the basin during certain low flow conditions.

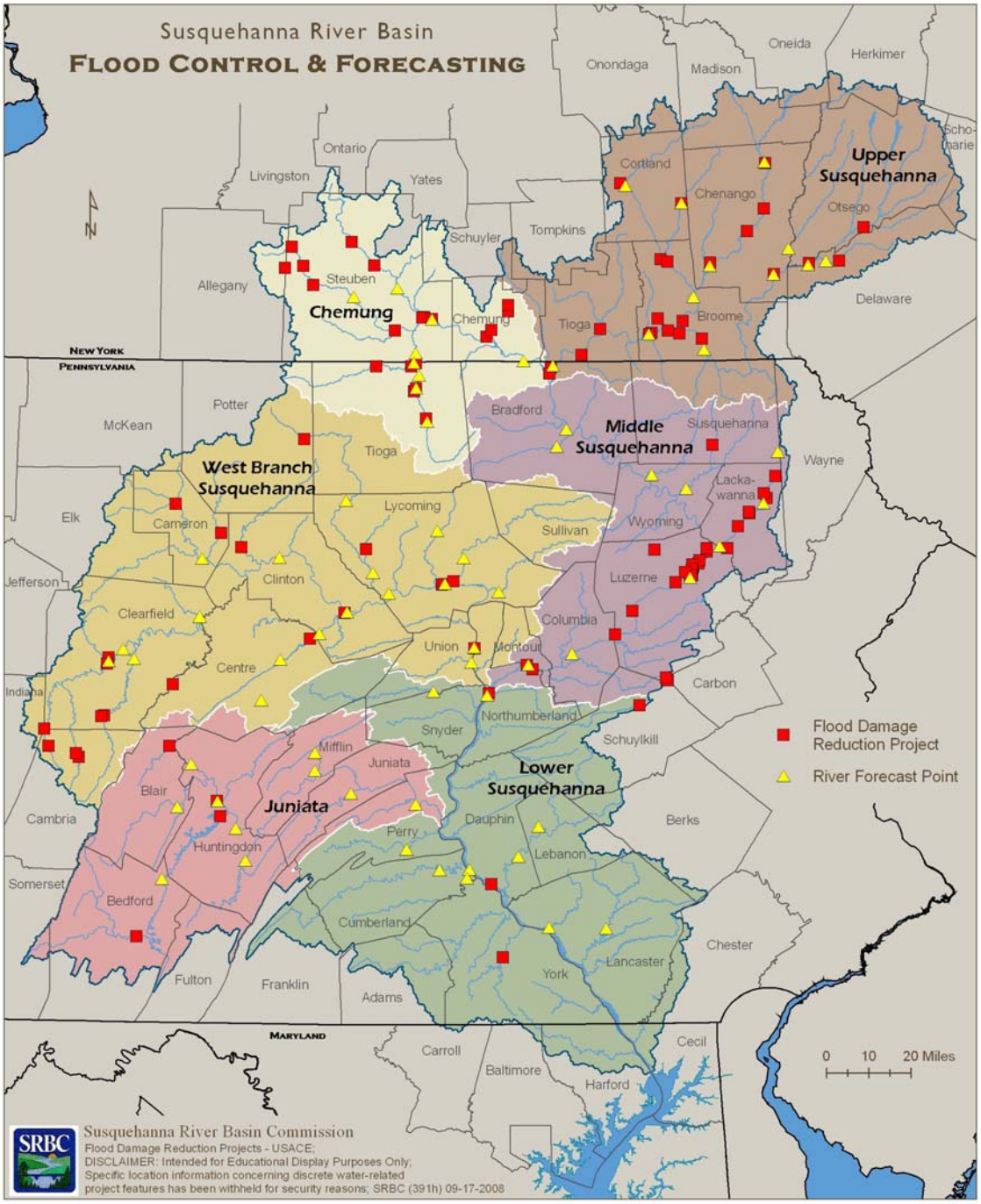


Figure 10. Location of Flood Damage Reduction Projects and River Forecast Points

3. Wastewater Treatment Facilities

There are nearly 800 existing wastewater treatment plants in the basin. Based on information compiled from state datasets, 736 plants are in Pennsylvania with 47 and 9 plants located in the New York and Maryland portions of the basin, respectively. These data include facilities for municipalities, schools, mobile home parks, prisons, and subdivisions. A number of large industrial facilities provide their own on-site wastewater treatment.

4. Recreation

The basin's resources provide residents and visitors with excellent opportunities for outdoor, water-based or oriented recreation. Fishing, waterfowl hunting, boating, swimming, hiking, camping, and bird watching are among the activities that can be enjoyed. Recreational features include 76 state parks available for use on approximately 136 square miles (87,000 acres) of public lands having an estimated 340 miles of streams. More than 370 public boat launches along the Susquehanna River and its major tributaries offer excellent access to the waterways. There are 10 designated "Water Trails" in the basin having a total length of in excess of 900 miles. A total of 43 moderate to large lakes in the basin offer more than 57,000 acres of surface area. In addition to parks, waterway access and lakes, there are 188 public forests and 153 game lands in the basin, encompassing a total of almost 4,600 square miles of land, respectively. There is an estimated 6,500 miles of streams within the public forests and game lands.

5. Power Production

There are 20 major electric power generating plants located in the Susquehanna River Basin that use water resources in their operation. The major plants are listed in Table 3 in alphabetical order. Table 4 summarizes the facilities by state, type of operation (i.e., hydropower, fossil fuel or nuclear), capacity and water use data. The power production of the large plants is fed into the electric power grid for widespread residential, commercial and industrial use. There are an additional 39 facilities in the basin that generate electric power, but have limited power production and related water use. The small facilities primarily produce power for local use with relatively minor excess power fed into the electrical power grid. For comparison purposes, the 20 large plants have a total power capacity of 13,939 megawatts (MW), or 91 percent of the total for all 59 plants, while the 39 small plants' capacity is 1,380 MW, or 9 percent of the system's total capacity. The general location of the 20 major power plants is shown in Figure 11.

Two new natural gas-fired (fossil fuel) power plants are under development in the Pennsylvania portion of the basin and are scheduled to be in operation by 2011-2012. These two peaking plants are expected to have a total capacity of 1,390 MW. A new nuclear power plant with an expected capacity of 1,600 MW is also being considered in the Pennsylvania portion of the basin with potential implementation by 2016-2018. Other proposals for new plants and upgrades of existing plants are expected to occur over time and will increase the total power production capacity and water use in the basin.

Table 3. Major Power Plants in the Susquehanna River Basin

Power Plant Name	Subbasin	County and State
1. AES Hickling[1]	Chemung	Steuben, N.Y.
2. AES Ironwood CCGT Power Plant	Lower Susq.	Lebanon, Pa.
3. AES Jennison	Upper Susq.	Chenango, N.Y.
4. AES Westover Generating Station	Upper Susq.	Broome, N.Y.
5. Archbald Power Station	Middle Susq.	Lackawanna, Pa.
6. Brunner Island Steam Electric Station	Lower Susq.	York, Pa.
7. Conowingo Hydroelectric Station	Lower Susq.	Cecil, Md.
8. Holtwood Hydroelectric Project	Lower Susq.	Lancaster, Pa.
9. Hunlock Power Station	Middle Susq.	Luzerne, Pa.
10. John B Rich Memorial Power Station/ Gilberton CoGen Plant	Lower Susq.	Schuylkill, Pa.
11. Montour Steam Electric Station	West Br. Susq.	Montour, Pa.
12. Muddy Run Pumped Storage Facility	Lower Susq.	Lancaster, Pa.
13. Peach Bottom Atomic Power Station	Lower Susq.	Lancaster, Pa.
14. Rock Springs Generation Facility	Lower Susq.	Cecil, Md.
15. Safe Harbor Hydroelectric Station	Lower Susq.	York, Pa.
16. Shawville Generating Station	West Br. Susq.	Clearfield, Pa.
17. Sunbury Generation Facility	Lower Susq.	Snyder, Pa.
18. Susquehanna Steam Electric Station	Middle Susq.	Luzerne, Pa.
19. Three Mile Island Nuclear Station	Lower Susq.	Dauphin, Pa.
20. York Haven Hydro Station	Lower Susq	York, Pa.

[1] AES Hickling Plant is currently inactive, but is expected to be reactivated.

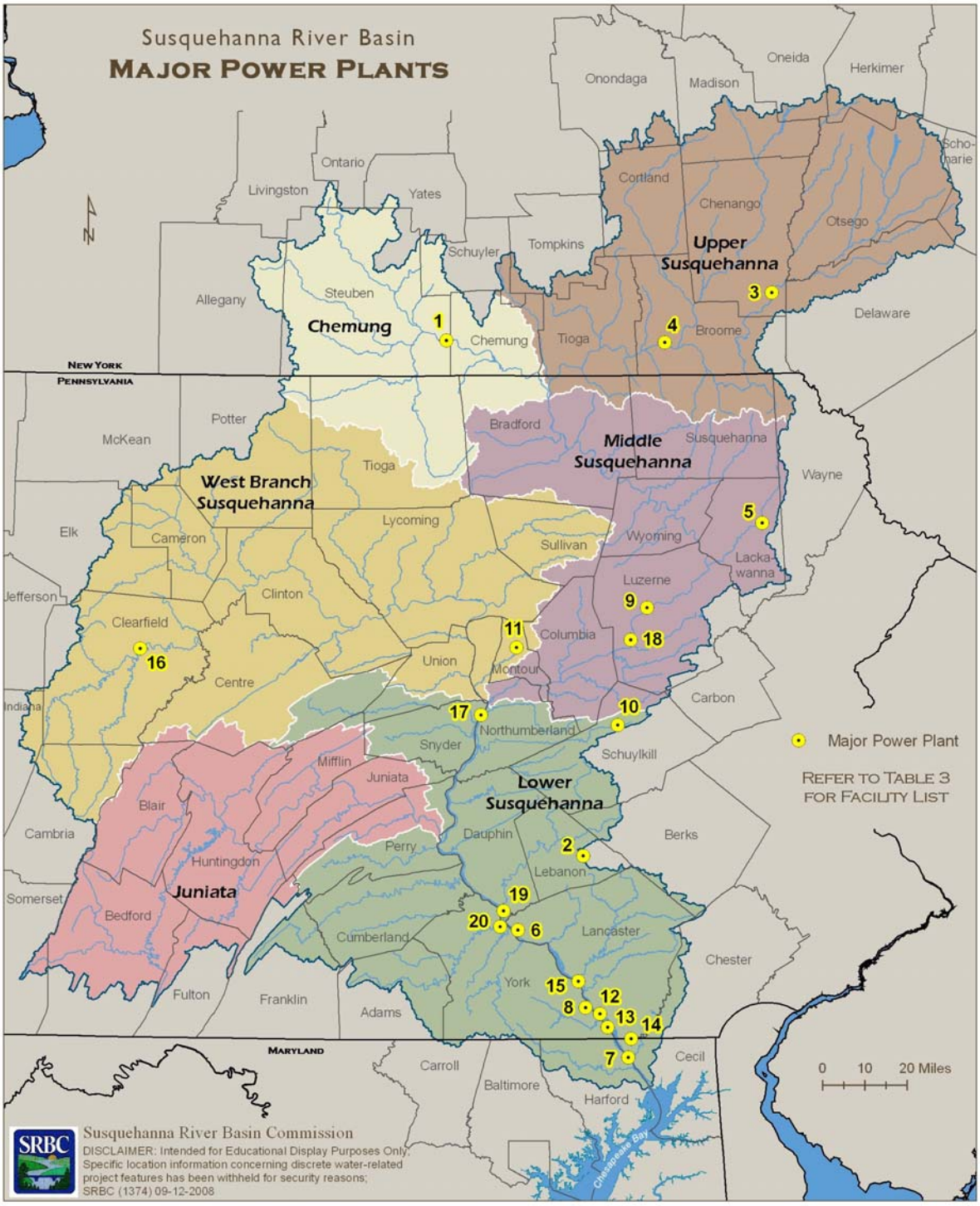


Figure 11. Major Power Plants

Table 4. Power Plant Data

State	Hydro	Fossil	Nuclear	Total	Capacity (MW)	Water Withdrawal (mgd)*	Consumptive Water Use (mgd)*
NY	0	3	0	3	249	239.0	3.3
PA	4	8	3	15	12,443	4,217.0	168.0
MD	1	1	0	2	1,247	0.4	0.3
Total	**5**	**12**	**3**	**20**	**13,939**	**4,456.4**	**171.6**

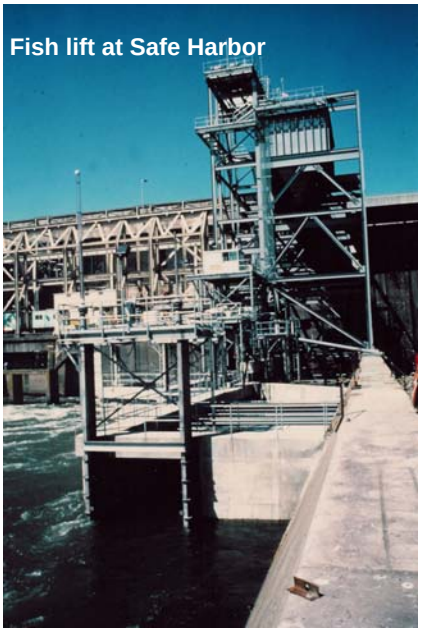
* Water use at hydropower plants is not included in totals.

6. Water Diversions

Water that is transported by man-made means (e.g., pumping) from the Susquehanna River Basin for use outside the basin is considered an out-of-basin diversion. Table 5 lists the existing out-of-basin diversions and their authorized rates. Unless otherwise noted, the diversions were approved by the Commission under its regulatory program. There are also three small in-basin diversions that are approved under regulatory authority to import a maximum of .7 million gallons daily into the Susquehanna River Basin. There are other existing in-basin diversions that did not require the regulatory approval of the Commission.

All water diverted from the basin is considered a consumptive use. Out-of-basin diversions and power plants consumptively use approximately 470 mgd as approved by the Commission. This represents about 80 percent of the consumptive water use for projects approved by the Commission since 1971. All other types of approved consumptive water uses including golf courses, natural gas extraction, manufacturing, mining, educational facilities and other categories total 120 mgd or 20 percent of the total amount approved.

7. Migratory Fish Passage



Several species of migratory fish (e.g., American shad, blueback herring, and American eel) were once important recreational and commercial resources throughout the Susquehanna River Basin. Construction of the four major power dams on the lower Susquehanna River in the early 1900s ended migratory fish movement into the river system. Modern efforts to restore migratory fish to the Susquehanna River Basin began in the 1950s and continue today. The Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) has set a goal of restoring all migratory fish species in the basin. Major accomplishments toward meeting this goal include installation of fish passages at Conowingo, Holtwood, Safe Harbor, and York Haven Dams located below Harrisburg, Pa., on the lower Susquehanna River and construction of a shad hatchery along the Juniata River. As a result of the modifications at the dams below Harrisburg, the lower Susquehanna River and much of the Juniata River have been opened to migratory fish passage. The removal of small dams on tributary streams and modifications of other small dams for fish passage are other actions that have taken place in the basin. Figure 12 displays the main river areas that are open to migration and the areas of the basin that are closed due to a number of main stream blockages.

Table 5. Diversions from the Susquehanna River Basin

Names & Locations of Diversions	Waterbodies or Basins Involved	Authorized Diversions
1. City of Aberdeen, Md.	Deer Creek to Chesapeake Bay	3.0 mgd, but limited to 1.8 mgd as of 2008
2. AES Ironwood, Lebanon, Pa.	Swatara Creek to Delaware basin	4.5 mgd
3. Aqua Pennsylvania – SCI Waymont, at Waymont, Pa.	Middle Susquehanna subbasin to Delaware basin	0.494 mgd
4. City of Baltimore, Md.	Susquehanna River to Chesapeake Bay	250 mgd originally authorized.[1] Diversion is limited to lesser amounts during certain low flow conditions.[2]
5. Berlin Borough, Pa.	Juniata subbasin to Potomac basin	0.498 mgd
6. Chester, Pa. Water Authority	a. Susquehanna River to Delaware basin b. Octoraro Creek to Delaware basin	30 mgd[1] 30 mgd[1]
7. City of Dubois, Pa.	West Branch Susquehanna River tributary to Allegheny basin	3 mgd[1]
8. Franklin County, Pa. General Authority	Conodoquinet Creek to Potomac basin	1.4 mgd
9. Morgantown Properties, L.P., New Morgan Borough, Pa.	Conestoga River to Delaware basin	0.004 mgd
10. New York State Canal Corp. near Bouckville, N.Y.	Chenango watershed to Mohawk basin	18.4 mgd[1]
11. New York State Canal Corp. near DeRuyter, N.Y.	Tioughnioga watershed to Mohawk basin	4.3 mgd[1]
12. PA American Water Authority, Coatesville, Pa.	West Branch Octoraro Creek to Delaware basin	2.0 mgd[1]
13. Town of Perryville, Md.	Susquehanna River to Chesapeake Bay	1 mgd

8. <u>Abandoned Mine Drainage</u>

Coal mining has been an important part of the economy in the basin since the 1800s but has caused many environmental problems. Abandoned mine drainage (AMD) continues to be a significant cause of stream impairment in the Pennsylvania portion of the basin, with more than 1,600 miles of streams negatively impacted. Since the 1960s, significant efforts have been made to treat AMD and reclaim abandoned mine lands. Pennsylvania's Operation Scarlift was active from 1968 to 1995 and resulted in more than 500 AMD projects. The federal Surface Mining Control and Reclamation Act was enacted in 1977, under the auspices of the Office of Surface Mining, and has resulted in significant funding to address AMD treatment and reclamation work.

[1] These diversions pre-date the Commission and were originally authorized by various state actions.
[2] As set forth in a 2001 Settlement Agreement between the Commission and the City of Baltimore, the diversion is limited to a maximum of 64 mgd (measured as a 30-day average) and 107 mgd on any one day when established trigger flows occur at the Marietta, Pennsylvania gage.

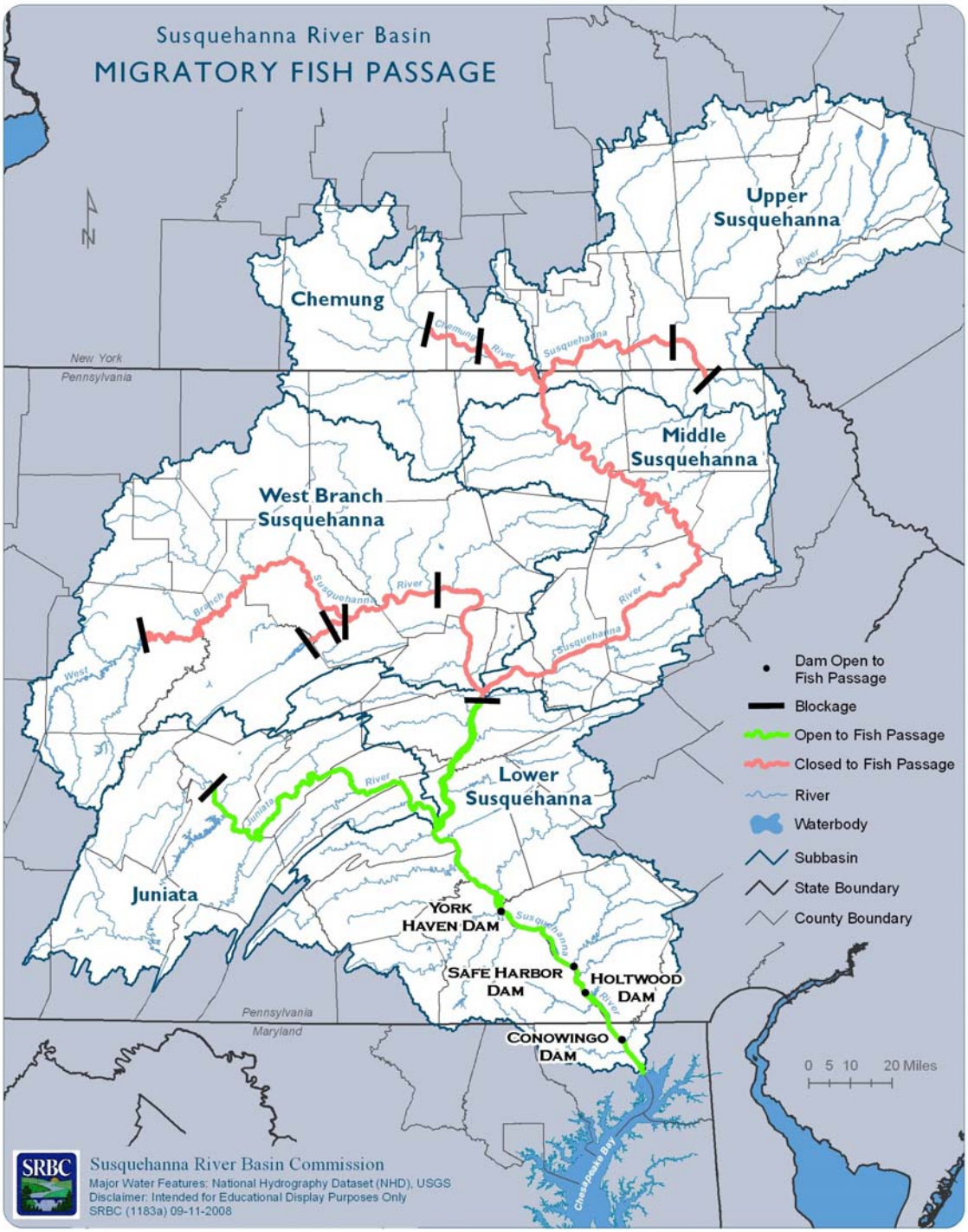


Figure 12. Migratory Fish Passage Conditions

In 1998, Pennsylvania began an initiative called Reclaim PA, which emphasized reclamation and re-mining of abandoned mine lands. The Pa. Department of Environmental Protection has played a major lead role in AMD actions in the basin. In addition, several federal agencies, watershed organizations, the Eastern and Western Pennsylvania Coalitions for Abandoned Mine Reclamation, and the coal mining industry have played important roles in reducing AMD impacts. As a result of the combined efforts of all parties, a significant number of AMD projects and measures have been implemented and stream water quality has been improved.

9. Projects, Plans and Other Actions Incorporated into the Comprehensive Plan

The Commission has incorporated certain projects, plans and other actions into its Comprehensive Plan since the 1970s. Actions to incorporate measures into the Plan were taken by resolutions, approval of dockets, or other formal means by the commissioners in public sessions. All projects, plans and other actions were reviewed by Commission staff before being recommended to the commissioners for approval. During preparation of this updated Comprehensive Plan, a review of all projects and other actions previously incorporated was made. Most of the measures were retained but some were identified for deletion from the Plan, primarily because (1) they had not been implemented as planned, (2) had become inactive for a substantial time, or (3) were modified for a subsequent new incorporation action.

Appendix 2 contains lists of the projects, plans and other actions that have been incorporated into the Comprehensive Plan from 1971 through 2008, but not including those deleted items as discussed above. The historical record is organized by lists of (1) federal and state projects, (2) plans, policies, programs and regulations and (3) Commission-approved water use projects. Appendix 2 includes those projects, plans and other actions that have been incorporated as a result of the updating the Comprehensive Plan; they are discussed in Part VII.

Future projects, plans and other actions will be incorporated into the Comprehensive Plan in two ways. First, the Commission will incorporate all water use projects approved under its regulatory program. Unless otherwise determined by the Commission, projects approved under the regulatory program will be incorporated by reference into the Plan. This process will be used for those projects, while beneficial, are generally limited in scope and will not significantly affect the waters of the basin. Separate and specific actions will be taken to incorporate those projects that the Commission determines should not be incorporated by reference.

Second, other water resource projects, plans, and other actions (e.g., policies, programs, and regulations) will be considered for incorporation by the Commission on a case-by-case basis. Measures can be proposed for incorporation into the Plan by project proponents, member jurisdictions, or the Commission itself. During review of proposed measures, consideration will first be given to their scope and significance. If warranted, a more in-depth consideration of key factors will be made. The factors include:

- Immediate and long-range beneficial management and development of the water resources of the basin.
- Optimum planning, development, conservation, utilization, management, and control of the water resources of the basin to meet present and future needs.

- Findings and recommendations of the signatory members, their political subdivisions, and interested groups.
- Effect of the project upon receiving waters of the Chesapeake Bay.
- The planning objectives of national economic development, environmental quality, social well-being and regional development.
- Integration of water resource planning and development actions with land use planning.
- Inherent public rights attached to all waters of the basin held in public trust.

More detailed information on the evaluation of proposed projects is contained in Part III, Section B, of the Plan. Based upon the results of the review, a decision will be made on whether to incorporate a proposed measure into the Comprehensive Plan.

PART II - ASSESSMENT OF WATER RESOURCE NEEDS IN THE BASIN

Water is an essential need for all life and can both enhance and detract from quality of life. Dependable water supplies and good water quality are important, for example, to public health and welfare, economic development, and environmental protection. Sustained low flows, poor water quality, and serious flooding have adverse effects on the public, economy, and environment. Effective water resource management requires a balanced approach to maintain or improve the dependable quantity and quality of water and to reduce the impact of flow extremes.

An important consideration in water resource management is the preservation and promotion of certain key public values. In the Susquehanna River Basin, these values are associated with diverse and wide-ranging topics including recreation, tourism, economic viability, and historic, scenic and other natural amenities. The Commission must evaluate projects and proposals for development, use and management of the water resources of the basin in terms of their compatibility with the public values inherent in the locality and member jurisdiction for which they are planned.

This portion of the Comprehensive Plan provides an overview of the water resource needs in the Susquehanna River Basin that fall within the programs and responsibilities of the Commission. The basin needs have been organized into six categories related to: (1) water supply; (2) water quality; (3) flooding; (4) ecosystems; (5) the Chesapeake Bay; and (6) coordination, cooperation, and public information. A discussion of each category of needs and the issues addressed by the Commission follows.

A. Water Supply

The water resources of the Susquehanna River Basin are abundant and renewable, due to an average annual precipitation of 40 inches. Normally, there are ample groundwater and surface water resources available for drinking water, freshwater inflow to the Chesapeake Bay, agricultural and industrial activity, power generation, recreational opportunities, and ecological diversity. Even with a natural abundance of water, the resource is neither limitless nor always distributed across the basin in time, location, and quantity commensurate with existing and future demands. In addition, infrastructure problems (e.g., leakage and water delivery issues) can exacerbate water supply problems.

A growing population in the basin will require more water and major industrial water users, such as power generation companies, will continue to look to basin water resources in order to increase their production output. In addition, there are growing demands for water to be diverted from the basin to meet out-of-basin water supply needs. Current examples of out-of-basin needs are those for Aberdeen and Baltimore, Md., and Gettysburg, Pa. As the demand for water increases, so does the challenge of managing the resource to avoid shortages and conflicts, including water use efficiencies. This challenge is particularly difficult during drought periods which occur periodically in the basin and may become even more extreme due to climate change. Estimates of population for the basin in 1990 and 2000 were made using census data and projections to 2025 were made using best available information. Table 6 summarizes the population information by time period for the six major subbasins and the entire basin.

Table 6. Population of the Susquehanna River Basin (1,000's of people)

				Change – 2000 to 2025	
Major Subbasin	**1990[1]**	**2000[1]**	**2025[2]**	**Number**	**Percent**
Upper Susquehanna	499	489	490	+1	+0.3
Chemung	231	225	188	-37	-16.5
Middle Susquehanna	708	697	668	-29	-4.1
West Branch Susquehanna	455	475	520	+45	+9.4
Juniata	306	313	324	+11	+3.7
Lower Susquehanna	1,613	1,762	2,290	+528	+30.0
Basin Totals	**3,812**	**3,961**	**4,480**	**+519**	**+13.2**

The projected increase by 2025 for the basin of 519,000 people is largely due to the increase of 528,000 in the Lower Susquehanna Subbasin. This subbasin is the most densely populated area of the basin and will contain just over one-half of the basin's population by 2025. Clearly, water supply demands in the Lower Susquehanna Subbasin will require close management attention to balance the needs, environmental protection, and economic development. All other subbasins will also have areas of growth that will require close attention. A particular concern is for areas which are now potentially stressed due to the demand for water resources approaching or exceeding the sustainable limit. Part IV-A2 discusses potentially stressed areas, many of which are in the Lower Susquehanna River Subbasin.

Based on an average daily use of 100 gallons per capita, an increase in the basin of 519,000 people would result in an increased need of 52 million gallons (mgd) of water supply per day. Most of this water (90% +/-) will be returned to the basin and not consumptively used. In comparison, existing power plants use an estimated 4,456 mgd with 172 mgd being consumptively used (see Table 4). Increased population can also impact other water resource needs related to water quality, flooding, ecosystems, and the Chesapeake Bay. However, it is believed effective water resource management and regulation by federal, state, and local interests as well as the Commission will minimize increased adverse impacts in these areas.

The particular water supply needs that have been identified for the Commission to consider are: (1) sustainability of water supply for various uses in the basin, (2) equitable allocations of water for various uses, including protecting instream flows and the receiving waters of the Chesapeake Bay, (3) mitigation of drought impacts, (4) management of water diversions to avoid resource impacts, and (5) management of consumptive water use to avoid resource impacts.

[1] 1990 and 2000 data are based on census block information prorated by geographic area of census blocks contained in each major subbasin.

[2] 2025 data are based on county population projections from the New York State Data Center (Cornell University), Pennsylvania State Data Center (Pennsylvania State University), and Maryland State Data Center (Maryland Department of Planning).

B. Water Quality


Susquehanna River near Windsor, N.Y.

Good water quality is needed for all facets of life and is essential to well balanced watershed management. The vast majority of surface and groundwater sources in the basin exhibit good water quality as well as varied and extensive biological activity. However, degraded quality in some of these waters limits their use and requires costly treatment to make withdrawals from them acceptable for use. Abandoned mine drainage, agriculture, and urbanization are the leading causes of surface water impairment in the basin, with localized problems resulting from transportation activities, malfunctioning septic systems, and other sources. Groundwater quality issues in portions of the basin include elevated iron, manganese, nitrates, and organic contaminants.

The overall water quality need in the basin is the achievement of established water quality standards so that water bodies can meet their designated uses over the long term. Examples of designated uses are warm water aquatic ecosystems, public water supply, recreational fishing, and exceptional value and high quality. The Commission does not have a regulatory responsibility in the area of water quality, but can and does play an important role. First, water quality impacts of projects are considered in regulatory decisions involving water withdrawals, consumptive water use, and out-of-basin diversions. Second, Article 5 (Section 5.2) of the Compact mandates a primary coordination role for the Commission. Section 5.2 states: "In order to conserve, protect, and utilize the water quality of the basin in accordance with the best interests of the people of the basin and the states, it shall be the policy of the Commission to encourage and coordinate the efforts of the signatory parties to prevent, reduce, control, and eliminate water pollution and to maintain water quality as required by the Comprehensive Plan."

The particular water quality needs that have been identified for the Commission to consider are: (1) support for and coordination of the member jurisdiction's water quality efforts, (2) monitoring and assessment of the quality of the basin's waters to support restoration and protection efforts, (3) development, support, and implementation of measures to remediate and enhance the basin's water quality, (4) protection of the basin's biological resources and sources of public drinking water supply, and (5) enhancement of the water quality data program.

C. Flooding


Devastation from Tropical Storm Agnes, 1972

The Susquehanna River Basin is one of the most flood prone watersheds in the country. The basin is susceptible to the impacts of tropical weather systems, intense thunderstorms, snowmelt and ice jams, and has a varied topography that creates rapid runoff scenarios. Floods are natural events whose effects often, and dramatically, result from the vulnerability of public and private development on the basin's flood plains. Tremendous flood damages occurred in several historical events, including the March 1936 flood, the Tropical Storm Agnes flood in

June 1972 that left an unprecedented trail of destruction behind, and the June 2006 flood when the Susquehanna River in New York State overran its banks, exceeding previous high river stages. The substantial record of past flood destruction, together with the reality of future floods, clearly demonstrates the need for additional and improved flood hazard mitigation in the basin.

Numerous structural flood control projects, such as dams and levees, have been developed within the Susquehanna River Basin. These projects have saved lives and prevented many millions of dollars in flood damages. Nonstructural measures to foster flood preparedness, response, and recovery have also been developed and include public education and outreach, flood forecasting and warning, the National Flood Insurance Program, and floodplain regulations. Despite these efforts, the potential in the basin for extensive flood damage remains high. Implementation issues for additional major structural projects, including high costs and environmental impacts, mean they will receive limited application in the future. However, the proper application of additional nonstructural flood damage reduction measures can result in further reduction in flood losses at a much lower cost with little or no environmental impact.

The particular flood hazard mitigation needs that have been identified for the Commission to consider are: (1) continued effectiveness of the Susquehanna Flood Forecast and Warning System through implementing its strategic plan, (2) protective flood plain management activities by member jurisdictions, (3) improvements in community flood preparedness, and (4) reduction of man-made debris in the basin's waterways and into the Chesapeake Bay.

D. Ecosystems

Healthy ecosystems in the Susquehanna River Basin are needed to support a vast array of water resource needs in the basin to include sustainable water supply, good water quality, biological productivity and species diversity, recreation, and the ecological health of the Chesapeake Bay. Water quantity and quality are interdependent and equally important to the health of aquatic ecosystems. Ecosystems in the basin range in size from relatively small areas such as individual forests or wetlands to much larger areas such as major streams and watersheds. Humans are one of the most influential living components of most ecosystems.

The overall need in the basin is the achievement of healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply to support abundant and diverse populations of aquatic, riparian, and terrestrial organisms, and provide resources for human use. Existing, healthy ecosystems warrant protection, while degraded ecosystems should be restored to healthy status. In general, it is far more cost-effective to maintain and protect healthy systems than to take corrective action after degradation has occurred. The particular ecosystem needs that have been identified for the Commission to consider are: (1) monitoring and assessment of ecosystems to provide data needed for effective watershed management, (2) protection and restoration of biological resources in the basin, and (3) restoration of populations of migratory fish throughout the Susquehanna River system.

E. Chesapeake Bay

The Chesapeake Bay is the largest estuary in the United States and supports a wide array of habitat types and aquatic life. The Bay's living resources are also economically important, supporting the regional economy as a major source of seafood, with an annual harvest worth $1 billion. Other activities dependent on a healthy Bay and its fish and wildlife resources are vast recreational opportunities and tourism.

The ecology of the Bay is both important and complex, with a major contributor being the Susquehanna River, which provides about 50 percent of the total freshwater inflow into the Bay. Low flow and consumptive water use management in the Susquehanna basin are important to ensure the adequacy of river flows into the Upper Bay. The Commission plays a key role in this management effort by regulating withdrawals and consumptive uses of water in the Susquehanna basin. The Compact states, “The comprehensive plan shall take into consideration the effect of the plan or any part thereof upon the receiving waters of the Chesapeake Bay.”

Restoration of the Chesapeake Bay encompasses a large program involving all levels of government, the private sector and citizens. The particular needs related to Chesapeake Bay that have been identified for the Commission to consider are: (1) identification of the minimum freshwater inflows needed from the Susquehanna River, (2) development and implementation of measures to address the minimum flow requirements, (3) support for the sediment and nutrient reduction strategies developed for the Susquehanna River Basin, and (4) provision of habitat for migratory waterfowl and shorebirds found in the Bay.

F. Coordination, Cooperation, and Public Information

Water resource use, development and management in the Susquehanna River Basin involve the administration of programs of a large number of governmental agencies. This can result in a splintering of authority and responsibility, an inefficient use of scarce governmental resources, and inconsistent treatment of water users. Effective communications, coordination, and cooperation among these entities are desirable to minimize causes of potential controversy and resolve conflicts.

The Commission was established as a chief agency to foster coordination in the basin, but the member jurisdictions remain as the chief stewards of their own natural resources. In order to do so in the most efficient and effective manner, the offices and agencies of the jurisdictions need to work together under the coordinative oversight of the Commission. However, the Commission may assume jurisdiction in any matter affecting water resource whenever it determines the effectuation of the comprehensive plan or the implementation of the Compact so requires. Providing an effective program for disseminating water resource information to the public is also a key responsibility of the Commission.

There are continuing needs for good coordination and cooperation among the many entities involved in the basin's water resources and for providing information to the public. The particular needs that have been identified for the Commission to consider are: (1) use of interagency committees and ad hoc committee mechanisms, (2) use of memoranda of understandings with member jurisdictions, (3) support for uniform water management policies and standards, (4) coordination of major interagency efforts such as flood forecasting and warning, drought management, and hydropower license renewal, (5) providing information on basin water resource matters to legislators and policy makers, (6) effective means to inform the public, (7) enhanced public access to Commission information and procedures, and (8) increased involvement of non-governmental organizations in water resource management.

PART III - PRINCIPLES, GUIDANCE AND STANDARDS

The Commission executes its mission in accordance with a set of general principles, project guidance and project standards that are essential for effective water resource planning and management. These considerations jointly form the basis for Commission programs and activities that are consistent, equitable and well founded. Furthermore, they better enable the Commission to meet its duties and responsibilities and advance the goals of the Compact.

A. General Principles

The Commission employs a number of important principles in its management of the water resources of the Susquehanna River Basin. These principles give direction to both Commission efforts and those of others in planning for the conservation, management, development, and use of the water resources of the basin. The principles are:

1. Watersheds should be utilized and promoted as the best units for water resource planning and management.
2. There are inherent public rights attached to all waters of the basin held in public trust for navigation, recreation, and protection of the fishery resources, and preservation of the natural, scenic, historic and aesthetic values of the environment without undue restriction, disruption or degradation by other uses; provided however, that nothing herein shall be construed as affecting or intending to affect or in any way to interfere with the law of the respective member jurisdictions to the Compact relating to riparian rights.
3. The optimum use or combination of uses of the basin's water and related natural resources should be promoted to address foreseeable immediate and long-range demands in a balanced, efficient and timely manner under sustainable development principles.
4. The multiple planning objectives of economic development, environmental quality, and social welfare should be considered so as to facilitate reasoned, balanced choices.
5. Surface and groundwater resources should be managed as an integrated unit, recognizing that the chemical, biological and physical aspects of ground and surface water systems are interrelated; that natural processes and human activities affect these interactions; and that ground and surface waters are inextricably linked parts of the same resource and cannot be managed separately.
6. The water resources of the basin should be managed on an integrated basis and with a recognition of the interrelationship between land and water resources, that those resources are finite, and that their development and utilization on a sustainable basis is vital to the basin’s ecological, economic and social well-being.
7. Decision-making should be based on sound scientific principles and policies, consistent with requirements in law and regulations, with due regard to both water quantity and water quality considerations.
8. Public input and involvement in the water resource planning and management process should be actively sought and encouraged.
9. Water resource planning and management efforts should be coordinated with local, state, and federal agencies and with the private sector.
10. Coordination and cooperation among the member jurisdictions in matters of water resource management should be promoted so as to avoid or minimize conflicts related to the basin’s water resources and foster amicable solutions when conflicts do arise.
11. The commission should utilize the offices and agencies of its member jurisdictions in the effectuation of this Plan so as to preserve and benefit from their function, powers and duties.
12. The development of long-term local capability to foster local stewardship of water resources should be encouraged and promoted.
13. All users of water and water-related facilities should be afforded equal and uniform treatment without regard to political boundaries.

14. The drought management activities of member jurisdictions should be coordinated to enhance their effectiveness and minimize adverse impacts during droughts.
15. Sound water conservation practices and policies should continue to be integrated into the Commission's regulatory program and their use should be promoted with all water users throughout the basin.
16. Proper flood plain management is integral to effective water resource management and for protection of the health and safety of persons and property in the basin.
17. Flood mitigation efforts, both structural and nonstructural, are essential to reducing the impacts of flooding in the basin, including preventing loss of life and minimizing future flood damages.
18. The efforts of the member jurisdictions to minimize flood-related impacts through effective flood plain management, including restrictions on development and relocation of existing development, and the regulation of encroachments should be encouraged and coordinated.
19. For planning purposes only, diversions existing prior to the effective date of the Compact should be recognized and identified in the Comprehensive Plan; provided, however, that such recognition should not in any way be construed as limiting the review and approval authority of the Commission under the Compact or Commission regulations.
20. The diversion of water from the basin should be discouraged in order to conserve, protect and utilize the water resources of the basin in accordance with the best interests of the people of the basin and the Commission's signatory members. Any diversion of water into the basin that may result in the introduction of invasive species or water quality degradation should likewise be discouraged.

B. Project Guidance

While the general principles give overall, broad direction to both Commission efforts and those of others in dealing with the water resources of the basin, more specific guidance is needed for the development and implementation of projects. The project guidance listed below outlines a sound basis for rational, well-considered decisions among alternatives or competing uses of basin water resources, and forms major considerations upon which the Commission will evaluate project proposals of federal, state, local and private sectors.

1. Projects should provide for beneficial water resource management and development.
2. Proposed projects and programs should consider appropriate combinations of nonstructural and structural measures.
3. Proposed projects should consider the potential impact on upstream and downstream areas and uses.
4. Development and use of water resources should be planned and managed to assure that such actions do not adversely affect the quantity and quality of flow in such a manner as would disrupt seasonal salinity, circulation patterns and biological productivity of the Upper Chesapeake Bay.
5. The average annual base flow (recharge) available in the contributing watershed during a 1-in-10-year average annual drought should be considered to be the sustainable limit of groundwater development.
6. The conjunctive use of water sources to meet water supply needs should be encouraged. Conjunctive use is the combined use of two or more sources to optimize availability and minimize adverse impacts.
7. The demonstration of need for proposed increases in water supply allocations should include: a) the allocation shall not exceed reasonably foreseeable future maximum day demands, and b) the amount of system water loss is reasonable and in conformance with the Commission's water conservation regulations. The least costly means for meeting water supply needs consistent with environmental quality and resource conservation objectives and goals should be given the highest consideration.
8. Water supply allocations should not be granted which exceed the available yield of the source, and where demand is projected to exceed such yield in the future, project sponsors should be required to develop adequate additional sources by the projected date when demand will exceed the current available yield.
9. In any area of the basin where demand for water supply has developed or threatens to develop to such a degree as to create a water shortage or impair or conflict with the requirements or effectuation of this Comprehensive Plan, the Commission may designate such area as a protected area, as provided for in the Compact, and may establish special regulatory standards for the utilization of water in such areas.

10. Provisions should be made for a minimum stream flow for normal stream maintenance, protection of the natural biological community of the stream and other purposes. Minimum release conditions should be based on determination and evaluation of instream use impacts resulting from the withdrawal.
11. Proposed projects that include withdrawals from groundwater should be limited to the amount (quantity and rate) of groundwater that can be withdrawn from an aquifer or aquifer system without causing long-term progressive lowering of groundwater levels, rendering competing supplies unreliable, causing water quality degradation that may be injurious to any existing or potential ground or surface water use, causing permanent loss of aquifer storage capacity, or having substantial impact on low flows of perennial streams.
12. Project proposals should recognize the high public value of wild and scenic river reaches, scenic and historic areas, open space and other natural amenities and recreational use of waters.
13. Migratory fish passage is an essential element of migratory fish management and restoration planning, and should be incorporated, where appropriate, into projects in a manner consistent with such management and planning objectives.
14. Dredging or other human alterations of stream banks, channels and wetlands which may adversely affect the quantity or quality of surface or groundwater, fish and wildlife habitat or other environmental or cultural values should be carefully planned and controlled to minimize their adverse effect and be avoided whenever possible.
15. New proposals for installation of hydropower should consider the potential for both peaking and non-peaking operations, and should provide sufficient information to evaluate the tradeoff between the value of the power and the environmental impacts of both types of operation.
16. New proposals for installation of hydropower facilities at existing dams should identify both the costs and benefits of reallocation of storage as well as costs and benefits based on existing storage allocations and operations, unless the operation is run-of-river at all streamflows.
17. As part of relicensing with the Federal Energy Regulatory Commission, hydroelectric facilities should be required to enhance recreation, including boating opportunities, fish passage, fishery access and portage provisions, and other navigational concerns.
18. Thermoelectric facilities should be required to evaluate the costs, benefits, trade-offs and drawbacks of various cooling and water conservation techniques, and fully evaluate options for providing effective consumptive use mitigation.

C. Project Standards

Project standards are the requirements set forth in Commission regulations or those otherwise applicable to projects as a matter of policy, including the following:

1. Projects shall be developed and operated consistent with the policies of the Commission and this Comprehensive Plan, and in compliance with all conditions of approval and all regulations of the Commission.
2. No allocation of waters made by the Commission shall constitute prior appropriation of the waters of the basin or confer any superiority of right in respect to the use of those waters.
3. The provisions of 18 CFR Part 801, including any amendments thereto hereafter made, are hereby incorporated by reference into this Comprehensive Plan.
4. The provisions of 18 CFR Parts 806-808, including any amendments thereto hereafter made, are hereby incorporated by reference into this Comprehensive Plan.

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PART IV - PRIORITY MANAGEMENT AREAS

The mission of the Susquehanna River Basin Commission covered in Part I is to enhance public welfare through comprehensive planning, water supply allocation, and management of the water resources of the Susquehanna River Basin. By virtue of the Compact, the Commission has powers and authorities to act on a broad range of water resource issues, provided that the actions taken do not duplicate those of the existing offices and agencies of its member jurisdictions.

Over the years, the Commission has focused its resources to effectively accomplish its mission and meet its responsibilities. For the purposes of this Comprehensive Plan, the Commission has grouped its management responsibilities into six key water resource needs that have been identified as "priority management areas." These management areas are: (1) water supply; (2) water quality; (3) flooding; (4) ecosystems; (5) Chesapeake Bay; and (6) coordination, cooperation, and public information.

Actions taken by the Commission in these priority management areas are carefully considered so that deference is given to the member jurisdictions' responsibilities, as appropriate. This management approach has been used by the Commission since its inception in 1971 and has proven to be mutually beneficial to the Commission, its member jurisdictions, and the citizens of the basin.

A vision of future conditions in the basin has been developed based on the belief that water resource management in the basin will be effective and successful. The vision statement serves as a focused objective for the Commission's efforts in addressing the needs and meeting desired results over the long term. The statement is contained in the Comprehensive Plan preceding the executive summary.

Each of the six priority management areas covers desired results, goals, and both ongoing Commission activities and actions needed to meet the goals. The ongoing activities are currently being accomplished in the work programs of the Commission. An example of an ongoing activity that is common to all of the priority management areas is the utilization of new technology to collect and analyze data, disseminate information, improve systems, etc. Actions needed are those items that are new or require additional emphasis by the Commission. Achieving the goals and taking the actions are, of course, dependent on the resources available to the Commission over the long term. A good faith effort will be made to succeed in all priority management areas and resources will be allocated accordingly.

A. Water Supply

1. Desired Result

To meet immediate and future water needs of the people of the basin for domestic, municipal, commercial, agricultural and industrial water supply and recreational activities, in order to maintain sustainable economic viability, protect instream uses, and ensure ecological diversity through regulation and planning.

2. Discussion of Issues

Ensuring water supplies that meet immediate and future needs calls for a number of key principles to be adhered to and conditions met, including: (1) water supplies or combinations of supplies must be reliable, (2) impacts to instream needs must be minimized, (3) appropriate flows to the Chesapeake Bay must be maintained, (4) water supplies must be adequate during droughts to obviate the need for emergency intervention by the Commission or its member jurisdictions, (5) potential natural water supply shortages must

be recognized, and (6) long-term flow reductions due to consumptive water use, loss of groundwater recharge and increased surface runoff must be mitigated.

The Susquehanna River Basin is considered largely water-rich with ample groundwater and surface water resources that are important for drinking water, freshwater inflow to the Chesapeake Bay, industrial activity, power generation, recreational opportunities, and ecological diversity. The water resources, however, are neither limitless nor equally distributed across the basin, resulting in some areas being identified as Potentially Stressed Areas by the Commission (see Figure 13 and Part V-K). In Potentially Stressed Areas, the demand for and use of water resources are potentially approaching or have exceeded the sustainable limit. Such areas may exhibit diminishing water levels and expanding dry stream reaches. To address these and other emerging areas of concern, water managers must recognize and plan for the possibility of shortages related to droughts and competing uses.

Projections for the basin indicate a growing population that will require more water for domestic and economic needs, while power companies – the largest consumers of water in the basin – continue to look to basin water resources for use in generating more power. A related and immediate water need is that associated with drilling for natural gas in the Marcellus shale. The large number of proposed wells and surface water withdrawal requests, along with their locations – predominantly in high quality, small drainage headwater areas – necessitates considerable expenditure of staff effort for review of withdrawals to meet the water demand. As the demand for water increases, so too does the challenge of managing the resource to avoid shortages and conflicts. Climate change is another factor that appears to be an increasing reality, with the potential to cause extreme weather swings and severe droughts.

There are four principal causes of water availability shortages, and they are: (1) natural drought, (2) oversubscription of a watershed's supply, (3) reduction of natural flows due to consumptive water use, and (4) loss of groundwater recharge. While droughts are part of the natural hydrologic cycle and cannot be controlled, proper planning and allocation to avoid overuse can help a watershed's supply withstand the impacts of droughts.

It is incumbent upon water managers to mitigate for consumptive water use and loss of groundwater recharge to sustain instream flows and appropriate flows to the Chesapeake Bay. The failure to plan for sustainable water supplies increases the potential for insufficient supply during droughts to meet system demands, maintain minimum releases and consumptive loss compensation requirements. This may result in deficiencies for other purposes, including maintenance of water quality.

3. <u>Goals</u>

Six goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Figure 13. Potentially Stressed and Water Challenged Areas

Goal a. Support and encourage the sustainable use of water for domestic, industrial, municipal, commercial, agricultural, and recreational activities in the basin.

Through planning and regulatory actions, the Commission should strive to manage water resources beginning at the watershed level, based on a 15-year planning horizon, to assure short-term resource availability and long-term balance between healthy ecosystems and economic viability. Commission programs should also serve to promote sustainability in all water uses, including recreation, with the goal of establishing drought-resistant systems. Recreational water use promotes public appreciation for healthy waters and serves as a catalyst to encourage protection and restoration.

Ongoing Commission Activities:

1. Support the sustainable use of water through the Commission's regulatory project review and planning activities, through public education and outreach efforts, and through solicitation of the necessary guidance from the Water Resources Management Advisory Committee.
2. Assess the potential for climate change to impact the hydrology of the basin and the potential implications to the basin's water availability and the occurrence and severity of floods and droughts.

Actions Needed:

1. Determine water availability through water budget assessments (analysis of demand increases and expected base flow levels) to establish local sustainable limits for water use development.
2. Protect healthy ecosystems and instream flow needs, including recreation.
3. Identify additional Potentially Stressed Areas, address incidental distribution losses of water in approved projects, and implement the recommendations contained in the 2005 Groundwater Management Plan.
4. Assess potential impacts of increased water use and the potential to temper increases through conservation and water reuse, particularly in Potentially Stressed Areas, and otherwise manage water resources for sustainability.
5. Support efforts by member jurisdictions to safeguard groundwater recharge by preserving recharge contributing areas.

Goal b. Maintain an equitable system for allocating water for various uses, including the protection of instream flows and receiving waters of the Chesapeake Bay.

The Commission was created by a federal-interstate compact, with signatories to the Compact recognizing their combined interests in the coordinated management of the water resources of the Susquehanna River Basin. The agency is charged with continually balancing water resource needs to enable economic growth while protecting the environment. The Commission's regulatory program provides statutory requirements to evaluate water resource needs and make determinations that maintain this delicate balance, and staff is required to review any changes to the purpose or quantity of approved uses. (Also discussed in the Chesapeake Bay priority management area.)

Ongoing Commission Activities:

1. Perform periodic evaluation of the Commission's regulatory program to determine the efficacy and consistency of the program.
2. Evaluate the need for new and amended regulatory requirements and policies.

Action Needed:

1. Evaluate Potentially Stressed Areas to determine if special protection status is warranted, for the purpose of preventing or addressing water shortages that would conflict with requirements of the Comprehensive Plan, and to allow sustainable development of water resources in the area.

Goal c. Ensure sustainability of water sources by improving systems and managing water resources more efficiently.

Efficient use of water helps to ensure long-term sustainability of water resources by reducing water supply demand during low flow periods, providing aquifer recharge during high flow periods, and minimizing ecological impacts to water resources overall. While efficiency alone cannot be relied on to provide sustainable water resources, the judicious use of water is an important component of water resource management and should be encouraged.

Ongoing Commission Activities:

1. Support and coordinate efforts of member jurisdictions in oversight of public water suppliers to incorporate system improvements, including the use of multiple sources, metering and pricing, recycling, and other conservation practices.
2. Encourage conjunctive use of water sources, where appropriate.

Actions Needed:

1. Review and adjust Commission-approved withdrawal rates, as needed and in accordance with existing regulations, to ensure sustainability and protection of water quality.
2. Encourage and incentivize water conservation by water suppliers, industry, and the public through education and application of regulatory requirements.

Goal d. Mitigate drought impacts through coordination and use of drought emergency powers.

The Susquehanna River Basin has experienced many droughts, which have prompted the imposition of various levels of water-use restrictions. The Commission, as well as its member jurisdictions, has certain drought emergency authorities. The exercise of those authorities and various stages of droughts are coordinated through the Commission's Drought Coordinating Committee. Article 11, Section 11.4, of the Compact directs the Commission, upon declaration of drought emergency or other natural or manmade emergency that causes an immediate shortage of water supply, to "direct increases or decreases in any allocations, diversions, or releases previously granted."

Ongoing Commission Activities:

1. Support drought-related actions of the Commission's member jurisdictions, as appropriate.
2. Implement the Commission's drought emergency powers under Section 11.4 of the Compact, as appropriate.

Action Needed:

1. Revise the Commission's Drought Coordination Plan in consultation with the Drought Coordinating Committee.

Goal e. Manage diversions to avoid impacts to the basin's water resources.

There are currently a number of out-of-basin diversions that provide drinking water to populations outside of basin boundaries. While diversions into the basin are scrutinized for water quality impacts, diversions of water out of the Susquehanna River Basin are regulated as consumptive water uses. Out-of-basin diversions, in particular, require special attention and more detailed analyses, because they reduce streamflow and have potential to impact the Chesapeake Bay. Though out-of-basin diversions are generally discouraged because they provide no benefits to the basin, there may be instances where, because of legitimate public welfare considerations, approval of out-of-basin diversions is appropriate.

Ongoing Commission Activities:

1. Evaluate potential impacts of out-of-basin diversions and investigate conjunctive use alternatives in Commission actions; include and enforce protective conditions for approved diversions.
2. Assess potential adverse impacts and benefits of proposed diversions into the basin, including their potential to compensate for other diversions or consumptive water use.

Actions Needed:

1. Periodically review the criteria for review of out-of-basin diversions to ensure that adequately protective standards are in place.
2. Monitor the ecosystem effects of diversions of water to and from the basin and transfers of water from one waterbody to another within the basin, including water quality requirements.

Goal f. Manage consumptive water use to mitigate impacts to its basin's water resources.

Increasing consumptive use, and the cumulative impact, will reduce streamflows and adversely affect instream uses, riparian rights, and flows to the Chesapeake Bay. Commission regulations with respect to consumptive water provide three options for projects to mitigate their consumptive water use: (1) provide storage of the quantity of water necessary to offset a project's consumptive water use during low flow periods, (2) discontinue consumptive use during low flow periods, or (3) pay a consumptive use fee to the Commission that is, in turn, used by the Commission to provide mitigation to replace water consumptively used. The intent of mitigation is to protect and maintain instream flows and flows to the Chesapeake Bay; however, an important basis of this intent is the mitigation of man-made consumptive use, rather than the prevention of naturally occurring low flows. Growth in water use for power generation will constitute a major component of future mitigation needs. It is likely that the best opportunities for new mitigation will be through additional water supply storage.

Ongoing Commission Activities:

1. Monitor consumptive water use in the basin and periodically revise projections for needed mitigation.
2. Periodically review consumptive water use fees paid to the Commission to ensure that this mitigation option is commensurate with the real costs of acquiring and managing sources of mitigation.

Actions Needed:

1. Implement recommendations of the Commission's Consumptive Use Mitigation Plan (see Part V-C). Key recommendations include, among others: a) the evaluation of existing U.S. Army Corps of Engineers and other reservoirs for the potential to enhance current release operations; b) the evaluation of the ability of abandoned mines and quarries to supply water for releases during droughts; and c) the assessment of specific needs for instream flows to meet riparian, water supply, water quality, habitat and recreational uses.
2. In the absence of adequate water for local mitigation, restrict new water use to avoid impacts to vulnerable watersheds.

B. Water Quality

1. Desired Result

To support the existing and designated uses of all water bodies by achieving water quality that meets or exceeds standards.

2. Discussion of Issues

Each waterbody has a designated use assigned to it by the state in which the waterbody occurs – keeping in mind that groundwater and surface water are part of the same resource, with groundwater providing the base flow of streams. Water quality standards are established so that waterbodies can meet those designated uses over the long term. (The terms "waterbody," "designated use," and "water quality standard" are used in the federal Clean Water Act.) Good water quality refers to chemical, physical, and biological conditions that achieve or exceed water quality standards.

Monitoring and assessments are necessary to determine if water quality standards are being met, and to support restoration and protection efforts. The ultimate goal is to protect water quality and, where possible, improve it over time.

Good water quality is essential to holistic watershed management, and is needed for all facets of life. Although the majority of surface and groundwater sources in the basin exhibit good water quality, some areas are affected by pollution which limits water use, requiring either costly treatment or making water unfit for certain uses. The leading causes of surface water impairment in the basin are agriculture, past coal mining operations, and urbanization, although local problems also can stem from transportation activities, malfunctioning septic systems, and other sources (see Figure 14). Increased urbanization in the basin has the potential to increase stormwater runoff and cause impacts associated with water quality, flooding, and aquatic habitat. Specific groundwater quality issues in portions of the basin include elevated iron, manganese, nitrates, and organic contaminants. Following is an expanded discussion of the six essential areas requiring good water quality in the Susquehanna basin.

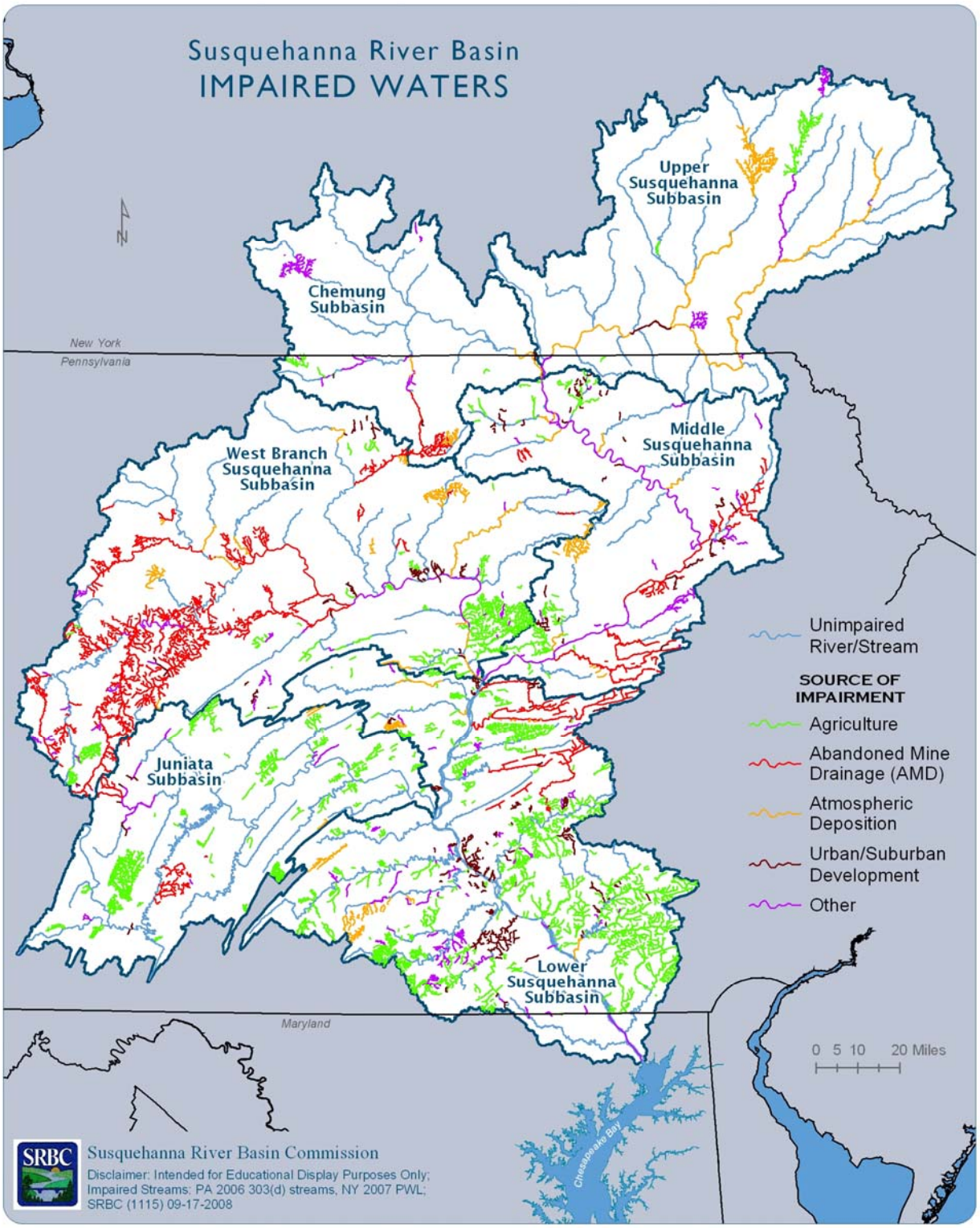


Figure 14. Impaired Waters

a. Drinking Water Supply

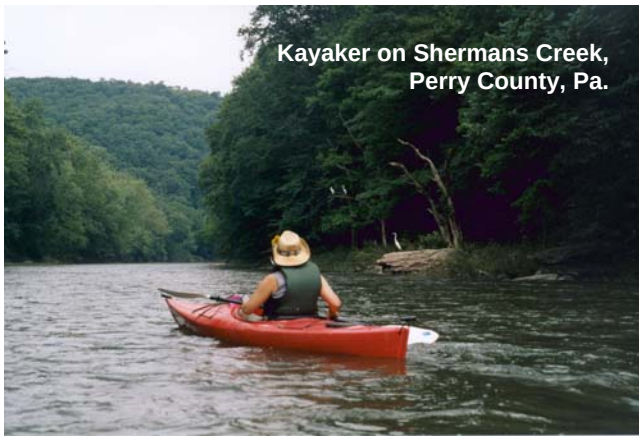
Public drinking water suppliers rely on surface water and groundwater sources. Individual homeowners, without access to public water, rely upon wells. In addition to the sources of impairment identified above, spills and other accidental discharges of contaminants can adversely affect drinking water. Source water assessments, which consider the vulnerability of public water supplies to contamination, were prepared for both surface and groundwater sources in all three of the Commission's member states. However, additional work remains, including in the area of early warnings of specific pollutant events to allow suppliers to adjust operations to protect public health and safety.

b. Agricultural, Industrial, and Commercial Use

Water quality requirements for these water uses may be less stringent, or in some cases more stringent, than those for drinking water. The quality of wastewater returned to streams and rivers can affect downstream water withdrawals and instream uses, especially if the volume and quality of water in the receiving stream are inadequate to assimilate the return flows. Thermal discharges from fossil fuel and nuclear generating facilities also can impact downstream users, especially in streams with poor water quality or limited flow.

c. Recreation

Bacteria and other pathogens can render water unfit for water contact recreation, including fishing, boating, swimming, hunting, bird watching, and eco-tourism. Periods of high rainfall can wash pathogens, nutrients, road runoff, and other contaminants into streams and rivers, resulting in sanitary septic and combined sewer overflows in urban areas. Increased turbidity (cloudy water) can impact recreational use during high flow events, and often is associated with increased bacteria and contaminant levels. Low flow conditions can lead to elevated water temperatures and increased algal growth that also can impact recreational use.


Kayaker on Shermans Creek, Perry County, Pa.

d. Fish and Wildlife, Including Natural Species Diversity

Water quality affects the abundance and diversity of fish and water-dependent wildlife and wetland and aquatic vegetation, plankton, and other organisms that are components of aquatic food webs. Biologists and water quality managers often use benthic macroinvertebrates (aquatic insects, worms, snails, and other animals without backbones) as indicators of long-term water quality. Also, invasive species can compete with native flora and fauna, and may upset natural species diversity and aquatic food webs. Some invasive species, such as zebra mussels, can also cause significant impacts on water quality.


Brook trout

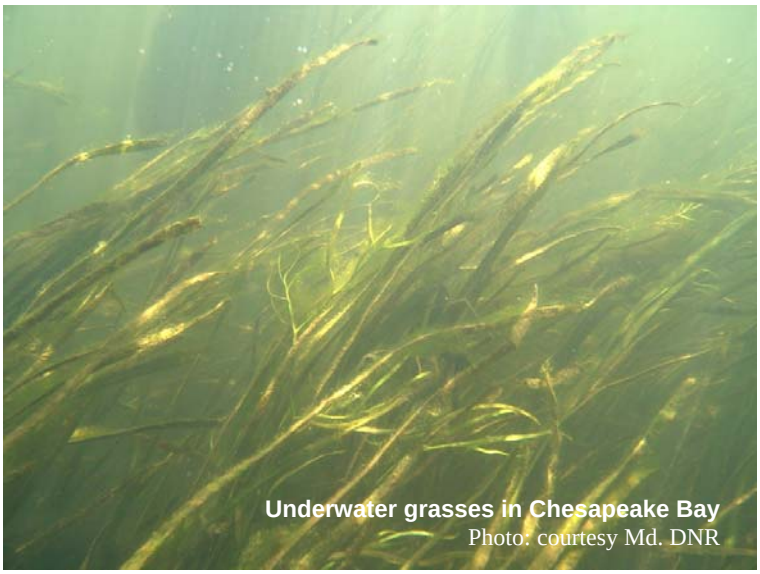
Photo: D. Heggenstaller

e. Quality of Life and Public Health

Good water quality improves the aesthetics associated with water-based recreation and can enhance the desirability and value of land, projects, and activities associated with a waterbody. In addition to the public health hazards associated with pathogens and traditional pollutants having established water quality criteria, other, less well-known contaminants such as many pharmaceuticals and personal care products, also are causes for concern. Relatively little is known regarding the ecological and human health effects of these products, which are used by the public and then discharged to local streams and rivers through wastewater treatment plants. Some pharmaceuticals and personal care products are suspected of causing endocrine-disrupting and reproductive effects in fish and amphibians, and the extensive use of antibiotics and anti-bacterial products also may contribute to the development of antibiotic resistant bacteria in local waterbodies.

f. Ecological Health of the Chesapeake Bay

The need for good water quality extends to the Chesapeake Bay. New York, Pennsylvania, and Maryland are actively participating in the Bay restoration effort and have pledged to meet and maintain specific reductions in nitrogen, phosphorus, and sediment loads delivered by the Susquehanna River to the Bay. Nutrients and sediment affect the levels of dissolved oxygen, water clarity, and chlorophyll a (a measure of algal activity) that are needed to restore underwater grasses, blue crabs, oysters, fish, and other biological resources in the Bay. Water quality monitoring in the basin allows the Commission and others to determine trends in sediment and nutrient loading, target areas where work is needed most, and document progress in the Bay restoration effort.



Underwater grasses in Chesapeake Bay
Photo: courtesy Md. DNR

3. Goals

Five goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Goal a. Support and coordinate the efforts of the Commission's member jurisdictions in managing the basin's water quality.

Although the primary regulatory role in water quality management is given to the U.S. Environmental Protection Agency (USEPA) and the Commission's member states, the Susquehanna River Basin Compact (Compact) directs the Commission to coordinate water quality management activities, encourage cooperation and uniform water quality management policies among its member jurisdictions, and recommend the establishment and amendment of water quality standards.

The Commission also considers water quality and supports USEPA and state efforts during its regulatory review of water withdrawal and consumptive water use projects. For example, when reviewing applications associated with natural gas development from the Marcellus and other shale formations, the

Commission evaluates impacts on stream ecology and water quality that would result due to withdrawal and consumptive water use. The states and USEPA are responsible for ensuring that the brine and other waste materials withdrawn from the well are properly evaluated, treated and disposed of. In this way, the Commission's work complements that of its member jurisdiction and does not duplicate efforts.

Ongoing Commission Activities:

1. Review and seek interstate compatibility of impaired waterbody listings, Total Maximum Daily Load (TMDL) development activities, and point and nonpoint source pollution control activities.
2. Coordinate basinwide water quality activities through the Commission's Water Quality Advisory Committee as well as state and interstate advisory committees and workgroups.
3. Consider physical, chemical, and biological water quality impacts during the regulatory review of applications for water withdrawals and consumptive water uses.

Actions Needed:

No new actions recommended under this goal.

Goal b. Monitor and assess the biological, chemical, and physical quality of the basin's waters to support restoration and protection efforts.

Monitoring and assessment are core Commission water quality activities that complement state and federal programs and provide a consistent approach for management of the basin's water resources across state lines. Monitoring provides the raw data for assessments, which identify problem areas as well as areas with pristine water quality and biological resources. Monitoring and assessment are essential for the development of appropriate restoration plans, as well as plans to provide appropriate protection of high and exceptional value resources for future generations. Post-project monitoring and assessment provide measures of success for constructed projects and are valuable in planning new restoration projects.

The Commission performs water quality, aquatic habitat, and benthic macroinvertebrate monitoring for its subbasin survey, interstate streams, and large river assessment projects, and has also performed some monitoring for volatile organics, bacteria, and fisheries. In addition, the Commission monitors sediment and nutrients and calculates loads and trends at a network of sites for the Chesapeake Bay restoration effort. The Commission is building its capacity to monitor fisheries and wetlands in conjunction with the Whitney Point Environmental Restoration Project in New York and basin-wide monitoring programs. Additional water quality monitoring is performed under the Commission's Early Warning System for public water suppliers in New York and Pennsylvania.

The Commission and others use stream flow gages with radio telemetry to determine when to perform water quality sampling during both low and high stream flow events. Flow data are required for the calculation of pollutant loads, TMDL development, evaluation of tributary strategies for restoration of the Chesapeake Bay, and for many other water quality management activities.

Ongoing Commission Activities:

1. Maintain and improve a.) core monitoring and assessment activities such as the Commission's subbasin survey, interstate streams, and large river assessment programs; and b.) monitoring and data analysis to support Chesapeake Bay restoration activities.
2. Perform assessments under Section 305(b) of the Clean Water Act, and provide the results to USEPA, the Commission's member states, and the public.

Actions Needed:

1. Monitor and assess waters for bacteria, pharmaceuticals and personal care products, and other emerging contaminants of concern.
2. Monitor for zebra mussels and other invasive species.
3. Expand the Commission's Early Warning System for public water suppliers in the basin.

Goal c. Develop, support, and implement plans and projects to remediate and enhance the basin's water quality.

The Compact allows the Commission to undertake water quality investigations and to acquire, construct, operate, and maintain projects to manage the basin's water quality whenever the Commission determines that this is necessary to implement any of the provisions of the Compact. The Commission has supported water quality planning of its member jurisdictions by performing studies such as the watershed assessment and remediation strategy for abandoned mine drainage in the upper Tioga River Watershed and the remediation strategy for the West Branch Susquehanna Subbasin. The Commission also has constructed a number of demonstration projects for wetland establishment, stream restoration, and stormwater management, and has provided funding for operation and maintenance of the Barnes and Tucker abandoned mine drainage (AMD) treatment project to provide mitigation for agricultural consumptive water use and improve water quality in the West Branch Susquehanna River.

The Commission has worked with the Paxton Creek Watershed and Education Association on a three-year project to develop an innovative and cooperative stormwater management approach for Pennsylvania communities, using the Paxton Creek Watershed as a demonstration model. The watershed is a 27-square-mile area encompassing parts of the City of Harrisburg and surrounding communities in Dauphin County, Pa. The project includes demonstration projects as well as development of multi-jurisdictional stormwater management scenarios for public, residential, and commercially controlled lands. Emphasis has been placed on project transferability to other areas in Pennsylvania and the basin to improve water quality through more effective stormwater management. The Commission seeks to perform additional work related to stormwater, which is a growing source of impairment in the basin as well as the Chesapeake Bay watershed.

Ongoing Commission Activity:

1. Support the Commission's member jurisdictions in controlling discharges from point and nonpoint sources, including upland activities.

Actions Needed:

1. Develop, support, and implement remediation plans for areas of the basin that are impacted by AMD, agricultural, urban, and other sources.
2. Encourage public and private support, maintenance, and upgrades of the infrastructure needed for drinking water withdrawal, treatment, and distribution; wastewater collection and treatment; on-lot septic treatment; stormwater management projects; combined sewer overflows; sanitary septic overflows; and other projects needed for the maintenance and improvement of water quality.
3. Promote the use of green infrastructure and stormwater management approaches that mimic natural hydrologic regimes as well as water use efficiency in combination with Action 2 above.
4. Encourage and support restoration planning as follow-up to the Commission's Year-2 subbasin surveys and TMDL development activities for waterbodies impaired by AMD, urban, agricultural, and other nonpoint sources, with the goal of removing impaired waterbodies from state lists established under Section 303(d) of the Clean Water Act.

5. Seek water quality improvements to complement water quantity mitigation provided for water withdrawal and consumptive water use projects.

Goal d. Protect the quality of the basin's biological resources and sources of public drinking water supply.

Many state and federal activities associated with the Clean Water Act have focused on the restoration of impaired waterbodies. The protection of existing resources with good water quality also is important, and often is more cost effective than the restoration of waters that have been impaired.

Climate change will be a major influence on future conditions of aquatic ecosystems, producing physical changes in water temperature, hydrological cycles, and the number of degree-days. Temperature changes will influence levels of dissolved oxygen, pH, and the solubility of dissolved materials in the water column. Physical changes in the environment are expected to alter growing seasons, produce shifts in the distribution and abundance of aquatic and terrestrial species, and affect nutrient cycling. Increased opportunities are expected for colonization by invasive species. Changes in precipitation, groundwater recharge, and stream flow will affect the waste assimilation capability of waterbodies, as well as the quality and quantity of aquatic habitat.

Ongoing Commission Activities:

1. Encourage the protection of threatened and endangered species and natural biological diversity in the basin.
2. Support further research on the effects of climate change on water quality in the basin, and support efforts to mitigate those effects. (See related climate change ongoing activity under Goal a. for Water Supply priority management area.)

Actions Needed:

1. Identify waterbodies with exceptionally high quality water, habitat, and biological resources, based on monitoring results.
2. Provide increased protection for headwater areas and watersheds with existing good water quality.
3. Provide educational materials regarding the spread of aquatic invasive species in the basin and downstream to the Chesapeake Bay.
4. Develop regional source water protection plans for drinking water supply systems.
5. Establish a Susquehanna Source Water Partnership to work with public water suppliers and other stakeholders to protect drinking water supplies.

Goal e. Organize, maintain, and distribute water quality data to facilitate basinwide water quality improvement and protection activities.

The Commission has developed a water quality database to store and share information from Commission monitoring projects and has provided information to USEPA's Storage and Retrieval (STORET) database, which is being phased out over time and will be replaced with USEPA's new Water Quality Exchange (WQX) database. The Commission will be providing data to WQX when it is available.

The Commission also has expanded its Geographic Information Systems (GIS) capability and has developed interstate GIS data layers using data from its monitoring, assessment, protection, TMDL, and drinking water activities. There is a continuing need to develop datasets and GIS layers that are compatible across state lines, and to facilitate the sharing of data among the Commission's member jurisdictions and others involved in water quality assessment, restoration, and protection activities.

Ongoing Commission Activities:

1. Maintain and enhance the Commission's water quality database and provide data for inclusion in appropriate USEPA databases.
2. Make data available to the public via the Commission's website and other electronic means.

Actions Needed:

1. Encourage integration of state and federal data systems, develop consistent basinwide datasets and GIS layers, and enhance existing geospatial and tabular datasets.
2. Enhance and improve the sharing of information contained in water quality databases maintained by the Commission and its member jurisdictions.

C. Flooding

1. Desired Result

To prevent loss of life and significantly reduce future damages from floods within the basin through an integrated system of structural and nonstructural flood damage reduction measures.

2. Discussion of Issues

The Susquehanna River Basin is one of the most flood prone watersheds in the country due to its geography and physiographic features. The basin is susceptible to the impacts of tropical weather systems, intense thunderstorms, snowmelt and ice jams, and has a varied topography that creates rapid runoff scenarios. Tropical storm Agnes in 1972 caused the worst recorded widespread flooding in the basin. The flooding caused 72 deaths and $2.8 billion in damage. Flood levels exceeded the previous record levels by as much as six feet in some places. It was the nation's most costly natural disaster until Hurricane Andrew hit Florida in 1992.

The basin experiences damages in excess of $150 million on average every year, and 1,160 of the 1,400 communities (more than 80 percent) in the river basin have some residents who live in flood-prone areas. For these residents, flood warning and flood management and protection are of utmost concern. While a number of flood damage reduction projects are in place to protect the basin's citizens, studies have determined the best way to further reduce flood damages in the Susquehanna basin is through nonstructural measures such as flood forecasting and warning systems.


Lourdes hospital in Binghamton, N.Y.
Photo: D. Lupardo

Flood hazard mitigation measures, whether structural or nonstructural, are undertaken to reduce flood damages and prevent loss of life. Structural flood hazard mitigation measures are designed to slow or decrease flooding in a targeted area, and include dams, levees, building elevations and modifications, and stream channel modifications. Nonstructural flood hazard mitigation measures provide citizens and communities with information and other tools to assist them in flood preparedness, response, and recovery, and

include public education and outreach, flood forecasting and warning, the National Flood Insurance Program, and local floodplain regulation. The simplest and most straightforward mitigation strategy is to prevent further floodplain encroachment and to reclaim and restore natural floodplain and wetland functions.

Floods are natural and frequent occurrences in the basin and cannot be prevented. However, with appropriate mitigation planning, the impacts of flooding on the basin's infrastructure and the risk to life and property can be minimized. To date, the primary role assumed by the Commission is the coordination of improvements to forecasting and flood preparedness.

3. Goals

Four goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Goal a. Implement the goals of the strategic plan for the Susquehanna Flood Forecast and Warning System (SFFWS).

Since mid-1980s, the Commission has led an interagency partnership of federal and state agencies dedicated to operating, maintaining and enhancing the SFFWS to provide timely and accurate flood forecasts. The Commission is joined by the National Weather Service (NWS), U.S. Geological Survey (USGS) and USACE as the federal partners and the environmental and emergency management agencies from New York, Pennsylvania and Maryland. Pennsylvania is also represented on the committee by its community and economic development agency. The System is composed of an integrated network of gages, sensors, and data transmitters, and has been a model of coordination and cooperation. Managers of the SFFWS continually strive to improve forecast lead time, with the goal of reducing flood damages and protecting human life.

Ongoing Commission Activities:

1. Coordinate SFFWS committee meetings and activities.
2. Answer media requests for information before, during and after flood events.
3. Compile information on major flood events and damage summaries.
4. Support annual SFFWS funding and a permanent funding source for the gage network.
5. Coordinate ice monitoring.
6. Maintain the SFFWS website and information portal.
7. Work with system partners to maintain a state-of-the-art observation network.
8. Endorse, promote and develop new technologies to increase lead-time and improve forecast accuracy.
9. Conduct education and outreach activities to promote awareness of forecast services and their proper use.

Actions Needed (also see Part IV-F, Goal d., Action 4):

1. Conduct an annual evaluation and update of the SFFWS Strategic Plan.
2. Develop, in cooperation with SFFWS partners, a high-resolution observational network.
3. Develop the infrastructure necessary to provide high-resolution flash flood forecasts.
4. Develop, in cooperation with SFFWS partners, new forecast points and flood forecast maps for priority damage locations.

Goal b. Promote protective floodplain management practices.

Local communities have primary responsibility for effective flood plain management and flood hazard mitigation but rely on support from federal and state government to implement regulation, improve infrastructure, and recover from disaster. The Federal Emergency Management Agency (FEMA) conducts flood analyses, certifies flood protection projects, and administers the National Flood Insurance Program, through which it provides local communities the opportunity to participate in and benefit from the program. The Commission should work to strengthen and enhance existing ties between the numerous governmental entities.

Ongoing Commission Activities:

1. Improve public understanding of flood risk management.
2. Support FEMA flood insurance map modernization efforts.
3. Maintain and distribute community flood insurance maps.
4. Participate in professional state and national floodplain management organizations.
5. Work cooperatively with municipalities, private interests, and the Commission's member jurisdictions to identify and encourage potential stormwater management projects.
6. Support and publicize local community efforts to encourage development practices with low impacts to flood risk and water quality, and to discourage new development in floodplains.
7. Evaluate the effects of climate change on the nature of flooding in the basin.

Actions Needed:

1. Assist in the evaluation of need and implementation of flood damage reduction alternatives for high-risk communities.
2. Assist local and county flood managers in planning efforts and assessments of floodplain reclamation projects.

Goal c. Improve community flood preparedness to ensure adequate and appropriate response by emergency managers before, during and after a flood event.

Flood plain managers at all levels of government must remain diligent and up-to-date with a clear understanding of specific flood hazards and opportunities available for flood hazard mitigation. Various agencies provide information about hydrologic conditions, flood plain zoning, flood insurance, emergency response and disaster mitigation, but it is not always accessible to community leaders. A program to coordinate the dissemination of pertinent information and assist communities in understanding and using the information will better prepare vulnerable areas for future flooding.

Ongoing Commission Activities:

1. Provide technical assistance to communities for flood warning or mitigation programs.
2. Advocate participation in the Community Rating System of FEMA's National Flood Insurance Program to incentivize communities to implement flood damage reduction measures and receive discounted flood insurance premiums.
3. Provide technical support to Pennsylvania's Emergency Operations Center during flood events.
4. Coordinate, encourage and develop basinwide education and training programs regarding importance of flood warnings and offer information on flood insurance programs.

Actions Needed:

1. Conduct post-flood assessments to identify information needs, educational opportunities, lapses in forecast coverage, and other measures that can assist communities in reducing flood damages.
2. Develop a flood inundation mapping program, including a training component, for communities in the basin. These maps delineate areas of flooding corresponding to various river stages, designate evacuation routes, locate major buildings for potential mass evacuation shelters, and list general flood response procedures.

Goal d. Assist the Commission's member jurisdictions, as appropriate, in reducing the introduction of man-made debris into the waters of the Susquehanna River Basin and, ultimately, Chesapeake Bay.

Water borne debris reaches rivers and streams from natural sources as well as the intentional, careless, or inadvertent actions of humans. Woody debris and leaf litter naturally fall into streams from riparian vegetation. This material often enhances instream habitat for fish and wildlife, and serves as a source of energy that is cycled naturally through aquatic systems.

Problems arise when humans use streams or their flood plains as disposal sites for trash, grass clippings, cut tree limbs, tires, plastic, barrels, and other debris. Storage of floatable materials on flood plains also contributes to the problem. When flooding or high flows occur, this material clogs the river system, creates unsightly conditions and public health problems, and accumulates behind power dams on the lower Susquehanna River. The hydropower companies routinely remove and dispose of significant quantities of this debris. However, high flow events make removal operations impossible and the material then must be passed through and over the dams and into the tidal portion of the Susquehanna River and the Chesapeake Bay. Here, the material causes the same problems as in upstream areas, damages nets and fishing gear, causes a hazard to navigation, and interferes with marina operations.

Ongoing Commission Activities:

1. Encourage the enforcement of existing laws dealing with the deposit of debris into the basin's streams and rivers.
2. Encourage public and private land owners to reduce the amount of debris and man-made materials stored adjacent to stream banks and in flood plains where they are vulnerable to removal by flood waters.

Action Needed:

1. During dam relicensing, advocate for the continued removal of material from behind power dams on the lower Susquehanna River.

D. Ecosystems

1. Desired Result

To achieve healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply to support abundant and diverse populations of aquatic, riparian, and terrestrial organisms, as well as human use.

2. Discussion of Issues

Ecosystems range in size from relatively small areas such as individual forests, wetlands, or streams to much larger areas such as oceans, continents, or even the entire earth, and are composed of living things as well as non-living components of the environment. Relationships among the living, also known as biotic, components of the environment and the non-living, or abiotic, components are interdependent and complex. Humans are one of the most influential biotic components of most ecosystems, whether at a local, regional, or even global scale.


Collecting samples

Environmental assessments are the foundation for restoration and protection activities. Monitoring provides the data for environmental analysis. Metrics, or evaluation parameters, are used to evaluate the data to determine which ecosystems and ecosystem components are healthy and which are degraded or under stress. Monitoring data also are valuable in identifying the cause of environmental degradation.

By performing assessments through time, it is possible to identify the trend for various parameters and determine whether the overall health of an ecosystem is improving or becoming worse. Healthy systems warrant protection, while degraded systems should be restored to a healthy status. In general, it is far more cost-effective to maintain healthy systems than to take corrective action after degradation has occurred.

Healthy ecosystems are important in maintaining the quality of life for the basin's residents. They are needed to support sustainable water supply, good water quality, biological productivity and species diversity; domestic, industrial, municipal, commercial, agricultural, and recreational use; and ecological health of the Chesapeake Bay.

Water quantity and quality are interdependent and equally important to the health of aquatic ecosystems. This priority management area discussion, therefore, is interwoven with components of both the Water Supply and Water Quality priority management areas, necessitating the overlapping of some goals and objectives within each of the three management areas. When managed properly, healthy streams and rivers should provide adequate quantities of good quality water for water withdrawals and instream recreational use. In addition to providing local benefits, healthy ecosystems within the Susquehanna basin and its six major subbasins support the ecological health of the Chesapeake Bay. Stormwater management and protection of critical recharge areas can benefit the quantity and quality of groundwater supplies, and help maintain stream flow during times of low water availability. Water conservation and reuse of water, when possible, also can benefit groundwater levels and stream flow during water-short periods.

Groundwater is an important source for domestic, industrial, municipal, commercial, agricultural, and recreational use, and provides the base flow for most streams during low flow periods. Flowing water is a key component of river and stream systems. Adequate streamflow is required for natural sediment transport, maintenance of stream morphology, good water quality, fish and wildlife habitat, and for the maintenance of aquatic food webs.

Wetland and riparian plant communities can be impacted by lowered groundwater levels and reduced flow. Riparian vegetation provides shade to help moderate daily fluctuations in water temperature. Leaf litter and other detritus from riparian vegetation serve as important food sources for aquatic insects and other fish-food organisms. Both wetland and riparian vegetation help regulate biogeochemical cycles, influence water quality,

help dampen the duration and magnitude of flooding, and provide food, cover, nesting sites, and migration corridors for a variety of fish and wildlife species.

As discussed under Goal d. of the Water Quality Priority Management Area, climate change will be a major influence on future conditions of aquatic ecosystems, affecting both the physical and biological components of aquatic ecosystems. The distribution and abundance of species will be affected in ways that are not yet thoroughly understood.

3. Goals

Three goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Goal a. Perform ecosystem monitoring and assessment to provide data needed for effective watershed management.

Water quantity and quality monitoring provide data to assess the health of aquatic systems and support planning activities for the protection and restoration of aquatic resources. Unlike state and most federal programs, the Commission monitors water quality, aquatic habitat, and stream biota on a consistent basis throughout the entire basin, crossing both state lines and EPA regions. This monitoring, much of which has been performed since the 1980's, provides data for water quality assessment, Total Maximum Daily Load (TMDL) development, restoration activities, and the evaluation of impacts associated with water withdrawals and consumptive water uses.

The Commission has performed instream flow studies with other organizations and is continuing this effort. Because of the breadth and consistency of the Commission's biological data for macroinvertebrates (described below), these data were used by The Nature Conservancy (TNC) to prepare a report on the development of instream flow criteria in Pennsylvania to support ecologically sustainable water resource planning and management. The Commission plans to continue this effort with TNC, and to expand it throughout the Susquehanna River Basin.

However, few datasets exist that document the impacts of reduced flow on water quality and biological resources during actual events in the basin. Because of the need for additional, supporting water quality and quantity data, increased monitoring during low flow events is a high priority that will assist the Commission in assessing the effects of flow and in managing water withdrawals and consumptive uses.

Ongoing Commission Activities:

1. Perform water quantity and quality monitoring through the Commission’s watershed assessment and protection activities, and require appropriate monitoring for projects subject to the Commission's regulatory program.

2. Monitor and assess the health of fish, wildlife, and other biological resources.

Actions Needed:

1. Encourage the maintenance of critical stream gaging stations in the basin.
2. Plan, implement, and maintain a program to monitor and assess impacts occurring during individual low flow events.
3. Perform additional instream flow studies to provide scientifically-based estimates of the amount of water needed for fish, wildlife, and recreational use.

Goal b. Protect and restore biological resources throughout the basin and in each of the major subbasins.

Biological resources such as aquatic macroinvertebrates (insects, worms, snails, and other animals without backbones) and fish serve as indicators of water quality and reflect the ecological health of aquatic systems. Fish and wildlife support a wide range of outdoor recreation activities such as hunting, fishing, trapping, nature study, wildlife photography, bird watching, and eco-tourism.

Property values and less tangible factors such as aesthetics and quality of life for humans are enhanced by the presence of diverse and abundant fish and wildlife populations and the habitat that supports them. Invasive species such as zebra mussels and emerging contaminants such as pharmaceuticals and personal care products (PPCPs) pose increased threats to the biological integrity of the basin and warrant further consideration for management action.

Government funding for fish and wildlife conservation is provided by a variety of mechanisms, including hunting, fishing, and trapping license fees. In Pennsylvania, additional funding is provided through the State Wildlife Grants Program, which is driven by Pennsylvania's Comprehensive Wildlife Conservation Strategy. Protection of biological resources can be enhanced significantly with the assistance of conservation, fishing, and hunting organizations (e.g. Sierra Club, Trout Unlimited, Ducks Unlimited, and others) that promote and have a stake in outdoor recreational pursuits.

Ongoing Commission Activities:

1. Provide protection to wetlands, aquatic life, and downstream water users by requiring aquifer testing, passby flows, wetland monitoring, and conservation releases through the Commission’s regulatory project review and approval process.
2. Participate in activities of the Mid-Atlantic Panel on Aquatic Invasive Species and disseminate pertinent information to the public regarding aquatic invasive species.

Actions Needed:

1. Consider the potential spread of invasive species when evaluating project review applications for diversions and transfers of untreated water from one waterbody to another.
2. Disseminate information regarding the effects of PPCPs on the biological resources of the basin.
3. Provide information on the biological resources of the basin and promote fishing, boating, hunting, outdoor photography, eco-tourism, bird watching, and other water-based outdoor recreation through the Commission's website and appropriate links to other websites.

Goal c. Restore populations of migratory fish throughout the Susquehanna River system.

American shad and blueback herring as well as alewife and hickory shad ascend rivers to spawn in the spring and the young fish migrate to brackish and salt water in the fall. American shad and blueback

herring were once important recreational and commercial resources throughout the basin, with shad ranging at least as far north in the Susquehanna River as Binghamton, N.Y. Although less information is available for blueback herring, evidence indicates that they also traveled as far north as Binghamton. Substantial shad fisheries existed on the West Branch Susquehanna River between Lewisburg and Lock Haven, Pa., as well as throughout the main stem of the Susquehanna River. Historically, shad were reported as far upstream as Hollidaysburg, Pa., on the Juniata River, but most commercial fisheries on the Juniata River were located downstream of Lewistown, Pa.

Striped bass and white perch are also important commercial and recreational species that live in salt or brackish water, but do not travel as far upstream as the other species discussed above. Both use the lower Susquehanna River as spawning habitat. The Chesapeake Bay provides some of the most important spawning and nursery habitat for striped bass on the east coast of North America and is important in helping to sustain the entire east coast fishery.

American eels were once an important commercial and recreational resource throughout the basin. Although American shad, blueback herring, and related species spawn in fresh water and live most of their adult lives in salt water (anadromous species), American eels do the reverse. American eels (catadromous) spawn in deep ocean waters south of Bermuda. After hatching, immature eels ride the Gulf Stream north and enter North American rivers to live their adult lives in fresh water. Downstream migration of adults occurs during the fall. Because the triggers and characteristics of eel migration are very different from those of shad and herring, eels have different requirements for successful upstream and downstream movement past dams.

In addition to providing direct ecosystem and recreational benefits, American eels serve as the intermediate host for immature *Elliptio complanata*, a freshwater mussel. The immature mussels (called glochidia) are host-specific for American eels, to which they attach and are carried upstream, where they drop off into the stream substrate to mature into adults. The adult mussels filter water and thereby improve stream water quality. Populations of *Elliptio complanata* are currently at very low levels in the basin upstream of Conowingo Dam, but could potentially be increased if improved fish passage were provided for American eels.

Migratory fish passage was hindered in the basin by the construction of mill dams on tributaries, as well as construction of feeder dams for canal systems during the mid-1800s. Construction of the four major power dams on the Susquehanna in the early 1900s virtually ended migratory fish movement in the Susquehanna River system. Significant restoration activities have occurred during recent years, and passage for American shad is now provided at the four major hydropower facilities on the lower Susquehanna River below Harrisburg, Pa. (see Figure 12 under Part I-D.7.).

Areas of poor water quality in streams, such as that caused by abandoned mine drainage, can also constitute blockages to fish passage. The removal of blockages can provide benefits to both migratory and local, non-migratory fish populations by re-connecting fragmented habitat.

Ongoing Commission Activities:

1. Serve as a member of the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) and work with dam owners and operators and others to restore populations of American shad, hickory shad, blueback herring, alewife, striped bass, and other anadromous fish to the Susquehanna River system.
2. Implement and periodically update SRAFRC's Migratory Fish Management and Restoration Plan for the Susquehanna River Basin.

Actions Needed:

1. Work with SRAFRC, dam owners and operators, sportsmen groups, conservation organizations, and others to produce, by 2025, self-sustaining annual populations of 2 million American shad and 5 million river herring, reproducing in the free-flowing Susquehanna River above York Haven Dam and in suitable tributaries, provide 500,000 angler days annually throughout the basin for these species, and provide effective upstream and downstream passage for American eels arriving at dams in the basin. Note: The numeric goals cited above for shad, herring, and angling were established in SRAFRC's most recent (May 2002) "Alosid Management and Restoration Plan for the Susquehanna River Basin." SRAFRC is currently revising the plan to re-evaluate goals and include American eel and other migratory species. The revised plan is scheduled for completion in 2009, when SRAFRC will request that it be incorporated into the Commission's Comprehensive Plan.
2. With assistance of SRAFRC and others, support studies of eel migration and implement restoration plans to reestablish a fishable population of American eel in the Susquehanna River system and restore adult recruitment from the river to help rebuild spawning stocks for the east coast eel fishery.
3. Support preservation and restoration of tributary streams that provide habitat for migratory fish, including the removal of obstacles to upstream movement and remediation of AMD-impaired streams.
4. Require viable upstream and downstream migratory fish passage as part of relicensing activities for power dams on the lower Susquehanna River.

E. Chesapeake Bay

1. Desired Result

To manage the water resources of the Susquehanna River Basin to assist in restoring and maintaining the Chesapeake Bay so it meets or exceeds applicable water quality standards and supports healthy populations of living resources, including oysters, crabs, fish, waterfowl, shore birds, and underwater grasses.

2. Discussion of Issues

The Chesapeake Bay is the largest estuary in the United States and supports a wide array of habitat types and aquatic life. By the middle of the twentieth century, the health of the Bay had deteriorated due to excess nutrients and sediment, releases of toxic pollutants, lost or degraded aquatic habitat, and over-harvesting of commercial fishery resources.

A number of key agreements between the early 1980s and early 2000s are the basis for programmatic actions initiated by the Commission's member jurisdictions to restore the Chesapeake Bay. Those agreements include: the 1983 agreement among Pennsylvania, Maryland, Virginia, the District of Columbia, the USEPA, and the Chesapeake Bay Commission to reduce excess nitrogen and phosphorus; the 1987 agreement by the same entities to achieve a 40 percent reduction in controllable nutrient loads to the Bay by the year 2000; and the June 2000 agreement by the same entities to "continue efforts to achieve and maintain the 40 percent nutrient reduction goal agreed to in 1987 and correct the nutrient- and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal

portions of its tributaries from the list of impaired waters under the Clean Water Act by 2010."

With the Bay and some of its tidal tributaries listed as being impaired, which requires development of a total maximum daily load to meet water quality standards in compliance with the federal Clean Water Act, the States of Delaware, New York, and West Virginia signed a Memorandum of Understanding to provide their help in implementing the Water Quality Protection and Restoration section of the agreement.

More scientific studies have been performed on the Chesapeake Bay than nearly any other estuary on earth. Public policy and state-of-the-art science both led to the development of sediment, nitrogen, and phosphorus load allocations from the Susquehanna River designed to meet and maintain water quality conditions that will restore and protect biological resources in the Bay. To restore conditions in the Bay, the basin's water resources must be managed to provide both the quality and quantity of water needed. The basin also must be managed to provide adequate habitat for migratory fish and to limit the amount of man-made, floating debris that is carried from the river to the Bay.

The Susquehanna River Basin Compact specifically recognized the importance of the Bay – Section 14.1 states, "The comprehensive plan shall take into consideration the effect of the plan or any part thereof upon the receiving waters of the Chesapeake Bay." Water from the Susquehanna River Basin plays a significant role in the restoration effort because the Susquehanna River provides 50 percent of the Bay's total freshwater inflow. However, it is not currently known how much reduction of inflows to the Chesapeake Bay, if any, is tolerable.

The Commission regulates withdrawals and consumptive uses of water in the Susquehanna basin, and both of these are increasing. Because of the interrelationships between water quantity and quality, the Commission believes that low flow and consumptive use management in the Susquehanna basin must be part of the Bay restoration effort.

The ecology of the Chesapeake Bay is both important and complex. The Bay provides habitat for more than 500 species of fish and shellfish, more than 2,700 plant species, and 29 species of waterfowl. The Bay is a major feeding and resting stop for migratory birds and also provides wintering habitat for a number of migratory species. The Bay's living resources are economically important, supporting the regional economy as a major source of seafood, with an annual harvest worth $1 billion.

The Bay also provides a wide range of recreational opportunities such as fishing, boating, waterfowl hunting, crabbing, swimming, bird watching, and nature study. Many of these activities are dependent on the ecological health of the Bay and its fish and wildlife resources. Bay-related tourism provides the regional economy with billions of dollars in revenue each year.

Excessive amounts of nutrients, namely nitrogen and phosphorus, in the Chesapeake Bay and tidal regions of its tributaries have aggravated a number of water quality conditions producing excessive algal growth, low concentrations of dissolved oxygen, and reduced water clarity. The increased algae concentrations and reduced water clarity inhibit growth of the Bay's submerged aquatic vegetation (SAV), which provides important habitat for fish, wildlife, and blue crabs, which are one of the most economically important species in the Bay. SAV also provides food for ducks and other waterfowl, absorbs nutrients, reduces suspended sediment, helps stabilize substrate, and produces oxygen in the water. Significant progress has been made in recent years toward meeting the SAV goals for the Upper Chesapeake Bay. Only 29 percent of the 14,978-acre SAV restoration goal for the Upper Bay was met in 1991, while 87 percent of the goal was met in 2007.

Fish and other forms of aquatic life have specific dissolved oxygen requirements for survival. Algal blooms, when not eaten by fish and shellfish, deplete dissolved oxygen in the Bay, making some of its deeper waters uninhabitable for some species.

The effects of excessive nutrient loading on water quality show considerable variation according to season and the particular region of the Bay. Generally, problems related to low levels of dissolved oxygen are greatest in the deeper portions of the upper Bay during the summer. The restoration target values developed for nutrients relate to this issue, although dissolved oxygen problems may occur in other areas on a periodic basis.

The results of best management practices, sewage treatment plant upgrades, and other restoration activities in the basin will first be seen in the chemical and physical quality of local streams and rivers, followed by the biological response in the Bay.

Abandoned mine drainage (AMD) carrying metals is a major concern in portions of the Susquehanna River Basin, although specific load allocations have not been set for metals provided to the Bay from its major tributaries. AMD degrades normal biological processes and reduces the ability of streams to assimilate nutrients, with increased amounts being transported downstream and delivered to the Chesapeake Bay. The air-borne transport and deposition of acid rain, nitrogen, sulfur, and toxins into the Bay watershed area also are of concern.

3. Goals

Four goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Goal a. Identify the minimum freshwater inflows needed from the Susquehanna River to assist in restoring and maintaining the ecological health of the Chesapeake Bay, while also identifying opportunities for enhancement.

Low flow maintenance planning has been a priority activity at the Commission throughout most of its existence. In the mid-1980s, the Commission prepared a series of planning reports related to the storage and release of water from Cowanesque Lake in Tioga County, Pa., and initiated a series of low flow management framework plans that were prepared for each of the six major subbasins in the basin. Planning for potential pooled water storage from large federal and state reservoirs was continued in the 1990s and storage was obtained from Cowanesque Lake and Curwensville Lake on the West Branch Susquehanna River in Clearfield County, Pa. Also, arrangements were made to provide low flow releases from Whitney Point Lake in Broome County, N.Y. In 2007, arrangements were made with the Commonwealth of Pennsylvania to provide water storage from the Barnes and Tucker abandoned mine pool in Clearfield County, Pa. The Commission is actively continuing to perform consumptive use mitigation planning and seek additional sources of water for release during low flow periods.

In 1996, the Commission published the *Chesapeake Bay Low Flow Strategy Study*, which was prepared by the Commission and the University of Maryland's Horn Point Environmental Laboratory. The purpose of the study was to develop a general strategy to study and manage the impacts of low freshwater inflows from the Susquehanna River on the salinity, water quality, available habitat, and living resources of the Bay.

The study analyzed the hydrology of the Susquehanna River, provided an extensive review of the available literature related to flow impacts on the Bay, and included the results of an opinion survey directed toward agencies and researchers involved with living resources and flow issues. A summary of pertinent issues was included in the study report, as well as a summary of activities conducted at a workshop conducted in 1995. As discussed previously, climate change will alter the ecology of the Susquehanna River system, which will also have downstream effects on the Chesapeake Bay.

The study's literature review indicated potentially significant impacts of low flows and consumptive uses on salinity, water quality, and living resources and provided 10 major recommendations for development of a strategy, as well as a list of 29 issues for further consideration.

Ongoing Commission Activity:

1. Plan and implement low flow water management activities. (Also discussed under Water Supply priority management area)

Actions Needed:

1. Work with USEPA's Chesapeake Bay Program, the USACE, the State of Maryland, and others to support the process to determine flow regimes under which the ecological health of the Bay can be restored and sustained.
2. Plan any additional studies and modeling efforts that are needed and seek appropriate funding and implementation.

Goal b. Develop and implement plans to address the flow requirements in Goal a. above.

The Commission will need to determine the amount of water and costs associated with providing the amount of water needed for the ecological health of the Bay. Planning, implementation, and reevaluation also will need to be performed over the long term.

Ongoing Commission Activity:

1. See Goal a. above.

Actions Needed:

1. Assess the feasibility of providing recommended flow regimes to the Bay.
2. Implement recommendations from the feasibility study through the Commission's regulatory and planning activities, with support from the Commission's member jurisdictions.
3. Continue to update and review progress in providing the flows needed for the Bay.

Goal c. Support the Chesapeake Bay restoration effort, including sediment and nutrient reduction strategies developed by each of the Commission's member states.

The Compact directs the Commission to consider the effects of its Comprehensive Plan on the receiving waters of the Chesapeake Bay. The Commission has participated on a number of Chesapeake Bay Program committees and subcommittees, has performed sediment and nutrient monitoring in support of Bay restoration activities since the mid-1980's, and chaired a sediment task force that studied the accumulations of sediment behind dams on the lower Susquehanna River and recommended specific actions for the management of sediment in the basin. The Commission serves on the Chesapeake Bay Water Quality Steering Committee, which is chaired by USEPA's Chesapeake Bay Program and was responsible for the planning process leading to the establishment of new water quality criteria for the Bay and the development of target loads for sediment and nutrients delivered to the Bay from its major tributaries, including the Susquehanna River. Although previous actions related to the Chesapeake Bay cleanup have been largely voluntary, preparations are currently underway for USEPA to prepare a Total Maximum Daily Load (TMDL), which would require states to revise discharge permits and perform a wide array of other implementing activities to achieve the desired results.

Maryland, Pennsylvania, and New York each developed and adopted state tributary strategies to achieve and maintain the load allocations developed for the Susquehanna River and each state. All three states used a variety of approaches to reduce loads from point source discharges such as sewage treatment plants and industrial facilities, as well as from nonpoint sources such as agricultural and urban runoff. The focus of each state tributary strategy varied depending on the magnitude of loading from various sources and the tools available to control those loads. Significant efforts are under way to implement the strategies in all three of the Commission's member states.

Ongoing Commission Activities:

1. Perform sediment and nutrient monitoring in the basin to help refine the Chesapeake Bay watershed model, support restoration activities, identify water quality trends, and document progress in meeting sediment and nutrient reduction goals established for the Susquehanna River.
2. Promote adequate funding and support tributary strategies developed by each of the Commission's member states, and participate on committees and workgroups to advance restoration and protection efforts.

Actions Needed:

1. Perform trend analyses for additional sediment and nutrient monitoring sites as sufficient data are accumulated.
2. Coordinate, encourage and support efforts to manage sediment within the basin, including legacy sediments from mill dams and sediment that has accumulated behind dams on the lower Susquehanna River.
3. Support studies to determine the remaining sediment trapping efficiency of dams on the lower Susquehanna River and determine if and how trapping capability may be retained.
4. Promote the installation of best management practices for point and nonpoint sources, including stormwater, and water quality infrastructure improvement for point sources in the Susquehanna River Basin to benefit local water quality improvement and the Bay restoration effort.

Goal d. Provide habitat for migratory waterfowl and shorebirds found in the Chesapeake Bay.

Restoration of wetlands and other habitat for waterfowl and shore birds in the Susquehanna River Basin will help to increase the numbers of those species passing through the Bay area and over-wintering there. Increased SAV production in the Bay through other restoration activities should help support over-wintering populations of waterfowl and provide return benefits to the basin.

Ongoing Commission Activity:

1. Perform restoration and protection planning for water quality and habitat improvement.

Action Needed:

1. Work with municipalities, developers, conservation and sportsmen groups, and others to support wetland establishment and enhancement in the basin to provide downstream benefits to water quality and migratory birds using the Bay.

F. Coordination, Cooperation and Public Information

1. Desired Result

To maximize available human resources and achieve common and complementary management objectives by the Commission, its member jurisdictions and others; to promote the planning and management of the basin's water resources in the most efficient manner possible; to inform the public on the Commission's water management responsibilities; and to enhance the public's access to Commission information and decision making procedures.

2. Discussion of Issues

This priority management area includes: (1) meeting the water management needs of the Susquehanna basin by utilizing government resources – both personnel and financial – in the most effective and efficient manner, (2) making the public aware of the basin's priority needs and the programs and activities in place by the Commission and its member jurisdictions to meet those priority management needs, (3) ensuring public access and input to Commission decision making, and (4) involving and seeking the advice of non-governmental organizations.

As stated in the preamble of the Compact, the water resources of the basin are subject to the duplicating, overlapping, and uncoordinated administration of a large number of governmental agencies that exercise a multiplicity of powers. This can result in a splintering of authority and responsibility, an inefficient use of scarce governmental resources, and inconsistent treatment of water users.

The Commission's member jurisdictions and their political subdivisions are engaged in a many water resource management activities that have basinwide impacts and effects on the Chesapeake Bay. Examples include stream classifications, water quality standards, water withdrawal regulations, flood damage reduction, and waste treatment. It is therefore critical that there be some overarching mechanism that promotes communication and coordination among these entities. Communication and cooperation among the member jurisdictions are likely to preemptively remove causes of potential controversy before they rise to the level of open conflicts.

While the Commission is established as the chief agency to foster coordination, the Compact specifically declares that it is the intention of the member jurisdictions to preserve and utilize the existing offices and agencies of government. The member jurisdictions should remain as the chief stewards of their own natural resources. However, to do so in the most efficient and effective manner, those offices and agencies need to be working together under the coordinative oversight of the Commission.

With respect to public information, a basic purpose of the Compact is to manage the basin's waters in the public interest. The Compact preamble recognizes in its very first declaration that management of the basin's water resources under comprehensive multipurpose planning will bring the greatest benefits and produce the most efficient public service in the public interest. Also, Goal No. 6 of the Commission's Statement of Mission calls on the Commission "To provide public information and education about the water resources of the basin."

As required by its Compact and regulations, the Commission seeks public input to the greatest extent possible on regulatory, planning and other programmatic areas. For the public to provide meaningful input, it must be informed of the relevant water management issues. Only through a public information and outreach effort by the Commission can this be accomplished.

3. Goals

Eight goals have been established to achieve the desired results and are discussed below. For each goal, ongoing Commission activities and actions needed are identified.

Goal a. Continue use of interagency committees and ad hoc committee mechanisms to gather input from member jurisdictions and to encourage consistent interstate water management policies and actions.

Over the years, the Commission has relied upon and productively utilized various interagency and citizen/interest group committees of both a permanent and ad hoc nature to accomplish important water management objectives. Successes include the implementation of a basinwide flood forecasting and warning system, management of severe droughts, promulgation of important regulations, consideration of agricultural issues and oversight of water quality monitoring and assessment efforts. The Commission should continue to build on these successes and look for additional opportunities to utilize committees.

Ongoing Commission Activity:

1. Continue to participate in member jurisdiction water resource planning efforts and support the enhanced federal agency coordination activities of the USACE Baltimore District.

Actions Needed:

1. Consult the Commission's established advisory committees such as the Water Resources Management Advisory Committee and Water Quality Advisory Committee and, as needed, activate ad hoc committees to address special issues or projects.
2. Facilitate interagency and interstate committees to deal with selected water management topics.

Goal b. Execute, review, and update memoranda of understanding (MOUs) with member jurisdictions to coordinate regulatory or other programs that overlap.

The Commission exercises its regulatory and programmatic authority concurrently with numerous state and federal agencies. Section 806.7 of the Commission's project review regulations states that "[t]o avoid duplication of work and to cooperate with other government agencies, the Commission may develop administrative agreements or other cooperative arrangements…with appropriate agencies of the member jurisdictions regarding joint review of projects." The Commission has had a project review MOU in effect with the Pennsylvania Department of Environmental Protection (PADEP) since 1999 and seeks opportunities to update that MOU as needed to continue improving coordination between the two agencies. There are no other member state MOUs in effect. In its early years, the Commission had an MOU in effect with the Federal Energy Regulatory Commission (FERC) on concurrent review of hydroelectric projects, and the Commission executed an MOU with USACE in August 2008 to enable USACE to provide technical services to and funded by the Commission. Additional opportunities for MOUs with state and federal agencies should be evaluated and appropriately considered.

Ongoing Commission Activity:

1. Review existing MOUs with federal agencies and evaluate the benefits of executing new MOUs with other federal agencies.

Action Needed:

1. Keep the Commission-PADEP MOU current to ensure more effective implementation of Commission regulatory standards, and explore possibilities of executing similar MOUs with Maryland, New York and the federal government or establishing an alternate procedure for coordination and exchange of information on project approvals and other work programs.

Goal c. Support uniform water management policies and standards in areas such as water quality, stream classification, flood plain management, instream flow protection, stream passby requirements and aquifer protection.

A stated purpose of the Compact is to "apply the principle of equal and uniform treatment to all users of water and of water-related facilities without regard to political boundaries." "Uniform" water management standards do not mean that such standards must be identical. Instead, standards should be complementary and mutually supportive, aiming toward the achievement of the common management objectives established under this comprehensive plan.

Ongoing Commission Activity:

1. Continue to participate in national water organizations such as the Interstate Council on Water Policy and the Association of State and Interstate Water Pollution Control Administrators, where common management problems and solutions can be more readily identified.

Actions Needed:

1. Determine the need for uniform standards in such areas as instream flows, aquifer testing, water conservation, and flood plain management.
2. As appropriate, assemble special interagency and interstate task force committees to address special water management topics and the development of uniform water management policies or standards.

Goal d. Coordinate major interagency efforts such as flood forecasting and warning, drought emergency management, water conservation, and hydro power license renewal.

The Compact recognizes the Commission as the "single administrative agency…essential for effective and economical direction, supervision, and coordination of water resource efforts and programs of federal, state, and local governments and of private enterprises." In this oversight capacity, it is appropriate that the Commission be a leader in addressing water management issues of critical importance to the basin.

Ongoing Commission Activity:

1. As discussed in Priority Management Areas A, C, and F respectively, continue coordination and cooperative activities in the following areas: (1) the Interagency Drought Coordination Committee, (2) the basinwide flood forecast and warning system, and (3) Chesapeake Bay Program committees and related bay organizations.

Actions Needed:

1. Organize a consortium of resource agencies with jurisdiction over water at the federal and state level to facilitate the coordination of input into federal licensing and relicensing of hydroelectric and nuclear power facilities in the basin, including new facilities and updates at existing facilities.
2. Develop basinwide water conservation standards in cooperation with member states.

3. Facilitate interagency coordination of post-flood actions for the purpose of improving emergency response, technical information and flood damage reduction.
4. Expand leadership role and advocacy for the collection of water quality and quantity data for science, including the maintenance of an effective and sustainable stream and rain gage network.
5. Evaluate the establishment of a Susquehanna River Basin Monitoring Council.

Goal e. Inform legislators and executive branch policy makers on important issues related to the basin's water resources.

The efficacy of the Commission's work in the management of the basin's water resources is directly linked to financial and policy support from the Commission's member jurisdictions. The Commission should therefore maintain a strategy of informing legislators and executive branch policy makers about relevant water management issues.

Ongoing Commission Activities:

1. Continue informing state and federal legislators on the Commission's work in managing the basin's water resources and related legislative priorities.
2. Maintain contact with policy makers in the executive branches of the member jurisdictions to retain their support for the Commission's work.

Actions Needed:

No new actions recommended under this goal.

Goal f. Inform the public on matters affecting the basin's water resources and utilize current tools, methods and strategies to effectively reach the public.

By requiring the Commission to take its actions in public meetings and hearings, by placing significant emphasis on the issuance of public notifications, and by requiring the public issuance of Commission documents including the annual report, annual Water Resources Program and the Comprehensive Plan, it is clear that the drafters of the Susquehanna Compact recognized the importance of an informed citizenry. Over the years, the commissioners and Commission managers have supported and further strengthened the Commission's public information initiatives, including producing and disseminating various publications, working with the media and disseminating information through the Internet. In addition to applying traditional methods of disseminating public information, in a time of ever-changing communication technologies, the Commission must strive to keep current on the tools, methods and strategies for educating and informing the public.

Ongoing Commission Activities:

1. Continue to rely on the Commission's web site as one of the primary public information tools, produce and disseminate publications, produce and disseminate television and radio public service announcements, and periodically conduct workshops on specific water resource topics.
2. Routinely disseminate information to the media using the full range of available communication options.
3. Incorporate GIS maps and other tools to the greatest extent possible to enhance public information products.
4. Organize and distribute to the public water resource data maintained by the Commission.

Action Needed:

1. Periodically evaluate existing and emerging communication technologies and methods to determine their potential application and benefits to the Commission's public information program and strategies.

Goal g. Enhance public access to Commission information and decision making procedures.

The Commission, as a government agency and a steward of public resources, functions in the public domain. It is important that information be readily available to the public in the most effective and efficient manner and the public have access to the Commission's decision making and policy setting procedures. At the same time, the need to safeguard security related and confidential information in restricted files and data bases should be clearly recognized.

Ongoing Commission Activity:

1. Provide timely notice of Commission meetings and hearings via newspapers, legal notice publications and the Commission's web site, and provide direct notice and other information electronically or by regular mail to individuals and organizations who have expressed an interest in a particular matter before the Commission.

Actions Needed:

1. Utilize currently available technologies to make information readily available through electronic means, including non-restricted files and records requested by interested parties to eliminate the need to physically visit the Commission's headquarters building.
2. Identify, assess, and consider a range of options for enhancing access to the Commission by the public and stakeholder groups to facilitate input to ongoing and emerging issues and programmatic matters; options for consideration could include holding periodic topical meetings or public forums, forming a general advisory committee, and using the Commission's web site more effectively for direct public input.

Goal h. Involve and seek the advice of non-governmental organizations on the management of the basin's water resources.

Many non-governmental organizations such as individual businesses and business groups, environmental groups and watershed associations are located in the Susquehanna basin. These groups possess considerable resources and expertise that, if effectively harnessed and coordinated, can be of great assistance to the Commission in the management of the basin's water resources. Over the span of its existence, the Commission has developed and cultivated relationships with many non-governmental organizations and has worked cooperatively with them on such achievements as the basinwide Flood Forecast and Warning System, migratory fish restoration, and stream cleanup and restoration. The Commission should continue these relationships and explore new ways that non-governmental organizations can make meaningful contributions to the Commission's programs and activities.

Ongoing Commission Activity:

1. Continue existing communications and contacts with non-governmental organizations on a range of water resource management issues.

Actions Needed:

1. Expand on existing relationships with to non-governmental organizations to maximize the beneficial use of their resources and expertise in the management of the basin's water resources.
2. Identify opportunities to collaborate with academic institutions to maximize resources and scientific knowledge.
3. Provide opportunities for non-governmental organizations' involvement in Commission activities and, through coordination efforts, encourage communication on activities/issues of mutual interest.
4. Coordinate with trade associations related to the various types of water use in the basin to promote sustainable water use in conjunction with economic development.

PART V - AREAS OF SPECIAL INTEREST

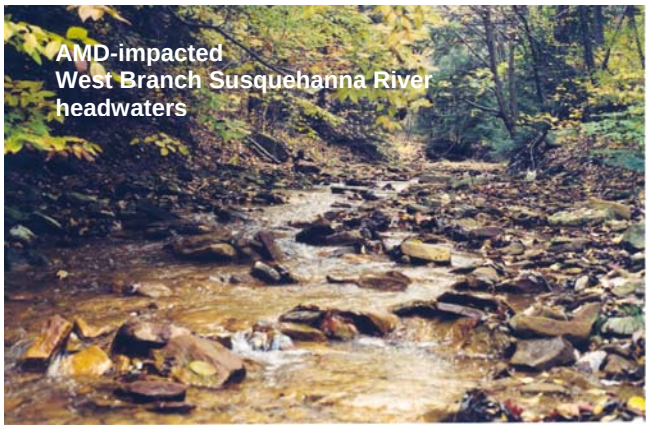
While Part IV-Priority Management Areas – with its goals, ongoing Commission activities, and actions – serves as the primary vehicle for meeting the basin's water resource needs, the Commission also recognizes the benefits of highlighting other essential water resource topics. The selected topics that warrant this separate discussion were designated as "areas of special interest" by the Commission, and they are a mix of both long-standing and emerging programs and problems. The Commission believes the selected topics are of interest to many interested parties in the Susquehanna basin.

The areas of special interest do not include Commission goals and actions as with the priority management areas. Rather, they provide an overview of their impact on water resources and present initiatives underway or needed to address them. The 12 areas of special interest are:

(1) abandoned mine drainage;
(2) climate change;
(3) consumptive use mitigation;
(4) drought coordination;
(5) economic development, recreation and other public values;
(6) emerging contaminants;
(7) energy production;
(8) flood forecast and warning;
(9) invasive species;
(10) migratory fish restoration;
(11) potentially stressed areas and water challenged areas; and
(12) water and wastewater infrastructure.

The Commission believes these areas of special interest need to be addressed by the combined efforts of all levels of government, the private sector and the Commission. Both Commission activities and those of others in the areas of special interest are discussed. Part V-M provides a matrix displaying the relationship of the areas of special interest with the priority management areas.

A. Abandoned Mine Drainage



1. Background

The Susquehanna basin contains areas with both bituminous (soft) and anthracite (hard) coal. Bituminous coal is most prevalent in areas draining into the West Branch Susquehanna, Juniata, and Tioga Rivers, while most anthracite coal is in areas draining to the main stem of the Susquehanna River from the east.

Abandoned mine drainage (AMD) is formed when mining operations expose coal and bedrock containing pyrite (iron sulfide) to water and oxygen. Sulfuric acid and iron hydroxide are produced through both chemical and biological processes, and water containing acidity, iron, manganese, aluminum, and other metals can result. In addition to the toxic effects associated with AMD, iron and aluminum compounds are precipitated out of solution to coat the bottom of streams, making habitat unsuitable for most bottom-dwelling aquatic life. Coal fines may affect human health through airborne exposure, and can be eroded into streams to degrade aquatic

habitat. Studies are currently underway to determine whether metals in AMD may contribute to human neurodegenerative diseases.

AMD is a significant cause of stream impairment in the basin (see Figure 15). Of the basin's total 49,350 stream miles, more than 6,000 miles are impaired, with more than 1,600 of them impaired due to AMD. All of the basin's AMD-impaired streams are located in Pennsylvania, with about 63 percent located in the West Branch Susquehanna Subbasin, 18 percent in the Middle Susquehanna and Chemung Subbasins (including the Tioga River Watershed), 15 percent in the Lower Susquehanna Subbasin, and 4 percent in the Juniata Subbasin.

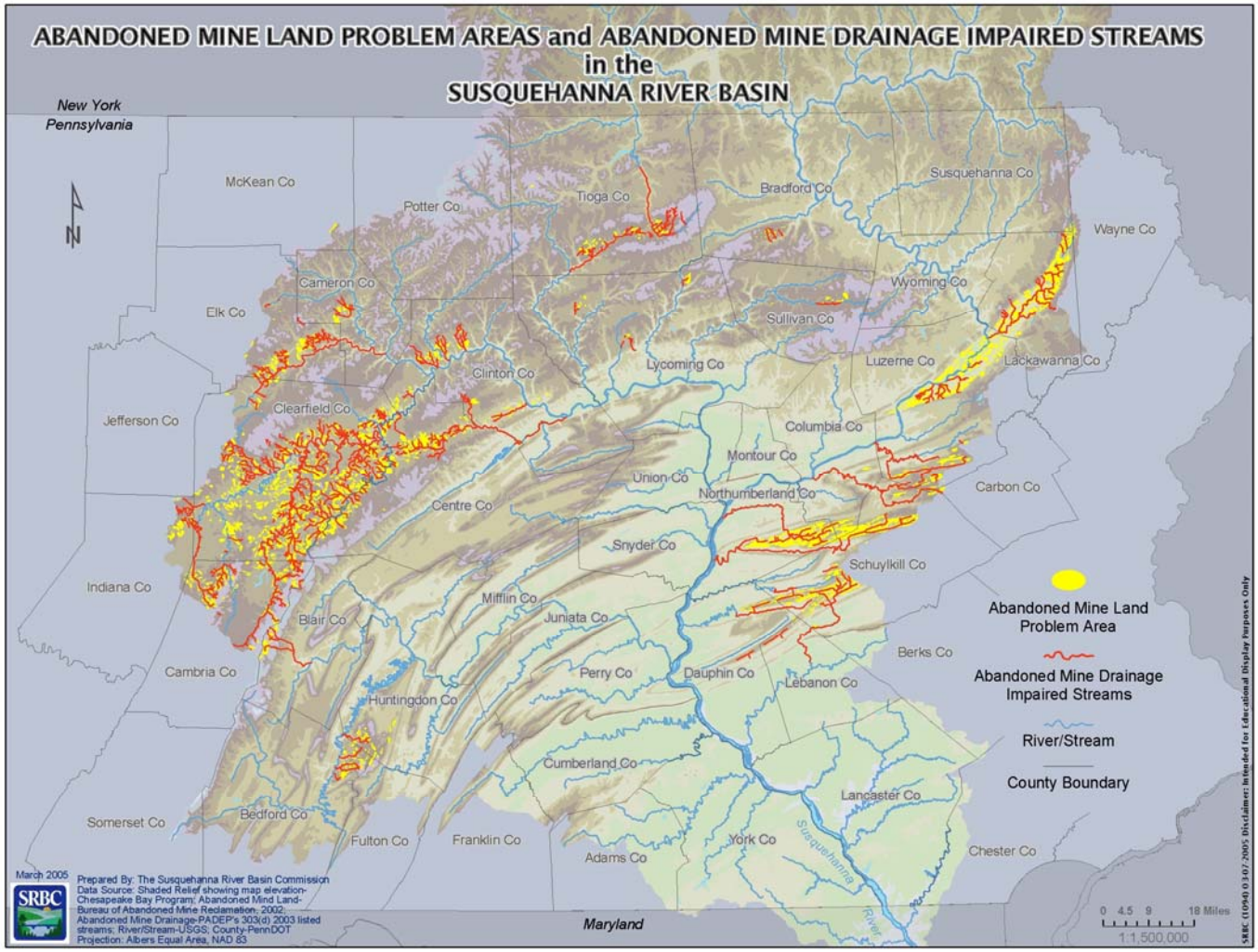


Figure 15. Abandoned Mine Lands and AMD Impaired Streams

Most AMD in Pennsylvania is the result of operations that ceased prior to enactment of the 1964 amendment to the Commonwealth's Clean Streams Law, which required mine operators to treat mine drainage. In the early 1980s, the ability to predict AMD water quality impacts improved significantly. The success rate for avoiding AMD impacts increased in 1984, when permit applicants were first required to submit scientific data to assess the potential for AMD production. Today, only a small percentage of mining permits results in post-mining discharges significant enough to require treatment, and most of these are easily treated.

2. Management Activities

In 1945, Pennsylvania passed the Bituminous Coal Open Pit Mining Conservation Act, requiring coal operators to register their mines, post bonds, cover exposed coal, round off refuse banks, and re-vegetate the land. The bonding was to insure that money would be available for the Commonwealth to complete reclamation if the mine operator did not do so. Pennsylvania adopted similar reclamation standards for anthracite mines in 1947.

Pennsylvania amended its Clean Streams Law in 1945 to make it unlawful to discharge mine drainage into clean waters devoted to public use. In 1963, Pennsylvania passed legislation to increase bonding rates, require bituminous mine operators to obtain a license and permit before mining, and require anthracite mine operators to backfill mine pits. Amendments to the Clean Streams Law in 1965 classified mine drainage as an industrial waste product and required operators to obtain a permit.

Pennsylvania passed the Land and Water Conservation and Reclamation Act in 1968, providing $120 million for Operation Scarlift to prevent and control AMD and construct 524 AMD projects. The last Operation Scarlift funds were spent in 1995.

In 1998, Pennsylvania launched its Reclaim PA initiative to enhance reclamation efforts by mine operators, volunteers, and the Pennsylvania Department of Environmental Protection (PADEP). An important component of Reclaim PA is to provide incentives for the active mining industry to re-mine abandoned mine lands. In Pennsylvania, the amount of abandoned mine land reclaimed by the coal industry far exceeds the amount reclaimed by government projects.

The 1977 Surface Mining Control and Reclamation Act (SMCRA) is the primary federal law dealing with mine reclamation activities. In 2006, SMCRA was reauthorized for another 15 years, increasing reclamation funding to Pennsylvania by three to four times over a period of years. The amended SMCRA law will provide nearly $1.4 billion to Pennsylvania to reclaim many of its Priority I and II health and safety abandoned mine land sites, as well as provide up to 30 percent funding for future AMD remediation efforts and operation and maintenance of existing state-funded AMD treatment systems. Although funding is directed primarily toward Priority I and II sites with health and safety issues, a 30 percent set-aside provision (an increase from 10 percent) is available to fund staff, projects, and other activities associated with treatment of AMD. The federal Office of Surface Mining provides SMCRA funding to PADEP, which has the option of determining whether or not use the set-aside provision within SMCRA.

Under the federal Clean Water Act, the U.S. Environmental Protection Agency (USEPA) works with the states to regulate water quality activities. The Commission provides a supporting role, as discussed in Priority Management Area B - Water Quality. The U.S. Geological Survey (USGS) and the U.S. Army Corps of Engineers (USACE) also have performed various monitoring and planning activities related to AMD in the basin. Also, the federal Office of Surface Mining has been providing a considerable amount of funding for the construction of AMD treatment systems through what was once called the Appalachian Clean Streams Initiative and is currently called the Watershed Cooperative Agreement Program.

The Eastern and Western Pennsylvania Coalitions for Abandoned Mine Reclamation (EPCAMR and WPCAMR), as well as watershed organizations such as Tioga County Concerned Citizens Committee and Catawissa Creek Restoration Association, have played a key role in constructing AMD remediation projects in the basin. EPCAMR has been working within the Susquehanna River Basin for nearly a decade, taking a lead role to create partnerships and build coalitions to seek out funding for the assessment of mining-impacted watersheds leading to the successful implementation of many watershed restoration plans, river conservation plans, and the construction of fully functional AMD treatment systems. Pennsylvania has provided considerable

funding for this work through its Growing Greener grant program. Additional information is available on the EPCAMR and WPCAMR web sites.

The Commission has helped coordinate AMD issues in the basin and has performed AMD monitoring and assessments, total maximum daily loads, and planning studies such as the Watershed Assessment and Remediation Strategy for AMD in the Upper Tioga River Watershed and the West Branch Susquehanna Subbasin AMD Remediation Strategy. In addition, the Commission is providing operation and maintenance funding for the Barnes and Tucker AMD treatment plant for mitigation of agricultural consumptive water use in the Pennsylvania portion of the basin, and is studying the capability of other mine pools to provide low flow augmentation for consumptive use mitigation.

3. Future Direction

Several action items under Priority Management Area B – Water Quality relate to AMD. Goal c of Priority Management Area D – Ecosystems also discusses AMD with regard to migratory fish passage and the discussion of issues under Priority Management Area E – Chesapeake Bay discusses AMD with regard to the assimilation of nutrients.

Continued AMD monitoring and more detailed planning are needed for the West Branch Susquehanna Subbasin, and strategies and plans are needed for the anthracite coal region in the vicinity of Scranton/Wilkes-Barre, Pa., in the Broadtop coalfield within the Juniata Subbasin, and in the small, bituminous coal mining region west of Altoona, Pa. Currently, little funding is available for the operation and maintenance of AMD treatment facilities after they have been constructed. Additional operation and maintenance monies are needed for continued operation of facilities over the long term.

The Commission is particularly interested in continuing AMD remediation planning and implementation in the West Branch Susquehanna Subbasin, and in preparing a restoration plan for the anthracite coal region in the Susquehanna River Basin. The Commission also plans to strengthen working relationships with the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation and other groups involved in restoring waters impaired by AMD. EPCAMR has expressed interest in working with the Commission in the anthracite region of the basin.

The increase in SMCRA funding will provide additional reclamation and AMD remediation opportunities in Pennsylvania. The Commission's Year 2 Subbasin Survey work will help to provide additional data to support local remediation plans and projects.

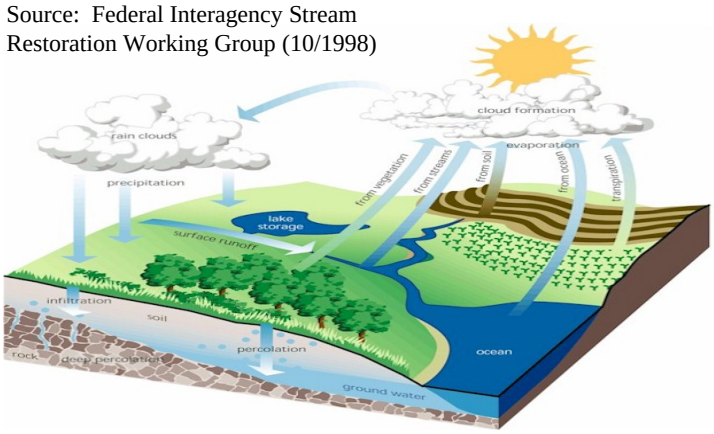
B. Climate Change

1. Background

More and more information is becoming available about potential climate changes associated with carbon dioxide and other greenhouse gases. Water resources are obviously an integral part of the earth's climate, and any changes to the mid-Atlantic's climate could, likewise, have implications for basin water resources. The Pennsylvania State Climatologist has reported climate trends observed over the past 100 years, with changes to both temperature and rainfall.

Hydrologic Cycle Diagram

Source: Federal Interagency Stream Restoration Working Group (10/1998)



Specifically, there has been a slight increase in winter temperatures of 1.2 degrees Fahrenheit, a slight decrease of 0.5 degrees in summer temperatures, and an increase in rainfall of up to 8 inches per year. Predictions for changes in Pennsylvania over the next 100 years include increases in winter and summer temperatures of up to 12 and 14 degrees, respectively, and a 23 percent increase in average annual precipitation, from 40.4 inches to 49.7 inches. Predictions also include an increase in the frequency and severity of heavy rainfall – raising the likelihood of flooding – and, at the opposite extreme, an increase in the frequency of summer droughts. It is important that the Commission's water resource managers know how such changes are affecting long-term hydrologic patterns. (Also discussed in the Flooding and Drought Management priority management areas.)

Aside from hydrologic changes, there are also implications to the reliability of hydrologic data. When planning for water resources, water managers typically rely upon heavily for valuable streamflow records stretching back 100 years or more. However, if climatic patterns are shifting, water managers can no longer be certain that those records still reliably reflect current conditions or expected changing conditions. An investigation of streamflow records at several long-term gages in the Susquehanna River Basin already shows a distinct difference in patterns pre- and post-1970. It is not yet known whether the shift is in response to climate change or to some other cause. (Also discussed in the Water Supply priority management area.)

Whatever the cause, the implications for water resources could be extensive, and management, planning and protection cannot occur without a good understanding of what the new natural patterns are, or how they are expected to change. Also, although most focus has been on water quantity, there is the potential for impacts to management of water quality as well. For example, Chesapeake Bay Tributary Strategy for New York, Pennsylvania, and Maryland will be implemented using assumptions about the entry of nutrients into streams and how they interact with natural systems, but those assumptions may vary depending on factors such as average flows and water temperatures. (Also discussed in the Water Quality priority management area.)

There are studies indicating that the Chesapeake Bay is already showing the first signs of impact from climate change, specifically from increased air and water temperatures. Since the 1960s, water temperatures in the Chesapeake have warmed by about 2 degrees. As the Bay's water warms, some existing problems could be aggravated and new problems could emerge. Increased water levels in the Bay also pose threats. In the last century, Bay water levels have risen by more than a foot.

Likely implications of climate change to the Chesapeake Bay include expansion of the oxygen-depleted dead zones, die-off of critical habitat grasses, increased runoff carrying more nutrients and sediments, increases in algae blooms and diseases, higher and more destructive storm surges associated with tropical systems, loss of tidal wetlands and their pollutant-filtering capacity, changes to salinity patterns, changes in the timing of breeding and migrations, and the out-migration of native species and in-migration of non-native species as they adjust to changing conditions in the Bay and surrounding waters. (Also discussed in the Chesapeake Bay priority management area.)

2. Management Activities

The potential effects of climate change will impact Commission programs both directly and indirectly. Most immediately and directly, shifts in rainfall patterns that cause more floods and more droughts will require the Commission to dedicate more resources to its already active flood and drought coordination programs. In addition to increased response activities, there will likely be interest in Commission participation in cooperative long-term planning and management for the mitigation of increased flood and drought hazards.

Other impacts of climate change will be less direct, but could actually have more far-reaching implications for Commission programs. Because climate change could significantly shift temperatures and the delivery of precipitation, the very nature and design of hydrologic resources and regimes in the Susquehanna basin could

be altered. Such an alteration has the potential to render invalid many of the assumptions underlying basic Commission programs, including consumptive use mitigation, flood and drought planning, development of total maximum daily loads, trends in nutrient and sediment loading from storm runoff, instream flow protection, water availability studies, and Chesapeake Bay protection and restoration efforts.

3. Future Direction

Streamflow statistics are needed for water resource planning and management. The magnitude and frequency of streamflows in the Susquehanna River Basin are used by the Commission and other agencies for water quality and quantity planning and management. By using streamflow data and statistics, streamflow series are implicitly assumed to be stationary in water resource planning and management. If the assumption is invalid, then provisions must be made for generating and providing the most updated hydrologic information for water resource management in the basin. To do that, two questions must be asked and answered: (1) Are there trends in the streamflow in the Susquehanna River Basin, and (2) if so, what is the pattern of the trends, i.e. are the trends gradual or abrupt? The most direct method for ensuring proper use of hydrologic data could be to use only the data that reflect current conditions, either through the revision of existing statistics or through the establishment of new monitoring gages.

C. Consumptive Use Mitigation

1. Background

Commission regulations require mitigation for consumptive use of water. Consumptive use is broadly defined to be the loss of water due to a variety of processes by which the water is not returned to the waters of the basin undiminished in quantity. As discussed in Priority Management Area A – Water Supply, consumptive use is one of the principle causes of water availability shortages in the basin.

The Commission's consumptive use regulation, as adopted in 1976, required project sponsors to provide mitigation for their consumptive use during low flow events. Sponsors were expected to comply with the regulations by providing compensatory water or discontinuing consumptive use during low flow events. In 1990 and 1994, the Commission contracted with the USACE for releases of water stored at Cowanesque and Curwensville Lakes, respectively, for the purpose of consumptive use mitigation. The storage in Cowanesque is almost entirely dedicated to mitigation for the nuclear power plants at Berwick and Three Mile Island. Releases at both facilities are tied to Q7-10 conditions at one or more main stem Susquehanna River gages.

While a few power companies were able to make the financial investments to secure water storage at the USACE facilities and Lake Chillisquaque for compensatory purposes, this option proved impractical for most sponsors, and discontinuation of consumptive use was largely impractical for facilities. In response, the Commission made provision in 1993 for project sponsors to pay a consumptive use fee to the Commission in lieu of providing actual mitigation. The payment of fees was intended to allow the Commission to undertake additional large-scale storage projects to provide low flow mitigation for consumptive use projects paying the fee. The Commission has performed several storage project studies and hydrologic investigations over the past decade, culminating in a proposed plan for achieving necessary consumptive use mitigation.

2. Management Activities

The intent of the Commission's Consumptive Use Mitigation Program is to replace regulated consumptive use during low flow periods, not to maintain critical flow levels. As a result, manmade impacts caused by regulated consumptive use during low flows are targeted for mitigation, allowing the hydrologic regime to follow a natural decline pattern without being aggravated by consumptive use. A total of more than 450 million gallons per day of consumptive use in the basin currently has active mitigation in the form of Commission-owned water storage, self-supplied storage, other compensation releases, or agreements to cease or reduce usage during droughts. Figure 16 displays changes in consumptive water use, including that which is mitigated and the portion that requires mitigation.

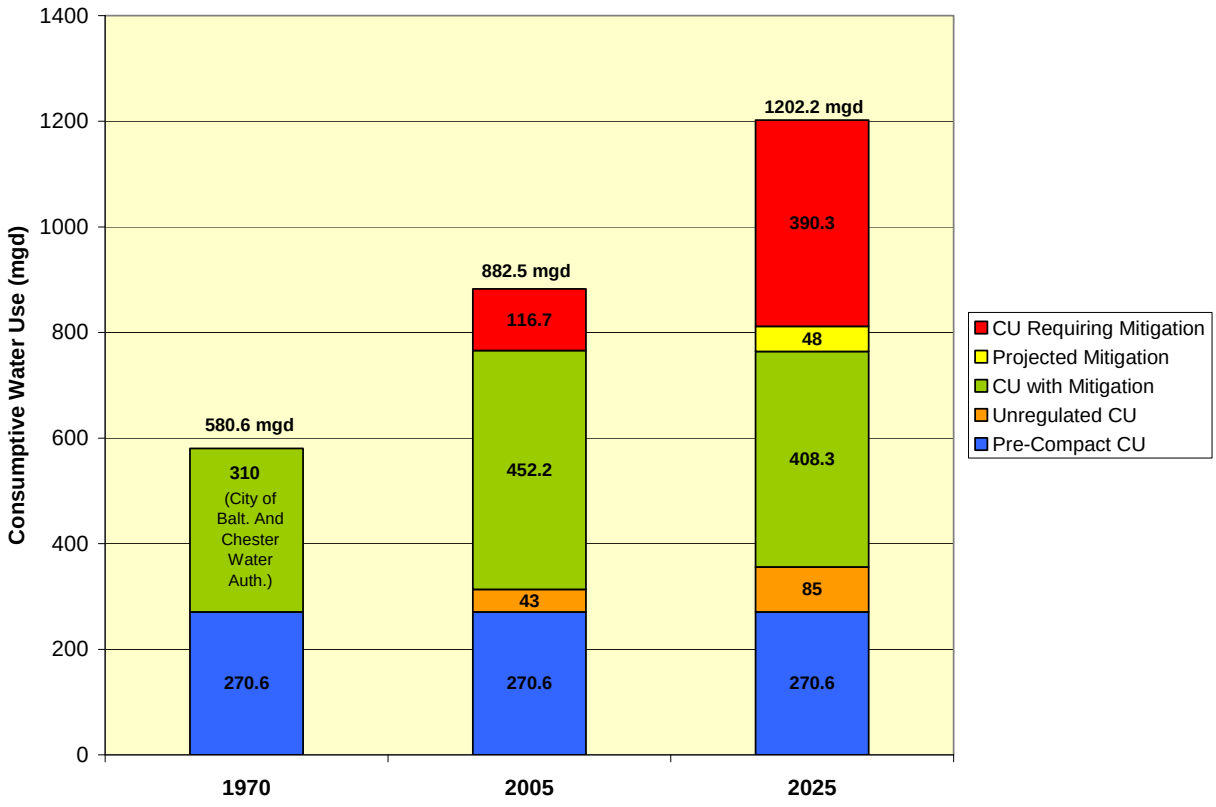


Figure 16. Projected Change in Consumptive Water Use in the Susquehanna River Basin

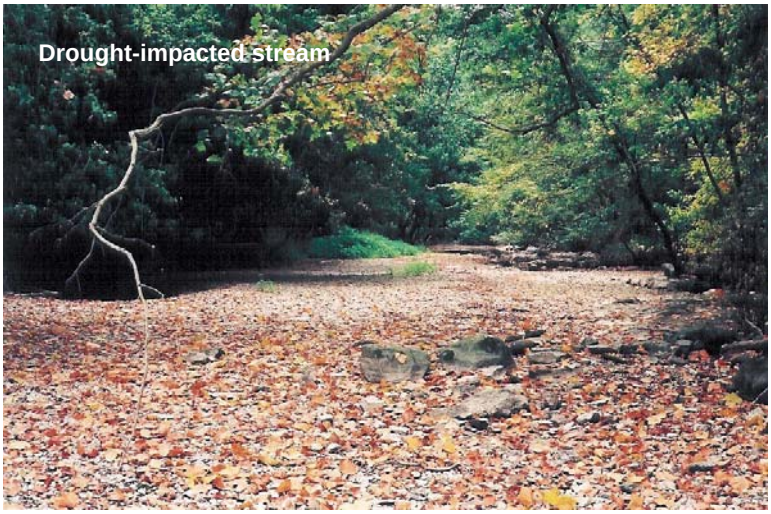
The traditional threshold for implementing mitigation has been the Q7-10 flow, a standard that was applied as a matter of rule across the basin and remained constant year round. However, in instances when mitigation needs were determined at specific locations based on the avoidance of downstream impacts, the resultant thresholds were significantly greater than Q7-10, and varied seasonally. Because the Q7-10 threshold has no basis in protecting riparian or instream resources, mitigation would be more appropriately applied based on thresholds demonstrated to provide protection. Statistical analyses of the protective thresholds will allow protective standards to be developed and implemented at other locations throughout the basin where specific instream assessments are not available.

3. Future Direction

As the Commission's regulatory and management programs have developed and evolved in response to emerging science and changing standards, it has become apparent that modifications to the existing consumptive use mitigation plan are warranted. At issue are the timing of mitigation releases, the location of available storage, the thresholds for implementing mitigation, and the specific mitigation or riparian protection goal. The implementation of consumptive use mitigation can be driven by local conditions to protect the local stream source, or it can be driven by conditions at a downstream location with the goal of not reducing inflows to the Bay beyond the 1-in-20-year monthly low flows in August, September and October. Alternately, a combination of both factors could be important, and consideration of multiple indicators would be appropriate.

The mitigation plan projects that nearly 400 mgd in additional mitigation will be needed by 2025. The Commission does not have adequate storage to provide mitigation to meet the projected need; nor is there likely to be sufficient funding readily available to procure additional needed storage. Because addressing the issues and mitigation goals described above will require significant changes to the way the Commission manages both its existing and new storage, it will be necessary to undertake various analyses including: (1) a reevaluation of Commission storage at Cowanesque and Curwensville reservoirs; (2) an evaluation of enhanced or modified operations at existing federal, state and local reservoirs; (3) an assessment of the potential for mitigation storage at innovative locations such as underground mine pools and limestone mines; (4) the use of instream flow assessments to assure mitigation occurs where it is needed and at appropriate levels; and (5) consideration of modifications to the consumptive use fee and the fee structure.

D. Drought Coordination



1. Background

The Susquehanna River Basin is susceptible to extended drought due to varied topography, geology, and climatic influences. In the northern and western portions of the basin, climate is influenced by Great Lakes and Midwest weather patterns, while the southern and eastern portions experience Atlantic coastal weather conditions. Situated at the interface of these climatic influences, basin weather patterns can lock into extended periods of dryness, followed by violent storm events. As discussed in Priority Management Area A – Water Supply, drought is a principle cause of water availability shortages in the basin.

Steep topography, particularly within the Appalachian Plateau and Ridge and Valley Provinces, and complex geology produce rapid runoff in watersheds, which, when deprived of winter snowpack, offers little opportunity for groundwater recharge. This condition results in depletion of aquifer storage during drought events as groundwater moves towards stream channels to maintain base flow. At these times, the basin must rely primarily on available surface and groundwater storage to meet its water supply needs until nature again provides a replenishment of the resource.

Shortly before the formation of the Commission, the extended drought of the mid-1960s set the benchmark for drought planning, and many drought operation plans are still based on recurrence of 1964 conditions. Following the adoption of the Susquehanna River Basin Compact, severe droughts occurred in 1980-81, 1985, 1991-92, 1995, 1998-99, and 2001-03. Several other years also exhibited significantly dry conditions.

2. Management Activities

As part of its coordination responsibilities, the Commission monitors the waters of the basin and informs the public of emerging drought conditions. The Commission also coordinates activities of its member jurisdictions to deal with drought conditions. If conditions reach established thresholds, the Commission has the authority to declare a drought emergency.

In response to drought emergency conditions spreading across nearly the entire basin in 1999, the Commission coordinated the development of the Susquehanna River Basin Drought Coordination Plan with its member jurisdictions. The plan details methodologies for monitoring hydrometeorological variables and includes recommendations for relating and combining these data to indicate the onset and termination of drought and drought severity. The drought indicators are precipitation deficit, streamflows, groundwater levels, soil moisture, reservoir storage depletion, and evidence of problems at public water supplies. During a drought event, the Commission relies on the Drought Coordinating Committee, comprised of representatives from the Commission, the States of Maryland and New York, the Commonwealth of Pennsylvania, and the federal government, to review data and recommend appropriate response actions.

The potential for drought conditions is also recognized in the Commission's regulatory program. Any project requesting withdrawal of water is subject to analysis of the ability of the proposed source to sustain the withdrawal during times of drought. If the source is deemed unable to meet the demand without posing the threat of adverse impacts, the applicant is required to implement protective measures or develop an alternate source. Similarly, consumptive water users are required to provide mitigation for their consumptive use during droughts, or pay the consumptive use fee to the Commission. Funds collected through payment of the fee enable the Commission to identify, develop and operate mitigation projects on behalf of the water users.

3. Future Direction

Current climatic trends, loss of groundwater recharge, and ever-increasing water usage require vigilant planning and preparedness exercises with respect to drought coordination. Drought contingency planning should be at the forefront of public water supply planning. In addition, the Commission should carefully weigh the impacts of proposed diversions to in-basin water uses during times of drought and emphasize the importance of mitigation of the diversions. The Commission should be more aggressive in ensuring that public water purveyors promote water use efficiency within their systems and that all water users have sound water conservation plans in place.

E. Economic Development, Recreation and Other Public Values

1. Background

The framers of the Compact clearly recognized the importance of developing water-related recreational opportunities (Article 8), conserving and managing water resources for economic development as well as for enhancing quality of life through tourism and preservation of historic and scenic amenities (Article 9), and developing and facilitating the transmission of hydroelectric power (Article 10).


Greenway signage
Photo: courtesy PEC

The Commission combined the focus of those three Compact provisions into one area of special interest because over time they have become very much inter-related and inseparable. For example, tourism is one of the leading

contributors to economic development in the Susquehanna basin, and water-based recreation and sporting activities, historic and scenic preservation, and riverfront community revitalization are among the top tourism activities. Also, while the four hydroelectric power facilities in the lower Susquehanna basin have commercial benefits and one also has water supply benefits, they all are renown for providing major water-based and land-based recreational activities, including boating, kayaking, fishing, biking, hiking, bird-watching, and outdoor interpretive learning, as well as their enormous contribution to recreation through their migratory fish passage facilities (see I. Migratory Fish Restoration area of special interest). The USACE's flood control reservoirs also provide multipurpose benefits, including Raystown Lake, which is often referred to as a "jewel" in the basin.

In recent decades, there have been dramatic growths in:

- river trails and greenways development, such as the Susquehanna Greenway, the Chemung River Basin Trail, and the Lower Susquehanna Heritage Greenway;
- riverfront community revitalization projects;
- designation of heritage, historical and cultural areas, such as the Lancaster-York Heritage Region, the Lumber Heritage Region, and the Tioughnioga River Trail Project; and
- designation of natural areas and other destination points such as PA Wilds.

There has also been increasing interest in and consideration of preserving or restoring open spaces not only for recreational and conservation purposes but as part of an evolving trend to restore floodplains. The use of open spaces for these purposes also enhances an area's economics by reducing damages and losses suffered during flood events.

2. Management Activities

Numerous federal, state, regional, county and local agencies and non-governmental agencies are involved and interested in the management of the resources that support the basin's economic development, recreation and other public values.

The Commission is involved in the regulation of surface water and groundwater withdrawals and consumptive uses to help maintain adequate flows for aquatic habitat, recreational uses, and business entities that rely on sustainable supplies. The Commission, in carrying out its water resource responsibilities, must weigh proposed projects not solely on feasibility but also on their compatibility with the public values inherent in the locality and member jurisdiction for which they are planned. To that end, the Commission must evaluate projects and proposals for water resource development, use and management in terms of their compatibility with the principles, guidance and standards set forth in the Comprehensive Plan and on the basis of public input regarding project impacts.

The Commission also has interest in and involvement with the power utilities, including those that operate the hydroelectric dams. As shown on Table 4, power utilities are very intensive users of the basin's water resources in terms of consumptive use (for cooling water), and account for nearly 60 percent of the total consumptive water use approved for in-basin purposes. This intensive use often results in immediate local impact (via thermal discharge or flow alteration). These power facilities – using nuclear, fossil fuel, pumped storage and conventional hydropower techniques – provide enormous benefits to the local region and the basin as a whole. However, given their impact on the basin's water resources, power companies also have more obligations to promote and honor the public values entrusted to their stewardship. New and existing power facilities should be expected to foster and protect the inherent public rights attached to all waters of the basin.

Probably the largest public values involvement by the Commission came in connection with the relicensing of the four major hydroelectric projects in the lower Susquehanna River in the late 1970s and early 1980s. Leading a consortium of state and federal resource agencies, the Commission advocated several relicensing

planks that would enhance the use and enjoyment of the impounded and upstream reaches of the Susquehanna River including: (1) the installation of fish passage facilities to accommodate restored runs of migratory fish; (2) the installation of a broader range of recreational facilities for swimming, fishing and boating; and (3) the establishment of debris removal programs. Upon future relicensing or proposed license amendments, the Commission anticipates again playing a leading role in addressing critical issues for consideration in proceedings by the Federal Energy Regulatory Commission and through the Commission's own regulatory process.

The Commission is, to a lesser extent, involved in greenways and water trails, riverfront revitalization and other conservation activities. The conservation of natural resources and promotion of recreation have historically been managed and regulated by numerous resource agencies at all levels of government, including the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, U.S. Department of Agriculture's Natural Resources Conservation Service, U.S. Department of Interior's National Park Service, New York State Department of Environmental Conservation, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania's Fish & Boat and Game Commissions, Maryland Department of Natural Resources, county soil and water and conservation districts, and others.

Government, however, is not alone in supporting and meeting the basin's economic development and recreation needs. Many environmental, conservation, sporting and business interests are actively involved in their respective areas of conservation and tourism, including Trout Unlimited, The Nature Conservancy, the Audubon Society, regional and local conservancies, watershed associations, recreational outfitters and chambers of commerce.

3. Future Direction

The Susquehanna basin's largely water-rich resources and forested and rural settings offer abundant opportunities for continued growth in tourism and recreation. The Commission and other governmental agencies and nongovernmental agencies will need to be vigilant to balance the needs of the environment while promoting sustainable development and growth. Future actions should include a prioritization toward minimizing the footprint of new development by revitalizing depressed or abandoned areas and discouraging development in headwater areas. There should also be incentives for wastewater reuse, conjunctive water uses and reductions in the use of impervious covers.

With regard to power facilities:

- Hydroelectric facilities in their relicensing processes with the Federal Energy Regulatory Commission should be required to enhance recreation, including boating opportunities, fishery access, and portage provisions and other navigational facilities.
- Thermoelectric facilities should be required to evaluate the costs, benefits, trade-offs and drawbacks of various cooling techniques, including the use of wet cooling towers, once-through cooling and dry cooling. They should fully evaluate options for providing consumptive use mitigation.
- The design and location of new power facilities should consider the role, value, benefits and relative worth of open space, historic sites, scenic vistas, wild and scenic stream reaches, and other natural amenities. Impacts on public rights in streams and streambeds should also be carefully reviewed and minimized.

F. Emerging Contaminants

1. Background

Emerging contaminants consist of a wide variety of materials that are largely unregulated and often have environmental effects that are poorly understood. Unlike traditional pollutants such as nutrients and metals, water quality standards for these contaminants generally do not exist. Emerging contaminants include human and veterinary drugs, antibiotics, hormones, steroids, plastics, some pathogens, antioxidants, fire retardants, disinfectants, fumigants, fragrances, cosmetics, pesticides, and other chemical compounds that are often present in water at very low concentrations – often at several parts per billion, parts per trillion, or less. The ability to detect emerging contaminants is increasing as laboratory analytical methods become more sensitive.

Some emerging contaminants, such as pharmaceutical products, are taken internally by humans and animals and subsequently excreted in feces and urine. They can eventually travel to surface water or groundwater through wastewater treatment plant discharges, combined wastewater overflows, septic system discharges, landfills, animal waste lagoons, and through animal manure and biosolids (wastewater treatment plant sludge) applied to the land. In addition to being present in water, some emerging contaminants are found in bottom sediments of rivers, lakes, and streams. Some bioaccumulate in the tissue of aquatic life over the long term and can be passed through aquatic food webs.

Some emerging contaminants were designed to affect the human hormone system, and are suspected of causing harm to reproduction in aquatic life. Increased public interest has been generated due to reports of intersex fish (males with female reproductive organs) in many areas, including the Potomac River Basin, which is near the Susquehanna.

Other emerging contaminants were developed to treat disease organisms. The production and use of antimicrobial products has increased significantly during the past decade, and new risks are developing in creating strains of antibiotic-resistant bacteria in the environment.

The risks to aquatic life and humans are uncertain, and the list of emerging contaminants being produced and released into the environment is increasing. Most sewage treatment plant systems are not equipped to remove emerging contaminants, and removal methods are often expensive, poorly known, or otherwise infeasible.

2. Management Activities

The USEPA has devoted increased attention to monitoring for emergent contaminants and determining their fate and effects on aquatic life and human health. The USEPA's Office of Water has performed studies of emerging contaminants in fish tissue, wastewater treatment plant effluent and sludge, and biosolids applied to land. The USEPA's Office of Research and Development has prioritized research to develop new analytical methods, improved waste treatment, endocrine disruptor screening, and new approaches for monitoring.

The USGS also has been involved in emerging contaminant issues and has performed increased monitoring for such contaminants in recent years. During the Commission’s 2000 Sediment Symposium, USGS staff reported the presence of antibiotic resistant bacteria from sediments obtained from behind Conowingo Dam on

the lower Susquehanna River. Bacteria from all sampling sites were resistant to penicillin and ampicillin at the concentrations used for analysis.

New York, Pennsylvania, Maryland, the Commission, and several other interstate commissions are members of the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), which has expressed growing concern over the broad issue of emerging contaminants. Both ASIWPCA's Monitoring and Standards Task Force and its Research Task Force have identified emerging contaminants as priority issues. Commission staff participates in ASIWPCA conference calls and meetings related to emerging contaminants and assist in coordinating this issue with the Commission's member jurisdictions.

3. Future Direction

Emerging contaminants were discussed in Priority Management Area B - Water Quality, which includes the goal of monitoring and assessing the biological, chemical, and physical quality of the waters of the basin to support restoration and protection efforts. One of the actions needed to accomplish this goal is to perform increased monitoring and assessments for bacteria and emerging contaminants of concern. Emerging contaminants were also discussed under Priority Management Area D – Ecosystems.

Additional research is also needed to determine both the ecological and human health effects associated with the many emerging contaminants presently known, and considerably more effort is needed to keep pace with the host of new compounds being invented and marketed to the public. For example, Johns Hopkins University has reported that at least 1,500 new antimicrobial products have been developed since the year 2000, with production increasing and no benefits from their use being provided to the average consumer (2005 Food and Drug Administration panel).

Additional information needs to be provided to the public regarding the extent and effects of emerging contaminants, as well as safe methods of treatment and disposal.

G. Energy Production

1. Background

a. Electric Power Production

The generation of electric power figures prominently in the Susquehanna River Basin. The basin's water resources have long been an integral part of any power project, whether it's the need for process water, water for cooling purposes or the use of water to turn turbines. Given the large quantities of water needed for the various processes, such projects have the potential to impact the basin's water resources.

Base load steam generating plants such as nuclear and coal-fired facilities, which are operated on a relatively constant basis, are the largest generators of power in the basin and consume the highest quantities of water, exceeding an average of 100 million gallons per day in a typical year. They require a means of dissipating massive amounts of rejected heat. Most utilities would prefer the use of "once-through" cooling systems for heat dissipation, but limitations in volume of available flow and heat absorption capacity of receiving waters often dictate the use of "closed-loop" cooling systems. Such systems are usually characterized by natural draft wet cooling towers, which require a source of water to replace evaporative losses (consumptive uses). Where once-through cooling is available, the thermal input has the net effect of raising the temperature of the receiving body of water but results in a relatively low loss of water due to evaporation onsite, although evaporation continues from the water surface until the discharge reaches ambient temperatures.

The other major type of generating facility in the basin is hydroelectric power plants. While no water is withdrawn or consumed at these facilities, they are not without impacts to water resources, particularly ecological effects and issues related to the manipulation and modification to natural flow regimes. The Compact requires the Commission to fully review and regulate hydroelectric facilities in the basin for the purpose of assessing and mitigating impacts to habitat, fish migration, low flow alteration and water availability to other water users.

Recent developments at the federal level are also having implications for the basin's water resources. New emissions rules have prompted the owners of many coal-burning plants to consider the installation of air scrubbers, which can consumptively use several million gallons per day of water in their operations. Also, the January 2007, ruling by the U.S. Court of Appeals for the Second Circuit concerning the USEPA 316(b) regulations has many plant operators contemplating the need to implement cooling towers to reduce river withdrawals and impacts to fish.

b. Natural Gas Extraction

Strong interest exists in the potential to extract natural gas from a geologic formation that underlays much of the basin and is suspected to contain the resource but is as yet largely unexplored. Recent developments in fuel costs and drilling techniques have increased the possibility that natural gas in the Marcellus and other shales is now more economically accessible than in the past. The occurrence of Marcellus shale is widespread in the basin as shown in Figure 17. Because of the low permeability of the shale, horizontal drilling combined with a fracturing process using the injection of high-pressure water, called hydrofracturing, is necessary to access the gas. Unlike most traditional water withdrawal and use projects, the use does not occur at the site of the withdrawal, and multiple drilling sites can be served by many discrete withdrawals. Rather than a continuous withdrawal, intermittent and short-term withdrawals are conducted to accumulate the water needed for a hydrofracturing job.

Based on communications with gas companies, land owners and mining agencies, Commission staff expects the demand for water associated with gas extraction to be extremely active. Preliminary estimates suggest that the total annual quantity of water consumptively used for hydrofracturing will be approximately 30 million gallons per day, roughly equivalent to water use by a coal-fired power plant but less than the water used by all the golf courses in the basin.

In order to efficiently evaluate numerous requests and accommodate the needs of the companies with respect to timely review and response, the Commission has acted responsively by adopting review protocols and rules that encourage conservative approaches, direct withdrawals to viable sources, and limit withdrawal rates to sustainable levels. This effort has and will continue to require considerable expenditure of Commission staff resources not only to assess proposed water withdrawal locations, but also to ensure compliance by the gas extractors and water providers with project docket conditions. In addition to the withdrawals and consumptive water uses related to hydrofracturing and drilling, there is likely to be the need to review associated activities such as the construction of gas storage facilities and the hydrostatic testing of newly constructed pipelines for transport of the extracted gas.

In developing review protocols, staff worked closely with allocation, water quality, stormwater, and mining personnel in the member jurisdictions to ensure a coordinated approach. The outcome is such that the role of the Commission is to direct companies to viable sources based on hydrologic analyses of streams and to impose restrictions as necessary. The Commission will require in its withdrawal and consumptive use approvals that gas companies acquire all necessary permits and comply with all requirements of member jurisdictions with respect to stormwater management, wastewater disposal, and site construction. The Commission has taken a proactive role in identifying potential sources for withdrawal, including streams, public water supplies, reservoirs and mine pools and quarries, and will continue to do so.

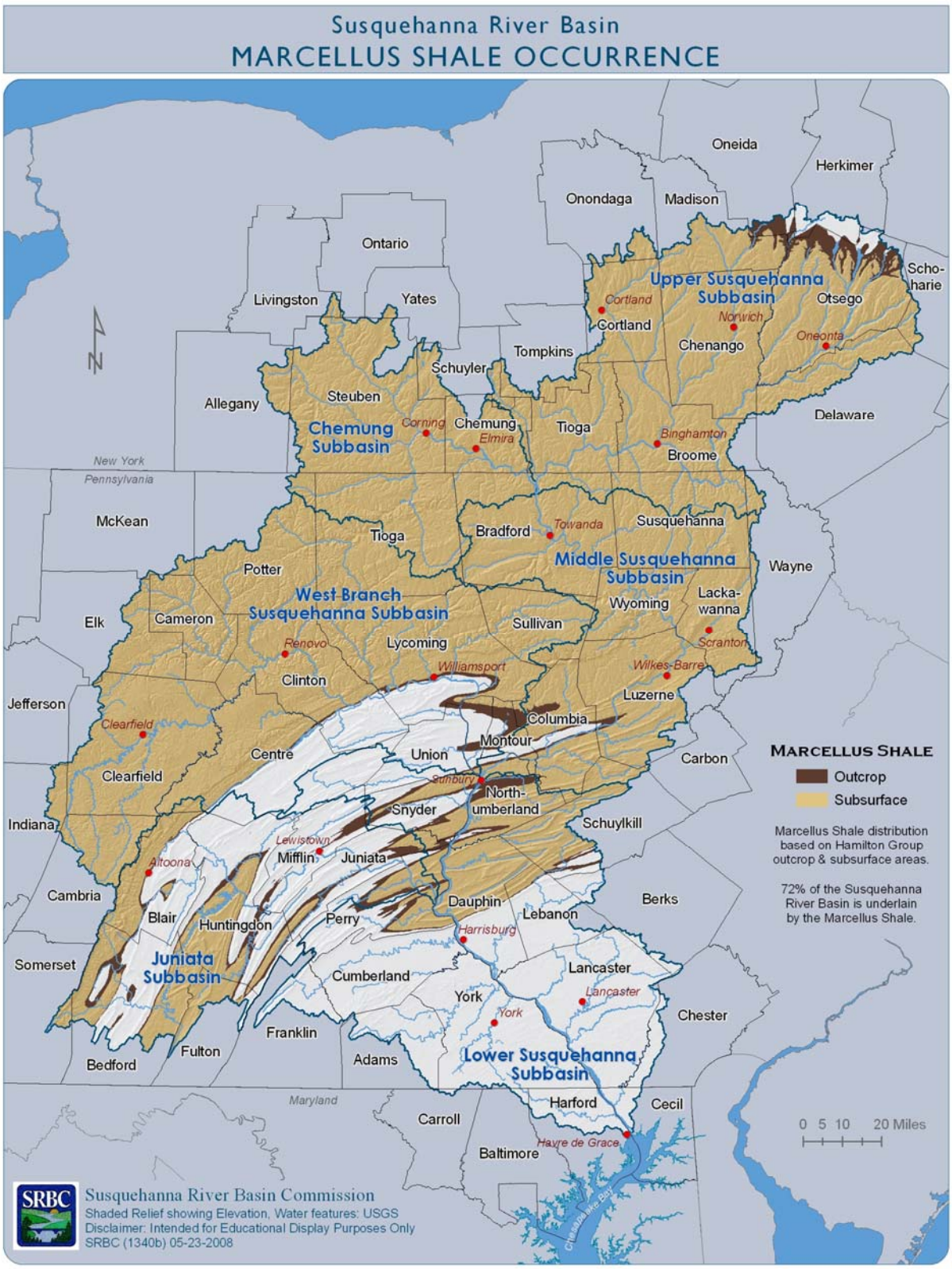


Figure 17. Marcellus Shale Occurrence

The objective of the Commission is to balance the important economic incentive to accommodate requests as efficiently as possible without sacrificing quality of the review and without subjecting water resources to undue impact. The Commission views energy development in the basin as extremely important, but there is a diligent effort to incorporate review of water use for gas extraction into the existing regulatory program without adversely impacting the review of other water use projects.

2. Management Activities

The power generation industry, as a whole, already accounts for the majority of the water withdrawal and consumption in the basin. Three nuclear power plants and PPL's coal-fired plant at Montour are among the largest Commission-approved consumptive water users in the basin; only the diversions by the City of Baltimore and Chester Water Authority for public water supply are larger. In 2005, for example, the four aforementioned base load plants were responsible for more than 50 percent of all the water consumed by regulated projects in the basin. The bulk of consumptive use at these power facilities is for cooling through cooling towers. There are also several coal-fired plants that employ once-through cooling. While this form of cooling consumes much less water, it requires very large surface water withdrawals and is associated with significant thermal discharges.

Because of the relative quantity of consumptive water use associated with power production and the concentrated local impacts, flow augmentation is generally needed to compensate for consumptive use by base load and peaking steam-generating power generation facilities during low flow periods.

Finally, the federal licenses on several hydroelectric plants on the lower Susquehanna River are set to expire in 2014; under consideration for renewal will be the impacts that the 100-year history of the dams has had on the Susquehanna River and its migratory fish species.

3. Future Direction

The Commission must remain aware of trends in power development at existing and planned facilities and their potential impact on the basin's water resources. Specifically, issues include the quantity and method of heat dissipation, the water resource requirements for generation processes, and the water-related ecological effects of each proposed project. Different types of generation facilities will present different challenges related to these issues.

The Commission recognizes the potential in the basin for growth in electric power generation and is aware of the power industry's interest in using this potential. The emphasis on ethanol-based energy as well as interest in new coal and nuclear units has led to proposals for additional power generation facilities in the basin. There are also opportunities for expansion at existing facilities such as power uprates at nuclear facilities and modifications to install cooling towers and flue-gas desulfurization at coal-fired plants. Finally, potential natural gas exploration and extraction could have implications over large portions of the basin. By 2025, total consumptive water use associated with power initiatives in the basin could double to nearly 350 million gallons per day.

Significant capital investment and resources – natural and financial resources – are employed in the planning, design, construction and operation of power generation facilities. Considering the heavy reliance on power and the large consumption of the basin's water resources, it is appropriate that the Commission also plan to allocate significant resources to the review and oversight of power generation. In addition to reviewing proposed facilities, staff will need to coordinate with state and federal environmental and energy agencies and devote time for thorough monitoring and planning.

H. Flood Forecast and Warning

1. Background

As discussed in Priority Management Area C - Flooding, the Susquehanna River Basin is one of the most flood prone watersheds in the nation and experiences on average $150 million of damages every year (in 2006 dollars). The basin's topography and geography leave it vulnerable to tropical weather systems, intense thunderstorms, snowmelt and ice jams, and rapid surface water runoff. More than 80 percent of the basin's 1,400 communities have residents in flood-prone areas.

In February 1985, a report entitled *Proposed Flood Forecasting System Improvement Program* recognized the limited ability of structural flood control measures to reduce flood damages in the basin and stated justification for improving flood forecasting and warning. In response to this report, the Commission coordinated formation of a new interagency committee and partnership that initiated an enhanced flood warning system that continues to operate today as the Susquehanna Flood Forecast and Warning System (SFFWS). The SFFWS is maintained and administered by the Interagency Committee on the SFFWS, also coordinated by the Commission. Other key members of the committee include the National Weather Service (NWS), USGS, USACE, and New York, Pennsylvania and Maryland state emergency management and environmental agencies, as well as Pennsylvania's community and economic development agency.

The mission of the SFFWS is to provide timely and accurate forecasts and warnings to help save lives and reduce property damages during basin floods. The SFFWS is a state-of-the-art, technological system comprised of radar and a network of stream and rain gages. The data provided by the system are used by NWS to forecast river levels and issue timely and accurate early warnings to businesses, communities and emergency managers. In turn, the emergency management officials use the warnings to make decisions regarding actions residents and businesses vulnerable to flooding should take to protect themselves and their properties. See Figure 18 for locations of current river forecast points and stream and rainfall gages in the basin.

The SFFWS is extremely cost-effective, with an estimated benefit-cost ratio of 20-to-1. For every federal dollar invested in the SFFWS, $20 is saved through reduced damages and reduced federal flood recovery payouts. The system helps save lives and reduces average annual flood damages by $32 million.

2. Management Activities

The Commission serves as a liaison between the members of the Interagency Committee and the residents and communities of the basin. In addition to coordinating the annual committee meeting and the annual budget, Commission staff strives to provide outreach and education to basin residents and to maintain lines of communication between the forecasters and the customers who rely on the forecasts. Based on input from the partners and emergency managers, the Commission periodically coordinates a program of system improvements and leads the effort to secure the necessary funding to implement the recommendations.

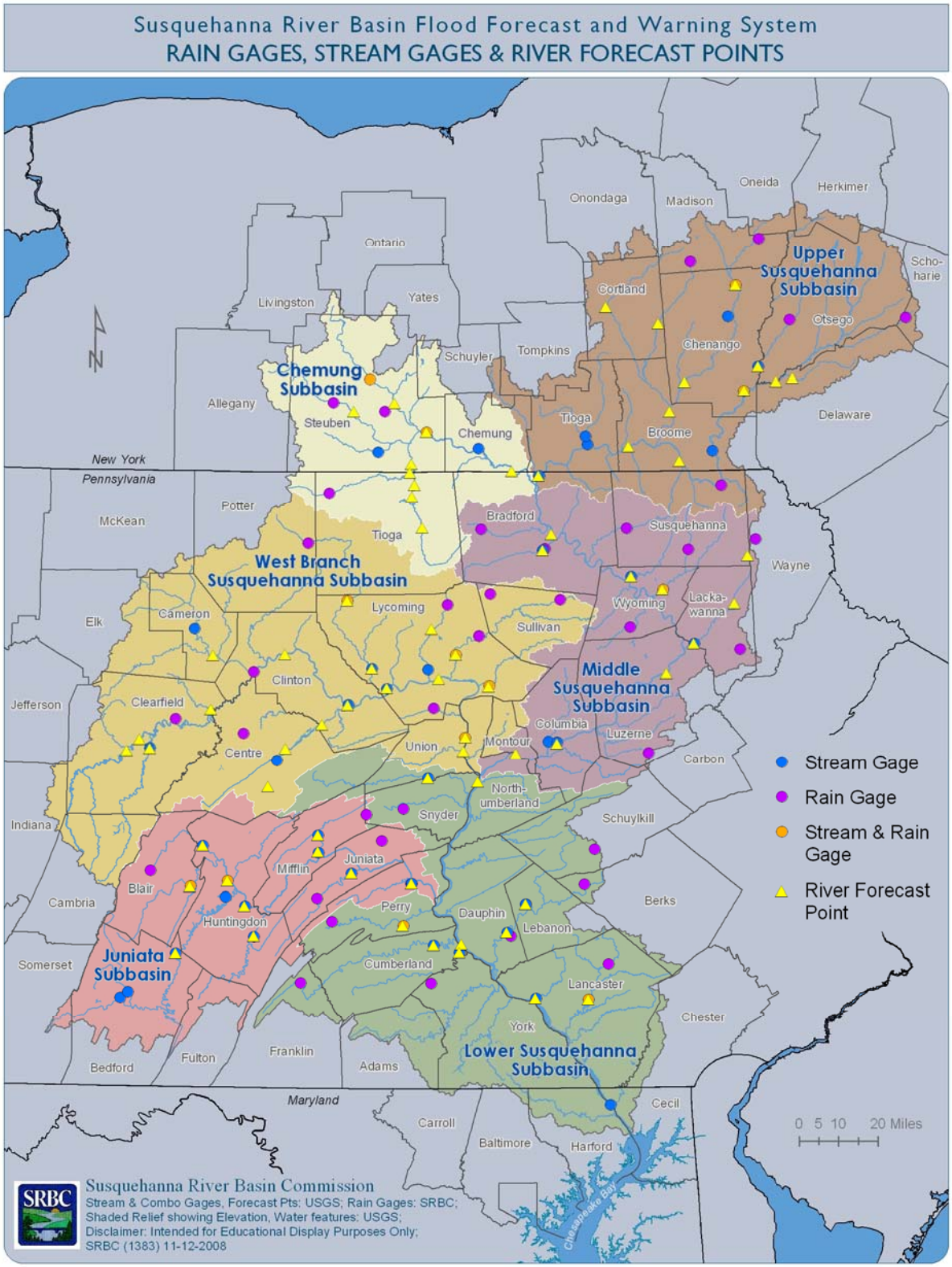


Figure 18. Gages and Forecast Points

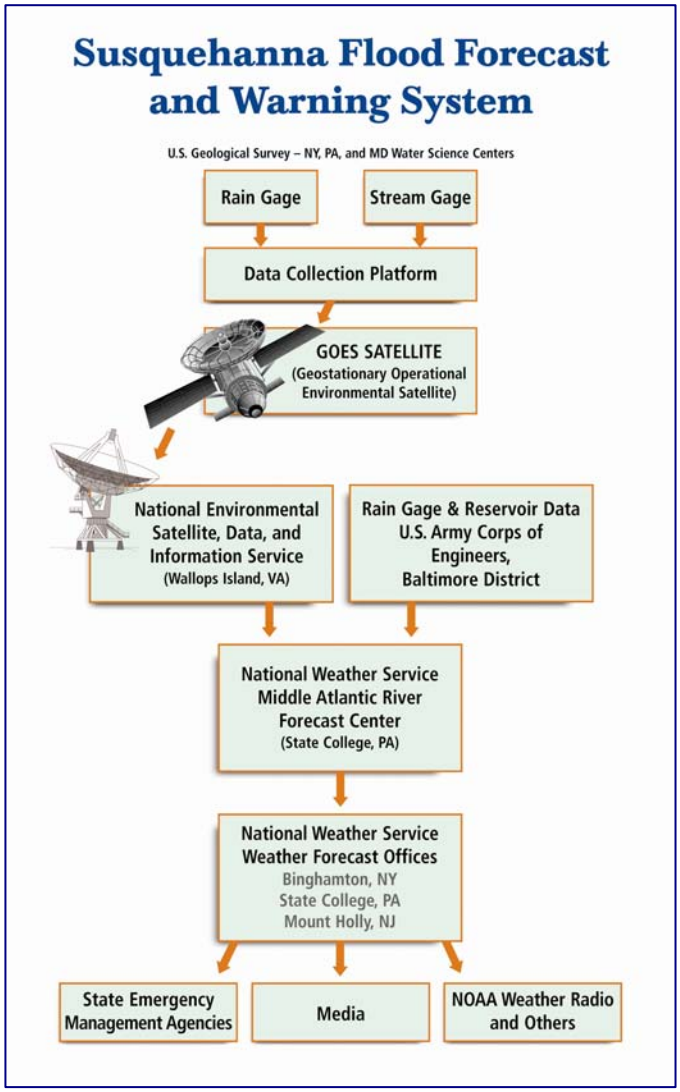
A recurring theme since initial system implementation has been the struggle to ensure adequate annual funding for maintaining the existing system and for continuing improvements to it. Each year, difficult decisions are made with respect to allocating limited funds among competing needs. The program has managed to continue to operate through cooperative efforts at cost-cutting measures and compromises, and still maintains a state-of-the-art and cost-effective flood warning system. Consistently reliable annual funding remains the biggest challenge for the system on an annual basis.

June 2006 brought record flooding to several locations in the Upper Susquehanna Subbasin and, as of 2008, is the most recent test of the SFFWS. Evaluation of the SFFWS following this event indicates that in most cases it met the goal of providing lead time for preparedness activities to be activated. There were, however, some shortfalls recognized and efforts were initiated to correct and improve upon those shortfalls, a task that remains ongoing.

3. Future Direction

The SFFWS interagency committee identified the following goals to ensure that the program continues to meet the forecasting and warning needs of the Susquehanna River Basin.

a. Develop and maintain a sustainable, state-of-the-art observation network.
b. Provide as much lead-time and accuracy in forecasts and warnings as practicably possible (the current goal of the SFFWS is to provide at least six hours of advance warnings).
c. Evaluate the spatial distribution of flood damages in the basin and prioritize problem areas.
d. Expand the flood warning system to support other important water resource programs, including public water supply, drought management, and recreation enhancement within the basin.
e. Take advantage of emerging technologies to improve flood warning dissemination.
f. Increase public awareness, support, and use of services available from the National Weather Service.
g. Establish procedures for obtaining dedicated funding for the SFFWS and for managing the funds.



I. Invasive Species

1. Background

As discussed in Priority Management Area B - Water Quality, invasive species can compete with native flora and fauna to upset natural species diversity and aquatic food webs. Invasive species are non-native species that are introduced by humans into waterbodies. They often have few natural predators, enabling them to spread

Zebra mussels

rapidly and colonize areas in very large numbers. Some, such as zebra mussels, can also alter water quality, clog water supply intakes, and affect water contact sports. Effects of invasive species in the basin also have the potential to affect the ecological health of the Chesapeake Bay.

At the end of 2007, zebra mussels were firmly established in Canadarago Lake, Goodyear Lake, and Eaton Brook Reservoir in the New York portion of the basin, and have continued to spread to other areas. During the summer of 2007, adult zebra mussels were first reported in the West Branch Tioughnioga River in New York, Cowanesque Lake in northern Pennsylvania, Otsego Lake (the source of the Susquehanna River) in New York, and in the Susquehanna River downstream as far as Binghamton, New York. Quagga mussels, a closely-related species, have been identified from a small quarry in central Pennsylvania near Raystown Lake.

Priority Management Area B - Water Quality includes the goal of monitoring and assessing the biological, chemical, and physical quality of the waters of the basin to support restoration and protection efforts. Monitoring for zebra mussels and other invasive species is included as an action needed to support that goal. This management area also includes the goal of protecting the quality of the basin's biological resources and sources of public drinking water supply. One of the actions needed to accomplish that goal is to assist in controlling and limiting the spread of aquatic invasive species in the basin and downstream to the Chesapeake Bay.

Priority Management Area D - Ecosystems also relates to invasive species control and includes the goal of performing ecosystem monitoring and assessment to provide data needed for effective watershed management. Additionally, it includes the goal of protecting biological resources throughout the basin and in each of its major subbasins. One of the actions needed to accomplish this goal is to evaluate the potential spread of invasive species when evaluating project review applications for diversions and transfers of untreated water from one waterbody to another.

Northern snakehead
Photo: Phila. Water Co.

Flathead catfish
Photo: PA Fish and Boat Commission

Some of the aquatic invasive species currently known to occur in the basin include zebra mussels, quagga mussels, Asian clam, purple loosestrife, water chestnut, rusty crayfish, and flathead catfish. Species of concern that have not yet been reported in the basin include northern snakehead, bighead carp, and silver carp.

2. Management Activities

The federal government passed the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (amended in 1996), which calls for the development of state nonindigenous aquatic species management plans and provides funding for activities identified in these plans. The 1990 Act also established the Aquatic Nuisance Species Task Force and directed it to encourage the development of regional panels to protect marine and freshwater resources from aquatic nuisance species through coordinated planning and action.

In late 2004, the Commission accepted an invitation from the Aquatic Nuisance Species Task Force to serve on its Mid-Atlantic Regional Panel (later named the Mid-Atlantic Panel on Aquatic Invasive Species, or

MAPAIS). The Panel was established in 2005, meets twice each year, and contains education and outreach, policy, and science workgroups to deal with invasive species issues in the Mid-Atlantic Region. Membership includes representatives from resource agencies in New York, Pennsylvania, Maryland, Virginia, West Virginia, New Jersey, Delaware, North Carolina, and the District of Columbia. Staff members from the U.S. Coast Guard, USACE, U.S. Fish and Wildlife Service, Chesapeake Bay Program, USGS, and National Park Service also belong to Mid-Atlantic Regional Panel, as well as representatives of several trade organizations.

In July 1991, the New York State Legislature passed Chapter 456 of the Laws of 1991 requiring the New York State Department of Environmental Conservation (NYSDEC) to develop a Nonindigenous Aquatic Species Comprehensive Management Plan, which was published in 1993.

In 2004, Pennsylvania Governor Rendell created the Pennsylvania Invasive Species Council to advise the governor and direct development and implementation of a comprehensive invasive species management plan for the Commonwealth. The Council completed the plan in October 2006.

The Commission performs basinwide monitoring for zebra mussels and works with the Mid-Atlantic Regional Panel and its members to help control the spread of invasive species in the basin. Monitoring is needed to identify areas where invasive species exist. Educational materials are provided to the public to help avoid the inadvertent spreading of invasive species from areas where they are present to areas where they are not.

The Pennsylvania Zebra Mussel Monitoring Network was established by the Pennsylvania Department of Environmental Protection shortly after zebra mussels colonized the Great Lakes in the late 1980s. In 2006, responsibility for operating the network was transferred to the Pennsylvania Sea Grant Program, which maintains records of zebra mussel sightings in Pennsylvania and provides educational materials to help prevent the spread of zebra mussels and other invasive species.

The Pennsylvania Sea Grant provided initial training for Commission staff to monitor for zebra mussel adults. Zebra mussel monitoring has been incorporated into the Commission's large river, interstate, and subbasin survey monitoring programs.

3. Future Direction

The Commission and others need to continue to monitor and provide public information regarding the spread of invasive species. GIS mapping of the range of invasives should be performed, and management plans should be updated as new species become established and their ecological effects on native species are better understood.

J. Migratory Fish Restoration

1. Background

Migratory fish include both anadromous and catadromous species. Anadromous fish, such as American and hickory shad, blueback herring, and alewife, spawn in fresh water, with the juveniles migrating to brackish or salt water to grow and mature into adults. American eel, the only catadromous species in the basin, spawns in deep

waters of the Sargasso Sea near Bermuda. Young American eels ride the Gulf Stream north and enter rivers on the east coast of North America, where they grow and mature into adults.


American shad

In addition to the recreational, economic, and environmental benefits associated with migratory fish restoration, it is also one of the most readily recognized connections between the Susquehanna River and the Chesapeake Bay. Migratory fish restoration has a broad base of support, including angling and environmental organizations, power companies, resource agencies, and other partners in the Chesapeake Bay restoration effort.

Priority Management Area D - Ecosystems discusses the importance of restoring populations of migratory fish such as American shad, hickory shad, blueback herring, alewife, striped, bass, and American eel to the Susquehanna River system, and identifies several actions needed to support that goal.

2. Management Activities

Modern efforts to restore migratory fish to the Susquehanna River system began in the 1950s, when the U.S. Congress appropriated funds to study the potential to restore shad fisheries in the basin. Pennsylvania anglers and the Pennsylvania Fish Commission (now the Pennsylvania Fish and Boat Commission or PFBC) played a major role in persuading Congress to make this appropriation. Utility companies with dams on the lower Susquehanna River provided additional funding for studies to determine the migratory response of shad placed above dams, the suitability of the Susquehanna River for shad reproduction and survival, and the engineering feasibility of providing passage for shad over high dams.

Migratory fish restoration activities in the basin were a cooperative venture from the start. In 1963, the Pennsylvania Fish Commission, Maryland Board of Natural Resources (now the Maryland Department of Natural Resources or MDNR), the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Fish and Wildlife Service (USFWS) organized the Administrative Committee for shad studies on the Susquehanna River. In 1969, the Administrative Committee reorganized as the Susquehanna Shad Advisory Committee to begin the process to rebuild stocks of American shad and provide fish passage at dams. The Advisory Committee included both policy and technical subcommittees. In 1970, the resource agencies and power companies reached a settlement agreement that called for the Philadelphia Electric Company (now Exelon) to build an experimental fish lift on the west side of Conowingo Dam.

In 1976, the Advisory Committee changed its name to the Susquehanna River Anadromous Fish Restoration Committee (SRAFRC) to reflect its goal of restoring all anadromous fishes. SRAFRC included power utilities, which funded development of the Van Dyke Hatchery for juvenile shad production near Thompsontown, Pa., along the Juniata River. PFBC staff has operated the hatchery since its establishment and rear juvenile shad for release in the river system in Pennsylvania and New York State. The fish are marked with tetracycline dye prior to stocking, and studies are performed to determine the percentages of hatchery versus stocked fish returning to the basin. Surveys also are performed to determine the relative abundance of juvenile shad passing downstream through the river system to tidewater in the fall of the year.

The west fish lift at Conowingo Dam was initially used to trap adult shad for transport above the four power dams on the lower Susquehanna River. However, trap and transfer operations ceased in the 1990s after the construction and operation of the larger capacity east lift at Conowingo Dam, lifts at Holtwood and Safe Harbor Dams, and a fish ladder at York Haven Dam. The west lift is still used for various research activities, as well as collection of adult American and hickory shad eggs to support hatchery operations.

In 1995, the SRAFRC changed its name to the Susquehanna River Anadromous Fish Restoration Cooperative (acronym remained unchanged). An organizational charter was developed and signed by PFBC,

MDNR, NYSDEC, USFWS, as well as the National Marine Fisheries Service and the Susquehanna River Basin Commission. SRAFRC continues to work in cooperation with the power companies, although they are no longer official SRAFRC members.

Pennsylvania has provided strong support for migratory fish restoration activities, including continuing operation of the Van Dyke Hatchery and the removal of small dams to promote fish passage. NYSDEC has provided personnel to stock juvenile shad in New York waters and has actively promoted fish passage around existing dams. The migratory fish restoration effort on the Susquehanna River is a recognized component of the Chesapeake Bay Program, which has prioritized restoration of the Bay's living resources.

SRAFRC considers American eel to be a species of special interest and plans to address both upstream and downstream eel passage in SRAFRC's updated migratory fish management and restoration plan for the Susquehanna River Basin, as mentioned under Priority Management Area D – Ecosystems. The Commission's regulatory activities associated with water withdrawals, consumptive use, and resource protection also relate to migratory fish passage, and are discussed under Priority Management Area A - Water Supply.

3. Future Direction

In 2007, PPL Holtwood filed an application with the Federal Energy Regulatory Commission to amend its license to operate Holtwood Dam. The Commission needs to remain active in SRAFRC and in relicensing activities for all of the four major power dams on the lower Susquehanna River, and to promote passage of shad at these and other dams in the Susquehanna River Basin. Increased effort is needed to provide both upstream and downstream passage for river herring and American eel throughout their historic range in the basin, and to promote the significant recreational and economic benefits associated with migratory fish resources.

K. Potentially Stressed Areas and Water Challenged Areas

1. Background

The Commission has identified eight Potentially Stressed Areas within the Susquehanna River Basin. In these areas, the demand for and use of water resources are potentially approaching or have exceeded the sustainable limit. Several areas with intrinsically low available water resources, termed Water Challenged Areas, have also been identified. The procedures for identifying Potentially Stressed Areas and Water Challenged Areas are tools developed by Commission staff for the review of projects as part of its regulatory program. (Also discussed in the Water Supply priority management area and Part III.)

c. Potentially Stressed Areas – The Commission has defined the sustainable limit as the average annual base flow (recharge) available in the "local" watershed during a 1-in-10-year average annual drought. That is, the amount of water withdrawn annually should only exceed the average amount of water recharge on an average of once every 10 years. Water users draw water from groundwater storage to meet their needs during the drought years, and the groundwater system is allowed to recover (storage refills) during the intervening years. The choice of the 1-in-10-year drought recharge standard is a compromise among considerations related to resource conservation, environmental needs, sustainable growth and development, and the need for adequate (and often expensive) constructed water storage facilities.

Potentially Stressed Areas generally meet two or more of the following criteria:

- Diminished yields
- Declining water levels
- Diminishing stream or spring flows
- Expanded dry stream reaches
- A water budget analysis indicating that withdrawals within a groundwater basin exceed the recharge during a 1-in-10-year average annual drought
- Known withdrawals for rapidly developing areas exceeding 50 percent of the recharge during a 1-in-10-year average annual drought

d. Water Challenged Areas – Water Challenged Areas have natural conditions that strongly limit the amount of water resources available and will support very little water resource development. As such, these areas should be identified for potential applicants and be actively managed.

2. Management Activities

a. Potentially Stressed Areas – Using the criteria described above, the Commission identified eight Potentially Stressed Areas. As of 2008, they are:

- Corning Area, Steuben County, N.Y.
- Manheim/Lititz/Ephrata Valley, Lancaster County, Pa.
- Pennsylvania Fruit Belt, Adams and York Counties, Pa.
- Hanover Area, York County, Pa.
- Hershey Area (Spring Creek Basin), Dauphin and Lebanon Counties, Pa.
- Fredericksburg Area, Lebanon County, Pa.
- Roaring Spring Area, Bedford and Blair Counties, Pa.
- State College Area, Centre County, Pa.

Many of the Potentially Stressed Areas share characteristics such as rapid growth in development, low yield aquifers, and concentrated water uses. Project applications submitted for review that are located in Potentially Stressed Areas receive a greater degree of scrutiny from the Commission. The requests for withdrawal may be denied, approved at a lesser quantity than requested, or an approval may include requirements such as water level monitoring, streamflow monitoring, water table mapping, development of a water resource management plan, and/or development of a mitigation strategy such as relocating a discharge location. The additional information is used to provide a clearer picture of the available water resources and allow additional steps to be taken to mitigate potential adverse or cumulatively adverse impacts from the withdrawal, as needed.

b. Water Challenged Areas – The Commission has identified two as of 2008, and they are the diabase areas and the Bonneauville Shale Belt. Upon further assessment, it is likely that additional areas, particularly those underlain by shale, will be classified as water challenged, although perhaps not as severely as the diabase areas and Bonneauville Belt.

- Diabase areas - Found in a narrow band stretching from Adams County through York, Dauphin, Lancaster and Lebanon Counties and into Berks County, these areas are marked by one of the lowest yielding aquifers in the Susquehanna basin. The diabase areas are poorly suited to agricultural, commercial, residential, and industrial uses, and as a result are largely undeveloped. However, as undeveloped land becomes scarce in high growth areas, the diabase areas are coming under substantial development pressure.

- Bonneauville Shale Belt - The material in this Adams and York County formation has very low permeability. Well yields are extremely low, even for residential use. Stream base flows are also very low.

3. Future Direction

Development pressures are not likely to decline in the Susquehanna River Basin, and thus the Commission should anticipate the emergence of additional Potentially Stressed Areas. As resources allow, the Commission should assess other regions of the basin with unfavorable water availability and make determinations about their characterization as Water Challenged Areas. Coupled with the uncertainty of future hydrologic conditions due to the effects of climate change, management of these areas has the potential to demand significant Commission resources.

In addition to monitoring and identifying potentially stressed and water challenged areas, the Commission will want to consider using another tool provided by the Compact – the designation of special protected areas. As conditions develop, some of the aforementioned areas may warrant such a designation, along with the protection standards that accompany it.

Commission policies and activities designed to avoid the creation of stressed areas and emphasize sustainable water use are detailed in Priority Management Area A – Water Supply.

L. Water and Wastewater Infrastructure

1. Background

Much of our nation's water and wastewater infrastructure was constructed during the 30 years following World War II. Wastewater treatment plants typically have a useful life of 20-50 years until they need renovation, while underground pipes can last from 15 to over 100 years, depending on the type of material from which they are constructed and the environment into which they are placed.

Aging water and wastewater infrastructure threatens the long-term quality of water in streams, rivers, lakes, and groundwater in the basin. The USEPA estimated that nationwide, the funding gap for infrastructure needs for the period 2000-2019 was $122 billion for wastewater costs and $102 billion for water supply. In 2002, the American Waterworks Association estimated that costs of replacing drinking water infrastructure may be as high as $6,900 per household in some small towns.

Water is often under-priced by municipal systems in an effort to keep user rates low. Problems arise when the condition of existing infrastructure erodes, and when systems are unable to meet increased water supply or treatment demands.

Ensuring adequate funding for continued dam safety and required rehabilitation also are important. Unsafe dams are a public safety issue, and inspections must be performed on a regular basis. Several state-owned facilities in the basin have been lowered due to safety concerns and lack of rehabilitation funding, thereby reducing their recreational potential and water storage capability.

Adequate funding is also required for maintenance of an effective system to provide long-term, uninterrupted stream gage records. Stream gage records are needed for flood, drought, and consumptive water use management, as well as monitoring, assessment, restoration, and protection activities in both the Basin and Chesapeake Bay. The existing gaging network should be expanded rather than reduced to support research and management activities associated with climate change.

Priority Management Area A - Water Supply includes the goal of ensuring sustainability of water sources by improving systems and managing water resources more efficiently. One of the Commission's ongoing activities is to support and coordinate efforts of member jurisdictions in oversight of public water suppliers to incorporate system improvements, including multiple sources, metering and pricing, recycling, and other conservation practices.

Priority Management Area B - Water Quality includes the goal of developing, supporting, and implementing plans and projects for the remediation and enhancement of water quality in the basin. One of the action items listed under this goal is to encourage public and private support, maintenance and upgrades of the infrastructure needed for drinking water withdrawal, treatment and distribution; wastewater collection and treatment; on-lot septic treatment; stormwater management projects; combined wastewater overflows; sanitary septic overflows; and other projects needed for the maintenance and improvement of water quality. Another goal in Priority Management Area B promotes the use of green infrastructure.

Both Priority Management Areas A and B discuss the importance of an adequate stream gaging system. Priority Management Area F - Coordination, Cooperation, and Public Information contains action items related to stream gages under Goal d.

Priority Management Area C - Flooding also discusses infrastructure needed for adequate flood protection and stormwater management.

2. Management Activities

USEPA performs periodic reviews of infrastructure needs for the nation's water utilities. Reports on infrastructure needs are published and made available on the USEPA website. USEPA prepares its Drinking Water Infrastructure Needs Survey and Assessment to Congress on a periodic basis. USEPA's Office of Wastewater Management conducts its Clean Watersheds Needs Survey every four years in partnership with states, territories, and the District of Columbia.

In light of growing infrastructure concerns, USEPA developed a sustainable infrastructure initiative, which promotes sustainable practices to help reduce the gap between funding needs and spending at national and local levels. The initiative stresses four pillars of sustainable infrastructure; namely, (1) better management of utilities, (2) full cost pricing, (3) efficient water use, and (4) watershed approaches to resource management. USEPA also is promoting green infrastructure associated with transportation and in helping to manage wet-weather events, and is promoting water use efficiency to help alleviate additional infrastructure demands.

The federal Safe Drinking Water Act (amended in 1996) established the Drinking Water State Revolving Fund to help finance infrastructure improvements for drinking water. With passage of amendments to the Clean Water Act in 1987, the federal Construction Grants Program was replaced with the Clean Water State Revolving Fund. The Clean Water State Revolving Fund was intended to help finance nonpoint source, watershed protection, and restoration projects, as well as municipal wastewater treatment plants. Both funds provide money to states, which in turn, provide loans for infrastructure improvements.

3. Future Direction

Increased efforts are needed to support the maintenance and upgrade of water and wastewater infrastructure in the basin. Federal funding has not met this demand and has in fact decreased, putting additional burdens on state and local governments to meet the infrastructure gap. In the 2006-2008 time periods, federal financial support for water and wastewater infrastructure decreased by nearly half a billion dollars, and additional cuts were proposed for 2009. In response, Pennsylvania Governor Edward Rendell signed a 2008 executive order to focus on finding solutions to Pennsylvania's drinking water and wastewater system needs, including new funding options and non-structural alternatives to capital upgrades, such as nutrient credit trading, water re-use, and conservation.

In New York, statewide funding estimates to meet current wastewater infrastructure needs total approximately $36 billion over the next 20 years. New York published a March 2008 report on wastewater infrastructure needs and has established a Clean and Safe Water Infrastructure Funding Initiative in an attempt to address the infrastructure crisis.

In 2004, Maryland took a major step forward to upgrade infrastructure and protect the Chesapeake Bay when it passed legislation known as the “flush tax,” which established a restoration fund to be supported by a monthly fee of $2.50 included in sewer bills and a $30 annual fee to be paid by septic system owners. The funds collected are distributed to utilities to upgrade wastewater treatment plants. In addition, Maryland published a July 1, 2008, Final Report of the Advisory Committee on the Management and Protection of the State’s Water Resources entitled “Water for Maryland’s Future: What We Must Do Today.”

In addition to the above, USEPA worked in collaboration with the Association of State and Interstate Water Pollution Control Administrators, American Rivers, National Association of Clean Water Agencies, Natural Resources Defense Council, and The Low Impact Development Center to prepare its "Managing Wet Weather with Green Infrastructure Action Strategy 2008." Green infrastructure consists of systems and practices that mimic natural processes to infiltrate, evapotranspirate, or reuse stormwater or runoff on the site where it is generated. Green infrastructure holds much promise for the future, providing both economic and environmental benefits including: (1) cleaner water, (2) enhanced water supplies, (3) cleaner air, (4) reduced urban temperatures, (5) moderation of impacts associated with climate change, (6) increased energy efficiency, (7) source water protection, (8) other community benefits, and (9) cost savings.

The Commission will continue to participate with its member states on an infrastructure workgroup chaired by USEPA, Region III, and will continue to work with its member jurisdictions to address infrastructure issues. The Commission and its member states also will continue to work with USEPA and Association of State and Interstate Water Pollution Control Administrators to coordinate infrastructure issues and promote appropriate infrastructure funding.

M. Relationship of Areas of Special Interest and Priority Management Areas

There is significant linkage between the specific water resource issues embodied in the areas of special interest and the broader priority management areas. For instance, water quality (priority management area) is directly impacted by abandoned mine drainage (area of special interest). Table 7 is a matrix displaying the major linkages. Note that any of the areas of special interest could be a focus for the priority management area of coordination, cooperation and public information.

Table 7. Relationship of Areas of Special Interest and Priority Management Areas

Areas of Special Interest	Priority Management Areas					
	Water Supply	Water Quality	Flooding	Ecosystems	Chesapeake Bay	Coor., Coop. & Publ. Info.[1]
Abandoned Mine Drainage		X		X	X	X
Climate Change	X	X	X	X	X	X
Consumptive Use Mitigation	X	X		X	X	X
Drought Coordination	X					X
Econ. Devel., Recreation, and other Public Values	X	X	X	X	X	X
Emerging Contaminants		X		X		X
Energy Production	X			X	X	X
Flood Forecast and Warning			X			X
Invasive Species		X		X	X	X
Migratory Fish Restoration				X	X	X
Potentially Stressed and Water Challenged Areas	X			X		X
Water and Wastewater Infrastructure	X	X	X			X

[1] Coordination, cooperation, and public information could deal with any of the ASI topics.

PART VI – DESIRED RESULTS, GOALS AND ACTIONS INCLUDED IN THE COMPREHENSIVE PLAN

This part of the Comprehensive Plan presents a summary of the most important information in the Plan, i.e., desired results, goals, and actions. The summary is intended to provide essential information for a good understanding of the Plan's findings.

A. Desired Results and Goals

Part IV of the Comprehensive Plan discusses the desired results, goals and actions for each of the Commission's six priority management areas. The desired results represent a broad objective for successful water resource management in each priority area. A series of defined goals were established to provide measures needed to produce the desired results. Table 6 includes the desired results and goals in the same order as discussed in Part IV.

B. Development of the Actions

The actions necessary to meet goals were developed by the Commission and were designed to be fairly specific and reasonably achievable. They are primarily actions to be taken directly by the Commission with some actions taken by others with the assistance, support and/or encouragement of the Commission. Table 8 on the following page includes the actions that have been listed in the same order as discussed in Part IV.

The development of the actions was done in recognition of ongoing Commission activities that also support the goals established in the Comprehensive Plan. The ongoing activities are presented in Part IV and are also included in Table 8.

Table 8. Summary of Desired Results, Goals and Actions

Priority Management Area A – Water Supply		
Desired Result: To meet immediate and future water needs of the people of the basin for domestic, municipal, commercial, agricultural and industrial water supply and recreational activities, in order to maintain sustainable economic viability, protecting instream uses, and ensuring ecological diversity through regulation and planning.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Support and encourage the sustainable use of water for domestic, industrial, municipal, commercial, agricultural, and recreational activities in the basin	1. Support the sustainable use of water through the Commission's regulatory project review and planning activities, through public education and outreach efforts, and through solicitation of the necessary guidance from the Water Resources Management Advisory Committee. 2. Assess the potential for climate change to impact the hydrology of the basin and the potential implications to the basin's water availability and the occurrence and severity of floods and droughts.	1. Determine water availability through water budget assessments (analysis of demand increases and expected base flow levels) to establish local sustainable limits for water use development. 2. Protect healthy ecosystems and instream flow needs, including recreation. 3. Identify additional Potentially Stressed Areas, address unaccounted-for water in approved projects, and implement the recommendations contained in the 2005 Groundwater Management Plan. 4. Assess potential impacts of increased water use and the potential to temper increases through conservation and water reuse, particularly in Potentially Stressed Areas, and otherwise manage water resources for sustainability. 5. Support efforts by member jurisdictions to safeguard groundwater recharge by preserving recharge contributing areas.
Goal b. Maintain an equitable system for allocating water for various uses, including the protection of instream flows and receiving waters of the Chesapeake Bay.	1. Perform periodic evaluation of the Commission's regulatory program to determine the efficacy and consistency of the program. 2. Evaluate the need for new and amended regulatory requirements and policies.	1. Evaluate Potentially Stressed Areas to determine if special protected status is warranted, for the purpose of preventing or addressing water shortages that would conflict with requirements of the Comprehensive Plan, and to allow sustainable development of water resources in the area.
Goal c. Ensure sustainability of water sources by improving systems and managing water resources more efficiently.	1. Support and coordinate efforts of member jurisdictions in oversight of public water suppliers to incorporate system improvements, including the use of multiple sources, metering and pricing, recycling, and other conservation practices. 2. Encourage conjunctive use of water sources, where appropriate.	1. Review and adjust Commission-approved withdrawal rates, as needed and in accordance with existing regulations, to ensure sustainability and protection of water quality. 2. Encourage and incentivize water conservation by water suppliers, industry and the public through education and application of regulatory requirements.

Priority Management Area A – Water Supply (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal d. Mitigate drought impacts through coordination and use of drought emergency powers.	1. Support drought-related actions of the Commission's member jurisdictions, as appropriate. 2. Implement the Commission's drought emergency powers under Section 11.4 of the Compact, as appropriate.	1. Revise the Commission's Drought Coordination Plan in consultation with the Drought Coordinating Committee.
Goal e. Manage diversions to avoid impacts to the basin's water resources.	1. Evaluate potential impacts of out-of-basin diversions and investigate conjunctive use alternatives in Commission actions; include and enforce protective conditions for approved diversions. 2. Assess potential adverse impacts and benefits of proposed diversions into the basin, including their potential to serve as mitigation water for other diversions or consumptive water use.	1. Periodically review the criteria for review of out-of-basin diversions to ensure that adequately protective standards are in place. 2. Monitor the ecosystem effects of diversions of water to and from the basin and transfers of water from one waterbody to another within the basin, including water quality requirements.
Goal f. Manage consumptive water use to mitigate impacts to the basin's water resources.	1. Monitor consumptive water use in the basin and periodically revise projections for increased needed mitigation. 2. Periodically review consumptive water use fees paid to the Commission to ensure that this mitigation option is commensurate with the real costs of acquiring and managing sources of mitigation.	1. Implement recommendations of the Commission's Consumptive Use Mitigation Plan (see Part V-C). Key recommendations include, among others: a) the evaluation of existing U.S. Army Corps of Engineers and other reservoirs for the potential to enhance current release operations; b) the evaluation of the ability of abandoned mines and quarries to supply water for releases during droughts; and c) the assessment of specific needs for instream flows to meet riparian, water supply, water quality, habitat and recreational uses. 2. In the absence of adequate water for local mitigation, restrict new water use to avoid impacts to vulnerable watersheds.

Priority Management Area B – Water Quality		
Desired Result: To support the designated uses of all water bodies by achieving water quality that meets or exceeds standards.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Support and coordinate the efforts of the Commission's member jurisdictions in managing the basin's water quality.	1. Review and seek interstate compatibility of impaired waterbody listings, TMDL development activities, and point and nonpoint source pollution control activities. 2. Coordinate basinwide water quality activities through the Commission's Water Quality Advisory Committee as well as state and interstate advisory committees and workgroups. 3. Consider physical, chemical, and biological water quality impacts during the regulatory review of applications for water withdrawals and consumptive water uses.	No new actions recommended under this goal.
Goal b. Monitor and assess the biological, chemical, and physical quality of the basin's waters to support restoration and protection efforts.	1. Maintain and improve (a.) core monitoring and assessment activities such as the Commission's subbasin survey, interstate streams, and large river assessment programs; and (b.) monitoring and data analysis to support Chesapeake Bay restoration activities. 2. Perform assessments under Section 305(b) of the Clean Water Act, and provide the results to USEPA, the Commission's member states, and the public.	1. Monitor and assess waters for bacteria, pharmaceuticals and personal care products, and other emerging contaminants of concern. 2. Monitor for zebra mussels and other invasive species. 3. Expand the Commission's Early Warning System for public water suppliers in the basin.
Goal c. Develop, support, and implement plans and projects to remediate and enhance the basin's water quality.	1. Support the Commission's member jurisdictions in controlling discharges from point and nonpoint sources, including upland activities.	1. Develop, support, and implement remediation plans for areas of the basin that are impacted by AMD, agricultural, urban, and other sources. 2. Encourage public and private support, maintenance, and upgrades of the infrastructure needed for drinking water withdrawal, treatment, and distribution; wastewater collection and treatment; on-lot septic treatment; stormwater management projects; combined sewer overflows; sanitary septic overflows; and other projects needed for the maintenance and improvement of water quality.

Priority Management Area B – Water Quality (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal c. (cont.)		3. Promote the use of green infrastructure and stormwater management approaches that mimic natural hydrologic regimes and promote water use efficiency in combination with Action 2 above. 4. Encourage and support restoration planning as follow-up to the Commission's Year-2 subbasin surveys and TMDL development activities for waterbodies impaired by AMD, urban, agricultural, and other nonpoint sources, with the goal of removing impaired waterbodies from state lists established under Section 303(d) of the Clean Water Act. 5. Seek water quality improvements to complement water quantity mitigation provided for water withdrawal and consumptive water use projects.
Goal d. Protect the quality of the basin's biological resources and sources of public drinking water supply.	1. Encourage the protection of threatened and endangered species and natural biological diversity in the basin. 2. Support further research on the effects of climate change on water quality in the basin, and support efforts to mitigate those effects. (See related climate change ongoing activity under Goal a. for Water Supply priority management area.)	1. Identify waterbodies with exceptionally high quality water, habitat, and biological resources, based on monitoring results. 2. Provide increased protection for headwater areas and watersheds with existing good water quality. 3. Provide educational materials regarding the spread of aquatic invasive species in the basin and downstream to the Chesapeake Bay. 4. Develop regional source water protection plans for drinking water supply systems. 5. Establish a Susquehanna Source Water Partnership to work with public water suppliers and other stakeholders to protect drinking water supplies.
Goal e. Organize, maintain, and distribute water quality data to facilitate basinwide water quality improvement and protection activities.	1. Maintain and enhance the Commission's water quality database and provide data for inclusion in appropriate USEPA databases. 2. Make data available to the public via the Commission's website and other electronic means.	1. Encourage integration of state and federal data systems, develop consistent basinwide datasets and GIS layers, and enhance existing geospatial and tabular datasets. 2. Enhance and improve the sharing of information contained in water quality databases maintained by the Commission and its member jurisdictions.

Priority Management Area C – Flooding		
Desired Result: To prevent loss of life and significantly reduce future damages from floods within the basin through an integrated system of structural and nonstructural flood damage reduction measures.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Implement the goals of the strategic plan for the Susquehanna Flood Forecast and Warning System (SFFWS).	1. Coordinate SFFWS committee meetings and activities. 2. Answer media requests for information before, during and after flood events. 3. Compile information on major flood events and damage summaries. 4. Support annual SFFWS funding and a permanent funding source for the gage network. 5. Coordinate ice monitoring. 6. Maintain the SFFWS website and information portal. 7. Work with system partners to maintain a state-of-the-art observation network. 8. Endorse, promote and develop new technologies to increase lead-time and improve forecast accuracy. 9. Conduct education and outreach activities to promote awareness of forecast services and their proper use.	1. Conduct an annual evaluation and update of the SFFWS Strategic Plan. 2. Develop, in cooperation with SFFWS partners, a high-resolution observational network. 3. Develop the infrastructure necessary to provide high-resolution flash flood forecasts. 4. Develop, in cooperation with SFFWS partners, new forecast points and flood forecast maps for priority damage locations.
Goal b. Promote protective floodplain management practices.	1. Improve public understanding of flood risk management. 2. Support FEMA flood insurance map modernization efforts. 3. Maintain and distribute community flood insurance maps. 4. Participate in professional state and national floodplain management organizations. 5. Work cooperatively with municipalities, private interests, and the Commission's member jurisdictions to encourage and identify potential stormwater management projects.	1. Assist in the evaluation of need and implementation of flood damage reduction alternatives for high-risk communities. 2. Assist local and county flood managers in planning efforts and assessments of floodplain reclamation projects.

Priority Management Area C – Flooding (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal b. (cont.)	6. Support and publicize local community efforts to encourage development practices with low impacts to flood risk and water quality, and to discourage new development in floodplains. 7. Evaluate the effects of climate change on the nature of flooding in the basin.	
Goal c. Improve community flood preparedness to ensure adequate and appropriate response by emergency managers before, during and after a flood event.	1. Provide technical assistance to communities for flood warning or mitigation programs. 2. Advocate participation in the Community Rating System of FEMA's National Flood Insurance Program to incentivize communities to implement flood damage reduction measures and receive discounted flood insurance premiums. 3. Provide technical support to Pennsylvania's Emergency Operations Center during flood events. 4. Coordinate, encourage and develop basinwide education and training programs regarding importance of flood warnings and offer information on flood insurance programs.	1. Conduct post-flood assessments to identify information needs, educational opportunities, lapses in forecast coverage, and other measures that can assist communities in reducing flood damages. 2. Develop a flood inundation mapping program, including a training component, for communities in the basin. These maps delineate areas of flooding corresponding to various river stages, designate evacuation routes, locate major buildings for potential mass evacuation shelters, and list general flood response procedures.
Goal d. Assist the Commission's member jurisdictions, as appropriate, in reducing the introduction of man-made debris into the waters of the Susquehanna River Basin and, ultimately, Chesapeake Bay.	1. Encourage the enforcement of existing laws dealing with the deposit of debris into the basin's streams and rivers. 2. Encourage public and private land owners to reduce the amount of debris and man-made materials stored adjacent to stream banks and in flood plains where they are vulnerable to removal by flood waters.	1. During dam relicensing, advocate for the continued removal of material from behind power dams on the lower Susquehanna River.

Priority Management Area D – Ecosystems		
Desired Result: To achieve healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply to support abundant and diverse populations of aquatic, riparian, and terrestrial organisms, as well as human use.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Perform ecosystem monitoring and assessment to provide data needed for effective watershed management.	1. Perform water quantity and quality monitoring through the Commission's watershed assessment and protection activities, and require appropriate monitoring for projects subject to the Commission's regulatory program. 2. Monitor and assess the health of fish, wildlife, and other biological resources.	1. Encourage the maintenance of critical stream gaging stations in the basin. 2. Plan, implement, and maintain a program to monitor and assess impacts occurring during individual low flow events. 3. Perform additional instream flow studies to provide scientifically-based estimates of the amount of water needed for fish, wildlife, and recreational use.
Goal b. Protect and restore biological resources throughout the basin and in each of the major subbasins.	1. Provide protection to wetlands, aquatic life, and downstream water users by requiring aquifer testing, passby flows, wetland monitoring, and conservation releases through the Commission's regulatory project review and approval process. 2. Participate in activities of the Mid-Atlantic Panel on Aquatic Invasive Species and disseminate pertinent information to the public regarding aquatic invasive species.	1. Consider the potential spread of invasive species when evaluating project review applications for diversions and transfers of untreated water from one waterbody to another. 2. Disseminate information regarding the effects of PPCPs on the biological resources of the basin. 3. Provide information on the biological resources of the basin and promote fishing, boating, hunting, outdoor photography, eco-tourism, bird watching, and other water-based outdoor recreation through the Commission's website and appropriate links to other websites.
Goal c. Restore populations of migratory fish throughout the Susquehanna River system.	1. Serve as a member of the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) and work with dam owners and operators and others to restore populations of American shad, hickory shad, blueback herring, alewife, striped bass, and other anadromous fish to the Susquehanna River system. 2. Implement and periodically update SRAFRC's Migratory Fish Management and Restoration Plan for the Susquehanna River Basin.	1. Work with SRAFRC, dam owners and operators, sportsmen groups, conservation organizations, and others to produce, by 2025, self-sustaining annual populations of 2 million American shad and 5 million river herring, reproducing in the free-flowing Susquehanna River above York Haven Dam and in suitable tributaries, provide 500,000 angler days annually throughout the basin for these species, and provide effective upstream and downstream passage for American eels arriving at dams in the basin. Note: The numeric goals cited above for shad, herring, and angling were established in SRAFRC's most recent (May 2002) "Alosid Management and Restoration Plan for the Susquehanna River Basin." SRAFRC is currently revising the plan to re-evaluate goals and include American eel and other migratory species.

Priority Management Area D – Ecosystems (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal c. (cont.)		The revised plan is scheduled for completion in 2009, when SRAFRC will request that it be incorporated into the Commission's Comprehensive Plan. 2. With assistance of SRAFRC and others, support studies of eel migration and implement restoration plans to re-establish a fishable population of American eel in the Susquehanna River system and restore adult recruitment from the river to help rebuild spawning stocks for the east coast eel fishery. 3. Support preservation and restoration of tributary streams that provide habitat for migratory fish, including the removal of obstacles to upstream movement and remediation of AMD-impaired streams. 4. Require viable upstream and downstream migratory fish passage as part of relicensing activities for power dams on the lower Susquehanna River.

Priority Management Area E – Chesapeake Bay		
Desired Result: To manage the water resources of the Susquehanna River Basin to assist in restoring and maintaining the Chesapeake Bay so it meets or exceeds applicable water quality standards and supports healthy populations of living resources, including oysters, crabs, fish, waterfowl, shore birds, and underwater grasses.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Identify the minimum freshwater inflows needed from the Susquehanna River to assist in restoring and maintaining the ecological health of the Chesapeake Bay, while also identifying opportunities for enhancement.	1. Plan and implement low flow water management activities. (Also discussed under Water Supply priority management area).	1. Work with USEPA's Chesapeake Bay Program, the USACE, the State of Maryland, and others to support the process to determine flow regimes under which the ecological health of the Bay can be restored and sustained. 2. Plan any additional studies and modeling efforts that are needed and seek appropriate funding and implementation.
Goal b. Develop and implement plans to address the flow requirements in Goal a. above.	1. See Goal a. above.	1. Assess the feasibility of providing recommended flow regimes to the Bay. 2. Implement recommendations from the feasibility study through the Commission's regulatory and planning activities, with support from the Commission's member jurisdictions. 3. Continue to update and review progress in providing the flows needed for the Bay.
Goal c. Support the Chesapeake Bay restoration effort, including sediment and nutrient reduction strategies developed by each of the Commission's member states.	1. Perform sediment and nutrient monitoring in the basin to help refine the Chesapeake Bay watershed model, support restoration activities, identify water quality trends, and document progress in meeting sediment and nutrient reduction goals established for the Susquehanna River. 2. Promote adequate funding and support tributary strategies developed by each of the Commission's member states and participate on committees and workgroups to advance restoration and protection efforts.	1. Perform trend analyses for additional sediment and nutrient monitoring sites as sufficient data are accumulated. 2. Coordinate, encourage and support efforts to manage sediment within the basin, including legacy sediments from mill dams and sediment that has accumulated behind dams on the lower Susquehanna River. 3. Support studies to determine the remaining sediment trapping efficiency of dams on the lower Susquehanna River and determine if and how trapping capability may be retained. 4. Promote the installation of best management practices for point and nonpoint sources, including stormwater, and water quality infrastructure improvement for point sources in the Susquehanna River Basin to benefit local water quality improvement and the Bay restoration effort.

Priority Management Area E – Chesapeake Bay (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal d. Provide habitat for migratory waterfowl and shorebirds found in the Chesapeake Bay.	1. Perform restoration and protection planning for water quality and habitat improvement.	1. Work with municipalities, developers, conservation and sportsmen groups, and others to support wetland establishment and enhancement in the basin to provide downstream benefits to water quality and migratory birds using the Bay.

Priority Management Area F – Coordination, Cooperation and Public Information		
Desired Result: To maximize available human resources and achieve common and complementary management objectives by the Commission, its member jurisdictions and others; to promote the planning and management of the basin's water resources in the most efficient manner possible; to inform the public on the Commission's water management responsibilities; and to enhance the public's access to Commission information and decision making procedures.		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal a. Continue use of interagency committees and ad hoc committee mechanisms to gather input from member jurisdictions and to encourage consistent interstate water management policies and actions.	1. Continue to participate in member jurisdiction water resource planning efforts and support the enhanced federal agency coordination activities of the USACE Baltimore District.	1. Consult the Commission's established advisory committees such as the Water Resources Management Advisory Committee and Water Quality Advisory Committee and, as needed, activate ad hoc committees to address special issues or projects. 2. Facilitate interagency and interstate committees to deal with selected water management topics.
Goal b. Execute, review, and update memoranda of understanding (MOUs) with member jurisdictions to coordinate regulatory or other programs that overlap.	1. Review existing MOUs with federal agencies and evaluate the benefits of executing new MOUs with other federal agencies.	1. Keep the Commission-PADEP MOU current to ensure more effective implementation of Commission regulatory standards, and explore possibilities of executing similar MOUs with Maryland, New York and the federal government or establishing an alternate procedure for coordination and exchange of information on project approvals and other work programs.
Goal c. Support uniform water management policies and standards in areas such as water quality, stream classification, flood plain management, instream flow protection, stream passby requirements and aquifer protection.	1. Continue to participate in national water organizations such as the Interstate Conference on Water Problems and the Association of State and Interstate Water Pollution Control Administrators, where common management problems and solutions can be more readily identified.	1. Determine the need for uniform standards in such areas as instream flows, aquifer testing, water conservation, and flood plain management. 2. As appropriate, assemble special interagency and interstate task force committees to address special water management topics and the development of uniform water management policies or standards.

Priority Management Area F – Coordination, Cooperation and Public Information (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal d. Coordinate major interagency efforts such as flood forecasting and warning, drought emergency management, water conservation, and hydro power license renewal.	1. As discussed in Priority Management Areas A, C and F respectively, continue coordination and cooperative activities in the following areas: (1) the Interagency Drought Coordination Committee, (2) the basinwide flood forecast and warning system, and (3) Chesapeake Bay Program committees and related bay organizations.	1. Organize a consortium of resource agencies with jurisdiction over water at the federal and state level to facilitate the coordination of input into federal licensing and relicensing of hydroelectric and nuclear power facilities in the basin, including new facilities and uprates at existing facilities. 2. Develop basinwide water conservation standards in cooperation with member states. 3. Facilitate interagency coordination of post-flood actions for the purpose of improving emergency response, technical information and flood damage reduction. 4. Expand leadership role and advocacy for the collection of water quality and quantity data for science, including the maintenance of an effective and sustainable stream and rain gage network. 5. Evaluate the establishment of a Susquehanna River Basin Monitoring Council.
Goal e. Inform legislators and executive branch policy makers on important issues related to the basin's water resources.	1. Continue informing state and federal legislators on the Commission's work in managing the basin's water resources and related legislative priorities. 2. Maintain contact with policy makers in the executive branches of the member jurisdictions to retain their support for the Commission's work.	No new actions recommended under this goal.
Goal f. Inform the public on matters affecting the basin's water resources and utilize current tools, methods and strategies to effectively reach the public.	1. Continue to rely on the Commission's web site as one of the primary public information tools, produce and disseminate publications, produce and disseminate television and radio public service announcements, and periodically conduct workshops on specific water resource topics. 2. Routinely disseminate information to the media using the full range of available communication options.	1. Periodically evaluate existing and emerging communication technologies and methods to determine their potential application and benefits to the Commission's public information program and strategies.

Priority Management Area F – Coordination, Cooperation and Public Information (cont.)		
Goals	**Ongoing Commission Activities**	**Actions Needed**
Goal f. (cont.)	3. Incorporate GIS maps and other tools to the greatest extent possible to enhance public information products. 4. Organize and distribute to the public water resource data maintained by the Commission.	
Goal g. Enhance public access to Commission information and decision making procedures.	1. Provide timely notice of Commission meetings and hearings via newspapers, legal notice publications and the Commission's web site, and provide direct notice and other information electronically or by regular mail to individuals and organizations who have expressed an interest in a particular matter before the Commission.	1. Utilize currently available technologies to make information readily available through electronic means, including non-restricted files and records requested by interested parties to eliminate the need to physically visit the Commission's headquarters building. 2. Identify, assess and consider a range of options for enhancing access to the Commission by the public and stakeholder groups to facilitate input to ongoing and emerging issues and programmatic matters; options for consideration could include holding periodic topical meetings or public forums, forming a general advisory committee, and using the Commission's web site more effectively for direct public input.
Goal h. Involve and seek the advice of non-governmental organizations on the management of the basin's water resources.	1. Continue existing communications and contacts with non-governmental organizations on a range of water resource management issues.	1. Expand on existing ties to non-governmental organizations to maximize the beneficial use of their resources and expertise in the management of the basin's water resources. 2. Identify opportunities to collaborate with academic institutions to maximize resources and scientific knowledge. 3. Provide opportunities for non-governmental organizations involvement in Commission activities and, through coordination efforts, encourage communication on activities/issues of mutual interest. 4. Coordinate with trade associations related to the various types of water use in the basin to promote sustainable water use in conjunction with economic development.

PART VII - IMPLEMENTING ACTIONS IN THE COMPREHENSIVE PLAN

This Comprehensive Plan has been developed to provide an overarching framework for the Commission in regard to management and development of the water resources of the Susquehanna River Basin and to serve as a guide for all Commission programs and activities. The Plan supports the broad goals set forth in the Compact and provides a basis for achieving desired results, meeting specific goals, and taking actions necessary to meet the goals.

It is important that the actions identified in Part IV, Priority Management Areas, be taken by the Commission in order to progress toward the goals set. This part of the Plan discusses the implementation process, roles and responsibilities, and progress assessment process established to help ensure the actions are taken.

A. Implementation Process

The process to implement the identified actions began with approval of the Comprehensive Plan by the commissioners. Most of the identified actions involve the continuation or initiation of them in various Commission work activities and programs. Those actions that are ongoing activities will require continuing emphasis to ensure they remain viable and productive. New actions will require integration into the Commission's work program with appropriate resources and priorities assigned. In view of the Commission's demanding workload, it will be important that Commission leadership stress the importance of timely and high quality actions and that staff effectively implement the actions.

Certain existing projects and plans, and a program, were incorporated into the Comprehensive Plan upon its approval because they are required, in the judgment of the Commission, for optimum management of the water resources of the basin to meet present and future needs. The existing projects are: (1) the system of 13 U.S. Army Corps of Engineers' (USACE) multipurpose reservoirs, (2) 20 local flood protection projects constructed by the USACE, (3) 20 major electric power plants, (4) four fish passage facilities on the Susquehanna River, and (5) numerous facilities having water use approvals provided by the Commission since 1971. The plans are the Commission's 2005 *Groundwater Management Plan for the Susquehanna River Basin*, 2008 *Consumptive Use Mitigation Plan for the Susquehanna River Basin*, and 2000 *Susquehanna River Basin Drought Coordination Plan.* The program incorporated is the Susquehanna Flood Forecast and Warning System, including its 2007 *Strategic Plan for Flood Forecast and Warning-Susquehanna Improvements Program*. Appendix 2 contains listings that include these newly incorporated projects, plans, and program as well as those previously incorporated.

The procedure for incorporating new projects, plans and other actions into the Comprehensive Plan is discussed in Part I, Section D-9. New projects approved by the Commission under its regulatory program will be incorporated by reference into the Comprehensive Plan unless otherwise determined by the Commission. Separate and specific action will be taken to incorporate those projects, considered under the regulatory program, that the Commission determines should not be incorporated by reference. Other water resource projects, plans, and other actions (e.g. policies, programs, and regulations), not approved under the Commission's regulatory program, will be considered for incorporation by the Commission on a case-by-case basis. These measures can be proposed for incorporation into the Plan by project proponents, member jurisdictions, or the Commission itself.

Article 14.2 of the Compact requires that the Commission adopt an annual water resources program, based upon the Comprehensive Plan, and consisting of the projects and facilities which the Commission proposes to be undertaken by the Commission and others during the ensuing six years or other reasonably foreseeable period. Accordingly, the Commission's annual Water Resources Program (WRP) is an implementation document for the actions identified in this Comprehensive Plan. The time period considered for actions in the WRP is two to three years in order to have a "reasonably foreseeable" forecast of needs, workload, priorities, project schedules and

resource availability. The current WRP is included as Appendix 3 and it will be updated as annual revisions are made.

B. Roles and Responsibilities

The Commission's Executive Director has the responsibility to lead the ongoing operations of the Commission. He will ensure the actions from the Comprehensive Plan are assigned to the appropriate division office with adequate resources made available, provide guidance as needed, and monitor progress. He is also responsible to keep the federal and state commissioners informed on progress and seek their review and approval, as required, for significant issue resolution. The commissioners' views, decisions and directions will be used by the Executive Director and his staff for incorporation into the actions.

Management and implementation responsibilities for actions lie with the Commission's three divisions. The management and staff of each division are responsible for taking identified actions, resolving issues and reporting on progress. Each of the six Priority Management Areas discussed in Part IV is assigned to a lead division. There will be some overlap of actions among the Priority Management Areas and the divisions involved will need to work together effectively to preclude redundancy and conflicts.

Some of the actions are to be taken by member jurisdictions and other groups and organizations with the Commission providing support, assistance or encouragement. In these cases, the other entities have the responsibility to lead and manage the work with the Commission working collaboratively with them in a spirit of full cooperation.

C. Progress Assessment Process

The true value of this Comprehensive Plan will be measured by the degree to which its goals are met through taking the identified actions and continuing the ongoing Commission activities. An annual assessment of progress on meeting goals will be made by the Commission using a procedure to be determined. It is anticipated that performance measures to include a listing of accomplishments in the preceding year will be part of the assessment process. A review of the current Water Resources Program will be useful in identifying actions planned or being taken toward meeting the goals. The results of the annual assessment will be reported to the commissioners.

APPENDIX 1

SUSQUEHANNA RIVER BASIN COMPACT

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SUSQUEHANNA RIVER BASIN COMPACT

Published by the
Susquehanna River Basin Commission
May 1972

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Alternate

* * *

* * *

ROBERT J. BILEO
Executive Director

RALPH J. PUTT
Chief Administrative Officer
And
Treasurer

TABLE OF CONTENTS

PART I

PART II
RESERVATIONS AND EFFECTUATION

PART I
PREAMBLE

WHEREAS the signatory parties hereto recognize the water resources of the Susquehanna River Basin as regional assets vested with local, state, and national interest for which they have a joint responsibility; and declare as follows:

1. The conservation, utilization, development, management, and control of the water resources of the Susquehanna River Basin under comprehensive multiple purpose planning, will bring the greatest benefits and produce the most efficient service in the public interest; and

2. This comprehensive planning administered by a basin wide agency will provide flood damage reduction, conservation and development of surface and ground water supply for municipal, industrial, and agricultural uses, development of recreational facilities in relation to reservoirs, lakes and streams, propagation of fish and game, promotion of forest land management, soil conservation, and watershed projects, protection and aid to fisheries, development of hydroelectric power potentialities, improved navigation, control of the movement of salt water, abatement and control of water pollution, and regulation of stream flows toward the attainment of these goals; and

3. The water resources of the basin are presently subject to the duplicating, overlapping, and uncoordinated administration of a large number of governmental agencies which exercise a multiplicity of powers resulting in a splintering of authority and responsibility; and

4. The Interstate Advisory Committee on the Susquehanna River Basin, created by action of the states of New York, Pennsylvania, and Maryland, on the basis of its studies and deliberation has concluded that regional development of the Susquehanna River Basin is feasible, advisable, and urgently needed, and has recommended that an intergovernmental compact with Federal participation be consummated to this end; and

5. The Congress of the United States and the executive branch of the Federal government have recognized a national interest in the Susquehanna River Basin by authorizing and directing the Corps of Engineers of the Department of the Army, the Department of Agriculture, the Department of Health, Education and Welfare, the Department of Interior, and other Federal agencies to cooperate in making comprehensive surveys and reports concerning the water resources of the Susquehanna River Basin in which individually or severally the technical aid and assistance of many Federal and state agencies have been enlisted, and which are being, or have been coordinated through a Susquehanna River Basin Study Coordinating Committee on which the Corps of Engineers of the Department of the Army, the Department of Agriculture, the Department of Commerce, the Department of Health, Education and Welfare, the Department of Interior, the Department of Housing and Urban Development and its predecessor Housing and Home Finance Agency, the Federal Power Commission, and the States of New York, Pennsylvania, and Maryland are or were represented; and

6. Some 3 million people live and work in the Susquehanna River Basin and its environs, and the government, employment, industry, and economic development of the entire region and the health, safety, and general well being of its population are and will continue to be affected vitally by the conservation, utilization, development, management, and control of the water resources of the basin; and

7. Demands upon the water resources of the basin are expected to mount because of anticipated increases in population and by reason of industrial and economic growth of the basin and its service area; and

8. Water resources planning and development are technical, complex, and expensive, often requiring fifteen to twenty years from the conception to the completion of large or extensive projects; and

9. The public interest requires that facilities must be ready and operative when and where needed, to avoid the damages of unexpected floods or prolonged drought, and for other purposes; and

10. The Interstate Advisory Committee on the Susquehanna River Basin has prepared a draft of an intergovernmental compact for the creation of a basin agency, and the signatory parties desire to effectuate the purposes thereof,

NOW THEREFORE

The States of New York and Maryland and the Commonwealth of Pennsylvania, and the United States of America hereby solemnly covenant and agree with each other, upon the enactment of concurrent legislation by the Congress of the United States and by the respective state legislatures, to the Susquehanna River Basin Compact which consists of this Preamble and the Articles that follow.

ARTICLE 1

SHORT TITLE, DEFINITIONS, PURPOSES, and LIMITATIONS

Section 1.1—Short Title. This compact shall be known and may be cited as the Susquehanna River Basin Compact.

Section 1.2—Definitions. For the purposes of this compact, and of any supplemental or concurring legislation enacted pursuant to it:

1. "Basin" shall mean the area of drainage of the Susquehanna River and its tributaries into Chesapeake Bay to the southern edge of the Pennsylvania Railroad bridge between Havre de Grace and Perryville, Maryland.

2. "Commission" shall mean the Susquehanna River Basin Commission hereby created, and the term "Commissioner" shall mean a member of the commission.

3. "Cost" shall mean direct and indirect expenditures, commitment, and net induced adverse effects, whether or not compensated for, used or incurred in connection with the establishment, acquisition, construction, maintenance, and operation of a project.

4. "Diversion" shall mean the transfer of water into or from the basin.

5. "Facility" shall mean any real or personal property, within or without the basin, and improvements thereof or thereon, and any and all rights of way, water, water rights, plants, structures, machinery, and equipment acquired, constructed, operated, or maintained for the beneficial use of water resources or related land uses or otherwise including, without limiting the generality of the foregoing, any and all things and appurtenances necessary, useful, or convenient for the control, collection, storage, withdrawal, diversion, release, treatment, transmission, sale, or exchange of water; or for navigation thereon, or the development and use of hydroelectric energy and power, and public recreational facilities; or the propagation of fish and wildlife; or to conserve and protect the water resources of the basin or any existing or future water supply source, or to facilitate any other uses of any of them.

6. "Federal government" shall mean the government of the United States of America, and any appropriate branch, department, bureau, or division thereof, as the case may be.

7. "Project" shall mean any work, service, or activity which is separately planned, financed, or identified by the commission, or any separate facility undertaken or to be undertaken by the commission or otherwise within a specified area, for the conservation, utilization, control, development, or management of water resources which can be established and utilized independently or as an addition to an existing facility and can be considered as a separate entity for purposes of evaluation.

8. "Signatory party" shall mean a state or commonwealth party to this compact, or the Federal government.

9. "Waters" shall mean both surface and underground waters which are contained within the drainage area of the Susquehanna River in the states of New York, Pennsylvania, and Maryland.

10. "Water resources" shall include all waters and related natural sources within the basin.

11. "Withdrawal" shall mean a taking, or removal of water from any source within the basin for use within the basin.

12. "Person" shall mean an individual, corporation, partnership, unincorporated association, and the like and shall have no gender, and the singular shall include the plural.

Section 1.3—Purpose and Findings. The legislative bodies of the respective signatory parties hereby find and declare:

1. The water resources of the Susquehanna River Basin are affected with a local, state, regional, and national interest, and the planning, conservation, utilization, development, management, and control of these resources, under appropriate arrangements for intergovernmental cooperation, are public purposes of the respective signatory parties.

2. The water resources of the basin are subject to the sovereign rights and responsibilities of the signatory parties, and it is the purpose of this compact to provide for a joint exercise of these powers of sovereignty in the common interest of the people of the region.

3. The water resources of the basin are functionally interrelated, and the uses of these resources are interdependent. A single administrative agency is therefore essential for effective and economical direction, supervision, and coordination of water resources efforts and programs of federal, state, and local governments and of private enterprise.

4. Present and future demands require increasing economies and efficiencies in the use and reuse of water resources, and these can be brought about only by comprehensive planning, programming and management under the direction of a single administrative agency.

5. In general, the purposes of this compact are to promote interstate comity; to remove causes of possible controversy; to make secure and protect developments within the states; to encourage and provide for the planning; conservation, utilization, development, management, and control of the water resources of the basin; to provide for cooperative and coordinated planning and action by the signatory parties with respect to water resources; and to apply the principle of equal and uniform treatment to all users of water and of water related facilities without regard to political boundaries

6. It is the express intent of the signatory parties that the commission shall engage in the construction, operation and maintenance of a project only when the project is necessary to the execution of the comprehensive plan and no other competent agency is in a position to act, or such agency fails to act.

Section 1.4—Powers of Congress; Withdrawal. Nothing in this compact shall be construed to relinquish the functions, powers, or duties of the Congress of the United States with respect to the control of any navigable waters within the basin, nor shall any provisions hereof be construed in derogation of any of the constitutional powers of the Congress to regulate commerce among the states and with foreign nations. The power and right of the Congress to withdraw the Federal government as a party to this compact or to revise or modify the terms, conditions, and provisions under which it may remain a party by amendment, repeal, or modification of any Federal statute applicable hereto is recognized by the signatory parties.

Section 1.5—Duration of Compact

(a) The duration of this compact shall be for an initial period of 100 years from its effective date, and it shall be continued for additional periods of 100 years if not less than 20 years nor more than 25 years prior to the termination of the initial period or any succeeding period none of the signatory states, by authority of an act of its legislature, notifies the commission of intention to terminate the compact at the end of the then current 100-year period.

(b) In the event this compact should be terminated by operation of paragraph (a) above, the commission shall be dissolved, its assets and liabilities transferred in accordance with the equities of the signatory parties therein and its corporate affairs wound up in accordance with agreement of the signatory parties or, failing agreement, by act of the Congress.

ARTICLE 2

ORGANIZATION and AREA

Section 2.1—Commission Created. The Susquehanna River Basin Commission is hereby created as a body politic and corporate, with succession for the duration of this compact, as an agency and instrumentality of the governments of the respective signatory parties.

Section 2.2—Commission Membership. The members of the commission shall be the governor or the designee of the governor of each signatory state, to act for him, and one member to be appointed by the President of the United States to serve at the pleasure of the President.

Section 2.3—Alternates. An alternate from each signatory party shall be appointed by its member of the commission unless otherwise provided by the laws of the signatory party. The alternate, in the absence of the member, shall represent the member and act for him. In the event of a vacancy in the office of alternate, it shall be filled in the same manner as the original appointment.

Section 2.4—Compensation. Members of the commission and alternates shall serve without compensation from the commission but may be reimbursed for necessary expenses incurred in and incident to the performance of their duties.

Section 2.5—Voting Power. Each member is entitled to one vote. No action of the commission may be taken unless three of the four members vote in favor thereof.

Section 2.6—Organization and Procedure. The commission shall provide for its own organization and procedure, and shall adopt the rules and regulations governing its meetings and transactions. It shall organize annually by the election of a chairman and vice-chairman from among its members. It shall provide by its rules for the appointment by each member in his discretion of an advisor to serve without compensation from the commission, who may attend all meetings of the commission and its committees.

Section 2.7—Jurisdiction of the Commission. The commission shall have, exercise, and discharge its functions, powers, and duties within the limits of the basin. Outside the basin, the commission shall act at its discretion, but only to the extent necessary to implement its responsibilities within the basin, and where necessary subject to the consent of the state wherein it proposes to act.

ARTICLE 3
POWERS and DUTIES of the COMMISSION

Section 3.1—General. The commission shall develop and effectuate plans, policies, and projects relating to the water resources of the basin. It shall adopt and promote uniform and coordinated policies for water resources conservation and management in the basin. It shall encourage and direct the planning, development, operation, and subject to applicable laws the financing of water resources projects according to such plans and policies.

Section 3.2—Policy. It is the policy of the signatory parties to preserve and utilize the functions, powers, and duties of the existing offices and agencies of government to the extent consistent with this compact, and the commission is directed to utilize those offices and agencies for the purposes of this compact.

Section 3.3—Comprehensive Plan, Program and Budgets. The commission in accordance with Article 14 of this compact, shall formulate and adopt:

1. A comprehensive plan, after consultation with appropriate water users and interested public bodies for the immediate and long-range development and use of the water resources of the basin;

2. A water resources program, based upon the comprehensive plan, which shall include a systematic presentation of the quantity and quality of water resources needs of the area to be served for such reasonably foreseeable period as the commission may determine, balanced by existing and proposed projects required to satisfy such needs, including all public and private projects affecting the basin, together with a separate statement of the projects proposed to be undertaken by the commission during such period; and

3. An annual current expense budget and an annual capital budget consistent with the commission's program, projects, and facilities for the budget period.

Section 3.4—Powers of Commission. The commission may:

1. Plan, design, acquire, construct, reconstruct, complete, own, improve, extend, develop, operate, and maintain any and all projects, facilities, properties, activities, and services which are determined by the commission to be necessary, convenient, or useful for the purpose of this compact.

2. Establish standards of planning**,** decision, and operation of all projects and facilities in the basin to the extent they affect water resources, including without limitation thereto water, sewage and other waste treatment plants and facilities, pipelines, transmission lines, stream and lake recreational facilities, trunk mains for water distribution, local flood protection works, watershed management programs, and ground water recharging operations.

3. Conduct and sponsor research on water resources and their planning, use, conservation, management, development, control, and protection, and the capacity, adaptability, and best utility of each facility thereof, and collect, compile, correlate, analyze, report, and interpret data on water resources and uses in the basin, including without limitation thereto the relation of water to other resources, industrial water technology, ground water movement, relation between water price and water demand and other economic factors, and general hydrological conditions.

4. Collect, compile, coordinate, and interpret systematic surface and ground water data, and publicize such information when and as needed for water uses, flood warning, quality maintenance, or other purposes.

5. Conduct ground and surface water investigations, tests and operations, and compile data relating thereto as may be required to formulate and administer the comprehensive plan.

6. Prepare, publish, and disseminate information and reports concerning the water problems of the basin and for the presentation of the needs and resources of the basin and policies of the commission to executive and legislative branches of the signatory parties.

7. Negotiate loans, grants, gifts, services, or other aids as may be lawfully available from public or private sources to finance or assist in effectuating any of the purposes of this compact, and receive and accept them upon terms and conditions, and subject to provisions, as may be required by Federal or state law or as the commission may deem necessary or desirable.

8. Exercise such other and different powers as may be delegated to it by his compact or otherwise pursuant to law, and have and exercise all powers necessary or convenient to carry out its express powers and other powers which reasonably may be implied there from.

9. Adopt, amend, and repeal rules and regulations to implement this compact.

Section 3.5—Duties of the Commission. The commission shall:

1. Develop and effectuate plans, policies, and projects relating to water resources; adopt, promote, and coordinate policies and standards for water resources conservation, control, utilization, and management; and promote and implement the planning, development, and financing of water resources projects.

2. Undertake investigations, studies, and surveys, and acquire, construct, operate, and maintain projects and facilities in regard to the water resources of the basin, whenever it is deemed necessary to do so to activate or effectuate any of the provisions of this compact.

3. Administer, manage, and control water resources in all matters determined by the commission to be interstate in nature or to have a ma or effect on the water resources and water resources management.

4. Assume jurisdiction in any matter affecting water resources whenever it determines after investigation and public hearing upon due notice given, that the effectuation of the comprehensive plan or the implementation of this compact so requires. If the commission finds upon subsequent hearing requested by an affected signatory party that the party will take the necessary action, the commission may relinquish jurisdiction.

5. Investigate and determine if the requirements of the compact or the rules and regulations of the commission are complied with, and if satisfactory progress has not been made, institute an action or actions in its own name in any state or Federal court of competent jurisdiction to compel compliance with any and all of the provisions of this compact or any of the rules and regulations of the commission adopted pursuant thereto. An action shall be instituted in the name of the commission and shall be conducted by its own counsel.

Section 3.6—Cooperative Legislation and Further Jurisdiction.

(a) Each of the signatory parties agrees that it will seek enactment of such additional legislation as will be required to enable its officers, departments, commissions, boards, and agents to accomplish effectively the obligations and duties assumed under the terms of this compact.

(b) Nothing in the compact shall be construed to repeal, modify, or qualify the authority of any signatory party to enact any legislation or enforce any additional conditions and restrictions within its jurisdiction.

Section 3.7—Coordination and Cooperation. The commission shall promote and aid the coordination of the activities and programs of Federal, state, municipal, and private agencies concerned with water resources administration in the basin. To this end, but without limitation thereto, the commission may:

1. Advise, consult, contract, financially assist, or otherwise cooperate with any and all such agencies;

2. Employ any other agency or instrumentality of any of the signatory parties or of any political subdivision thereof, in the design, construction, operation, and maintenance of structures, and the installation and management of river control systems, or for any other purpose;

3. Develop and adopt plans and specifications for particular water resources projects and facilities which so far as consistent with the comprehensive plan incorporate any separate plans of other public and private organizations operating in the basin, and permit the decentralized administration thereof,

4. Qualify as a sponsoring agency under any Federal legislation heretofore or hereafter enacted to provide financial or other assistance for the planning, conservation, utilization, development, management, or control of water resources.

Section 3.8—Allocations, Diversions, and Releases.

(a) The commission shall have power from time to time as the need appears, to allocate the waters of the basin to and among the states signatory to this compact and impose related conditions, obligations, and release requirements.

(b) The commission shall have power from time to time as the need appears to enter into agreements with other river basin commissions or other states with respect to in-basin and out-of-basin allocations, withdrawals, and diversions.

(c) No allocation of waters made pursuant to this section shall constitute prior appropriation of the waters of the basin or confer any superiority of right in respect to the use of those waters, nor shall any such action be deemed to constitute an apportionment of the waters of the basin among the parties hereto. This subsection shall not be deemed to limit or restrict the power of the commission to enter into covenants with respect to water supply, with a duration not exceeding the life of this compact, as it may deem necessary for the benefit or development of the water resources of the basin.

Section 3.9—Rates and Charges. The commission, from time to time after public hearing upon due notice given, may fix, alter, and revise rates, rentals, charges, and tolls, and classifications thereof, without regulation or control by any department. Office, or agency of any signatory party, for the use of facilities owned or operated by it, and any services or products which it provides.

Section 3.10—Referral and Review. No projects affecting the water resources of the basin, except those not requiring review and approval by the commission under paragraph 3 following, shall be undertaken by any person, governmental authority or other entity prior to submission to and approval by the commission or appropriate agencies of the signatory parties for review.

1. All water resources projects for which a permit or other form of permission to proceed with construction or implementation is required by legislative action of a signatory party

or by rule or regulation of an office or agency of a signatory party having functions, powers, and duties in the planning,, conservation, development, management, or control of water resources shall be submitted as heretofore to the appropriate office or agency of the signatory party for review and approval. To assure that the commission is apprised of all projects within the basin, monthly reports and listings of all permits granted, or similar actions taken, by offices or agencies of the signatory parties shall be submitted to the commission in a manner prescribed by it.

Those projects which also require commission approval pursuant to the provisions of paragraphs 2 (ii) and 2 (iii) following shall be submitted to the commission through appropriate offices or agencies of a signatory party, except that, if no agency of a signatory party has jurisdiction, such projects shall be submitted directly to the commission in such manner as the commission shall prescribe.

2. Approval of the commission shall be required for, but not limited to, the following:

   (i) All projects on or crossing the boundary between any two signatory states;
   (ii) Any project involving the diversion of water;
   (iii) Any project within the boundaries of any signatory state found and determined by the commission or by any agency of a signatory party having functions, powers, and duties in the planning, conservation, development, management or control of water resources to have a significant effect on water resources within another signatory state, and
   (iv) Any project which has been included by the commission, after hearing, as provided in Article 14, Section 14.1, as a part of the commission's comprehensive plan for the development of the water resources of the basin, or which would have a significant effect upon the plan.

3. Review and approval by the commission shall not be required for:

   (i) Projects which fall into an exempt classification or designation established by legislative action of a signatory party or by rule or regulation of an office or agency of a signatory party having, functions, powers, and duties in the planning, conservation, development, management, or control of water resources. The sponsors of those projects are not required to obtain a permit or other form of permission to proceed with construction or implementation, unless it is determined by the commission or by the agency of a signatory party that such project or projects may cause an adverse, adverse cumulative, or an interstate effect on water resources of the basin, and the project sponsor has been notified in writing by the commission or by the agency of a signatory party that commission approval is required.

   (ii) Projects which are classified by the commission as not requiring its review and approval, for so long as they are so classified.

4. The commission shall approve a project if it determines that the project is not detrimental to the proper conservation, development, management, or control of the water resources of the basin and may modify and approve as modified, or may disapprove the project, if it determines that the project is not in the best interest of the conservation, development, management, or control of the basin's water resources, or is in conflict with the comprehensive plan.

5. The commission, after consultation with the appropriate offices or agencies of the signatory parties, shall establish the procedure of submission, review, and consideration of projects. Any procedure for review and approval of diversions of water shall include public hearing on due notice given, with opportunities for interested persons, agencies, governmental units, and signatory parties to be heard and to present evidence. A complete transcript of the proceedings at the hearing shall be made and preserved, and it shall be made available under rules for that purpose adopted by the commission.

6. Any determination of the commission pursuant to this article or any article of the compact providing for judicial review shall be subject to such judicial review in any court of competent jurisdiction, provided that an action or proceeding for such review is commenced within 90 days from the effective date of the determination sought to be reviewed; but a determination of the commission concerning a diversion, under Section 3.10-2 (ii) with the claimed effect of reducing below a proper minimum the flow of water in that portion of the basin within the area of a signatory party, shall be subject to judicial review under the particular provisions of paragraph 7 below.

7. Any signatory party deeming, itself aggrieved by an action of the commission concerning a diversion under Section 10-2 (ii) with the claimed effect of reducing below a proper minimum the flow of water in that portion of the basin which lies within the area of that signatory party, and notwithstanding the powers provided to the commission by this compact, may have review of commission action approving the diversion in the Supreme Court of the United States; provided that a proceeding for such review is commenced within one year from the date of action sought to be reviewed. Any such review shall be on the record made before the commission. The action of the commission shall be affirmed, unless the court finds that it is not supported by substantial evidence.

3.11—Advisory Committees. The commission may constitute and empower advisory committees.

ARTICLE 4
WATER SUPPLY

Section 4.1—Generally. The commission shall have power to develop, implement, and effectuate plans and projects for the use of the water of the basin for domestic, municipal, agricultural, and industrial water supply. To this end, without limitation thereto, it may provide for construct, acquire, operate, and maintain dams, reservoirs, and other facilities for utilization of surface and ground water resources, and all related structures, appurtenances, and equipment on the river and its tributaries and at such off river sites as it may find appropriate, and may regulate and control the use thereof

Section 4.2—Storage and Release of Waters.

(a) The commission shall have power to acquire, construct, operate, and control projects and facilities for the storage and release of waters, for the regulation of flows and supplies of surface and ground waters of the basin, for the protection of public health, stream quality control, economic development, improvement of fisheries, recreation, dilution and abatement of pollution, the prevention of undue salinity, and other purposes.

(b) No signatory party shall permit any augmentation of flow to be diminished by the diversion of any water of the basin during any period in which waters are being released from storage under the direction of the commission for the purpose of augmenting such flow, except in cases where the diversion is authorized by this compact, or by the commission pursuant thereto, or by the judgment, order, or decree of a court of competent jurisdiction.

Section 4.3—Assessable Improvements. The commission may provide water management and regulation in the main stream or any tributary in the basin and, in accordance with the procedures of applicable state laws, may assess on an annual basis or otherwise the cost thereof upon water users or any classification of them specially benefited thereby to a measurable extent, provided that no such assessment shall exceed the actual benefit to any water user. Any such assessment shall follow the procedure prescribed by law for local improvement assessments and shall be subject to review in any court of competent jurisdiction.

Section 4.4—Coordination. Prior to entering upon the execution of any project authorized by this article, the commission shall review and consider all existing rights, plans and programs of the signatory parties, their political subdivisions, private parties, and water users which are pertinent to such project, and shall hold a public hearing on each proposed project.

Section 4.5—Additional Powers. In connection with any project authorized by this article, the commission shall have power to provide storage, treatment, pumping, and transmission facilities, but nothing herein shall be construed to authorize the commission to engage in the business of distributing water.

ARTICLE 5

WATER QUALITY MAINAGEMENT and CONTROL

Section 5.1—General Powers.

(a) The commission may undertake or contract for investigations, studies, and surveys pertaining to existing water quality, effects of varied actual or projected operations on water quality, new compounds and materials and probable future water quality in the basin. The commission may receive, expend, and administer funds, Federal, state, local or private as may be available to carry out these functions relating to water quality investigations.

(b) The commission may acquire, construct, operate, and maintain projects and facilities for the management and control of water quality in the basin whenever the commission deems necessary to activate or effectuate any of the provisions of this compact.

Section 5.2—Policy and Standards.

(a) In order to conserve, protect, and utilize the water quality of the basin in accordance with the best interests of the people of the basin and the states, it shall be the policy of the commission to encourage and coordinate the efforts of the signatory parties to prevent, reduce, control, and eliminate water pollution and to maintain water quality as required by the comprehensive plan.

(b) The legislative intent in enacting this article is to give specific emphasis to the primary role of the states in water quality management and control.

(c) The commission shall recommend to the signatory parties the establishment, modification, or amendment of standards of quality for any waters of the basin in relation to their reasonable and necessary use as the commission shall deem to be in the public interest.

(d) The commission shall encourage cooperation and uniform enforcement programs and policies by the water quality control agencies of the signatory parties in meeting, the water quality standards established in the comprehensive plan.

(e) The commission may assume jurisdiction whenever it determines after investigation and public hearing upon due notice given that the effectuation of the comprehensive plan so requires. After such investigation, notice, and hearing, the commission may adopt such rules, regulations, and water quality standards as may be required to preserve, protect, improve, and develop the quality of the waters of the basin in accordance with the comprehensive plan.

Section 5.3—Cooperative Administration and Enforcement.

(a) Each of the signatory parties agrees to prohibit and control pollution of the waters of the basin according to the requirements of this compact and to cooperate faithfully in the control of future pollution in and abatement of existing pollution from the waters of the basin.

(b) The commission shall have the authority to investigate and determine if the requirements of the compact or the rules, regulations, and water quality standards of the commission are complied with and if satisfactory progress has not been made, may institute an action or actions in its own name in the proper court or courts of competent jurisdiction to compel compliance with any and all of the provisions of this compact or any of the rules, regulations, and water quality standards of the commission adopted pursuant thereto.

Section 5.4—Further Jurisdiction. Nothing in this compact shall be construed to repeal, modify, or qualify the authority of any signatory party to enact any legislation or enforce any additional conditions and restrictions to lessen or prevent the pollution of waters within its jurisdiction.

ARTICLE 6
FLOOD PROTECTION

Section 6.1—Flood Control Authority. The commission may plan, design, construct, and operate and maintain projects and facilities it deems necessary or desirable for flood plain development and flood damage reduction. It shall have power to operate such facilities and to store and release waters of the Susquehanna River and its tributaries and elsewhere within the basin, in such manner, at such times, and under such regulations as the commission may deem appropriate to meet flood conditions as they may arise.

Section 6.2—Regulation.

(a) The commission may study and determine the nature and extent of the flood plains of the Susquehanna River and its tributaries. Upon the basis of the studies, it may delineate areas subject to flooding, including but not limited to a classification of lands with reference to relative risk of flooding and the establishment of standards for flood plain use which will promote economic development and safeguard the public health, welfare, safety, and property. Prior to the adoption of any standards delineating, the area or defining the use, the commission shall hold public hearings with respect to the substance of standards in the manner provided by Article 15. The proposed standards shall be available from the commission at the time notice is given, and interested parsons shall be given an opportunity to be heard thereon at the hearings.

(b) The commission shall have power to promulgate, adopt, amend, and repeal from time to time as necessary, standards relating to the nature and extent of the uses of land in areas subject to flooding.

(c) In taking action pursuant to subsection (b) of this section and as a prerequisite thereto, the commission shall consider the effect of uses of the flood plain in question on the health and safety of persons and property in the basin, the economical and technical feasibility of measures available for the development and protection of the flood plain, and the responsibilities, if any, of local, state, and federal governments connected with the use or proposed use of the flood plain in question. The commission shall regulate the use of particular flood plains in the manner and degree it finds necessary for the factors enumerated in this

subsection, but only with the consent of the affected signatory state, and shall suspend such regulation when and so long as the signatory party or parties or political subdivision possessing jurisdiction have in force applicable laws which the commission finds give adequate protection for the purpose of this section.

(d) In order to conserve, protect, and utilize the Susquehanna River and its tributaries in accordance with the best interests of the people of the basin and the signatory parties, it shall be the policy of the commission to encourage and coordinate the efforts of the signatory parties to control modification of the river and its tributaries by encroachment.

Section 6.3—Flood Lands Acquisition. The commission shall have power to acquire the fee or any lesser interest in lands and improvements thereon within the area of a flood plain for the purpose of regulating the use or types of construction of such property to minimize the flood hazard, convert the property to uses or types of construction appropriate to flood plain conditions, or prevent constrictions or obstructions that reduce the ability of the river channel and flood plain to carry flood water.

Section 6.4—Existing Structures. No rule or regulation issued by the commission pursuant to this compact shall be construed to require the demolition, removal, or alteration of any structure in place or under construction prior to the issuance thereof, without the payment of just compensation therefor. However, new construction or any addition to or alteration in any existing structure made or commenced subsequent to the issuance of such rule or regulation, or amendment, shall conform thereto.

Section 6.5—Police Powers. The regulation of use of flood plain lands is within the policy powers of the signatory states for the protection of public health and the safety of the people and their property and shall not be deemed a taking of land or lands for which compensation shall be paid to the owners thereof.

Section 6.6—Cooperation. Each of the signatory parties agrees to control flood lain use along and encroachment upon the Susquehanna River and its tributaries and to cooperate faithfully in these respects.

Section 6.7—Other Authority. Nothing, in this article shall be construed to prevent or in any way to limit the power of any signatory party, or any agency or subdivision thereof, to issue or adopt and enforce any requirement or requirements with respect to flood plain use or construction thereon more stringent than the rules, regulations, or encroachment lines in force pursuant to this article. The commission may appear in any court of competent jurisdiction to bring actions or proceedings in law or equity to enforce the provisions of this article.

Section 6.8—Debris. The signatory states agree that dumping or littering upon or in the waters of the Susquehanna River or its tributaries or upon the frozen surfaces thereof any rubbish, trash, litter, debris, abandoned properties, waste material, or offensive matter, is prohibited and that the law enforcement officials of each state shall enforce this prohibition.

ARTICLE 7
WATERSHED MANAGEMENT

Section 7.1—Watersheds Generality. The commission shall promote sound practices of watershed management in the basin, including projects and facilities to retard runoff and waterflow and prevent soil erosion.

Section 7.2—Soil Conservation and Land and Forest Management. The commission, subject to the limitations in Section 7.4(b), may acquire, sponsor, or operate facilities and projects to encourage soil conservation, prevent and control erosion, and promote land reclamation and sound land and forest management.

Section 7.3—Fish and Wildlife. The commission, subject to the limitation in Section 7.4 (b), may acquire, sponsor, or operate projects and facilities for the maintenance and improvement of fish and wildlife habitat related to the water resources of the basin.

Section 7.4—Cooperative Planning and Operation.

(a) The commission shall cooperate with the appropriate agencies of the signatory parties and with other public and private agencies in the planning and effectuation of a coordinated program of facilities and projects authorized by this article.

(b) The commission shall not acquire or operate any such project or facility unless it has first found and determined that no other suitable unit or agency of government is in a position to acquire or operate the same upon reasonable conditions, or such unit or agency fails to do so.

ARTICLE 8
RECREATION

Section 8.1—Development. The commission may provide for the development of water related public sports and recreational facilities. The commission on its own account or in cooperation with a signatory party, political subdivision or any agency thereof, may provide for the construction, maintenance, and administration of such facilities, subject to the provisions of Section 8.2 hereof.

Section 8.2—Cooperative Planning and Operation.

(a) The commission shall cooperate with the appropriate agencies of the signatory parties and with other public and private agencies in the planning and effectuation of a coordinated program of facilities and projects authorized by this article.

(b) The commission shall not operate any such project or facility unless it has first found and determined that no other suitable unit or agency of government is available to operate the same upon reasonable conditions.

Section 8.3—Operation and Maintenance. The commission, within limits prescribed by this article, shall:

1. Encourage activities of other public agencies having water related recreational interests and assist in the coordination thereof;

2. Recommend standards for the development and administration of water related recreational facilities;

3. Provide for the administration, operation, and maintenance of recreation facilities owned or controlled by the commission and for the letting and supervision of private concessions in accordance with this article.

Section 8.4—Concessions. The Commission, after public hearing upon due notice given, shall provide by regulation a procedure for the award of contracts for private concessions in connection with its recreational facilities, including any renewal or extension thereof, under terms and conditions determined by the commission.

ARTICLE 9
OTHER PUBLIC VALUES

Section 9.1—Inherent Values. The signatory parties agree that it is a purpose of this compact in effectuating the conservation and management of water resources to preserve and promote the economic and other values inherent in this historic and the scenic and other natural amenities of the Susquehanna River Basin for the enjoyment and enrichment of future generations, for the promotion and protection of tourist attractions in the basin, and for the maintenance of the economic health of allied enterprises and occupations so as to effect orderly, balanced, and considered development in the basin.

Section 9.2—Project Compatibility. To this end, the signatory parties agree that in the consideration, authorization, construction, maintenance, and operation of all water resources projects in the Susquehanna basin, their agencies and subdivisions, and the Susquehanna River Basin Commission will consider the compatibility of such projects with these other public values.

Section 9.3—Regulation Standards. The commission may recommend to governmental units with jurisdiction within areas considered for scenic or historic designation minimum standards of regulation of land and water use and such other protective measures as the commission may deem desirable.

Section 9.4—Local Area Protection. The commission may draft and recommend for adoption ordinances and regulations which would assist, promote, develop, and protect those areas and the character of their communities. Local governments may consider parts of their area which have been designated scenic or historic areas under the provisions of this article separately from the municipality as a whole, and pursuant to the laws of the state governing the adoption of those regulations generally may enact regulations limited to the designated area. In making recommendations to a local government which is partly in and partly out of such a scenic or historic area the commission may make recommendations for the entire municipality.

ARTICLE 10

HYDROELECTRIC POWER

Section 10.1—Development. The waters of the Susquehanna River and its tributaries may be impounded and used by or under authority of the Commission for the generation of hydroelectric power and hydroelectric energy in accordance with the comprehensive plan.

Section 10.2—Power Generation. The commission may develop and operate, or authorize to be developed and operated dams and related facilities and appurtenances for the purpose of generating hydroelectric power and hydroelectric energy.

Section 10.3—Transmission. The commission may provide facilities for the transmission of hydroelectric power and hydroelectric energy produced by it where such facilities are not otherwise available upon reasonable terms, for the purpose of wholesale marketing of power and nothing herein shall be construed to authorize the commission to engage in the business of direct sale to consumers.

Section 10.4—Development Contracts. The commission, after public hearings upon due notice given, may enter into contracts on reasonable terms, consideration, and duration under which public utilities or public agencies may develop hydroelectric power and hydroelectric energy through the use of dams, related facilities, and appurtenances.

Section 10.5—Rates and Charges. Rates and charges fixed by the commission for power which is produced by its facilities shall be reasonable, nondiscriminatory, and just.

ARTICLE 11

REGULATION of WITHDRAWAL and DIVERSIONS; PROTECTED AREAS and EMERGENCIES

Section 11.1—Power of Regulation. The commission may regulate and control withdrawals and diversions from surface waters and ground waters of the basin, as provided by this article. The commission may enter into agreements with the signatory parties relating to the exercise of such power or regulation or control and may delegate to any of them such powers of the commission as it may deem necessary or desirable.

Section 11.2—Determination of Protected Area. The commission from time to time after public hearing upon due notice given, may determine and delineate such areas within the basin wherein the demands upon supply made by water users have developed or threaten to develop to such a degree as to create a water shortage or impair or conflict with the requirements or effectuation of the comprehensive plan, and any such area may be designated as a protected area, with the consent of the member or members from the affected state or states. The commission, whenever it determines that such shortage no longer exists, shall terminate the protected status of such area and shall give public notice of such termination.

Section 11.3—Diversion and Withdrawal Permits. In any protected areas so determined and delineated, no person shall divert or withdraw water for domestic, municipal, agricultural, or industrial uses in excess of such quantities as the commission may prescribe by general regulations, except ((1) pursuant to a permit granted under this article, or ((2) pursuant to a permit or approval heretofore granted under the laws of any of the signatory states.

Section 11.4—Emergency.

(a) In the event of a drought which may cause an actual and immediate shortage of available water supply within the basin, or within any part hereof, the commission after public hearing, upon due notice given, may determine and delineate the area of the shortage and by unanimous vote declare a drought emergency therein.

For the duration of the drought emergency as determined by the commission, it thereupon may direct increases or decreases in any allocations, diversions, or releases previously granted or required, for a limited time to meet the emergency condition.

(b) In the event of a disaster or catastrophe other than drought, natural or manmade, which causes or may cause an actual and immediate shortage of available and usable water, the commission by unanimous consent may impose direct controls on the use of water and shall take such action as is necessary to coordinate the effort of federal, state, and local agencies and other persons and entities affected.

Section 11.5—Standards. Permits shall be granted, modified, or denied, as the case may be, to avoid such depletion of the natural stream flows and ground waters in the protected area or in an emergency area as will adversely affect the comprehensive plan or the just and equitable interests and rights of their lawful users of the same source, giving due regard to the need to

balance and reconcile alternatives and conflicting uses in the event of an actual or threatened shortage of water of the quality required.

Section 11.6—Judicial Review. The determinations and delineations of the commission pursuant to Section 1 1.2 and the granting, modification or denial of permits pursuant to Section 11.3, 1 1.4, and 1 1.5 shall be subject to judicial review in any court of competent jurisdiction.

Section 11.7—Maintenance of Records. Each signatory party shall provide for the maintenance and preservation of such records of authorized diversions and withdrawals and the annual volume thereof as the commission shall prescribe. Such records and supplementary reports shall be furnished to he commission at its request.

Section 11.8—Existing State Systems. Whenever the commission finds it necessary or desirable to exercise the powers conferred with respect to emergencies by this article, any diversion or withdrawal permits authorized or issued under the laws of any of the signatory states shall be superseded to the extent of any conflict with the control and regulation exercised by the commission.

ARTICLE 12

INTERGOVERNMENTAL RELATIONS

Section 12.1—Federal Agencies and Projects. For the purposes of avoiding conflicts of jurisdiction and of giving full effect to the commission as a regional agency of the signatory parties, the following rules shall govern Federal projects affecting the water resources of the basin, subject in each case to the provision of Section 1.4 of this compact:

1. The planning of all projects related to powers delegated to the commission by this compact shall be undertaken in consultation with the commission.

2. No expenditure or commitment shall be made for or on account of the construction, acquisition, or operation of any project or facility nor shall it be deemed authorized, unless it shall have first been included by the commission in the comprehensive plan.

3. Each Federal agency otherwise authorized by law to plan, design, construct, operate or maintain any project or facility in or for the basin shall continue to have, exercise, and discharge such authority except as specifically provided by this section.

Section 12.2—State and Local Agencies and Projects. For the purposes of avoiding conflicts of jurisdiction and of giving full effect to the commission as a regional agency of the signatory parties, the following rules shall govern projects of the signatory states, their political subdivisions and public corporations affecting water resources of the basin:

1. The planning of all projects related to powers delegated to the commission by this compact shall be undertaken in consultation with the commission;

2. No expenditure or commitment shall be made for or on account of the construction, acquisition, or operation of any project or facility unless it first has been included by the commission in the comprehensive plan;

3. Each state and local agency otherwise authorized by law to plan, design, construct, operate, or maintain any project or facility in or for the basin shall continue to have, exercise and discharge such authority, except as specifically provided by this section.

Section 12.3—Reserved Taxing Powers of States. Each of the signatory parties reserves the right to levy, assess, and collect fees, charges, and taxes on or measured by the withdrawal or diversion of waters of the basin for use within the jurisdiction of the respective signatory parties.

Section 12.4—Project Costs and Evaluation Standards. The commission shall establish uniform standards and procedures for the evaluation, determination of benefits, and cost allocations of projects affecting the basin, and for the determination of project priorities, pursuant to the requirements of the comprehensive plan and its water resources program. The commission shall develop equitable cost sharing and reimbursement formulas for the signatory parties including:

1. Uniform and consistent procedures for the allocation of project costs among purposes included in multiple-purpose programs;

2. Contracts and arrangements for sharing financial responsibility among and with signatory parties, public bodies, groups, and private enterprise, and for the supervision of their performance;

3. Establishment and supervision of a system of accounts for reimbursement purposes and directing the payments and charges to be made from such accounts;

4. Determining the basis and apportioning amounts (i) of reimbursable revenues to be paid signatory parties or their political subdivisions, and (ii) of payments in lieu of taxes to any of them.

Section 12.5—Cooperative Services. The commission shall furnish technical services, advice, and consultation to authorized agencies of the signatory parties with respect to the water resources of the basin, and each of the signatory parties pledges itself to provide technical and administrative service to the commission upon request, within the limits of available appropriations, and to cooperate generally with the commission for the purposes of this compact, and the cost of such service may be reimbursable whenever the parties deem appropriate.

ARTICLE 13
CAPITAL FINANCING

Section 13.1—Borrowing Power. The commission may borrow money for any of the purposes of this compact and may issue its negotiable bonds and other evidences of indebtedness in respect thereto.

All such bonds and evidences of indebtedness shall be payable solely out of the properties and revenues of the commission without recourse to taxation. The bonds and other obligations of the commission, except as may be otherwise provided in the indenture under which they were issued, shall be direct and general obligations of the commission, and the full faith and credit of the commission are hereby pledged for the prompt payment of the debt service thereon and for the fulfillment of all other undertakings of the commission assumed by it to or for the benefit of the holders thereof.

Section 13.2—Funds and Expenses. The purposes of this compact shall include without limitation thereto all costs of any project or facility or any part thereof, including interest during a period of construction and a reasonable time thereafter and any incidental expenses (legal, engineering, fiscal, financial consultant, and other expenses) connected with issuing and disposing of the bonds; all amounts required for the creation of an operating fund, construction fund, reserve fund, sinking fund, or other special fund; all other expenses connected with the planning,, design, acquisition, construction, completion, improvement, or reconstruction of any facility or any part thereof, and reimbursement of advances by the commission or by others for such purposes and for working capital.

Section 13.3—Credit Excluded; Officers, State and Municipal. The commission shall have no power to pledge the credit of any signatory party or of any county or municipality, or to impose any obligation for payment of the bonds upon any signatory party or any county or municipality. Neither the commissioners nor any person executing the bonds shall be liable personally on the bonds of the commission or be subject to any personal liability or accountability by reason of the issuance thereof.

Section 13.4—Funding and Refunding. Whenever the commission deems it expedient, it may fund and refund its bonds and other obligation, whether or not such bonds and obligations have matured. It may provide for the issuance, sale, or exchange of refunding bonds for the purpose of redeeming or retiring any bonds (including payment of any premium, duplicate interest, or cash adjustment required in connection therewith) issued by the commission or issued by any other issuing body, the proceeds of the sale of which have been applied to any facility acquired by the commission or which are payable out of the revenues of any facility acquired by the commission. Bonds may be issued partly to refund bonds and other obligations when outstanding, and partly for any other purpose of the commission. All provisions of this compact applicable to the issuance of bonds are applicable to refunding bonds and to the issuance, sale, or exchange thereof.

Section 13.5—Bonds: Authorization Generally. Bonds and other indebtedness of the commission shall be authorized by resolution of the commission. The validity of the

authorization and issuance of any bonds by the commission shall not be dependent upon or affected in any way by: ((1) the disposition of bond proceeds by the commission or by contract, commitment or action taken with respect to such proceeds; or ((2) the failure to complete any part of the project for which bonds are authorized to be issued. The commission may issue bonds in one or more series and may provide for one or more consolidated bond issues, in such principal amounts and with such terms and provisions as the commission may deem necessary. The bonds may be secured by a pledge of all or any part of the property, revenues, and franchises under its control. Bonds may be issued by the commission in such amount, with such maturities and in such denomination and form or forms, whether coupon or registered, as to both principal and interest, as may be determined by the commission. The commission may provide for redemption of bonds prior to maturity on such notice and at such time or times and with such redemption provisions, including premiums, as the commission may determine.

Section 13.6—Bonds, Resolutions and Indentures Generallv. The commission may determine and enter into indentures providing for the principal amount, date or dates, maturities, interest rate, denominations, form, registration, transfer, interchange, and other provisions of the bonds and coupons and the terms and conditions upon which the same shall be executed, issued, secured, sold, paid, redeemed, funded, and refunded. The resolution of the commission authorizing any bond or any indenture so authorized under which the bonds are issued may include all such covenants and other provisions other than any restriction on the regulatory powers vested in the commission by this compact as the commission may deem necessary or desirable for the issue, payment, security, protection, or marketing of the bonds, including without limitation covenants and other provisions as to the rates or amounts of fees, rents, and other charges to be charged or made for use of the facilities; the use, pledge, custody, securing, application, and disposition of such revenues, of the proceeds of the bonds, and of any other monies of the commission; the operation, maintenance, repair, and reconstruction of the facilities and the amounts which may be expended therefor; the sale, lease, or other disposition of the facilities; the insuring of the facilities and of the revenues derived therefrom; the construction or other acquisition of other facilities; the issuance of additional bonds or other indebtedness; the rights of the bondholders and of any trustee for the bondholders upon default by the commission or otherwise; and the modification of the provisions of the indenture and of the bonds. Reference on the face of the bonds to such resolution or indenture by its date of adoption or the apparent date of the face thereof is sufficient to incorporate all of the provisions thereof and of this compact into the body of the bonds and their appurtenant coupons. Each taker and subsequent holder of the bonds or coupons, where the coupons are attached to or detached from the bonds, has recourse to all of the provisions of the indenture and of this compact and is bound thereby.

Section 13.7—Maximum Maturity. No bond or its terms shall mature in more than fifty**,** years from its own date, or on any date subsequent to the duration of this compact, and in the event any authorized issue is divided into two or more series or divisions, the maximum maturity date herein authorized shall be calculated from the date on the face of each bond separately, irrespective of the fact that different dates may be prescribed for the bonds of each separate series or division of any authorized issue.

Section 13.8—Tax Exemption. All bonds issued by the commission under the provisions of this compact and the interest thereon shall at all times be free and exempt from all taxation by or under authority of any of the signatory parties, except for transfer, inheritance, and estate taxes.

Section 13.9—Interest. Bonds shall bear interest at such rate as the commission shall determine, payable annually and semi-annually.

Section 13.10—Place of Payment. The commission may provide for the payment of the principal and interest of bonds at any place or places within or without the signatory states, and in any specified lawful coin or currency of the United States of America.

Section 13.11—Execution. The commission may provide for the execution and authentication of bonds by the manual, lithographed, or printed facsimile signature of officers of the commission, any by additional authentication by a trustee or fiscal agent appointed by the commission. If any of the officers whose signatures or countersignatures appear upon the bonds or coupons ceases to be an officer before the delivery of the bonds or coupons, his signature or countersignature is nevertheless valid and of the same force and effect as if the officer had remained in office until the delivery of the bonds and coupons.

Section 13.12—Holding Own Bonds. The commission shall have power out of any funds available therefor to purchase its bonds and may hold, cancel, or sell such bonds.

Section 13.13—Sale. The commission may fix terms and conditions for the sale or other disposition of any authorized issue of bonds and may sell its bonds at less than their par or face value. All bonds issued or sold for cash pursuant to this Compact shall be sold on sealed proposals to the highest bidder. Prior to such sale, the Commission shall advertise for bids by publication of a notice of sale not less than ten days prior to the date of sale, at least once in a newspaper of general circulation printed and published in New York City carrying municipal bonds notices and devoted primarily to financial news. The commission may reject any and all bids submitted and may thereafter sell the bonds so advertised for sale at private sale to any financially responsible bidder under such terms and conditions as it deems most advantageous to the public interest, but the bonds shall not be sold at a net interest cost calculated upon the entire issue so advertised, greater than the lowest bid which was rejected. In the event the Commission desires to issue its bonds in exchange for an existing facility or portion thereof, or in exchange for bonds secured by the revenues of an existing facility, it may exchange such bonds for the existing facility or portion thereof or for the bonds so secured, plus an additional amount of cash, without advertising such bonds for sale.

Section 13.14—Negotiability. All bonds issued under the provisions of this compact are negotiable instruments, except when registered in the name of a registered owner.

Section 13.15—Legal Investments. Bonds of the commission shall be legal instruments for savings banks, fiduciaries and public funds in each of the signatory states.

Section 13.16—Validation Proceedings. Prior to the issuance of any bonds, the commission may institute a special proceeding to determine the legality of proceedings to issue the bonds and their validity under the laws of any of the signatory parties. Such proceedings shall be instituted and prosecuted in rem, and the judgment rendered therein shall be conclusive against all persons whomsoever and against each of the signatory parties.

Section 13.17—Recording. No indenture need be recorded or filed in any public office, other than the office of the commission. The pledge of revenues provided in any indenture shall take effect forthwith as provided therein and irrespective of the date of receipts of such revenues by the commission or the indenture trustee. Such pledge shall be effective as provided in the indenture without physical delivery of the revenues to the commission or the indenture trustee.

Section 13.18—Pledged Revenues. Bond redemption and interest payments, to the extent provided in the resolution or indenture, shall constitute a first, direct and exclusive charge and lien on all such rates, rents, tolls, fees and charges and other revenues and interest thereon received from the use and operation of the facility, and on any sinking, or other funds created therefrom. All such rates, rents, tolls, fees, charges and other revenues, together with interest thereon, shall constitute a trust fund for the security and payment of such bonds, and except as and to the extent provided in the indenture with respect to the payment therefrom of expenses for other purposes including administration, operation, maintenance, improvements, or extensions of the facilities or other purposes shall not be used or pledged for any other purpose so long as such bonds, or any of them are outstanding, and unpaid.

Section 13.19—Remedies. The holder of any bond may for the equal benefit and protection of all holders of bonds similarly situated; ((1) by mandamus or other appropriate proceedings require and compel the performance of any of the duties imposed upon the commission or assumed by it, its officers, agents, or employees under the provisions of any indenture, in connection with the acquisition, construction, operation, maintenance, repair, reconstruction, or insurance of the facilities, or in connection with the collection, deposit, investment, application, and disbursement of the rates, rents, tolls, fees, charges, and other revenues derived from the operation and use of the facilities, or in connection with the deposit, investment and disbursement of the proceeds received from the sale of bonds; or ((2) by action or suit in a court of competent jurisdiction of any signatory party require the commission to account as if it were the trustee of an express trust, or enjoin any acts or things which may be unlawful or in violation of the rights of the holders of the bonds. The enumeration of such rights and remedies, however, does not exclude the exercise or prosecution of any other rights or remedies available to the holder of bonds.

Section 13.20—Capital Financing by Signatory Parties; Guarantees.

(a) The signatory parties shall provide such capital funds required for projects of the commission as may be authorized by their respective statutes in accordance with a cost sharing plan prepared pursuant to Article 12 of this compact; but nothing in this section shall be deemed to impose any mandatory obligation on any of the signatory parties other than such obligation as may be assumed by a signatory party in connection with a specific project or facility.

(b) Bonds of the commission, notwithstanding any other provision of this compact, may be executed and delivered to any duly authorized agency of any of the signatory parties without public offering and may be sold and resold with or without the guaranty of such signatory party, subject to and in accordance with the constitutions of the respective signatory parties.

(c) The commission may receive and accept, and the signatory parties may make loans, grants, appropriations, advances, and payments of reimbursable or nonreimbursable funds or property in any form for the capital or operating purposes of the commission.

ARTICLE 14

PLAN, PROGRAM and BUDGETS

Section 14.1—Comprehensive Plan. The commission shall develop and adopt, and may from time to time review and revise, a comprehensive plan for the immediate and long range development and use of the water resources of the basin. The plan shall include all public and private projects and facilities which are required, in the judgment of the commission, for optimum planning, development, conservation, utilization, management, and control of the water resources of the basin to meet present and future needs. The commission may adopt a comprehensive plan or any revision thereof in such part or parts as it may deem appropriate, provided that before the adoption of the plan or any part or revision thereof the commission shall consult with water users and interested public bodies and public utilities and shall consider and give due regard to the findings and recommendations of the various agencies of the signatory parties, their political subdivisions, and interested groups. The commission shall conduct public hearings upon due notice given, with respect to the comprehensive plan prior to the adoption of the plan or any part of the revision thereof, except that public and private projects and facilities which, in the judgment of the commission, are not required for the optimum planning, development, conservation, utilization, management, and control of the water resources of the basin and which, in the judgment of the commission, will not significantly affect the water resources of the basin, may be added directly to the comprehensive plan at any time at the discretion of the commission without public hearing thereon. The comprehensive plan shall take into consideration the effect of the plan or any part thereof upon the receiving waters of the Chesapeake Bay.

Section 14.2—Water Resources Program. The commission shall annually adopt a water resources program, based upon the comprehensive plan, consisting of the projects and facilities which the commission proposes to be undertaken by the commission and by other authorized governmental and private agencies, organizations, and persons during the ensuing six years or such other reasonably foreseeable period as the commission may determine. The water resources program shall include a systematic presentation of:

1. The quantity and quality of water resources needs for such period.

2. The existing and proposed projects and facilities required to satisfy such needs, including all public and private projects to be anticipated; and

3. A separate statement of the projects proposed to be undertaken by the commission during such period.

Section 14.3—Annual Current Expense and Capital Budgets.

(a) The commission shall annually adopt a capital budget including all capital projects it proposes to undertake or continue during the budget period containing a statement of the estimated cost of each project and the method of financing thereof.

(b) The commission shall annually adopt a current expense budget for each fiscal year. Such budget shall include the commission's estimated expenses for administration, operation, maintenance, and repairs, including a separate statement thereof for each project, together with its cost allocation. The total of such expenses shall be balanced by the commission's estimated revenues from all sources, including the cost allocations undertaken by any of the signatory parties in connection with any project. Following the adoption of the annual current expense budget by the commission, the executive director of the commission shall:

1. Certify to the respective signatory parties the amounts due in accordance with existing cost sharing established for each project; and

2. Transmit certified copies of such budget to the principal budget officer of the respective signatory parties at such time and in such manner as may be required under their respective budgetary procedures. The amount required to balance the current expense budget in addition to the aggregate amount of item I above and all other revenues available to the commission shall be apportioned equitably among the signatory parties by unanimous vote of the commission, and the amount of such apportionment to each signatory party shall be certified together with the bud et.

(c) The respective signatory parties covenant and agree to include the amounts so apportioned for the support of the current expense budget in their respective budgets next to be adopted, subject to such review and approval as may be required by their respective budgetary processes. Such amounts shall be due and payable to the commission in quarterly installments during its fiscal year, provided that the commission may draw upon its working capital to finance its current expense budget pending remittance by the signatory parties.

ARTICLE 15
GENERAL PROVISIONS

Section 15.1—Auxiliary Powers of Commission; Functions of Commissioners.

(a) The commission, for the purposes of this compact, may:

1. Adopt and use a corporate seal, enter into contracts, and sue and be sued in any court of competent jurisdiction;

2. Receive and accept such payments, appropriations, grant, gifts, loans, advances, and other funds, properties, and services as may be transferred or made available to it by any signatory party or by any other public or private corporation or individual, and enter into agreements to make reimbursement for all or part thereof,

3. Provide for, acquire, and adopt detailed engineering, administrative, financial, and operating plans and specifications to effectuate, maintain, or develop any facility or project;

4. Control and regulate the use of facilities owned or operated by the commission;

5. Acquire, own, operate, maintain, control, sell and convey real and personal property and any interest therein by contract, purchase, lease, license, mortgage, or otherwise as it may deem necessary for any project or facility, including any and all appurtenances thereto necessary, useful, or convenient for such ownership operation, control, maintenance, or conveyance;

6. Have and exercise all corporate powers essential to the declared objects and purposes of the commission.

(b) The commissioners, subject to the provisions of this compact, shall:

1. Serve as the governing body of the commission, and exercise and discharge its powers and duties, except as otherwise provided by or pursuant to this compact;

2. Determine the character of and the necessity for its obligations and expenditures and the manner in which they shall be incurred, allowed, and paid subject to any provisions of law specifically applicable to agencies or instrumentalities created by this compact;

3. Provide for the internal organization and administration of the commission;

4. Appoint the principal officers of the commission and delegate to and allocate among them administrative functions, powers and duties;

5. Create and abolish offices, employments and positions as it deems necessary for the purpose of the commission, and subject to the provisions of this article, fix and provide for the qualification, appointments, removal, term, tenure, compensation, pension, and retirement rights of its officers and employee;

6. Let and execute contracts to carry out the powers of the commission.

Section 15.2—Regulations; Enforcement. The commission may:

1. Make and enforce rules and regulations for the effectuation, application, and enforcement of this compact, and it may adopt and enforce practices and schedules for or in connection with the use, maintenance, and administration of projects and facilities it may own or operate and any product or service rendered thereby; provided that any rule or regulation, other than one which deals solely with the internal management of the commission, shall not be effective unless and until filed in accordance with the law of the respective signatory parties applicable to administrative rules and regulations generally; and

2. Designate any officer, agent, or employee of the commission to be an investigator or watchman and such person shall be vested with the powers of a peace officer of the state in which he is duly assigned to perform his duties.

Section 15.3—Tax Exemptions. The commission, its property, functions, and activities shall be exempt from taxation by or under the authority of any of the signatory parties or any political subdivision thereof, provided that in lieu of property taxes the commission, as to its specific projects, shall make payments to local taxing, districts in annual amounts which shall equal the taxes lawfully assessed upon property for the tax year next prior to its acquisition by the commission for a period of ten years. The nature and amount of such payments shall be reviewed by the commission at the end of ten years, and from time to time thereafter, upon reasonable notice and opportunity to be heard to the affected taxing district, and the payments may be thereupon terminated or continued in such reasonable amount as may be necessary or desirable to take into account hardships incurred and benefits received by the taxing, jurisdiction which are attributed to the project.

Section 15.4—Meetings; Public Hearings; Records, Minutes.

(a) All meetings of the commission shall be open to the public.

(b) The commission shall conduct at least one public hearing in each state prior to the adoption of the initial comprehensive plan. In all other cases wherein this compact requires a public hearing, such hearing shall be held upon not less than twenty days' public notice given by posting at the offices of the commission, and published at least once in a newspaper or newspapers of general circulation in the area or areas affected. The commission shall also provide forthwith for distribution of such notice to the press and by mailing of a copy thereof to any person who shall request such notices.

(c) The minutes of the commission shall be a public record open to inspection at its offices during regular business hours.

Section 15.5—Officers Generally.

(a) The officers of the commission shall consist of an executive director and such additional officers, deputies, and assistants as the commission may determine. The executive director shall be appointed and may be removed by the affirmative vote of a majority of the full membership of the commission. All other officers and employees shall be appointed or dismissed by the executive director under such rules of procedure as the commission may establish.

(b) In the appointment and promotion of officers and employees for the commission, no political, racial, religious, or residence test or qualification shall be permitted or given consideration, but all such appointments and promotions shall be solely on the basis of merit and fitness. Any officer or employee of the commission who is found by the commission to be guilty of a violation of this section shall be immediately dismissed.

Section 15.6—Oath of Office. An oath of office in such form as the commission shall prescribe shall be taken, subscribed, and filed with the commission by the executive director and by each officer appointed by him not later than fifteen days after the appointment.

Section 15.7—Bond. Each officer shall give such bond and in such form and amount as the commission may require, for which the commission shall pay the premium.

Section 15.8—Prohibited Activities.

(a) No commissioner, officer or employee shall:

1. Be financially interested, either directly or indirectly, in any contract, sale, purchase, lease, or transfer of real or personal property to which the commission is a party;

2. Solicit or accept money or any other thing of value in addition to the compensation or expense paid him by the commission for services performed within the scope of his official duties;

3. Offer money or any thing of value for or in consideration of obtaining an appointment, promotion, or privilege in his employment with the commission.

(b) Any officer or employee who willfully violates any of the provisions of this section shall forfeit his office or employment.

(c) Any contract or agreement knowingly made in contravention of this section is void.

(d) Officers and employee of the commission shall be subject, in addition to the provisions of this section, to such criminal and civil sanctions for misconduct in office as may be imposed by Federal law and the law of the signatory state in which such misconduct occurs.

Section 15.9—Purchasing. Contracts for the construction, reconstruction or improvement of any facility when the expenditure required exceeds ten thousand dollars, and contracts for the purchase of services, supplies, equipment, and materials when the expenditure required exceeds five thousand dollars shall be advertised and let upon sealed bids to the lowest reasonable bidder. Notice requesting such bids shall be published in a manner reasonably likely to attract prospective bidders, which publication shall be made at least thirty days before bids are received and in at least two newspapers of general circulation in the basin. The commission may reject any and all bids and readvertise in its discretion. If after rejecting bids the commission determines and resolves that in its opinion the supplies, equipment, and materials may be purchased at a lower price in the open market, the commission may give each responsible bidder an opportunity to negotiate a price and may proceed to purchase the supplies, equipment, and materials in the open market at a negotiated price which is lower than the lowest rejected bid of a responsible bidder, without further observance of the provisions requiring bids or notice. The commission shall adopt rules and regulations to provide for purchasing from the lowest responsible bidder when sealed bids, notice, and publication are not required by this section. The commission may suspend and waive the provisions of this section requiring competitive bids whenever:

1. The purchase is to be made from or the contract to be made with the Federal or any state government or any agency or political subdivision thereof or pursuant to any open and bulk purchase contract of any of them;

2. The public exigency requires the immediate delivery of the articles or performance of the service,

3. Only one source of supply is available;

4. The equipment to be purchased is of a technical nature and the procurement thereof without advertising is necessary in order to assure standardization of equipment and interchangeability of parts in the public interest; or

5. Services are to be provided of a specialized or professional nature.

Section 15.10—Insurance. The commission may self-insure or purchase insurance and pay the premiums therefor against loss or damage to any of its properties; against liability for injury to persons or property; and against loss of revenue from any cause whatsoever. Such insurance coverage shall be in such form and amount as the commission may determine, subject to the requirements of any agreement arising out of the issuance of bonds by the commission.

Section 15.11—Annual Independent Audit.

(a) As soon as practical after the closing of the fiscal year an audit shall be made of the financial accounts of the commission. The audit shall be made by qualified certified public accountants selected by the commission, who have no personal interest direct or indirect in the financial affairs of the commission or any of its officers or employees. The report of audit shall be prepared in accordance with accepted accounting practices and shall be filed with the

chairman and such other officers as the commission shall direct. Copies of the report shall be distributed to each commissioner and shall be made available for public distribution.

(b) Each signatory party by its duly authorized officers shall be entitled to examine and audit at any time all of the books, documents, records, files and accounts, and all other papers, things, or property of the commission. The representatives of the signatory parties shall have access to all books, documents, records, accounts, reports, files, and all other papers, things, or property belonging to or in use by the commission and necessary to facilitate audit and they shall be afforded full facilities for verifying transactions with the balances or securities held by depositories, fiscal agents, and custodians.

(c) The financial transactions of the commission shall be subject to audit by the General Accounting Office in accordance with the principles and procedures applicable to commercial corporate transactions and under such rules and regulations as may be prescribed by the Comptroller General of the United States. The audit shall be conducted at the place or places wherein the accounts of the commission are kept.

(d) Any officer or employee who shall refuse to give all required assistance and information to the accounts selected by the commission or to the authorized officers of any signatory party or who shall refuse to submit to them for examination such books, documents, records, files, accounts, papers, things, or property as may be requested shall forfeit his office.

Section 15.12—Reports. The commission shall make and publish an annual report to the legislative bodies of the signatory parties and to the public reporting on its programs, operations, and finances. It may also prepare, publish, and distribute such other public reports and informational materials as it may deem necessary or desirable.

Section 15.13—Grants, Loans, or Payments by States or Political Subdivisions.

(a) Any or all of the signatory parties or any political subdivision thereof may:

1. Appropriate to the commission such funds as may be necessary to pay preliminary expenses such as the expenses incurred in the making of borings, and other studies of subsurface conditions, in the preparation of contracts for the sale of water and in the preparation of detailed plans and estimates required for the financing of a project;

2. Advance to the commission, either as grants or loans, such funds as may be necessary or convenient to finance the operation and management of or construction by the commission of any facility or project;

3. Make payments to the commission for benefits received or to be received from the operation of any of the projects or facilities of the commission.

(b) Any funds which may be loaned to the commission either by a signatory party or a political subdivision thereof shall be repaid by the commission through the issuance of bonds or out of other income of the commission, such repayment to be made within such period and upon

such terms as may be agreed upon between the commission and the signatory party or political subdivision making the loan.

Section 15.14—Condemnation Proceedings.

(a) The commission shall have the power to acquire by condemnation the fee or any lesser interest in lands, lands lying under water, development rights in land, riparian rights, water rights, water and other real or personal property within the basin for any project or facility authorized pursuant to this compact. This grant of power of eminent domain includes but is not limited to the power to condemn for the purposes of this compact any property already devoted to a public use, by whomsoever owned or held other than property of a signatory party. Any condemnation of any property or franchises owned or used by a municipal or privately owned public utility, unless the affected public utility facility is to be relocated or replaced, shall be subject to the authority of such state board, commission, or other body as may have regulatory jurisdiction over such public utility.

(b) The power of condemnation referred to in subsection (a) shall be exercised in accordance with the provisions of the state condemnation law in force in the signatory state in which the property is located. If there is no applicable state condemnation law, the power of condemnation shall be exercised in accordance with the provisions of Federal condemnation law.

(c) Any award or compensation for the taking of property pursuant to this article shall be paid by the commission and none of the signatory parties nor any other agency, instrumentality or political subdivision thereof shall be liable for such award or compensation.

Section 15.15—Conveyance of Lands and Relocation of Public Facilities.

(a) The respective officers, agencies, departments, commissions, or bodies having jurisdiction and control over real and personal property owned by the signatory parties are authorized and empowered to transfer and convey iii accordance with the laws of the respective parties, to the commission any such property as may be necessary or convenient to the effectuation of the authorized purposes of the commission.

(b) Each political subdivision of each of the signatory parties, notwithstanding any contrary provisions of law, is authorized and empowered to grant and convey to the commission, upon the commission's request, any real property or any interest therein owned by such political subdivision including lands laying under water and lands already devoted to public use which may be necessary or convenient to the effectuation of the authorized purposes of the commission.

(c) Any highway, public utility, or other public facility which will be dislocated by reason of a project deemed necessary by the commission to effectuate the authorized purposes of this compact shall be relocated and the cost thereof shall be paid in accordance with the law of the state in which the facility is located; provided that the cost of such relocation payable by the commission shall not in any event exceed the expenditure required to serve the public convenience and necessity.

Section 15.16—Rights of Way. Permission is hereby granted to the commission to locate, construct, and maintain any aqueducts, lines, pipes, conduits, and auxiliary facilities authorized to be acquired, constructed, owned, operated, or maintained by the commission in, over, under, or across any streets and highways now or hereafter owned, opened, or dedicated to or for public use, subject to such reasonable conditions as the highway department of the signatory party may require.

Section 15.17—Penalty. Any person, association, or corporation who violates or attempts or conspires to violate any provisions of this compact or any rule, regulation, or order of the commission duly made, promulgated, or issued pursuant to the compact in addition to any other remedy, penalty, or consequence provided by law shall be punishable as may be provided by statute of any of the signatory parties within which the violation is committed; provided that in the absence of such provision any such person, association or corporation shall be liable to a penalty of not less than $50 nor more than $1,000 for each such violation to be fixed by the court which the commission may recover in its own name in any court of competent Jurisdiction and in a summary proceeding where available under the practice and procedure of such court. For the purposes of this section in the event of a continuing offense each day of such violation, attempt, or conspiracy shall constitute a separate offense.

Section 15.18—Tort Liability. The commission shall be responsible for claims arising out of the negligent acts or omissions of its officers, agents, and employees only to the extent and subject to the procedures prescribed by law generally with respect to officers, agents, and employees of the government of the United States.

Section 15.19—Effect on Riparian Rights. Nothing contained in this compact shall be construed as affecting or intending to affect or in any way to interfere with the law of the respective signatory parties relating to riparian rights.

Section 15.20—Amendments and Supplements. Amendments and supplements to this compact to implement the purposes thereof may be adopted by legislative action of any of the signatory parties concurred in by all of the others.

Section 15.21—Construction and Severability. The provisions of this compact and of agreements thereunder shall be severable and if any phrase, clause, sentence, or provision of the Susquehanna River Basin Compact or such agreement is declared to be unconstitutional or the applicability thereof to any signatory party, agency, or person is held invalid, the constitutionality of the remainder of such compact or such agreement and the applicability thereof to any other signatory party, agency, person, or circumstance shall not be affected thereby. It is the legislative intent that the provisions of such compact be reasonably and liberally construed.

Section 15.22—Effective Date; Execution. This compact shall become binding and effective thirty days after the enactment of concurring legislation by the Federal government, the states of Maryland and New York, and the Commonwealth of Pennsylvania. The compact shall be signed and sealed in five identical original copies by the respective chief executives of the signatory parties. One such copy shall be filed with the Secretary of State of each of the signatory parties or in accordance with the laws of the state in which the filing is made, and one copy shall be filed and retained in the archives of the commission upon its organization.

IN WITNESS WHEREOF, and in evidence of the adoption and enactment into law of this compact by the Congress and legislatures, respectively, of the signatory parties, the President of the United States and the respective Governors do hereby, in accordance with authority conferred by law, sign this compact in five duplicate original copies, as attested by the respective secretaries of state, and have caused the seals of the United States and of the respective states to be hereunto affixed this 24th day of December, 1970.

_____
PRESIDENT OF THE UNITED STATES

ATTEST

_____
SECRETARY OF STATE

_____
GOVERNOR OF
THE STATE OF MARYLAND

ATTEST

_____
SECRETARY OF STATE

_____
GOVERNOR OF
THE STATE OF NEW YORK

ATTEST

_____
SECRETARY OF STATE

_____
GOVERNOR OF THE
COMMONWEALTH OF
PENNSYLVANIA

ATTEST

_____
SECRETARY OF THE
COMMONWEALTH

PART II
RESERVATIONS AND EFFECTUATION

UNITED STATES: *(From Public Law 91-575, 84 Stat. 1509 et seq.)*

Section 2 Reservations. In the exercise of the powers reserved to the Congress, pursuant to section 1.4 of the compact, the consent to and participation in the compact by the United States is subject to the following conditions and reservations:

(a) Notwithstanding any provision of the Susquehanna River Basin Compact the Susquehanna River Basin Commission shall not undertake any project (as defined in such compact), other than a project for which state supplied funds only will be used, beyond the planning stage until—

(1) Such commission has submitted to the Congress such complete plans and estimates for such project as may be necessary to make an engineering evaluation of such project, including—

(A) Where the project will serve more than one purpose, an allocation of costs among the purposes served and an estimate of the ratio of benefits to costs for each such purpose.

(B) An appointment of costs among the beneficiaries of the project, including the portion of the costs to be borne by the Federal government and by State and local governments, and

(C) A proposal for financing the project, including the terms of any proposed bonds or other evidences of indebtedness to be use for such purpose, and

(2) Such project has been authorized by Act of Congress: **PROVIDED**, that when a project has been authorized by Congress, such additional or changed uses of storage therein as the commission may desire shall require project reauthorization, with reallocation of project costs to all project purposes served.

(b) No provision of section 3.9 of the compact shall be deemed to authorize the commission to impose any charge for water withdrawals or diversions from the basin if such withdrawals or diversions could lawfully have been made without charge on the effective date of the compact or to impose any charges with respect to commercial navigation within the basin, jurisdiction over which is reserved to the Federal government: **PROVIDED**, that this paragraph shall be applicable to the extent not inconsistent with section 1.4 of this compact.

(c) Nothing contained in the compact shall be deemed to restrict the Executive powers of the President in the event of a national emergency.

(d) Nothing contained in the compact shall be construed as impairing or in any manner affecting the applicability to all Federal funds budgeted and appropriated for use by the

commission of such authority over budgetary and appropriation matters as the President and Congress may have with respect to agencies in the executive branch of the Federal government.

(e) Except to the same extent that state bonds are or may continue to be free or exempt from Federal taxation under the Internal Revenue laws of the United States, nothing contained in the compact shall be construed as freeing or exempting from Internal Revenue taxation in any manner whatsoever any bonds issued by the commission, their transfer, or the income therefrom (including any profits made on the sale thereof.

(f) Nothing contained in the compact shall be construed to obligate the United States legally or morally to pay the principal or interest on any bonds issued by the Susquehanna River Basin Commission.

(g) All laborers and mechanics employed by contractors or subcontractors in the construction, alteration or repair, including painting and decorating of projects, buildings and works which are undertaken by the commission or are financially assisted by it, shall be paid wages at rates not less than those prevailing on similar construction in the locality so determined by the Secretary of Labor in accordance with the Davis-Bacon Act, as amended (40 U.S.C. 276a-276a-(5), and every such employee shall receive compensation at a rate not less than one and one half times his basic rate of pay for all hours worked in any workweek in excess of eight hours in any workday or forty hours in any workweek as the case may be. A provision stating the minimum wages thus determined and the requirement that overtime be paid as above provided shall be set out in each project advertisement for bids and in each bid proposal form and shall be made a part of the contract covering the project. The Secretary of Labor shall have, with respect to the administration and enforcement of labor standards specified in this provision, the supervisory, investigatory and other authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 F. R. 3176, 64 Stat. 126(7), and section 2 of the Act of June 13, 1934, as amended (48 Stat. 948, as amended. 50 U.S.C. 276(c)).

(h) The commission shall insure that there is no discrimination on the ground of race, color, religion, sex, or national origin in ((1) the programs and activities of the commission, ((2) the employment practices of the commission, and ((3) the employment practices of parties entering into contracts with the commission, including construction contracts and contracts for private concessions in connection with recreational facilities.

(i) Contracts for the manufacture or furnishing of materials, supplies, articles and equipment with the commission which are in excess of $10,000 shall be subject to the provisions of the Walsh-Healy Public Contracts Act (41 U.S.C. 35 et seq.).

(j) Nothing contained in this Act or in the compact shall be construed as superseding or limiting the functions, under any other law, of the Secretary of the Interior or of any other officer or agency of the United States, relating to water pollution: **PROVIDED**, that the exercise of such functions shall not limit the authority of the commission to control, prevent or abate water pollution.

(k) The provisions of section 8.4 of article 8 of the compact shall not be construed to apply to facilities pursuant to any other Federal law.

(l) For the purposes of the Federal Tort Claims Act, of June 25, 1948 (62 Stat. 98(2), as amended (28 U.S.C. ch. 171 and sections 1346 (b) and 2401 (b) and the Tucker Act of March 3, 1887 (24 Stat. 50(5), as amended (28 U.S.C. 1346(a)((2), 1402, 1491, 1496, 1501, 1503, 2411, 2412, 250(1), and the Administrative Procedure Act of June 11, 1946 (60 Stat. 23(7), as amended (5 U.S.C. 551-558, 701-70(6), and the Federal Power Act of June 10, 1920 (41 Stat. 106(3), as amended (16 U.S.C. 791-82(3), the commission shall not be considered a Federal agency.

(m)The officers and employees of the commission (other than the United States member, alternate United States member, and advisors, and personnel employed by the United States member under direct Federal appropriation) shall not be deemed to be, for any purpose, officers or employees of the United States or to become entitled at any time by reason of employment by the commission to any compensation or benefit payable or made available by the United States solely and directly to its officers or employees.

(n) Neither the compact nor this Act shall be deemed to enlarge the authority of any Federal agency other than the commission to participate in or to provide funds for projects or activities in the Susquehanna River Basin.

(o) Notwithstanding paragraph 7 of section 3.10 of the compact, the United States district courts shall have original jurisdiction of all cases or controversies arising under the compact and this Act, and any case or controversy so arising initiated in a state court shall be removable to the appropriate United States district court in the manner provided by section 1446 of title 28, United States Code. Nothing contained in the compact or elsewhere in this Act shall be construed as a waiver by the United States of its immunity from suit.

(p) The right to alter, amend, or repeal this Act is hereby expressly reserved. The right is hereby reserved to the Congress or any of its standing committees to require the disclosure and furnishing of such information and data by the Susquehanna River Basin Commission as is deemed appropriate by the Congress or any such committee.

(q) The provisions of sections 2.4 and 2.6 of article 2 of the compact notwithstanding, the member and alternate member appointed by the President and advisor there referred to may be paid compensation by the United States, such compensation to be fixed by the President at the rates which he shall deem to prevail in respect to comparable officers in the executive branch.

(r) 1. Nothing contained in this compact or in this Act shall impair, affect, or extend the constitutional authority of the United States.

2. Nothing contained in this compact or in this Act and no action of the commission shall supersede, impair, affect, compel, or prevent the exercise of any of the powers, rights, functions, or jurisdiction of the United States under other existing or future legislation in or over the area or waters which are the subject of the compact, including projects of the commission: **PROVIDED**, That—

(i) The commission shall serve as the principal agency for the coordination of Federal, State, interstate, local and nongovernmental plans for water and related land resources in the Susquehanna River Basin.

(ii) Except as provided in reservation (j), whenever a comprehensive plan, or any part or revision thereof, has been adopted with the concurrence of the member appointed by the President, the exercise of any powers conferred by law on any officer, agency, or instrumentality of the United States with regard to water and related land resources in the Susquehanna River Basin shall not substantially conflict with any such portion of such comprehensive plan and the provisions of section 3.10 and article 12 of the compact shall be applicable to the extent necessary to avoid such substantial conflict: **PROVIDED FURTHER**, That whenever the President shall find and determine that the national interest so requires, he may suspend, modify, or delete any provision of the comprehensive plan to the extent necessary to permit action by the affected agency or officer in accord with the national interest. Such action shall be taken by executive order in which such finding, and determination shall be set forth.

(iii)To insure consideration by Congress or any committee thereof of the commission's views, proposals for Federal projects which come within one or more of the classes requiring commission review under section 3.10 of the compact shall be submitted to the commission for review and recommendation for a period of ninety days or such longer time as may be required by the commission with the concurring vote of the member appointed by the President; and the recommendations and views of the commission thereon, if any, shall be included in any report submitted by the sponsoring Federal agency to the Congress or to any committee thereof in connection with any request for authorization or appropriations therefore.

3. For the purposes of paragraph 2 (ii) hereof, concurrence by the member appointed by the President shall be presumed unless within sixty days after notice to him of adoption of the comprehensive plan, or any part or revision thereof, he shall file with the commission notice of (i) no objection, or (ii) nonconcurrence. Each concurrence of the member appointed by the President in the adoption of the comprehensive plan or any part or revision thereof may be withdrawn by notice filed with the commission at any time between the first and sixtieth day of the sixth year after the initial adoption of the comprehensive plan and of every sixth year thereafter.

(s) In the event that any phrase, clause, sentence or provision of section 1.4 of article I of the compact, is declared to be unconstitutional under the constitution of any of the signatory parties, or the applicability thereof to any signatory party, agency or person is held invalid by a court of last resort of competent jurisdiction, the United States shall cease to be a party to the compact: **PROVIDED**, That the President may continue United States participation in the activities of the commission to the extent that he deems necessary and proper to protect the national interest.

(t) 1. All Acts or parts of Acts inconsistent with the provisions of this Act are hereby amended for the purpose of this Act to the extent necessary to carry out the provisions of this Act.

2. No action of the commission shall have the effect of repealing, modifying, or amending any Federal law.

(u) Notwithstanding the provisions of section 2.2 and 2.3 of the compact, the Federal member of the commission and his alternate shall be appointed by the President of the United States and shall serve at the pleasure of the President.

(v) Notwithstanding the provisions of section 12.5 or any other provision of the compact, the furnishing of technical services to the commission by agencies of the executive branch of the Government of the United States is pledged only to the extent that the respective agencies shall from time to time agree thereto or to the extent that the President may from time to time direct such agencies to perform such services for the commission. Nothing, in the compact shall be deemed to require the United States to furnish administrative services or facilities for carrying out functions of the commission except to the extent that the President may direct.

(w) Nothing contained in this Act or in the compact shall supersede, impair, affect, compel, or prevent the exercise of any of the powers, rights, functions, or jurisdiction of the Federal Power Commission, Federal Communications Commission, Atomic Energy Commission, Interstate Commerce Commission, or other such Federal independent regulatory agency under existing or future legislation. Accordingly, no action of the Susquehanna River Basin Commission shall conflict with any of the terms or conditions of any license or permit granted or issued by the aforementioned Federal agencies. This reservation shall not be construed as a basis for noncompliance with the requirements of the compact or this Act; nor shall it be construed to permit use of waters of the Susquehanna River Basin or to endanger their quality without approval pursuant to the compact.

Section 3 Effectuation. (a) The President is authorized to take such action as may be necessary and proper, in his discretion, to effectuate the compact and the initial organization and operation of the commission thereunder.

(b) Executive departments and other agencies of the executive branch of the Federal government shall cooperate with and furnish appropriate assistance to the United States member. Such assistance shall include the furnishing of services and facilities and may include the detailing of personnel to the United States member. Appropriations are hereby authorized as necessary for the support of the United States member and his office, including appropriations for the employment of personnel by the United Sates member.

APPROVED DECEMBER 24, 1970.

MARYLAND: *(Maryland Act of 1967, Chapter No. 391)*

Section 2—Reservations. Nothing in the Susquehanna River Basin Compact shall be construed to impair or to derogate from any power exercisable by the mayor and city council of Baltimore or in any way to diminish any right which the mayor and city council of Baltimore may have to the waters of the Susquehanna River Basin. It is hereby recognized that article 1.3-6 of the compact (section 60) providing that "the commission shall engage in construction, operation, and maintenance of a project only when the project is necessary to the execution of the comprehensive plan and no other competent agency is in a position to act, or such agency fails to act"; and that article 3.2 of the compact (section 6(2) which provides that "it is the policy of the signatory parties to preserve and utilize the functions, powers, and duties of the existing offices and agencies of government to the extent consistent with this compact, and the commission is directed to utilize those offices and agencies for the purposes of this corn act" confirm the primary right of the mayor and city council of Baltimore to construct and operate any facilities for water supply from the Susquehanna River Basin which it determines to be in its own interest or in the interest of its service area to construct and operate and confirm that the power of condemnation possessed by the Susquehanna River Basin Commission pursuant to article 15.14 of the compact (section 74) may be exercised only with due regard for such primary right.

Section 2.3—Effectuation. Subject to other provisions in this Act covering the application and effect of the Susquehanna River Basin Compact, particularly those in section 74 (15.22 thereof), this Act shall take effect on June 1, 1967.

NEW YORK: *(From New York Act of 1967, Chapter No. 785)*

§ **835-a. Member and Alternate.**

1. As provided in section 2.2 of the compact, the Governor or his designee shall be this state's member on the commission established thereby. A member of the Water Resources Commission shall be appointed as the designee if one is appointed. The Governor shall appoint an alternate pursuant to section 2.3 of the compact. If the Governor does not appoint a designee to act for him, he shall appoint a member of the Water Resources Commission as alternate.

2. Any person serving on the Susquehanna River Basin Commission pursuant to this section shall be reimbursed for all necessary expenses incurred as an incident of such service and such reimbursement shall be from the funds of said person's department or office.

§ **835-b. Advisory Committee.** The members of the Water Resources Commission shall constitute an advisory committee with whom the member of the Susquehanna River Basin Commission from this state may consult with respect to the conduct of New York participation in the compact.

§ **835-c. Consent to Alteration of Diversion.**

1. Consent of the member from this state to the impairment, diminution, or other adverse effect on diversions, compensating releases, rights, conditions, obligations and provisions for the administration thereof as contemplated by section 3.8 of the compact shall not be Given, except with the prior approval of the Water Resources Commission.

2. Except with respect to diversions governed by subdivision one of this section the provisions of section four hundred fifty-two of the conservation law shall not apply to any diversion or furnishing of water authorized or made pursuant to the compact.

§ **835-d. Jurisdiction of Courts.** Except as otherwise specifically provided herein, the phrase "court of competent jurisdiction" as used in the compact shall mean, with reference to courts of this state, the supreme court, and said court is hereby given all necessary and appropriate jurisdiction to hear and determine any action or proceeding brought before it pursuant to appropriate provisions of the compact. As used in section 11.6 of the compact, the phrase "court of competent jurisdiction" shall mean, with reference to courts of this state, a court in which an appropriate proceeding under article seventy-eight of the civil practice law and rules may be brought. As used in clause one of subdivision (a) of section 15.1 of the compact, the phrase "court of competent jurisdiction" shall mean with reference to courts of this state, any court in which an action or proceeding of the class brought by the Susquehanna River Basin Commission may be heard and determined.

§ **835-e. Prior Project Approval.** No project requiring license, permit or other approval by any agency or officer of this state, or any subdivision thereof, shall be given any final license, permit or approval, by such agency or officer of this state if such project requires approval of the

Susquehanna River Basin Commission pursuant to this compact and such approval has not been given.

§ **835-f. Delegations of Power.** No agency or officer of this state or any subdivision thereof shall accept or exercise any delegation or power pursuant to section 11.1 of the compact unless, in the absence of the compact, it would have the constitutional or statutory power to exercise such power on its own account.

§ **835-g. Cooperative Services.** Departments, agencies and officers shall provide technical and administrative services to the Susquehanna River Basin Commission upon request within the limits of available appropriations and shall cooperate generallv with said commission for the purposes of the compact.

§ **835-h. Budget.** The Susquehanna River Basin Commission shall submit annually to the director of the budget in accordance with the rules and practices of the state for study and consideration by such director, an estimate of monies required to administer, manage and support the commission during, the ensuing, fiscal year. Such estimates shall include any request for appropriation of funds by New York and shall be accompanied by a tabulation of similar requests which the commission expects to make to each signatory and the formula or factors upon which such respective requests are based. The provisions of section 14.3 of the compact apply to the budgetary and other fiscal matters related to the participation of this state in the compact.

§ **835-i. Audit.** Pursuant to subdivision (b) of section 15.1 1 of the compact, the state comptroller is hereby authorized and empowered from time to time to examine the accounts and books of the commission including its receipts, disbursements and other items referring to its financial standing as the comptroller may deem proper and to report the results of such examination to the Governor.

§ **835-j. Inconsistent Laws.** No provisions of the conservation law or of any other law of this state which is inconsistent with the provisions of the compact shall be applicable to the Susquehanna River Basin Commission or to any matter governed by the compact.

§ **4.** The compact above set forth shall become binding and effective in accordance with the provisions of section 15.22 thereof. The Governor is hereby authorized and directed to sign and seal the compact as provided in said section 15.22 and to cause copies thereof to be filed in accordance therewith.

§ **5.** This act shall take effect immediately.

PENNSYLVANIA: *(From Pennsylvania Act of 1968, Act No. 18(1)*

Section 2—Repealer. All acts and parts of acts inconsistent with any provision of this act are to the extent of such inconsistency hereby repealed.

Section 3—Effectuation by Governor. The Governor is authorized to take such action as may be necessary and proper in his discretion to effectuate the compact and the initial organization and operation of the commission thereunder.

Section 4—Entire Agreement. It is declared to be the intention of the General Assembly of the Commonwealth of Pennsylvania that the provisions of the compact shall constitute the entire agreement of the signatories and any matters within any enabling legislation not included in the compact shall have no effect on the signatories without their specific concurrence.

Section 5—Technical and Administrative Services. The Commonwealth or any agency thereof shall furnish technical and administrative service to the commission pursuant to section 12.5 of the compact only under written agreement between the Commonwealth or any agency thereof and the commission. Any such agreement shall detail fully the terms and conditions under which the service is to be provided, including cost. Payments by the commission pursuant to any such agreement shall be not later than within the fiscal period immediately following the fiscal period when such services are rendered.

Section 6—Minutes of Meetings. The commission shall file promptly copies of the minutes of each of its meetings, the comprehensive plan and any additions, modifications, deletions, or other amendments thereto with the Secretary of the Senate, the Clerk of the House, and the majority and minority chairmen of the committees on appropriations of the General Assembly of the Commonwealth. Neither the comprehensive plan nor any additions, modifications, deletions, or other amendments thereto shall take effect with respect to the Commonwealth or any agency, subdivision, or other entity therein until provisions of this section have been met. The requirements of this section are in addition to those providing for examination and inspection of commission records and reports to the General Assembly contained in section 15.11 and 15.12 of the compact, and shall be inclusive of the water resources program prepared annually in compliance with the provisions of section 14.2 of the compact. Upon its approval by the commission, the initial comprehensive plan shall be furnished to each member of the General Assembly, and thereafter the commission, at the time it furnishes its annual report, shall furnish also to each member of the General Assembly the minutes of all commission meetings in the fiscal year covered by such report, containing the additions, modifications, deletions, or other amendments to the comprehensive plan approved in said fiscal year.

Section 7—Budget. The term "budgetary processes" in section 14.3 of the compact shall be construed to include the presentation by the commission of its proposed budget for each fiscal period to the Budget Secretary in the Office of Administration in accordance with the rules and practices of the Commonwealth governing administrative agencies, for study and consideration by such Budget Secretary, and each such budget shall include a statement of monies required to administer, manage, and support the commission during the ensuing fiscal period. Such statement shall include any request for appropriation of funds by the Commonwealth and shall be

accompanied by a tabulation of similar requests which the commission makes or expects to make to each other signatory party, and the formula or factors upon which such respective requests are based. Further, the term "budgetary processes" as applied to the Commonwealth shall not be considered complied with until it includes appropriation by the General Assembly and the signing of the appropriation into law by the Governor.

Section 8—Fish and Game Laws. Anything in Section 270 of the act of December 15, 1959 (P.L. 177(9), known as the "The Fish Law of 1959", to the contrary notwithstanding. no person acting within the Commonwealth pursuant to section 15.2-2 of the compact shall enforce fish or game laws or regulations.

Section 9—Effectuation. This act shall take effect immediately.

APPROVED—The 17th day of July, A.D. 1968.

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APPENDIX 2

PROJECTS, PLANS AND OTHER ACTIONS INCORPORATED INTO THE COMPREHENSIVE PLAN

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PROJECTS, PLANS, AND OTHER ACTIONS INCORPORATED INTO THE COMPREHENSIVE PLAN

The Commission has been incorporating projects, plans, and other actions into its Comprehensive Plan since 1973. Section 14.1 of the Compact states that the Plan shall include public and private projects and facilities "which are required, in the judgment of the commission, for optimum planning, development, conservation, utilization, management, and control of the water resources of the basin to meet present and future needs." In accordance with this authority, the following projects, plans, policies, programs, and regulations are included in the Comprehensive Plan.

Table 2-1 lists federal, state, and private water resource projects. Table 2-2 lists plans, policies, programs, and regulations.

Finally, Table 2-3 lists the numerous water use facilities approved under the Commission's regulatory program. These facilities include many individual projects since some facilities have more than one project as indicated by the multiple approvals listed in Table 2-3. A brief description of the facilities is included under the NAICS (North American Industry Classification System) Title column. Project approval remains in effect until the expiration date unless: (1) the withdrawal, diversion or consumptive use of water has not commenced within three years of the approval; (2) the withdrawal, diversion or consumptive use of water is discontinued for five years; or (3) the project is abandoned. Extension of the project approval beyond the expiration date requires an application be submitted by the project sponsor and it be approved by the Commission. Table 2-3 lists a few projects that are past their expiration dates, but are still considered active. In these cases, the project sponsors have submitted or are in the process of submitting applications to reapply for water use approvals. If approved, a new expiration date will be set.

Table 2-1. Water Resource Projects

	Year Incorporated	Federal Projects
1	1976	Loyalsock Township Local Flood Protection Project (Pa.)
2	1980	Lock Haven Local Flood Protection Project (Pa.)
3	1981	Wyoming Valley Local Flood Protection Project (Pa.)
4	1992	Lackawanna River Flood Protection Projects (Scranton and Olyphant, Pa.)
5	1992	Curwensville Lake Storage Reallocation Project (Pa.)
6	2007	Whitney Point Lake Section 1135 Project Modification, Broome County, N.Y.
7	2008	USACE Reservoir System - Almond Lake (N.Y.), Arkport Dam (N.Y.), Aylesworth Lake (Pa.), Alvin R. Bush Dam (Pa.), Cowanesque Lake (Pa.), Curwensville Lake (Pa.), East Sidney Lake (N.Y.), Indian Rock Dam (Pa.), Raystown Lake (Pa.), Foster J. Sayers Dam (Pa.), Stillwater Lake (Pa.), Whitney Point Lake (N.Y.), Tioga-Hammond Lakes (Pa.)
8	2008	Addison Local Flood Protection Project (N.Y.)
9	2008	Avoca Local Flood Protection Project (N.Y.)
10	2008	Bath Local Flood Protection Project (N.Y.)
11	2008	Binghamton Local Flood Protection Project (N.Y.)
12	2008	Canisteo Local Flood Protection Project (N.Y.)
13	2008	Corning-Painted Post Local Flood Protection Project (N.Y.)
14	2008	Elmira Local Flood Protection Project (N.Y.)
15	2008	Endicott-Johnson City Local Flood Protection Project (N.Y.)
16	2008	Greene Local Flood Protection Project (N.Y.)

	Year Incorporated	Federal Projects
17	2008	Hornell Local Flood Protection Project (N.Y.)
18	2008	Lisle Local Flood Protection Project (N.Y.)
19	2008	Nichols Local Flood Protection Project (N.Y.)
20	2008	Oxford Local Flood Protection Project (N.Y.)
21	2008	Whitney Point Village Local Flood Protection Project (N.Y.)
22	2008	Elkland Local Flood Protection Project (Pa.)
23	2008	Howard Local Flood Protection Project (Pa.)
24	2008	Mansfield Local Flood Protection Project (Pa.)
25	2008	Sunbury Local Flood Protection Project (Pa.)
26	2008	Williamsport-South Williamsport Local Flood Protection Project (Pa.)
27	2008	York Local Flood Protection Project (Pa.)

	Year Incorporated	Pennsylvania Projects
1	1980	Lebanon Local Flood Protection Project
2	1984	Moosic Local Flood Protection Project
3	1984	Cherry Tree Local Flood Protection Project
4	1984	Huntingdon Local Flood Protection Project
5	1991	Wildcat Creek Flood Protection Project
6	1994	Tanners Run Flood Protection Project
7	1994	Wadham Creek Flood Protection Project
8	1994	Mill Creek Flood Control Project (City of Wilkes-Barre and Plains Twp.)
9	1994	Milesburg Borough Stream Diversion Project
10	1994	Mahoning Creek Flood Protection Project
11	1994	Hop Bottom Flood Protection Project
12	1994	Exeter Borough Flood Protection Project
13	1994	Abrahams Creek Stream Improvement Project
14	1995	City of Scranton and Dunmore Borough Flood Control Project (Lindy Creek, Keyser Creek and Meadow Brook)
15	1999	Mill Creek Flood Control Project (Borough of Avoca)
16	2002	Migratory fish passageway at Lake Augusta Inflatable Dam, near Sunbury
17	2007	Lancashire No. 15 Abandoned Mine Drainage Treatment Plant, Cambria County

	Year Incorporated	New York Projects
1	1977	Gang Mills Local Flood Protection Project
2	1977	Hodgmans Creek Local Flood Protection Project

	Year Incorporated	Major Electric Power Plants
	2008	AES Hickling AES Ironwood CCGT Power Plant * AES Jennison AES Westover Generating Station * Archbald Power Station Brunner Island Steam Electric Station * Conowingo Hydroelectric Station Holtwood Hydroelectric Project Hunlock Power Station John B Rich Memorial Power Station/Gilberton CoGen Plant * Montour Steam Electric Station * Muddy Run Pumped Storage Facility Peach Bottom Atomic Power Station * Rock Springs Generation Facility * Safe Harbor Hydroelectric Station * Shawville Generating Station Sunbury Generation Facility Susquehanna Steam Electric Station * Three Mile Island Nuclear Station * York Haven Hydro Station

* **Note:** These facilities have also been approved for specific water use by the Commission. See Table 2-3.

	Year Incorporated	Major Fish Passage Facilities
	2008	At Conowingo Hydroelectric Station At Holtwood Hydroelectric Project At Safe Harbor Hydroelectric Station At York Haven Hydro Station

Table 2-2. Plans, Policies, Programs and Regulations

	Year Incorporated	Commission Plan, Policy, Program or Regulation – Action Taken
1	1973	Comprehensive Plan – Adopted
2	1980	Comprehensive Plan – Amended to set a goal to acquire and manage water supply storage
3	1980	Comprehensive Plan – Amended to recognize pre-Compact diversions
4	1982	Cowanesque Reservoir Project Purpose – Modified through a plan to include water supply (along with flood control and recreation)
5	1982	Comprehensive Plan – Amended to include "Amendment to Comprehensive Plan Providing a Strategic Plan for Restoration of Diadromous Fishes to the Susquehanna River Basin" (In 2002, this program was changed to "Alosid Management and Restoration Plan for the Susquehanna River Basin")
6	1987	Comprehensive Plan – Revised
7	1996	ICEJAMS Committee Action Plan – Adopted (plan was led by the Commission but developed by an interagency committee)
8	2006	Conowingo Pond Management Plan – Adopted
9	2006	Regulations and Procedures for Review of Projects – Revised
10	2007	Comprehensive Plan – Revised to incorporate provisions of revised regulations (#9 above) and incorporate revised Aquifer Testing Guidance
11	2008	Groundwater Management Plan for the Susquehanna River Basin – Adopted
12	2008	Consumptive Use Mitigation Plan for the Susquehanna River Basin – Adopted
13	2008	Susquehanna River Basin Drought Coordination Plan
14	2008	Comprehensive Plan – Revised
15	2009	Low Flow Monitoring Plan for the Susquehanna River Basin – Adopted
16	2009	Comprehensive Plan – Amended to include "Low Flow Monitoring Plan for the Susquehanna River Basin," various water use projects, and the Water Resources Program for Fiscal Year 2010-2011
17	2011	Comprehensive Plan – Amended to include "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin," various water use projects, and the Water Resources Program for Fiscal Year 2012-2013
18	2012	Comprehensive Plan – Amended to include various water use projects and the Water Resources Program for Fiscal Year 2013-2014

	Year Incorporated	Plan, Policy, Program or Regulation of Others
1	1980	Pa. Wild and Scenic Rivers System – Stony Creek
2	1981	Pa. Wild and Scenic Rivers System – Lick Run
3	1983	Pa. Wild and Scenic Rivers System – Octoraro Creek
4	1987	Pa. Wild and Scenic Rivers System – Letort Spring Run
5	1988	Pa. Wild and Scenic Rivers System – Tucquan Creek and Clark Run Tributary
6	1991	Pa. Wild and Scenic Rivers System – Pine Creek
7	1993	Pa. Wild and Scenic Rivers System –Yellow Breeches Creek
8	1995	Chesapeake Bay Policy for the Introduction of Non-Indigenous Aquatic Species
9	2008	National Weather Service's Susquehanna Flood Forecast and Warning System
10	2008	Strategic Plan for Flood Forecast and Warning-Susquehanna Improvements Program
11	2011	Migratory Fish Management and Restoration Plan for the Susquehanna River Basin – Adopted

Table 2-3. Active Commission Approved Water Use Projects

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Aaronsburg Water Pipes, Inc.	Haines Township	PA	SW	Water Supply and Irrigation Systems	1/13/1994	3/3/2018
Aberdeen, City of	Bel Air District	MD	SW,CU	Water Supply and Irrigation Systems	12/12/2002, 06/12/2003, 08/14/2003, 09/08/2004	12/12/2014, 12/12/2014, 12/12/2014, 12/12/2014
Adamstown Borough / Adamstown, Borough of	Adamstown Borough	PA	GW	Water Supply and Irrigation Systems	11/13/1980	11/13/2010
ADM Cocoa / Hazleton	Hazle Township	PA	CU	Chocolate and Confectionery Manufacturing from Cacao Beans	3/24/2009	3/24/2024
AES / AES Ironwood, LLC	South Lebanon Township	PA	SW,CU,GW	Electric Power Generation	05/21/1998, 06/13/2007	05/21/2023, 05/21/2023
AES / Westover Generating Station	Union Township	NY	SW,CU	Electric Power Generation	9/12/2007	9/12/2022
Afton Golf Club, Inc.	Chenango Township	NY	CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Agro Farma Inc. / Norwich Plant	Norwich City	NY	GW	Pharmaceutical and Medicine Manufacturing	3/10/2004	3/10/2029
Air Products and Chemicals, Inc. / Air Products and Chemicals, Inc.	East Hempfield Township	PA	CU	Industrial Gas Manufacturing	6/8/2005	6/8/2030
Akron, Borough of / Akron, Borough of	Akron Borough	PA	GW	Water Supply and Irrigation Systems	12/10/1981, 01/14/1982	12/10/2011, 01/14/2012
Albany International / Albany International	Cortland City	NY	GW	Spring and Wire Product Manufacturing	12/15/2004, 12/05/2006	12/15/2029, 12/15/2029
Albemarle Corporation	Tyrone Borough	PA	CU	Chemical Manufacturing	02/08/2001, 03/10/2004	02/08/2026, 02/08/2026
Allegheny Energy Supply Company, LLC / Hunlock Creek Unit - 4	Hunlock Township	PA	CU	Electric Power Generation	3/9/2010	3/9/2015
Alliance Sanitary Landfill, Inc.	Taylor Borough	PA	GW,SW,CU	Solid Waste Landfill	6/9/2004	6/9/2029
Altoona Water Authority	Altoona City	PA	SW	Water Supply and Irrigation Systems	05/10/1984, 05/01/2008	05/21/2034, 05/01/2032
Alumax Mill Products, Inc.	Manheim Township	PA	CU	Aluminum Sheet, Plate, and Foil Manufacturing	10/10/2002, 06/08/2005	10/10/2027, 10/10/2027
American Infrastruction, Inc. / Compass Quarries, Inc., d.b.a. Independence Construction Materials	Paradise Township	PA	CU	Crushed and Broken Limestone Mining and Quarrying	6/9/2004	6/9/2029
American Legion Country Club	Wayne Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Anadarko E&P Company LP / Ann C Good Pad B	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Anadarko E&P Company LP / Ann M. Mercier Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Anadarko E&P Company LP / Beech Creek at Kato	Snow Shoe Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Anadarko E&P Company LP / Brian K Frymire Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Anadarko E&P Company LP / C.O.P. Tract 231 (1000)	Boggs Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / C.O.P. Tract 285 (1000)	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 03/04/2010	4/6/2014
Anadarko E&P Company LP / C.O.P. TRACT 343 PAD C	Noyes Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2009	9/3/2014
Anadarko E&P Company LP / C.O.P. Tract 653 - 1000	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / Charles J McNamee Pad B	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / Clearview HC Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2010	7/22/2015
Anadarko E&P Company LP / COP Tr 231 C	Boggs Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Anadarko E&P Company LP / COP Tr 231 D	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2010	5/18/2015
Anadarko E&P Company LP / COP Tr 231 Pad E	Boggs Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Anadarko E&P Company LP / COP Tr 244 #1000H	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2009	9/15/2014
Anadarko E&P Company LP / COP Tr 244 #1001H & #1002H	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2009	9/15/2014
Anadarko E&P Company LP / COP Tr 252 #1000H	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/2/2014
Anadarko E&P Company LP / COP Tr 252 #1001H & #1002H	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/27/2014
Anadarko E&P Company LP / COP Tr 255 A	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Anadarko E&P Company LP / COP Tr 259 #1000H	Burnside Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
Anadarko E&P Company LP / COP Tr 259 #1001H	Burnside Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/27/2014
Anadarko E&P Company LP / COP Tr 259 #1002H	Burnside Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/27/2014
Anadarko E&P Company LP / COP Tr 285 Pad C	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Anadarko E&P Company LP / COP Tr 285 Pad D	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/2/2010	8/2/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Anadarko E&P Company LP / COP Tr 285 Pad E	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/21/2010, 07/26/2011	07/21/2015, 07/21/2015
Anadarko E&P Company LP / COP Tr 285 Pad F	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / COP Tr 285 Pad G	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015
Anadarko E&P Company LP / COP Tr 285 Pad H	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / COP Tr 289 C	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
Anadarko E&P Company LP / COP Tr 289 Pad D	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/06/2010, 07/26/2011	08/06/2015, 08/06/2015
Anadarko E&P Company LP / COP Tr 289 Pad E	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Anadarko E&P Company LP / COP Tr 290 Pad A	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/10/2010, 07/26/2011	09/10/2015, 09/10/2015
Anadarko E&P Company LP / COP Tr 290 Pad B	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
Anadarko E&P Company LP / COP Tr 342 A	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015
Anadarko E&P Company LP / COP Tr 342 D	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
Anadarko E&P Company LP / COP Tr 343 Pad B	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Anadarko E&P Company LP / COP Tr 344 Pad A	Noyes Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015
Anadarko E&P Company LP / COP Tr 344 Pad B	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / COP Tr 356 Pad A	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
Anadarko E&P Company LP / COP Tr 356 Pad D	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/16/2010	7/16/2015
Anadarko E&P Company LP / COP Tr 356 Pad F	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
Anadarko E&P Company LP / COP Tr 356 Pad H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / COP Tr 356 Pad I	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Anadarko E&P Company LP / COP Tr 357 Pad A	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
Anadarko E&P Company LP / COP Tr 357 Pad B	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Anadarko E&P Company LP / COP Tr 678 #1000H	Noyes Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2009	8/26/2014
Anadarko E&P Company LP / COP Tr 678 #1001H & #1002H	Noyes Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2009	8/26/2014
Anadarko E&P Company LP / COP Tr 685 A	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2010	5/24/2015
Anadarko E&P Company LP / COP Tr 685 Pad C	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Anadarko E&P Company LP / COP Tr 728 C	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/5/2011	4/5/2016
Anadarko E&P Company LP / COP Tr 728 D	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/4/2011	4/4/2016
Anadarko E&P Company LP / COP Tr 728 Pad A	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2010	6/10/2015
Anadarko E&P Company LP / COP Tr 731 Pad A	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/13/2010	9/13/2015
Anadarko E&P Company LP / COP Tract 027B Pad A	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/14/2011	7/14/2016
Anadarko E&P Company LP / COP Tract 231 (1001H, 1002H)	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / COP Tract 285 (1001H, 1002H)	Grugan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / COP Tract 289 (1000H & 1001H)	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / COP Tract 356 Pad E	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2011	12/20/2016
Anadarko E&P Company LP / COP Tract 356 Pad G	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2011	8/10/2016
Anadarko E&P Company LP / COP Tract 653 (1001H)	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / COP Tract 653 (1002H)	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / COP Tract 685 Pad B	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Anadarko E&P Company LP / COP Tract 728 Pad B	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/30/2011	6/30/2016
Anadarko E&P Company LP / COP Tract 728 Pad G	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2011	5/13/2016
Anadarko E&P Company LP / COP Tract 728 Pad H	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2011	5/13/2016
Anadarko E&P Company LP / COP Tract 731 Pad C	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2011	9/20/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Anadarko E&P Company LP / COP Tract 731 Pad D	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2011	9/20/2016
Anadarko E&P Company LP / COP Tract 731 Pad E	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Anadarko E&P Company LP / Cynthia M Knispel Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2011	3/24/2016
Anadarko E&P Company LP / David C Duncan Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
Anadarko E&P Company LP / David G Wascher Pad A	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2010	11/8/2015
Anadarko E&P Company LP / David O Vollman Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/24/2010	11/24/2015
Anadarko E&P Company LP / Don J Davis Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
Anadarko E&P Company LP / Douglas C Kinley Pad A	Lycoming Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Anadarko E&P Company LP / Elbow F&G Pad B	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2012	6/18/2017
Anadarko E&P Company LP / Elbow Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Anadarko E&P Company LP / Elbow Pad C	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / Eugene P Nelson Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2011	3/23/2016
Anadarko E&P Company LP / Frank L Hartley Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Anadarko E&P Company LP / Gayla D Loch Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Anadarko E&P Company LP / George E Hagemeyer Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Anadarko E&P Company LP / H Lyle Landon Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2011	6/24/2016
Anadarko E&P Company LP / Harry W Stryker Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Anadarko E&P Company LP / Jack L Hipple Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / Jason M Phillips Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
Anadarko E&P Company LP / Kenneth T Schriner Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2010	9/30/2015
Anadarko E&P Company LP / Larry's Creek F&G -1	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014

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Anadarko E&P Company LP / Larry's Creek F&G 2H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / Larry's Creek F&G 3H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / Larrys Creek F&G Pad C	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/20/2011	5/20/2016
Anadarko E&P Company LP / Larry's Creek F&G Pad D	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Anadarko E&P Company LP / Larrys Creek F&G Pad E	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2011	12/20/2016
Anadarko E&P Company LP / Larrys Creek F&G Pad H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2011	6/24/2016
Anadarko E&P Company LP / Lycoming Creek - Huff	Lewis Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Anadarko E&P Company LP / Lycoming H&FC Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Anadarko E&P Company LP / Lycoming H&FC Pad B	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2010	9/27/2015
Anadarko E&P Company LP / Lycoming H&FC Pad C	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/6/2011	9/6/2016
Anadarko E&P Company LP / Lycoming H&FC Pad D	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Anadarko E&P Company LP / Lycoming H&FC Pad E	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/20/2011	5/20/2016
Anadarko E&P Company LP / Maurice D Bieber Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Anadarko E&P Company LP / Michael R Fulkerson Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Anadarko E&P Company LP / Nevin L Smith Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Anadarko E&P Company LP / Penn State Forest Tr 289 #1	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Anadarko E&P Company LP / Pine Creek - 2	McHenry Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Anadarko E&P Company LP / Pine Creek - Jersey Mills	McHenry Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Anadarko E&P Company LP / Pine Creek (PC1N)	Watson Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
Anadarko E&P Company LP / Plants Evergreen Farm Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Anadarko E&P Company LP / R Carlin #1H	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/27/2014

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Anadarko E&P Company LP / R Carlin #2H & #3H	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2009	4/27/2014
Anadarko E&P Company LP / Robert C Ulmer Pad A	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/16/2010	7/16/2015
Anadarko E&P Company LP / Scott E Ely Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Anadarko E&P Company LP / Stephen M Sleboda Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Anadarko E&P Company LP / Texas Blockhouse F&G B	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/9/2010	2/9/2015
Anadarko E&P Company LP / Thomas E Smith Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Anadarko E&P Company LP / Tx Gulf B #1H	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2009	8/26/2014
Anadarko E&P Company LP / Tx Gulf B #2H & #3H	Beech Creek Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	8/26/2009	8/26/2014
Anadarko E&P Company LP / Wallis Run HC Pad A	Cascade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
Anadarko E&P Company LP / West Branch Susquehanna River - 3	Nippenose Township	PA	SW	Crude Petroleum and Natural Gas Extraction	03/12/2009, 03/11/2011	03/12/2013, 03/12/2013
Anadarko E&P Company LP / West Branch Susquehanna River - Linden	Piatt Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2027
Anadarko E&P Company LP / West Branch Susquehanna River - Riverview	Colebrook Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Anadarko E&P Company LP / William S Kieser Pad A	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Anadarko E&P Company LP / WW Litke #1H	Curtin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2009	8/19/2014
Anadarko E&P Company LP / WW Litke Pad B	Curtin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Applewood Golf Course	Exeter Township	PA	CU	Golf Courses and Country Clubs	10/11/2001, 06/12/2003	10/11/2026, 10/11/2026
Aqua America	Shamokin Dam Borough	PA	SW	Water Supply and Irrigation Systems	9/14/1995	2/8/2016
Aqua America, Inc. / Aqua Pennsylvania, Inc.-Eagle Rock Utilities	Black Creek Township	PA	GW	Water Supply and Irrigation Systems	03/29/2005, 12/05/2006, 06/07/2012	03/29/2030, 12/05/2031, 06/06/2027
Aqua America, Inc. / Aqua Pennsylvania, Inc.-Monroe Manor	Monroe Township	PA	GW	Water Supply and Irrigation Systems	09/16/2010, 12/16/2010, 06/23/2011	09/15/2025, 12/15/2025, 06/22/2026
Aqua America, Inc. / Aqua Pennsylvania, Inc.–SCI Waymart	Canaan Township	PA	GW,CU	Correctional Institutions	8/14/2003	8/14/2028

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Aqua America, Inc. / Aqua Pennsylvania, Inc.-Susquehanna Division	Athens Borough	PA	GW	Water Supply and Irrigation Systems	6/14/2001	6/14/2026
Aqua America, Inc. / Aqua Pennsylvania, Inc.–White Rock Acre Estates	Monroe Township	PA	GW	Water Supply and Irrigation Systems	12/15/2004	12/15/2029
Aqua America, Inc. / Aqua Pennsylvania-Roaring Creek Division: Parent Co. Aqua America	Coal Township	PA	SW	Water Supply and Irrigation Systems	9/8/1988	9/30/2038
Aqua Infrastructure, LLC / West Branch Susquehanna River	Piatt Township	PA	SW	Crude Petroleum and Natural Gas Extraction	03/15/2012, 06/07/2012	03/14/2027, 03/14/2027
Arendtsville Municipal Authority / Arendtsville Municipal Authority	Arendtsville Borough	PA	GW	Water Supply and Irrigation Systems	09/08/1988, 03/15/2006	09/08/2018, 03/15/2031
Armitage Golf Club	Hampden Township	PA	CU	Golf Courses and Country Clubs	01/23/1992, 02/10/2000, 10/11/2001	01/23/2022, 01/23/2022, 01/23/2022
Armstong World Industries / Armstrong World Industries, Inc.–Marietta Ceiling Plant	East Donegal Township	PA	GW,CU	Nonupholstered Wood Household Furniture Manufacturing	3/10/2004	3/10/2029
Artesian Water Co., Inc.	Little Britain Township	PA	SW,CU	Water Supply and Irrigation Systems	11/26/1996	6/30/2021
Artesian Water Maryland, Inc. / Port Deposit Plant	Port Deposit Township	MD	SW	Water Supply and Irrigation Systems	3/13/2008	3/13/2023
Ashland Area Municipal Water Authority	Butler Township	PA	SW,GW	Water Supply and Irrigation Systems	07/08/1993, 11/23/1993	07/14/2018, 11/23/2023
Atlas Resources, LLC / Lundy Well Pad	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016
Atlas Resources, LLC / Perry Well Pad	Mill Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/18/2012	1/18/2017
Atlas Resources, LLC / Rhodes Well Pad	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/18/2012	1/18/2017
Augusta Spring Water	Upper Augusta Township	PA	CU	Bottled Water Manufacturing	10/10/2002	10/10/2027
Avoca, Village of	Avoca Village	NY	GW	Water Supply and Irrigation Systems	03/12/1998, 05/13/1999	03/12/2023, 05/13/2024
Bainbridge, Village of	Bainbridge Village	NY	GW	Water Supply and Irrigation Systems	6/12/2002	6/12/2027
Barton, Town of	Waverly Village	NY	GW	Water Supply and Irrigation Systems	4/10/2003	4/10/2028
Bath Electric, Gas, & Water Systems	Bath Township	NY	GW	Water Supply and Irrigation Systems	1/15/1998	1/15/2023
BC Natural Chicken, LLC	Bethel Township	PA	GW,CU	Poultry Processing	03/10/2004, 09/14/2005	03/10/2029, 03/10/2029
Beavertown, Borough of	Beaver Township	PA	GW	Water Supply and Irrigation Systems	9/16/1993	9/16/2023
Bedford Borough Water Authority	Bedford Borough	PA	SW	Water Supply and Irrigation Systems	3/6/2001	3/6/2026

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Bedford Resort Partners / Shobers Run Golf Company, LLC	Bedford Township	PA	CU,SW,GW	Golf Courses and Country Clubs	10/10/2002, 06/14/2006, 06/14/2006	10/10/2027, 10/10/2027, 06/14/2031
Bedford Township Municipal Authority	Bedford Township	PA	SW,GW	Water Supply and Irrigation Systems	09/16/1993, 05/13/1999, 09/12/2007, 09/13/2006, 09/13/2006	09/30/2016, 05/13/2024, 05/13/2024, 09/12/2031, 09/13/2031
Beech Creek Borough Authority	Beech Creek Borough	PA	GW	Water Supply and Irrigation Systems	6/29/1987	6/29/2017
Bellefonte, Borough of	Bellefonte Borough	PA	SW	Water Supply and Irrigation Systems	9/8/1988	9/27/2038
Belles Springs Golf Course	Lamar Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Bellwood, Borough of	Antis Township	PA	SW	Water Supply and Irrigation Systems	5/13/1993	5/21/2018
Bent Creek Country Club / Bent Creek Country Club	Manheim Township	PA	GW,CU	Golf Courses and Country Clubs	07/09/1992, 09/09/1999, 06/08/2000	07/09/2022, 07/09/2022, 07/09/2022
Berwick Enterprises/The Bridges Golf Club / Berwick Enterprises/The Bridges Golf Club	Berwick Township	PA	GW,CU	Golf Courses and Country Clubs	01/12/1995, 02/10/2000, 02/08/2001	01/12/2025, 01/12/2025, 01/12/2025
Berwick Golf Club	Briar Creek Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Big Flats, Town of	Big Flats Township	NY	GW	Water Supply and Irrigation Systems	03/14/1991, 05/11/1995	03/14/2021, 03/14/2021
Biglerville Borough Authority	Biglerville Borough	PA	GW	Water Supply and Irrigation Systems	5/13/1993	5/13/2023
Binghamton Country Club	Endicott Village	NY	CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Bioenergy International, LLC / Clearfield	Clearfield Borough	PA	SW,CU	Ethyl Alcohol Manufacturing	09/12/2007, 12/15/2011	09/12/2022, 12/14/2015
Black Bear Waters, LLC / Lycoming Creek	Lewis Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Blair Township Water and Sewer Authority	Blair Township	PA	SW	Water Supply and Irrigation Systems	09/16/1993, 05/10/2007	12/30/2018, 05/07/2032
Bloomfield Borough Water Authority	Centre Township	PA	GW	Water Supply and Irrigation Systems	11/08/1990, 10/11/2001	11/08/2020, 10/11/2026
Bloomsburg University	Bloomsburg Borough	PA	CU	Colleges, Universities, and Professional Schools	4/11/2002	4/11/2027
Blossburg Municipal Authority / Blossburg Municipal Authority	Hamilton Township	PA	GW	Water Supply and Irrigation Systems	1/12/1989	1/12/2019
Blossburg Municipal Authority / Route 15 Well	Bloss Township	PA	GW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Blue Knob Water Co.	Greenfield Township	PA	GW	Water Supply and Irrigation Systems	5/12/1983	5/12/2013
Blue Mountain View Golf Course	Bethel Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Blue Ridge Country Club	Lower Paxton Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027

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Blue Ridge Trail Golf Club, Inc.	Dorrance Township	PA	CU,GW	Golf Courses and Country Clubs	04/11/2002, 06/08/2005, 12/05/2006	04/11/2027, 04/11/2027, 04/11/2027
Bon Air Country Club	Shrewsbury Township	PA	GW,CU	Golf Courses and Country Clubs	4/10/2003	4/10/2028
Borough of Ephrata / Ephrata Area Joint Authority	Ephrata Borough	PA	SW,GW	Water Supply and Irrigation Systems	03/09/1989, 07/14/1994, 09/08/2004, 09/15/2011, 12/15/2011	04/05/2039, 07/14/2024, 09/08/2029, 09/14/2026, 09/14/2026
Bottling Group, LLC, d.b.a. The Pepsi Bottling Group – Harrisburg	Lower Paxton Township	PA	CU	Soft Drink Manufacturing	3/13/2008	3/13/2023
Bradford Forest–Tioga Operations	Lawrence Township	PA	SW,CU	Sawmills	6/12/2003	6/12/2028
Briarwood Golf Club / Briarwood Golf Club	West Manchester Township	PA	GW,CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Buck Ridge Stone, LLC / Salt Lick Creek	New Milford Township	PA	SW	Crude Petroleum and Natural Gas Extraction	09/16/2010, 03/15/2012	09/15/2014, 09/15/2014
Bucknell University	East Buffalo Township	PA	CU	Colleges, Universities, and Professional Schools	10/10/2002	10/10/2027
c/o IBG Partners, LLC / Four Seasons Golf Club – Exeter	Exeter Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
c/o National Corporate Research / Hain Pure Protein Corporation	Bethel Township	PA	GW	Poultry Processing	7/8/1999	7/8/2024
Cabot Oil & Gas Corporation / AdamsJ P1	Harford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Cabot Oil & Gas Corporation / Augustine P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/9/2011	5/9/2016
Cabot Oil & Gas Corporation / Baker P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2010	1/11/2015
Cabot Oil & Gas Corporation / BerryD P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/15/2010	2/15/2015
Cabot Oil & Gas Corporation / BlaisureJe P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/19/2010	4/19/2015
Cabot Oil & Gas Corporation / BlaisureJo P1	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/15/2010	3/15/2015
Cabot Oil & Gas Corporation / Bowman Creek	Eaton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Cabot Oil & Gas Corporation / BrooksJ P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2009	7/27/2014
Cabot Oil & Gas Corporation / BrooksW P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014

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Cabot Oil & Gas Corporation / BrooksW P2	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/16/2009	7/16/2014
Cabot Oil & Gas Corporation / BunnellE P2	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/4/2012	5/4/2017
Cabot Oil & Gas Corporation / BurtsL P1	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Cabot Oil & Gas Corporation / BusikJ P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2012	6/11/2017
Cabot Oil & Gas Corporation / CareyR P1	Harford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2011	12/14/2016
Cabot Oil & Gas Corporation / CarlsonW P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/10/2015
Cabot Oil & Gas Corporation / CarsonJ P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Cabot Oil & Gas Corporation / ChudleighW P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2009	7/28/2014
Cabot Oil & Gas Corporation / ChudleighW P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Cabot Oil & Gas Corporation / CorbinJ P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/30/2011	8/30/2016
Cabot Oil & Gas Corporation / Cosner P1R	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Cabot Oil & Gas Corporation / DavisG P1	Gibson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Cabot Oil & Gas Corporation / Depaola P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2010	3/25/2015
Cabot Oil & Gas Corporation / DerianchoF P1	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/22/2010	11/22/2015
Cabot Oil & Gas Corporation / Dobrosielski P1	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Cabot Oil & Gas Corporation / Elk Lake School District P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2009	7/28/2014
Cabot Oil & Gas Corporation / EllsworthA P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2011	10/20/2016
Cabot Oil & Gas Corporation / Ely P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / FraserE P1	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Cabot Oil & Gas Corporation / FrystakC P1	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Cabot Oil & Gas Corporation / Gesford P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014

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Cabot Oil & Gas Corporation / Gesford P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / Gesford P3	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Gesford P4	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Greenwood P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / GrimsleyJ P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Cabot Oil & Gas Corporation / GrosvenorD P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/18/2015
Cabot Oil & Gas Corporation / HawleyJ P1	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016
Cabot Oil & Gas Corporation / HawleyW P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Cabot Oil & Gas Corporation / Heitsman P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Heitsman P1A	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / HeitsmanA P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / HeitzenroderA P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/26/2011	9/26/2016
Cabot Oil & Gas Corporation / HessR P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2011	11/30/2016
Cabot Oil & Gas Corporation / HibbardAM P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2009	12/21/2014
Cabot Oil & Gas Corporation / HibbardAM P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2009	12/21/2014
Cabot Oil & Gas Corporation / HinkleyR P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2010	3/12/2015
Cabot Oil & Gas Corporation / Hoover P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2009	9/22/2014
Cabot Oil & Gas Corporation / Hubbard P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Hubbard P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / HullR P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / HullR P2	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/4/2010	6/4/2015

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Cabot Oil & Gas Corporation / HunsingerA P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2009	7/28/2014
Cabot Oil & Gas Corporation / HunsingerA P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/18/2009	9/18/2014
Cabot Oil & Gas Corporation / Jeffers Farms P1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Cabot Oil & Gas Corporation / KellyP P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/3/2010	3/3/2015
Cabot Oil & Gas Corporation / KielarD P1	Lathrop Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Cabot Oil & Gas Corporation / King P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Cabot Oil & Gas Corporation / KrisuleviczV P1	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/23/2011	2/23/2016
Cabot Oil & Gas Corporation / LarueC P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / LaRueC P3	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Cabot Oil & Gas Corporation / Lathrop P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Lauffer P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Cabot Oil & Gas Corporation / LippincottF P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2011	10/20/2016
Cabot Oil & Gas Corporation / LopatofskyJ P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/23/2011	5/23/2016
Cabot Oil & Gas Corporation / LymanJ P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/15/2011	4/15/2016
Cabot Oil & Gas Corporation / MacDowallR P1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Cabot Oil & Gas Corporation / MackeyR P1	Lathrop Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2012	3/14/2017
Cabot Oil & Gas Corporation / Maiolini P2	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Cabot Oil & Gas Corporation / ManzerA P1	Gibson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2012	3/14/2017
Cabot Oil & Gas Corporation / Meshoppen Creek	Lemon Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Cabot Oil & Gas Corporation / Mogridge P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
Cabot Oil & Gas Corporation / OakleyJ P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015

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Cabot Oil & Gas Corporation / PetersenH P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/4/2012	5/4/2017
Cabot Oil & Gas Corporation / PettyJ P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
Cabot Oil & Gas Corporation / PlonskiJ P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Cabot Oil & Gas Corporation / Post P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Cabot Oil & Gas Corporation / Ramey P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Cabot Oil & Gas Corporation / Ratzel P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Rayias P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/19/2010	4/19/2015
Cabot Oil & Gas Corporation / RoseC P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2010	4/6/2015
Cabot Oil & Gas Corporation / Rozanski P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / RozellC P1	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2010	5/24/2015
Cabot Oil & Gas Corporation / RussoB P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/26/2010	2/26/2015
Cabot Oil & Gas Corporation / RussoB P2	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/15/2010	3/15/2015
Cabot Oil & Gas Corporation / SevercoolB P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / ShieldsG P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/18/2009	9/18/2014
Cabot Oil & Gas Corporation / ShieldsG P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/22/2009	10/22/2014
Cabot Oil & Gas Corporation / Smith P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Smith P3	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / SmithR P2	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / StalterD P1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Cabot Oil & Gas Corporation / StockholmK P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2010	6/18/2015
Cabot Oil & Gas Corporation / StockholmK P2	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015

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Cabot Oil & Gas Corporation / StockholmK P3	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Cabot Oil & Gas Corporation / Susquehanna River - 2 (Susquehanna Depot Boro.)	Susquehanna Depot Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	09/11/2008, 03/15/2012	09/11/2012, 09/11/2012
Cabot Oil & Gas Corporation / Susquehanna River - 3 (Great Bend Twp.)	Great Bend Township	PA	SW	Crude Petroleum and Natural Gas Extraction	09/11/2008, 03/15/2012	09/11/2012, 09/11/2012
Cabot Oil & Gas Corporation / TeddickM P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2012	3/14/2017
Cabot Oil & Gas Corporation / Teel P1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Teel P5	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Teel P6	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2009	5/27/2014
Cabot Oil & Gas Corporation / Teel P7	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Cabot Oil & Gas Corporation / Tunkhannock Creek	Lenox Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Cabot Oil & Gas Corporation / VandermarkR P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/12/2011	7/12/2016
Cabot Oil & Gas Corporation / WaldenbergerP P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2012	6/11/2017
Cabot Oil & Gas Corporation / WarnerA P1	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2010	3/17/2015
Cabot Oil & Gas Corporation / WarrinerR P2	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2010	5/13/2015
Cabot Oil & Gas Corporation / WarrinerR P4	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/17/2010, 11/29/2011	8/17/2015
Cabot Oil & Gas Corporation / WarrinerR P5	Dimock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2010	5/13/2015
Cabot Oil & Gas Corporation / WellsP P1	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2011	11/15/2016
Cabot Oil & Gas Corporation / WilliamsD P1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/25/2011	10/25/2016
Cabot Oil & Gas Corporation / WoodW P1	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/2/2010	8/2/2015
Cabot Oil & Gas Corporation / ZickJ P1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
Cabot Oil & Gas Corporation / ZuppK P1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Caernarvon Township Authority / Caernarvon Township Authority	Caernarvon Township	PA	GW	Water Supply and Irrigation Systems	09/09/1982, 09/27/1994	09/09/2012, 09/27/2024

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Calpine Mid-Merit, LLC / York Energy Center	Drumore Township	PA	SW,CU	Electric Power Generation	3/15/2006	3/15/2031
Campbell Oil & Gas, Inc. / Mid Penn Unit B Well Pad	Bigler Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
CAN DO, Inc. / Corporate Center	Butler Township	PA	GW	Water, Sewage and Other Systems	3/12/2009	3/12/2024
CAN DO, Inc. / Humbolt Industrial Park	Hazle Township	PA	GW	Folding Paperboard Box Manufacturing	5/23/1996	5/23/2021
Canisteo, Village of	Canisteo Township	NY	GW	Water Supply and Irrigation Systems	9/14/1995	9/14/2020
Cargill Incorporated / Cargill Meat Solutions Corporation	Wyalusing Township	PA	GW,CU	Meat Processed from Carcasses	09/10/1987, 11/14/1991, 07/09/1992, 03/11/1999	09/10/2017, 11/14/2021, 07/09/2022, 03/11/2024
Carlisle Barracks Golf Course	North Middleton Township	PA	GW,CU	Golf Courses and Country Clubs	11/04/1999, 04/12/2001	11/04/2024, 04/12/2026
Carlisle Syntec, Inc.	Carlisle Borough	PA	CU	Asphalt Paving, Roofing, and Saturated Materials Manufacturing	2/21/2002	2/21/2027
Carmeuse Lime, Inc. / Carmeuse Lime, Inc.	North Londonderry Township	PA	CU	Crushed and Broken Limestone Mining and Quarrying	12/15/2004	12/15/2029
Carrizo (Marcellus), LLC / Armbruster	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2011	4/6/2016
Carrizo (Marcellus), LLC / Baker 2H	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/20/2010	8/20/2015
Carrizo (Marcellus), LLC / Baker North	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Carrizo (Marcellus), LLC / Baker West (Brothers)	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Carrizo (Marcellus), LLC / Bonnice	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Carrizo (Marcellus), LLC / Bonnice 2	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2010	11/10/2015
Carrizo (Marcellus), LLC / Bush Pad	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2011	9/27/2016
Carrizo (Marcellus), LLC / CK-21	Karthaus Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2011	12/9/2016
Carrizo (Marcellus), LLC / Clearfield Creek 1.1	Reade Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Carrizo (Marcellus), LLC / Cowfer - 1	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Carrizo (Marcellus), LLC / Cowfer B (CC-09) Pad	Gulich Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / East Branch Wyalusing Creek (Bonnice)	Jessup Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014

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Carrizo (Marcellus), LLC / EP Bender B (CC-03) Pad	Reade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / EP Bender B (CC-03) Pad (2)	Reade Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/30/2012	1/30/2017
Carrizo (Marcellus), LLC / Erickson Family Trust Pad	Woodward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / Frystak Central Pad	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Carrizo (Marcellus), LLC / Giangrieco Pad	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / Hegarty (CC-04) Pad	Beccaria Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / Henninger Pad	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/24/2011	10/24/2016
Carrizo (Marcellus), LLC / Karthaus CK-19	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2011	12/9/2016
Carrizo (Marcellus), LLC / Kile	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
Carrizo (Marcellus), LLC / Mazzara	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
Carrizo (Marcellus), LLC / Meshoppen Creek	Washington Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Carrizo (Marcellus), LLC / Middle Branch Wyalusing Creek SWW	Forest Lake Township	PA	SW	Crude Petroleum and Natural Gas Extraction	06/23/2011, 03/15/2012	06/22/2015, 06/22/2015
Carrizo (Marcellus), LLC / Moshannon Creek	Decatur Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Carrizo (Marcellus), LLC / Mosquito Creek	Karthaus Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Carrizo (Marcellus), LLC / Mosquito Creek 2	Karthaus Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Carrizo (Marcellus), LLC / River Hill Power Karthaus Pad	Karthaus Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / Selma Stang 2H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Carrizo (Marcellus), LLC / Shaskas	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/20/2010	7/20/2015
Carrizo (Marcellus), LLC / Shaskas South	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2010	11/10/2015
Carrizo (Marcellus), LLC / Shields Well Pad	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
Carrizo (Marcellus), LLC / Sickler 5H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015

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Carrizo (Marcellus), LLC / Solanick 5H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015
Carrizo (Marcellus), LLC / Steinman Development Co. (CC-11) Pad	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2011	7/6/2016
Carrizo (Marcellus), LLC / Sterling Farms	Noxen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Carrizo (Marcellus), LLC / Trecoske North Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/25/2012	1/25/2017
Carrizo (Marcellus), LLC / Trecoske South Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/25/2012	1/25/2017
Carrizo (Marcellus), LLC / UNT to Middle Branch Wyalusing Creek	Forest Lake Township	PA	SW	Crude Petroleum and Natural Gas Extraction	06/23/2011, 03/15/2012	06/22/2015, 06/22/2015
Carrizo (Marcellus), LLC / Yarasavage Well Pad	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
Carrolltown Borough Municipal Authority	Carrolltown Borough	PA	GW	Water Supply and Irrigation Systems	09/10/1987, 02/08/2001	09/10/2017, 02/08/2026
Cascades Tissue Pennsylvania, a Divsion of Cascades Tissue Group LLC	Ransom Township	PA	SW,CU	Sanitary Paper Product Manufacturing	10/11/2001, 12/11/2003	10/11/2026, 10/11/2026
CBS Corporation	Horseheads Township	NY	GW	Telecommunications	9/11/1997	9/11/2022
Cedar Rock Materials Corp. / Bower Quarry	Salem Township	PA	GW,CU	Stone Mining and Quarrying	3/10/2011	3/9/2026
Central Builders Supply Company / Montandon Sand & Gravel Processing Plant	West Chillisquaque Township	PA	CU	Construction Sand and Gravel Mining	12/12/2002	12/12/2027
Central Builders Supply Company / Northumberland Sand & Gravel Processing Plant	Point Township	PA	CU	Construction Sand and Gravel Mining	12/12/2002	12/12/2027
Central Clinton County Water Filtration Authority	Loganton Borough	PA	SW	Water Supply and Irrigation Systems	11/19/1992	11/19/2022
Central New York Oil and Gas Company, LLC / Susquehanna River	Wilmot Township	PA	SW,CU	Oil and Gas Pipeline and Related Structures Construction	12/15/2011	6/14/2013
Centre Hall Borough	Potter Township	PA	GW	Water Supply and Irrigation Systems	12/15/2004	12/15/2029
Centre Hills Country Club	College Township	PA	CU,GW	Golf Courses and Country Clubs	08/14/2003, 06/13/2007	08/14/2028, 08/14/2028
Chapman Township Water Authority	Chapman Township	PA	SW	Water Supply and Irrigation Systems	9/29/2008	1/28/2023
Charles Header-Laurel Springs Development	Barry Township	PA	GW,CU	Bottled Water Manufacturing	9/10/2009	9/10/2024
Chemung Golf Course, Inc.	Chemung Township	NY	CU	Golf Courses and Country Clubs	6/12/2003	6/12/2028
Chenango, Town of	Binghamton City	NY	GW	Water Supply and Irrigation Systems	11/20/1987	11/20/2017
Cherokee Golf Course, Inc.	Rush Township	PA	CU	Golf Courses and Country Clubs	4/11/2002	4/11/2027
Chesapeake Appalachia, LLC / Abel	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/25/2010	10/25/2015

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Chesapeake Appalachia, LLC / Acla	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/15/2010	3/15/2015
Chesapeake Appalachia, LLC / Acton	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/16/2011	3/16/2016
Chesapeake Appalachia, LLC / ACW	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Chesapeake Appalachia, LLC / Adams	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/24/2011	8/24/2016
Chesapeake Appalachia, LLC / Aikens	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Chesapeake Appalachia, LLC / Akita NEW	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
Chesapeake Appalachia, LLC / Alberta	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Chesapeake Appalachia, LLC / Albertson	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/30/2011	8/30/2016
Chesapeake Appalachia, LLC / Alderfer NEW	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2010	6/21/2015
Chesapeake Appalachia, LLC / Alexander	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Chesapeake Appalachia, LLC / Alkan	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
Chesapeake Appalachia, LLC / Allen	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Chesapeake Appalachia, LLC / Allford	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015
Chesapeake Appalachia, LLC / Alton	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015
Chesapeake Appalachia, LLC / Amburke	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Chesapeake Appalachia, LLC / Ammerman	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
Chesapeake Appalachia, LLC / Angie	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/22/2010	4/22/2015
Chesapeake Appalachia, LLC / Arch	Sweden Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/27/2011	6/27/2016
Chesapeake Appalachia, LLC / Atgas	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Chesapeake Appalachia, LLC / Aukema	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/14/2011	1/14/2016
Chesapeake Appalachia, LLC / Balduzzi	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015

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Chesapeake Appalachia, LLC / Balent NEW	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Chesapeake Appalachia, LLC / Ballibay	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015
Chesapeake Appalachia, LLC / Baltzley	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
Chesapeake Appalachia, LLC / Barclay	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Chesapeake Appalachia, LLC / Barnes	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chesapeake Appalachia, LLC / Bartholomew	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / BDF	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Chesapeake Appalachia, LLC / Beaver Dam	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Chesapeake Appalachia, LLC / Bedford	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/20/2010	8/20/2015
Chesapeake Appalachia, LLC / Beebe	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
Chesapeake Appalachia, LLC / Beech Flats	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/14/2011	1/14/2016
Chesapeake Appalachia, LLC / Beeman	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/28/2011	1/28/2016
Chesapeake Appalachia, LLC / Belawske	Burlington Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Chesapeake Appalachia, LLC / Bennett NMPY-38	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/16/2015
Chesapeake Appalachia, LLC / Benscoter	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2009	6/2/2014
Chesapeake Appalachia, LLC / Benspond	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Chesapeake Appalachia, LLC / Black Creek	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
Chesapeake Appalachia, LLC / Blannard	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015
Chesapeake Appalachia, LLC / Bluegrass	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / Bo	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Chesapeake Appalachia, LLC / Bodolus	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2011	11/23/2016

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Chesapeake Appalachia, LLC / Bonin	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Chesapeake Appalachia, LLC / Bonnie	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
Chesapeake Appalachia, LLC / Boyanowski	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Chesapeake Appalachia, LLC / Brackman	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Breezy	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chesapeake Appalachia, LLC / Brink	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2010	4/28/2015
Chesapeake Appalachia, LLC / Broughton	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/1/2010	12/1/2015
Chesapeake Appalachia, LLC / Brule	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/11/2011	10/11/2016
Chesapeake Appalachia, LLC / Bucks Hill	LeRaysville Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2011	12/13/2016
Chesapeake Appalachia, LLC / Bumpville	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/21/2012	2/21/2017
Chesapeake Appalachia, LLC / Burke	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
Chesapeake Appalachia, LLC / Burkhart	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/30/2012	1/30/2017
Chesapeake Appalachia, LLC / Burkmont Farms	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/2/2010	12/2/2015
Chesapeake Appalachia, LLC / Burleigh	Wyalusing Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2010	9/15/2015
Chesapeake Appalachia, LLC / Burns	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Chesapeake Appalachia, LLC / Bustin Homestead	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/26/2011	1/26/2016
Chesapeake Appalachia, LLC / Calmitch	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/30/2012	1/30/2017
Chesapeake Appalachia, LLC / Cannella	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
Chesapeake Appalachia, LLC / Cappucci	Mehoopany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/5/2010	3/5/2015
Chesapeake Appalachia, LLC / Carter	North Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Chesapeake Appalachia, LLC / Cerca	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2010	5/21/2015

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Chesapeake Appalachia, LLC / Champdale	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/29/2010	4/29/2015
Chesapeake Appalachia, LLC / Champluvier	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / Chancellor	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Chemung River - Barrett	Athens Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
Chesapeake Appalachia, LLC / Circle H	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2011	9/30/2016
Chesapeake Appalachia, LLC / Circle Z BRA	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2012	3/30/2017
Chesapeake Appalachia, LLC / Clapper	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Clarke	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Chesapeake Appalachia, LLC / Claude	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/10/2010	3/10/2015
Chesapeake Appalachia, LLC / Claudia	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Chesapeake Appalachia, LLC / CMI	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/20/2012	3/20/2017
Chesapeake Appalachia, LLC / Coates	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/6/2010	5/6/2015
Chesapeake Appalachia, LLC / Colcam	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2011	8/12/2016
Chesapeake Appalachia, LLC / Comstock	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/19/2010	11/19/2015
Chesapeake Appalachia, LLC / Connell	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Chesapeake Appalachia, LLC / Cook	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/4/2011	11/4/2016
Chesapeake Appalachia, LLC / Corl	Colley Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/10/2011	2/10/2016
Chesapeake Appalachia, LLC / Coveytown	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Chesapeake Appalachia, LLC / Covington	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Chesapeake Appalachia, LLC / Coyle	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / CPD	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/21/2012	2/21/2017

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Chesapeake Appalachia, LLC / Craige	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/7/2010	10/7/2015
Chesapeake Appalachia, LLC / Crain	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/26/2011	4/26/2016
Chesapeake Appalachia, LLC / Cranrun	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Chesapeake Appalachia, LLC / Crawford	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/1/2010	4/1/2015
Chesapeake Appalachia, LLC / Crystal	North Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/2/2010	11/2/2015
Chesapeake Appalachia, LLC / CSB	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Chesapeake Appalachia, LLC / CSI	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
Chesapeake Appalachia, LLC / Curtain NEW	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2010	6/29/2015
Chesapeake Appalachia, LLC / Curtis New	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2010	9/27/2015
Chesapeake Appalachia, LLC / Cuthbertson	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/3/2011	2/3/2016
Chesapeake Appalachia, LLC / Dan Ellis	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/11/2010, 03/10/2010	2/11/2015
Chesapeake Appalachia, LLC / Dave	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Chesapeake Appalachia, LLC / Decker Farms	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Chesapeake Appalachia, LLC / Delhagen	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2010	9/15/2015
Chesapeake Appalachia, LLC / Delima	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2010	7/22/2015
Chesapeake Appalachia, LLC / Dewees	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/20/2010	7/20/2015
Chesapeake Appalachia, LLC / DGSM	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Chesapeake Appalachia, LLC / DJ	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2011	1/21/2016
Chesapeake Appalachia, LLC / Donna	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
Chesapeake Appalachia, LLC / Donovan	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/24/2011	10/24/2016
Chesapeake Appalachia, LLC / Doss	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014

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Chesapeake Appalachia, LLC / DPH	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2011	3/14/2016
Chesapeake Appalachia, LLC / Drake	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/28/2010	10/28/2015
Chesapeake Appalachia, LLC / Driscoll	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/14/2010	9/14/2015
Chesapeake Appalachia, LLC / Duane	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Chesapeake Appalachia, LLC / Duffield	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Dulcey	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Dunham	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Dunny	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Chesapeake Appalachia, LLC / Dziuba	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2011	3/14/2016
Chesapeake Appalachia, LLC / Eagle Rock	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2011	11/15/2016
Chesapeake Appalachia, LLC / EDF NEW	Mehoopany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
Chesapeake Appalachia, LLC / Edger	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2011	12/13/2016
Chesapeake Appalachia, LLC / Eileen	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Chesapeake Appalachia, LLC / Elevation	North Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2010	3/24/2015
Chesapeake Appalachia, LLC / Elk Lake Stream	Rush Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/4/2008	12/4/2012
Chesapeake Appalachia, LLC / Elwell	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Engelke	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2010	3/12/2015
Chesapeake Appalachia, LLC / Epler	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Chesapeake Appalachia, LLC / Evanchick	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/3/2009	6/3/2014
Chesapeake Appalachia, LLC / Everbreeze	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015
Chesapeake Appalachia, LLC / Falconero	Forkston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2011	10/20/2016

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Chesapeake Appalachia, LLC / Farr	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
Chesapeake Appalachia, LLC / Fausto	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Chesapeake Appalachia, LLC / Felter-NEW	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/5/2010	8/5/2015
Chesapeake Appalachia, LLC / Ferraro	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chesapeake Appalachia, LLC / Feusner New	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
Chesapeake Appalachia, LLC / Field	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/12/2010	10/12/2015
Chesapeake Appalachia, LLC / Finnerty	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Chesapeake Appalachia, LLC / Fisher	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Chesapeake Appalachia, LLC / Fitzsimmons	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Chesapeake Appalachia, LLC / Flash	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2010	5/21/2015
Chesapeake Appalachia, LLC / Floydie	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/20/2012	3/20/2017
Chesapeake Appalachia, LLC / Folta	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Chesapeake Appalachia, LLC / Forbes NEW	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Chesapeake Appalachia, LLC / Ford	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/9/2011	6/9/2016
Chesapeake Appalachia, LLC / Foster	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2010	9/23/2015
Chesapeake Appalachia, LLC / Fox	Mehoopany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Franclaire	Braintrim Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2010	12/6/2015
Chesapeake Appalachia, LLC / Fred	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Chesapeake Appalachia, LLC / Freed	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Chesapeake Appalachia, LLC / Fremar	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Chesapeake Appalachia, LLC / Frisbee	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2010	4/8/2015

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Chesapeake Appalachia, LLC / Gardner	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/27/2011	10/27/2016
Chesapeake Appalachia, LLC / Gary	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
Chesapeake Appalachia, LLC / GB	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/13/2011	6/13/2016
Chesapeake Appalachia, LLC / Gemm	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Chesapeake Appalachia, LLC / George	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
Chesapeake Appalachia, LLC / Gerbino #1	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Chesapeake Appalachia, LLC / Gestewitz	North Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2011	11/8/2016
Chesapeake Appalachia, LLC / Goll	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/12/2010	10/12/2015
Chesapeake Appalachia, LLC / Governale	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Chesapeake Appalachia, LLC / Gowan	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/5/2009	10/5/2014
Chesapeake Appalachia, LLC / Graham	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/2/2010	12/2/2015
Chesapeake Appalachia, LLC / Grant	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2010	10/20/2015
Chesapeake Appalachia, LLC / Gregerson	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/21/2011	11/21/2016
Chesapeake Appalachia, LLC / Gregory	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/1/2010	11/1/2015
Chesapeake Appalachia, LLC / Grippo	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Gunn	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/12/2011	1/12/2016
Chesapeake Appalachia, LLC / Hannan	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2009	5/19/2014
Chesapeake Appalachia, LLC / Harnish	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/8/2011	2/8/2016
Chesapeake Appalachia, LLC / Harper	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/11/2015
Chesapeake Appalachia, LLC / Harry	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2009	10/20/2014
Chesapeake Appalachia, LLC / Hart	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/17/2012	5/17/2017

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Hartz	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Chesapeake Appalachia, LLC / Hattie BRA	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2012	3/30/2017
Chesapeake Appalachia, LLC / Hayward New	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/20/2010	5/20/2015
Chesapeake Appalachia, LLC / Hemlock Valley	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Henderson	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chesapeake Appalachia, LLC / Henry	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Herr	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
Chesapeake Appalachia, LLC / Hershberger	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2009	7/28/2014
Chesapeake Appalachia, LLC / Hess	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/10/2011	5/10/2016
Chesapeake Appalachia, LLC / Hi-Lev	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Chesapeake Appalachia, LLC / Hillis	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2011	8/23/2016
Chesapeake Appalachia, LLC / Hilltop NEW	Jessup Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chesapeake Appalachia, LLC / Hoffman	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2010	3/17/2015
Chesapeake Appalachia, LLC / Holtan	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2010	4/28/2015
Chesapeake Appalachia, LLC / Hope	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/28/2010	9/28/2015
Chesapeake Appalachia, LLC / Hopson	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/4/2010	10/4/2015
Chesapeake Appalachia, LLC / Horst	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2010	1/11/2015
Chesapeake Appalachia, LLC / Hottenstein	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Chesapeake Appalachia, LLC / Hulslander	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/20/2011	4/20/2016
Chesapeake Appalachia, LLC / Hunsinger	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
Chesapeake Appalachia, LLC / Iceman	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / IH	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/17/2011	6/17/2016
Chesapeake Appalachia, LLC / Insinger	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Chesapeake Appalachia, LLC / Isbell	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2009	5/19/2014
Chesapeake Appalachia, LLC / J & J	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/20/2011	6/20/2016
Chesapeake Appalachia, LLC / Jack	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/6/2010	5/6/2015
Chesapeake Appalachia, LLC / Jacobs	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/13/2010	7/13/2015
Chesapeake Appalachia, LLC / Jag	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/6/2011	9/6/2016
Chesapeake Appalachia, LLC / James Barrett	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / James Smith	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2009	10/20/2014
Chesapeake Appalachia, LLC / Janet	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Chesapeake Appalachia, LLC / Jayne	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2009	10/20/2014
Chesapeake Appalachia, LLC / Joanclark	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/4/2010	8/4/2015
Chesapeake Appalachia, LLC / Joe	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Chesapeake Appalachia, LLC / John Barrett	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Johnson	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Jokah	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/7/2011	2/7/2016
Chesapeake Appalachia, LLC / Jones Pad	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
Chesapeake Appalachia, LLC / Joyce Road	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/26/2011	1/26/2016
Chesapeake Appalachia, LLC / Judd	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Juser	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/29/2010	10/29/2015
Chesapeake Appalachia, LLC / Kalinowski	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/18/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Karp	Lemon Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2011	5/31/2016
Chesapeake Appalachia, LLC / Kathryn	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Katzenstein NEW	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/13/2010	7/13/2015
Chesapeake Appalachia, LLC / Keeler Hollow	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Chesapeake Appalachia, LLC / Keir	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/1/2010	12/1/2015
Chesapeake Appalachia, LLC / Kent	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2009	7/22/2014
Chesapeake Appalachia, LLC / Kenyon	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
Chesapeake Appalachia, LLC / King	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Chesapeake Appalachia, LLC / Kingsley	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/26/2011	4/26/2016
Chesapeake Appalachia, LLC / Kinnarney	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Chesapeake Appalachia, LLC / Kipar NEW	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chesapeake Appalachia, LLC / Knapp	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2011	11/8/2016
Chesapeake Appalachia, LLC / Knickerbocker	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/17/2011	6/17/2016
Chesapeake Appalachia, LLC / Kohler	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/28/2010	9/28/2015
Chesapeake Appalachia, LLC / Koromlan	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Kriebel NEW	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chesapeake Appalachia, LLC / Krise	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2011	11/15/2016
Chesapeake Appalachia, LLC / Lambert Farms	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Chesapeake Appalachia, LLC / Lambs Farm	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/27/2011	6/27/2016
Chesapeake Appalachia, LLC / Landmesser	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/12/2010	10/12/2015
Chesapeake Appalachia, LLC / Lantz	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016

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Chesapeake Appalachia, LLC / Lattimer	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
Chesapeake Appalachia, LLC / Laurel	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/11/2011	10/11/2016
Chesapeake Appalachia, LLC / Layton	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Chesapeake Appalachia, LLC / Leaman	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2010	3/24/2015
Chesapeake Appalachia, LLC / Lemoreview Farms	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/4/2010	10/4/2015
Chesapeake Appalachia, LLC / Lillie-NEW	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chesapeake Appalachia, LLC / Lines	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Linski	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/17/2010	6/17/2015
Chesapeake Appalachia, LLC / Lionetti	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Chesapeake Appalachia, LLC / LKM	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2011	9/19/2016
Chesapeake Appalachia, LLC / Lomison Inc	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2011	5/26/2016
Chesapeake Appalachia, LLC / Lopatofsky NEW	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / LRJ	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2011	5/19/2016
Chesapeake Appalachia, LLC / Lundy	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2010	3/24/2015
Chesapeake Appalachia, LLC / LW	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/21/2011	11/21/2016
Chesapeake Appalachia, LLC / Lyon	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Lytwyn	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Chesapeake Appalachia, LLC / M&M Estates	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/4/2010	11/4/2015
Chesapeake Appalachia, LLC / Mad Dog	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/15/2011	8/15/2016
Chesapeake Appalachia, LLC / Madden	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2010	5/21/2015
Chesapeake Appalachia, LLC / Maggie	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/20/2012	3/20/2017

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Chesapeake Appalachia, LLC / Makayla	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chesapeake Appalachia, LLC / Manahan	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Manella Acres	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2011	9/19/2016
Chesapeake Appalachia, LLC / Manning	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/23/2012	4/23/2017
Chesapeake Appalachia, LLC / Maple Ln Farms	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/21/2012	2/21/2017
Chesapeake Appalachia, LLC / Marbaker	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2010	3/11/2015
Chesapeake Appalachia, LLC / Maris	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/17/2012	5/17/2017
Chesapeake Appalachia, LLC / Martin	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
Chesapeake Appalachia, LLC / Masso	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/18/2010, 03/12/2010	2/18/2015
Chesapeake Appalachia, LLC / Matt	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Chesapeake Appalachia, LLC / Matt Will Farms	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2010	5/26/2015
Chesapeake Appalachia, LLC / Matthews	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/20/2012	3/20/2017
Chesapeake Appalachia, LLC / Maurice	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/18/2012	4/18/2017
Chesapeake Appalachia, LLC / May	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / McCabe	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
Chesapeake Appalachia, LLC / McConnell	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Chesapeake Appalachia, LLC / McGavin	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Chesapeake Appalachia, LLC / McGraw	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2010	5/21/2015
Chesapeake Appalachia, LLC / McGroarty	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2011	9/19/2016
Chesapeake Appalachia, LLC / Meas	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Chesapeake Appalachia, LLC / Mel	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/17/2011	6/17/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Meng	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2011	1/11/2016
Chesapeake Appalachia, LLC / Merryall	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/30/2011	8/30/2016
Chesapeake Appalachia, LLC / Messersmith	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Miller	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Milochik	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chesapeake Appalachia, LLC / Mobear	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/2/2010	12/2/2015
Chesapeake Appalachia, LLC / Moody	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/25/2011	4/25/2016
Chesapeake Appalachia, LLC / Moore Farm	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Chesapeake Appalachia, LLC / Moose	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Chesapeake Appalachia, LLC / Morse	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Chesapeake Appalachia, LLC / Mowry	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Mowry2	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/10/2015
Chesapeake Appalachia, LLC / Moyer	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2012	2/17/2017
Chesapeake Appalachia, LLC / MPC New	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/26/2011	4/26/2016
Chesapeake Appalachia, LLC / Neal	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2011	6/14/2016
Chesapeake Appalachia, LLC / Nichols	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/27/2011	6/27/2016
Chesapeake Appalachia, LLC / Nicholson	Nicholson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
Chesapeake Appalachia, LLC / Nickolyn	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Chesapeake Appalachia, LLC / Norconk	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
Chesapeake Appalachia, LLC / North40	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/21/2011	11/21/2016
Chesapeake Appalachia, LLC / Norton	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/2/2010	11/2/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Oilcan	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Chesapeake Appalachia, LLC / Otis	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/10/2010	3/10/2015
Chesapeake Appalachia, LLC / Otten	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Packard	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2011	5/26/2016
Chesapeake Appalachia, LLC / Paul	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Chesapeake Appalachia, LLC / Pauliny	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/6/2010	5/6/2015
Chesapeake Appalachia, LLC / Penecale	North Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Chesapeake Appalachia, LLC / Petty	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
Chesapeake Appalachia, LLC / Phillips	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Chesapeake Appalachia, LLC / Pieszala	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/20/2010	7/20/2015
Chesapeake Appalachia, LLC / Plymouth	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2010	3/24/2015
Chesapeake Appalachia, LLC / Polomski	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2010	4/28/2015
Chesapeake Appalachia, LLC / Popivchak	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2010	1/11/2015
Chesapeake Appalachia, LLC / Potter	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/1/2010	4/1/2015
Chesapeake Appalachia, LLC / Potuck Farm	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
Chesapeake Appalachia, LLC / Primrose	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2010	11/15/2015
Chesapeake Appalachia, LLC / Przybyszewski	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/29/2009	5/29/2014
Chesapeake Appalachia, LLC / Quail	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2011	6/21/2016
Chesapeake Appalachia, LLC / R&N	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/14/2012	3/14/2017
Chesapeake Appalachia, LLC / Raimo	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Rain	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Rainbow BRA	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2012	3/30/2017
Chesapeake Appalachia, LLC / Ramblinrose	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/10/2011	5/10/2016
Chesapeake Appalachia, LLC / RBF BRA	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2012	3/30/2017
Chesapeake Appalachia, LLC / Readinger	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Redbone	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Redling	Thompson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Redmond	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015
Chesapeake Appalachia, LLC / Reilly	Colley Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Chesapeake Appalachia, LLC / Rexford	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Chesapeake Appalachia, LLC / RGB	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2011	12/13/2016
Chesapeake Appalachia, LLC / Rich	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2010	5/21/2015
Chesapeake Appalachia, LLC / Richard	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Ridenour	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chesapeake Appalachia, LLC / Rinker	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/11/2011	2/11/2016
Chesapeake Appalachia, LLC / Robbins	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Robinson NEW	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chesapeake Appalachia, LLC / Rock Ridge	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Chesapeake Appalachia, LLC / Rocks	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2011	1/10/2016
Chesapeake Appalachia, LLC / Roeber	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2010	11/15/2015
Chesapeake Appalachia, LLC / Roger	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Roland	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Rosalie	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
Chesapeake Appalachia, LLC / Rose	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/16/2010	3/16/2015
Chesapeake Appalachia, LLC / Rossi	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Roundtop	Colley Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Chesapeake Appalachia, LLC / Rowe	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / Rylee	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/3/2010	6/3/2015
Chesapeake Appalachia, LLC / Sarah	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2011	3/25/2016
Chesapeake Appalachia, LLC / Scheffler	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / Schlapfer	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chesapeake Appalachia, LLC / Schoonover	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/26/2010	3/26/2015
Chesapeake Appalachia, LLC / Schulze	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/21/2012	3/21/2017
Chesapeake Appalachia, LLC / Scrivener	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/4/2010	10/4/2015
Chesapeake Appalachia, LLC / Sensinger	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/4/2011	4/4/2016
Chesapeake Appalachia, LLC / Serengeti	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Chesapeake Appalachia, LLC / SGL 289A	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/10/2010	12/10/2015
Chesapeake Appalachia, LLC / SGL 289B	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Chesapeake Appalachia, LLC / SGL289C	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Sharer	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2009	9/8/2014
Chesapeake Appalachia, LLC / Sharidan	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2011	12/16/2016
Chesapeake Appalachia, LLC / Shaw	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
Chesapeake Appalachia, LLC / Shirley	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015

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Chesapeake Appalachia, LLC / Shores	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/27/2010	10/27/2015
Chesapeake Appalachia, LLC / Shumhurst	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Chesapeake Appalachia, LLC / Sidonio	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/14/2010	10/14/2015
Chesapeake Appalachia, LLC / Simplex	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2012	4/27/2017
Chesapeake Appalachia, LLC / Simpson	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/13/2010	7/13/2015
Chesapeake Appalachia, LLC / Sivers	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/10/2010	3/10/2015
Chesapeake Appalachia, LLC / SJW	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Chesapeake Appalachia, LLC / Skoronski	Northmoreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Chesapeake Appalachia, LLC / Slumber Valley	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Chesapeake Appalachia, LLC / Smurkoski	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2011	9/30/2016
Chesapeake Appalachia, LLC / Solowiej	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2010	1/11/2015
Chesapeake Appalachia, LLC / Sophia	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2011	6/10/2016
Chesapeake Appalachia, LLC / Stalford	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Chesapeake Appalachia, LLC / Steinbright	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Chesapeake Appalachia, LLC / Stempel	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/20/2011	4/20/2016
Chesapeake Appalachia, LLC / Stevens	Standing Stone Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2010	1/11/2015
Chesapeake Appalachia, LLC / Stone	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2011	9/30/2016
Chesapeake Appalachia, LLC / Stoorza	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
Chesapeake Appalachia, LLC / Storms	Tuscarora Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Chesapeake Appalachia, LLC / Stoudt	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Chesapeake Appalachia, LLC / Strom	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2009	6/2/2014

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Chesapeake Appalachia, LLC / Strope	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chesapeake Appalachia, LLC / Struble	Litchfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Chesapeake Appalachia, LLC / Sugar Creek	Burlington Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
Chesapeake Appalachia, LLC / Susan	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2011	8/23/2016
Chesapeake Appalachia, LLC / Susquehanna River - Athens Twp	Athens Township	PA	SW	Crude Petroleum and Natural Gas Extraction	09/11/2008, 09/15/2011	09/11/2012, 09/11/2012
Chesapeake Appalachia, LLC / Susquehanna River - Babcock	Ulster Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Chesapeake Appalachia, LLC / Susquehanna River - Elmglade	Wilmot Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Chesapeake Appalachia, LLC / Susquehanna River - Hicks	Great Bend Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009	12/16/2013
Chesapeake Appalachia, LLC / Susquehanna River - Mehoopany Twp.	Mehoopany Township	PA	SW	Crude Petroleum and Natural Gas Extraction	09/11/2008, 09/16/2010	09/11/2012, 09/11/2012
Chesapeake Appalachia, LLC / Susquehanna River - Newton	Terry Township	PA	SW	Crude Petroleum and Natural Gas Extraction	06/18/2009, 09/15/2011	06/18/2013, 06/18/2013
Chesapeake Appalachia, LLC / Susquehanna River - Salsman	Braintrim Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Chesapeake Appalachia, LLC / Susquehanna River - Wysox Twp.	Wysox Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Chesapeake Appalachia, LLC / Tall Maples	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2010	10/20/2015
Chesapeake Appalachia, LLC / Tama	North Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2010	10/20/2015
Chesapeake Appalachia, LLC / Taylor	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2010	11/15/2015
Chesapeake Appalachia, LLC / Thall	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/20/2010	8/20/2015
Chesapeake Appalachia, LLC / Them	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Chesapeake Appalachia, LLC / Tiffany	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Chesapeake Appalachia, LLC / Towanda Creek - Sechrist	Canton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Chesapeake Appalachia, LLC / Towner	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Chesapeake Appalachia, LLC / Treat	Rome Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015

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Chesapeake Appalachia, LLC / Tyler	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2011	8/23/2016
Chesapeake Appalachia, LLC / Updike	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	03/01/2010, 03/12/2010	3/1/2015
Chesapeake Appalachia, LLC / Van DeMark	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Chesapeake Appalachia, LLC / VanNoy	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/22/2009	5/22/2014
Chesapeake Appalachia, LLC / Vargson	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/3/2009	6/3/2014
Chesapeake Appalachia, LLC / Vera	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Chesapeake Appalachia, LLC / Verex	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/6/2010	5/6/2015
Chesapeake Appalachia, LLC / VRGC	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2011	1/21/2016
Chesapeake Appalachia, LLC / Walker	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2011	1/31/2016
Chesapeake Appalachia, LLC / Walt	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2010	3/17/2015
Chesapeake Appalachia, LLC / Wappasening Creek - Yeagle	Windham Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Chesapeake Appalachia, LLC / Warburton	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chesapeake Appalachia, LLC / Ward	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2009	5/19/2014
Chesapeake Appalachia, LLC / Warren	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Chesapeake Appalachia, LLC / Warren #1	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2009	7/6/2014
Chesapeake Appalachia, LLC / Wasyl	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2011	1/10/2016
Chesapeake Appalachia, LLC / Way	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2010	4/28/2015
Chesapeake Appalachia, LLC / Weisbrod	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/3/2010	11/3/2015
Chesapeake Appalachia, LLC / Welles 1	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2014
Chesapeake Appalachia, LLC / Welles 2	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/25/2009	9/25/2014
Chesapeake Appalachia, LLC / Welles 3	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chesapeake Appalachia, LLC / Welles 4	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/10/2015
Chesapeake Appalachia, LLC / Welles 5	Terry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/19/2010, 03/10/2010	2/19/2015
Chesapeake Appalachia, LLC / WGC	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Chesapeake Appalachia, LLC / White	Auburn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2009	5/21/2014
Chesapeake Appalachia, LLC / Wildonger	Wyalusing Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2011	12/16/2016
Chesapeake Appalachia, LLC / Williams	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Chesapeake Appalachia, LLC / Williamson	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Chesapeake Appalachia, LLC / Wolf	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
Chesapeake Appalachia, LLC / Wootten	Mehoopany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2011	6/21/2016
Chesapeake Appalachia, LLC / Wyalusing Creek	Rush Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	12/4/2012
Chesapeake Appalachia, LLC / Wygrala	Wysox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Chesapeake Appalachia, LLC / Wysox Creek	Rome Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Chesapeake Appalachia, LLC / Yadpad	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2012	2/17/2017
Chesapeake Appalachia, LLC / Yengo	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/09/2010, 03/10/2010	2/9/2015
Chesapeake Appalachia, LLC / Yoder	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
Chesapeake Appalachia, LLC / Yost	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2011	12/14/2016
Chesapeake Appalachia, LLC / Yvonne	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/8/2010	10/8/2015
Chesapeake Appalachia, LLC / Zaleski	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/9/2010	11/9/2015
Chester County Solid Waste Authority / Lanchester Landfill	Salisbury Township	PA	GW,CU,DIV	Solid Waste Landfill	6/11/2010	6/10/2025
Chester Water Authority	Little Britain Township	PA	SW,CU	Water Supply and Irrigation Systems	11/26/1996	12/31/2021
Chevron Appalachia, LLC / Boileau Drilling Pad #1	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/29/2010	10/29/2015

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Chevron Appalachia, LLC / Borough of Ebensburg	Cambria Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Chevron Appalachia, LLC / Cambria Somerset Authority	Summerhill Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Chevron Appalachia, LLC / Chase A-1H Drilling Pad #1	Boggs Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2009	9/23/2014
Chevron Appalachia, LLC / Chest Creek (Kitchen)	Chest Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
Chevron Appalachia, LLC / Clearfield Creek	Boggs Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/4/2008	12/4/2012
Chevron Appalachia, LLC / Davis Drilling Pad #1	West St. Clair Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
Chevron Appalachia, LLC / Highland Sewer and Water Authority	Portage Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Chevron Appalachia, LLC / Hodge Unit Drilling Pad #1	Juniata Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/1/2009	12/1/2014
Chevron Appalachia, LLC / Hutton Unit #1H	Chest Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2009	5/18/2014
Chevron Appalachia, LLC / Lightner Drilling Pad #1	Juniata Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Chevron Appalachia, LLC / Lightner East Drilling Pad #1	Juniata Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/21/2010	9/21/2015
Chevron Appalachia, LLC / Lytle Unit Drilling Pad #1H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Chevron Appalachia, LLC / McVicker Drilling Pad #1	West St. Clair Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/5/2011	4/5/2016
Chevron Appalachia, LLC / Ritchey Unit Drilling Pad	Juniata Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/7/2009	10/7/2014
Chevron Appalachia, LLC / Shannon Land & Mining Drilling Pad #1	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/9/2010	6/9/2015
Chevron Appalachia, LLC / Smithmyer Drilling Pad #1	Clearfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2011	1/21/2016
Chevron Appalachia, LLC / Snow Shoe 1	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/1/2010	11/1/2015
Chevron Appalachia, LLC / Snow Shoe 2	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/1/2010	11/1/2015
Chevron Appalachia, LLC / Snow Shoe 4	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Chief Oil & Gas LLC / Allen Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Chief Oil & Gas LLC / Ambrosius Drilling Pad #1	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/7/2012	5/7/2017

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Chief Oil & Gas LLC / American Asphalt Drilling Pad #1	Eaton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/24/2011	2/24/2016
Chief Oil & Gas LLC / Andrus Drilling Pad #1	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2011	1/21/2016
Chief Oil & Gas LLC / B & B Investment Group Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/29/2010	10/29/2015
Chief Oil & Gas LLC / Bacon Drilling Pad #1	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/2/2010	2/2/2015
Chief Oil & Gas LLC / Bailey Drilling Pad #1	Overton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2012	1/9/2017
Chief Oil & Gas LLC / Beinlich Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Chief Oil & Gas LLC / Beirne Green Hills Farms A Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/18/2011	11/18/2016
Chief Oil & Gas LLC / Black Unit #1H	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
Chief Oil & Gas LLC / Bouse Drilling Pad #1	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/11/2011	10/11/2016
Chief Oil & Gas LLC / Castle A Drilling Pad #1	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chief Oil & Gas LLC / Castrogiovanni Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Chief Oil & Gas LLC / Clear Springs Dairy Drilling Pad #1	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2009	12/14/2014
Chief Oil & Gas LLC / Crandall Drilling Pad #1	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chief Oil & Gas LLC / Curtin Drilling Pad #1	Albany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Chief Oil & Gas LLC / D & J Farms Drilling Pad #1	Sheshequin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/11/2012	4/11/2017
Chief Oil & Gas LLC / Dacheux Drilling Pad #1	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Chief Oil & Gas LLC / Duane Jennings Drilling Pad #1	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2010	3/22/2015
Chief Oil & Gas LLC / Elliott B Drilling Pad #1	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2011	9/27/2016
Chief Oil & Gas LLC / Elliott Drilling Pad #1H	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Chief Oil & Gas LLC / Frey Drilling Pad #1	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/25/2010	6/25/2015
Chief Oil & Gas LLC / Garrison Drilling Pad #1	Lemon Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/25/2011	2/25/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Chief Oil & Gas LLC / Harper Unit #1H	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
Chief Oil & Gas LLC / Harris #1H	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/29/2009	5/29/2014
Chief Oil & Gas LLC / Hemlock Hunting Club Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/16/2015
Chief Oil & Gas LLC / Hurley Drilling Pad #1	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chief Oil & Gas LLC / Jennings Unit #1H	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
Chief Oil & Gas LLC / Jerauld Drilling Pad #1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2011	5/13/2016
Chief Oil & Gas LLC / Kaufmann Drilling Pad #1	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chief Oil & Gas LLC / Kerr B Drilling Pad #1	Lathrop Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2011	9/27/2016
Chief Oil & Gas LLC / Kerr Drilling Pad #1	Lathrop Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/5/2010	5/5/2015
Chief Oil & Gas LLC / Kerrick Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2011	3/24/2016
Chief Oil & Gas LLC / King Drilling Pad #1	Towanda Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2012	5/14/2017
Chief Oil & Gas LLC / Kingsley B Drilling Pad #1	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/7/2011	12/7/2016
Chief Oil & Gas LLC / Kingsley Drilling Pad #1	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2010	3/23/2015
Chief Oil & Gas LLC / Kobbe Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/14/2010	7/14/2015
Chief Oil & Gas LLC / Kupscznk Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
Chief Oil & Gas LLC / Kuziak Drilling Pad #1	Fox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/12/2011	7/12/2016
Chief Oil & Gas LLC / L & L Construction A Drilling Pad #1	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
Chief Oil & Gas LLC / Leh Drilling Pad #1	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/11/2012	4/11/2017
Chief Oil & Gas LLC / Longmore Drilling Pad #1	Monroe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
Chief Oil & Gas LLC / Lucarino Drilling Pad #1	Wilmot Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/7/2011	12/7/2016
Chief Oil & Gas LLC / Madigan Farms A Drilling Pad #1	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016

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Chief Oil & Gas LLC / Martins Creek	Hop Bottom Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Chief Oil & Gas LLC / McCarty Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Chief Oil & Gas LLC / Muzzy Drilling Pad #1	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/27/2012	2/27/2017
Chief Oil & Gas LLC / Myers Unit Drilling Pad #1	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Chief Oil & Gas LLC / Nelson Drilling Pad #1	Forks Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/28/2011	11/28/2016
Chief Oil & Gas LLC / Noble Drilling Pad #1	Brooklyn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/12/2011	4/12/2016
Chief Oil & Gas LLC / Ober Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2012	3/23/2017
Chief Oil & Gas LLC / Oliver Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/14/2010	4/14/2015
Chief Oil & Gas LLC / Phelps Unit #1H	Lathrop Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/17/2009, 09/14/2009, 11/19/2009	8/17/2014
Chief Oil & Gas LLC / PMG Annie Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
Chief Oil & Gas LLC / PMG God Drilling Pad #1	Asylum Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/24/2010	11/24/2015
Chief Oil & Gas LLC / Polovitch East Drilling Pad #1	Nicholson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/13/2011	6/13/2016
Chief Oil & Gas LLC / Polovitch Unit #1H	Nicholson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/28/2009	8/28/2014
Chief Oil & Gas LLC / Polovitch West Drilling Pad #1	Nicholson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/25/2011	4/25/2016
Chief Oil & Gas LLC / Polowy Drilling Pad #1	Ulster Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2012	5/14/2017
Chief Oil & Gas LLC / R & A Harris Drilling Pad #1	Tunkhannock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
Chief Oil & Gas LLC / R & D Group Drilling Pad #1	Mehoopany Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
Chief Oil & Gas LLC / R & L Wilson Drilling Pad #1	Eaton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Chief Oil & Gas LLC / Ransom Drilling Pad #1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2010	3/23/2015
Chief Oil & Gas LLC / Savage Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2011	8/10/2016

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Chief Oil & Gas LLC / Sechrist Drilling Pad #1	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2010	3/23/2015
Chief Oil & Gas LLC / Severcool Drilling Pad #1	Forkston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
Chief Oil & Gas LLC / Signore Drilling Pad #1	Elkland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015
Chief Oil & Gas LLC / Smith Drilling Pad #1	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/29/2010	10/29/2015
Chief Oil & Gas LLC / Squier B Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/11/2011	10/11/2016
Chief Oil & Gas LLC / Squier Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/7/2010	7/7/2015
Chief Oil & Gas LLC / Stasiak Drilling Pad #1	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2012	3/23/2017
Chief Oil & Gas LLC / Stone Drilling Pad #1	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/25/2010	2/25/2015
Chief Oil & Gas LLC / Taylor Drilling Pad #1	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/25/2011	4/25/2016
Chief Oil & Gas LLC / Teel Unit #1H	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009, 02/11/2010	11/16/2014
Chief Oil & Gas LLC / Teel Unit Drilling Pad #2H	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/3/2009	12/3/2014
Chief Oil & Gas LLC / Teel Unit Drilling Pad #3H	Springville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/3/2009	12/3/2014
Chief Oil & Gas LLC / W & L Wilson Drilling Pad #1	Lemon Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/16/2011	3/16/2016
Chief Oil & Gas LLC / Walters Unit #1H	West Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
Chief Oil & Gas LLC / Wright A Drilling Pad #1	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/6/2012	2/6/2017
Chief Oil & Gas LLC / Yanavitch Drilling Pad #1	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/11/2012	4/11/2017
Chief Oil & Gas LLC / Yoder Drilling Pad #1	Leroy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2012	1/4/2017
Chief Oil & Gas LLC / Yonkin Drilling Pad #1	Cherry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2011	9/23/2016
Church & Dwight Co. Inc. / Davies Facility	Jackson Township	PA	CU	Soap and Other Detergent Manufacturing	3/6/2009	3/6/2024
Cinram Manufacturing	Olyphant Borough	PA	CU	Audio and Video Equipment Manufacturing	07/08/1996, 12/13/2001	07/08/2021, 07/08/2021
Citrus Energy / Johnston 1 Pad	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/13/2011	6/13/2016

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Citrus Energy / Macialek 1 Pad	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/6/2012	1/6/2017
Citrus Energy / Mattocks 1	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/6/2011	10/6/2016
Citrus Energy / McConnell 1	Tunkhannock Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/6/2011	10/6/2016
Citrus Energy / Mirabelli Pad 1-1H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/20/2010	8/20/2015
Citrus Energy / North Branch Susquehanna	Washington Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/04/2008, 09/16/2010	12/04/2012, 12/04/2012
Citrus Energy / P&G Warehouse 1-1H	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
Citrus Energy / Procter & Gamble Mehoopany Plant 2 1H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
Citrus Energy / Procter & Gamble Mehoopany Plant 3V	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Citrus Energy / Procter & Gamble Mehoopany Plant 4V	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	01/08/2010, 04/12/2010	1/8/2015
Citrus Energy / Procter & Gamble Mehoopany Plant 5V	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Citrus Energy / Procter and Gamble Mehoopany Plant 1V	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2009, 10/14/2009	10/13/2014
Citrus Energy / Reimiller 1	Meshoppen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/6/2011	10/6/2016
Citrus Energy / Ruark East 1 1H	Washington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2010	8/1/2015
Clark Trucking, LLC Northeast Division / Lycoming Creek	Lewis Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Clark Trucking, LLC Northeast Division / Muncy Creek	Muncy Creek Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Clearfield Municipal Authority	Pike Township	PA	GW,SW	Water Supply and Irrigation Systems	07/11/1991, 02/10/2000, 10/10/2002, 06/13/2006	07/11/2021, 02/10/2025, 10/10/2027, 06/13/2031
Clinton Country Club	Bald Eagle Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Cohocton, Town of	Addison Township	NY	GW	Water Supply and Irrigation Systems	07/08/1999, 09/12/2007	07/08/2024, 09/12/2022
College Township Water Authority	College Township	PA	GW	Water Supply and Irrigation Systems	03/11/1999, 10/10/2002	03/11/2024, 10/10/2027
Commonwealth Environmental Systems, Inc. / Commonwealth Environmental Systems, L.P.	Foster Township	PA	GW,CU	Solid Waste Landfill	03/14/2007, 06/12/2008	03/14/2022, 03/14/2022

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Community Refuse Service, Inc., d.b.a. Cumberland County Landfill	Hopewell Township	PA	CU,GW	Solid Waste Landfill	09/14/2005, 09/10/2009	09/14/2030, 09/14/2030
Conestoga Country Club	Manor Township	PA	SW,CU,GW	Golf Courses and Country Clubs	10/10/2002, 06/12/2008	10/10/2027, 06/12/2023
Conklin, Town of	Binghamton City	NY	GW	Water Supply and Irrigation Systems	10/09/2003, 06/13/2007	10/09/2028, 06/13/2022
Conyngham Borough Authority	Conyngham Borough	PA	GW	Water Supply and Irrigation Systems	3/14/2007	3/14/2022
Cool Creek Golf Club / Cool Creek Country Club	Hellam Township	PA	CU	Golf Courses and Country Clubs	6/8/2000	6/8/2025
Coon Industries, Inc.	Pittston Township	PA	CU	Ready-Mix Concrete Manufacturing	12/12/2002	12/12/2027
Cooperstown Dreams Park, Inc.	Cooperstown Village	NY	CU,SW	Spectator Sports	06/14/2006, 03/13/2008	06/14/2031, 06/14/2031
Corey Creek Golf Club	Richmond Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Corixa Corporation / Corixa Corporation	East Donegal Township	PA	CU,GW	Pharmaceutical and Medicine Manufacturing	06/12/2003, 12/15/2004	06/12/2028, 12/15/2029
Corning, City of	Addison Township	NY	GW	Water Supply and Irrigation Systems	4/9/1986	4/9/2016
Corning, Inc. / Corning Incorporated-Diesel Ceramic Manufacturing Facility	Addison Township	NY	CU	Other Engine Equipment Manufacturing	12/11/2003	12/11/2028
Corning, Inc. / Corning Incorporated–Headquarters	Corning City	NY	GW	Pottery, Ceramics, and Plumbing Fixture Manufacturing	05/12/1994, 12/03/1998, 06/08/2005	05/12/2024, 12/03/2023, 06/08/2030
Corning, Inc. / Corning Incorporated–Houghton Park	Corning City	NY	GW	Pottery, Ceramics, and Plumbing Fixture Manufacturing	5/15/1997	5/15/2022
Corning, Inc. / Corning Incorporated–Sullivan Park	Corning City	NY	GW,CU	Pottery, Ceramics, and Plumbing Fixture Manufacturing	07/10/1997, 11/13/1997, 06/14/2001	07/10/2022, 07/10/2022, 07/10/2022
Cortlandville, Town of	Cortland City	NY	GW	Water Supply and Irrigation Systems	09/08/1988, 12/12/2002, 12/12/2002	09/08/2018, 09/08/2018, 12/12/2027
Country Club of Harrisburg / Country Club of Harrisburg	Middle Paxton Township	PA	SW,CU,GW	Golf Courses and Country Clubs	06/12/2002, 03/15/2006, 12/05/2006, 12/05/2006	06/12/2027, 06/12/2027, 06/12/2027, 12/05/2031
Country Club of York	Spring Garden Township	PA	CU	Golf Courses and Country Clubs	8/10/2000	8/10/2025
CraftMaster Manufacturing, Inc. / CraftMaster Manufacturing, Inc.	Wysox Township	PA	GW,CU	Cutlery and Handtool Manufacturing	11/13/1980, 02/10/2000	11/13/2010, 11/13/2010
Crawford Township Authority	Crawford Township	PA	SW	Water Supply and Irrigation Systems	5/23/1996	5/29/2021
Crossgates Golf Course	Manor Township	PA	CU,SW	Golf Courses and Country Clubs	05/09/1991, 09/12/1991, 11/01/1999	09/12/2016, 09/12/2016, 09/12/2016

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Crown Club LP	Lower Paxton Township	PA	GW	Golf Courses and Country Clubs	6/14/2001	6/14/2026
Dairy Farmers of America, Inc.	Lower Allen Township	PA	CU	Dairy Product Manufacturing	12/12/2002, 09/13/2006	12/12/2027, 12/12/2027
Dallastown - Yoe Water Authority	Dallastown Borough	PA	NULL	Water Supply and Irrigation Systems	6/18/2009	6/18/2034
Dart Container Corporation / Dart Container Corporation of Pennsylvania	Upper Leacock Township	PA	GW,CU	Food Manufacturing	09/08/2004, 06/14/2006, 09/11/2008, 09/08/2004, 06/13/2007	09/08/2029, 09/08/2029, 09/08/2029, 09/08/2029, 09/08/2029
Dauphin County General Authority/Highlands Golf Course	Swatara Township	PA	GW,CU	Golf Courses and Country Clubs	01/13/1994, 02/10/2000, 08/09/2001	01/13/2024, 01/13/2024, 01/13/2024
Dean Dairy Holdings, LLC / Swiss Premium Dairy, LLC	North Cornwall Township	PA	CU	Beverage Manufacturing	06/12/2002, 06/14/2006, 03/10/2011	06/12/2027, 06/12/2027, 06/12/2027
Defense Distribution Depot Susquehanna Pennsylvania-Riverview Golf Club	Fairview Township	PA	CU	Golf Courses and Country Clubs	08/15/2002, 06/12/2003	08/15/2027, 08/15/2027
Delta Borough Municipal Authority / Delta Borough Water System	Peach Bottom Township	PA	GW	Water Supply and Irrigation Systems	03/11/1993, 03/14/2007, 03/12/2009	03/11/2023, 03/14/2022, 03/12/2024
Denver Borough Authority	Denver Borough	PA	GW	Water Supply and Irrigation Systems	01/12/1989, 01/11/1996	01/12/2019, 01/11/2021
Department of Veterans Affairs Medical Center	South Lebanon Township	PA	CU	General Medical and Surgical Hospitals	2/6/2003	2/6/2028
Dial Corporation	Conyngham Borough	PA	CU	Soap and Other Detergent Manufacturing	2/6/2003	2/6/2028
Dillsburg Area Authority	Carroll Township	PA	GW	Water Supply and Irrigation Systems	03/09/1989, 07/09/1998, 09/12/2007, 12/04/2008, 12/04/2008	03/09/2019, 07/09/2023, 09/12/2022, 12/04/2023, 12/04/2023
DLM Foods, L.L.C.	South Centre Township	PA	GW,CU	Food Manufacturing	07/11/1991, 06/12/2003, 06/12/2003	07/11/2021, 07/11/2021, 06/12/2028
Dover Township Water Department	Dover Township	PA	GW,SW	Water Supply and Irrigation Systems	02/11/1988, 11/14/1991, 07/08/1993	02/11/2018, 11/14/2021, 09/16/2017
Dover, Borough of	Dover Township	PA	SW	Water Supply and Irrigation Systems	3/19/1995	3/28/2014

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DPS Holdings, Inc. / DPS Holdings, Inc.-Mott's Aspers Plant	Menallen Township	PA	GW,CU	Food Manufacturing	03/10/1994, 08/10/2000, 10/10/2002, 02/08/2001	03/10/2024, 03/10/2024, 03/10/2024, 02/08/2026
DS Waters of America, Inc / DS Waters of America, Inc.	Clay Township	PA	GW,CU	Bottled Water Manufacturing	2/10/2000	2/10/2025
DuBois, City of / DuBois, City of	Union Township	PA	SW,CU	Water Supply and Irrigation Systems	3/15/2006	3/15/2031
Duncannon, Borough of	Duncannon Borough	PA	GW	Water Supply and Irrigation Systems	5/9/1991	5/9/2021
Dunn Lake LLC / Dunn Pond	Ararat Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Eagle Rock Community Association / Eagle Rock Resort Co.–Quarry	Black Creek Township	PA	GW,CU,SW	Golf Courses and Country Clubs	10/10/2002, 09/08/2004, 12/05/2006	10/10/2027, 10/10/2027, 10/10/2027
Eagles Crossing, Inc.	North Middleton Township	PA	SW,CU	Golf Courses and Country Clubs	12/3/1998	12/3/2023
Eagles Mere Country Club	Shrewsbury Township	PA	CU	Golf Courses and Country Clubs	03/20/1997, 02/10/2000	03/20/2022, 03/20/2022
Earlville, Village of	Earlville Village	NY	GW	Water Supply and Irrigation Systems	05/11/1989, 01/11/1996	05/11/2019, 01/11/2021
East Berlin Area Joint Authority	Hamilton Township	PA	GW	Water Supply and Irrigation Systems	06/05/1986, 09/11/2008	06/05/2016, 09/11/2023
East Cocalico Township Authority / East Cocalico Township Authority	East Cocalico Township	PA	GW	Water Supply and Irrigation Systems	01/11/1979, 01/12/1989, 07/09/1992, 12/03/1998, 09/09/1999, 10/09/2003, 06/13/2007	01/11/2009, 01/12/2019, 07/09/2022, 12/03/2023, 09/09/2024, 10/09/2028, 06/13/2022
East Donegal Township Municipal Authority / East Donegal Township Municipal Authority	East Donegal Township	PA	GW	Water Supply and Irrigation Systems	07/08/1999, 03/10/2011	07/08/2024, 03/09/2026
East Hempfield Township / Four Seasons Golf Course - East Hempfield	East Hempfield Township	PA	GW,CU	Golf Courses and Country Clubs	05/15/1997, 02/10/2000	05/15/2022, 05/15/2022
East Hempfield Township Municipal Authority / East Hempfield Township Municipal Authority	East Hempfield Township	PA	GW	Water Supply and Irrigation Systems	03/12/1981, 03/12/1987, 05/11/1989, 01/14/1993	03/12/2011, 03/12/2017, 05/11/2019, 01/14/2023
East Petersburg Borough Water Authority	East Petersburg Borough	PA	SW	Water Supply and Irrigation Systems	7/9/1998	6/8/2005
East Resources, Inc. / Fitch 115	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/26/2009, 03/26/2010	NULL

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Eastern Industries, Inc. / Eastern Industries, Inc.	Mehoopany Township	PA	CU	Construction Sand and Gravel Mining	07/11/1991, 02/10/2000	07/11/2021, 07/11/2021
Eastern Industries, Inc. / Eastern Industries, Inc.–Lewisburg Quarry	Buffalo Township	PA	SW,CU	Stone Mining and Quarrying	9/8/2004	9/8/2029
Egg Harbor Springs, Inc.	Porter Township	PA	CU	Bottled Water Manufacturing	6/12/2003	6/12/2028
Elizabethtown Area Water Authority / Elizabethtown Area Water Authority	Mount Joy Township	PA	GW,SW	Water Supply and Irrigation Systems	11/13/1986, 04/14/1988, 05/15/1997, 01/15/1998	11/13/2016, 04/14/2018, 06/10/2022, 01/15/2023
Elizabethville Area Authority / Elizabethville Area Authority	Washington Township	PA	GW	Water Supply and Irrigation Systems	09/16/1993, 12/03/1998	09/16/2023, 12/03/2023
Elizabethville Area Authority / Spradley Run / Canoe Run / Stroups Spring	Washington Township	PA	SW	Water Supply and Irrigation Systems	7/22/2010	7/22/2014
Elk Mountain Ski Resort, Inc.	Clifford Township	PA	SW,CU	Skiing Facilities	10/09/2003, 12/14/2005, 03/15/2006	10/09/2028, 10/09/2028, 03/15/2031
Elkview Country Club	Greenfield Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Elmhurst Country Club	Roaring Brook Township	PA	CU	Golf Courses and Country Clubs	10/10/2002, 06/14/2006	10/10/2027, 10/10/2027
Elmira Water Board	Elmira City	NY	GW	Water Supply and Irrigation Systems	11/8/1990	11/8/2020
Ely Park Municipal Golf Course	Binghamton City	NY	CU	Golf Courses and Country Clubs	4/10/2003	4/10/2028
Emanon Country Club	Exeter Township	PA	GW,CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Empire Kosher Poultry, Inc. / Empire Kosher Poultry, Inc.	Walker Township	PA	GW,CU	Turkey Production	08/14/2003, 06/07/2012	08/14/2028, 08/14/2028
EnCana Oil & Gas (USA) Inc. / Farrell 1H	Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/19/2010	NULL
EnCana Oil & Gas (USA) Inc. / Lansberry Perry 1V	Lehman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/26/2010, 02/26/2010	NULL
Energy Corporation of America / Coldstream Affiliates #1MH	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/16/2010, 07/05/2011	07/16/2015, 07/16/2010
Energy Corporation of America / Coldstream Affiliates B	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/25/2011	10/25/2016
Energy Corporation of America / COP 325 A	Girard Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/8/2011	12/8/2016
Energy Corporation of America / West Branch Susquehanna River - Moore	Goshen Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009	12/16/2013
Energy Corporation of America / Whitetail #1-5MH	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/16/2010, 07/05/2011	08/16/2015, 08/16/2015
Enerplus Resources (USA) Corporation / Dutch Run Camp 1 Well Pad	West Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016

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Enerplus Resources (USA) Corporation / Winner 1	West Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/26/2011	1/26/2016
Enerplus Resources (USA) Corporation / Winner 1 Well Pad	East Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2011	12/20/2016
Enerplus Resources (USA) Corporation / Winner 2 Well Pad	East Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2011	9/27/2016
Enerplus Resources (USA) Corporation / Winner 4H	West Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2010	9/23/2015
Enerplus Resources (USA) Corporation / Winner 6 Well Pad	East Keating Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
En-Joie Golf Club	Endicott Village	NY	CU	Golf Courses and Country Clubs	3/10/2004	3/10/2029
EOG Resources, Inc. / ASHBY Pad	Athens Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / Beardslee 1V Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / BEARDSLEE 2H Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / Blue Valley AMD Treatment Plant	Horton Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
EOG Resources, Inc. / CASEMAN 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
EOG Resources, Inc. / CASEMAN 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
EOG Resources, Inc. / Chapman Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
EOG Resources, Inc. / COP Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2010	5/18/2015
EOG Resources, Inc. / COP Pad B	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
EOG Resources, Inc. / COP Pad C	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
EOG Resources, Inc. / COP Pad J	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
EOG Resources, Inc. / COP Pad N	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/4/2011	3/4/2016
EOG Resources, Inc. / COP Pad O	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / COP Pad P	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
EOG Resources, Inc. / COP Pad S	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
EOG Resources, Inc. / CRANE Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / DEMEO 1H PAD	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2010	9/30/2015
EOG Resources, Inc. / Dodge Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / FAY 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / Furman Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / GARVER Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EOG Resources, Inc. / GEROULD Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
EOG Resources, Inc. / GHC Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
EOG Resources, Inc. / GHFC Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / GHFC Pad B	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / GHFC Pad D	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/13/2012	3/13/2017
EOG Resources, Inc. / GROSS 1H Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
EOG Resources, Inc. / GUINAN 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/18/2009	11/18/2014
EOG Resources, Inc. / GUINAN 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/18/2009	11/18/2014
EOG Resources, Inc. / HALSTEAD Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/14/2010	9/14/2015
EOG Resources, Inc. / HARKNESS 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/15/2009	12/15/2014
EOG Resources, Inc. / HARKNESS 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/15/2009, 03/02/2010	12/15/2014
EOG Resources, Inc. / HARKNESS 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/15/2009	12/15/2014
EOG Resources, Inc. / HAVEN 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
EOG Resources, Inc. / HAVEN 2 H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / HAVEN 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015

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EOG Resources, Inc. / HOLCOMBE 1H Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / HOPPAUGH 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/20/2009	11/20/2014
EOG Resources, Inc. / HOPPAUGH 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2009	11/23/2014
EOG Resources, Inc. / HOPPAUGH 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2009	11/23/2014
EOG Resources, Inc. / Houseknecht 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EOG Resources, Inc. / Houseknecht C 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EOG Resources, Inc. / HOUSER 1H Pad	Burlington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / Housknecht 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 12/02/2009, 12/02/2009	04/06/2014, 04/06/2014
EOG Resources, Inc. / Housknecht 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EOG Resources, Inc. / JACKSON 1H Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
EOG Resources, Inc. / JANOWSKY 1H	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EOG Resources, Inc. / JBR PARTNERS 1V	Saint Marys City	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
EOG Resources, Inc. / JENKINS 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/15/2010	4/15/2015
EOG Resources, Inc. / JOHNSON Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
EOG Resources, Inc. / JONES 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/2/2009	12/2/2014
EOG Resources, Inc. / KENYON 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/30/2009	12/30/2014
EOG Resources, Inc. / KINGSLEY 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
EOG Resources, Inc. / KINGSLEY 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015
EOG Resources, Inc. / KINGSLEY 4H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / KINGSLEY 5H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015

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EOG Resources, Inc. / KINGSLEY 5HA/6HA Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / KINGSLEY 6H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / Kingsley 7V Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
EOG Resources, Inc. / LEE 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2009	11/23/2014
EOG Resources, Inc. / LEE 2H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2009	11/23/2014
EOG Resources, Inc. / LEE 3H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2009	11/23/2014
EOG Resources, Inc. / Lee 4H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
EOG Resources, Inc. / LIDDELL 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2010	1/21/2015
EOG Resources, Inc. / MacBride Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
EOG Resources, Inc. / Manzek Land Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
EOG Resources, Inc. / MATTOCKS 1V	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
EOG Resources, Inc. / McKEE Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / MELCHIONNE 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / MICCIO 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
EOG Resources, Inc. / MULLALY Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
EOG Resources, Inc. / NICHOLS 1H Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / NICHOLS 2H Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / OBERKAMPER Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
EOG Resources, Inc. / Otten Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EOG Resources, Inc. / PHC 10V	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2009	7/9/2014
EOG Resources, Inc. / PHC 11V	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2009	7/9/2014

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EOG Resources, Inc. / PHC 20V	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2010	1/21/2015
EOG Resources, Inc. / PHC 21V	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/15/2010	4/15/2015
EOG Resources, Inc. / PHC 23H/24H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 03/16/2010	09/08/2014, 09/08/2014
EOG Resources, Inc. / PHC 28H/29H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 05/19/2010	09/08/2014, 09/08/2014
EOG Resources, Inc. / PHC 3H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EOG Resources, Inc. / PHC 4H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	05/07/2009, 05/19/2010	05/07/2014, 05/07/2014
EOG Resources, Inc. / PHC 5H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	05/07/2009, 05/19/2010	05/07/2014, 05/07/2014
EOG Resources, Inc. / PHC 6H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/09/2009, 10/28/2009, 05/19/2010	07/09/2014, 07/09/2014, 07/09/2014
EOG Resources, Inc. / PHC 7H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/09/2009, 10/28/2009	07/09/2014, 07/09/2014
EOG Resources, Inc. / PHC 8H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/09/2009, 10/28/2009	07/09/2014, 07/09/2014
EOG Resources, Inc. / PHC 9H	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/7/2009	5/7/2014
EOG Resources, Inc. / PHC Pad S	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
EOG Resources, Inc. / PHC Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
EOG Resources, Inc. / PHC Pad AA	Goshen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / PHC Pad B	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
EOG Resources, Inc. / PHC Pad BB	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / PHC Pad CC	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / PHC Pad DD	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / PHC Pad Q	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
EOG Resources, Inc. / PHC Pad R	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015

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EOG Resources, Inc. / PHC Pad T	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
EOG Resources, Inc. / PHC Pad U	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
EOG Resources, Inc. / PHC Pad Z	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / PPHC Pad B	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / PRUYNE 1H Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / REITER 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EOG Resources, Inc. / Rightmire 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / RIGHTMIRE 2H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / ROBBINS Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
EOG Resources, Inc. / ROGERS 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/10/2010	5/10/2015
EOG Resources, Inc. / SEAMAN 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
EOG Resources, Inc. / SG Pad P	Jones Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
EOG Resources, Inc. / SGL 90A Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/30/2010	8/30/2015
EOG Resources, Inc. / SGL 90C Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2010	11/10/2015
EOG Resources, Inc. / SGL 90D Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
EOG Resources, Inc. / SGL 90E Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2010	11/10/2015
EOG Resources, Inc. / SGL 90F Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2010	11/10/2015
EOG Resources, Inc. / SGL 94 Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
EOG Resources, Inc. / SGL 94C Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/13/2012	3/13/2017
EOG Resources, Inc. / SGL 94D Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
EOG Resources, Inc. / SSHC Pad A	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/13/2010	9/13/2015

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EOG Resources, Inc. / STAHL 1H Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
EOG Resources, Inc. / STURDEVANT 1H	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
EOG Resources, Inc. / SUTHERLAND CHEVROLET 1H Pad	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
EOG Resources, Inc. / TYLER Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
EOG Resources, Inc. / W TYLER Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
EOG Resources, Inc. / WALLACE Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / Ward M 1H	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 12/02/2009, 12/02/2009	04/06/2014, 04/06/2014
EOG Resources, Inc. / WATSON Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2010	8/18/2015
EOG Resources, Inc. / WENGER Pad	Springfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
EOG Resources, Inc. / WOLFE B Pad	Athens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
EOG Resources, Inc. / WOLFE Pad	Smithfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
EOG Resources, Inc. / WOOD 1H Pad	Ridgebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EQT Production Company / Bearer	Susquehanna Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/4/2011	1/4/2016
EQT Production Company / Bennett Branch Sinnemahoning Creek	Jay Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
EQT Production Company / COP 63 Hogback	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2011	10/13/2016
EQT Production Company / Doe	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
EQT Production Company / Frano Freshwater Impoundment	Washington Township	PA	CU,DIV	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
EQT Production Company / Gobbler	Huston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
EQT Production Company / Hurd	Ferguson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/10/2009, 11/18/2009	8/10/2014
EQT Production Company / Longhorn C-1 (WDV1)	Jay Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015

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EQT Production Company / Phoenix C	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2010	6/29/2015
EQT Production Company / Phoenix E	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2010	8/18/2015
EQT Production Company / Phoenix H	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2010	10/20/2015
EQT Production Company / Phoenix I	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2011	8/16/2016
EQT Production Company / Phoenix N (ANT6)	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2012	4/27/2017
EQT Production Company / Phoenix P	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2011	5/31/2016
EQT Production Company / Phoenix R	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/22/2010	11/22/2015
EQT Production Company / Phoenix S	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2010	12/6/2015
EQT Production Company / Stoney Brook	Jay Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/17/2011	5/17/2016
EQT Production Company / Turkey	Huston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
EQT Production Company / West Branch Susquehanna River	Greenwood Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
EQT Production Company / Whippoorwill	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
EQT Production Company / Wilson Creek	Duncan Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
EQT Production Company / Wohler	Chest Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/6/2011	6/6/2016
Erwin, Town of / Erwin, Town of	Corning City	NY	GW	Water Supply and Irrigation Systems	05/13/1999, 12/14/2005, 06/13/2007, 09/12/2007	05/13/2024, 05/13/2024, 06/13/2022, 06/13/2022
Essential Power Operating Company, LLC / Rock Springs Generation Facility	Perryville Township	MD	SW,CU,GW	Electric Power Generation	12/14/2000, 06/12/2008	12/14/2025, 12/14/2025
EXCO Resources (PA), LLC / Arthur Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
EXCO Resources (PA), LLC / Barto Unit #1H, #2H	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
EXCO Resources (PA), LLC / Bogumil	North Abington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
EXCO Resources (PA), LLC / Bower Unit #1H Drilling Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2009	8/18/2014

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EXCO Resources (PA), LLC / Budman Well Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/11/2012	1/11/2017
EXCO Resources (PA), LLC / Cadwalader Pad	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/24/2011	3/24/2016
EXCO Resources (PA), LLC / Confer (Pad 31)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2010	6/21/2015
EXCO Resources (PA), LLC / Confer (Pad 32)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2010	6/21/2015
EXCO Resources (PA), LLC / COP Tract 706 (Pad 10)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EXCO Resources (PA), LLC / COP Tract 706 (Pad 25)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EXCO Resources (PA), LLC / COP Tract 706 (Pad 7)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EXCO Resources (PA), LLC / COP Tract 706 (Pad 8)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EXCO Resources (PA), LLC / COP Tract 706 (Pad 9)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
EXCO Resources (PA), LLC / Daisy Barto Unit Well Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/7/2012	5/7/2017
EXCO Resources (PA), LLC / Dale Bower Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/15/2010, 07/08/2011	02/15/2015, 02/15/2015
EXCO Resources (PA), LLC / Dale Bower East Unit Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
EXCO Resources (PA), LLC / DCNR Tract 323 Pad-2	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/1/2010	12/1/2015
EXCO Resources (PA), LLC / Derrick Unit #1	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EXCO Resources (PA), LLC / Doebler Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010, 07/11/2011	12/20/2015, 12/20/2015
EXCO Resources (PA), LLC / Dunwoody Pad	Plunketts Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/24/2012	2/24/2017
EXCO Resources (PA), LLC / Elk Run Hunt Club Drilling Pad 1	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/8/2012	3/8/2017
EXCO Resources (PA), LLC / Elk Run Hunt Club Drilling Pad 2	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2012	6/22/2017
EXCO Resources (PA), LLC / Emig Drilling Pad #1	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/29/2010	4/29/2015
EXCO Resources (PA), LLC / Falk Unit #1H	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2009	9/9/2014
EXCO Resources (PA), LLC / Farnsworth Unit 1H Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2011	11/30/2016

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EXCO Resources (PA), LLC / Fidatti-Bianconi	Scott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
EXCO Resources (PA), LLC / Flook Drilling Pad #1	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/5/2010	5/5/2015
EXCO Resources (PA), LLC / Fulmer Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/6/2010	6/6/2015
EXCO Resources (PA), LLC / Guinter Drilling Pad #1	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/17/2010	12/17/2015
EXCO Resources (PA), LLC / Hake Pad 53	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/26/2011	1/26/2016
EXCO Resources (PA), LLC / Herring Pad - 9	Graham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/16/2015
EXCO Resources (PA), LLC / Hess Drilling Pad #1	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010, 08/08/2011	12/20/2015, 12/20/2011
EXCO Resources (PA), LLC / Houseknecht Drilling Pad #1	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/09/2010, 07/05/2011	12/09/2015, 12/09/2015
EXCO Resources (PA), LLC / Kensinger 3H Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/09/2010, 07/05/2011	02/09/2015, 02/09/2015
EXCO Resources (PA), LLC / Kensinger Unit Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014
EXCO Resources (PA), LLC / Kepner Unit Well Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/25/2012	5/25/2017
EXCO Resources (PA), LLC / Kitzmiller Drilling Pad #1	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
EXCO Resources (PA), LLC / Lamborne Pad 195	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
EXCO Resources (PA), LLC / Larrys Creek	Mifflin Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
EXCO Resources (PA), LLC / Litke (14H, 15H, 16H)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EXCO Resources (PA), LLC / Litke (7H & 8H)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 09/04/2010, 03/05/2010	04/06/2014, 04/06/2014
EXCO Resources (PA), LLC / Litke (Pad 2)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/12/2010	5/12/2015
EXCO Resources (PA), LLC / Litke (Pad 3)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/12/2010	5/12/2015
EXCO Resources (PA), LLC / Litke (Pad 5)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/12/2010	5/12/2015
EXCO Resources (PA), LLC / Litke 1H, 2H	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 09/04/2010	04/06/2014, 04/06/2014

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EXCO Resources (PA), LLC / Livergood (Pad 28)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
EXCO Resources (PA), LLC / Lopatofsky	Clifford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	05/14/2009, 10/01/2009	5/14/2014
EXCO Resources (PA), LLC / Maguire Unit Drilling Pad #1	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014
EXCO Resources (PA), LLC / Marquardt Drilling Pad #1	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/03/2010, 08/15/2011	08/03/2015, 08/03/2015
EXCO Resources (PA), LLC / Muncy Creek	Picture Rocks Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
EXCO Resources (PA), LLC / Muncy Creek - McClintock	Penn Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
EXCO Resources (PA), LLC / Murray Unit Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/11/2012	4/11/2017
EXCO Resources (PA), LLC / Myers Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/12/2010	4/12/2015
EXCO Resources (PA), LLC / Niedzwiecki Drilling Pad #1	Sugarloaf Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2010, 07/18/2011	12/16/2015, 12/16/2015
EXCO Resources (PA), LLC / Painters Den Pad 1	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
EXCO Resources (PA), LLC / Patterson Drilling Pad #1	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/10/2015
EXCO Resources (PA), LLC / Pine Creek - Welshans	Porter Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
EXCO Resources (PA), LLC / Poor Shot East Drilling Pad #2	Anthony Township	PA	CU	Crude Petroleum and Natural Gas Extraction	06/22/2010, 06/30/2011	06/22/2015, 06/22/2015
EXCO Resources (PA), LLC / Poor Shot East Unit Drilling Pad #1	Anthony Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/5/2009	10/5/2014
EXCO Resources (PA), LLC / Poor Shot Unit Drilling Pad #1	Anthony Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014
EXCO Resources (PA), LLC / Quava Drilling Pad #1	Davidson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/15/2010, 08/15/2011	09/15/2015, 09/15/2015
EXCO Resources (PA), LLC / Remley Drilling Pad #1	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010, 08/08/2011	12/20/2015, 12/20/2015
EXCO Resources (PA), LLC / Roba	Scott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
EXCO Resources (PA), LLC / Skyline Golf Course Unit	Greenfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/07/2009, 10/30/2009	7/7/2014
EXCO Resources (PA), LLC / Snyder Unit #1	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 02/27/2012	4/6/2014
EXCO Resources (PA), LLC / Spotts Unit Drilling Pad #1	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014

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EXCO Resources (PA), LLC / Spotts Unit Drilling Pad 3H, 4H, 5H, 7H, 8H, 9H	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/6/2012	2/6/2017
EXCO Resources (PA), LLC / Sterling Run Club #4	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EXCO Resources (PA), LLC / Sterling Run Club #5	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
EXCO Resources (PA), LLC / Sterner Drilling Pad #1	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010, 08/12/2011	12/20/2015, 12/20/2015
EXCO Resources (PA), LLC / Stroble Unit Drilling Pad #1	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014
EXCO Resources (PA), LLC / Taylor (Pad 33)	Burnside Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/3/2010	6/3/2015
EXCO Resources (PA), LLC / Treval LLC Unit	Greenfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/24/2009	8/24/2014
EXCO Resources (PA), LLC / Tunkhannock Creek - Dobrinski	Tunkhannock Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2013
EXCO Resources (PA), LLC / Warburton Unit #1H Drilling Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2009	8/18/2014
EXCO Resources (PA), LLC / Warner Drilling Pad #1	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/29/2010	4/29/2015
EXCO Resources (PA), LLC / Warner North Unit Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/6/2012	2/6/2017
EXCO Resources (PA), LLC / West Branch Susquehanna River - Johnson	Clinton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
EXCO Resources (PA), LLC / West Branch Susquehanna River-Curwensville Boro.	Curwensville Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
EXCO Resources (PA), LLC / Wistar-Shaffer Tracts Drilling Pad #1	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/16/2010, 08/15/2011	09/16/2015, 09/16/2015
EXCO Resources (PA), LLC / Zinck Unit #1H	Watson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/09/2009, 09/17/2009	7/9/2014
Exelon Generation Company, L.L.C. / Peach Bottom Atomic Power Station	Peach Bottom Township	PA	SW,CU	Electric Power Generation	12/05/2006, 06/23/2011	07/03/2034, 07/03/2034
Exelon Generation Company, LLC / Three Mile Island Generating Station	Londonderry Township	PA	SW,CU	Electric Power Generation	6/23/2011	11/26/2021
Fairchild Semiconductor	Wright Township	PA	GW,CU	Semiconductor and Other Electronic Component Manufacturing	3/10/2004	3/10/2029
Fairview Golf Course	West Cornwall Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Far-Away Springs, Inc. / Brandonville	East Union Township	PA	GW,CU	Bottled Water Manufacturing	6/13/2007	6/13/2022
Farmers Pride, Inc.	Bethel Township	PA	GW	Poultry Processing	11/10/1988	11/10/2018
Federal Correctional Institution at Loretto	Loretto Borough	PA	GW	Water Supply and Irrigation Systems	10/11/2001	10/11/2026

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First Quality Tissue, LLC	Lock Haven City	PA	SW,CU	Electric Power Generation	3/13/2008	3/13/2023
Flatbush Golf Course	Union Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Forest Springs Water Company / Perry	Wayne Township	PA	CU	Bottled Water Manufacturing	02/08/2001, 03/29/2005	02/08/2026, 02/08/2026
Fox Hill Country Club	Exeter Borough	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Fox Ledge, Inc. / Orson Property	Preston Township	PA	CU	Bottled Water Manufacturing	9/14/2005	9/14/2030
Fox Ledge, Inc. / White Property	Clifford Township	PA	CU	Bottled Water Manufacturing	8/14/2003	8/14/2028
Fox Road Waterworks, LLC / South Branch Tunkhannock Creek	Tunkhannock Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Franklin County General Authority	Letterkenny Township	PA	SW,CU	Water Supply and Irrigation Systems	7/8/1999	1/3/2024
Fredericksburg Sewer & Water Authority / Fredericksburg Sewer & Water Authority	Bethel Township	PA	SW,GW	Water Supply and Irrigation Systems	11/26/1996, 03/15/2006	12/11/2015, 03/15/2031
Freedom Township Water & Sewer Authority	Allegheny Township	PA	SW	Water Supply and Irrigation Systems	9/27/2004	9/27/2029
Froelich & Company, Inc.–(dba) Mayapple Golf Links	South Middleton Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Frosty Valley Country Club	Mahoning Township	PA	CU	Golf Courses and Country Clubs	4/11/2002	4/11/2027
Furman Foods, Inc. / Furman Foods, Inc.	Point Township	PA	GW	Food Manufacturing	09/12/1985, 07/14/1994	09/12/2015, 07/14/2024
Galen Hall Country Club	Bethel Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Galeton Borough Water Authority / Galeton Borough Authority	West Branch Township	PA	SW,GW	Water Supply and Irrigation Systems	09/10/1992, 12/13/2001	12/15/2017, 12/13/2026
Gallitzin Water Authority	Gallitzin Borough	PA	SW,GW	Water Supply and Irrigation Systems	03/08/1990, 04/12/2001	04/11/2040, 04/12/2026
Geary Enterprises / Buttermilk Creek	Falls Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Geisinger System Services / Geisinger Health System	Mahoning Township	PA	GW,CU	General Medical and Surgical Hospitals	01/17/1991, 04/11/2002, 04/10/2003	01/17/2021, 01/17/2021, 01/17/2021
Genegantslet Golf Club	Greene Township	NY	SW,CU	Golf Courses and Country Clubs	6/12/2003	6/12/2028
Geneva Farm Golf Club	Bel Air District	MD	CU	Golf Courses and Country Clubs	01/17/1991, 02/10/2000	01/17/2021, 01/17/2021
Gettysburg Municipal Authority / Hunterstown Wastewater Treatment Plant	Straban Township	PA	DIV	Sewage Treatment Facilities	9/16/2010	9/15/2025
Gilberton Power Corporation	West Mahanoy Township	PA	CU	Electric Power Generation	12/11/1985	12/11/2015
Glen Oak Country Club	South Abington Township	PA	GW,CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Glen Rock Water Authority	Shrewsbury Township	PA	SW	Water Supply and Irrigation Systems	10/1/1996	11/8/2015

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Glen-Gery Corp. / Glen-Gery Corporation	Spring Garden Township	PA	CU	Concrete Block and Brick Manufacturing	6/12/2003	6/12/2028
Glenmaura National Golf Club	Moosic Borough	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Glenn O. Hawbaker, Inc. / Greens Landing Aggregate Plant	Athens Township	PA	SW,CU	Stone Mining and Quarrying	12/15/2011	12/14/2026
Glenn O. Hawbaker, Inc. / Hostetler	Armagh Township	PA	GW,CU	Mining	9/14/2005	9/14/2030
Glenn O. Hawbaker, Inc. / Pleasant Gap Facility	Spring Township	PA	CU,GW	Mining	03/29/2005, 06/13/2007, 12/05/2007	03/29/2030, 03/29/2030, 03/29/2030
Global Tungsten & Powders Corp. / Global Tungsten & Powders Corp.	Towanda Borough	PA	GW,CU	Audio and Video Equipment Manufacturing	05/15/1997, 03/12/2009	05/15/2022, 03/12/2024
Golf Enterprises, Inc., d.b.a. Valley Green Golf Course	Newberry Township	PA	CU,SW	Golf Courses and Country Clubs	10/10/2002, 06/13/2007	10/10/2027, 10/10/2027
Gotham Golf / Springwood, LLC	York Township	PA	SW,CU	Golf Courses and Country Clubs	3/13/2008	3/13/2023
Grand Water Rush, LLC / Grand Farm Pond	Dunnstable Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
Graymont (PA), Inc. / Pleasant Gap Facility	Spring Township	PA	CU,GW	Crushed and Broken Limestone Mining and Quarrying	03/29/2005, 12/05/2007, 03/18/2010	03/29/2030, 03/29/2030, 03/17/2025
Great Plains Operating, LLC / SGL Tract 268-Pad B	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2012	6/22/2017
Great Plains Operating, LLC / Sturgis-B	Gallagher Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/25/2011	5/25/2016
Greene, Village of	Greene Township	NY	GW	Water Supply and Irrigation Systems	3/20/1997	9/18/2021
Group Mountain Springs / Group Mountain Springs	Sugarloaf Township	PA	CU	Bottled Water Manufacturing	3/29/2005	3/29/2030
Guilford Mills, Inc. / Guilford Mills, Inc.– Penn Dye and Finishing Plant	Pine Grove Borough	PA	GW,CU	Paint and Coating Manufacturing	05/12/1994, 06/08/2000	05/12/2024, 05/12/2024
Guilford Water Authority	Greene Township	PA	SW	Water Supply and Irrigation Systems	3/10/2004	7/26/2024
Halifax Area Water Authority	Halifax Township	PA	SW	Water Supply and Irrigation Systems	5/13/1993	5/28/2018
Hamilton Township Municipal Authority / Blossburg Municipal Authority	Hamilton Township	PA	NULL	Water Supply and Irrigation Systems	6/22/2009	2/2/2040
Hamilton, Village of	Hamilton Township	NY	GW	Water Supply and Irrigation Systems	11/20/1987, 05/14/1992, 07/10/1997	11/20/2017, 11/20/2017, 07/10/2022
Hanover Country Club	Abbottstown Borough	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Hanover Foods Corporation / Hanover Foods Corporation	Penn Township	PA	GW,CU	Food Manufacturing	05/21/1998, 11/04/1999, 08/10/2000, 08/14/2003	05/21/2023, 11/04/2024, 11/04/2024, 08/14/2028

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Hanson Aggregates Pennsylvania, Inc. / Oak Hall Quarry	College Township	PA	CU	Stone Mining and Quarrying	9/8/2004	9/8/2029
Hardinge Bros., Inc.	Horseheads Township	NY	GW	Cutlery and Handtool Manufacturing	03/08/1990, 05/14/1992	03/08/2020, 03/08/2020
Harley-Davidson Motor Company Operations, Inc. / York Plant	Springettsbury Township	PA	GW	Motorcycle, Bicycle, and Parts Manufacturing	07/12/1990, 03/18/2010, 09/23/1998, 03/18/2010	07/12/2020, 07/12/2020, 09/23/2023, 09/23/2023
Harrisburg Authority / The-Harrisburg Materials, Energy, Recycling and Recovery Facility	Rush Township	PA	CU	Solid Waste Combustors and Incinerators	02/11/1988, 12/12/2002	02/11/2018, 02/11/2018
Harrisburg Authority / The-PWS	Gratz Borough	PA	SW	Water Supply and Irrigation Systems	5/12/1994	7/5/2019
Hazleton City Authority	Hazle Township	PA	GW	Water Supply and Irrigation Systems	3/8/1979	3/8/2009
Hazleton Creek Properties, LLC / Hazleton Mine Reclamation	Hazleton City	PA	GW,CU	Remediation and Other Waste Management Services	03/10/2011, 09/15/2011, 12/15/2011	03/09/2026, 03/09/2026, 03/09/2026
Hazleton Water Company Inc. / Hazleton Area Water Company, Inc.	Sugarloaf Township	PA	CU	Bottled Water Manufacturing	6/9/2004	6/9/2029
Healthy Properties, Inc. / Sugar Creek	North Towanda Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Hegins-Hubley Authority	Hegins Township	PA	GW	Water Supply and Irrigation Systems	12/03/1998, 02/21/2002, 12/15/2004	12/03/2023, 12/03/2023, 12/15/2029
Heidelberg Township Municipal Authority	Heidelberg Township	PA	GW	Water Supply and Irrigation Systems	6/10/1982	6/10/2012
Heritage Hills Golf Resort / Heritage Hills Golf Resort	York Township	PA	CU	Golf Courses and Country Clubs	08/09/2001, 04/10/2003, 06/14/2006	08/09/2026, 08/09/2026, 08/09/2026
Hershey Creamery Company	Harrisburg City	PA	CU	Food Manufacturing	2/21/2002	2/21/2027
Hershey Entertainment & Resort Co. / Hershey Entertainment & Resorts Company–Hersheypark Sports Entertainment Complex	Derry Township	PA	GW,CU	Amusement and Theme Parks	12/15/2004, 06/14/2006	12/15/2029, 12/15/2029
Hershey Entertainment and Resorts Company / Spring Creek Golf Course	Derry Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2008	6/12/2023
Hershey Trust Company, Trustee for Milton Hershey School (dba Hershey Links)	South Hanover Township	PA	SW,CU	Golf Courses and Country Clubs	04/11/2002, 08/14/2003	04/11/2027, 04/11/2027
Hess Corporation / Galiardo	Starrucca Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Hess Corporation / Gerhard	Scott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015

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Hess Corporation / Kraft	Starrucca Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015
Hess Corporation / Medved	Preston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Hess Corporation / Miller	Scott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/12/2010	7/12/2015
Hess Corporation / Steinberg	Preston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/12/2010	7/12/2015
Hess Corporation / Steinberg 1H	Preston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015
Hickory Heights Golf Club	North Codorus Township	PA	CU	Golf Courses and Country Clubs	12/13/2001	12/13/2026
Hidden Valley Country Club	Wayne Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
High Concrete Structures, Inc.	East Cocalico Township	PA	CU	Cement and Concrete Product Manufacturing	2/21/2002	2/21/2027
Highlands of Donegal, LLC / Highlands of Donegal, LLC	East Donegal Township	PA	SW,CU	Golf Courses and Country Clubs	2/21/2002	2/21/2027
Hitachi Metals Automotive Components USA, LLC	Lawrence Township	PA	GW,CU	Automobile Manufacturing	10/1/1996	10/1/2021
Hollidaysburg, Borough of	Juniata Township	PA	SW	Water Supply and Irrigation Systems	11/23/1993	3/30/2019
Horseheads, Village of	Horseheads Township	NY	GW	Water Supply and Irrigation Systems	3/12/1987	3/12/2017
Houtzdale Municipal Authority / Houtzdale Municipal Authority	Rush Township	PA	GW	Water Supply and Irrigation Systems	01/12/1995, 06/08/2005	01/12/2025, 06/08/2030
Huckleberry Land Water Association	Shippensburg Borough	PA	SW	Water Supply and Irrigation Systems	10/17/2001	8/2/2015
Hughesville Borough Authority	Wolf Township	PA	GW	Water Supply and Irrigation Systems	6/13/2007	6/13/2022
Hughesville-Wolf Township JMA / WWTP	Wolf Township	PA	NULL	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
Hydro Recovery, LP / Blossburg	Blossburg Borough	PA	GW,CU	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Hydro Recovery, LP / Clearfield Municipal Authority	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/31/2011	3/31/2026
Hydro Recovery-Antrim LP / Antrim Treatment Plant	Duncan Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2013
IBM Corp. / IBM Corp.–Endicott	Endicott Village	NY	GW	Computer and Electronic Product Manufacturing	03/12/2009, 03/15/2012	03/12/2024, 03/12/2024
IBM Corp. / IBM Corp.–Owego	Tioga Borough	NY	GW	Computer and Electronic Product Manufacturing	5/9/1991	5/9/2021
Indian Hills Golf and Tennis Club	Shamokin Township	PA	GW,CU	Golf Courses and Country Clubs	05/21/1998, 04/18/2000	05/21/2023, 05/21/2023
Indian Trail Mountain Spring Water	Gratz Borough	PA	CU	Bottled Water Manufacturing	12/14/2000	12/14/2025

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Inflection Energy, LLC / Eck	Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/27/2012	6/27/2017
Inflection Energy, LLC / Eichenlaub A Pad	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
Inflection Energy, LLC / Eichenlaub B Pad	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
Inflection Energy, LLC / G. Adams	Mill Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
Inflection Energy, LLC / Iffland	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
Inflection Energy, LLC / Mussina	Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/2/2012	7/2/2017
Inflection Energy, LLC / Nature Boy	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2011	11/30/2016
Inflection Energy, LLC / Nature Boy East	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/13/2012	3/13/2017
Inflection Energy, LLC / Stunner	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2011	11/30/2016
Inflection Energy, LLC / Ultimate Warrior	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2011	11/30/2016
Irem Temple Golf Club	Dallas Township	PA	CU	Golf Courses and Country Clubs	4/11/2002	4/11/2027
Iron Masters Country Club	Bloomfield Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Jay Township Water Authority / Jay Township Water Authority	Jay Township	PA	SW	Water Supply and Irrigation Systems	3/14/1996	3/22/2021
Jefferson Township Sewer Authority	Jefferson Township	PA	SW,CU	Water Supply and Irrigation Systems	12/14/2000	12/14/2025
Jersey Shore Area Joint Water Authority	Anthony Township	PA	SW	Water Supply and Irrigation Systems	11/13/1986	12/8/2036
Jo Jo Oil Company, Inc. / Tunkhannock Creek	Tunkhannock Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Johnson & Johnson / Johnson & Johnson Healthcare Products Division of McNeil-PPC, Inc.	Lititz Borough	PA	CU	Pharmaceutical and Medicine Manufacturing	8/3/2010	8/3/2025
Juniata College	Huntingdon Borough	PA	CU	Colleges, Universities, and Professional Schools	10/9/2003	10/9/2028
J-W Operating Company / Abandoned Mine Pool - Unnamed Tributary to Finley Run	Shippen Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
J-W Operating Company / Pardee & Curtin Lumber Co. C-04	Lumber Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
J-W Operating Company / Pardee & Curtin Lumber Co. C-05	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
J-W Operating Company / Pardee & Curtin Lumber Co. C-07H	Lumber Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
J-W Operating Company / Pardee & Curtin Lumber Co. C-09H	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
J-W Operating Company / Pardee & Curtin Lumber Co. C-10H	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
J-W Operating Company / Pardee & Curtin Lumber Co. C-12H	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
J-W Operating Company / Pardee-F	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2011	8/9/2016
KBK-HR Associates LLC / Honey Run Golf Club	Dover Township	PA	CU,SW	Golf Courses and Country Clubs	12/04/2008, 12/04/2008, 12/04/2008	12/04/2023, 12/04/2023, 12/04/2023
Kellogg's USA, Inc.	East Hempfield Township	PA	CU	Food Manufacturing	11/14/1991, 07/08/1999	11/14/2021, 11/14/2021
Keystone / Keystone Landfill, Inc.	Dunmore Borough	PA	CU,GW	Solid Waste Landfill	06/12/2008, 03/15/2012	06/12/2023, 06/12/2023
Keystone Clearwater Solutions, LLC / Babb Creek	Morris Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2013
Keystone Clearwater Solutions, LLC / Driftwood Branch Sinnemahoning Creek	Emporium Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Keystone Clearwater Solutions, LLC / Lycoming Creek-2	Lewis Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Keystone Clearwater Solutions, LLC / Moshannon Creek	Snow Shoe Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Keystone Clearwater Solutions, LLC / West Branch Susquehanna River	Goshen Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
King Drive Corporation / King Drive Corp.	Middle Paxton Township	PA	SW,CU	Golf Courses and Country Clubs	06/12/2002, 12/05/2007	06/12/2027, 06/12/2027
Kirkwood, Town of	Binghamton City	NY	GW	Water Supply and Irrigation Systems	3/12/1992	3/12/2022
Kline Township Municipal Authority	Kline Township	PA	GW	Water Supply and Irrigation Systems	6/14/2001	6/14/2026
KMI, LLC / West Branch Susquehanna River	Mahaffey Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
Knight Settlement Sand & Gravel, LLC	Bath Township	NY	CU	Construction Sand and Gravel Mining	03/15/2006, 12/05/2006	03/15/2031, 03/15/2031
Knouse Foods Cooperative / Knouse Foods Cooperative, Inc.–Gardners Plant	Tyrone Township	PA	CU	Food Manufacturing	12/15/2004	12/15/2029
Knouse Foods Cooperative / Knouse Foods Cooperative, Inc.–Peach Glen Plant	Tyrone Township	PA	CU	Food Manufacturing	9/8/2004	9/8/2029
Koppers Inc. / Koppers Inc.	Clinton Township	PA	GW,CU	Rail Transportation	02/11/1988, 01/18/1990, 03/10/2004, 06/14/2006	01/18/2020, 01/18/2020, 01/18/2020, 01/18/2020

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Kovach & Kovach / Chetremon Golf Course, Inc.	Burnside Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Kratzer Run Development / Kratzer Run Development, LLC, T/A Eagles Ridge Golf Club	Ferguson Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2008	6/12/2023
Kratzerville Municipal Authority	Jackson Township	PA	GW	Water Supply and Irrigation Systems	1/12/1989	1/12/2019
Kunzler & Company, Inc.	Lancaster City	PA	CU	Meat Processed from Carcasses	12/11/2003	12/11/2028
Labrador Mountain	Truxton Township	NY	SW,CU	Skiing Facilities	8/14/2003	8/14/2028
Lancaster Country Club	East Lampeter Township	PA	SW,CU	Golf Courses and Country Clubs	6/8/2005	6/8/2030
Lancaster County Solid Waste Management Authority / Frey Farm and Creswell Landfills	Manor Township	PA	GW,CU	Solid Waste Landfill	12/05/2006, 03/14/2007	12/05/2031, 12/05/2031
Lancaster County Solid Waste Management Authority / Solid Waste Resource Recovery Facility	Conoy Township	PA	CU	Electric Power Generation	09/08/1988, 11/09/1989, 09/27/1994, 05/11/1995, 12/11/2003	09/08/2018, 09/08/2018, 09/08/2018, 09/08/2018, 09/08/2018
Lancaster Leaf Tobacco Co. of PA, Inc.	Lancaster City	PA	CU	Tobacco Product Manufacturing	12/12/2002	12/12/2027
LDG Innovation, LLC / Lawrenceville	Lawrenceville Borough	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	03/18/2010, 06/07/2012	03/17/2014, 03/17/2014
Lebanon Valley College	Annville Township	PA	CU	Colleges, Universities, and Professional Schools	4/10/2003	4/10/2028
Lebanon Valley Golf Club, Inc / Lebanon Valley Golf Club, Inc.-(dba) Iron Valley Golf Club	Cornwall Borough	PA	GW,CU	Golf Courses and Country Clubs	12/03/1998, 08/10/2000	12/03/2023, 12/03/2023
Leola Sewer Authority	Upper Leacock Township	PA	GW	Water Supply and Irrigation Systems	06/10/1982, 07/13/1989	06/10/2012, 07/13/2019
Leonard and Jean Marie Azaravich / Meshoppen Creek	Springville Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
Lettermen, Inc.–Rich Valley Golf Course	Silver Spring Township	PA	SW,CU	Golf Courses and Country Clubs	3/11/1999	3/11/2024
Lewistown Borough Municipal Authority	Union Township	PA	SW,GW	Water Supply and Irrigation Systems	03/14/1991, 09/02/1993, 03/12/1992	03/21/2016, 03/21/2016, 03/12/2022
Lewistown Country Club	Menno Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
LHP Management, LLC / Fishing Creek (Clinton Country Club)	Bald Eagle Township	PA	SW	Crude Petroleum and Natural Gas Extraction	09/10/2009, 12/16/2010, 06/23/2011	09/10/2013, 09/10/2013, 09/10/2013
LHP Management, LLC / Muncy Creek	Muncy Creek Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2014

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LHP Management, LLC / West Branch Susquehanna River (MEP Site)	Muncy Creek Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Liberty Forge Golf Course, Inc.	Lower Allen Township	PA	SW,CU	Golf Courses and Country Clubs	09/23/1998, 04/10/2003	09/23/2023, 09/23/2023
Liberty Valley Country Club	Danville Borough	PA	CU	Golf Courses and Country Clubs	04/11/2002, 10/09/2003	04/11/2027, 04/11/2027
Linde Corporation / Lackawanna River	Fell Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
Lititz, Borough of	Warwick Township	PA	GW	Water Supply and Irrigation Systems	12/15/2004	12/15/2029
Log Cabin Springs / Log Cabin Springs	Pine Grove Township	PA	GW,SW,CU	Bottled Water Manufacturing	2/21/2002	2/21/2027
Lost Creek Golf Club-Juniata Recreation Center	Fayette Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Lycoming, County of—Lycoming County Resource Management Services	Brady Township	PA	CU	Solid Waste Landfill	3/14/2007	3/14/2022
Lykens Borough Authority	Jackson Township	PA	SW	Water Supply and Irrigation Systems	9/10/1992	8/13/2017
Lykens Valley Golf Course	Upper Paxton Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2008	6/12/2023
M & P Energy Services, Inc. / Susquehanna River	Briar Creek Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Mahanoy Township Authority	Mahanoy Township	PA	SW	Water Supply and Irrigation Systems	9/16/1993	11/16/2018
Mahoning Township Authority	Mahoning Township	PA	SW	Water Supply and Irrigation Systems	12/03/1998, 03/06/2001	04/13/2022, 04/13/2022
Maitland Investment Corp. / South Hills Golf Club	Penn Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Manada Golf Club	East Hanover Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Manheim Borough Authority	Manheim Borough	PA	GW	Water Supply and Irrigation Systems	09/01/1983, 09/13/2006	09/01/2013, 09/13/2031
Mansfield Borough Municipal Authority	Richmond Township	PA	GW	Water Supply and Irrigation Systems	07/14/1994, 09/13/2006	07/14/2024, 09/13/2031
Maplemoor, Inc. / Huntsville Golf Club	Lehman Township	PA	CU,SW	Golf Courses and Country Clubs	09/10/1992, 03/11/1993, 02/10/2000, 10/05/2000	09/10/2022, 09/10/2022, 09/10/2022, 09/10/2022
Marathon, Village of	Marathon Village	NY	GW	Water Supply and Irrigation Systems	12/14/2005	12/14/2030
Mark Twain Golf Course	Chemung Township	NY	CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Mars, Inc. / Mars Snack Food US, LLC	Elizabethtown Borough	PA	CU	Sugar and Confectionery Product Manufacturing	8/9/2001	8/9/2026
Marshland Links, L.L.C.–The Links at Hiawatha Landing	Tioga Borough	NY	SW,CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Martin Limestone, Inc. / Burkholder Quarry	Earl Township	PA	CU,GW	Stone Mining and Quarrying	03/10/2004, 03/13/2008	03/10/2029, 03/10/2029

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Martin Limestone, Inc. / Kurtz Quarry	East Cocalico Township	PA	CU	Stone Mining and Quarrying	3/10/2004	3/10/2029
Martin Limestone, Inc. / Weaverland Quarry	East Earl Township	PA	CU	Stone Mining and Quarrying	3/10/2004	3/10/2029
Martinsburg Municipal Authority / Martinsburg Municipal Authority	North Woodbury Township	PA	GW,SW	Water Supply and Irrigation Systems	03/12/1987, 03/12/1993	03/12/2017, 05/03/2018
Masonic Village at Elizabethtown	West Donegal Township	PA	GW,CU	Continuing Care Retirement Communities	08/14/2003, 03/29/2005	08/14/2028, 08/14/2028
Matchplay Management Corporation / Skytop Mountain Golf Course	Huston Township	PA	SW,CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Mayor and City Council of Baltimore, Maryland Water Supply System	Halls Cross Roads District	MD	SW,CU,DIV	Water Supply and Irrigation Systems	08/09/2001, 09/15/2011	08/08/2051, 08/08/2051
McClure Municipal Authority	West Beaver Township	PA	SW	Water Supply and Irrigation Systems	1/13/1994	2/9/2019
McGraw, Village of	Cortland City	NY	GW	Water Supply and Irrigation Systems	5/11/1995	5/11/2025
McStern, L.L.C. (dba) Deer Valley Golf Club	South Hanover Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Meadia Heights Golf Club of Lancaster / Meadia Heights Golf Club	West Lampeter Township	PA	SW	Golf Courses and Country Clubs	2/10/2000	2/10/2025
Mechanicsburg Water Company	Monroe Township	PA	SW	Water Supply and Irrigation Systems	1/18/1990	1/29/2040
Merck Sharp & Dohme Corp. / Cherokee Pharmaceuticals, LLC	Riverside Borough	PA	CU,GW,SW	Pharmaceutical and Medicine Manufacturing	03/12/2009, 03/12/2009, 03/12/2009	03/12/2024, 03/12/2024, 03/12/2024
Messiah College	Upper Allen Township	PA	CU	Colleges, Universities, and Professional Schools	2/6/2003	2/6/2028
Michaels Foods Inc. / Papetti's Hygrade Egg Products, Inc., d.b.a. Michael Foods Egg Products Company	Upper Mahantango Township	PA	GW,CU	Food Manufacturing	09/09/1999, 04/18/2000, 09/11/2008	09/09/2024, 09/09/2024, 09/09/2024
Middlesex Township Municipal Authority	Middlesex Township	PA	GW	Water Supply and Irrigation Systems	12/5/2006	12/5/2031
Middletown Borough Authority	Middletown Borough	PA	GW	Water Supply and Irrigation Systems	07/13/1989, 07/10/1997	07/13/2019, 07/10/2022
Mifflin Township Water Authority	Mifflin Township	PA	GW	Water Supply and Irrigation Systems	10/1/1996	10/1/2021
Mifflinburg, Borough of / Mifflinburg, Borough of	Lewis Township	PA	SW,GW	Water Supply and Irrigation Systems	05/13/1993, 11/23/1993, 12/15/2004, 06/08/2005	05/18/2018, 11/23/2023, 12/15/2029, 12/15/2029
Mifflintown Municipal Authority	Milford Township	PA	SW	Water Supply and Irrigation Systems	03/11/1993, 01/30/2007	05/19/2018, 05/19/2018
Miles Township Water Authority East / Spring Source - 1	Miles Township	PA	SW	Water Supply and Irrigation Systems	6/15/2009	6/15/2034
Milesburg Borough Water Authority / Milesburg Borough Water Authority	Bellefonte Borough	PA	SW	Water Supply and Irrigation Systems	9/30/2005	9/27/2038
Mill Race Golf and Camping Resort, Inc.	Benton Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027

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Millersburg Area Authority	Millersburg Borough	PA	GW,SW	Water Supply and Irrigation Systems	03/31/1983, 03/11/1993, 11/12/2002	03/31/2013, 03/11/2023, 11/12/2027
Millersville University of Pennsylvania	Millersville Borough	PA	GW,CU	Colleges, Universities, and Professional Schools	01/14/1982, 10/10/2002	01/14/2012, 01/14/2012
Millheim Borough Water Company	Penn Township	PA	SW	Water Supply and Irrigation Systems	3/10/1994	4/7/2019
Milton Hershey School / Milton Hershey School	Derry Township	PA	GW,CU	Elementary and Secondary Schools	11/26/1996, 07/08/1999, 06/08/2000	11/26/2021, 11/26/2021, 11/26/2021
Milton Regional Sewer Authority / WWTP	Milton Borough	PA	NULL	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
MJ Real Estate Holdings LLC / The Links at Hemlock Creek	Hemlock Township	NY	GW,CU	Golf Courses and Country Clubs	6/9/2004	6/9/2029
Moccasin Run Golf Club	West Fallowfield Township	PA	CU	Golf Courses and Country Clubs	12/14/2000	12/14/2025
Monroe Valley Golf Course	Swatara Township	PA	SW,CU	Golf Courses and Country Clubs	08/15/2002, 09/13/2006	08/15/2027, 08/15/2027
Montgomery Water and Sewer Authority / Montgomery Water & Sewer Authority	Clinton Township	PA	GW	Water Supply and Irrigation Systems	11/10/1988, 07/11/1991, 12/17/2009	11/10/2018, 07/11/2021, 12/16/2024
Morgantown Properties, L.P. by CDG New Morgan Management, Inc.	Caernarvon Township	PA	SW,CU	Water Supply and Irrigation Systems	12/5/2006	12/5/2013
Mount Joy Borough Authority	Mount Joy Borough	PA	GW	Water Supply and Irrigation Systems	06/13/2007, 06/23/2011	06/13/2022, 06/22/2026
Mount Joy Township Authority	Mount Joy Township	PA	GW	Water Supply and Irrigation Systems	9/12/1991	9/12/2021
Mount Union Municipal Authority	Shirley Township	PA	GW	Water Supply and Irrigation Systems	10/10/2002, 03/14/2007	10/10/2027, 03/14/2022
Mountain Country Energy Services, Inc. / Driftwood Branch Sinnemahoning Creek	Lumber Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/4/2008	12/4/2012
Mountain Energy Services, Inc. / Tunkhannock Creek	Tunkhannock Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Mountainview Thoroughbred Racing Association, Inc. / Mountainview Thoroughbred Racing Association, Inc.	East Hanover Township	PA	CU,GW	Racetracks	08/15/2002, 12/05/2007, 03/13/2008	08/15/2027, 08/15/2027, 08/15/2027
Mt. Carmel Cogeneration, Inc.	Mt Carmel Township	PA	CU	Electric Power Generation	06/05/1986, 07/12/1990, 11/08/1990, 09/12/1991, 06/08/2000	06/05/2016, 06/05/2016, 06/05/2016, 06/05/2016, 06/05/2016
Nature's Way Purewater Systems, Inc. / Dupont Bottling Plant	Dupont Borough	PA	GW,CU	Bottled Water Manufacturing	6/23/2011	6/22/2026

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Nature's Way Purewater Systems, Inc. / Nature's Way Springs	Foster Township	PA	GW,DIV	Bottled Water Manufacturing	6/23/2011	6/22/2026
Nelson Township Authority	Nelson Township	PA	SW	Water Supply and Irrigation Systems	1/10/2008	1/28/2023
Nestle Waters North America Inc. / Nestle Waters North America, Inc.	Pine Grove Township	PA	GW,CU	Bottled Water Manufacturing	2/10/2000	2/10/2025
New Berlin, Village of	New Berlin Township	NY	GW	Water Supply and Irrigation Systems	1/15/1998	1/15/2023
New Enterprise Stone & Lime Co., Inc. / Ashcom Quarry	Snake Spring Township	PA	CU,GW,SW	Stone Mining and Quarrying	12/11/2003, 06/13/2007, 03/12/2009	12/11/2028, 12/11/2028, 12/11/2028
New Enterprise Stone & Lime Co., Inc. / Roaring Spring	Taylor Township	PA	CU	Construction Sand and Gravel Mining	7/14/1994	7/14/2024
New Enterprise Stone & Lime Co., Inc. / Tyrone Quarry	Warriors Mark Township	PA	CU,GW,SW	Stone Mining and Quarrying	12/11/2003, 06/13/2007, 09/11/2008	12/11/2028, 12/11/2028, 12/11/2028
New Freedom, Borough of	New Freedom Borough	PA	SW	Water Supply and Irrigation Systems	5/13/1999	9/14/2022
New Holland Borough Authority	New Holland Borough	PA	GW,SW	Water Supply and Irrigation Systems	05/12/1983, 05/10/1990, 03/09/1995, 06/12/2003	05/12/2013, 05/22/2040, 03/09/2025, 06/12/2028
New Morgan Landfill Company Inc. / Conestoga Landfill	New Morgan Borough	PA	CU,GW	Solid Waste Landfill	12/05/2006, 06/11/2010, 09/16/2010, 06/23/2011	12/05/2031, 12/05/2031, 09/15/2025, 06/22/2026
New Oxford Foods, LLC	New Oxford Borough	PA	GW,CU	Meat Processed from Carcasses	12/4/2008	12/4/2023
New Oxford Municipal Authority / New Oxford Municipal Authority	Oxford Township	PA	SW	Water Supply and Irrigation Systems	6/29/1987	7/22/2037
Newark Valley, Village of	Newark Valley Township	NY	GW	Water Supply and Irrigation Systems	12/11/2003	12/11/2028
Newport Borough Water Authority	Newport Borough	PA	GW,SW	Water Supply and Irrigation Systems	05/14/1992, 07/09/1992, 12/14/2005, 10/09/2009	05/14/2022, 07/09/2022, 12/14/2030, 10/09/2034
Newville Borough Water & Sewer Authority / Newville Borough Water and Sewer Authority	Newville Borough	PA	SW	Water Supply and Irrigation Systems	11/08/1990, 03/15/2006, 03/15/2006	11/16/2015, 11/16/2015, 03/15/2031
Niagara Gas & Oil Services Inc. / Susquehanna River	Athens Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Nissin Foods U.S.A. Inc. / Nissin Foods (USA) Co., Inc.	East Hempfield Township	PA	CU	Food Manufacturing	10/10/2002, 12/17/2009	10/10/2027, 10/10/2027
Norse Energy Corporation USA / Aarismaa #1	Preston Township	NY	CU	Crude Petroleum and Natural Gas Extraction	6/21/2010	6/21/2015

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Norse Energy Corporation USA / Anderson, C. #1	Coventry Township	NY	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Norse Energy Corporation USA / Byler, R. #1	Lebanon Township	NY	CU	Crude Petroleum and Natural Gas Extraction	6/9/2010	6/9/2015
Norse Energy Corporation USA / Klecha, M. #1	Coventry Township	NY	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Norse Energy Corporation USA / Knapp,J. #1	Colesville Town	NY	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Norse Energy Corporation USA / Krawiec #2	Smyrna Township	NY	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Norse Energy Corporation USA / Mulligan #1	Lebanon Township	NY	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Norse Energy Corporation USA / Norse East #1	Afton Township	NY	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Norse Energy Corporation USA / Norse West #1	Afton Township	NY	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Norse Energy Corporation USA / Norse#3	Colesville Town	NY	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Norse Energy Corporation USA / Stone#1	Afton Township	NY	CU	Crude Petroleum and Natural Gas Extraction	7/30/2010	7/30/2015
Norse Energy Corporation USA / Thornhill#1	Colesville Town	NY	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Northeast Natural Energy LLC / West Branch Susquehanna River	Cooper Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Northrop Grumman Systems Corp.	Danville Borough	PA	GW	Engine, Turbine, and Power Transmission Equipment Manufacturing	07/11/1991, 09/14/1995	07/11/2021, 09/14/2025
Northwestern Lancaster County Authority / Northwestern Lancaster	Penn Township	PA	GW	Water Supply and Irrigation Systems	6/7/2012	6/6/2027
Norwich Pharmaceuticals Inc.	North Norwich Township	NY	GW,CU	Pharmaceutical and Medicine Manufacturing	9/14/2005	9/14/2030
Novus Operating, LLC / Austinburg 1H	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/8/2010	3/8/2015
Novus Operating, LLC / Brookfield #1	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2009	8/10/2014
Novus Operating, LLC / Chicken Hawk	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Novus Operating, LLC / Cowanesque River	Westfield Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Novus Operating, LLC / Golden Eagle	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015

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Novus Operating, LLC / Merlin	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/22/2010	12/22/2015
Novus Operating, LLC / NorthFork 1H	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/28/2010	1/28/2015
Novus Operating, LLC / Red Tailed Hawk	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Novus Operating, LLC / Sparrow Hawk	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
Novus Operating, LLC / Strange	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/2/2010	4/2/2015
Novus Operating, LLC / Sylvester 1H	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/21/2010	1/21/2015
Novus Operating, LLC / Sylvester 4H Pad	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/1/2010	11/1/2015
Novus Operating, LLC / Tioga River	Covington Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Novus Operating, LLC / Wilcox #1	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/10/2009, 11/04/2009, 11/04/2009	8/10/2014
Oakland Borough Water Co. / Oakland Borough Water Authority	Oakland Township	PA	GW	Water Supply and Irrigation Systems	7/8/1982	7/8/2012
Old Castle Materials, Inc. / Pennsy Supply, Inc. – Hummelstown Quarry	South Hanover Township	PA	SW	Mining	9/11/2008	9/11/2023
Old Castle Materials, Inc. / Pennsy Supply, Inc. - Mt. Holly Springs Quarry	Dickinson Township	PA	CU	Stone Mining and Quarrying	3/10/2004	3/10/2029
Old Castle Materials, Inc. / Pennsy Supply, Inc. (dba) Slusser Brothers–Pittston Quarry	Jenkins Township	PA	CU	Crushed and Broken Limestone Mining and Quarrying	3/29/2005	3/29/2030
Old Castle Materials, Inc. / Pennsy Supply, Inc.–Fiddler's Elbow Quarry	Lower Swatara Township	PA	CU	Crushed and Broken Limestone Mining and Quarrying	6/8/2005	6/8/2030
Old Castle Materials, Inc. / Pennsy Supply, Inc.–Millard Quarry	North Londonderry Township	PA	CU	Stone Mining and Quarrying	9/8/2004	9/8/2029
Old Castle Materials, Inc. / Pennsy Supply, Inc.–Penn Township	Penn Township	PA	CU	Mining (except Oil and Gas)	9/8/2004	9/8/2029
Old Castle Materials, Inc. / Pennsy Supply, Inc.–Small Mountain Quarry	Dorrance Township	PA	CU	Stone Mining and Quarrying	3/10/2004	3/10/2029
Oneonta, City of	Oneonta City	NY	GW	Water Supply and Irrigation Systems	3/12/1992	3/12/2022
ORIX Capital Markets, LLC. / EP FCL, LLC, dba Ron Jaworski's Edgewood in the Pines	Butler Township	PA	CU,SW	Golf Courses and Country Clubs	01/15/1998, 02/21/2002, 09/13/2006	01/15/2023, 01/15/2023, 01/15/2023
Out Door Country Club	Manchester Township	PA	CU	Golf Courses and Country Clubs	4/11/2002	4/11/2027
Oxford, Village of	Oxford Township	NY	GW	Water Supply and Irrigation Systems	6/9/2004	6/9/2029

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P.H. Glatfelter Company / Industrial Wastewater Treatment Plant (IWTP)	Spring Grove Borough	PA	CU	Paper Manufacturing	6/11/2010	6/10/2025
P.H. Glatfelter Company / Paper/Pulp Mill and Cogen Operations	Spring Grove Borough	PA	SW,CU	Paper Manufacturing	06/05/1986, 05/13/1993	06/05/2016, 05/13/2023
PA American Water Company / Berwick Dist.	Berwick Township	PA	GW	Water Supply and Irrigation Systems	6/9/1988	6/9/2018
PA American Water Company / Capitol Div. E.	South Hanover Township	PA	SW	Water Supply and Irrigation Systems	5/11/1989	6/12/2039
PA American Water Company / Frackville Dist.	West Mahanoy Township	PA	GW	Water Supply and Irrigation Systems	11/13/1997, 06/14/2001	11/13/2022, 06/14/2026
PA American Water Company / Hallstead Dist.	Great Bend Township	PA	GW,SW	Water Supply and Irrigation Systems	03/08/1990, 07/08/1993	03/08/2020, 07/27/2018
PA American Water Company / Moshannon District	Rush Township	PA	GW	Water Supply and Irrigation Systems	03/09/1989, 02/08/2001	03/09/2019, 02/08/2026
PA American Water Company / Nittany Water Co., Inc.	Walker Township	PA	GW	Water Supply and Irrigation Systems	11/14/1991	11/14/2021
PA American Water Company / Riverton Dist.	Silver Spring Township	PA	SW	Water Supply and Irrigation Systems	11/30/1989, 06/11/1993	11/30/2039, 11/30/2039
PA Fish and Boat Commission / Benner Spring State Fish Hatchery	Benner Township	PA	GW	Finfish Farming and Fish Hatcheries	7/14/1994	7/14/2024
PADEP - Bureau of Abandoned Mine Reclamation / Hollywood Mine Pool	Huston Township	PA	GW	Mining	6/18/2009	6/18/2024
PADEP - Bureau of Abandoned Mine Reclamation / Lancashire No. 15	Barr Township	PA	GW,SW,DIV	Mining	6/18/2009	6/18/2024
Parks and Recreation / Manheim Township	Manheim Township	PA	CU,GW	Nature Parks and Other Similar Institutions	08/15/2002, 12/05/2006	08/15/2027, 08/15/2027
Parline Golf Course	Londonderry Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Peak Resorts, Inc.–Greek Peak Mountain Resort	Cortland City	NY	SW,CU	Skiing Facilities	8/9/2001	8/9/2026
Penn State Milton S. Hershey Medical Center	Derry Township	PA	CU	General Medical and Surgical Hospitals	2/21/2002	2/21/2027
Pennsylvania College of Technology	Williamsport City	PA	CU	Colleges, Universities, and Professional Schools	6/14/2001	6/14/2026
Pennsylvania General Energy Company, L.L.C. / COP Tract 293 Pad B	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2012	6/18/2017
Pennsylvania General Energy Company, L.L.C. / COP Tract 293 Pad F	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/6/2011	5/6/2016
Pennsylvania General Energy Company, L.L.C. / COP Tract 293 Pad G	McHenry Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/14/2011	9/14/2016
Pennsylvania General Energy Company, L.L.C. / COP Tract 293 Pad H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016

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Pennsylvania General Energy Company, L.L.C. / COP Tract 293 Pad I	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Pennsylvania General Energy Company, L.L.C. / COP Tract 356 Pad J	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2012	1/10/2017
Pennsylvania General Energy Company, L.L.C. / COP TRACT 724 - PAD A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/19/2009	11/19/2014
Pennsylvania General Energy Company, L.L.C. / COP Tract 729 Pad B	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/14/2011	11/14/2016
Pennsylvania General Energy Company, L.L.C. / COP Tract 729 Pad C	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Pennsylvania General Energy Company, L.L.C. / COP Tract 729 Pad D	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Pennsylvania General Energy Company, L.L.C. / COP Tract 729 Pad E	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Pennsylvania General Energy Company, L.L.C. / Loyalsock Creek (Hershberger)	Gamble Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
Pennsylvania General Energy Company, L.L.C. / Pine Creek (Poust)	Watson Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
Pennsylvania General Energy Company, L.L.C. / Pine Hill 1941 A-B	Eulalia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2014
Pennsylvania General Energy Company, L.L.C. / Pine Hill Pad C Wharton	Wharton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/23/2011	2/23/2016
Pennsylvania General Energy Company, L.L.C. / Pine Hill West Pad B	Sylvania Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/17/2009	9/17/2014
Pennsylvania General Energy Company, L.L.C. / Reed Run Norwich Pad D	Norwich Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/16/2015
Pennsylvania General Energy Company, L.L.C. / Scaffold Lick Pond - 1	Liberty Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Pennsylvania General Energy Company, L.L.C. / Scaffold Lick Pond - 2	Liberty Township	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Pennsylvania General Energy Company, L.L.C. / Shannon Todd Pad A	Todd Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Pennsylvania General Energy Company, L.L.C. / Sinnemahoning Creek	Portage Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/11/2008	9/11/2012
Pennsylvania General Energy Company, L.L.C. / State Forest Tract 293 well pad #1	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2009	7/27/2014
Pennsylvania General Energy Company, L.L.C. / Tract 729 well # 2384	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2009	7/27/2014
Pennsylvania General Energy Company, L.L.C. / West Branch Susquehanna River	Pine Creek Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Pennsylvania State University	College Township	PA	GW,CU	Colleges, Universities, and Professional Schools	01/12/1989, 08/09/2001	01/12/2019, 01/12/2019

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Pepsi Beverages Co. / Pepsi Bottling Group–Williamsport	Lycoming Township	PA	CU	Soft Drink Manufacturing	11/19/1992, 08/10/2000	11/19/2022, 11/19/2022
Perryville, Town of	Perryville Township	MD	SW,CU	Water Supply and Irrigation Systems	12/5/2006	12/5/2031
PFBC-Pleasant Gap Fish Culture Station	Benner Township	PA	GW	Finfish Farming and Fish Hatcheries	6/8/2000	6/8/2025
Philipsburg Elks & Country Club	Rush Township	PA	CU	Golf Courses and Country Clubs	06/12/2002, 08/14/2003	06/12/2027, 06/12/2027
Pike Township Municipal Authority	Pike Township	PA	SW	Water Supply and Irrigation Systems	3/8/1990	4/20/2040
Pilgrim's Oak Golf Course	Drumore Township	PA	SW,CU	Golf Courses and Country Clubs	5/21/1998	5/21/2023
Pine Creek Municipal Authority / WWTP	Pine Creek Township	PA	NULL	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Pine Grove Borough Water Authority	Pine Grove Borough	PA	GW	Water Supply and Irrigation Systems	9/10/1992	9/10/2022
Pine Hills Country Club	Taylor Borough	PA	CU	Golf Courses and Country Clubs	6/9/2004	6/9/2029
Pine Meadows Golf Complex	Bethel Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Pioneer Hi-Bred International, Inc / Pioneer Hi-Bred International, Inc.	Earl Township	PA	GW	Agriculture, Forestry, Fishing and Hunting	5/12/1994	5/12/2024
Pollio Div. of Kraft Foods	Greenwood Township	NY	GW	Cheese Manufacturing	02/13/1986, 09/14/1995	02/13/2016, 09/14/2020
Port Royal Municipal Authority	Turbett Township	PA	GW	Water Supply and Irrigation Systems	3/10/1994	3/10/2024
Porter Township Municipal Authority	Porter Township	PA	SW	Water Supply and Irrigation Systems	11/19/1992	12/21/2017
PPG Industries, Inc., Works No. 6	South Middleton Township	PA	CU	Flat Glass Manufacturing	02/21/2002, 08/14/2003	02/21/2027, 02/21/2027
PPL / Brunner Island Steam Electric Station	East Manchester Township	PA	SW,CU	Electric Power Generation	9/12/2007	9/12/2022
PPL / Holtwood, LLC	Martic Township	PA	NULL	Hydroelectric Power Generation	6/18/2009	8/31/2030
PPL / Montour, LLC	Derry Township	PA	CU,SW	Electric Power Generation	09/27/1994, 03/15/2006, 12/05/2006	03/15/2031, 03/15/2031, 03/15/2031
PPL / Susquehanna, LLC	Salem Township	PA	GW,SW,CU	Electric Power Generation	03/09/1995, 09/12/2007	03/09/2025, 03/09/2025
PPL Generation Services, LLC / Royal Manchester Golf Links	East Manchester Township	PA	CU	Golf Courses and Country Clubs	6/14/2006	6/14/2031
Procter & Gamble / Procter & Gamble – Mehoopany	Washington Township	PA	CU	Pharmaceutical and Medicine Manufacturing	07/14/1994, 05/13/1999	07/14/2024, 07/14/2024
Prospect Aggregates, Inc.–Landisville Quarry	West Hempfield Township	PA	CU	Stone Mining and Quarrying	6/12/2003	6/12/2028
QC, LLC / Quebecor World Atglen, Inc.	West Sadsbury Township	PA	CU	Other Commercial Printing	6/12/2003	6/12/2028
Quarryville, Borough of	Quarryville Borough	PA	GW	Water Supply and Irrigation Systems	11/23/1993	11/23/2023

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R.C. Rickard Development Corporation, d.b.a. Conklin Players Club	Binghamton City	NY	CU	Golf Courses and Country Clubs	4/10/2003	4/10/2028
R.R. Donnelley & Sons Co. / East Plant	Lancaster City	PA	CU	Other Commercial Printing	07/11/1991, 05/21/1998	05/21/2023, 05/21/2023
R.R. Donnelley & Sons Co. / West Plant	Lancaster Township	PA	GW,CU	Other Commercial Printing	07/11/1991, 10/11/2001	07/11/2021, 07/11/2021
Randy M. Wiernusz / Bowman Creek	Eaton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Range End Country Club, Inc.	Carroll Township	PA	GW,CU	Golf Courses and Country Clubs	10/11/2001	10/11/2026
Range Resources - Appalachia, LLC / Arrowhead Hunting Club Unit	Gallagher Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/20/2010	5/20/2015
Range Resources - Appalachia, LLC / Bidlespacher Unit #1H - #4H Drilling Pad	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Range Resources - Appalachia, LLC / Bobst Mountain Hunting Club #18H - #23H Drilling Pad	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
Range Resources - Appalachia, LLC / Bobst Mtn Hunting Club 24H-29H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2012	2/17/2017
Range Resources - Appalachia, LLC / Bobst Mtn Hunting Club 30H-33H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2012	2/17/2017
Range Resources - Appalachia, LLC / Bobst Unit #34H-#37H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2011	11/10/2016
Range Resources - Appalachia, LLC / Carmen III Unit #1H Drilling Pad	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/5/2011	4/5/2016
Range Resources - Appalachia, LLC / Cornhill C Unit 1H-5H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2012	1/13/2017
Range Resources - Appalachia, LLC / Cornwall Mountain	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2011	12/28/2016
Range Resources - Appalachia, LLC / Corson, Eugene 1H-6H	Anthony Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2012	1/13/2017
Range Resources - Appalachia, LLC / Dog Run Hunting Club Unit	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2010	4/30/2015
Range Resources - Appalachia, LLC / Fuller, Eugene Unit #1H - #3H Drilling Pad	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/2/2010	12/2/2015
Range Resources - Appalachia, LLC / Genter 3	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2010	1/20/2015
Range Resources - Appalachia, LLC / Goodwill Hunting Club Unit #4H-#9H Drilling Pad	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/19/2010	11/19/2015
Range Resources - Appalachia, LLC / Gray's Run Club Unit #2H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2010	4/30/2015

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Range Resources - Appalachia, LLC / Gulf USA #40H Drilling Pad	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Range Resources - Appalachia, LLC / Gulf USA #63H Drilling Pad	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2011	3/25/2016
Range Resources - Appalachia, LLC / Harman, Lewis Unit #1H	Moreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
Range Resources - Appalachia, LLC / Hess Unit #1H	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2011	12/28/2016
Range Resources - Appalachia, LLC / Laurel Hill 1	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2010	1/20/2015
Range Resources - Appalachia, LLC / Lone Walnut H.C. Unit #3H Drilling Pad	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/13/2010	7/13/2015
Range Resources - Appalachia, LLC / McWilliams 1	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/5/2009	6/5/2014
Range Resources - Appalachia, LLC / Mohawk Lodge Unit	Gallagher Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Range Resources - Appalachia, LLC / Null, Eugene Unit #2H - #7H Drilling Pad	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Range Resources - Appalachia, LLC / Ogontz 3	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/5/2009	6/5/2014
Range Resources - Appalachia, LLC / Ogontz Fishing Club #18H - #23H Drilling Pad	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
Range Resources - Appalachia, LLC / Ogontz Fishing Club #24H - #29H Drilling Pad	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
Range Resources - Appalachia, LLC / Ogontz Fishing Club #30H - #35H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2010	12/21/2015
Range Resources - Appalachia, LLC / Ogontz Fishing Club 41H-44H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/23/2012	1/23/2017
Range Resources - Appalachia, LLC / Ogontz Fishing Club Unit #12H - #17H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/15/2010	6/15/2015
Range Resources - Appalachia, LLC / Paulhamus, Frederick Unit #5H & #6H Drilling Pad	Mifflin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
Range Resources - Appalachia, LLC / Porter, Stephen	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/27/2012	3/27/2017
Range Resources - Appalachia, LLC / Red Bend B Unit #1H-#8H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2011	11/10/2016
Range Resources - Appalachia, LLC / Red Bend C Unit #1H-#5H	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2011	11/10/2016

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Range Resources - Appalachia, LLC / Red Bend Hunting & Fishing Club Unit #3H-#5H Drilling Pad	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Range Resources - Appalachia, LLC / Ritzenthaler Living Trust Unit #1H - #4H Drilling Pad	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Range Resources - Appalachia, LLC / Roaring Run Unit	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/27/2012	3/27/2017
Range Resources - Appalachia, LLC / Rupert, Elton Unit #1H Drilling Pad	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2010	12/23/2015
Range Resources - Appalachia, LLC / Sechrist, Mark -#1H-#3H	Anthony Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2011	11/10/2016
Range Resources - Appalachia, LLC / Shipman, James Unit #1H & #2H Drilling Pad	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Range Resources - Appalachia, LLC / Shipman-Goodwill Unit #1H - #4H Drilling Pad	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2011	4/13/2016
Range Resources - Appalachia, LLC / Shohocken Hunt Club Unit #1H - #6H	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Range Resources - Appalachia, LLC / State Game Lands 075A - West Pad	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2012	7/6/2017
Range Resources - Appalachia, LLC / State Game Lands 75A #3H Drilling Pad	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
Range Resources - Appalachia, LLC / West Branch Susquehanna River - Piatt Twp.	Piatt Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Range Resources - Appalachia, LLC / Winner Unit #2H - #5H Drilling Pad	Gallagher Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/27/2010	12/27/2015
Rausch Creek Land, L.P. / Pit #21	Porter Township	PA	GW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Red Lion Municipal Authority	Chanceford Township	PA	SW	Water Supply and Irrigation Systems	7/10/1986	3/25/2033
Regents Glen Country Club, L.L.C.	Spring Garden Township	PA	GW,CU,SW	Golf Courses and Country Clubs	07/10/1997, 06/14/2001	07/10/2022, 07/10/2022
Renovo, Borough of	Renovo Borough	PA	SW	Water Supply and Irrigation Systems	1/15/1998	1/28/2023
Republic Services, Inc. / Republic Services of Pennsylvania, L.L.C.	Windsor Township	PA	GW	Solid Waste Landfill	09/11/1986, 06/29/1987	09/11/2016, 09/11/2016
RES Coal LLC / Clearfield Creek	Boggs Township	PA	SW	Coal Mining	6/7/2012	6/6/2027
Rice Energy, LP / Ultimate Warrior #1	Upper Fairfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2009	11/30/2014
Rising Sun, Town of	Rising Sun District	MD	GW	Water Supply and Irrigation Systems	03/09/1989, 10/09/2003	03/09/2019, 10/09/2028

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River Hill Power Company, LLC	Karthaus Township	PA	SW,CU	Fossil Fuel Electric Power Generation	12/15/2004	12/15/2029
River Valley Country Club	Westfield Township	PA	CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Roaring Spring Water - Division of Roaring Spring Blank Book / Roaring Spring	Roaring Spring Borough	PA	SW	Bottled Water Manufacturing	3/15/2012	3/14/2027
ROGC Golf Partners, L.P.	North Cornwall Township	PA	CU,GW	Golf Courses and Country Clubs	02/21/2002, 08/15/2002	02/21/2027, 08/15/2027
Roger D. Jarrett / West Branch Susquehanna River	Muncy Creek Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Rohrer's Quarry, Inc.	Warwick Township	PA	CU	Stone Mining and Quarrying	8/14/2003	8/14/2028
Rosebud Mining / Cherry Tree Mine	Burnside Township	PA	CU	Bituminous Coal Underground Mining	12/5/2007	12/5/2022
Safe Harbor Hydroelectric Project	Wrightsville Borough	PA	NULL	Hydroelectric Power Generation	5/21/1998	5/21/2023
Sand Springs Development Corp.-Sand Springs Golf Community	Butler Township	PA	GW,CU	Golf Courses and Country Clubs	04/10/2003, 03/13/2008	04/10/2028, 04/10/2028
Saxton Borough Municipal Authority / Saxton Borough Municipal Authority	Carbon Township	PA	SW	Water Supply and Irrigation Systems	7/2/2001	7/2/2026
Schuylkill County Municipal Authority	Tremont Township	PA	GW,CU,DIV	Water Supply and Irrigation Systems	01/12/1995, 09/09/1999, 06/18/2009, 06/18/2009	01/12/2025, 09/09/2024, 06/18/2024, 06/18/2024
Schuylkill Energy Resources, Inc.	Mahanoy Township	PA	GW,CU	Electric Power Generation	01/08/1987, 06/09/1988, 03/09/1989	01/08/2017, 01/08/2017, 01/08/2017
Selinsgrove, Borough of	Penn Township	PA	GW	Water Supply and Irrigation Systems	9/12/1991	9/12/2021
Seneca Resources Corporation / Arnot No. 5 (Signor)	Bloss Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2013
Seneca Resources Corporation / Covington Pad L	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Seneca Resources Corporation / Covington Pad M	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/25/2011	2/25/2016
Seneca Resources Corporation / D.M. Pino Pad H	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/19/2009, 02/19/2010	09/19/2014, 09/19/2014
Seneca Resources Corporation / DCNR 001 Pad C	Ulysses Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/22/2011	12/22/2016
Seneca Resources Corporation / DCNR 001 Pad E	Ulysses Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2011	12/23/2016
Seneca Resources Corporation / DCNR 001 Pad G	Sweden Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/7/2011	2/7/2016
Seneca Resources Corporation / DCNR 007 PAD C	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2011	3/25/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Seneca Resources Corporation / DCNR 007 Pad D	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/22/2011	12/22/2016
Seneca Resources Corporation / DCNR 007 Pad D 11V	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Seneca Resources Corporation / DCNR 007 Pad G 10V	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Seneca Resources Corporation / DCNR 007 Pad H	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2011	10/20/2016
Seneca Resources Corporation / DCNR 007 Pad H 12V	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Seneca Resources Corporation / DCNR 007 Pad K	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2011	12/13/2016
Seneca Resources Corporation / DCNR 007 Pad K 49V	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2011	11/23/2016
Seneca Resources Corporation / DCNR 007 PAD L	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2011	4/21/2016
Seneca Resources Corporation / DCNR 007 Pad R	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/22/2011	12/22/2016
Seneca Resources Corporation / DCNR 007 Pad T 20V	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/11/2011	7/11/2016
Seneca Resources Corporation / DCNR 100 1V	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Seneca Resources Corporation / DCNR 100 Pad A	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/11/2011	10/11/2016
Seneca Resources Corporation / DCNR 100 PAD B	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Seneca Resources Corporation / DCNR 100 Pad C	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/8/2011	2/8/2016
Seneca Resources Corporation / DCNR 100 Pad D	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/4/2011	2/4/2016
Seneca Resources Corporation / DCNR 100 Pad D 85V	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Seneca Resources Corporation / DCNR 100 PAD E	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2011	5/18/2016
Seneca Resources Corporation / DCNR 100 Pad G	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Seneca Resources Corporation / DCNR 100 Pad L	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/31/2012	1/31/2017
Seneca Resources Corporation / DCNR 100 Pad P	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2012	5/18/2017
Seneca Resources Corporation / DCNR 293 38939	Cummings Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Seneca Resources Corporation / DCNR 595 1V	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Seneca Resources Corporation / DCNR 595 PAD C	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/28/2011	3/28/2016
Seneca Resources Corporation / DCNR 595 Pad D	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/28/2009, 02/09/2010	08/28/2014, 08/28/2014
Seneca Resources Corporation / DCNR 595 Pad E	Blossburg Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Seneca Resources Corporation / DCNR 595 Pad E 70V	Blossburg Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Seneca Resources Corporation / DCNR 595 Pad G	Blossburg Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Seneca Resources Corporation / DCNR 595 Pad I 1V	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/5/2011	7/5/2016
Seneca Resources Corporation / DCNR 595 Pad L	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Seneca Resources Corporation / DCNR 595 Pad N	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/30/2011	9/30/2016
Seneca Resources Corporation / DCNR Tract 001 1H	Sweden Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/23/2010	8/23/2015
Seneca Resources Corporation / DCNR Tract 001 Pad F	Sweden Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Seneca Resources Corporation / DCNR Tract 007 1H	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/10/2010	8/10/2015
Seneca Resources Corporation / DCNR Tract 100 5H	Lewis Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/21/2010	4/21/2015
Seneca Resources Corporation / DCNR Tract 595 Pad F	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2010	8/9/2015
Seneca Resources Corporation / DCNR Tract 595 Pad I	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2010	8/9/2015
Seneca Resources Corporation / DNCR Tract 001 1V	Sweden Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
Seneca Resources Corporation / DNCR Tract 007 1V	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/4/2010	6/4/2015
Seneca Resources Corporation / Gamble Pad A	Gamble Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2011	10/20/2016
Seneca Resources Corporation / Genesee Forks - Nauman	Pike Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Seneca Resources Corporation / Hemenway (TSRC 1)	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Seneca Resources Corporation / J. Pino Pad G	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/08/2009, 02/19/2010	07/08/2014, 07/08/2014

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Seneca Resources Corporation / Lehmann Pad K	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
Seneca Resources Corporation / Marsh Creek - Brooks	Delmar Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Seneca Resources Corporation / Marvin 1V Pad	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2009	9/19/2014
Seneca Resources Corporation / Murray Pad A	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	03/10/2010, 06/14/2010	03/10/2015, 03/10/2015
Seneca Resources Corporation / Rich Valley 1V Pad	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2009	12/28/2014
Seneca Resources Corporation / Rich Valley Pad B	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Seneca Resources Corporation / Rich Valley Pad E	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2011	7/15/2016
Seneca Resources Corporation / T. Wivell Horizontal Pad	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/17/2009, 12/18/2009	08/17/2014, 08/17/2014
Seneca Resources Corporation / Valldes Pad C	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Seneca Resources Corporation / Warren Pad B	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
Seneca Resources Corporation / Wilcox (TEOG 1)	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Seneca Resources Corporation / Wilcox Pad F	Covington Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	05/11/2009, 02/09/2010	05/11/2014, 05/11/2014
Seneca Resources Corporation / Wivell Pad I	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
Seneca Resources Corporation / Wolfinger	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2009	12/28/2014
Seneca Resources Corporation / Wolfinger Pad A	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Seneca Resources Corporation / Wolfinger Pad B	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
Shade Mountain Golf Course	Franklin Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Shadow Ranch Resort, Inc. / Tunkhannock Creek - Shadowbrook Resort	Tunkhannock Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Shadowbrook Golf Course	Tunkhannock Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Sherburne, Village of	Sherburne Village	NY	GW	Water Supply and Irrigation Systems	09/14/2005, 06/14/2006	09/14/2030, 06/14/2031

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Shippensburg Borough Authority	Lurgan Township	PA	GW	Water Supply and Irrigation Systems	07/12/1990, 05/12/1994, 10/12/2005, 03/14/2007	07/12/2020, 05/12/2024, 07/26/2024, 03/14/2022
Shippensburg University	Shippensburg Township	PA	CU	Colleges, Universities, and Professional Schools	04/11/2002, 10/09/2003	04/11/2027, 04/11/2027
Shrewsbury Borough / Shrewsbury, Borough of	Shrewsbury Borough	PA	GW	Water Supply and Irrigation Systems	12/10/1981, 01/14/1982, 05/11/1989, 01/18/1990, 05/14/1992, 03/10/2004	12/10/2011, 01/14/2012, 05/11/2019, 01/18/2020, 05/14/2022, 03/10/2029
Sidney, Village of	Sidney Township	NY	GW	Water Supply and Irrigation Systems	2/13/1986	2/13/2016
Sinking Valley Country Club	Tyrone Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Ski Roundtop Operating Corporation	Warrington Township	PA	SW,CU	Skiing Facilities	12/11/2003	12/11/2028
Smith Transport Warehouse / Bald Eagle Creek	Snyder Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Snake Spring Township Municipal Authority	Snake Spring Township	PA	GW	Water Supply and Irrigation Systems	12/14/2005	12/14/2030
Sno Mountain, LLC	Archbald Borough	PA	SW,CU	Other Amusement and Recreation Industries	04/10/2003, 12/05/2007	04/10/2028, 04/10/2028
Snow Shoe Borough Authority	Snow Shoe Township	PA	SW,GW	Water Supply and Irrigation Systems	09/08/1988, 01/13/1994, 04/18/2000	10/30/2039, 01/13/2024, 04/18/2025
South Middleton Township Municipal Authority	South Middleton Township	PA	GW	Water Supply and Irrigation Systems	4/14/1988	4/14/2018
South Slope Development Corporation-Song Mountain Ski Resort	Cortland City	NY	GW,SW,CU	Skiing Facilities	9/12/2007	9/12/2022
Southern Union Company / PEI Power Corporation	Archbald Borough	PA	SW,CU	Electric Power Generation, Transmission and Distribution	04/12/2001, 09/11/2008	04/12/2026, 04/12/2026
Southwestern Energy Production Company / Alexander Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/15/2011	8/15/2016
Southwestern Energy Production Company / ASNIP-ABODE	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/8/2012	2/8/2017
Southwestern Energy Production Company / Ball	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Southwestern Energy Production Company / Bark'em Squirrel Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Southwestern Energy Production Company / Behrend Pad	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/18/2010	10/18/2015
Southwestern Energy Production Company / Belcher Pad	Clifford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/5/2010	11/5/2015

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Southwestern Energy Production Company / Bernstein Pad	Clifford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Southwestern Energy Production Company / BIENKO	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
Southwestern Energy Production Company / Blockhouse Creek	Jackson Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Southwestern Energy Production Company / Chamberlin	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
Southwestern Energy Production Company / Charles Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2012	4/27/2017
Southwestern Energy Production Company / CHILSON-JENNINGS	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2012	1/9/2017
Southwestern Energy Production Company / Clark Pad	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Southwestern Energy Production Company / Claytor Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/27/2012	4/27/2017
Southwestern Energy Production Company / Conigliaro Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Conklin South Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Cramer Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/4/2011	8/4/2016
Southwestern Energy Production Company / Daniels Pad	Gibson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/12/2010	10/12/2015
Southwestern Energy Production Company / Demento Pad	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2011	2/28/2016
Southwestern Energy Production Company / East Branch Tunkhannock Creek - Puza	Lenox Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Southwestern Energy Production Company / EASTMAN	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
Southwestern Energy Production Company / Estabrooks Pad	Harford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Ferguson	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	02/01/2010, 02/09/2010	2/1/2015
Southwestern Energy Production Company / Fields	Herrick Township	PA	GW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Southwestern Energy Production Company / FIELDS PAD 1	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2012	2/28/2017
Southwestern Energy Production Company / FLICKS RUN	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2012	1/9/2017
Southwestern Energy Production Company / FRIES PAD	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2011	12/21/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Southwestern Energy Production Company / Gaylord Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Gerfin Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
Southwestern Energy Production Company / Glover Pad	Thompson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / GOOD	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/27/2012	1/27/2017
Southwestern Energy Production Company / Greenzweig 1	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 07/07/2010	04/06/2014, 04/06/2014
Southwestern Energy Production Company / GREMMEL	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
Southwestern Energy Production Company / Grizzanti Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/15/2011	8/15/2016
Southwestern Energy Production Company / HEBDA-VANDERMARK	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/27/2012	1/27/2017
Southwestern Energy Production Company / HOWLAND-LENT	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2011	12/21/2016
Southwestern Energy Production Company / Humbert III Pad (RU-9)	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Southwestern Energy Production Company / Humbert Pad (RU-8)	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2012	6/18/2017
Southwestern Energy Production Company / INNES	New Milford Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	11/28/2011	11/28/2016
Southwestern Energy Production Company / KILMER	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2011	12/16/2016
Southwestern Energy Production Company / KOZIOL PAD	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017
Southwestern Energy Production Company / LOCH	Cogan House Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2011	12/21/2016
Southwestern Energy Production Company / Longacre Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/28/2011	1/28/2016
Southwestern Energy Production Company / Lycoming Creek	Lewis Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009, 12/17/2009	12/16/2013, 12/16/2013
Southwestern Energy Production Company / Lyncott Corp Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Southwestern Energy Production Company / Marcucci_Jones Pad	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Southwestern Energy Production Company / Martins Creek	Brooklyn Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Southwestern Energy Production Company / Mastri Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Southwestern Energy Production Company / O'Brien Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2012	5/24/2017
Southwestern Energy Production Company / Page Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / PEASE	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2012	2/28/2017
Southwestern Energy Production Company / Preston-Perkins	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Price No. 1 Vertical and Horizontal	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Southwestern Energy Production Company / Price Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2011	4/13/2016
Southwestern Energy Production Company / Range No. (1 and 1H)	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2009	4/6/2014
Southwestern Energy Production Company / RANSOM (HH PAD)	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2011	12/14/2016
Southwestern Energy Production Company / Ransom Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016
Southwestern Energy Production Company / Reeve	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/1/2010	4/1/2015
Southwestern Energy Production Company / Robinson	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
Southwestern Energy Production Company / Roman Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/15/2011	8/15/2016
Southwestern Energy Production Company / Ross Pad	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Southwestern Energy Production Company / Scarlet Oaks Pad (RU-38)	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/30/2012	5/30/2017
Southwestern Energy Production Company / Scott Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Southwestern Energy Production Company / Seamans Pad	Harford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Sheldon Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/23/2011	2/23/2016
Southwestern Energy Production Company / Shively Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Southwestern Energy Production Company / SKELLY	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Southwestern Energy Production Company / Strong Pad	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Southwestern Energy Production Company / Susquehanna River - Hinkle	Oakland Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Southwestern Energy Production Company / TNT 1 LIMITED PARTNERSHIP	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
Southwestern Energy Production Company / TONYA WEST	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/27/2012	1/27/2017
Southwestern Energy Production Company / Tunkhannock Creek - Lenox	Lenox Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/15/2012	3/14/2016
Southwestern Energy Production Company / Tuscarora Creek	Tuscarora Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Southwestern Energy Production Company / Valentine.A Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016
Southwestern Energy Production Company / Valentine.F Pad	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/15/2011	4/15/2016
Southwestern Energy Production Company / Van Order Pad	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Southwestern Energy Production Company / Walker Pad	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / Warner Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2012	4/30/2017
Southwestern Energy Production Company / WATTS	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2012	2/28/2017
Southwestern Energy Production Company / Wells Pad	Benton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/5/2010	11/5/2015
Southwestern Energy Production Company / WHENGREEN	Lenox Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/28/2011	11/28/2016
Southwestern Energy Production Company / Wyalusing Creek	Wyalusing Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/10/2009	9/10/2013
Southwestern Energy Production Company / Zeffer Pad	New Milford Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2011	8/19/2016
Spectrum Control, Inc. / Spectrum Control Technology, Inc.	Ferguson Township	PA	GW	Automobile Manufacturing	5/11/1995	5/11/2025
Spring Mill Group, LLC	Bellefonte Borough	PA	SW	Water Supply and Irrigation Systems	7/25/2008	2/4/2038
Spring Township Municipal Authority	Spring Township	PA	SW,GW	Water Supply and Irrigation Systems	09/16/1993, 02/06/2003	10/13/2018, 02/06/2028
Standing Stone Golf Club	Oneida Township	PA	CU	Golf Courses and Country Clubs	06/12/2002, 08/14/2003	06/12/2027, 06/12/2027
State College Borough Water Authority	Ferguson Township	PA	GW,SW	Water Supply and Irrigation Systems	05/13/1982, 05/11/1989, 01/23/1992, 01/23/1992, 01/23/1992, 05/13/1993, 09/27/1994	05/13/2012, 05/11/2019, 01/23/2022, 01/23/2022, 01/31/2017, 05/13/2023, 09/27/2024

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
State College Elks Country Club	Harris Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Steelton Borough Authority / United Water	Steelton Borough	PA	NULL	Water Supply and Irrigation Systems	6/28/2011	1/25/2016
Stewartstown Borough Authority	Stewartstown Borough	PA	GW,SW	Water Supply and Irrigation Systems	07/13/1989, 09/16/1993, 03/09/1995, 03/21/2001	07/13/2019, 09/16/2023, 03/09/2025, 03/21/2026
Stone Energy Corporation / Loomis Well No. 1	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/29/2009	9/29/2014
Stone Energy Corporation / Loomis Well No. 2H	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/4/2010	5/4/2015
Stone Energy Corporation / Stang Well No. 1	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/25/2009	9/25/2014
Stone Energy Corporation / Wyalusing Creek	Rush Township	PA	SW	Crude Petroleum and Natural Gas Extraction	06/18/2009, 06/11/2010	06/18/2013, 06/10/2014
Stone Hedge Country Club	Tunkhannock Township	PA	CU	Golf Courses and Country Clubs	10/11/2001	10/11/2026
Stoney Mountain Springs	Tremont Township	PA	CU	Bottled Water Manufacturing	3/29/2005	3/29/2030
Strasburg Borough Authority	Strasburg Borough	PA	GW	Water Supply and Irrigation Systems	1/12/1989	1/12/2019
Suburban Lock Haven Water Authority	Logan Township	PA	SW	Water Supply and Irrigation Systems	11/19/1992, 04/19/2011	02/13/2013, 02/13/2013
Sugar Hollow Trout Park and Hatchery / Sugar Hollow Trout Park and Hatchery	Eaton Township	PA	GW	Crude Petroleum and Natural Gas Extraction	09/16/2010, 12/15/2011	09/15/2014, 09/15/2014
Sugar Hollow Water Services, LLC / Susquehanna River (Chellis)	Eaton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
Sunbury Generation LP	Monroe Township	PA	SW,CU	Fossil Fuel Electric Power Generation	12/04/2008, 12/17/2009	12/04/2023, 12/16/2013
Sunbury Municipal Authority	Sunbury City	PA	SW	Water Supply and Irrigation Systems	4/2/2007	4/2/2032
Sunset Golf Course	Londonderry Township	PA	CU	Golf Courses and Country Clubs	5/13/1999	5/13/2024
Susquehanna Gas Field Services, L.L.C. / Meshoppen Creek	Meshoppen Borough	PA	SW	Crude Petroleum and Natural Gas Extraction	06/18/2009, 09/15/2011	06/18/2013, 06/18/2013
Susquehanna Gas Field Services, L.L.C. / Meshoppen Pizza	Meshoppen Borough	PA	GW	Crude Petroleum and Natural Gas Extraction	06/11/2010, 09/15/2011	06/10/2014, 06/10/2014
Susquehanna Valley Country Club	Monroe Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
SVC Manufacturing, Inc. / Gatorade - Mountaintop	Wright Township	PA	CU	Food Manufacturing	12/20/2010	12/20/2025
SWEPI LP / 212 1H	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/23/2009	7/23/2014
SWEPI LP / 235A 1H	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/23/2009, 10/30/2009	7/23/2014
SWEPI LP / Ackley 806	Clymer Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/11/2010	2/11/2015

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SWEPI LP / Allen 264	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/07/2009, 10/26/2009, 10/26/2009, 10/26/2009, 10/26/2009	10/7/2014
SWEPI LP / Allen 620	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
SWEPI LP / Anthony 564	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2010	6/29/2015
SWEPI LP / Appold 493	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2010	8/18/2015
SWEPI LP / Baker 1105	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/14/2011	1/14/2016
SWEPI LP / Baker 128	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Baker 897	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
SWEPI LP / Baldwin 881	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
SWEPI LP / Barbine 292	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/4/2010	6/4/2015
SWEPI LP / Barner 709	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/30/2012	1/30/2017
SWEPI LP / Barrett 410	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Bartlett 531	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
SWEPI LP / Bauer 849	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
SWEPI LP / Becker 404	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 10/01/2009, 10/01/2009, 10/01/2009	9/2/2014
SWEPI LP / Benson 130D	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2009	10/13/2014
SWEPI LP / Berguson 622	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
SWEPI LP / Biegalski 592	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2011	5/24/2016
SWEPI LP / Bielski 628	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2011	1/13/2016

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SWEPI LP / Boroch 477	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Bowers 408	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/09/2009, 10/01/2009, 10/01/2009, 10/01/2009	9/9/2014
SWEPI LP / Bowers 838	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Breon 492	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
SWEPI LP / Brewer 258	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2010	12/9/2015
SWEPI LP / Broadbent 466	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
SWEPI LP / Brown 425	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Brucklacher 734	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2011	6/21/2016
SWEPI LP / Bryan 406	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/8/2009	10/8/2014
SWEPI LP / Buckwalter 429	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2010	12/23/2015
SWEPI LP / Burke 285	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2010	9/23/2015
SWEPI LP / Burleigh 508	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/14/2009, 10/30/2009, 10/30/2009, 10/30/2009	10/14/2014
SWEPI LP / Burt 518	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
SWEPI LP / Busia 457	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2009, 10/30/2009	10/19/2014
SWEPI LP / Butler 127	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Butler 853	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/23/2011	3/23/2016
SWEPI LP / Button 402	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Byrne 510	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/13/2010	9/13/2015
SWEPI LP / Camp Never Too Late 521	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015

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SWEPI LP / Cascarino 443	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
SWEPI LP / Castle 113D	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Chapman 237	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/8/2009	12/8/2014
SWEPI LP / Chappell 855	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2011	10/13/2016
SWEPI LP / Charles Stock 144	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Chemung River - Big Flats	Big Flats Township	NY	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
SWEPI LP / Clark 392	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
SWEPI LP / Clark 486	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/16/2010	4/16/2015
SWEPI LP / Clegg 722	McNett Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Cleveland 616	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
SWEPI LP / Cochran 705	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/7/2010	7/7/2015
SWEPI LP / Cole 236	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/21/2009, 10/26/2009, 10/26/2009, 10/26/2009	9/21/2014
SWEPI LP / Cole 495	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Coolidge 464	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
SWEPI LP / Cooper 400	Tioga Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2009, 10/30/2009	10/13/2014
SWEPI LP / Costanzo 818	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2010	6/29/2015
SWEPI LP / Courtney 129 1H-2H	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/23/2009	7/23/2014
SWEPI LP / Courtney H 255-1H	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/23/2009	7/23/2014
SWEPI LP / Cowanesque River - Westfield	Westfield Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/15/2014
SWEPI LP / Cowanesque River (Egleston)	Nelson Township	PA	SW	Crude Petroleum and Natural Gas Extraction	06/11/2010, 03/15/2012	06/10/2014, 06/10/2014

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SWEPI LP / Cowanesque River (Losey)	Lawrence Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
SWEPI LP / Crittenden 593	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
SWEPI LP / Cruttenden 846	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
SWEPI LP / Cummings 823	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/29/2010	3/29/2015
SWEPI LP / Dandois 482	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/12/2010	5/12/2015
SWEPI LP / Davis 829	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
SWEPI LP / Dewey Hollow Rod & Gun Club 601	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
SWEPI LP / Dietz 490	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/15/2010	10/15/2015
SWEPI LP / Doan 893	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/21/2010	6/21/2015
SWEPI LP / Drake 274	Lawrence Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/9/2011	6/9/2016
SWEPI LP / East Point Fish & Game Club 726	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/8/2010	10/8/2015
SWEPI LP / Empson 235-1H	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 09/25/2009, 09/25/2009, 10/26/2009	9/8/2014
SWEPI LP / Empson 899	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2010	9/23/2015
SWEPI LP / Erickson 423	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
SWEPI LP / Erickson 448	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Fenton 473	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Fish 301	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
SWEPI LP / Fish 826	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
SWEPI LP / Fitch 115-1H	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/06/2009, 10/26/2009, 10/26/2009	10/6/2014

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SWEPI LP / Foti 721	McNett Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Frost 573	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2010	7/8/2015
SWEPI LP / Fuleihan 417	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
SWEPI LP / Gee 832	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/26/2010	4/26/2015
SWEPI LP / Gee 848V	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
SWEPI LP / Gilman 812	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
SWEPI LP / Greenwood Hunting Lodge 427	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2010	5/18/2015
SWEPI LP / Groff 720	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
SWEPI LP / Guillaume 714	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2012	6/22/2017
SWEPI LP / Guillaume 715	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/1/2010	11/1/2015
SWEPI LP / Guindon 706	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
SWEPI LP / Hackman 143	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Halteman 611	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/6/2010	4/6/2015
SWEPI LP / Hamblin 860	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Harer 713	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2012	6/18/2017
SWEPI LP / Harman 565	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/15/2010	10/15/2015
SWEPI LP / Harsell 883	Nelson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/20/2010	7/20/2015
SWEPI LP / Hauswirth 516	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
SWEPI LP / Hazelton 424	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/8/2010	6/8/2015
SWEPI LP / Heath 418	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/7/2010	10/7/2015
SWEPI LP / Hedrick 702	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015

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SWEPI LP / Hege 426	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/7/2010	6/7/2015
SWEPI LP / Hepler 235	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/23/2012	4/23/2017
SWEPI LP / Heuer 701	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/7/2010	10/7/2015
SWEPI LP / Heyler 748	Morris Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
SWEPI LP / Hitesman 580	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/27/2010	12/27/2015
SWEPI LP / Hoffman 1201	Brookfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2011	12/23/2016
SWEPI LP / Hotchkiss 472	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Houck 433	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/9/2009	12/9/2014
SWEPI LP / Howe 257	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/07/2009, 10/26/2009, 10/26/2009, 10/26/2009, 10/26/2009	10/7/2014
SWEPI LP / Hudson 575	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/15/2010	10/15/2015
SWEPI LP / Hungerford 458	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2009, 10/30/2009	10/19/2014
SWEPI LP / I G Coveney Revocable LVG Trust 282	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
SWEPI LP / Ingalls 710	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
SWEPI LP / Jenkins 523	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2009	12/14/2014
SWEPI LP / Johnson 434	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/3/2010	5/3/2015
SWEPI LP / Johnson 435	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Jones 276	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/25/2012	1/25/2017
SWEPI LP / Kalke 819	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Kennedy 137	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015

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SWEPI LP / Kindon 374	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/4/2010	10/4/2015
SWEPI LP / Kinnan 845	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015
SWEPI LP / Kipferl 261-1H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/23/2009, 10/30/2009	7/23/2014
SWEPI LP / Klettlinger 294	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Knight 271-1H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 10/01/2009, 10/01/2009, 10/01/2009	9/8/2014
SWEPI LP / Knowlton 303	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2011	1/13/2016
SWEPI LP / Kreitzer 505	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/29/2012	2/28/2017
SWEPI LP / Kuhl 529	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Lange 447	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/15/2010	4/15/2015
SWEPI LP / Lingle 1102	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Lopatofsky 287	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2010	9/22/2015
SWEPI LP / Lovell 707	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2012	6/18/2017
SWEPI LP / M L Mitchell Trust 554	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2011	3/17/2016
SWEPI LP / Maneval 296	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
SWEPI LP / Marshall Brothers Inc 731	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2010	12/29/2015
SWEPI LP / Martin 421	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2010	9/22/2015
SWEPI LP / Matz 824	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/7/2010	7/7/2015
SWEPI LP / McClure 527	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2010	1/10/2015
SWEPI LP / McConnell 471	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2010	12/28/2015
SWEPI LP / McNett 708	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015

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SWEPI LP / Miller 116D	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Miller 394	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
SWEPI LP / Mitchell 456	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/4/2010	6/4/2015
SWEPI LP / Murdock 862	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2010	7/8/2015
SWEPI LP / MY TB INV LLC 891	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/10/2011	2/10/2016
SWEPI LP / Neal 134D	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/23/2009	7/23/2014
SWEPI LP / Neal 375	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2010	12/28/2015
SWEPI LP / Neal 815	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/22/2010	11/22/2015
SWEPI LP / Nestor 551	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2010	11/15/2015
SWEPI LP / Newlin 476	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/3/2010	5/3/2015
SWEPI LP / Old Possessions Hunting Club 485	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
SWEPI LP / Oldroyd 509	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2009	12/14/2014
SWEPI LP / Ostrander 412	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/07/2009, 10/26/2009, 10/26/2009, 10/26/2009, 10/26/2009	10/7/2014
SWEPI LP / Owlett 843	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/13/2010	9/13/2015
SWEPI LP / Owlett 843R	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/23/2012	4/23/2017
SWEPI LP / Palmer 112	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/06/2009, 10/26/2009, 10/26/2009, 10/26/2009	10/6/2014
SWEPI LP / Palmer 809	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/28/2010	6/28/2015
SWEPI LP / Pannebaker 515	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2009	12/14/2014

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
SWEPI LP / Parent 749	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2010	12/28/2015
SWEPI LP / Parker 727	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/21/2012	3/21/2017
SWEPI LP / Parsons 613	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
SWEPI LP / Parthemer 284	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/3/2010	3/3/2015
SWEPI LP / Patterson 570	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/24/2010	9/24/2015
SWEPI LP / Pazzaglia 507	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/06/2009, 10/26/2009, 10/26/2009, 10/26/2009	10/6/2014
SWEPI LP / Pennsylvania American - Warren District	Warren City	PA	SW,DIV	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
SWEPI LP / Phillips 504	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2009, 10/30/2009, 10/30/2009, 10/30/2009	10/19/2014
SWEPI LP / Propheta 288	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/30/2010	11/30/2015
SWEPI LP / Red Run Mountain 736	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/3/2010	5/3/2015
SWEPI LP / Red Run Mountain Inc 739	McIntyre Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/5/2010	10/5/2015
SWEPI LP / Redl 600	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/7/2010	10/7/2015
SWEPI LP / Reese 289	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
SWEPI LP / Salese 802	Clymer Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/23/2010	2/23/2015
SWEPI LP / Salevsky 335	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2011	3/25/2016
SWEPI LP / Sampson 147 1H-3H	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/27/2009, 10/30/2009	8/27/2014
SWEPI LP / Sanchis 1129	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2011	5/24/2016
SWEPI LP / Sawyer 376	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
SWEPI LP / Schanbacher 711	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/21/2012	3/21/2017

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SWEPI LP / Scheible 898	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2011	12/23/2016
SWEPI LP / Schildt 259	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/27/2009	10/27/2014
SWEPI LP / Schimmel 828	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
SWEPI LP / Schimmel 830	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2010	9/22/2015
SWEPI LP / Schmelzle 703	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2010	9/15/2015
SWEPI LP / Seeley 524	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Sevem 474	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/29/2010	11/29/2015
SWEPI LP / Seymour 599	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2010	9/15/2015
SWEPI LP / Sharretts 805	Clymer Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/25/2010	2/25/2015
SWEPI LP / Shaw Trust 500	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/29/2010	11/29/2015
SWEPI LP / Shedd 514	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/11/2012	4/11/2017
SWEPI LP / Shelman 291	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/17/2010	6/17/2015
SWEPI LP / Sherman 234-1H	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/21/2009, 10/26/2009, 10/26/2009, 10/26/2009	9/21/2014
SWEPI LP / Sherman 498	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2010	9/27/2015
SWEPI LP / Sherman 563	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/27/2010	12/27/2015
SWEPI LP / Showalter 822	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/24/2011	5/24/2016
SWEPI LP / Signor 566	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
SWEPI LP / Signor 578	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2010	10/13/2015
SWEPI LP / Signor 583	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
SWEPI LP / Signor Pad A	Charleston Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	5/11/2009	5/11/2014

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SWEPI LP / Smith 140	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2010	7/22/2015
SWEPI LP / Smith 253 1H	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	08/27/2009, 09/25/2009, 09/25/2009	8/27/2014
SWEPI LP / Smith 260	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/6/2012	2/6/2017
SWEPI LP / Smith 589	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2010	9/22/2015
SWEPI LP / Smith 606	Duncan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Smithgall 293	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2010	10/20/2015
SWEPI LP / Soderburg 501	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/06/2009, 10/26/2009, 10/26/2009, 12/07/2009	10/6/2014
SWEPI LP / Sorensen 876	Osceola Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
SWEPI LP / Spencer 729	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2010	9/15/2015
SWEPI LP / Stanley 1106	Osceola Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/16/2011	2/16/2016
SWEPI LP / Staples 804	Clymer Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
SWEPI LP / Starks 460	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/14/2009	12/14/2014
SWEPI LP / Starks 461	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Stefanowich 269-1H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 09/16/2009, 09/16/2009, 09/16/2009	9/8/2014
SWEPI LP / Stehmer 420	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2009	11/15/2014
SWEPI LP / Sterling 525	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/9/2010	1/9/2015
SWEPI LP / Stevens 142	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Stevens 413	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015

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SWEPI LP / Sticklin 610	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Stratton 885	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2011	1/13/2016
SWEPI LP / Susquehanna River - Welles	Sheshequin Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009	12/16/2013
SWEPI LP / Swan 1122	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2011	4/28/2016
SWEPI LP / Swingle 591	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2010	12/13/2015
SWEPI LP / Swingle 725	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
SWEPI LP / Synnestvedt 878	Osceola Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/7/2010	7/7/2015
SWEPI LP / Taft 851	Middlebury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
SWEPI LP / Talley 488	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
SWEPI LP / Taylor 718	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2010	7/8/2015
SWEPI LP / Thomas 503	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/16/2010	7/16/2015
SWEPI LP / Tioga River - Greer	Richmond Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
SWEPI LP / Tioga River- Tioga Junction	Lawrence Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
SWEPI LP / Tolbert 263	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/25/2012	1/25/2017
SWEPI LP / Topf 416	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/23/2010	4/23/2015
SWEPI LP / Torpy & Van Order Inc 574	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
SWEPI LP / Vandergrift 290	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/23/2010	4/23/2015
SWEPI LP / Vanvliet 614	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/21/2010	12/21/2015
SWEPI LP / Violet Bieser Revoc Liv Tr 833	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/14/2011	1/14/2016
SWEPI LP / Walker 438	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/12/2010	5/12/2015
SWEPI LP / Waskiewicz 445	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/17/2010	3/17/2015

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SWEPI LP / Watkins 820	Chatham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2011	6/14/2016
SWEPI LP / Webster 549	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2010	3/22/2015
SWEPI LP / Weiner 882	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/25/2011	3/25/2016
SWEPI LP / Wesneski 724	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2010	7/8/2015
SWEPI LP / West 299	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Westbrook 487	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
SWEPI LP / Westerbaan 723	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/14/2010	7/14/2015
SWEPI LP / Wheeler 268-1H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/31/2009	8/31/2014
SWEPI LP / White 262-1H	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/08/2009, 10/01/2009, 10/01/2009, 10/01/2009	9/8/2014
SWEPI LP / Willard 419-1H	Delmar Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Williams 889	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/10/2010	9/10/2015
SWEPI LP / Wilson 283	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2010	12/23/2015
SWEPI LP / Wilson 286	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/27/2012	3/27/2017
SWEPI LP / Wolfe 1114	Nelson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
SWEPI LP / Wood 496	Richmond Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
SWEPI LP / Wood 499	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/28/2010	7/28/2015
SWEPI LP / Wood 512	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/9/2010	4/9/2015
SWEPI LP / Wood 513	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Wood 513R	Rutland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2010	7/8/2015
SWEPI LP / Wood 626	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2011	6/10/2016

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
SWEPI LP / Wood 874	Deerfield Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2010	7/21/2015
SWEPI LP / Worden 571	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2010	9/22/2015
SWEPI LP / Yaggie 704	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2010	6/29/2015
SWEPI LP / York 480-5H	Sullivan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
SWEPI LP / Young 431	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2010	5/31/2015
SWEPI LP / Yourgalite 1119	Farmington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2010	12/28/2015
SWEPI LP / Youst 405	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/30/2011	6/30/2016
SWEPI LP / Yungwirth 307	Charleston Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
SWEPI LP / Zeafla 747	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
SWEPI LP / Zimmer 586	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Talisman Energy USA Inc. / 01 080 Ferguson	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Talisman Energy USA Inc. / 01 084 O'Reilly	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/25/2010	8/25/2015
Talisman Energy USA Inc. / 01 086 Brelsford	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2010	8/18/2015
Talisman Energy USA Inc. / 01 088 McClellan	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/13/2011	12/13/2016
Talisman Energy USA Inc. / 01 091 Hoherchak J	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/12/2011	12/12/2016
Talisman Energy USA Inc. / 01 095 Terrel L	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/12/2011	12/12/2016
Talisman Energy USA Inc. / 01 097 Terrel L	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/12/2011	12/12/2016
Talisman Energy USA Inc. / 02 010 DCNR 587	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
Talisman Energy USA Inc. / 02 011 DCNR 587	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/30/2011	6/30/2016
Talisman Energy USA Inc. / 02 012 DCNR 587	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Talisman Energy USA Inc. / 02 015 DCNR 587	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/8/2010	12/8/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Talisman Energy USA Inc. / 02 100 Detweiler R	Covington Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Talisman Energy USA Inc. / 02 105 Berguson J	Hamilton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/25/2011	8/25/2016
Talisman Energy USA Inc. / 02 109 Frederick L	Hamilton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/30/2011	8/30/2016
Talisman Energy USA Inc. / 02 110 Martin G	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2011	9/23/2016
Talisman Energy USA Inc. / 02 113 Reinfried C	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/14/2011	9/14/2016
Talisman Energy USA Inc. / 02 114 Shanley R	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/29/2011	8/29/2016
Talisman Energy USA Inc. / 02 121 Pine Hill Inc.	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/29/2011	8/29/2016
Talisman Energy USA Inc. / 02 128 Brier Mountain Sportsmen	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/9/2011	3/9/2016
Talisman Energy USA Inc. / 02 153 Mountain Run Hunting Club	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016
Talisman Energy USA Inc. / 02 155 Mountain Run Hunting Club	Union Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
Talisman Energy USA Inc. / 02 201 DCNR 594	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
Talisman Energy USA Inc. / 02 202 DCNR 594	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2010	8/6/2015
Talisman Energy USA Inc. / 02 203 DCNR 594	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2010	8/9/2015
Talisman Energy USA Inc. / 02 204 DCNR 594	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2010	8/9/2015
Talisman Energy USA Inc. / 02 205 DCNR 594	Bloss Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/9/2010	8/9/2015
Talisman Energy USA Inc. / 03 003 Vanblarcom	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/3/2010	9/3/2015
Talisman Energy USA Inc. / 03 011 Eick	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Talisman Energy USA Inc. / 03 028 Jennings	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Talisman Energy USA Inc. / 03 034 Roy B	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/29/2011	8/29/2016
Talisman Energy USA Inc. / 03 052 Watkins	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/17/2010	11/17/2015
Talisman Energy USA Inc. / 03 070 Wolf	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Talisman Energy USA Inc. / 03 071 Wolf	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
Talisman Energy USA Inc. / 03 072 Szumski	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Talisman Energy USA Inc. / 03 073 Ritz	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Talisman Energy USA Inc. / 03 074 Haralambous	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/24/2011	8/24/2016
Talisman Energy USA Inc. / 03 088 Andrews A	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/11/2011	3/11/2016
Talisman Energy USA Inc. / 03 109 Alderfer H	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/12/2012	3/12/2017
Talisman Energy USA Inc. / 03 110 Barlow	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
Talisman Energy USA Inc. / 03 111 Stephani	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Talisman Energy USA Inc. / 03 113 Vanblarcom	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
Talisman Energy USA Inc. / 03 125 Stiles D	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
Talisman Energy USA Inc. / 03 126 Stiles D	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/31/2011	10/31/2016
Talisman Energy USA Inc. / 05 002 Warner Valley Farm LLC	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/29/2010	7/29/2015
Talisman Energy USA Inc. / 05 004 Cooley P	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Talisman Energy USA Inc. / 05 005 Ayers	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/18/2010	8/18/2015
Talisman Energy USA Inc. / 05 006 Ugliuzza L	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Talisman Energy USA Inc. / 05 008 Michnich	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2011	8/17/2016
Talisman Energy USA Inc. / 05 009 Alderson V	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/3/2010	8/3/2015
Talisman Energy USA Inc. / 05 010 Willard S	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Talisman Energy USA Inc. / 05 011 Alderson V	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/8/2011	4/8/2016
Talisman Energy USA Inc. / 05 014 Warner	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2010	11/16/2015
Talisman Energy USA Inc. / 05 015 Warner Valley Farm LLC	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Talisman Energy USA Inc. / 05 016 Warner Valley Farm LLC	Stevens Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
Talisman Energy USA Inc. / 05 019 Cobb	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Talisman Energy USA Inc. / 05 022 DeCristo	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/14/2010	10/14/2015
Talisman Energy USA Inc. / 05 023 Edsell	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Talisman Energy USA Inc. / 05 024 Edsell	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/9/2010	9/9/2015
Talisman Energy USA Inc. / 05 026 Strope	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2010	8/26/2015
Talisman Energy USA Inc. / 05 027 Nekoranik	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Talisman Energy USA Inc. / 05 028 Neville V	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/15/2010	11/15/2015
Talisman Energy USA Inc. / 05 029 Neville	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/14/2010	10/14/2015
Talisman Energy USA Inc. / 05 031 Smolko	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/27/2010	10/27/2015
Talisman Energy USA Inc. / 05 034 Jones	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/18/2010	10/18/2015
Talisman Energy USA Inc. / 05 035 Antisdel	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Talisman Energy USA Inc. / 05 036 Antisdel	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Talisman Energy USA Inc. / 05 039 Powell Trust	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Talisman Energy USA Inc. / 05 040 Cook	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/13/2010	10/13/2015
Talisman Energy USA Inc. / 05 044 O'Gorman	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
Talisman Energy USA Inc. / 05 045 Mountain Paradise Club LLC	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/16/2010	8/16/2015
Talisman Energy USA Inc. / 05 046 O'Rourke	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2010	8/17/2015
Talisman Energy USA Inc. / 05 047 Kipp	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Talisman Energy USA Inc. / 05 056 Miller	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/6/2010	10/6/2015
Talisman Energy USA Inc. / 05 057 Michnich	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/17/2011	8/17/2016

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Talisman Energy USA Inc. / 05 058 Vough	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Talisman Energy USA Inc. / 05 067 Green Newland LLC	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/25/2010	8/25/2015
Talisman Energy USA Inc. / 05 073 Harvey	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/12/2010	11/12/2015
Talisman Energy USA Inc. / 05 074 Zimmerli	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Talisman Energy USA Inc. / 05 076 Brown	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/19/2010	11/19/2015
Talisman Energy USA Inc. / 05 080 Young	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2010	7/22/2015
Talisman Energy USA Inc. / 05 081 Uhouse D	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/8/2011	2/8/2016
Talisman Energy USA Inc. / 05 082 Abell Living Trust	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/19/2010	11/19/2015
Talisman Energy USA Inc. / 05 092 Upham	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
Talisman Energy USA Inc. / 05 097 Hartnett	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Talisman Energy USA Inc. / 05 098 Younger	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/1/2011	8/1/2016
Talisman Energy USA Inc. / 05 100 Dewing R	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/17/2011	2/17/2016
Talisman Energy USA Inc. / 05 102 Wheeler E	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/9/2011	3/9/2016
Talisman Energy USA Inc. / 05 104 Rennekamp R	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/29/2011	8/29/2016
Talisman Energy USA Inc. / 05 109 Ostrander R	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2011	9/19/2016
Talisman Energy USA Inc. / 05 118 Allyn A	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/18/2010	10/18/2015
Talisman Energy USA Inc. / 05 128 Upham R	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/16/2010	12/16/2015
Talisman Energy USA Inc. / 05 129 Upham R	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/18/2010	10/18/2015
Talisman Energy USA Inc. / 05 143 Bacon	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Talisman Energy USA Inc. / 05 152 Brown D	Orwell Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/19/2011	9/19/2016
Talisman Energy USA Inc. / 05 164 Bennett	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2011	7/26/2016

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Talisman Energy USA Inc. / 05 165 Hutchinson	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2010	11/23/2015
Talisman Energy USA Inc. / 05 167 Hutchinson	Warren Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/23/2010	12/23/2015
Talisman Energy USA Inc. / 05 174 Carlsen C	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/31/2011	8/31/2016
Talisman Energy USA Inc. / 05 178 Peck Hill Farm	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/20/2011	1/20/2016
Talisman Energy USA Inc. / 05 180 Peck Hill Farm	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/22/2010	11/22/2015
Talisman Energy USA Inc. / 05 181 Peck Hill Farm	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/10/2011	2/10/2016
Talisman Energy USA Inc. / 05 202 Slovak M	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/20/2010	12/20/2015
Talisman Energy USA Inc. / 05 213 Rinker J	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/31/2011	8/31/2016
Talisman Energy USA Inc. / 05 223 Wheaton	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/29/2010	11/29/2015
Talisman Energy USA Inc. / 05 229 Acres	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/8/2011	8/8/2016
Talisman Energy USA Inc. / 05 235 Rogers H	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/31/2011	8/31/2016
Talisman Energy USA Inc. / 05 253 Senn W	Windham Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2011	6/2/2016
Talisman Energy USA Inc. / 05-003 Edsell C	Pike Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Talisman Energy USA Inc. / 07 018 Bennett R	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2011	9/20/2016
Talisman Energy USA Inc. / 07 185 Camp Comfort	Middletown Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/27/2011	6/27/2016
Talisman Energy USA Inc. / Barrett 03 009	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/25/2010	2/25/2015
Talisman Energy USA Inc. / Bense	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2009	5/13/2014
Talisman Energy USA Inc. / Boor 03 010	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2010	6/18/2015
Talisman Energy USA Inc. / Boor 03 015	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/26/2010	2/26/2015
Talisman Energy USA Inc. / Carpenter 03 023	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/20/2010	8/20/2015
Talisman Energy USA Inc. / Castle 01 047	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015

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Talisman Energy USA Inc. / Catatonk Creek - Spencer	Spencer Township	NY	SW	Crude Petroleum and Natural Gas Extraction	6/12/2008	6/12/2012
Talisman Energy USA Inc. / Cease	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2009	5/13/2014
Talisman Energy USA Inc. / Chemung River - Chemung	Chemung Township	NY	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
Talisman Energy USA Inc. / Cole 03 016	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
Talisman Energy USA Inc. / Crank 03 067	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/19/2010	4/19/2015
Talisman Energy USA Inc. / Cummings 01 081	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Talisman Energy USA Inc. / DCNR 587 02 003	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Talisman Energy USA Inc. / DCNR 587 02 005	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2010	3/30/2015
Talisman Energy USA Inc. / DCNR 587 02 006	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/30/2010	3/30/2015
Talisman Energy USA Inc. / DCNR 587 02 008	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
Talisman Energy USA Inc. / DCNR 587 02 013	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Talisman Energy USA Inc. / DCNR 587 02 014	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Talisman Energy USA Inc. / DCNR 587 02 018	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/19/2010	2/19/2015
Talisman Energy USA Inc. / DCNR 587 02 019	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/11/2010	8/11/2015
Talisman Energy USA Inc. / DCNR 587 Pad #17	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/18/2009	9/18/2014
Talisman Energy USA Inc. / DCNR 587 Pad #2	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Talisman Energy USA Inc. / DCNR 587 Pad #4	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Talisman Energy USA Inc. / DCNR 587 Pad #9	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/24/2009	10/24/2014
Talisman Energy USA Inc. / Eick 013	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/16/2009	11/16/2014
Talisman Energy USA Inc. / Fall Brook - Bense	Troy Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Talisman Energy USA Inc. / Fall Brook - C.O.P. Tioga State Forest	Ward Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009	12/16/2013

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Talisman Energy USA Inc. / Fellows Creek	Ward Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/17/2009	12/16/2013
Talisman Energy USA Inc. / Ferguson 01 023	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2010	4/30/2015
Talisman Energy USA Inc. / Feusner 03 044	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Talisman Energy USA Inc. / Feusner 03 045	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Talisman Energy USA Inc. / Feusner 03 053	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/25/2010	6/25/2015
Talisman Energy USA Inc. / Foust J 1H	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Gardiner 01 071	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Talisman Energy USA Inc. / Harnish 01 032	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
Talisman Energy USA Inc. / Harris A	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2009	5/19/2014
Talisman Energy USA Inc. / Harris M	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2009	5/13/2014
Talisman Energy USA Inc. / Harvest Holdings 01 036	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
Talisman Energy USA Inc. / Hoover G 017	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Kirkowski 01 066	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Talisman Energy USA Inc. / Klein R	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2009	8/13/2014
Talisman Energy USA Inc. / Knights	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/19/2009	5/19/2014
Talisman Energy USA Inc. / Knights 24	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/24/2009	10/24/2014
Talisman Energy USA Inc. / Longnecker 03 008	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/22/2010	2/22/2015
Talisman Energy USA Inc. / Lutz 01 015	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/12/2010	2/12/2015
Talisman Energy USA Inc. / Lutz T1	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Lutz T2	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Lyon 01 078	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015

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Talisman Energy USA Inc. / McMurray 01 031	Canton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/19/2010	7/19/2015
Talisman Energy USA Inc. / Moretz 03 036	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/27/2010	3/27/2015
Talisman Energy USA Inc. / Morgan 01 073	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/24/2010	6/24/2015
Talisman Energy USA Inc. / Morgan 01 074	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/1/2010	3/1/2015
Talisman Energy USA Inc. / Noble 03 029	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/7/2010	7/7/2015
Talisman Energy USA Inc. / Nolt 01 082	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/9/2010	7/9/2015
Talisman Energy USA Inc. / Phinney	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2009	5/13/2014
Talisman Energy USA Inc. / Putnam 01 076	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/26/2010	2/26/2015
Talisman Energy USA Inc. / Putnam 01 077	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/12/2010	2/12/2015
Talisman Energy USA Inc. / Roy 03 039	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2010	6/10/2015
Talisman Energy USA Inc. / Roy 03 040	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/15/2010	6/15/2015
Talisman Energy USA Inc. / Roy 03 046	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2010	6/10/2015
Talisman Energy USA Inc. / Roy 03 062	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/12/2010	8/12/2015
Talisman Energy USA Inc. / Schucker 03 006	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2010	6/16/2015
Talisman Energy USA Inc. / Seeley Creek At Jones	Wells Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014
Talisman Energy USA Inc. / Shedden 01 075	Granville Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015
Talisman Energy USA Inc. / Shedden D 13-43	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/10/2009	6/10/2014
Talisman Energy USA Inc. / Shedden D 26/27	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/13/2009	5/13/2014
Talisman Energy USA Inc. / State Lands 587 Pad #1	Ward Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/16/2009	6/16/2014
Talisman Energy USA Inc. / Storch 03 035	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/28/2010	4/28/2015
Talisman Energy USA Inc. / Sugar Creek - South Branch (Shedden)	Troy Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014

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Talisman Energy USA Inc. / Sugar Creek (Hoffman)	West Burlington Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	03/12/2009, 03/18/2010	03/12/2013, 03/12/2013
Talisman Energy USA Inc. / Susquehanna River - Thrush	Sheshequin Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	09/11/2008, 12/17/2009	09/11/2012, 09/11/2012
Talisman Energy USA Inc. / Susquehanna River - Welles	Terry Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/10/2014
Talisman Energy USA Inc. / Szumski 03 022	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Talisman Energy USA Inc. / Thomas F 38	Troy Borough	PA	CU	Crude Petroleum and Natural Gas Extraction	5/21/2009	5/21/2014
Talisman Energy USA Inc. / Thomas FT 1	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Thomas FT 2	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Thorp 03 049	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/23/2010	7/23/2015
Talisman Energy USA Inc. / Towanda Creek - Franklin Twp. Volunteer Fire Department	Franklin Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	12/04/2008, 09/10/2009	12/04/2012, 12/04/2012
Talisman Energy USA Inc. / TWL Assoc 01 016	Armenia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / UT - North Branch Sugar Creek (Besley)	Columbia Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
Talisman Energy USA Inc. / Vanblarcom 03 054	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/15/2010	5/15/2015
Talisman Energy USA Inc. / Vanblarcom R 004	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/8/2010	1/8/2015
Talisman Energy USA Inc. / Walters 05 001	Herrick Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/27/2010	7/27/2015
Talisman Energy USA Inc. / Wappasening Creek at Adriance	Windham Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/23/2011	6/22/2015
Talisman Energy USA Inc. / Watson 03 051	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
Talisman Energy USA Inc. / White 03 025	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/25/2010	6/25/2015
Talisman Energy USA Inc. / Wilber 03 065	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/27/2010	5/27/2015
Talisman Energy USA Inc. / Williams 41-42	Troy Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2009	6/23/2014
Talisman Energy USA Inc. / Wray 03 058	Wells Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/15/2010	6/15/2015
Talisman Energy USA Inc. / Wyalusing Creek	Stevens Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/16/2010	9/15/2014

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Talisman Energy USA Inc. / Yurkanin 03 014	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/14/2010	7/14/2015
Talisman Energy USA Inc. / Ziegler 03 001	Columbia Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/14/2010	4/14/2015
Talon Holdings LLC / Hawk Valley Golf Club	Brecknock Township	PA	CU	Golf Courses and Country Clubs	4/18/2000	4/18/2025
Tanglewood Manor, Inc., Golf Club	East Drumore Township	PA	SW,CU	Golf Courses and Country Clubs	6/12/2002	6/12/2027
Tenaska Resources, LLC / Pine Creek	Pike Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/10/2011	3/9/2015
Tenaska Resources, LLC / Traub Pad A	Abbott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/10/2011	11/10/2016
Tennessee Gas Pipeline Company / Meshoppen Creek (Loop 319)	Springville Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Tennessee Gas Pipeline Company / Susquehanna River	Asylum Township	PA	SW,CU	Oil and Gas Pipeline and Related Structures Construction	6/7/2012	12/6/2013
Tennessee Gas Pipeline Company / Susquehanna River (Loop 317)	Asylum Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Tennessee Gas Pipeline Company / Tioga River (Loop 315)	Richmond Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Tennessee Gas Pipeline Company / Towanda Creek (Loop 317)	Monroe Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Tennessee Gas Pipeline Company / UNT North Elk Run (Loop 315)	Richmond Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Tennessee Gas Pipeline Company / White Creek (Loop 319)	Springville Township	PA	SW	Oil and Gas Pipeline and Related Structures Construction	6/23/2011	12/22/2012
Terre Hill / Terre Hill, Borough of	East Earl Township	PA	GW	Water Supply and Irrigation Systems	4/14/1988	4/14/2018
Textron-Lycoming	Williamsport City	PA	GW	Engine, Turbine, and Power Transmission Equipment Manufacturing	2/11/1988	2/11/2018
The Arundel Corporation / Vulcan Construction Materials, LP	Havre de Grace City	MD	CU	Construction Sand and Gravel Mining	01/23/1992, 02/10/2000	01/23/2022, 01/23/2022
The Borough of Hanover / Hanover Borough	Conewago Township	PA	SW	Water Supply and Irrigation Systems	9/13/1990	9/21/2015
The Coca-Cola Company / Graysville Spring A	Franklin Township	PA	SW,CU	Bottled Water Manufacturing	9/23/1998	9/23/2023
The Coca-Cola Company / The Coca-Cola Bottling Facility (Big Spring)	Boggs Township	PA	CU	Bottled Water Manufacturing	7/9/1998	7/9/2023
The Hershey Company / H. B. Reese Company - Division of The Hershey Company	Derry Township	PA	GW,CU	Food Manufacturing	12/13/2001, 06/12/2003	12/13/2026, 12/13/2026
The Municipal Authority of the Borough of Berlin / Berlin Borough Municipal Authority	Allegheny Township	PA	GW,CU	Water Supply and Irrigation Systems	07/09/1998, 12/15/2011	07/09/2023, 07/09/2023

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The Valspar Corporation / Valspar Coatings Lebanon Facility	North Lebanon Township	PA	CU	Paint and Coating Manufacturing	6/9/2004	6/9/2029
Titanium Metals Corporation (TIMET) / Titanium Metals Corporation (TIMET)	Caernarvon Township	PA	CU,GW	Fabricated Metal Product Manufacturing	06/12/2008, 06/18/2009	06/12/2023, 06/18/2024
Toftrees Resort and Conference Center	Patton Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Towanda Country Club	Wysox Township	PA	CU	Golf Courses and Country Clubs	10/10/2002	10/10/2027
Tower City Borough Authority	Porter Township	PA	GW	Water Supply and Irrigation Systems	03/12/1992, 06/12/2003	03/12/2022, 06/12/2028
Tree Top Golf Course, Inc.	Mount Joy Township	PA	CU	Golf Courses and Country Clubs	2/21/2002	2/21/2027
Triana Energy, LLC / Triana-Young Pad A	Hector Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/22/2010	6/22/2015
Triana Energy, LLC / Triana-Young Pad B	Hector Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/3/2010	12/3/2015
Tunkhannock Borough Municipal Authority	Tunkhannock Township	PA	GW	Water Supply and Irrigation Systems	08/14/2003, 09/13/2006	08/14/2028, 09/13/2031
Turkey Hill, L.P. / Turkey Hill Dairy, Inc.	Manor Township	PA	GW,CU	Food Manufacturing	08/14/2003, 08/14/2003	08/14/2028, 08/14/2028
Twin Hickory Golf Course	Hornell City	NY	CU	Golf Courses and Country Clubs	8/14/2003	8/14/2028
Tyco Electronics / Lickdale	Union Township	PA	CU	Electrical Equipment Manufacturing	12/18/2009	12/18/2024
Tyoga Country Club	Delmar Township	PA	CU	Golf Courses and Country Clubs	10/11/2001, 08/14/2003	10/11/2026, 10/11/2026
U.S. Geological Survey-Northern Appalachian Research Laboratory	Wellsboro Borough	PA	GW	Research and Development in the Physical, Engineering, and Life Sciences	04/09/1986, 07/13/1989, 08/14/2003	04/09/2016, 04/09/2016, 08/14/2028
UGI Development Company / Hunlock Creek Energy Center	Hunlock Township	PA	SW,CU	Electric Power Generation	9/10/2009	9/10/2024
Ultra Resources, Inc. / 808 Thomas	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/26/2010	3/26/2015
Ultra Resources, Inc. / 905 Fowler	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/5/2010	4/5/2015
Ultra Resources, Inc. / Bergey 812	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/13/2010	9/13/2015
Ultra Resources, Inc. / Button B 901 Pad	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2009, 03/02/2010	12/29/2014
Ultra Resources, Inc. / Coon Hollow 904	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
Ultra Resources, Inc. / Cowanesque River	Deerfield Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/4/2008	12/4/2012
Ultra Resources, Inc. / Fox 813	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
Ultra Resources, Inc. / Geiser 907	Abbott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/4/2011	4/4/2016
Ultra Resources, Inc. / Granger 850	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/10/2011	1/10/2016
Ultra Resources, Inc. / Granger 853	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/19/2012	3/19/2017
Ultra Resources, Inc. / Hillside Pad	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2009	12/29/2014
Ultra Resources, Inc. / Ken-Ton 902	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	01/08/2010, 03/02/2010	1/8/2015
Ultra Resources, Inc. / Kjelgaard Pad	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	09/01/2009, 03/02/2010	9/1/2014
Ultra Resources, Inc. / Lick Run Pad	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2009	12/29/2014
Ultra Resources, Inc. / Marshlands H. Bergey Unit #1	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2009	12/29/2014
Ultra Resources, Inc. / Marshlands K. Thomas Unit #1	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/29/2009	12/29/2014
Ultra Resources, Inc. / Martin 806	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/23/2010	6/23/2015
Ultra Resources, Inc. / Miksis 831	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
Ultra Resources, Inc. / Mitchell A 903	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	1/13/2010	1/13/2015
Ultra Resources, Inc. / Patel 914	Abbott Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/17/2010	5/17/2015
Ultra Resources, Inc. / Paul 906	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/8/2010	3/8/2015
Ultra Resources, Inc. / Pierson 810	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/11/2010	6/11/2015
Ultra Resources, Inc. / Pine Creek	Pike Township	PA	SW	Crude Petroleum and Natural Gas Extraction	03/12/2009, 12/16/2010	03/12/2013, 03/12/2013
Ultra Resources, Inc. / Ritter 828	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/19/2010	8/19/2015
Ultra Resources, Inc. / Simonetti 817 (rev)	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2010	5/26/2015
Ultra Resources, Inc. / State 811	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Ultra Resources, Inc. / State 814	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/6/2010	10/6/2015
Ultra Resources, Inc. / State 815	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/22/2010	4/22/2015

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Ultra Resources, Inc. / State 816	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 818	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 819 (rev)	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Ultra Resources, Inc. / State 820	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 822	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Ultra Resources, Inc. / State 824	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Ultra Resources, Inc. / State 825	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Ultra Resources, Inc. / State 826	Shippen Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/15/2010	7/15/2015
Ultra Resources, Inc. / State 827	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 841	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 842	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 843	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/19/2010	10/19/2015
Ultra Resources, Inc. / State 844	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/7/2010	9/7/2015
Ultra Resources, Inc. / Stewart 805	Elk Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/6/2010	7/6/2015
Ultra Resources, Inc. / T Pierson Pad	Gaines Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/1/2009	9/1/2014
Union Deposit Corportation / Sportsman's Golf Course	Lower Paxton Township	PA	CU	Golf Courses and Country Clubs	10/9/2003	10/9/2028
Union Township Municipal Authority	Union Township	PA	SW	Water Supply and Irrigation Systems	9/13/1990	9/21/2015
United Water Resources / United Water PA–Dallas Operation	Dallas Township	PA	GW	Water Supply and Irrigation Systems	10/10/1985, 11/10/1988, 03/29/2005, 12/05/2006	10/10/2015, 11/10/2018, 03/29/2030, 03/29/2030

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United Water Resources / United Water PA–Harrisburg Operation	Newberry Township	PA	GW,SW	Water Supply and Irrigation Systems	04/14/1988, 01/17/1991, 07/14/1994, 08/30/2005, 09/10/2009, 06/11/2010, 06/11/2010	04/14/2018, 01/17/2021, 07/14/2024, 08/31/2030, 09/10/2024, 06/10/2025, 06/10/2025
United Water Resources / United Water Pennsylvania	Upper Allen Township	PA	GW	Water Supply and Irrigation Systems	11/13/1986, 11/08/1990	11/13/2016, 11/08/2020
Univar USA, Inc.	Middletown Borough	PA	CU	Chemical Manufacturing	6/12/2002	6/12/2027
Upper Halfmoon Water Company / Upper Halfmoon Water Company	Halfmoon Township	PA	GW	Water Supply and Irrigation Systems	5/13/1993	5/13/2023
Valley Country Club / Valley Country Club	Sugarloaf Township	PA	CU,GW	Golf Courses and Country Clubs	08/15/2002, 06/14/2006, 06/18/2009	08/15/2027, 08/15/2027, 06/18/2024
Valley View Springs–Eagle Springs Co.	Hegins Township	PA	SW,CU	Bottled Water Manufacturing	11/13/1997	11/13/2022
Vestal Hills Country Club	Binghamton Township	NY	CU	Golf Courses and Country Clubs	4/10/2003	4/10/2028
Vestal, Town of / Vestal, Town of	Binghamton City	NY	GW	Water Supply and Irrigation Systems	05/14/1981, 05/11/1995	05/14/2011, 05/11/2025
Victory Energy Corporation / Brown #1	West Branch Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/20/2009	10/20/2014
Viking Energy of Northumberland, LLC / Power Plant	Point Township	PA	GW,CU	Electric Power Generation	6/7/2012	6/6/2027
Village of Cohocton / Cohocton, Village of	Cohocton Township	NY	GW	Water Supply and Irrigation Systems	10/09/2003, 09/08/2004	10/09/2028, 09/08/2029
Walden Oaks Country Club, Inc.	Cortland City	NY	CU	Golf Courses and Country Clubs	2/6/2003	2/6/2028
Walker Township Water Association / Walker Township Water Association	Walker Township	PA	GW	Water Supply and Irrigation Systems	03/14/1991, 09/14/1995, 09/12/2007, 12/15/2011	03/14/2021, 09/14/2020, 09/12/2022, 09/12/2022
Warwick Township Municipal Authority / Warwick Township Municipal Authority	Warwick Township	PA	GW	Water Supply and Irrigation Systems	1/12/1989	1/12/2019
Waverly, Villiage of / Waverly, Village of	Waverly Village	NY	GW	Water Supply and Irrigation Systems	02/11/1982, 02/06/2003, 12/05/2007	02/11/2012, 02/06/2028, 02/06/2028
Weis Markets, Inc.	Northumberland Borough	PA	CU	Bottled Water Manufacturing	04/10/2003, 09/14/2005	04/10/2028, 04/10/2028
Wellsboro Municipal Authority / Wellsboro Municipal Authority	Duncan Township	PA	SW	Water Supply and Irrigation Systems	3/11/1999	12/18/2034
West Cocalico Township Authority	West Cocalico Township	PA	GW	Water Supply and Irrigation Systems	01/12/1978, 02/06/2003	01/12/2008, 02/06/2028

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West Earl Water Authority	West Earl Township	PA	GW,SW	Water Supply and Irrigation Systems	02/11/1982, 09/11/1997	02/11/2012, 05/27/2022
West Manchester Township Authority / West Manchester Township Authority	West Manchester Township	PA	GW	Water Supply and Irrigation Systems	09/15/1978, 09/23/1998, 09/14/2005	09/15/2008, 09/23/2023, 09/14/2030
West Shore Country Club	East Pennsboro Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
West Winfield, Village of	West Winfield Village	NY	GW	Water Supply and Irrigation Systems	9/8/2004	9/8/2029
White Deer Golf Courses–Lycoming County Recreation Authority	Brady Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
Wilbur Chocolate Company	Lititz Borough	PA	GW	Sugar and Confectionery Product Manufacturing	4/12/2001	4/12/2026
William C. Wingo / Wingo Ponds	Ulysses Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Williamsburg, Borough of	Woodbury Township	PA	GW	Water Supply and Irrigation Systems	07/14/1994, 03/09/1995	07/14/2024, 07/14/2024
Williamsport Country Club	Loyalsock Township	PA	GW,CU	Golf Courses and Country Clubs	05/10/1990, 02/10/2000, 04/10/2003	05/10/2020, 05/10/2020, 05/10/2020
Williamsport Municipal Water Authority / Williamsport Municipal Water Authority	Williamsport City	PA	GW	Water Supply and Irrigation Systems	6/23/2011	6/22/2026
Willow Valley Golf Club, Inc.	West Lampeter Township	PA	CU	Golf Courses and Country Clubs	12/13/2001	12/13/2026
Windsor, Village of	Windsor Township	NY	GW	Water Supply and Irrigation Systems	1/11/1979	1/11/2009
Wise Foods, Inc. / Wise Foods, Inc.	Berwick Borough	PA	GW	Food Manufacturing	5/14/1992	5/14/2022
Wissahocken Spring Water / Temple Springs	Rapho Township	PA	CU	Bottled Water Manufacturing	3/29/2005	3/29/2030
WMPI PTY, L.L.C.	Mahanoy Township	PA	GW,CU	Coal Mining	9/14/2005	9/14/2030
Wood-Mode, Inc.	Middlecreek Township	PA	CU	Electric Power Generation	07/13/1989, 02/10/2000	07/13/2019, 07/13/2019
Woolrich, Inc. / Woolrich, Inc.	Pine Creek Township	PA	CU	Textile Mills	3/29/2005	3/29/2030
World Kitchen, LLC / World Kitchen, Inc. - Pressware Plant	Corning City	NY	GW	Kitchen Utensil, Pot, and Pan Manufacturing	12/13/2001, 09/08/2004, 03/15/2006	12/13/2026, 12/13/2026, 03/15/2031
WPS Westwood Generation, LLC	Frailey Township	PA	GW,CU	Electric Power Generation	03/11/1999, 08/15/2002	03/11/2024, 03/11/2024
WPX Energy Appalachia, LLC / Adams Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/13/2012	3/13/2017
WPX Energy Appalachia, LLC / Alder Run Land LP #2H	Cooper Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/30/2010	4/30/2015

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WPX Energy Appalachia, LLC / Alder Run Land LP #5H	Cooper Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/26/2010	7/26/2015
WPX Energy Appalachia, LLC / Barnhart Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/7/2012	5/7/2017
WPX Energy Appalachia, LLC / Blye Pad Site	Middletown Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/8/2010	2/8/2015
WPX Energy Appalachia, LLC / Campbell Well Pad	Benton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2010	12/6/2015
WPX Energy Appalachia, LLC / Carrar Pad Site	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/16/2009	7/16/2014
WPX Energy Appalachia, LLC / Carty Pad Site	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2009	9/8/2014
WPX Energy Appalachia, LLC / Carty-Wisemen Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/15/2016
WPX Energy Appalachia, LLC / Conaty Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/24/2012	2/24/2017
WPX Energy Appalachia, LLC / Coyle Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/7/2012	5/7/2017
WPX Energy Appalachia, LLC / Depue Well #2H	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/27/2010	9/27/2015
WPX Energy Appalachia, LLC / Fiondi - 1	Middletown Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 09/02/2009	04/06/2014, 04/06/2014
WPX Energy Appalachia, LLC / Five E's FLP Pad Site	Middletown Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/6/2009	8/6/2014
WPX Energy Appalachia, LLC / Hartle Pad Site	Cooper Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/23/2011	11/23/2016
WPX Energy Appalachia, LLC / Hayes Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2011	2/28/2016
WPX Energy Appalachia, LLC / HDK Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/6/2011	12/6/2016
WPX Energy Appalachia, LLC / Herman Well Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2011	2/28/2016
WPX Energy Appalachia, LLC / Holbrook # 1	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 11/09/2010	04/06/2014, 04/06/2014
WPX Energy Appalachia, LLC / Hollenbeck ABR	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/12/2010	10/12/2015
WPX Energy Appalachia, LLC / Inez Moss Pond	Benton Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
WPX Energy Appalachia, LLC / Ivey Pad Site	Forest Lake Township	PA	SW,CU	Crude Petroleum and Natural Gas Extraction	6/10/2009	6/10/2014
WPX Energy Appalachia, LLC / Kass North Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/15/2016

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WPX Energy Appalachia, LLC / Knapik Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/28/2011	2/28/2016
WPX Energy Appalachia, LLC / Knosky Pad Site	Rush Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2009	9/8/2014
WPX Energy Appalachia, LLC / M. Martin 1V	Sugarloaf Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/22/2010	7/22/2015
WPX Energy Appalachia, LLC / MacGeorge Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/13/2012	2/13/2017
WPX Energy Appalachia, LLC / Markovitch Pad Site	Bridgewater Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/31/2009	8/31/2014
WPX Energy Appalachia, LLC / McNamara Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/13/2012	3/13/2017
WPX Energy Appalachia, LLC / Micks Pad Site	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/22/2009	9/22/2014
WPX Energy Appalachia, LLC / Middle Branch Wyalusing Creek	Forest Lake Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
WPX Energy Appalachia, LLC / Mitchell Well Pad	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2011	5/31/2016
WPX Energy Appalachia, LLC / Moore Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2012	5/31/2017
WPX Energy Appalachia, LLC / Nayavich Well Pad	Sugarloaf Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/18/2011	5/18/2016
WPX Energy Appalachia, LLC / North Branch Wyalusing Creek	Middletown Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/7/2012	6/6/2016
WPX Energy Appalachia, LLC / O'Reilly Well Pad	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2012	5/31/2017
WPX Energy Appalachia, LLC / Powers Pad Site	Forest Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/14/2009	5/14/2014
WPX Energy Appalachia, LLC / Resource Recovery Well Pad 1	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/21/2010	10/21/2015
WPX Energy Appalachia, LLC / Resource Recovery Well Pad 2	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/3/2010	11/3/2015
WPX Energy Appalachia, LLC / Resource Recovery Well Pad 3	Snow Shoe Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/21/2010	10/21/2015
WPX Energy Appalachia, LLC / Robinson Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/16/2011	9/16/2016
WPX Energy Appalachia, LLC / S. Farver 1V	Benton Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/13/2010	8/13/2015
WPX Energy Appalachia, LLC / Sadecki Well Pad	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2011	5/26/2016
WPX Energy Appalachia, LLC / Snake Creek	Liberty Township	PA	SW	Crude Petroleum and Natural Gas Extraction	03/12/2009, 09/16/2010	03/12/2013, 03/12/2013

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WPX Energy Appalachia, LLC / Snake Creek - 2	Franklin Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
WPX Energy Appalachia, LLC / Susquehanna River	Great Bend Township	PA	SW	Crude Petroleum and Natural Gas Extraction	03/12/2009, 12/15/2011	03/12/2013, 03/12/2013
WPX Energy Appalachia, LLC / Susquehanna River - 2	Great Bend Township	PA	SW	Crude Petroleum and Natural Gas Extraction	12/15/2011	12/14/2015
WPX Energy Appalachia, LLC / Turner - 1	Liberty Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 09/02/2009	04/06/2014, 04/06/2014
WPX Energy Appalachia, LLC / Turner Lake	Liberty Township	PA	SW	Crude Petroleum and Natural Gas Extraction	6/18/2009	6/18/2013
WPX Energy Appalachia, LLC / Webster - 1	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	04/06/2009, 11/09/2010	04/06/2014, 04/06/2014
WPX Energy Appalachia, LLC / Wheeler Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2012	5/31/2017
WPX Energy Appalachia, LLC / Wilkes Well Pad	Silver Lake Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/29/2012	2/28/2017
Wrightsville Borough Municipal Authority	Hellam Township	PA	SW	Water Supply and Irrigation Systems	3/11/1999	3/29/2024
Wyncote Golf Course-Penn View, Inc.	Lower Oxford Township	PA	CU	Golf Courses and Country Clubs	8/10/2000	8/10/2025
Wynding Brook Inc. / Wynding Brook Golf Club	Turbot Township	PA	SW,CU	Golf Courses and Country Clubs	3/13/2008	3/13/2023
Wyoming Valley Country Club	Hanover Township	PA	CU	Golf Courses and Country Clubs	8/15/2002	8/15/2027
XTO Energy, Inc. / Booth	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/28/2009	12/28/2014
XTO Energy, Inc. / Brown 8519H	Moreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/2/2010	6/2/2015
XTO Energy, Inc. / Buck Unit A	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/21/2011	7/21/2016
XTO Energy, Inc. / Dietterick	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/9/2010	3/9/2015
XTO Energy, Inc. / Everbe Farms 8518H	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/20/2010	5/20/2015
XTO Energy, Inc. / Everbe Farms Unit B	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/21/2012	2/21/2017
XTO Energy, Inc. / FOX 8501H	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/14/2010	9/14/2015
XTO Energy, Inc. / Free Library Unit E	Beech Creek Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/11/2011	7/11/2016
XTO Energy, Inc. / Glidewell Unit A	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/26/2011	5/26/2016
XTO Energy, Inc. / Hazlak	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/07/2009, 12/14/2009	07/07/2014, 07/07/2014

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XTO Energy, Inc. / Hazlak 8504	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/12/2010	2/12/2015
XTO Energy, Inc. / Houseweart 8527H	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/8/2010	9/8/2015
XTO Energy, Inc. / Jenzano	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/07/2009, 12/01/2009	07/07/2014, 07/07/2014
XTO Energy, Inc. / Kepner 8503H	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/11/2010	2/11/2015
XTO Energy, Inc. / King Unit	Shrewsbury Township	PA	CU	Crude Petroleum and Natural Gas Extraction	12/22/2009	12/22/2014
XTO Energy, Inc. / Levan 8526H	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/1/2010	10/1/2015
XTO Energy, Inc. / Levan 8532H	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2010	11/8/2015
XTO Energy, Inc. / Lick Run	Shrewsbury Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
XTO Energy, Inc. / Little Muncy Creek	Moreland Township	PA	SW	Crude Petroleum and Natural Gas Extraction	3/18/2010	3/17/2014
XTO Energy, Inc. / Litwhiler Unit A	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
XTO Energy, Inc. / Lucella 8564H	Moreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/20/2010	9/20/2015
XTO Energy, Inc. / Marquardt	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/07/2009, 01/14/2010, 10/15/2009	07/07/2014, 07/07/2014
XTO Energy, Inc. / MARQUARDT 8534H	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/18/2010	6/18/2015
XTO Energy, Inc. / MARQUARDT UNIT 8517H	Penn Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/13/2010	4/13/2015
XTO Energy, Inc. / Moser 8521H	Franklin Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/14/2010	6/14/2015
XTO Energy, Inc. / PA TRACT 8524H	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	4/22/2011	4/22/2016
XTO Energy, Inc. / PA TRACT 8546H	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	10/29/2010	10/29/2015
XTO Energy, Inc. / PA Tract Unit E	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2011	8/26/2016
XTO Energy, Inc. / PA Tract Unit G	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	9/23/2011	9/23/2016
XTO Energy, Inc. / PA Tract Unit H	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	6/29/2012	6/29/2017

Facility Name	Municipality	State	Approval Type Approval by Rule (ABR) Consumptive Use (CU) Diversion (DIV) Groundwater (GW) Surface Water (SW)	NAICS Title	Approval Date	Expiration Date
XTO Energy, Inc. / PA Tract Unit I	Chapman Township	PA	CU	Crude Petroleum and Natural Gas Extraction	8/26/2011	8/26/2016
XTO Energy, Inc. / Raymond Unit A	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
XTO Energy, Inc. / Raymond Unit B	Pine Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
XTO Energy, Inc. / Renn Unit A	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	3/22/2011	3/22/2016
XTO Energy, Inc. / Renn8506H	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2010	11/8/2015
XTO Energy, Inc. / Shaner8507H	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	11/8/2010	11/8/2015
XTO Energy, Inc. / Spiece Unit A	Jackson Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/1/2011	7/1/2016
XTO Energy, Inc. / Temple	Moreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	07/07/2009, 12/14/2009	07/07/2014, 07/07/2014
XTO Energy, Inc. / TLT	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	2/2/2010	2/2/2015
XTO Energy, Inc. / TLT Unit A	Jordan Township	PA	CU	Crude Petroleum and Natural Gas Extraction	7/8/2011	7/8/2016
XTO Energy, Inc. / Tome 8522H	Moreland Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/28/2010	5/28/2015
XTO Energy, Inc. / West Branch Susquehanna River	Chapman Township	PA	SW	Crude Petroleum and Natural Gas Extraction	9/15/2011	9/14/2015
Y&S Candies	East Hempfield Township	PA	CU	Sugar and Confectionery Product Manufacturing	07/11/1991, 08/10/2000	07/11/2021, 07/11/2021
York County Solid Waste & Refuse Authority / Hopewell Township	Hopewell Township	PA	GW	Solid Waste Landfill	5/15/1997	5/15/2022
York County Solid Waste & Refuse Authority / Manchester Township	Manchester Township	PA	CU	Electric Power Generation	09/11/1986, 09/12/1991	09/11/2016, 09/11/2016
York Plant Holding LLC	Springettsbury Township	PA	CU	Electric Power Generation	12/5/2007	12/5/2022
York Springs Municipal Authority	York Springs Borough	PA	GW	Water Supply and Irrigation Systems	1/14/1982	1/14/2012
York Water Company, The / Abbottstown	Abbottstown Borough	PA	GW	Water Supply and Irrigation Systems	5/14/1981	5/14/2011
York Water Company, The / York Water Company, The	Spring Garden Township	PA	SW	Water Supply and Irrigation Systems	10/10/2002	10/10/2027
Young Pad #4	Portage Township	PA	CU	Crude Petroleum and Natural Gas Extraction	5/31/2011	5/31/2016
Zausner Foods Corporation	New Holland Borough	PA	CU	Food Manufacturing	12/13/2001	12/13/2026
TOTAL FACILITIES: 2,551						

APPENDIX 3

SUSQUEHANNA RIVER BASIN COMMISSION WATER RESOURCES PROGRAM

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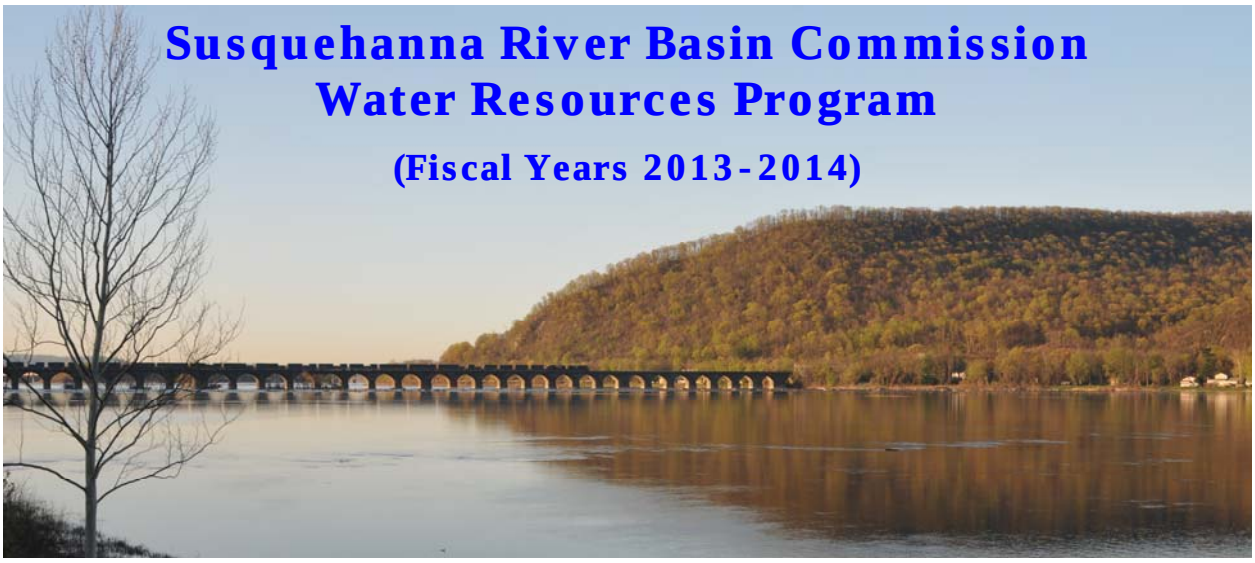

June 7, 2012

SUSQUEHANNA RIVER BASIN COMMISSION

1721 N. Front Street, Harrisburg, PA 17102
Phone: (717) 238-0423 Fax: (717) 238-2436 Email: srbc@srbc.net Website: www.srbc.net

Section 14.2 of the Susquehanna River Basin Compact (Compact), P.L. 91-575 states that "the Commission will annually adopt a water resources program, based upon the comprehensive plan, consisting of the projects and facilities which the Commission proposes to be undertaken by the Commission and by other authorized governmental and private agencies, organizations, and persons during the ensuing six years or such other reasonably foreseeable period as the Commission may determine." The Susquehanna River Basin Commission (SRBC), in general, considers a 2-year period for the water resources program. This water resources program is for SRBC's fiscal years 2013 through 2014, which covers the period beginning on July 1, 2012, and ending on June 30, 2014.

In accordance with SRBC's 2008 Comprehensive Plan, as amended (which can be found at http://www.srbc.net/planning/compplanfiles.asp), the annual water resources program is the mechanism for implementing the "Actions Needed" listed in the Comprehensive Plan under six Priority Management Areas. Those management areas are listed below and serve as the foundation by which SRBC, the federal, state and local agencies, and the non-governmental organizations identify and catalogue their programs and projects within the Water Resources Program to help meet the water resource needs in the Susquehanna River Basin.

1. Water Supply (pp. 5-18)
2. Water Quality (pp. 19-52)
3. Flooding (pp. 53-66)
4. Ecosystems (pp. 67-80)
5. Chesapeake Bay (pp. 81-96)
6. Coordination, Cooperation, and Public Information (pp. 97-112)

In January 2012, the Commission solicited input from agencies, non-governmental organizations, and the public, requesting their input for the Water Resources Program by

March 5, 2012. Individual agencies of the federal government and the Commission's member states (New York, Pennsylvania, and Maryland) were contacted by letter. Local agencies, non-governmental organizations, and the public were contacted and invited to provide comments through a mass e-mail distribution as well as through the Commission's website.

In soliciting comments, the Commission encouraged the federal and state agencies to consider, when possible, how the following priority issues could be addressed:

- Managing the development of unconventional natural gas wells in shale formations for both water quality and quantity and its implications on coordination and research.
- Devising a low flow management scheme for the entire Susquehanna River Basin to protect aquatic habitat and provide adequate flows to the Chesapeake Bay.
- Ensuring the sustainability of the Susquehanna River Basin Flood Forecast and Warning System, including the maintenance of critical stream gages.
- Managing nutrients and sediments in the Susquehanna River Basin, including implementation of the Chesapeake Bay Total Maximum Daily Load (TMDL).
- Participating in licensing/relicensing activities for hydroelectric projects and other possible new power-producing facilities in the Susquehanna River Basin.

Twelve federal agencies, as well as a wide array of agencies from all three of the Commission's member states, provided an extensive list of activities they intend to pursue in support of the above, as well as other "Actions Needed" in the Comprehensive Plan. Additional support was provided by county conservation districts and planning agencies; environmental organizations such as Trout Unlimited, the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation, Southern Tier (New York) Regional Planning and Development Board, and the Upper Susquehanna Coalition; municipalities; universities; watershed organizations; and many others.

The Commission's own list of activities for Fiscal Years 2013-2014 is also included in the Water Resources Program, with a major focus on activities related to shale gas development in the basin. The Commission will continue its major activity to conduct project reviews and extensive compliance monitoring to ensure that water withdrawals and consumptive uses are in compliance with Commission regulatory requirements. The Commission will also continue to support and expand its Remote Water Quality Monitoring Network and other water quality monitoring activities in shale gas development areas. Two research activities related to shale gas development will be completed and a third shale gas related research effort (regarding headwater areas) will be initiated in FY-2013.

Shale gas extraction in the basin is discussed as a component of the Energy Production Area of Special Interest in Part V of the Commission's Comprehensive Plan, which was approved in 2008. To ensure that the plan remains current and retains its long-term value and usefulness, the Commission determined that the plan should be updated every five years, and that a complete revision should be made every 15 years. The first 5-year update to the plan is scheduled for completion by December 2013.

Given the rapid expansion of the shale gas industry in the basin, the Commission intends to increase the focus on this activity in the 2013 update and to consider additional "Actions Needed" for potential inclusion in the plan. In performing the update, the Commission will

continue to emphasize its regulatory role with respect to water withdrawals and consumptive water uses, and its member jurisdictions will maintain their lead regulatory responsibilities in the area of water quality management.

In order to support the 2013 update to the Comprehensive Plan, the Commission will undertake a cumulative impact analysis of water withdrawals and consumptive uses on the water resources of the Susquehanna River Basin. Through its monitoring programs and other activities, the Commission will continue to support the work of its member jurisdictions in managing water quality impacts associated with shale gas development.


Susquehanna River Basin
SUBBASINS
1 - Upper Susquehanna
2 - Chemung
3 - Middle Susquehanna
4 - West Branch Susquehanna
5 - Juniata
6 - Lower Susquehanna
CORTLAND
NORWICH
ONEONTA
CORNING
ELMIRA
BINGHAMTON
TOWANDA
SCRANTON
RENOVO
WILLIAMSPORT
WILKES-BARRE
CLEARFIELD
SUNBURY
LEWISTOWN
ALTOONA
HARRISBURG
LANCASTER
YORK
HAVRE DE GRACE
Onondaga
Madison
Oneida
Herkimer
Ontario
Livingston
Yates
Schoharie
Otsego
Chenango
Cortland
Tompkins
Schuyler
Steuben
Allegany
Chemung
Tioga
Broome
Delaware
New York
Pennsylvania
McKean
Potter
Bradford
Susquehanna
Wayne
Elk
Cameron
Lycoming
Sullivan
Wyoming
Lackawanna
Jefferson
Clinton
Clearfield
Columbia
Luzerne
Centre
Union
Montour
Carbon
Indiana
Snyder
Northumberland
Schuylkill
Mifflin
Juniata
Cambria
Blair
Perry
Dauphin
Lebanon
Berks
Huntingdon
Somerset
Cumberland
Chester
Lancaster
Franklin
Bedford
Fulton
Adams
York
Maryland
Cecil
Carroll
Baltimore
Harford
0 5 10 20 Miles
Susquehanna River Basin Commission
Major Water Features: National Hydrography Dataset (NHD), USGS
Disclaimer: Intended for Educational Display Purposes Only
SRBC (1164) 07-20-2005

Priority Management Area A – Water Supply

Natural gas drilling operation (left), and hydraulic fracturing (right).

Desired Result: *To meet immediate and future water needs of the people of the basin for domestic, municipal, commercial, agricultural, industrial water supply, and recreational activities, in order to maintain sustainable economic viability, protect instream uses, and ensure ecological diversity through regulation and planning.*

The following Actions Needed under Priority Management Area A – Water Supply are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 44-47. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests.

ACTION NEEDED:
Determine water availability through water budget assessments (analysis of demand increases and expected base flow levels) to establish local sustainable limits for water use development.

Susquehanna River Basin Commission Programs and Projects

1. By December 2012: Compile a comprehensive, basin-wide water use data library, including estimated water use datasets, and refine the methodology for calculating cumulative water use at the watershed scale.
2. By June 2013: Conduct a literature review, select preferred methodologies, and quantify water availability for individual watersheds based on an evaluation of natural flow regimes, sustainable yield, and acceptable limits of hydrologic alteration.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Continue to assess USACE reservoirs for the potential to augment low flow releases and reduce downstream ecological impacts.

U.S. Environmental Protection Agency (USEPA)

1. Through USEPA's Water Quality Standards flow workgroup, work in partnership with SRBC's efforts to assess flow impacts on ecosystems.

U.S. Geological Survey

1. Complete the "Comprehensive Plan to Assess Potential Environmental Effects of Marcellus Shale Gas Exploration and Production" that will describe a collection of integrated federal/state collaborative studies to be conducted evaluating the potential environmental effects of Marcellus Shale gas production in the Susquehanna, Delaware, and Ohio River Basins. Changes in surface and groundwater availability will be addressed through research, surveys, and monitoring. A specific application of the plan in the Marcellus Shale play will include establishing at least one research-intensive area in each of the Susquehanna, Delaware, and Ohio River Basins.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Develop a comprehensive water withdrawal program that uses SRBC to authorize withdrawals with water conservation and passby flow requirements.

Cortland County Health Department

1. Continue to review the water use of all municipal public water systems and the sustainability of aquifers, particularly use of the Otter/Dry Creek Aquifer by Cortland and Cortlandville.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. Implement a recently approved PFBC policy under which it will consider water access leasing at PFBC-owned facilities. Sustainable water withdrawal limits will be determined consistent with SRBC policy through the docket approval process.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Assist SRBC in determining water availability for potential consumptive use mitigation through EPCAMR's mine pool mapping work.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Continue to manage Maryland's water resources through implementation of water appropriation and use permits. As part of this process, water budget assessments establish sustainable allocations for water supply withdrawals. The Coastal Plain aquifer study has been underway since 2007. This project will conduct detailed studies of regional groundwater flow systems and water budgets for the Coastal Plain aquifers. The study will also include enhanced monitoring of groundwater level, streamflow, and water quality in the Maryland Coastal Plain. A similar study was initiated in 2009 for the Fractured Rock region of the state. MDE continues to seek funding to fully support the Coastal Plain and Fractured Rock water supply studies, which will enhance the information and tools available for estimating water availability and making appropriate determinations regarding withdrawal requests.

   MDE also commented that both Maryland and SRBC need to consider the impact of increased variability and changing rainfall patterns due to climate change on the long-term sustainability of current and future withdrawals. Current information is not yet available to consider this impact in Maryland and SRBC's respective allocation programs.

ACTION NEEDED:
Protect healthy ecosystems and instream flow needs, including recreation.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Incorporate The Nature Conservancy's (TNC) ecosystem flow recommendations into Commission programs and policies (including the Low Flow Protection Policy, water budget analyses, and consumptive use mitigation strategy), and implement the revised programs and policies.
2. By December 2012: Finalize the Low Flow Protection Policy, containing specifications for headwaters protection and passby flow and conservation release determinations consistent with TNC's ecosystem flow recommendations.
3. By March 2013: Complete the Evaluation of Passby Flow Reference Gage Determinations research project to determine the predictive accuracy associated with passby flow reference gage selections for ungaged watersheds in the basin.
4. By November 2012: Complete expansion of the Low Flow Monitoring Program basinwide and complete analysis of the datasets by March 2013.
5. Throughout FY-2013 and FY-2014: Continue to conduct aquatic resource surveys in support of the project review process, especially in areas experiencing natural gas development, in order to ensure protection of aquatic life and habitat.
6. By March 2013: Complete the Aquatic Resource Survey Research Project, with the results of the project to focus on verifying whether or not natural gas water withdrawals are impacting aquatic life and habitat along target study stream reaches.
7. Throughout FY-2013 and FY-2014: Work with project sponsors, agency representatives, and contractors through Federal Energy Regulatory Commission relicensing processes to promote environmental flow protection for the lower Susquehanna River.

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Continue to work with the Pennsylvania Fish and Boat Commission (PFBC), the Pennsylvania Department of Environmental Protection, and the U.S. Army Corps of Engineers to ensure that federal highway projects meet all regulatory requirements of those agencies, which include efforts to protect healthy ecosystems. Proposed projects within Pennsylvania are provided through the Statewide Transportation Improvement Program, which is currently undergoing revisions, and should be in final form in late August 2012 or early September 2012. For all projects, the PFBC has identified recreational water trails. These water trails are considered when developing projects to ensure that the recreational function is preserved, and the site is properly equipped with signs during construction to protect boaters and fishermen under an Aid to Navigation Plan. Hydrology and hydraulic studies are performed when rehabilitating or replacing bridges to ensure that flows are maintained and flooding problems are not created.

National Park Service

1. Continue efforts to protect the environmental, historic, cultural, and recreational value of the region's forests, wetlands, river corridors, and open spaces. These activities were identified in the federal Strategy for Protecting and Restoring the Chesapeake Bay, and were to be performed in collaboration with other state, local, and federal agencies as well as non-governmental organizations. The federal government will target funding to support state and local efforts to conserve landscapes and provide public access through purchases of land and conservation easements. National Trails and the Chesapeake Bay Gateways and Watertrails Network will improve public access in concert with state and local governments and non-governmental partners.
2. Continue to provide appropriate technical and financial assistance to enhance public access, interpretation, and resource stewardship, with a focus on public access and water trail development.

3. Implement priority recommendations of the Carr's Creek Watershed Management Plan including permanent protection (via conservation easements) of forested lands in the headwaters of Carr's Creek and Willow Brook. Seek New York State protection for stream reaches with viable trout fisheries and propose establishment of an environmental protection overlay zone for the Carr's Creek and Willow Brook riparian corridor.

U.S. Army Corps of Engineers

1. Make flow augmentation releases from Whitney Point Lake during specified low flow conditions to help protect downstream aquatic resources. Physical and operational modifications were made at the lake during 2008 and 2009 to help restore and enhance in-lake and downstream ecosystems.
2. Establish "ecological flow" criteria and produce final report for the Susquehanna River Basin Low Flow Management and Environmental Restoration Project.
3. Participate in SRBC's Susquehanna River Flow Management Project.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Support USEPA Headquarters' Healthy Watersheds Initiative through activities of USEPA Region 3's Water Protection Division, Environmental Assessment and Innovation Division, and Chesapeake Bay Program. The Healthy Watersheds Initiative augments the watershed approach with proactive, holistic aquatic ecosystem conservation and protection. This initiative includes both assessment and management approaches that encourage states, local governments, watershed organizations, and others to take a strategic, systems approach to conserve healthy components of watersheds and avoid additional water quality impairments in the future.

U.S. Fish and Wildlife Service

1. Provide technical expertise for a hydrologic study of the Lower Susquehanna River as a modeling exercise to determine baseline conditions for subsequent models. This work relates to relicensing activities for the Conowingo and Muddy Run hydropower projects.
2. Promote regional water supply and demand analyses to help identify alternatives to meet water supply needs and protect living resources.
3. Continue to be involved with the Conowingo Pond Management Plan, and work to help meet the flow needs of aquatic and riparian resources.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Use the recently completed Baseline Streamflow Estimator (BaSE) computer program to support instream flow ecological criteria. The BaSE estimates baseline streamflow conditions at a daily time scale for minimally-impacted, ungaged streams in Pennsylvania for the time period from 1960 to 2008. A baseline streamflow hydrograph can be generated at ungaged stream locations that are selected by the user. The report documenting the methodologies is currently in peer review. The project was funded through Pennsylvania's Growing Greener Program in partnership with The Nature Conservancy and SRBC.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. In accordance with the September 2010 Commissioner Policy on Climate Change, incorporate climate change considerations into all aspects of NYSDEC's activities, taking into account both mitigation of climate change and adaptation to the expected effects of climate change. Anticipated threats include a greater likelihood of damage from strong storms and flooding, as well as less predictable rainfall to grow crops and replenish surface and groundwater.
2. Publish the final Supplemental Generic Environmental Impact Statement (SGEIS) that evaluates the potential environmental impacts of shale gas development using horizontal drilling and high-volume hydraulic fracturing, including those impacts related to water withdrawal, use, and

disposal. The revised SGEIS will outline mitigation strategies, protection standards, and safety measures that well operators will have to follow in order to obtain a permit to drill.

Upper Susquehanna Coalition and Member Soil and Water Conservation Districts

1. Continue to implement a wetland restoration and construction program to provide multiple benefits, including maintenance of base flows and mitigation of drought impacts.
2. Continue to implement a stream program that rehabilitates stream systems and restores instream functions.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Through PADCNR's Conservation Landscape Initiatives, promote healthy ecosystems and compatible recreation in high-priority ecosystems across the state through investment, government coordination, outreach, and education (http://www.dcnr.state.pa.us/cli/index.htm).
2. Coordinate planning for healthy ecosystems and recreation through Pennsylvania's Comprehensive Outdoor Recreation Plan, which covers a period of five years. The current plan is for 2009 through 2013 (www.paoutdoorrecplan.com).

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Protect headwater ecosystems by restricting extraction of groundwater and surface water resources from headwater areas within state forest lands.

Pennsylvania Department of Environmental Protection (PADEP), Bureaus of Abandoned Mine Reclamation and Conservation and Restoration, Division of Watershed Restoration

1. Continue to work with other PADEP programs and with industry to provide guidance in the re-use of abandoned mine drainage (AMD) for Marcellus shale well development. The use of AMD reduces the need for stream water withdrawals and their potential for impacts to ecosystems and instream flows. A draft White Paper that was developed in 2011 is being finalized and will be available in 2012. The White Paper provides guidance to industry on the approval process for projects that will use AMD for Marcellus well development.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Safe Drinking Water

1. Continue to collaborate with SRBC on instream flow work, particularly as the Low Flow Protection Policy is finalized and implemented.

Pennsylvania Fish and Boat Commission (PFBC)

1. Continue to review and comment on proposed SRBC dockets for water withdrawal and consumptive water use.
2. Continue to participate in activities of the Water Resource Management Advisory Committee, including work related to SRBC's Low Flow Protection Policy.

Lancaster County Planning Commission

1. Adopt a Lancaster County Model Stormwater Ordinance with riparian corridor easement provisions.

York County Conservation District

1. Continue to provide protection through ongoing public education and outreach, and financial and technical assistance to landowners and managers.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Through the appropriation permitting program, continue to establish instream flow requirements for surface water withdrawals, with the goal of protecting aquatic ecosystems and downstream users.

Maryland Department of Natural Resources

1. Through a contract from MDE, evaluate instream flow requirements to determine whether they are adequate to maintain the ecological integrity of Maryland's streams. This work is being performed as a component of MDE's study of the Fractured Rock region of the state.
2. Continue to monitor water quality and biological conditions at sites in the lower Susquehanna River Basin to assess ecosystem health.

Harford County

1. Implement the Deer Creek Watershed Restoration Action Strategy developed by Harford County in 2007, using funding obtained under a Conservation Technical Assistance (CTA) Grant from the Natural Resources Conservation Service. The time period for the grant extends through June 2013. This grant will be used by the Harford County Soil Conservation District to plan, design, and promote riparian buffer plantings, streambank stabilization projects, wetland creation, and equine farm conservation plans. A Deer Creek Watershed outreach coordinator was hired through the grant to promote conservation efforts and implementation of agricultural best management practices in the watershed. In addition, the grant funded a stream corridor assessment of the Stout Bottle/Cabin Run subwatershed to identify additional conservation projects that will improve habitat and water quality.

ACTION NEEDED:
Identify additional Potentially Stressed Areas, address unaccounted-for water in approved projects, and implement the recommendations contained in the 2005 Groundwater Management Plan.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2014: Based on desktop screening of cumulative water use versus water availability at the watershed scale through water budget analyses, identify priorities for consideration as additional Potentially Stressed Areas.

ACTION NEEDED:
Assess potential impacts of increased water use and the potential to temper increases through conservation and water reuse, particularly in Potentially Stressed Areas, and otherwise manage water resources for sustainability.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Complete the report for the Susquehanna River Basin Low Flow Management and Environmental Restoration Project, which assessed the impacts of flow alteration on aquatic resources and the establishment of "ecological flow" criteria.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. Finalize the draft report estimating water budgets for hydrologic conditions of the Spring Creek Basin in central Pennsylvania using the coupled surface water/groundwater model, GSFLOW. The Spring Creek Basin is a Potentially Stressed Area in Centre County, Pa.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to evaluate and implement appropriate recommendations contained in the 2010 report *Potential Reuses of Greywater and Reclaimed Wastewater in New York State*. Recommendations include development of a guidance document that provides technical criteria for wastewater reuse.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Continue to manage Maryland's water resources through implementation of water appropriation and use permits. The goal of this permitting program is to ensure sustainability of Maryland water resources for all beneficial uses. Withdrawal requests are routinely evaluated for reasonableness with respect to the proposed use. The Coastal Plain aquifer study is building a regional model that will include water use as an input. Eventually, this model will be able to evaluate various water use scenarios to optimize water withdrawals for sustainability. MDE encourages water appropriation permit applicants, including power plants, to seek alternate water sources such as treated wastewater when the intended use is for industrial processes or cooling water.

ACTION NEEDED:
Encourage and incentivize water conservation by water suppliers, industry and the public through education and application of regulatory requirements.

Federal Programs and Projects

Natural Resources Conservation Service

1. Improve the efficient use of existing water supplies, improve irrigation water management, improve soil health, increase the use of moisture conserving crop production practices, and protect source water from agricultural pollutants by providing technical and financial assistance to agricultural producers through Farm Bill programs and Conservation Technical Assistance.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to support WaterSense, which is a USEPA-sponsored, voluntary partnership program that seeks to protect the future of our nation's water supply by promoting water efficiency and enhancing the market for water-efficient products, programs, and practices. WaterSense helps people save water. It is both a label for products and an information resource to help people use water more efficiently. WaterSense labeled products use at least 20 percent less water and perform as well or better than standard models. Products that earn the WaterSense label have been independently tested and certified. WaterSense labeled products will perform well, help save money, and encourage innovation in manufacturing.
2. Through WaterSense, work in partnership with irrigation professionals and irrigation certification programs to promote water-efficient landscape irrigation practices. Also, work in partnership with homebuilders, manufacturers, retailers, distributors, utilities, government agencies, and trade associations to bring WaterSense products to the marketplace and make it easy to purchase high-performing, water-efficient products. For more information, see www.epa.gov/watersense or contact Ramon D. Albizu, Environmental Scientist, at 215-814-5779.
3. Sponsor and/or participate in WaterSense outreach activities including the Pennsylvania Municipal Authorities Association's 70th Annual Conference and Trade Show on August 26-29, 2012.

U.S. Fish and Wildlife Service

1. Provide technical expertise in conjunction with SRBC and other resource agencies in developing a low flow protection plan and a technical guidance document for the Susquehanna River Basin.

New York Programs and Projects

New York State Department of Agriculture and Markets

1. Monitor and manage activities during agricultural droughts as conditions warrant.

New York State Department of Health

1. Encourage water conservation for new water supplies.
2. Recommend installation of meters.
3. Work with communities on water conservation plans during droughts, main breaks, and other emergency conditions.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Encourage reuse and treatment of wastewater produced by gas development on state forest lands by allowing and carefully maintaining the establishment of wastewater storage and treatment operations.

York County Conservation District

1. Encourage water conservation by water suppliers, industry, and the public through education and the application of source water and wellhead protection planning and implementation.

Maryland Programs and Projects

Maryland Department of the Environment (MDE)

1. Continue to require all water utilities that use more than 10,000 gallons per day, and all utilities requesting funding through the State Revolving Loan Fund, to submit annual water audits. If water losses are greater than 10 percent, utilities are asked to develop and implement a water loss reduction plan.
2. MDE finalized new Guidelines for Land Application of Wastewater in 2010. MDE will continue to work with stakeholders to develop water reuse regulations to authorize use of treated wastewater effluent for other purposes including residential landscape irrigation.
3. Continue to encourage water appropriation permit applicants, including power plants, to seek alternate water sources such as treated wastewater when the intended use is for industrial processes or cooling water.

ACTION NEEDED:
Revise the Commission's Drought Coordination Plan in consultation with the Drought Coordinating Committee.

Susquehanna River Basin Commission Programs and Projects

1. By June 2013: Revise SRBC's Drought Coordination Plan.

ACTION NEEDED:
Monitor the ecosystem effects of diversions of water to and from the basin and transfers of water from one waterbody to another within the basin, including water quality requirements.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. Perform selective monitoring at projects of special interest to PFBC, such as Hartzdale Municipal Authority's withdrawal from Trim Root Run, Clearfield County, Pa.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

1. If resources were to be made available, potentially continue to monitor ecosystem effects associated with transfers and diversions of mine pool water and/or AMD from the Susquehanna River Basin to the Delaware River Basin, from the Delaware River Basin to the Susquehanna River Basin, and from one watershed to another within the Susquehanna River Basin.
2. Continue to provide updated information regarding EPCAMR's recent study (http://www.epcamr.org/storate/projects/MinePoolMapping/Mine_Water_Resources_of_the_Anthracite_Coal_Fields_-_Report.pdf) that provided estimates of water budgets and groundwater volumes stored in abandoned underground mines in the Western Middle Anthracite Coalfield. The work was performed in partnership with the U.S. Geological Survey (http://pa.water.usgs.gov/projects/groundwater/westernmiddle/), and encompassed a 120 square mile area in eastern Pennsylvania. The Mahanoy and Shamokin Creek Basins were the focus of the study because they exhibit extensive hydrologic effects and water quality degradation from AMD in their headwaters and throughout their respective watersheds.

York County Conservation District

1. Monitor the ecosystem effects of transfers of water from one waterbody to another including water quality effects, as necessary.

Maryland Programs and Projects

Maryland Department of the Environment

1. Continue the water supply study of the Fractured Rock region of Maryland which was initiated in 2009. This study will evaluate all water uses within specific basins, including withdrawals, discharges, and interbasin transfers. One goal of the study is to provide information and tools that enable the Water Supply Program to assess the potential cumulative impacts of withdrawals on aquatic resources within a basin.

ACTION NEEDED:

Implement recommendations of the Commission's Consumptive Use Mitigation Plan. Key recommendations include, among others: (a) the evaluation of existing U.S. Army Corps of Engineers' and other reservoirs for the potential to enhance current release operations; (b) the evaluation of the ability of abandoned mines and quarries to supply water for releases during droughts; and (c) the assessment of specific needs for instream flows to meet riparian, water supply, water quality, habitat and recreational uses.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013: Provide necessary support to the U.S. Army Corps of Engineers (USACE) for the study of optimizing the use of water storage at Cowanesque and Curwensville Lakes. After completion of the existing phase of study, work with USACE to scope and initiate the next phase of work leading to implementation of revised low flow operations at the two lakes.
2. Throughout FY-2013: Coordinate with USACE regarding the Section 1135 Study for Foster Joseph Sayers Lake and, if federal funding is provided, initiate the study with SRBC as the non-federal project sponsor.

3. By December 2012: Finalize the scope of work for Phase 2 of the Susquehanna Basin Section 729 Study in cooperation with USACE. If federal funding is provided, initiate the study in FY-2013 or FY-2014 with SRBC as the non-federal project sponsor.
4. Throughout FY-2013: Complete preliminary assessments of potential mine pool storage in the Anthracite Coal Fields, develop prioritized lists of mine pools by major subfield, continue mine pool mapping and water quantity/quality monitoring, and develop preliminary cost estimates and next steps for implementation.
5. Throughout FY-2013: Continue coordination with the Pennsylvania Department of Conservation and Natural Resources regarding the optimization of existing Commonwealth-owned lake storage and releases for consumptive use mitigation and ecosystem flow protection.
6. By June 2013: Complete the Barnes and Tucker Transit Loss Study to quantify and memorialize pass-through at USACE's Curwensville Lake.
7. Throughout FY-2013 and FY-2014: Continue to work with the Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation and its consultants on mine pool projects for mitigating agricultural consumptive use in the Pennsylvania portion of the Susquehanna River Basin.
8. Throughout FY-2013 and FY-2014: Implement The Nature Conservancy's ecosystem flow recommendations at existing and proposed consumptive use mitigation projects.
9. Throughout FY-2013 and FY-2014: Update and refine the existing and projected amounts of water needed for consumptive use mitigation.
10. Throughout FY-2013 and FY-2014: Reevaluate the existing consumptive use mitigation program to ensure its reasonableness and effectiveness in meeting the desired objectives, and develop and memorialize the program standards and criteria.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Continue to assess the potential for USACE reservoirs to provide low flow releases and reduce downstream ecological impacts

U.S. Fish and Wildlife Service

1. Coordinate with other resource agencies and provide technical expertise through SRBC's Water Resource Management Advisory Committee to develop recommendations that will protect ecosystem flow needs through SRBC guidance, policy, and regulations.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue working with SRBC to investigate the potential to adjust the timing of planned drawdowns at several PADCNR lakes to help meet instream flow requirements.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks and Bureau of Forestry

1. Continue to cooperate closely with the U.S. Army Corps of Engineers and other partners regarding reservoir release plans and releases at state park and forest recreation facilities, including Bald Eagle State Park, Kettle Creek Reservoir, and Sinnemahoning State Park.

Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation

1. Continue operation of the recently constructed Lancashire #15 Mine Drainage Treatment Plant in the headwaters of the West Branch Susquehanna River. The completed plant is now discharging up to 10 million gallons of water per day of treated mine water back into the basin. This water

was previously being treated at another treatment plant across the watershed divide and was being discharged into Blacklick Creek in the Ohio River Basin.

Pennsylvania Department of Environmental Protection, Bureau of Conservation and Restoration, Division of Watershed Restoration

1. Continue the pre-design phase of the Cresson Acid Mine Drainage Treatment Project, to be located in the headwaters of Clearfield Creek. This plant is proposed to provide up to 5.7 million gallons per day of treated abandoned mine drainage from mine pools into the basin during low flow conditions. The current project phase will be completed in 2012 and will be followed by initiation of the design phase. The tentative target date for the start of construction is 2014.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

1. If resources were to be made available, potentially evaluate the ability of abandoned mines and abandoned, water-filled stripping pits and/or dry stripping pits to supply water for releases during low flow conditions in the Susquehanna River Basin.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Through the appropriation permitting program, continue to establish instream flow requirements for surface water withdrawals, with the goal of protecting aquatic ecosystems and downstream users. In 2009, a study of the Fractured Rock region of Maryland was initiated. One goal of this study is to evaluate instream flow requirements to determine whether they are adequate to maintain ecological integrity in Maryland's streams.
2. Continue to provide feedback to local governments on their comprehensive plans' water resources element (WRE) submittals, as required in a 2006 law. One element of the WRE is the evaluation of nutrient loadings based on current and future zoning scenarios.

ACTION NEEDED:

In the absence of adequate water for local mitigation, restrict new water use to avoid impacts to vulnerable watersheds.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2014: Based on desktop screening of cumulative water use versus water availability at the watershed scale through water budget analyses, identify vulnerable watersheds for potential restrictions in new water use.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Susquehanna River Basin Commission Programs and Projects

1. In FY-2013: Prepare a cumulative impact analysis of water withdrawals and consumptive uses on the water resources of the Susquehanna River Basin.
2. Throughout FY-2013 and FY-2014: Continue to provide effective enforcement of SRBC's regulatory program through the use of improved technology and operation of SRBC's Sayre field office, which is located in the portion of the basin under rapid development for natural gas production.

Federal Programs and Projects

Natural Resources Conservation Service (NRCS)

1. Ensure proper local operation and maintenance of NRCS-assisted multiple purpose dams that include water supply and are located in the following watershed projects in Pennsylvania: Marsh Creek, Middle Creek, and Mill Creek (Tioga County).

NOAA National Weather Service

1. Provide long-term (30-day) probability forecasts for 59 river locations within the Susquehanna River Basin (Sherburne, Greene, Chenango Forks, Cortland, Cincinnatus, Unadilla, Rockdale, Bainbridge, Windsor, Conklin, Binghamton, Vestal, Owego, West Cameron, Campbell, Mansfield, Tioga Junction, Lindley, Corning, Elmira, Chemung, Waverly, Towanda, Monroeton, Meshoppen, Tunkhannock, Old Forge, Wilkes-Barre, Bloomsburg, Danville, Karthaus, Sinnemahoning, Renovo, Beech Creek Station, Lock Haven, Cedar Run, Jersey Shore, Williamsport, Loyalsockville, Milton, Lewisburg, Penns Creek, Sunbury, Raystown Bridge, Williamsburg, Spruce Creek, Huntingdon, Mapleton Depot, Shirleysburg, Lewistown, Newport, Shermans Dale, Hogestown, Harrisburg, Camp Hill, Harper Tavern, Hershey, Marietta, and Lancaster).
2. Support the National Integrated Drought Information System through stakeholder engagement and provision of hydrometeorological data.
3. Provide comprehensive snow observations, snow modeling and data assimilation, analyses, map products, Interactive Visualization Tools, integrated snow datasets for geospatial applications, satellite snow cover mapping, and airborne snow surveys (http://www.nohrsc.noaa.gov/).
4. Provide routine web-based Water Resources Outlook information on a year-round basis (http://www.erh.noaa.gov/marfc/wro_north.shtml).
5. Provide seasonal water supply outlook information in winter/spring river flood potential outlook statements (January through April).

New York Programs and Projects

New York State Department of Health (NYSDOH)

1. Continue to work closely with the New York State Department of Environmental Conservation's Division of Water on source water protection activities such as, but not limited to, nutrients, harmful algal blooms, water quality standards, and natural gas drilling. The NYSDOH role is mainly to ensure that protection of drinking water resources is a priority. For example, in March 2011 NYSDOH worked closely with the U.S. Environmental Protection Agency (USEPA) to sponsor the source water collaborative forum for the Delaware River Basin held at Sullivan County Community College. (NYSDOH has primacy from the USEPA for the drinking water program under the Safe Drinking Water Act. In that role, NYSDOH is responsible for overseeing the public water supplies in New York State.)

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey

1. Continue to further enhance the Pennsylvania Groundwater Information System, which is a database available to the public.
2. Initiate an update of oil and gas databases.

Pennsylvania Fish and Boat Commission (PFBC)

1. As indicated in the *PFBC Strategic Plan for July 2010 to June 2015* and *Strategic Plan for Management of Trout Fisheries in Pennsylvania*, PFBC will assist with development of instream flow methods and criteria for statewide application in concert with the Pennsylvania Department

of Environmental Protection, other government agencies, and non-governmental organizations such as The Nature Conservancy.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to work with SRBC and others to implement the Anthracite AMD strategy.

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Priority Management Area B – Water Quality

Remote Water Quality Monitoring Station (left) and taking stream flow measurements (right).

Desired Result: *To support the designated uses of all waterbodies by achieving water quality that meets or exceeds standards.*

The following Actions Needed under Priority Management Area B – Water Quality are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 50-54. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests.

ACTION NEEDED:
Monitor and assess waters for bacteria, pharmaceuticals and personal care products, and other emerging contaminants of concern.

Federal Programs and Projects

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to participate in the Susquehanna River Fish Health Issue Project coordinated with the Pennsylvania Fish and Boat Commission (PFBC) and the Pennsylvania Department of Environmental Protection (PADEP), and to serve on the technical and policy advisory panels for the project. The project taskforce and technical advisory panel were formed to investigate the cause(s) of and address die-offs of young-of-the-year smallmouth bass due to lesions and other health issues in the Susquehanna River mainstem and selected tributaries. Members of the technical advisory panel include the PFBC, PADEP, U.S. Geological Survey, SRBC and USEPA. To date, USEPA has provided technical advice and loaned the taskforce a set of five multi-probe water quality monitors to be deployed in tributaries to monitor water quality. USEPA will continue to serve on the advisory panel for this collaborative project.

U.S. Geological Survey, Pennsylvania Water Science Center

1. By October 1, 2012, publish a report evaluating wastewater byproducts, hormones, personal care products, and pharmaceuticals in water and sediment downstream of wastewater treatment plants in Pennsylvania. Many of the evaluation sites are located in the Susquehanna River Basin.

New York Programs and Projects

New York State Department of Health (NYSDOH)

1. Work on emerging issues on an as-needed and proactive basis. For example, NYSDOH has external funding for research on pharmaceuticals and personal care products, as well as harmful algal bloom toxins. Staff continues to apply for additional funding to continue and expand this work.
2. Update monitoring requirements and safe drinking water standards for public water supplies.
3. Provide existing and new water suppliers with information and monitoring assistance

New York State Department of Health/County Health Departments

1. Assist with interpretation of water quality monitoring results for public and private water supplies.
2. Conduct monitoring of private water supplies for bacteria and other contaminants, including onetime surveys in selected high risk areas when resources allow.

Cortland County Health Department

1. Continue to oversee monitoring for coliform bacteria in public water supplies. The Cortland County Health Department has an interest in monitoring for pharmaceuticals and personal care products.

Biological Field Station for the State University of New York at Oneonta/Otsego County Conservation Association

1. Continue biweekly monitoring of Otsego and Canadarago Lakes for a variety of physical and biological parameters.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. Continue to collect water quality samples twice each week at Shawnee Lake for *E. coli* analysis by the Pennsylvania Department of Environmental Protection (PADEP).
2. Continue to collect water quality samples twice each week at Glendale Lake, Prince Gallitzin State Park, for *E. coli* analysis by PADEP.
3. From Memorial Day until Labor Day each year, continue to collect weekly water samples at Worlds End State Park in partnership with Lycoming Creek Watershed Association and Lycoming College.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Point and Non-Point Source Management

1. Organize volunteers to collect bacteria samples at selected streams across the Commonwealth. Two sets of five samples will be collected to compute two geometric means for comparison to criteria. The results will be evaluated and the resulting assessments will be included in PADEP's Integrated Section 305(b)/303(d) Report submitted to the U.S. Environmental Protection Agency.

Lake Marburg Advisory Committee

1. Continue to perform periodic water quality monitoring of tributary streams entering Lake Marburg.

York County Conservation District

1. Perform monitoring and assessments for bacteria, pharmaceuticals, personal care products, and other emerging contaminants of concern, as time and resources allow.

Maryland Programs and Projects

Maryland Resource Agencies

1. No emerging contaminant monitoring activities are planned by the Maryland Department of Natural Resources in Fiscal Years 2013 – 2014. Maryland Department of the Environment considers pharmaceuticals and personal care products as only a potential problem. In general, risk concentrations have not been determined, so interpretation of monitoring results is uncertain. Because bacterial contamination is an existing problem with measurable risk levels, Maryland is recommending that all jurisdictions list water impairments based on bacteria and develop appropriate total maximum daily loads (TMDLs).

ACTION NEEDED:
Monitor for zebra mussels and other invasive species.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to implement zebra mussel monitoring protocols for river stations as part of the interstate, subbasin survey, and large river monitoring programs, as well as aquatic resource surveys.
2. By December 2012: Complete development of an invasive species tracking database and begin populating it with data collected during FY-2012 and FY-2013.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Carefully monitor development and spread of zebra mussels and other invasive species at USACE reservoirs. Monitoring is being performed at Cowanesque Lake in conjunction with Pennsylvania Sea Grant, because some zebra mussels were discovered at the project in 2007.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Support efforts to eradicate hydrilla in the Cayuga Inlet and monitor for the spread of this invasive aquatic plant into neighboring areas, including the Susquehanna River Basin. Conduct training sessions on invasive species identification to facilitate early detection of any new occurrences of hydrilla or other invasive species.
2. Promote monitoring through iMap Invasives, and research through the Invasive Species Research Institute throughout the Susquehanna River Basin.
3. Continue to conduct biological surveys in Susquehanna River Basin streams as part of the Eastern Brook Trout Joint Venture and in other locations within the basin, providing the opportunity to detect zebra mussels and other invasive species.

Biological Field Station for the State University of New York at Oneonta

1. Conduct monitoring and research on invasive species in Otsego Lake and the Upper Susquehanna River Basin, including work on zebra mussels (first discovered in Otsego Lake in 2007) and starry stonewort (*Nitellopsis obtusa*, an aquatic species of macroalgae that can form dense mats along the lake bottom, pushing out most other plant species).

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue to plan, manage, and perform educational outreach regarding invasive plant species, particularly within targeted state parks and forests.

2. Continue to address purple loosestrife issues on Susquehanna River islands by using loostrife beetles.

Pennsylvania Department of Conservation and Natural Resources (PADCNR), Bureau of State Parks

1. At Shawnee State Park, continue to monitor Shawnee Lake for the presence of zebra mussels and other invasive species, and work with PADCNR, Resource Management and Planning Division to control and improve lake water quality. In addition, provide environmental education programs on invasive species and water quality in the lake.
2. At Prince Gallitzin State Park, continue to monitor Glendale Lake for the presence of Eurasian watermilfoil and other invasive species and work in partnership with PADCNR, Resource Management and Planning Division to control invasive species. In addition, provide environmental education on invasive species and how to avoid transporting them to other areas.
3. At Gifford Pinchot State Park, continue control of invasive of aquatic plant species.

Pennsylvania Department of Environmental Protection, Bureau of Point and Non-Point Source Management

1. Continue to participate in the interagency monitoring program, with Pennsylvania Sea Grant as the lead agency for monitoring zebra mussels and other invasive species.

Pennsylvania Fish and Boat Commission (PFBC)

1. Through PFBC's Environmental Services Division, assist with invasive species monitoring and response.

York County Conservation District

1. Monitor for aquatic and terrestrial invasive species, as time and resources allow.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to look for invasive species among other biological samples collected from sites in the Susquehanna River Basin in Maryland.

ACTION NEEDED:
Expand the Commission's Early Warning System (EWS) for public water suppliers in the basin.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Maintain SRBC support for the existing EWS and continue public outreach with water suppliers and universities to identify additional monitoring sites for possible addition to the system.
2. Throughout FY-2013 and FY-2014: Add additional sites to the EWS as financial resources allow.
3. Throughout FY-2013 and FY-2014: Through updates to the EWS website, increase availability of non-sensitive data to the public.

ACTION NEEDED:
Develop, support, and implement remediation plans for areas of the basin that are impacted by AMD, agricultural, urban, and other sources.
(AMD stands for abandoned mine drainage. This acronym is referenced periodically from this point on.)

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Complete the Susquehanna Mine Drainage Database by December 2012, and maintain the database to assist the Pennsylvania Department of Environmental Protection and the U.S. Office of Surface Mining in identifying potential areas for remediation and/or use of lesser quality water.
2. Throughout FY-2013 and FY-2014: Complete additional phases of the Bear Run AMD Restoration Project through the Pennsylvania Growing Greener Renaissance Grant Program by June 2013 and pursue additional funding that could be used for continued restoration.
3. Throughout FY-2013 and FY-2014: Continue to provide information on the SRBC website to publicize the Paxton Creek and Cedar Run stormwater project results and continue stormwater remediation support work within targeted watersheds in the Lower Susquehanna Subbasin.
4. Throughout FY-2013 and FY-2014: Continue work on Total Maximum Daily Loads (TMDLs) for impaired watersheds in the basin, more specifically through support to Pennsylvania associated with data collection, modeling, document preparation, and public participation.
5. Throughout FY-2013 and FY-2014: Continue collecting data for the Chesapeake Bay Program in support of the Chesapeake Bay TMDL, and also participate in periodic conference calls and meetings of the Chesapeake Bay Water Quality Goal Implementation Team (WQGIT) (formerly Chesapeake Bay Water Quality Steering Committee), as well as the Non-Tidal Workgroup.
6. By August 2012: Complete the pilot test for the project inventory database tool for tracking completed/proposed planning and implementation work within the Lower Susquehanna Region. Contingent upon funding, support use of the tool with partner groups throughout FY-2013 and FY-2014.

Federal Programs and Projects

National Park Service

1. Implement priority recommendations of the Carr's Creek Watershed Management Plan including planting riparian buffers on stream reaches adjacent to active agricultural lands and installing livestock exclusion fencing at priority sites on Carr's Creek and Willow Brook.

Natural Resources Conservation Service (NRCS)

1. Address critical agricultural surface and groundwater resource concerns related to soil erosion, sediment, nutrients, organic materials, pathogens, and agri-chemicals by providing technical and financial assistance to agricultural producers through Farm Bill programs and Conservation Technical Assistance
2. Provide Watershed Program planning assistance to address nonpoint source and mine drainage pollution at the request of local project sponsors, if funded.
3. Ensure proper local operation and maintenance of NRCS Watershed Program assisted mine drainage remediation measures in the Glenwhite Run Watershed, Blair County, Pa.
4. Assist and collaborate with Soil and Water Conservation Districts, Cornell Cooperative Extension, and other partner agencies and groups in the establishment of a formalized ranking process to prioritize projects for funding to address water quality concerns for agricultural operations. The ranking should be supported by data derived from the New York State Agricultural Environmental Management (AEM) process.

U.S. Army Corps of Engineers (USACE)

1. Support development of AMD solutions, including investigations, design, and construction activities within the USACE Continuing Authorities Program as funding becomes available. Studies regarding AMD are currently underway for Powderly Creek, Brubaker Run, Fall Brook, Six Mile Run, and Sandy Run.
2. As funding becomes available, support development of studies or projects for: The Susquehanna and Delaware River Basins Southern Anthracite Coal Region Study; The Juniata, Chemung, and

Upper Susquehanna River Basin Program under Section 567 of WRDA 1996; The Chesapeake Bay Environmental Restoration and Protection Program under Section 510 of WRDA 1996; The North Central, Pennsylvania Study (Resolution, House Committee on Transportation and Infrastructure, October 26, 2005); and the Chesapeake Bay Comprehensive Plan under the USACE General Investigations Program.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to fund projects under USEPA's Nonpoint Source Program under Section 319 of the Clean Water Act. In 2012, approximately 38 on-the-ground projects are being supported with at least $7.03 million in funding within the Susquehanna River Basin. These projects are detailed in watershed implementation plans submitted to USEPA outlining the actions needed to remediate streams impacted by abandoned mine drainage and agricultural and urban stormwater runoff pollution. In addition, significant Section 319 funds not included in the project totals above help support state staff positions. More information is available from Fred Suffian, Program Manager, Nonpoint Source Pollution Program at 215-814-5753.
2. Promote new stormwater science, practices, and treatment through an ongoing Stormwater Science Team comprised of members from USEPA's Office of Research and Development, as well as USEPA Regions 1, 2, and 3. Concepts include: 1) mimicking and restoring natural ecosystems and hydrologic cycles (flow regimes), 2) implementing innovative best management practices (BMPs), 3) enhancing regulatory mechanisms, and 4) addressing economic incentives, concerns, and issues.

U.S. Fish and Wildlife Service

i. Continue to provide technical support in reducing sediment in tributaries through identification, assessment, prioritization, and implementation of projects.
ii. Provide technical assistance in developing watershed level sediment management plans.
iii. Develop a strategy to restore sediment trapping capacity of Conowingo and upstream dams.
iv. Continue habitat restoration efforts such as restoring riparian buffers using assessment data developed by SRBC.
v. Coordinate with resource agencies to study water treatment and discharges (including deep well injection) associated with natural gas production to help determine any potential adverse impacts to surface and groundwater resources.
vi. Construct the Dalebrook Farms bog turtle habitat restoration project in Adams County, Pa. This is a 45-acre site needing 6,000 feet of woven-wire livestock fencing, with an additional 1,700 feet of subdivision fencing. This is a Partners for Fish and Wildlife Program project involving Dalebrook Farms, the Pennsylvania Fish and Boat Commission (PFBC), California University of Pennsylvania, the Mid-Atlantic Center for Herpetology and Conservation, Sir Sanford Fleming College, and Penn State University.
vii. Restore a riparian buffer and woodcock habitat along Elk Creek, Pa. This is a Partners for Fish and Wildlife Program project that includes plantings of aspen, alder, and silky dogwood along 1,000 feet of stream. Partners include the Fox Gap Rod and Gun Club and the Conservation Reserve Enhancement Program of the Natural Resources Conservation Service.
viii. Construct the Dinges Stream Restoration Project along Elk and Pine Creeks. This Partners for Fish and Wildlife Program project includes restoration of 1,000 feet of stream using 20 instream structures including rock vanes, mudsills, and log vanes. Partners include the Natural Resources Conservation Service, PFBC, Habitat Forever, California University of Pennsylvania, and the landowner.
ix. Construct the Tom Donmoyer Stream Restoration Project along an unnamed tributary to Swatara Creek. Runoff from parking lots and the Hollywood Casino and racetrack has increased flows, leading to increased bank erosion. Partners for this project include Lebanon County Conservation District, the Natural Resources Conservation Service, California University of Pennsylvania, Habitat Forever, and the landowner.

x. Work in partnership with the Lancaster County Conservation District to restore over 1,500 feet of stream habitat in Mill Creek using log and rock vanes and mudsills. Other partners include the Pennsylvania Department of Environmental Protection and the Mill Creek preservation Association.

xi. Restore about 1,200 feet of stream along Penns Creek using mudsills, log vanes, and rock vanes. Project partners include Penn State University, the Natural Resources Conservation Service, Habitat Forever, and the landowner.

U.S. Forest Service

1. In 2012, produce a Forest Restoration Strategy for the Chesapeake Bay to maximize the use of tree plantings to restore priority areas including: residential land currently managed as lawn; areas covered by community tree canopy expansion and green infrastructure programs; gaps in core wildlife habitat; deficient lands such as abandoned mine lands, brownfield areas, and lands with vulnerable soils; and agro-forestry areas.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Prepare a draft report evaluating the effectiveness of mine drainage treatment systems in the Pennsylvania bituminous and anthracite coal fields to remove priority pollutants. Permitted mine effluent sites were sampled to demonstrate that routine treatment effectively removes metals. This project was performed in cooperation with the Pennsylvania Department of Environmental Protection.
2. Continue to work in partnership with the Pennsylvania Department of Agriculture to assess pesticides in vulnerable aquifers. A project goal is to document long term changes in pesticide concentrations and evaluate hotspot areas where aquifers have pesticide contamination. A journal article documenting results from data collected in 2008 – 2010 will be published in the Journal of Environmental Quality by September 30, 2012.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to implement water quality restoration and protection measures recommended in the Priority Waterbodies Lists for the Chemung and Susquehanna Basins.
2. Maintain accurate and up-to-date assessment information for the "Susquehanna River Basin Waterbody Inventory and Priority Waterbodies List" that reflects findings from the latest Rotating Integrated Basin Study of the eastern Susquehanna River Basin, and other available information.

New York State Soil and Water Conservation Committee

1. Promote water quality improvements and the protection of potable water sources in agricultural areas through the Agricultural Environmental Management Program and the Agricultural Nonpoint Source Grant Program.

County Soil and Water Conservation Districts

1. Work with both the agricultural sector and municipalities to deal with nonpoint source pollution from agricultural runoff and stormwater. (Following the state-legislated Agricultural Environmental Management plan, identify and work with farms in the county that need conservation plans and ultimately implementation projects.)

Upper Susquehanna Coalition

1. Develop regional projects and grant applications to support and enhance the water quality restoration and protection efforts of member Soil and Water Conservation Districts.

2. Implement the Upper Susquehanna Coalition Grazing Initiative which supports prescribed grazing, riparian buffers, and cow exclusion from streams. (This initiative addresses sediment and nutrient loading to streams and rivers and reduces stream erosion problems.)

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue to promote the remediation of abandoned mine lands on PADCNR lands through reforestation and support for the principles of the Appalachian Regional Reforestation Initiative.
2. Through PADCNR's TreeVitalize program, continue to promote establishment of urban tree canopy in major cities. The program has a statewide goal of one million street trees to be planted by 2015.
3. Continue to work with the Pennsylvania Association for Sustainable Agriculture, Penn State University, Shaver's Creek Environmental Center, and other partners to encourage active forest management and to promote agricultural forestry and permaculture practices on private forest and agricultural lands.

Pennsylvania Department of Conservation and Natural Resources (PADCNR), Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Provide incentives for AMD reclamation projects by offering mineral rights in exchange for capital or labor applied toward AMD reclamation.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. At Ricketts Glen State Park, continue to treat 245-acre Lake Jean on an as-needed basis with high quality lime to increase low pH caused by acid rain
2. At Little Buffalo State Park, pursue a potential stream bank rehabilitation project in partnership with the Pennsylvania Fish and Boat Commission (PFBC). The rehabilitation area is along Little Buffalo Creek at the west end of the park, where the creek enters the lake. Details of the project are being developed, with a possible start date in summer 2012.
3. During FY-2013 and FY-2014: At the Kings Gap Environmental Education Center, upgrade erosion controls on sections of the park's trail system and institute control measures in the recently acquired 1,007 acre Ritter Property.
4. During FY-2013 and FY-2014: At Shawnee State Park, work with the Bedford County Conservation District to develop a watershed plan to restore water quality in the lake. In-lake measures will also be developed to address nutrient concentrations, reduce turbidity, and water column issues.
5. During FY-2013 and FY-2014: At Prince Gallitzin State Park, work with the Cambria County Conservation District and the PFBC to complete shoreline stabilization projects along McKee's Run, Turtle Cove, Cabin Area, and other shorelines at Glendale Lake.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Abandoned Mine Reclamation (BAMR)

1. Complete construction of the Hollywood AMD Treatment Plant using Commonwealth of Pennsylvania capital budget and PADEP AMD set aside funds. BAMR has developed a Hydrologic Unit Plan to restore Bennett Branch Sinnemahoning Creek from the impacts of AMD. Several surface reclamation projects that included alkaline addition have been completed in the watershed. More projects are planned or underway, including the Hollywood plant that will provide a centralized facility to treat a number of discharges to be collected via a pipeline collection system.
2. By FY-2013: Initiate construction of a surface reclamation/alkaline addition project known as Fran Contracting, which will be located in the Cooks Run Watershed, a tributary of the West

Branch Susquehanna River. BAMR staff completed development of the Cooks Run Qualified Hydrologic Unit report in 2011. This allows for the funding of watershed restoration activities using AMD set aside funds in that watershed.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Conservation and Restoration, Division of Watershed Restoration (BCR-DWR)

1. Continue to perform work that will lead toward restoration of the West Branch Susquehanna River. A Qualified Hydrologic Unit report for the headwaters of the West Branch Susquehanna River was completed in 2010, making the upper West Branch Susquehanna River eligible for funds under PADEP's AMD set aside program. The transfer of the Lancashire #15 mine drainage treated water to the headwaters from outside the basin will facilitate restoration of the upper West Branch Susquehanna River and is a very important aspect of this watershed restoration plan. PADEP staff is evaluating the potential to direct additional abandoned mine discharges into the Lancashire #15 Plant.
2. Continue to review existing Hydrologic Unit Plans in the basin to determine if original restoration goals have been met or if additional projects are needed to meet the goals. Once this evaluation is complete, PADEP will determine whether to spend additional AMD set aside funds to meet the goals of the existing Hydrologic Unit Plans.

Pennsylvania Department of Environmental Protection, Bureau of Mining Programs

1. During FY-2013 and FY-2014: Construct AMD treatment systems for the projects listed below.
    a. Chews Contracting, Boggs Township, Clearfield County
    b. Avery Coal (Victoria #1), Boggs Township, Clearfield County
    c. Avery Coal (Pine Glen), Burnside Township, Centre County
    d. Power Operating (Dugan #2), Rush Township, Centre County
    e. Thompson Brothers (Alder Run #1), Morris Township, Clearfield County

Pennsylvania Department of Environmental Protection, Bureau of Point and Non-Point Source Management

1. Continue to participate in the Chesapeake Bay Non-Tidal Monitoring Program that includes targeting high priority watersheds for implementing best management practices and remediation plans.

Pennsylvania Fish and Boat Commission

1. Assist in development of abandoned mine drainage remediation plans and goals in coordination with the Pennsylvania Department of Environmental Protection's Bureau of Abandoned Mine Reclamation and SRBC.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to work with watershed groups to develop, support, and implement remediation plans for areas impacted by AMD, and to develop Qualified Hydrologic Unit Plans under the guidance of the Pennsylvania Department of Environmental Protection (PADEP) to make those watersheds eligible for Surface Mining Control and Reclamation Act Title IV set-aside funding.
2. Continue to provide technical assistance to the PADEP and the oil and gas industry regarding the use of abandoned mine drainage for Marcellus Shale gas well development. The use of AMD reduces the need for stream water withdrawals and can help reduce the potential for impacts to ecosystems and instream flows.
3. Continue to support a strategic, geographically based process to prioritize projects for abandoned mine land restoration, including potential reclamation projects under the Pennsylvania Highlands Action Program.
4. Continue to implement AMD projects with funding provided by the Environmental Protection Agency under Section 319 of the Clean Water Act.

5. Continue to promote the remediation of AMD from abandoned surface and underground coal mine lands by providing grant assistance and technical support for best treatment approaches.

Trout Unlimited Eastern Abandoned Mine Program

1. Complete construction of the Swamp Area and Robbins Hollow 10A/10B AMD passive treatment projects in the Kettle Creek Watershed, Clinton County.
2. Complete a comprehensive evaluation of AMD discharges, abandoned mine land features, and biological and chemical status of the Potts Run Watershed, Clearfield County.
3. Continue to provide funding, as needed and available, to SRBC for West Branch Susquehanna River database updates. Trout Unlimited recently committed $10,000 to SRBC for updates.
4. Continue to provide project and financial support to the Clinton County Conservation District for construction of the Muddy Run passive treatment system in the Tangascootack Creek Watershed, Clinton County.
5. Provide financial support to the Clearfield County Conservation District for the design, permitting, and construction of the Deer Creek Powerline Discharge AMD Treatment System in the Deer Creek Watershed, Clearfield County.
6. Continue to support the assessment and plans for AMD remediation in the Drury Run and Birch Island Run Watersheds in Clinton County. To date, Trout Unlimited has supported these efforts by providing sampling assistance and contributing funding from its Brook Trout Mini-Grant Program. Pending resource availability, Trout Unlimited intends to continue assistance for these projects.
7. Support AMD remediation, along with the establishment of long-term operation and maintenance trust funds, for the purpose of use by the natural gas industry in well development activities.
8. Continue to implement Trout Unlimited's AMD Technical Assistance program, which has provided technical assistance to 37 groups for 65 projects in the Susquehanna River Basin. These projects included rapid characterization of AMD, conceptual design of AMD treatment systems, rapid watershed assessments, existing treatment system evaluation and recommendations, and biological monitoring.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which encourages municipalities to implement remediation plans.

York County Conservation District

1. Support the development and implementation of remediation plans for areas of York County that are affected by nonpoint sources.

Maryland Programs and Projects

Maryland Resource Agencies

1. Continue to work closely with county governments to develop Watershed Implementation Plans that meet the nutrient and sediment reductions called for in the Chesapeake Bay total maximum daily load (TMDL). Plans will be developed on a county geographic scale and will include 2-year milestones for both best management practice implementation and programmatic changes needed to accelerate nutrient and sediment reductions. These include activities in the Susquehanna River Basin within Baltimore, Carroll, Cecil, and Harford Counties. Phase II Plan drafts were submitted before 2012, with final plans due for submission to the U.S. Environmental Protection Agency in mid-2012. Implementation activities and reporting on pollutant loadings will continue as part of Maryland's routine, biennial evaluation process.

Harford County

1. Implement the Deer Creek Watershed Restoration Action Strategy developed by Harford County in 2007, using funding obtained under a Conservation Technical Assistance (CTA) Grant from the Natural Resources Conservation Service.

ACTION NEEDED:

Encourage public and private support, maintenance, and upgrades of the infrastructure needed for drinking water withdrawal, treatment; stormwater management projects; combined sewer overflows; sanitary septic overflows; and other projects needed for the maintenance and improvement of water quality.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Support development of Section 219 water infrastructure projects in Pennsylvania.
2. Develop the Section 510, Chesapeake Bay Environmental Restoration and Protection Program to support environmental infrastructure and restoration.
3. Continue water quality data collections and evaluations at USACE reservoirs. Where possible, operate dams and reservoirs to improve both in-lake and downstream water quality.
4. Pursue opportunities to develop watershed assessments and plans.
5. Conduct the Lower Susquehanna River Watershed Assessment to help manage sediment in the lower Susquehanna River and its impact on Chesapeake Bay.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to oversee National Pollutant Discharge Elimination System permitting and enforcement programs in Pennsylvania and Maryland, with emphasis on:
    a. insuring that municipal, stormwater, and industrial permits in the Chesapeake Bay Watershed incorporate limits consistent with the Chesapeake Bay Total Maximum Daily Load,
    b. reviewing permits authorizing disposal of Marcellus shale wastes through publicly owned treatment works or industrial waste facilities,
    c. implementing the Pretreatment Program in Pennsylvania, and
    d. overseeing Pennsylvania's Confined Animal Feeding Operation (CAFO) Program.
2. Continue to provide funding for the Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF), which are state-managed programs that fund infrastructure projects with public health and water quality benefits, in addition to funding green infrastructure, water efficiency, stormwater, and nonpoint source projects. New York, Pennsylvania, and Maryland solicit and rank applications for funding and select projects based on established priorities.
3. Provide guidance and technical assistance to federal facilities to meet the Energy Independence and Security Act (EISA) requirement to match pre- and post-development hydrology or meet the proposed guidance of capturing the volume of the 95th percentile storm event.
4. Finalize the Pennsylvania Stormwater Program Assessment (conducted in July 2011) and ensure that Pennsylvania's stormwater programs :
    a. will be able to meet the goals (with regulations and policies) set forth in Pennsylvania's Watershed Implementation Plans,
    b. have current, effective, and enforceable Municipal Separate Storm Sewer System (MS4) permits,
    c. have adequate staff to implement the program, and
    d. perform inspections at an appropriate frequency and are taking appropriate enforcement actions.

5. Provide implementation assistance for Pennsylvania's recently approved Municipal Separate Storm Sewer System (MS4) general permit (PAG-13). USEPA's perspective and guidance are being provided at several workshops sponsored by the Pennsylvania Department of Environmental Protection. Also, USEPA has asked to receive and review several Total Maximum Daily Load (TMDL) and Chesapeake Bay plans as they are submitted with the new permit authorization packages.

U.S. Fish and Wildlife Service

1. As part of relicensing activities, provide technical expertise on a water quality study to identify any adverse conditions from power generation, pumping, or idling conditions at the Conowingo and Muddy Run hydroelectric projects.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Fund Water Quality Management Planning and Water Quality Improvement Projects.
2. Educate local officials, federal officials, and the public about the importance of investing in water and wastewater infrastructure.
3. With the Environmental Facilities Corporation, provide low interest financing and technical assistance for municipal wastewater treatment and water quality improvement projects through the Clean Water State Revolving Fund.

New York State Department of Health (NYSDOH)/County Health Departments

1. Provide technical assistance, training, and regulatory oversight for public water supplies, septic systems, and realty subdivisions. NYSDOH provides only technical assistance for conventional septic systems and is establishing a local waiver system to facilitate permitting of alternative systems. Any significant modification to existing systems or development of new public water systems requires NYSDOH approval.

Environmental Facilities Corporation/New York State Department of Health

1. Provide low interest financing and technical assistance to improve public water system infrastructure through the Drinking Water State Revolving Fund.

Environmental Facilities Corporation/New York State Department of Environmental Conservation

1. Provide low interest financing and technical assistance for municipal wastewater treatment and water quality improvement projects through the Clean Water State Revolving Fund.

Environmental Facilities Corporation

1. Continue to evaluate the scope of aging water supply and wastewater infrastructure problems and develop cost-effective and sustainable solutions. A 2008 report, *Wastewater Infrastructure Needs of New York State*, forms the basis for establishing a sustainable wastewater infrastructure funding program.

Broome-Tioga Stormwater Coalition/Chemung County Stormwater Coalition

1. Support successful implementation of Municipal Separate Storm Sewer System (MS4) Stormwater Management Programs by maintaining stormwater web sites, providing training, conducting public education, facilitating public involvement activities, and providing direct assistance to MS4 municipalities.
2. Obtain grants to assist with stormwater management practices and stormwater management programs.

Lamoka and Waneta Lakes Protection and Rehabilitation Districts/Schuyler County Watershed Protection Agency/Towns of Wayne, Orange, and Tyrone

1. Implement the Lamoka-Waneta Lakes Wastewater Management Program, which provides authority for inspection of septic systems for lakeside properties on a 5-year basis, requiring repairs and upgrades as necessary.

Regulated Municipal Separate Storm Sewer System (MS4) Operators in the Elmira and Binghamton Urban Areas

1. Identify and eliminate sanitary septic overflows and other illicit discharges.
2. Regulate construction and post-construction stormwater runoff from new development (with technical assistance from stormwater coalitions and Soil and Water Conservation Districts).
3. Provide for long-term maintenance of stormwater management facilities.
4. Implement programs and practices that protect and restore stormwater quality (good housekeeping practices).

Rural Stormwater Coalition of Chemung, Schuyler and Steuben Counties

1. Promote progressive stormwater management policies and practices in non-urban areas through training, public education, technical assistance, and other efforts.

Schuyler County Watershed Protection Agency

1. Monitor installation of septic systems and individual water supplies to ensure proper designs are used to meet New York State Department of Health standards and local laws.
2. Provide analytical services for public and private water quality testing of surface and groundwater.
3. Seek funding for cost sharing of septic system improvements.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. Continue to replace and upgrade equipment used for operation of water supply and wastewater treatment at Little Buffalo State Park, and apply recent training provided to staff for wastewater treatment operations.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to encourage public and private support, maintenance, and upgrades of the infrastructure needed for drinking water withdrawal in areas where EPCAMR has performed water quality assessments or planning investigations.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which outlines many strategies related to this action.

York County Conservation District

1. Encourage and support infrastructure improvements as time and resources allow.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Continue to work closely with the Water Quality Infrastructure Program to identify and provide funding for the highest priority drinking water system upgrades.

ACTION NEEDED:

Promote the use of green infrastructure and stormwater management approaches that mimic natural hydrologic regimes and promote water use efficiency in combination with the prior Action Needed listed above.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Promote green infrastructure through efforts related to the Lower Susquehanna Source Water Protection Strategy, and develop new project proposals.
2. Throughout FY-2013 and FY-2014: Promote the use of green infrastructure and better stormwater management techniques through development of the Cedar Run Watershed Total Maximum Daily Load, and by working with the local municipalities.

Federal Programs and Projects

National Park Service

1. Guided by the findings of a strategic land protection and site restoration workshop conducted in 2011, permanently protect priority riparian lands and re-vegetate steep farm fields underlain by clay soils to reduce excessive sheet flow during severe storm events.

Natural Resources Conservation Service

1. Promote the use of green infrastructure and stormwater management approaches that mimic natural hydrologic regimes and promote water use efficiency when providing technical and financial assistance to agricultural producers.

U.S. Army Corps of Engineers

1. Through Planning Assistance to States, Section 22, pursue opportunities to develop watershed management plans, conduct total maximum daily load (TMDL) analyses, and stormwater infrastructure and best management plan assessments and inventories.
2. Support the Department of Defense in identifying opportunities to improve its Low Impact Development Program. This includes completion of the Army Low Impact Development Technical Users Guide, which is expected to be released to the public in draft form in 2012.

U.S. Environmental Protection Agency, Region 3

1. Provide technical and policy assistance to the Pennsylvania Department of Environmental Protection and the regulated community to support new low impact development and stream buffer provisions in the National Pollutant Discharge Elimination System permit program (Clean Streams Law, Chapter 102 regulations).
2. Provide additional assistance under the Section 319 Nonpoint Source Program described previously under this Priority Management Area.

U.S. Fish and Wildlife Service

1. Restore and protect stream channels, riparian areas, and adjacent wetlands to reduce sediment and nutrient inputs.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Provide training and enforcement related to the runoff reduction requirements and stormwater green infrastructure practices included in the updated New York State Stormwater Design Manual (released August 2010).

Environmental Facilities Corporation

1. Support the use of green infrastructure as an alternative to grey infrastructure through Clean Water State Revolving Fund financing and technical support.

2. Implement the New York State Clean Water State Revolving Fund Sustainability Initiative Advisory Group Recommendations (June 2010) for promoting smart growth through modification of New York's Clean Water State Revolving Fund.
3. Administer the Green Innovation Grant Program, which provides seed money for projects that spur green innovation, build green capacity, and facilitate technology transfer. Eligible projects will improve water quality and demonstrate sustainable wastewater infrastructure.

Broome-Tioga Stormwater Coalition/Chemung County Stormwater Coalition/ Rural Stormwater Coalition of Chemung, Schuyler and Steuben Counties

1. Promote maintenance and restoration of natural hydrology by providing training, technical assistance, and educational resources regarding stormwater green infrastructure practices, including practical information for homeowners (about rain gardens, rain barrels, driveway drainage, etc.).

Cornell Cooperative Extension, Schuyler County

1. Encourage and pursue implementation of the 2010-2011 Schuyler County Green Infrastructure Strategy. This plan includes actions related to green infrastructure and stormwater management.

County Planning Departments/Cornell Cooperative Extension, Schuyler County

1. Help municipalities to incorporate open space, riparian corridor, floodplain, and green infrastructure considerations into municipal master plans and land use regulations.

County Soil and Water Conservation Districts/Southern Tier Central Regional Planning and Development Board/Upper Susquehanna Coalition

1. Continue to educate municipal officials, property owners, and others about stream processes, naturally beneficial floodplain functions, and watershed functions through training, websites, distribution of the award-winning educational booklet entitled "Stream Processes: A Guide to Living in Harmony with Streams," and other methods.
2. Investigate options for implementing policies and practices that protect and restore beneficial hydrologic functions.

Southern Tier Central Regional Planning and Development Board

1. Promote implementation and monitor progress of the *Susquehanna-Chemung Action Plan*, an ecosystem-based management strategy for the Chemung and Susquehanna Basins in New York. (By considering the entire ecological community, including humans, this management approach is intended to restore both the ecological and economic values of ecosystems.)
2. Provide technical assistance, training, and public outreach on watershed planning, stormwater management, Low Impact Development, and other topics.
3. Provide planning assistance to help municipalities integrate stormwater green infrastructure objectives into land use regulations and eliminate obstacles to green infrastructure implementation.
4. Update the Low Impact Development Sampler with new projects and continue to use it as an educational tool.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources

1. In partnership with the Pennsylvania Department of Environmental Protection and federal partners, continue to fund a multi-year program in the City of Lancaster to add and retrofit green infrastructure elements to reduce urban stormwater runoff into the Conestoga River. Projects include green roofs, green alleys, and urban tree canopy.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. In summer 2012: At the park office at Little Buffalo State Park, plan and implement stormwater management projects such as rain gardens and water barrels to be used for educational purposes.
2. In summer 2013: At Lackawanna State Park, hold a program on rain garden benefits and installation procedures.

Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering and Wetlands

1. Require riparian buffers or riparian forest buffers and attain reasonable assurance of success as stipulated under revised Chapter 102 regulations.
2. Continue to include green infrastructure that mimics natural hydrologic regimes and other stormwater management principles, during development of Act 167 Stormwater Management Plans, and during the review of permits that include stormwater practices authorized under Chapter 102.
3. Continue to use the Pennsylvania Stormwater Best Management Practice Manual (DEP No. 363-0300-002), which provides technical guidance and standardized methodologies.

Pennsylvania Fish and Boat Commission (PFBC)

1. Consider stormwater projects funded by the PFBC and National Park Service in the Valley Creek Watershed, Chester County, that may be applicable to other settings that are within the Susquehanna River Basin. Funding was provided for a green roof, rain gardens, and stormwater infiltration projects.

Lancaster County Planning Commission

1. Continue to implement Greenscapes, the green infrastructure element of the Lancaster County Comprehensive Plan.
2. Adopt the Lancaster County Integrated Water Resources Plan, which includes strategies for increasing tree canopy and improving stormwater management by incorporating green infrastructure.

York County Conservation District

1. Promote the use of green infrastructure and stormwater management approaches that mimic natural hydrologic regimes and promote water efficiency in conjunction with remediation planning.

Maryland Programs and Projects

Maryland Resource Agencies

1. Continue to enforce Maryland's 2007 Stormwater Management Act, which requires all new development disturbing 5,000 square feet or more to implement environmental site design (ESD) to the maximum extent practical. ESD integrates natural hydrology, site design, and smaller controls to capture and treat runoff, and provides treatment closer to the source of runoff pollution than conventional stormwater management practices.

ACTION NEEDED:

Encourage and support restoration planning as follow-up to the Commission's Year-2 subbasin surveys and TMDL development activities for water bodies impaired by AMD, urban, agricultural, and other nonpoint sources with the goal of removing impaired waterbodies from state lists established under Section 303(d) of the Clean Water Act.

Susquehanna River Basin Commission Programs and Projects

1. During FY-2013 and FY-2014: Coordinate with stakeholders to develop Year-2 subbasin survey monitoring programs to support restoration projects in the Chemung and Upper Susquehanna Subbasins, respectively.
2. During FY-2013: Continue to coordinate with Trout Unlimited and other AMD restoration partners to share data and develop possible AMD restoration opportunities from the West Branch Subbasin Survey Year-2 monitoring work completed in Drury Run and Birch Island Run in 2010.
3. During FY-2013: Conduct water quality and biological monitoring in the vicinity of the Barnes and Tucker operation in order to document water quality improvements.

Federal Programs and Projects

Natural Resources Conservation Service

1. Support restoration of impaired waterbodies impacted by agricultural sources of pollution by targeting additional technical and financial assistance to agricultural producers through Farm Bill programs and Conservation Technical Assistance in coordination with the State Technical Committees.

U.S. Army Corps of Engineers

1. Pursue opportunities to develop watershed assessments and plans, including the Lower Susquehanna River Watershed Assessment, which is focused on the sources and fate of sediment.

U.S. Environmental Protection Agency, Region 3

1. Provide funding to implement TMDLs with load allocations under the Section 319 Nonpoint Source Program described previously under this Priority Management Area.
2. Seek additional financial support in conjunction with the Pennsylvania Department of Environmental Protection (PADEP) to support TMDL development activities.
3. Provide follow-up on TMDLs prepared by SRBC for the following watersheds:
    a. West Branch Chillisquaque Creek,
    b. Muddy Run,
    c. Delaware Run,
    d. Mahoning Creek,
    e. Lycoming Creek,
    f. Hemlock Creek,
    g. Possum Creek,
    h. Mahantango Creek, and
    i. South Branch Conewago Creek
4. Work closely with the PADEP and SRBC in selecting waters for further TMDL development.
5. Continue to work with SRBC as it refines the Octoraro Creek TMDL and conducts monitoring in the Conestoga River Basin.

U.S. Fish and Wildlife Service

1. Assist partners with water quality improvement and protection planning activities.

U.S. Geological Survey

1. Continue to maintain the Decision Support System that the U.S. Geological Survey developed for total nitrogen and phosphorus load, yield, and concentration estimates using the SPARROW model for the Chesapeake Bay drainage basin. The system maps predictions of long-term average water quality conditions (loads, yields, concentrations) and source contributions by stream reach and catchment. It also tracks transport to downstream receiving waters, and can be used to evaluate user-defined management source reduction scenarios. (http://cida.usgs.gov/sparrow/)

New York Programs and Projects

New York State Department of Environmental Conservation

1. Support implementation of the TMDL for phosphorus in Lake Salubria (Steuben County, 2009).
2. Collect data to allow for development of TMDLS for: 1) phosphorus in Smith Pond (Steuben County), 2) phosphorus in Whitney Point Reservoir (Broome County), 3) pathogens in North Winfield Creek and tributaries (Herkimer County), and 4) phosphorus in Cayuta Lake (Schuyler County).

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue to provide technical guidance and install riparian buffer projects in the basin.
2. Continue to conduct innovative work in establishing urban tree canopy through PADCNR's work with Treevitalize.
3. Continue to identify forestry best management practices that reduce sedimentation and assist in implementing total maximum daily load (TMDL) studies. PADCNR is working with the U.S. Environmental Protection Agency, PENNVEST, and other partners to implement a nutrient credit trading program that would promote buffers on agricultural lands.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Point and Non-Point Source Management

1. Continue to develop TMDLs on a statewide basis for 350 impaired stream segments annually. The majority of those TMDLs are for waters within the Susquehanna River Basin, and address many sources of impairment.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. Continue to require riparian forest buffers as required under the PADEP's Chapter 102 regulations.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

1. Continue to support restoration planning and make suggestions to the Pennsylvania Department of Environmental Protection regarding stream segments that should be considered for de-listing under Section 303(d) of the Clean Water Act.

Trout Unlimited Eastern Abandoned Mine Program

1. Continue to support SRBC plans for AMD remediation in the Drury Run and Birch Island Run Watersheds in Clinton County. To date, Trout Unlimited has supported these efforts by providing sampling assistance and funding obligated from its Brook Trout Mini-Grant Program. Trout Unlimited intends to assist with these projects as they are developed, pending resource availability.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which includes a strategy for conducting regional stormwater management planning.

York County Conservation District

1. Encourage and support restoration planning as follow-up to Commission monitoring efforts.

Maryland Programs and Projects

Maryland Department of the Environment

1. Through National Pollutant Discharge Elimination System (NPDES) permits for Municipal Separate Storm Sewer Systems (MS4s), require Baltimore, Carroll, Harford, and Cecil Counties

to perform urban restoration activities, develop TMDL implementation plans, and be consistent with any TMDLs approved by the U.S. Environmental Protection Agency.

ACTION NEEDED:
Seek water quality improvements to complement water quantity mitigation provided for water withdrawal and consumptive water use projects.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Investigate other AMD sites in addition to the Barnes and Tucker AMD treatment project as possible sources of mitigation water for consumptive water use projects.
2. In spring 2013 and spring 2014: Provide water quality, fishery, macroinvertebrate, wetlands, and aquatic vegetation data in the form of an annual technical summary to the New York State Department of Environmental Conservation, U.S. Army Corps of Engineers, and others from SRBC's Whitney Point monitoring activities.

ACTION NEEDED:
Identify waterbodies with exceptionally high quality water, habitat, and biological resources, based on monitoring results.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: For applicable programs, continue to evaluate, modify, and expand monitoring parameter lists to keep pace with new or emerging threats to water quality from a range of potential sources (i.e. natural gas development, stormwater).
2. By December 2012: Begin to utilize developed methods for assessing the health of headwater streams within select portions of the basin, such as through water quality baseline analyses and indices of biological integrity for macroinvertebrates, with specific focus in areas experiencing natural gas development.
3. Throughout FY-2013 and FY-2014: Continue to conduct monitoring associated with the Remote Water Quality Monitoring Network project, Subbasin Surveys, Interstate Streams Surveys, and Large Rivers Assessments, and utilize the results to assist with basinwide assessments of the health of rivers and streams.
4. By November 2012: Complete expansion of the Low Flow Monitoring Program basinwide, and complete analysis of the datasets by March 2013.

Federal Programs and Projects

National Park Service

1. Delineate undesignated reaches of Carr's Creek and Willow Brook that support viable trout fisheries based on volunteer monitoring and macroinvertebrate surveys.

Natural Resources Conservation Service

1. Target Conservation Stewardship Program (CSP) outreach to landowners in high quality resource areas to preserve and further enhance these exceptional areas with practices such as expanding riparian buffers and increasing resource-conserving crop rotations.,

U.S. Environmental Protection Agency (USEPA), Region 3

1. Collaborate with state and tribal partners to implement the National Wetland Condition Assessment to meet the following goals:
    a. Produce a national report that describes the quality of the nation's wetlands,
    b. Help states implement wetland monitoring and assessment programs to guide policy development and project decision-making, and

c. Advance the science of wetlands monitoring and assessment.

2. Through the Environmental Assessment and Innovation Division, continue to work with the Commonwealth of Pennsylvania on the Resource Water and Lands Assessment to identify and assess high quality systems and watersheds based on landscape-level data analysis.
3. Through USEPA's Chesapeake Bay Program, provide resources for interstate water quality monitoring to identify high quality resources.

U.S. Fish and Wildlife Service

1. Provide technical support to the Susquehanna River Anadromous Fish Restoration Cooperative members and other partners to identify spawning and nursery habitat for diadromous migratory fish and develop plans to protect and enhance the quality and availability of that habitat.

U.S. Forest Service

1. Assist with Pennsylvania's Unassessed Waters Initiative through a 2011 grant from the National Fish and Wildlife Foundation to the Western Pennsylvania Conservancy. This project will sample unassessed streams to ensure proper classification, which is vital to successfully protect streams from human-induced degradation. The initiative has five objectives which are: 1) Develop geographic information systems (GIS) technology to identify potential wild trout streams that are at greatest risk, 2) Develop a prioritized list of unassessed streams for each priority watershed, 3) Develop a status and trends monitoring program and update a priority list of unassessed streams annually, 4) Develop a way to involve interested partners in identifying wild trout populations in unassessed waters, and 5) Sample 3,000 unassessed waters from 2011-2015.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to monitor water quality in streams, rivers, lakes, and groundwater on a 5-year cycle. (The Statewide Ambient Water Quality Monitoring Program includes physical assessments; water, sediment, and organism tissue chemistry; macroinvertebrate community analyses; and toxicity testing for some or all waterbody types.)
2. Continue to conduct biological surveys as part of the Eastern Brook Trout Venture, providing the opportunity to identify waterbodies with exceptionally high quality water, habitat, and biological resources.

Upper Susquehanna Coalition/Cornell University

1. Identify hydrologically sensitive areas that can be targeted for implementation projects to maximize water resource benefits.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources

1. Throughout FY-2013 and FY-2014: Identify waterbodies with exceptionally high quality water, habitat, and biological resources by developing a water resource monitoring program on state forest lands affected by gas development.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Point and Non-Point Source Management

1. Continue to implement PADEP's antidegradation program to protect exceptional value and high quality waters, based on monitoring results.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. Finalize wetland and aquatic resource assessment protocols and use the assessment process to identify and manage the Commonwealth's wetland and aquatic resources.

Pennsylvania Fish and Boat Commission (PFBC)

1. Assist in identifying high quality resources and habitat through PFBC's aquatic surveys consistent with its policy to seek the highest water quality designation for Pennsylvania waters.
2. In partnership with academic institutions, continue PFBC's Unassessed Waters Program to identify and list streams with reproducing trout, and annually update PFBC's listing of stream sections containing reproducing trout.

Trout Unlimited Eastern Abandoned Mine Program

1. Continue to work in partnership with the Pennsylvania Fish and Boat Commission's Unassessed Waters Program, targeting Trout Unlimited's work to identify undocumented wild trout populations in AMD-impacted watersheds.

York County Conservation District

1. Assist in identifying waterbodies with exceptionally high quality water, habitat, and biological resources.

York County Planning Commission

1. Continue to collect chemical water quality samples in the headwaters of Deer Creek in southern York County in coordination with PADEP to determine if this stream meets the qualifications to be re-designated as a special protection stream (High Quality or Exceptional Value).

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR)

1. Monitor fish and macroinvertebrates at a site on Deer Creek to evaluate its water quality status. The work will be performed for use by Maryland Department of the Environment.

ACTION NEEDED:
Provide increased protection for headwater areas and watersheds with existing good water quality.

Susquehanna River Basin Commission Programs and Projects

1. By December 2012: Finalize the SRBC Low Flow Protection Policy containing specifications for headwaters protection and passby flow and conservation release determinations based on aquatic resource class designations that provide hierarchal protection levels based on water source size and quality.
2. In FY-2013: Develop and initiate headwaters research project to support SRBC's regulatory program and member jurisdictions.
3. In FY-2014: Complete headwaters research project.
4. Throughout FY-2013 and FY-2014: Identify high quality stream reaches targeted primarily for natural gas development through the use of environmental screenings and Aquatic Resource Surveys.
5. Throughout FY-2013 and FY-2014: Monitor implementation of the new protective standards for headwaters in accordance with revisions to SRBC's low flow protection policy.
6. By December 2012: Complete comprehensive water quality baseline analyses for all 50 stations associated with the Remote Water Quality Monitoring Network project, with some focused analyses for determining if there are any verifiable impacts, to date, associated with natural gas development.
7. Throughout FY-2013 and FY-2014: Under contract with the Pennsylvania Department of Conservation and Natural Resources, design, initiate, and complete a research monitoring project

focused on surface water quality conditions within select forest tract lands undergoing natural gas development to determine if there are any impacts.

Federal Programs and Projects

National Park Service

1. Implement recommendations of the Carr's Creek Management Plan addressing the permanent protection (via conservation easements) of forested lands in the headwaters of Carr's Creek and Willow Brook.
2. Protect headwater areas and watersheds with good water quality under the Chesapeake Treasured Landscape Initiative.

Natural Resources Conservation Service

1. Address critical agricultural surface and groundwater resource concerns in watersheds with existing good water quality by providing technical and financial assistance to agricultural producers through Farm Bill programs and Conservation Technical Assistance.

U.S. Environmental Protection Agency, Region 3

1. In conjunction with the Pennsylvania Department of Environmental Protection, encourage full implementation of anti-degradation reviews as part of on-going evaluations of impacts of Marcellus Shale natural gas development activities.
2. Continue to support the Chesapeake Executive Council's 2007 forest conservation commitment to conserve forests in high priority places, including headwater areas and watersheds with existing good water quality. Both the Commonwealth of Pennsylvania and the State of New York signed this commitment.
3. Through the Chesapeake Bay Program Office, coordinate a continuing forum called the Chesapeake Bay Program Maintain Healthy Watersheds Goal Implementation Team (GIT). The goal of the Maintain Healthy Watersheds GIT is to maintain local watersheds at optimal health across a range of landscape contexts. With this goal, the GIT intends to bring attention to the challenge of protecting streams and watersheds that are healthy today, as a programmatic complement to the "dirty waters" approach which focuses on restoring waters after they are allowed to be degraded.
4. Through the Defining Healthy Watersheds Workgroup, define health watersheds and create a system for tracking watershed health and protection status.

U.S. Fish and Wildlife Service

1. Coordinate with other state and federal resource agencies and provide technical expertise through the SRBC Water Resource Management Advisory Committee to develop recommendations for the protection of instream flows.
2. Construct a 0.25-mile long instream restoration project in the upper reaches of the Susquehanna River Basin through the New York Fish and Wildlife Program.
3. Through the Partners for Fish and Wildlife Program, protect an unnamed tributary to Penns Creek by establishing 2,000 feet of grassy, riparian buffer. Partners include Penn State University, Pheasants Forever, Habitat Forever, California University of Pennsylvania, and several landowners.
4. Through the Partners for Fish and Wildlife Program and the Wetland Reserve Program, construct the following:
    a. The Baker Wetland Project, which will restore about 13 acres of wetland habitat along Frankstown Branch of the Little Juniata River,
    b. The Wilt Wetland Project, which will restore about 15 acres of wetland habitat near the Little Juniata River,

c. The Hawkins Wetland Project, which will restore 1 acre of wetland habitat near Standing Stone Creek,
d. The Walters Wetland Project, which will restore 2 acres of wetland habitat near the Little Juniata River,
e. The Spittler Wetland project, which will restore about 4 acres of wetland habitat near Swatara Creek,
f. The Rhoads Wetland Project, which will restore about 1.5 acres of wetland habitat near Middle Creek,
g. The Rodicik Wetland and Stream Project, which will restore 2 acres of wetland habitat and 500 feet of stream habitat, and
h. The Thompkins Wetland and Stream Project, which will restore about 5 acres of forested wetlands and 0.25 mile of stream in a tributary to Fishing Creek.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. Complete a project in cooperation with the Williamsport Municipal Authority to conduct scientific sampling and analyses to establish baseline data and guide further study as natural gas exploration and production activities accelerate in the Lycoming Creek watershed in north-central Pennsylvania. The Williamsport Municipal Water Authority supplements its surface water sources during periods of low streamflow using a well field consisting of nine wells that are located along Lycoming Creek at Williamsport, just upstream of the confluence with the West Branch Susquehanna River. The source of water to these wells is induced infiltration from Lycoming Creek.
2. Publish a report documenting baseline groundwater quality conditions near the USGS Northern Appalachian Research Laboratory (NARL) in the Marsh Creek Watershed, Tioga County, Pa. The NARL uses groundwater as the sole source of water for the laboratory. The report will include an update to a groundwater flow model of the Marsh Creek valley near the NARL to analyze the impacts of increased groundwater withdrawals due to Marcellus Shale gas development activities. Additional collection of water quantity and quality data may be performed in the future.
3. In partnership with the Pennsylvania Department of Environmental Protection, continue to operate and maintain four continuous water quality monitors in the headwaters of the Susquehanna River Basin.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Seek to provide increased habitat protection for stream sections shown in recent biological surveys to support trout and/or trout spawning. Many waters fitting this category have been identified in surveys conducted as part of the Eastern Brook Trout Joint Venture.
2. Publish the final Supplemental Generic Environmental Impact Statement (SGEIS) that evaluates the potential environmental impacts of shale gas development using horizontal drilling and high-volume hydraulic fracturing. The final SGEIS will outline mitigation strategies, protection standards, and safety measures that well operators will have to follow in order to obtain a permit to drill.
3. Continue protecting that portion of the Susquehanna River Basin in New York through numerous state, regional, and local programs.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation

1. Continue to distribute posters, brochures, and pamphlets that address aquatic invasive species. These materials are disseminated to schools, education centers, and environmental centers. All materials are available in print version and also are downloadable from the PADCNR website.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Point and Non-Point Source Management

1. Through PADEP's antidegradation program, continue to protect headwaters and watersheds with existing exceptional value and high quality waters.

Pennsylvania Fish and Boat Commission (PFBC)

1. Continue to provide protection for headwater areas and watersheds with good water quality through recommendations in permit and docket reviews and through PFBC's management activities, law enforcement activities, and regulatory authority associated with fish, reptiles, amphibians, and aquatic life.
2. Coordinate with SRBC and its Water Resource Management Advisory Committee to finalize and implement a revised low flow protection policy.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which includes an Act 167 Stormwater Management Plan and model ordinance.

York County Planning Commission

1. Provide water quality data to PADEP to help determine if the headwaters of Deer Creek meet the qualifications for re-designation as a special protection stream (High Quality or Exceptional Value).

York County Conservation District

1. Assist in providing protection for headwaters and areas with good water quality through public education and outreach and financial and technical assistance through the HELP-Streams Program, as time and resources allow.

Maryland Programs and Projects

Maryland Department of the Environment

1. Through the Fractured Rock water supply study, continue to analyze the impacts of water withdrawals on various settings, including headwater streams and high quality watersheds.

ACTION NEEDED:
Provide educational materials regarding the spread of aquatic invasive species in the basin and downstream to the Chesapeake Bay.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to provide invasive species information to the public through printed material such as tip sheets, and SRBC's website and tracking database.

Federal Programs and Projects

U.S. Fish and Wildlife Service

1. Develop a recreational trail on Garrett Island in the lower Susquehanna River to include interpretive panels and information about the spread of aquatic invasive species.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Continue to install "Aquatic Hitchhiker" cleaning and disposal stations and informational kiosks at public and NYSDEC-maintained boat launch facilities throughout the basin.
2. Participate in Partnerships for Regional Invasive Species Management (PRISM) that stakeholders have formed within the Susquehanna River Basin to address the threat of invasive species, and are key to New York's integrated approach to invasive species management. The partnerships will plan for regional invasive species management, develop early detection and rapid response capacity, deliver education and outreach, implement eradication projects, and more. NYSDEC will, within the limits of available funding, support a fiscal/administrative sponsor for each PRISM in New York State.
3. Continue to provide information about nuisance species on the NYSDEC website, and provide information about invasive species on the Invasive Species Clearinghouse website (www.nyis.info) and Invasive Species Research Institute website (www.nyissi.org).

Biological Field Station for the State University of New York at Oneonta

1. Conduct research on techniques for controlling alewife, Eurasian milfoil, purple loosestrife, and other invasive species.

Hydrilla Task Force

1. Educate boaters, marina operators, lakeshore property owners, and others about ways to prevent the spread of hydrilla and other invasive aquatic species. Educational strategies include an online resource library, training sessions, letters to marina owners, handouts, posters, and press releases. The Hydrilla Task Force is a partnership of local, regional, and state agencies that was established to attempt to eradicate existing hydrilla beds in the Cayuga Inlet and prevent the spread of this invasive aquatic plant into neighboring areas, including the Susquehanna River Basin.
2. Seek funding for an aggressive program to eradicate hydrilla from the Cayuga Inlet (in the Finger Lakes watershed).

Otsego County Conservation Association

1. Continue to educate the public about invasive species identification, prevention, and control, focusing on zebra mussels (in Otsego and Canadarago Lakes) and water chestnut (in Goodyear Lake).

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR), Bureau of State Parks

1. During FY-2013 and FY-2014: Post invasive species information on park bulletin boards at Shawnee State Park, and provide information to park visitors during education programs.
2. During FY-2013 and FY-2014: Provide purple loosestrife pamphlets to the public at Nescopeck State Park.
3. During FY-2013 and FY-2014: Continue to post information regarding zebra mussels at the two public boat launches at Ricketts Glen State Park.
4. During FY-2013 and FY-2014: Continue to post invasive species information at boat launches at Codorus and Prince Gallitzin State Parks
5. During FY-2013 and FY-2014: The Environmental Educator at Worlds End State Park will continue to provide invasive species information to park visitors.

Pennsylvania Fish and Boat Commission (PFBC)

1. Continue invasive species educational efforts through PFBC's boating education program and expanded aquatic invasive species educational efforts in coordination with agencies such as Pennsylvania Sea Grant.

York County Conservation District

1. Provide educational materials regarding the spread of aquatic invasive species through the York County Conservation District's newsletter, website, public forums, and four annual York County Envirothons.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to post and maintain educational signs at all public access points including boat ramps and fishing piers along the Susquehanna River, and send information flyers to boaters in an effort to prevent the spread of zebra mussels.
2. Continue to post signs at public fishing points along the Susquehanna River and its tributaries to alert anglers to the ban on use and possession of live crayfishes.

ACTION NEEDED:
Develop regional source water protection plans for drinking water supply systems.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to support implementation of a regional source water protection plan for the Lower Susquehanna River Basin, through use of the established partnership structure.
2. Throughout FY-2013 and FY-2014: Continue to operate, maintain, and expand the Early Warning System for public water suppliers established by SRBC in 2003.
3. July through October 2012: Produce the 2012 State of the Susquehanna Report with the feature issue being drinking water, which will include information on the importance of source water protection plans.

Federal Programs and Projects

U.S. Environmental Protection Agency (USEPA), Region 3

1. Through activities of USEPA's Groundwater and Enforcement Branch in fiscal years 2013-2014, inspect and inventory facilities that are disposing drinking water treatment residuals (from treatment for nitrate removal) into Underground Injection Control (UIC) Class 5 Industrial Wells (septic systems, French drains, etc.). Measures will be the numbers of: 1) facilities that are Authorized by Rule under the UIC regulations, 2) Notices of Violations, and possibly 3) well closures.
2. Under the Lower Susquehanna River Regional Basin Source Water Protection Plan Project, USEPA will continue to provide funding and work with Pennsylvania in the development and implementation of source water program activities including operations in the lower Susquehanna River Basin. This project will establish various mechanisms for communication, coordination, and resource sharing while seeking new partnerships. Activities are listed below.
    a. Perform Outreach through participation in county-level water resource meetings in select areas in Adams, York, Cumberland, Lancaster, and Dauphin Counties, Pennsylvania.
    b. Continue to coordinate all efforts with the Pennsylvania Department of Environmental Protection's central and regional offices, source water protection partners, county conservation districts, and local watershed groups.
    c. Continue to coordinate activities between the Source Water Protection and Total Maximum Daily Load Programs, focusing on efforts within the Octoraro and Conestoga watersheds.
    d. Finalize a database using source water assessment information as the baseline.
    e. Continually update water quality information and add "readily available" water systems to the SRBC's Early Warning System (EWS) monitoring network.
    f. Potentially, hold a regional strategic planning meeting.

g. Continue to refine contaminant inventories.

U.S. Forest Service

1. As a planning tool, continue to advocate use of the U.S. Forest Service report on Forests, Water and People for the Northeast, http://www.na.fs.fed.us/watershed/fwp_preview.shtm, which includes state-specific fact sheets with maps of priority watersheds where forests should be maintained to protect drinking water supplies.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Require individual permits for construction activities on steep slopes draining into Class AA and AA-s drinking water sources.

New York State Department of Health

1. Continue to recommend that public water suppliers develop source water protection plans that expand the required area of control around public wells and intakes.

Cortland County Health Department

1. Continue to promote aquifer and wellhead protection efforts, including municipal zoning. Cortland County has six municipalities with aquifer/wellhead protection zoning, and four more municipalities are developing this type of zoning.

Municipalities

1. Enforce and update existing wellhead or aquifer protection plans and develop new plans and regulations as needed.

Pennsylvania Programs and Projects

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which encourages communities to collaborate on water resources planning.

York County Planning Commission

1. Participate in the development of SRBC's regional source water protection plan for the Lower Susquehanna River Basin.

York County Conservation District

1. Assist local municipalities in developing regional source water protection plans for drinking water supply systems as time and resources allow.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Continue to manage contracts awarded to two private consultants to work with local governments to develop and implement protection plans for twenty vulnerable water systems. Source water protection areas had previously been delineated for all public drinking water systems. The two consultants will update existing source water assessments, facilitate stakeholder workgroup activities, and work with the systems and stakeholders to develop and implement protection plans.

ACTION NEEDED:

Establish a Susquehanna Source Water Partnership to work with public water suppliers and other stakeholders to protect drinking water supplies.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Encourage community partnerships as a cooperative effort among local interests and public water suppliers.
2. July through October 2012: Produce the 2012 State of the Susquehanna Report with the feature issue being drinking water, which will include information on the benefits of forming source water protection partnerships.

Federal Programs and Projects

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to help form a Susquehanna Source Water Partnership. USEPA Region 3 is working with the steering committee to develop a strategic plan, and will continue to be engaged.

New York Programs and Projects

New York State Department of Health (NYSDOH)

1. NYSDOH would be interested in understanding what such a group would do and how it would support efforts to protect drinking water sources. However, given resource constraints and state level obligations, NYSDOH would have to evaluate whether limited resources should be prioritized to support such a regional effort.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection, Bureau of Safe Drinking Water

1. Continue to collaborate with SRBC on a Susquehanna Source Water Partnership.

Lancaster County Planning Commission

1. If requested, serve on the Susquehanna Source Water Partnership
2. Adopt the Lancaster County Integrated Water Resources Plan, which calls for the establishment of a county water resources council that could feed into the Susquehanna Source Water Partnership.

Maryland Programs and Projects

Maryland Department of the Environment, Water Supply Program

1. As opportunities develop, pursue regional efforts to protect drinking water sources. A representative of the Water Supply Program attended the Lower Susquehanna source water protection workshop sponsored by SRBC in February 2012. Maryland has requested that SRBC include Maryland water supply systems in any related efforts in the future.

ACTION NEEDED:

Encourage integration of state and federal data systems, develop consistent basinwide datasets and Geographic Information System (GIS) layers, and enhance existing geospatial and other tabular datasets.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Through use of the ArcGIS Server and data portals, continue to maintain consistent basinwide GIS datasets and layers for the Susquehanna River Basin, and maintain the consistency developed with assistance from SRBC's member jurisdictions.
2. Throughout FY-2013 and FY-2014: Continue the data exchange effort with the Pennsylvania Department of Environmental Protection (PADEP), including a comparison of SRBC's Source

Identification and PADEP's Water Use Data System Identifications in the Pennsylvania portion of the basin. Public Water Systems will be completed in 2013.

3. Throughout FY-2013 and FY-2014: Construct a Water Budget Analysis Geodatabase water use dataset that encompasses water use data from all member jurisdictions with SRBC datasets.

Federal Programs and Projects

Natural Resources Conservation Service (NRCS)

1. Maintain resource data including soils information via Web Soil Survey at http://soils.usda.gov, the National Resource Inventory (NRI), summary data from the NRCS Watershed Program database, and the NRCS Progress Reporting System.

U.S. Army Corps of Engineers

1. Support continued improvement of databases and data management systems, including sharing of data.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to enter state best management plan data into USEPA's tracking system that maintains and generates reports summarizing state watershed implementation plan details, milestones, and progress.
2. Continue to update USEPA's Geospatial Data Library, which currently contains about 120 "unique" geospatial data sets covering all of USEPA Region 3.
3. Investigate additional data sets for possible inclusion in the Geospatial Data Library.
4. Continue to seek data sets that could be useful in creating indicators describing human health and environmental conditions, stressors, and outcomes of programmatic activities. Data sets and indicators are used to help USEPA prioritize and target program implementation activities, and track progress toward meeting environmental goals.
5. Continue to work with the Pennsylvania Department of Environmental Protection and the Pennsylvania Department of Conservation and Natural Resources to develop a statewide "Resource Lands Assessment" that will identify areas that have a high value for ecosystem integrity, but may be threatened by future development.
6. Through the Chesapeake Bay Program Office, continue to provide resources related to interstate water quality monitoring and the development of consistent environmental data sets.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Maintain environmental mapping information on NYSDEC's website.
2. Continue to promote the development and use of iMap Invasives as an online Geographic Information Systems mapping tool.

New York State Data Sharing Cooperative

1. Continue to maintain current data on the New York State Geographic Information Systems Clearinghouse.

New York State Office of Emergency Management

1. Continue to maintain datasets documenting damages resulting from specific Federal Emergency Management Agency disaster declarations.
2. Continue to make the New York State Standard Multi-Hazard Mitigation Plan available at http://www.dhses.ny.gov/oem/mitigation/plan.cfm. The plan contains enhanced mapping. Data behind the images are available on request.

Southern Tier Central Regional Planning and Development Board

1. Maintain the web-based Geographic Information Systems data warehouse and applications that provide centralized storage and access for locally generated data.
2. Enhance the Susquehanna Chemung Data Atlas and the agency's water resource webpages to enable public access to additional map-based data and other information.
3. Conduct mapping of sewer and water infrastructure.

Upper Susquehanna Coalition

1. Maintain and expand a Geographic Information Systems-based data management system for New York's Agricultural Environmental Management Program and the Chesapeake Bay Program.
2. Maintain and update databases for wetlands, agricultural practices, streams, and drainage infrastructure.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Point and Non-Point Source Management

1. Continue PADEP's efforts to enhance integration of data systems through the use of federal datasets and layers in the ICE Geographic Information System and the SLIMS database.

Pennsylvania Fish and Boat Commission

1. Assist data integration by making current resource information available for permitting needs.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to encourage the integration of data systems as recently accomplished through integration of EPCAMR's Reclaimed Abandoned Mine Land Inventory System datasets, water quality databases, qualitative comments databases, and other GIS layers related to AMD.

Trout Unlimited Eastern Abandoned Mine Program

1. Continue to use and update the Conservation Success Index (CSI) to determine priority areas for conservation, protection, and restoration of brook trout populations in the West Branch Susquehanna Watershed. The CSI integrates state and federal fish population data with publicly available spatial data to provide a quantitative framework for assessing the status and threats to brook trout populations. Applied at the sub-watershed scale, the CSI provides accessible information at various geographic scales that can help identify data gaps, analyze threats to populations and habitat, and prioritize conservation actions for stakeholders. Additional information is provided at http://www.tu.org/science/conservation-success-index.

Lancaster County Planning Commission

1. Develop a water resources atlas as part of the Lancaster County Integrated Water Resources Plan. The atlas will include Geographic Information Systems (GIS) layers needed to implement the strategies in the Integrated Water Resources Plan.

York County Planning Commission

1. Through the York County Integrated Water Resources Plan, continue to encourage the integration of data systems and advocate development of an interactive computer tool (much like Turbo-Tax) that will collect, store, and share data as well as provide a uniform process for all water-related projects.

ACTION NEEDED:
Enhance and improve the sharing of information contained in water quality databases maintained by the Commission and its member jurisdictions.

Susquehanna River Basin Commission Programs and Projects

1. By December 31, 2012: Establish a water quality web portal for select monitoring programs to enhance data sharing with SRBC's member jurisdictions and the public.
2. Throughout FY-2013 and FY-2014: Continue to provide sediment and nutrient monitoring data to the Chesapeake Bay Program's Chesapeake Information Systems (CIMS).
3. Throughout FY-2013 and FY-2014: provide monitoring data to the U.S. Environmental Protection Agency's Water Quality Exchange (WQX) network.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Respond to data calls and other inquiries regarding details and contents of the USACE Water Resources Section database of water quality sampling results at USACE reservoirs.
2. Continue to coordinate with the federal agencies regarding SRBC's Water Resources Portal. This system sends automatic e-mail notifications and allows a degree of customization with regard to updates added to the users news feed.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Review the status of water quality data reporting under USEPA's Water Quality Exchange (WQX) protocols and work with SRBC to make any needed improvements.
2. Through the Chesapeake Bay Program Office, continue to provide resources for interstate sediment and nutrient monitoring, and for integrating and making the data available to all of the program partners.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Enhance the sharing of water quality information by continuing collaboration with SRBC on the Remote Water Quality Monitoring Network and by expanding collaboration to include new elements of the Bureau of Forestry's water resource monitoring program as it continues to be developed.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to support the improved sharing of information contained in water quality databases maintained by the Commission and its member jurisdictions.

Maryland Programs and Projects

Maryland Department of the Environment (MDE), Water Supply Program

1. Implement a contract to convert the Water Supply Program's existing data management system to SDWIS-State.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Continue to avoid impacts to wetlands and streams wherever possible for Federal Highway Administration projects. When impacts are unavoidable, efforts will be made to minimize or mitigate impacts in coordination with the U.S. Army Corps of Engineers, the Pennsylvania Department of Environmental Protection, and the Pennsylvania Fish and Boat Commission during permitting activities.

2. Continue to work with the Pennsylvania Department of Transportation to develop wetland mitigation banks, where appropriate, and to try to keep those within the same watershed as the impact, if possible.

NOAA National Weather Service

1. Provide daily stage/flow forecasts at 59 locations (cited under PMA A – Water Supply) and provide water information as necessary in conjunction with hazardous spills.

Office of Surface Mining

1. Continue to provide grant funding through Title IV of the Surface Mining Control and Reclamation Act to the Pennsylvania Department of Environmental Protection (PADEP) and non-profit watershed groups for the construction, operation, and maintenance of AMD treatment facilities on tributaries of the West Branch Susquehanna River
2. Continue to work closely with PADEP in providing technical support and program input into evaluations of mine drainage treatment proposals and guidance regarding PADEP's distribution of funds and project selection.
3. Continue to conduct regular oversight of PADEP's coal mining regulatory program and conduct inspections of coal mining permits to identify water quality issues and assess compliance with Pennsylvania and federal water quality laws and regulations.

U.S. Army Corps of Engineers (USACE)

1. Through the USACE regulatory program, review applications for Section 10 and 404 permits to ensure that no more than minimal impacts occur to waters of the United States, including jurisdictional wetlands. This includes requirements to avoid, minimize, and mitigate impacts to water quality.
2. Continue to work with SRBC and USACE districts regarding a consistent and coherent policy to evaluate impacts of hydraulic fracturing activities on water resources.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to provide assistance for SRBC to conduct water quality monitoring through the Chesapeake Bay Watershed water quality monitoring network, as well as other monitoring, restoration, and protection activities funded under Section 106 of the Clean Water Act.
2. Continue to work on a study directed by the U.S. Congress to understand the relationship between hydraulic fracturing and drinking water resources, and to identify factors that may lead to human exposure and risks. The final study plan was released on November 3, 2011. USEPA plans to release two reports on the study. The first is scheduled for release in 2012 and will summarize existing data intermediate progress regarding retrospective case studies, scenario modeling, and laboratory studies. The second report is scheduled for release in 2014 and will provide additional scientific results on the above topics and report on prospective case studies and toxicological analyses. USEPA Region 3 has coordinated with SRBC to ensure that data from SRBC's Remote Water Quality Monitoring Network and SRBC water availability data are accessible to researchers conducting the USEPA hydraulic fracturing study.
3. Under the purview of the Clean Water Act (CWA), work closely with states to ensure that gas extraction is carried out consistent with CWA regulations to protect surface water and drinking water. One area of USEPA's focus is treatment and disposal of wastewater from shale gas extraction, which USEPA describes as an important and challenging issue given the large volumes of flowback and produced waters generated. USEPA is assisting state personnel in evaluating the precautions that publicly owned treatment works (POTWs) and private centralized waste treatment facilities (CWTs) should take to process shale gas extraction wastewater safely.
4. Continue the process of developing standards for wastewater discharges produced by natural gas extraction from underground coalbed and shale formations. Pennsylvania and other states have asked USEPA to develop these standards, and USEPA will work closely with state experts and

stakeholders in moving forward. This will include the collection of information to better characterize shale gas wastewaters and the efficiency of various treatment, re-use, and disposal technologies that will reduce wastewater discharges, including those technologies currently used in public and private treatment plants.

5. Continue to work with SRBC to share information related to natural gas development in the Susquehanna River Basin to support hydraulic fracturing research efforts.

U.S. Fish and Wildlife Service

1. Assist conservation organizations in performing shoreline clean-ups at Garrett Island near the mouth of the Susquehanna River. The clean-ups help to educate the public regarding the impact of waste on natural resources, promote stewardship, and assist in improving water quality.

U.S. Geological Survey

1. Complete the "Comprehensive Plan to Assess the Environmental Effects of Marcellus Shale Gas Extraction" previously described above under Priority Management Area A – Water Supply.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Protect and improve water quality through permit programs and compliance monitoring for point discharges, stormwater management, stream and wetland disturbances, and agricultural discharges.
2. Administer chemical and pollution control programs, including spill response, waste site remediation, chemical and petroleum storage, pesticide program, and waste management.
3. Continue to protect water quality through administration of the existing permitting program for oil, gas, and solution mining activities conducted in accordance with NYSDEC's 1992 Generic Environmental Impact Statement.

County Soil and Water Conservation Districts/Upper Susquehanna Coalition (USC)

1. Protect and restore stream and riparian functions through implementation of projects that exclude livestock from streams and rehabilitate stream systems. The USC Stream Program establishes a consistent process that includes: 1) development of a Background Report of available information about the sub-watershed, 2) on-the-ground inspection and evaluation of conditions ("triage" assessment), 3) identification of potential management options by trained professionals, and 4) implementation of stream rehabilitation projects.
2. Promote prescribed grazing, riparian buffers, and other agricultural practices that reduce erosion by maintaining vegetative cover.

County Water Quality Coordinating Committees

1. Periodically update county water quality strategies and support implementation of strategy recommendations for restoration and protection of water resources.
2. Prepare annual reports of accomplishments related to the above.

Friends of the Chemung River Watershed

1. Conduct regular cleanups of litter and illegal dump sites along the Chemung River and its tributaries.

Public and Private Waste Management Facilities and Recycling Programs

1. Implement and enhance waste management and recycling efforts, including residential and business recycling programs, household hazardous waste collection, agricultural hazardous waste collection, latex paint exchanges, tire collection, electronic waste collection, and other activities.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. Continue to implement PADEP's Chapter 102 Erosion and Sediment Control and Stormwater Management Regulations, which provide baseline requirements for the development and implementation of erosion and sediment control plans for earth disturbance activities, including agricultural plowing and tilling, animal heavy use areas, and non-agricultural sources. The regulations also provide baseline requirements for post-construction stormwater management for all activities that require permit coverage under Chapter 102.

Pennsylvania Fish and Boat Commission (PFBC)

1. Formalize PFBC's involvement with Pennsylvania gas well permit reviews through funding provided by Pennsylvania Act 13 of 2012.
2. Through PFBC's Division of Environmental Services and its Bureau of Law Enforcement, respond to complaints and incidents of reported or suspected water pollution. SRBC compliance staff will be contacted when appropriate.

Priority Management Area C – Flooding

Flooding at Sayre, N.Y. during Tropical Storm Lee.

Desired Result: *To prevent loss of life and significantly reduce future damages from floods within the basin through an integrated system of structural and nonstructural flood damage reduction measures.*

The following Actions Needed under Priority Management Area C – Flooding are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 55-57. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests.

ACTION NEEDED:
Develop, in cooperation with Susquehanna Flood Forecast and Warning System (SFFWS) partners, new forecast points and flood forecast maps for priority damage locations.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013: Work with the U.S. Geological Survey, Pennsylvania Water Science Center to complete the flood inundation map library for the West Branch Susquehanna River at Lewisburg and Milton, Pennsylvania River Forecast Points.
2. Throughout FY-2013: Continue to work the U.S. Army Corps of Engineers Silver Jackets interagency team to develop flood inundation maps for the City of Harrisburg, Pa.

NOTE: Funding for the SFFWS was not renewed for FY-2011 or FY-2012, and is uncertain for FY-2013 and FY-2014, which has resulted in decreased services.

ACTION NEEDED:
Assist in the evaluation of need and implementation of flood damage reduction alternatives for high-risk communities.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013: Provide support to communities suffering catastrophic damage during Tropical Storm Lee as identified by the Federal Emergency Management Agency's long-term community recovery effort.

Federal Programs and Projects

Federal Emergency Management Agency

1. Provide post-disaster assessments after flooding events. The primary use is to identify the number of homes destroyed and damaged to evaluate the efficacy of a possible disaster relief declaration. FEMA also targets possible long-term recovery mitigation efforts for future projects under the unified Hazard Mitigation Assistance programs.

Federal Highway Administration (FHWA), Pennsylvania Division

1. Continue to consider flooding issues when the Pennsylvania Department of Transportation (PADOT) and FHWA review bridges for rehabilitation and/or replacement. PADOT's bridge program is of primary importance, and FHWA will continue to work with PADOT, county planners, and local planners to ensure that hydraulic and hydrologic analyses are performed to reduce flooding wherever possible in relation to projects. Bridge projects are shown on the Statewide Transportation Improvement Program, which is currently being revised.

National Park Service

1. Implement recommendations of the Carr's Creek Watershed Hydraulic and Hydrologic Study addressing the replacement of under-sized bridges and culverts in the Town of Sidney, N.Y.
2. Restore floodplain integrity in priority reaches of Carr's Creek above the hamlet of Sidney.

Natural Resources Conservation Service (NRCS)

1. Continue dam rehabilitation assistance under the NRCS Watershed Rehabilitation Program for flood control dams at Nanticoke Creek and Little Choconut Creek in New York.
2. Complete a flood damage reduction plan, if funded, for the Bentley Creek Watershed (an interstate stream in Pennsylvania and New York), in cooperation with local project sponsors. A submission for implementation authorization needs to be made under the NRCS Watershed Protection and Flood Prevention Program.
3. Implement stream restoration under the NRCS Emergency Watershed Program in areas where buildings, utilities, or other critical infrastructure are imperiled by debris and unstable streams and stream banks.
4. Provide NRCS Watershed Program planning assistance, if funded, to address other flood damage concerns at the request of local project sponsors.
5. Ensure proper local operation and maintenance of NRCS-assisted flood control dams and structures in the following watershed projects:
    a. Maryland: Little Deer Creek
    b. New York: Brandywine Creek, Brixus Creek, Bulkley Creek, Clark's Creek, Dean Creek, Finch Hollow Creek, Genegantslet Creek, Hoffman Creek, Jackson Creek, Little Choconut Creek, Millbrook Creek, Nanticoke Creek, Newtown Creek, Patterson Creek, and Trout Brook.
    c. Pennsylvania: Briar Creek, Marsh Creek, Middle Creek, Mill Creek (Tioga County), and North Fork Cowanesque River.

NOAA National Ocean Service Coastal Services Center

1. Provide Roadmap for Adapting to Coastal Risk – a participatory process for accessing a community's vulnerability to floods and other hazards. (http://www.csc.noaa.gov/digitalcoast/training/roadmap/index.html)

NOAA National Weather Service

1. Provide graphical representation of flood inundation for 18 water surface elevations at Jersey Shore, Pa.

U.S. Army Corps of Engineers

1. As warranted, support completion of the Lackawanna River and Wyoming Valley flood risk management projects and conduct coordination activities for other high-risk areas.
2. Publicize the need for basinwide evaluations of existing flood risk management projects and evaluations of new structural and/or nonstructural projects.
3. Continue coordination with the New York State Department of Environmental Conservation in the Upper Susquehanna River Watershed, especially regarding the Upper Susquehanna River Watershed Flood Risk Management Study.
4. Assist communities with studies and analyses of flood risk through the Floodplain Management Services Program.
5. Under PL 84-99, support funding and implementation of emergency rehabilitation projects as a result of June and September 2011 flood events.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Operate and maintain local flood control projects.
2. Protect against dam failure through increased emphasis on the Dam Safety Program.
3. Protect against increased stormwater discharges through outreach, training, stormwater construction permits, and Municipal Separate Storm Sewer Systems (MS4) stormwater permits (Binghamton and Elmira urban areas). New York stormwater sizing criteria include requirements for controlling discharge rates from channel protection, overbank flood, and extreme storm events (1-, 10-, and 100-year storms).

New York State Office of Emergency Management

1. Continue to maintain and update the New York State All Hazard Mitigation Plan and provide planning assistance for local and county hazard mitigation plans.
2. Continue to educate communities about and implement Federal Emergency Management Agency Repetitive Flood Claims and Severe Repetitive Loss Programs that fund the elevation or acquisition of flood-prone properties.

Broome County

1. Assess county-owned flood control structures and the operation of these structures during the Tropical Storm Lee flood to determine if they can be re-designed to work better.
2. Using a $35,000 Local Waterfront Revitalization Program grant, the Broome County Planning Department will prepare a Watershed Mitigation Strategy. Three floodprone areas will be prioritized and an engineering solution will be developed for each.
3. Provide information as needed to support the U.S. Army Corps of Engineers Scoping Study for mitigating flood damage in the Upper Susquehanna Watershed.

Broome County Flood Task Force

1. Advocate for the Brandywine Corridor flood gate and other flood mitigation projects, as warranted.

Chemung County/Chemung County Soil and Water Conservation District/Town of Ashland/Village of Wellsburg

1. Working with the Natural Resources Conservation Service, pursue funding for the Bentley Creek Watershed flood protection project to construct a levee in the Village of Wellsburg.

County Hazard Mitigation Coordinators/County Emergency Management Offices

1. Coordinate and provide assistance to identify, obtain funding, and implement flood mitigation projects.
2. Develop or assist with development of local and/or county hazard mitigation plans.

Environmental Emergency Services

1. Support emergency management offices in Chemung, Schuyler, and Steuben Counties by operating and enhancing a flood warning system with a locally operated network of real-time gages (stream/river gages, precipitation gages, and climate stations).
2. Provide public information and education about flood hazards and flood safety. Increase use of the organization's Stormwater-Floodplain model by trained volunteers.

Upper Susquehanna Coalition and Member Soil and Water Conservation Districts

1. Continue to maintain an active wetland restoration and construction program to provide multiple benefits, including flood mitigation.
2. Reduce erosion damage from flooding through implementation of stream rehabilitation projects.
3. Engage local governments to identify, assess, and promote measures that will mitigate the impact of floods.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. Continue to operate the Commonwealth's Flood Protection Program, which has been in existence since 1947 and has resulted in construction of over 200 state-funded flood protection projects in over 100 Pennsylvania communities. There are currently 18 active projects in the Susquehanna River Basin. Some of these projects are in the beginning stages of design and others are scheduled for construction in the near future. The following projects are scheduled for construction in the next two years.
    a. Fishing Creek Stabilization Project, Hemlock, Mount Pleasant, and Scott Townships, Columbia County: This project is located on three separate sites, with one in each of the above townships. The project involves removal of a lateral concrete weir and stabilization of severely eroded stream banks with riprap and root wads. Construction began in February 2012 and is scheduled for completion in November 2012.
    b. Mill Creek Elevated Flood Plain Project, Duryea and Moosic Boroughs, Luzerne and Lackawanna Counties: This project involves excavation to create an elevated flood plain along Mill Creek. The elevated flood plain will lower water surface elevations and increase the hydraulic capacity of an existing concrete channel flood protection project immediately upstream. Construction is anticipated to be complete near the beginning of July 2012.
    c. Irvona Drainage Structure Rehabilitation Project, Irvona Borough, Clearfield County: This project involves replacement of six levee drainage structures (including sluice gated inlet structures, pipe culverts, and flap gated outlet structures) in the existing levee system and replacement of two closure structures across an abandoned railway with a compacted earthen levee. The Borough received a grant to finance project construction, which is expected from June 2012 through September 2012.
    d. Danville Flood Protection Project, Danville Borough, Montour County: This project will remedy surficial failures in the existing right-side earthen levee system along Mahoning Creek by placing riprap slope protection. Construction is expected from July 2012 through April 2013.
    e. Additional Danville Flood Protection Project, Danville Borough, Montour County: This project will provide two stop log panel closure structures across the Route 11/SEDA-

COG railroad gaps in the existing earthen levee and concrete flood wall system along Mahoning Creek. Currently, sand bag closures must be installed for protection during high water events. The removable stop log panel closure structures can be installed much more quickly and with much less manpower than sand bags. Construction is expected from August 2012 through April 2013.

f. Mount Carmel Flood Protection Project, Mount Carmel Borough, Northumberland County: This project involves construction of a rectangular concrete channel and installation of a precast concrete box culvert along Shamokin Creek. Construction is expected from September 2012 through July 2014.

g. Duryea Flood Protection Project, Duryea Borough, Luzerne County: This project will provide a sheet pile flood wall and compacted earthen levee to close the gap between existing upstream and downstream earthen levees. This stretch near the cemetery is vulnerable to high water from the Lackawanna River. The project also will replace a number of older drainage structures with new flap gates and sluice gates. Construction is expected from May 2013 through December 2013.

h. Jermyn Flood Protection Project, Jermyn Borough, Lackawanna County: This project will construct an improved channel consisting of natural bottom and precast segmental concrete block walls along Rushbrook Creek so that it is capable of conveying the 100-year flood event. Work also includes construction of a short reach of rectangular concrete channel and replacing five existing bridges with precast concrete box culverts. Construction is expected from May 2013 through October 2014.

i. Spring Brook Stream Bank Stabilization Project, Pittston Township, Luzerne County: This project will provide riprap stabilization of eroding stream banks along Spring Brook. The work will reduce the heavy sediment load resulting from bank erosion. Construction is expected to begin in April 2014.

j. Clearfield Flood Protection Project, Clearfield Borough, Clearfield County: This project will provide a precast concrete box culvert and a trapezoidal grass-lined channel to replace a series of existing undersized and deteriorating culverts along a tributary locally known as Stinky Run. Construction is expected to begin in May 2014.

k. Bloomsburg Federal Flood Protection Project, Columbia: PADEP is providing 50 percent of the 25 percent non-federal cost share for this project. Act 35 of 1999 authorizes $12 million for PADEP to cost-share with Bloomsburg for the non-federal costs of the feasibility study, design, and construction of this project. To date, PADEP has provided $546,160 to Bloomsburg for costs related to the feasibility study and partial design. The U.S. Army Corps of Engineers is scheduled to complete an update to the original feasibility study in June 2012 to consider damages from the September 2011 Tropical Storm Lee flood event and to reevaluate the benefit-cost ratio of the project.

l. Wyoming Valley Federal Local Flood Protection Project: PADEP is providing 50 percent of the 25 percent non-federal cost share for this project. Act 223 of 1990 authorizes $45 million for PADEP to cost-share with the Luzerne County Flood Protection Authority (LCFPA) for the non-federal costs of the project. The work includes construction of an automated pump station to replace the existing pumps that are inoperative and not repairable. The automated pump station will lower water surface elevations and mitigate water back-up on Hicks Creek when flap gates on the U.S. Army Corps of Engineers' Susquehanna River levee close during high water events there.

York County Conservation District

1. Continue to assist local community emergency management agencies (EMAs), York County EMA, the Pennsylvania EMA, and the Federal EMA in the evaluation of need and implementation of flood damage reduction alternatives for high-risk communities as time and resources allow.

Maryland Programs and Projects

Harford County

1. Continue to assess properties that are damaged by flooding, and target those properties for flood mitigation efforts. Harford County focuses on repetitive loss properties, and informs the owners of potential flood mitigation grants.

ACTION NEEDED:
Assist local and county flood managers in planning efforts and assessments of floodplain reclamation projects.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to support ongoing activities of the Pennsylvania Association of Floodplain Managers to promote sound floodplain management activities.

Federal Programs and Projects

Federal Emergency Management Agency

1. Work in partnership with the Pennsylvania Department of Community and Economic Development and the Pennsylvania State Association of Township Supervisors to train and support local elected officials, permit officers, and floodplain managers in floodplain issues.
2. Provide planning support to communities in developing all-hazard plans that are needed to qualify for disaster assistance.

Natural Resources Conservation Service (NRCS)

1. If funded, complete a flood damage reduction plan that includes some voluntary removal of flood damaged homes for Bentley Creek Watershed, in cooperation with local project sponsors. A submission needs to be made for the project to authorize implementation under the NRCS Watershed Protection and Flood Prevention Program.

U.S. Army Corps of Engineers

1. Continue to work with non-federal sponsors of flood risk management projects through cost shared or technical assistance programs. Develop scope and costs for the Upper Susquehanna River Flood Risk Management Feasibility Study – Part 1. Continue coordination with other agencies in support of their programs, such as buy-outs by the Federal Emergency Management Agency in the wake of Tropical Storm Lee.
2. Coordinate with the interagency Silver Jackets flood risk management team to develop flood inundation mapping for the City of Harrisburg and surrounding communities. The mapping will be tied to the existing river gage at Harrisburg, will be part of the Susquehanna Flood Forecast and Warning System, and will also be accessible through other map viewers.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Provide floodplain management training and assistance to local governments.
2. Provide outreach and technical assistance to communities for which new Flood Insurance Rate Maps will become effective, including Broome and Otsego Counties.
3. Participate in and assist with the Federal Emergency Management Agency's Chemung Watershed Risk MAP Project, which includes portions of Chemung, Schuyler, and Steuben Counties.

Broome County Flood Task Force

1. Provide a forum for sharing of information, training, and county-wide coordination of efforts related to flood mitigation and flood recovery.

2. Advocate for improved federal policy related to levees, funding, and the National Flood Insurance Program.
3. Educate community leaders and the general public about flooding issues.
4. Encourage communities to participate in the Community Rating System of the National Flood Insurance Program (to enable reduced flood insurance premiums).

New York State Floodplain and Stormwater Managers Association

1. Promote effective floodplain and stormwater management by providing training, public outreach, communication, and coordination.
2. Provide training for educators and others to use the Stormwater Floodplain Simulation Model purchased in 2009.
3. Advocate for improved public policies related to floodplain management, flood mitigation, and stormwater management, including distribution of the Association's policy paper about Rethinking the National Flood Insurance Program.

Southern Tier Central Regional Planning and Development Board

1. Provide technical assistance and training for floodplain management, stormwater management, flood mitigation, flood warning, hazard mitigation planning, beneficial floodplain functions, flood-proofing, the Community Rating System, and other water resource issues. Maintain information and resources for these topics on the agency's website.
2. Provide planning assistance to: 1) help municipalities address flood hazards in comprehensive plans, 2) enact higher standards for floodplain development, and 3) incorporate additional measures for flood damage prevention into land use regulations.
3. Distribute floodplain management fact sheets and forms, which provide concise reference materials for managing floodplain development and educating constituents about floodplain management standards.
4. Work with partners across the region, state, and nation, to advocate for improved public policies related to flooding, floodplain mapping, levee safety, and flood insurance.
5. Provide technical support for the Federal Emergency Management Agency's (FEMA's) Chemung Watershed Risk MAP Project (which includes portions of Chemung, Schuyler, and Steuben Counties) and serve as the point of contact between FEMA and local representatives.

Tioga County Flood Mitigation Group

1. Provide a forum for agencies and municipalities to work in collaboration to address flooding issues.
2. Work with all communities in Tioga County to help answer questions about flooding needs.
3. Support development of an updated county hazard mitigation plan and assist with the acquisition of necessary funds to implement flood mitigation projects identified in the plan.
4. Promote efforts to address flooding issues on a watershed level for the entire Susquehanna River Basin in New York.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. If funds are made available, continue to operate PADEP's Stream Improvement (SI) Program that has been in existence since 1947 and resulted in construction of many streambank stabilization projects throughout Pennsylvania. Part of the SI Program deals with floodplain restoration. PADEP has implemented some stream restoration projects during the past few years and has partnered with the Pennsylvania Fish and Boat Commission and the U.S. Fish and Wildlife Service in providing SI grants for projects. Several PADEP staff have been trained in fluvial geomorphology using natural channel design techniques. Funding for this program has been

eliminated in the Commonwealth's budget, but if funding does become available, PADEP will construct projects through the SI Program.

York County Conservation District

1. Continue to assist local and county flood managers in planning efforts and assessments of floodplain reclamation projects

York County Planning Commission

1. Update York County's Hazard Mitigation Plan during calendar years 2012 and 2013.

ACTION NEEDED:

Conduct post-flood assessments to identify information needs, educational opportunities, lapses in forecast coverage, and other measures that can assist communities in reducing flood damages.

Susquehanna River Basin Commission Programs and Projects

1. By September 2012: Develop a draft evaluation of the Susquehanna Flood Forecast and Warning System's performance during Tropical Storm Lee.

Federal Programs and Projects

Federal Emergency Management Agency

1. Provide post disaster assessments after flooding events and assist communities in generating projects and in qualifying for funding under Hazard Mitigation Assistance programs.

Federal Highway Administration, Pennsylvania Division

1. Continue to work with the Pennsylvania Department of Transportation and other agencies to perform post-flood assessments as needed and develop solutions to ensure that the highway system remains operational and safe. This work is performed on an as-needed basis.

NOAA National Weather Service

1. In cooperation with partners, investigate needs for new forecast points and outreach activities for priority damage locations in the Susquehanna River Basin.
2. Conduct post-flood service assessments and publish findings, recommendations, and best practices regarding Hurricane Irene (August 2012) and Tropical Storm Lee (August 2012).
3. Provide comprehensive flood frequency analysis information and historical flood statistics. (http://www.erh.noaa.gov/marfc/Rivers/FloodClimo/)

U.S. Army Corps of Engineers

1. Assist in emergency and post-emergency assessments, as needed.

New York Programs and Projects

New York State Office of Emergency Management

1. Coordinate the emergency responses of all state agencies for manmade and natural disasters.
2. Maintain the State Emergency Operations Center.
3. Act as the state's focal point for all emergency management programs.
4. Administer federal disaster relief funds.
5. In carrying out the above, continue to interact with other agencies, such as the New York State Department of Environmental Conservation, to assess damages, provide information about federal programs, and discuss recovery and mitigation measures with local governments.

County Emergency Management Offices

1. Provide coordination for emergency response, flood recovery, post-flood assessments, and identification of mitigation opportunities.

Pennsylvania Programs and Projects

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

1. Pending the availability of funding, consider conducting post-flood assessments to identify information needs, educational opportunities, and other measures that could assist communities in reducing flood damages in communities historically impacted by mining. This work could also be performed in watersheds where stormwater management projects were used to reduce flood flows, and where natural stream channel restoration projects could reduce flooding potential or sedimentation issues, as on Hicks Creek in the Wyoming Valley.

York County Conservation District

1. Conduct post-flood assessments to identify information needs, educational opportunities, lapses in forecast coverage, and other measures that can help reduce flood damages.

ACTION NEEDED:
Develop a flood inundation mapping program, including a training component for communities in the basin. These maps delineate areas of flooding corresponding to various river stages, designate evaluation routes, locate major buildings for potential mass evacuation shelters, and list general flood response procedures.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Through the services of a contractor and SRBC staff, provide operation and maintenance of the Susquehanna Inundation Map Viewer to permit access and analysis of flood inundation mapping for effective flood risk communication to at-risk communities.

Federal Programs and Projects

Federal Emergency Management Agency

1. Work with county geographic information systems (GIS) departments and state departments to provide Flood Insurance Rate Maps (FIRMS) to identify risk areas for flooding in the 1 percent chance flood. FEMA and the U.S. Army Corps of Engineers coordinate the certification and mapping of areas behind structures such as levees and flood walls.

NOAA National Weather Service

1. Continue the partnered enhanced Advanced Hydrologic Prediction System Services to develop cost effective emergency management tools to be used prior to and during flood events.

NOAA North Atlantic Regional Collaboration Team

1. Collaborate with partners to identify funding and accelerate the prototype Chesapeake Bay Inundation Prediction System to facilitate emergency management decision-making.

U.S. Army Corps of Engineers

1. As a Silver Jackets pilot project, lead an interagency team to develop flood inundation mapping for the City of Harrisburg and surrounding communities.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. By fall 2012, publish a set of digital flood inundation maps for an approximately 6-mile reach of the West Branch Susquehanna River from about 1 mile downstream of the Borough of Lewisburg to about 1 mile upstream of the Borough of Milton. This project is being implemented in

cooperation with SRBC. The inundation maps depict estimates of the areal extent and depth of flooding corresponding to selected water levels at the USGS stream gage on the West Branch Susquehanna River at Lewisburg.

2. Continue as a partner in the "Silver Jackets" project to develop digital flood-inundation maps for an approximately 25 mile reach of the Susquehanna River from the mouth of the Juniata River to the mouth of Swatara Creek. The Silver Jackets partnership includes the U.S. Army Corps of Engineers, SRBC, NOAA's National Weather Service, and the Harrisburg Municipal Authority. The inundation maps depict estimates of the areal extend and depth of flooding corresponding to selected water levels at the USGS stream gage on the Susquehanna River at Harrisburg.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geological Survey

1. Continue to obtain new orthophotography and finalize lidar elevation data and make additional mapping information available to the public. Lidar is a significant improvement in topographic information, and allows for more accurate hydrologic data, better flood risk analyses, improved water management, and many other benefits. For more information, see http://www.dcnr.state.pa.us/toptgeo/pamap.

Maryland Programs and Projects

Maryland Department of the Environment

1. Continue to assist the Federal Emergency Management Agency and all participating National Flood Insurance Program communities in Harford and Cecil Counties in adopting and updating regulations.
2. Provide outreach on using and adopting new maps.
3. Assist communities on accessing and using the Federal Emergency Management Agency's RISK maps.

Harford County

1. In partnership with the Federal Emergency Management Agency, develop new flood map data through the RiskMap process. When complete, this information will be used and explained to citizens, and will identify actual flood depths on their properties. This will also be used to educate the public of flood risks and the need for adequate flood insurance.
2. Harford County Emergency Management will continue to update the County's Hazard Mitigation Plan, which identifies evacuation routes, shelters, at-risk populations, and general flood response procedures.

ACTION NEEDED:
During dam relicensing, advocate for the continued removal of material from behind power dams on the lower Susquehanna River.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Coordinate within USACE to ensure that Section 10 and 404 permits are obtained when required.
2. Complete technical analyses for the Lower Susquehanna River Watershed Assessment, which includes an assessment of sediment movement through the watershed and the impact of that sediment in the Chesapeake Bay. The study will include potential management measures to reduce the amount of sediment accumulation in the lower Susquehanna reservoirs and will assess the potential of that sediment to mobilize and cause ecological damage downstream.

U.S. Fish and Wildlife Service

1. Provide technical expertise during Federal Energy Regulatory Commission relicensing activities to develop mitigation for sediment transport issues in the lower Susquehanna River.

Pennsylvania Programs and Projects

York County Conservation District

1. Continue to advocate for the removal of material behind power dams on the lower Susquehanna River.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR)

1. Continue to pursue the removal of material from behind Conowingo Dam through Exelon-Conowingo relicensing activities. Maryland's Power Plant Research Team reviewed the study entitled "Effect of Project Operations on Downstream Flooding." Alternatives could include lower pond levels and increased pool volume if removal of material occurs at Conowingo. Other studies with reviews underway or completed include "Sediment Introduction and Transport (Sediment and Nutrient Loading)" and "Debris Management Study." Cooperating reviewers include SRBC, U.S. Army Corps of Engineers, and the Pennsylvania Department of Environmental Protection.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Federal Programs and Projects

Federal Emergency Management Agency

1. Work with state, county, and local agencies to provide training and education to develop floodplain ordinances.
2. Work with the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration to study and remap the coastal areas of Delaware, Virginia, and Maryland. Coastal remapping is part of a national effort to define the risk of flooding during storm events. Using improved resources and science, a more accurate forecast of water elevations during storm events can be depicted.

NOAA National Weather Service

1. Provide basin-wide flood forecast and warning services.
2. Provide oversight for an optimization study of the rain gage network in the basin and prioritize rain gages in the Susquehanna Flood Forecast and Warning System.
3. Publish the Susquehanna Flood Forecast and Warning System Improvement Plan including complimentary network of geographic information system (GIS) shapefiles and metadata.
4. Collect and disseminate hydrometeorological information.
5. Coordinate and manage the Susquehanna Ice Monitoring Network, which is a network of 80 ice observers, serving data collection and display on the web.
6. Continue the comparison analysis to determine the best soil moisture model for 8 areas in the Susquehanna River Basin. River forecasts are currently generated using a Continuous-Antecedent Precipitation Index Model. Calibration of the Sacramento Soil Moisture Accounting Model was recently completed for the selected sites for comparison purposes.
7. Maintain the calibrated and operational Kinematic Runoff and Erosion (KINEROS) Model for Towanda Creek near Monroeton, Pa. and Tuscarora Creek near South Addison, N.Y. Calibrate the KINEROS model at Mehoopany Creek in Wyoming County, Pa. for rain-on-frozen-ground events.

8. Test a combined distributed hydrologic model with a threshold frequency post-processor to improve flash flood forecasts (return periods) at ungaged stream locations in headwater areas of the Susquehanna River Basin.
9. Develop a basin-wide Flash Flood Potential Index as a visual reference tool to support flash flood operations in small watersheds.
10. Provide short term (1-7 day) hydrologic ensemble forecasts using forcing fields provided by meteorological ensemble systems.

U.S. Army Corps of Engineers (USACE)

1. Continue interagency coordination of flood risk management issues and activities through the state Silver Jacket teams, and collaborate and leverage resources to reduce flood risk. USACE will hold its annual Flood Risk Management/Silver Jackets workshop in Harrisburg, Pa. in August 2012. This will help publicize flood risks and allow agencies to share information and collaborate on flood risk projects and issues.
2. Support appropriate studies, designs, and construction as funds are available for projects such as those at Beldon Brook, N.Y.; Tyrone Borough, Pa.; Athens Borough, Pa., and the Middle Susquehanna Flood Risk Management Study.
3. Perform rehabilitation designs and award construction contracts for up to 16 projects before September 2012 as follow-up activities associated with Tropical Storm Lee which occurred in September 2011.
4. Continue to coordinate activities and share information among USACE, the National Weather Service, SRBC, emergency management agencies, and others.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Work with the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers to resolve technical, legal, and public relations issues associated with the accreditation of levees for Flood Insurance Rate Maps. (FEMA requires a full levee certification that a structure meets sufficient standards in order for the area behind it to be mapped as protected. Certification could be extremely expensive and thus far, the funds have not been found. In areas where new maps are released without certification of the levees, significant public backlash is occurring due to inclusion of additional areas in the high flood hazard zone.)
2. Work with local communities to provide data to assist with levee certification.
3. In accordance with the September 2010 Commissioner Policy on Climate Change, incorporate climate change considerations into all aspects of NYSDEC's activities, taking into account both mitigation of climate change and adaptation to the expected effects of climate change. Anticipated threats include a greater likelihood of damage from strong storms and flooding, as well as less-predictable rainfall to grow crops and replenish surface and groundwater.

New York State Disaster Preparedness Commission (coordinated through the Office of Emergency Management)

1. Coordinate statewide emergency planning and response efforts, including support for the activities listed above.

Municipalities

1. Manage floodplain development in a manner consistent with National Flood Insurance Program standards.
2. Consider adoption of higher standards for floodplain management.
3. Implement mitigation projects that protect life and property from flood damages.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR), Bureau of State Parks

1. During FY-2013 and FY-2014: At Little Buffalo State Park, continue to maintain the park's emergency action plan for high hazard dams and flooding to remain in compliance with state, local, and PADCNR rules and regulations.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation

1. Advocate for the removal of sand and gravel bar stones, cobble, and boulders in areas through the Lackawanna and Wyoming Valleys that are serving as constriction points and could potentially be causing additional flooding concerns.

Maryland Programs and Projects

Maryland Department of the Environment and Maryland Department of Natural Resources

1. Continue to work with The Nature Conservancy, the U.S. Army Corps of Engineers, and SRBC to develop management options for extending the sediment capacity behind Conowingo Dam. Modeling efforts will analyze the impacts of beneficial sediment uses just below the dam and potential water quality, sediment, and habitat impacts on the Chesapeake Bay in relationship to the Baywide total maximum daily load (TMDL). This 3-year project is dependent on continued USACE funding. The first two years of funding have been approved.

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Priority Management Area D – Ecosystems

Council Run headwaters, Clearfield Co., Pa. (left) and long-tailed salamander found in headwater areas (right).

Desired Result: *To achieve healthy ecosystems that provide groundwater and surface water of sufficient quality and in adequate supply to support abundant and diverse populations of aquatic, riparian, and terrestrial organisms, as well as human use.*

The following Actions Needed under Priority Management Area D – Ecosystems are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 59-62. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests. Please note that some of the Actions Needed under Priority Management Area A – Water Supply and Priority Management Area B – Water Quality also help to support the Desired Result for Priority Management Area D – Ecosystems.

ACTION NEEDED:
Encourage the maintenance of critical stream gaging stations in the basin.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to coordinate with partner agencies regarding funding of stream gages in the basin and explore approaches to securing long-term funding for stream gages critical to SRBC programs.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Continue to support and maintain the USACE stream gaging network in the basin as funding permits.
2. Communicate the need for a robust and diverse network of gaging stations and funding scenarios.

3. Continue to coordinate with both federal and non-federal partners to assure the stream gaging network will continue to provide the information needed for flood risk management and other areas.

NOAA National Weather Service

1. Collaborate with interagency partners in developing strategies to support the stream gaging infrastructure in the Susquehanna Flood Forecast and Warning System.

U.S. Environmental Protection Agency, Region 3

1. Through the Chesapeake Bay Program Office, continue to provide resources to support basinwide sediment and nutrient monitoring including maintenance of stream gaging stations critical to the monitoring program.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Continue to work with funding partners and stakeholders to make them aware of critical needs for stream gages.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Encourage the maintenance of critical stream gaging stations in the basin.

NYS Floodplain and Stormwater Managers Association

1. Provide information to members, elected officials, and others concerning the benefits of stream gaging stations for flood warning, flood response, floodplain management, flood mitigation, infrastructure design, and other purposes.

Environmental Emergency Services/Southern Tier Central Regional Planning and Development Board

1. Advocate for consistent funding for critical stream gages in the Chemung River Watershed, and for nationwide development of a mechanism for reliable funding of the stream gage network.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection, Bureau of Point and Non-Point Source Management

1. Continue to fund the maintenance of stream gaging stations in the Susquehanna River Basin.

Pennsylvania Department of Environmental Protection, Bureau of Safe Drinking Water

1. Continue to provide funding to maintain stream gaging stations in the basin and to coordinate closely with funding cooperators.

York County Conservation District

1. Continue to encourage the maintenance of critical stream gaging stations in the basin.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to support efforts to maintain and expand the stream gaging network as several studies have proposed, including several gages in the lower Susquehanna River Basin.

ACTION NEEDED:

Plan, implement, and maintain a program to monitor and assess impacts occurring during individual low flow events.

Susquehanna River Basin Commission Programs and Projects

1. Perform field data collections for the Low Flow Monitoring Program in summer 2012, and complete initial basinwide analyses by March 2013.
2. By summer 2013 and summer 2014: Complete annual monitoring reports for the Low Flow Monitoring Plan.
3. By May 31, 2013: Complete SRBC research project "Aquatic Resource Surveys to Determine Potential Impacts Associated with Approved Water Withdrawals," which will assist in verifying whether or not impacts to aquatic life are occurring as a result of withdrawals associated with natural gas development.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Monitor low flow conditions throughout the Susquehanna River Basin as they develop, and implement drought contingency plans at reservoirs as necessary.
2. Participate as a member of SRBC's Drought Coordination Committee.
3. Consider the use of drought assistance emergency authorities, if requested and applicable.

U.S. Environmental Protection Agency, Region 3

1. Through the Chesapeake Bay Program Office, continue to provide resources for water quality monitoring in support of flow related water quality analyses.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. Continue to provide the Pennsylvania Drought Monitoring page on the USGS website in cooperation with the Pennsylvania Department of Environmental Protection (PADEP) and NOAA's National Weather Service. The page displays drought indicator statistics for groundwater levels, streamflow levels, precipitation departures from normal, and the weekly Palmer drought severity index. The site is used by PADEP in its drought declaration decision making process. (http://pa.water.usgs.gov/drought/)

Pennsylvania Programs and Projects

Trout Unlimited Eastern Abandoned Mine Program

1. Work with SRBC to monitor the biological and chemical recovery (including during low flow periods) of the West Branch Susquehanna River headwaters after removal of the Barnes-Watkins coal refuse pile and construction of the Lancashire No. 15 water treatment plant. Treated water from the plant is being used to help provide mitigation for agricultural consumptive water use in the Pennsylvania portion of the Susquehanna River Basin.

York County Conservation District

1. Continue to monitor, respond to complaints, and assess impacts during low flow events.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR), Power Plant Research Program

1. Investigate any fish kills that occur during low flow events below Conowingo Dam, especially when minimum flows are reduced due to low river flows and exemption from including leakage flows during low flow conditions.

ACTION NEEDED:
Perform additional instream flow studies to provide scientifically-based estimates of the amount of water needed for fish, wildlife, and recreational use.

Susquehanna River Basin Commission Programs and Projects

1. By March 2013: Complete the research project entitled "Evaluation of Passby Flow Reference Gage Determinations" to determine the predictive accuracy associate with passby flow reference gage selections for ungaged watersheds in the basin.
2. Throughout FY-2013 and FY-2014: Use data collected under SRBC's Low Flow Monitoring Plan and Aquatic Resource Surveys to complement the Susquehanna River Basin Ecosystem Flow Study and other studies to facilitate future adaptive management.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Complete the low flow needs assessment for the Susquehanna River Basin and the Susquehanna River Basin Low Flow Management Study with SRBC and The Nature Conservancy.
2. With SRBC, perform aquatic biological surveys downstream of Whitney Point Lake as part of the adaptive management plan to evaluate effectiveness of the new water control plan for the lake.
3. Participate on SRBC's Water Resource Management Advisory Committee to finalize new low flow protection policy.

U.S. Fish and Wildlife Service

1. Coordinate with appropriate resource agencies and provide technical support for instream flow studies.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection, Bureau of Point and Non-Point Source Management

1. Continue to participate as an advisory partner on SRBC's Water Resource Management Advisory Committee, which deals with instream flow and water quantity issues.

York County Conservation District

1. Continue to support additional instream flow studies.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR), Power Plant Research Program

1. Continue to advocate appropriate stream flows in conjunction with Federal Energy Regulatory Commission relicensing activities. MDNR reviewed Exelon-Conowingo relicensing studies entitled "Instream Flow Habitat Assessment below Conowingo Dam," "Downstream Flow Ramping and Fish Stranding Study," "Characterization of Downstream Aquatic Communities," and "Freshwater Mussel Characterization Study below Conowingo Dam."

ACTION NEEDED:

Consider the potential spread of invasive species when evaluating project review applications for diversions and transfers of untreated water from one waterbody to another.

Susquehanna River Basin Commission Programs and Projects

1. By December 2012: Complete development of standard guidance and protocols for project applicants to assess occurrence and the needed control measures for invasive species.
2. Throughout FY-2013 and FY-2014: Condition SRBC approvals, as appropriate, to require the disinfection of withdrawal equipment and prohibit the transfer of untreated water from one waterbody to another.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission

1. Provide invasive species information during the review of SRBC draft dockets.

ACTION NEEDED:

Provide information on the biological resources of the basin and promote fishing, boating, hunting, outdoor photography, eco-tourism, bird watching, and other water-based outdoor recreation through the Commission's web site and appropriate links to other web sites.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to update SRBC's website to include additional information on biological resources.
2. Throughout FY-2013 and FY-2014: Continue to add information to SRBC's website to promote fishing, hunting, outdoor photography, eco-tourism, bird watching, and other water-based outdoor recreation, including the posting of reports to document water quality conditions of selected watersheds and streams.

Pennsylvania Programs and Projects

Visit Clearfield County

1. Focus the Visit Clearfield County marketing campaign on the West Branch Susquehanna River and its boating and other recreational resources.

ACTION NEEDED:

Work with the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC), dam owners and operators, sportsmen groups, conservation organizations, and others to produce, by 2025, self-sustaining annual populations of two million American shad and five million river herring, reproducing in the free-flowing Susquehanna River above York Haven Dam and in suitable tributaries, provide 500,000 angler days annually throughout the basin for these species, and provide effective upstream and downstream passage for American eels arriving at dams in the basin.

NOTE: The Commission's December 2008 Comprehensive Plan for the Water Resources of the Susquehanna River Basin stated that the numeric goals cited above for shad, herring, and angling were established in SRAFRC's May 2002 "Alosid Management and Restoration Plan for the Susquehanna River Basin." Since that time, the SRAFRC plan was revised, renamed, and approved by the SRAFRC Policy Committee on November 15, 2010, as the "Migratory Fish Management and Restoration Plan for the Susquehanna River Basin." In addition, the new plan was adopted by the Commission at its March 10, 2011, business meeting at Huntingdon, Pa.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to serve on the SRAFRC Technical and Policy Committees and assist in implementing the goal of the Migratory Fish Management and Restoration Plan for the Susquehanna River Basin, which is to "Restore self-sustaining, robust, and productive stocks of migratory fish capable of producing sustainable fisheries, to the Susquehanna River Basin throughout their historic ranges in Maryland, Pennsylvania, and New

York. The goals are 2 million American shad and 5 million river herring spawning upstream of the York Haven Dam. Goals for American eel and other migratory species are yet to be determined."

2. By March 2013 and March 2014: Work with other members of SRAFRC to incorporate appropriate tasks from the SRAFRC Plan into SRAFRC's annual workplans.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Investigate opportunities to implement fish passage projects within the basin under existing USACE authorities.

U.S. Fish and Wildlife Service

1. Provide technical expertise for a wide range of migratory fish studies at the Conowingo Dam and Muddy Run hydropower projects.
2. Continue to serve on the Atlantic States Marine Fisheries Commission shad and River Herring Plan Development Team and Technical Committee.
3. Work with the Susquehanna River Anadromous Fish Restoration Cooperative members and other partners to identify spawning and nursery habitat for diadromous fish and develop plans to protect and hance the quality and availability of that habitat.
4. As the lead federal agency for migratory fish restoration, continue to provide technical support to support fish passage and restoration to tributaries of the Susquehanna River.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to participate in meetings of the Susquehanna River Anadromous Fish Restoration Cooperative and, as time permits, provide comments on fish passage issues related to Federal Energy Regulatory Commission relicensing negotiations for hydroelectric facilities throughout the Susquehanna River Basin.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Waterways Engineering and Wetlands

1. Continue to work with dam owners to remove those dams that no longer serve a useful purpose. The following dam removal projects are expected to be completed by June 30, 2014:
    a. Heistand Sawmill Dam across Chickies Creek in East Donegal Township, Lancaster County. The dam is 15 feet high and 200 feet long.
    b. Duck Marsh Pond No. 26 across a tributary to Mosquito Creek in Girard Township, Clearfield County. The dam is 9 feet high and 600 feet long.
    c. Allenwood Dam across a tributary to Black Hole Creek in Lewis Township, Lycoming County. The dam is 6 feet high and 150 feet long.
    d. Pine Run No. 1 Dam across Pine Run in Hanover Township, Luzerne County. The dam is 43 feet high and 275 feet long.
    e. Laurel Run No. 2 Dam across Laurel Run in Plains Township, Luzerne County. The dam is 37 feet high and 298 feet long.
    f. Kladder Reservoir Dam across a tributary to Frankstown Branch Juniata River in Blair Township, Blair County. The dam is 10 feet high and 50 feet long.
    g. Rosegarden Dam across Yellow Breeches Creek in Monroe Township, Cumberland County. The dam is 4 feet high and 200 feet long.

h. Taylor Run Dam across Taylor Run in Hamilton Township, Tioga County. The dam is 6 feet high and 60 feet long.

Pennsylvania Fish and Boat Commission (PFBC)

1. Consider migratory fish passage in cooperation with SRBC and federal and state agencies when reviewing renewals of Federal Energy Regulatory Commission projects in the lower Susquehanna River and in PFBC's Habitat Management Dam Removal Program.
2. Continue to stock American shad fry annually.
3. Continue to conduct PFBC's study of the origin of adult shad through otolith tagging and analysis.
4. Continue to assist in implementing the Migratory Fish Management and Restoration Plan for the Susquehanna River Basin.

York County Conservation District

1. Encourage and support migratory fish restoration efforts.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to collect characterization data and tag adult American shad in the Susquehanna River below Conowingo Dam as part of an effort started in 1980 to estimate relative abundance of this species.

ACTION NEEDED:
With assistance of the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) and others, support studies of eel migration and implement restoration plans to re-establish a fishable population of American eel in the Susquehanna River system and restore adult recruitment from the river to help rebuild spawning stocks for the east coast eel fishery.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Work with SRAFRC per the previous "action needed" and include studies and implementation plans for American eel in SRAFRC's annual work plans.

Federal Programs and Projects

U.S. Fish and Wildlife Service

1. Work with the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) and other partners to protect and enhance the quality of eel habitat and support safe eel passage at Sunbury Dam and hydropower facilities on the lower Susquehanna River.
2. Continue to chair SRAFRC committees and work with the Pennsylvania Department of Conservation and Natural Resources and legislators to provide adequate fishways at all mainstem and major tributary dams.
3. Continue eel migration assessment and restoration work at Conowingo Dam, including collection of juvenile eels at the base of the dam and transporting them to locations upstream of the York Haven Dam. This is an ongoing activity that will be continued as long as funding is provided or activities are assumed by others as a result of relicensing activities.
4. Serve on the Atlantic States Marine Fisheries eel stock assessment subcommittee. The American eel stock assessment is currently undergoing peer review.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to participate in the Susquehanna River Anadromous Fish Restoration Cooperative's efforts regarding eel restoration.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. Support American eel restoration through PFBC's Fisheries Management Programs and participation in activities of the Susquehanna River Anadromous Fish Restoration Cooperative.

ACTION NEEDED:
Support preservation and restoration of tributary streams that provide habitat for migratory fish, including the removal of obstacles to upstream movement and remediation of AMD-impaired streams.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to promote implementation of the Anthracite Coal Region AMD Remediation Strategy and the West Branch Susquehanna Subbasin AMD Remediation Strategy and specific water quality improvement projects.
2. Throughout FY-2013 and FY-2014: Continue to support fish passage efforts at Sunbury Dam and at other blockages to migratory fish movement in the basin.

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Continue to work with the Pennsylvania Fish and Boat Commission, Pennsylvania Department of Environmental Protection, and the U.S. Army Corps of Engineers to ensure that projects meet all their regulatory requirements. Stream mitigation work is included in assessments when streams are impacted. Mitigation can include removal of obstacles, fish passage provisions, remediation of AMD, and other activities. The Federal Highway Administration advocates innovative solutions with an ecologically beneficial approach.

National Park Service

1. Implement priority recommendations of the Carr's Creek Watershed Management Plan including installation of riparian buffers and permanent protection of forested headwater areas of key tributaries to Carr's Creek.

Natural Resources Conservation Service (NRCS)

1. Improve or restore aquatic habitat and tributary water quality by providing technical and financial assistance to agricultural producers through Farm Bill programs and Conservation Technical Assistance.
2. Work in partnership with the Pennsylvania Fish and Boat Commission and the Maryland Department of Natural Resources to pursue opportunities in support of targeted dam removals and stream habitat improvements using NRCS programs.
3. Provide Watershed Program planning assistance, if funded, to address nonpoint source and mine drainage pollution at the request of local project sponsors.
4. Ensure proper local operation and maintenance of NRCS-assisted mine drainage remediation measures in the Glenwhite Run Watershed, Blair County, Pa.

U.S. Army Corps of Engineers (USACE)

1. Support development of AMD solutions, including investigations in the Southern Anthracite Region, Powderly Creek, Brubaker Run, Sandy Run, Six Mile Run, and other priority watersheds in Pennsylvania, pending availability of funds.
2. Continue to seek opportunities to remove fish blockages, both physical and chemical, and provide migratory fish passage throughout various watersheds.

U.S. Environmental Protection Agency, Region 3

1. Continue to support stream restoration projects to provide migratory fish passage and remediation of AMD impaired streams.

U.S. Fish and Wildlife Service

1. Provide technical assistance for development of watershed and stream management plans that restore native fish populations.
2. Conduct annual brook trout assessments in three tributaries to Lycoming Creek (Wolf Run, Upper Wolf Run, and Daugherty's Run) to evaluate brook trout populations, develop a 12-month temperature profile, and record fish population structure recovery following a stream restoration project.
3. Provide continued funding to the Pennsylvania Fish and Boat Commission (PFBC) for National Fish Habitat Action Plan/Eastern Brook Trout Joint Venture projects in Kettle Creek, Asaph Run, and Blacksmith Run
4. Provide continued funding to Spangler Municipal Authority for the National Fish Habitat Action Plan/Eastern Brook Trout Joint Venture project to restore Browns Run fish passage.
5. Conduct annual brook trout assessments in ten tributaries to Sinnemahoning Creek to evaluate inter-annual variation in brook trout populations, provide a description of reference conditions for other brook trout restoration projects, and provide sampling recommendations to the PFBC.

U.S. Forest Service

1. Continue to work with partners to provide technical assistance (outreach, training, funding, and education) for the remediation of forest buffers that are critical for migratory fish and for restoring AMD. In addition, the U.S. Forest Service has identified and prioritized important watersheds where populations of eastern brook trout should be restored. Brook trout is a species that is indicative of cool stream ecosystems requiring riparian forest buffers to maintain cool water, assist in processing excess nitrogen, and support stream food webs.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Work with the New York State Department of Transportation and local highway departments on culvert design and placement to protect habitat and restore connectivity.

Broome County/City of Binghamton

1. Continue efforts to procure funding for engineering specifications to reconfigure Rockbottom Dam for fish passage and a whitewater recreation site.

City of Elmira/Friends of the Chemung River Watershed

1. Pursue funding for construction of fish passage and a canoe/kayak route at the Chase-Hibbard Dam in Elmira.

Upper Susquehanna Coalition

1. Investigate options for re-connecting streams by removing dams and other barriers.
2. Work with property owners to minimize environmental impacts resulting from breaching dams.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Encourage AMD reclamation projects on state forest lands by offering mineral rights in exchange for capital or labor applied toward AMD reclamation.

Pennsylvania Department of Environmental Protection, Bureaus of Abandoned Mine Reclamation (BAMR) and Conservation and Restoration, Division of Watershed Restoration

1. Continue working with watershed groups to complete restoration of tributary streams to remediate AMD impacts where approved Hydrologic Unit Plans are in place. One such tributary is Two Mile Run, a tributary of Kettle Creek. BAMR is developing a surface mine reclamation project in Two Mile Run that will include a significant amount of alkaline addition in order to neutralize AMD being produced by highly acidic spoils. The project will be in design phase during 2012 and is expected to be under construction in 2013.

Pennsylvania Fish and Boat Commission

1. Through PFBC's Habitat Management Dam Removal Program, continue to seek funding and implement projects to remove barriers to fish migration and improve stream and riparian habitat.
2. Through pollution settlements with EOG and GenOn, pursue alkaline addition to streams affected by fallout of acidic materials near the Shawville Power Plant.
3. Continue to work with SRBC and the Pennsylvania Department of Environmental Protection to remediate sites producing abandoned mine drainage.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Continue to support the restoration of tributary streams including AMD remediation and the removal of blockages and material illegally dumped into streams. Pending the availability of funding, EPCAMR would be interested in working with the SRBC to evaluate areas where projects could be located, designed, and constructed to benefit fisheries in upstream tributaries.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to support preservation and restoration of tributary streams for migratory fish, although no specific plans are in place for barrier removal in the Susquehanna River Basin in 2013-2014.

ACTION NEEDED:
Require viable upstream and downstream migratory fish passage as part of relicensing activities for power dams on the lower Susquehanna River.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Work with other resource agencies to provide migratory fish passage in accordance with the Federal Energy Regulatory Commission relicensing process.
2. Throughout FY-2013 and FY-2014: Enforce applicable conditions of SRBC's approval for the PPL Holtwood project during redevelopment and operation.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Through the USACE regulatory branch, continue to review and, when apprioriate, authorize dam removal and stream restoration projects to support migratory fish restoration efforts within the basin.

U.S. Fish and Wildlife Service

1. Work with the Susquehanna River Anadromous Fish Restoration Cooperative members and other partners to identify spawning and nursery habitat for diadromous migratory fish, support fish passage in tributaries, and develop plans to protect and enhance the quality and availability of habitat.
2. Provide technical expertise for a downstream fish passage effectiveness study at the Conowingo Hydropower Project, to assess downstream turbine passage mortality for American eel, juvenile shad, and adult shad in conjunction with relicensing activities.
3. Review federal activities and provide appropriate comments, recommendations, and terms for federal permits and licenses to ensure installation of safe, timely, and effective fish passage facilities and measures.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission

1. Consider migratory fish passage in cooperation with SRBC and federal and state agencies when reviewing renewal of Federal Energy Regulatory Commission permits for projects in the lower Susquehanna River.

Trout Unlimited Eastern Abandoned Mine Program

1. Support and seek opportunities to conduct research, pursue land protection, and implement on-the-ground restoration projects that will preserve and restore tributary streams, and benefit both native brook trout populations and migratory fish.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to pursue viable fish passage during Federal Energy Regulatory Commission relicensing activities. MDNR reviewed several Exelon-Conowingo studies related to this effort in cooperation with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Pennsylvania Fish and Boat Commission, and SRBC.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to operate SRBC's Gage Notification System to monitor stream levels for passby flow information and support SRBC regulatory enforcement activities.
2. Throughout FY-2013 and FY-2014: Continue to monitor and enable project sponsors to input passby flow data into SRBC's Monitoring Data Website and its HYDRA database.

Federal Programs and Projects

NOAA National Weather Service

1. Collaborate with interagency partners to determine critical stream gages and priorities in the basin, considering the wide array of programs that are dependent on stream gage data.

NOAA National Marine Fisheries Service

1. Use the NOAA Habitat Blueprint to provide a framework for NOAA to plan strategically across programs and with partner organizations to address growing challenges related to riverine, coastal, and marine habitat loss and degradation. The Habitat Blueprint consists of a 4-pronged approach: 1) implementation of regional habitat initiatives, 2) establishment of geographic

priorities, 3) implementation of a systematic approach to habitat science, and 4) strengthening policy and legislation.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Through the Clean Water Act Section 106 grant program, provide funding for SRBC to perform assessments of targeted lakes in New York State under USEPA's National Aquatic Resource Survey during summer 2012. This National Lakes Assessment is designed to provide statistically valid regional and national estimates of the condition of lakes. It uses a probability-based sampling design to represent the condition of all lakes in similar regions sharing similar ecological characteristics. Consistent sampling and analytical procedures ensure that the results can be compared across the country. The National Lakes Assessment helps build state and tribal capacity for monitoring and assessment, and promotes collaboration across jurisdictional boundaries in the assessment of water quality.
   (See http://water.epa.gov/type/lakes/lakessurvey_index.cfm).

U.S. Fish and Wildlife Service

1. Provide technical expertise to identify and assess potential habitat and the presence or absence of the federally –listed bog turtle and the Pennsylvania and Maryland state-listed rough green snake in conjunction with hydropower relicensing activities on the lower Susquehanna River.
2. Provide technical expertise to help identify critical habitat for bald eagles at the Conowingo and Muddy Run hydropower projects.
3. Work with Towson University to assess northern map turtle (a state-listed endangered species) use of Garrett Island. The work will identify basking and nesting locations, assess connectivity with other known populations, and provide management recommendations.
4. Under the Partners for Fish and Wildlife Program, construct five 0.25 acre vernal pools and one wetland enhancement project in the upper reaches of the Susquehanna River Basin in New York State.

U.S. Forest Service

1. Continue to work with states to improve the health of public and private forests and reduce the loss of private forests.
2. Continue to lead development of a Working Lands Conservation Strategy for the Chesapeake Bay Watershed.
3. Continue to provide technical support through training, information, and grant assistance in the Chesapeake Bay Watershed to increase the restoration of riparian forest buffers and restore forests in priority places.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. Continue to develop a proposal to characterize a near optimal stream gage network for estimating streamflow at ungaged sites in Pennsylvania, including the entire Susquehanna River Basin. The project would be implemented in cooperation with the Pennsylvania Department of Environmental Protection (PADEP) and SRBC. Objectives of the project are to:
   a. Determine ungaged watersheds that are not adequately represented by a reference stream gage in the current gaging network,
   b. Identify stream gages in the current network that potentially provide redundant streamflow information for characterization of an ungaged watershed, and
   c. Identify watersheds requiring new stream gage locations where the current network does not adequately fulfill a reference function based on weighting criteria relevant to needs of PADEP and USGS.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Support implementation of the New York State Comprehensive Wildlife Conservation Strategy.
2. Finalize and implement a recovery plan for the hellbender (a rare salamander).
3. Monitor aquatic habitat in lakes and streams on a 5-year monitoring and assessment cycle.
4. Support the New York Citizens Statewide Lake Assessment Program, in which trained citizens conduct water quality monitoring.
5. Manage fisheries and other aquatic wildlife throughout the watershed.

Biological Field Station for the State University of New York at Oneonta

1. Monitor the pollution problems affecting pearly mussels in the Unadilla River.

Upper Susquehanna Coalition

1. Restore habitats through wetland construction, wetland restoration, stream rehabilitation, and prescribed grazing projects.
2. Design and install creative outreach signs for the Upper Susquehanna and Chemung River Watersheds.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Continue to conserve healthy ecosystems on state forest lands by managing gas development in a balanced, sustainable manner. Management will emphasize impact avoidance, minimization, mitigation, and monitoring. The Bureau will continue to apply best management practices through application of its *Guidelines for Administering Oil and Gas Activity on State Forest Lands*, which will be updated periodically as a result of applied adaptive management. The Bureau will continue development of a multi-disciplinary monitoring program that will annually report on the status of gas development and analyze potential effects on state forest lands.

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Priority Management Area E – Chesapeake Bay

Tidal portion of Lower Susquehanna River where it meets the Chesapeake Bay.

Desired Result: *To manage the water resources of the Susquehanna River Basin to assist in restoring and maintaining the Chesapeake Bay so it meets or exceeds applicable water quality standards and supports healthy populations of living resources, including oysters, crabs, fish, waterfowl, shore birds, and underwater grasses.*

The following Actions Needed under Priority Management Area E – Chesapeake Bay are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 64-66. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests. Please note that some of the Actions Needed under Priority Management Area A – Water Supply, Priority Management Area B – Water Quality, and Priority Management Area D – Ecosystems also help to support the Desired Result for Priority Management Area E – Chesapeake Bay.

ACTION NEEDED:
Work with USEPA's Chesapeake Bay Program, USACE, the State of Maryland, and others to support the process to determine flow regimes under which the ecological health of the Bay can be restored and sustained.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Work with project sponsors, agency representatives, and contractors through Federal Energy Regulatory Commission relicensing processes to promote environmental flow protection for the lower Susquehanna River.

Federal Programs and Projects

National Park Service

1. Through the National Park Service's Rivers, Trails, and Conservation Assistance Program, continue as an active Chesapeake Bay Program partner guiding implementation of best management practices and permanent conservation of priority natural resource lands.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Release a new version of the Chesapeake Bay watershed model that can provide modeling and data analysis support to determine flow regimes needed for the ecological health of the

Chesapeake Bay. The model could be used to support sediment management activities and analyze the trapping efficiency of dams on the Lower Susquehanna River as identified below under additional "actions needed" for this Priority Management Area.

U.S. Fish and Wildlife Service

1. Through Federal Energy Regulatory Commission relicensing activities, coordinate with state and federal partners and hydroelectric plant owners to assess and develop mitigation to meet instream flow needs in the lower Susquehanna River and Chesapeake Bay.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR)

1. Continue to pursue appropriate flow regimes through the Federal Energy Regulatory Commission relicensing process. MDNR reviewed several studies related to this effort in cooperation with the U.S. Army Corps of Engineers, the Pennsylvania Department of Environmental Protection, the U.S. Fish and Wildlife Service, and SRBC.

ACTION NEEDED:
Plan any additional studies and modeling efforts that are needed and seek appropriate funding and implementation.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Finalize technical analyses for the Lower Susquehanna River Watershed Assessment, which includes modeling of sediment movement in the watershed and the impact of sediment on Chesapeake Bay. The study will include potential management measures to reduce sediment delivered to the Bay, including that trapped in the lower Susquehanna reservoirs that can be mobilized by high flows and cause ecological damage downstream.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Continue analyses of the status and trends of River Input Monitoring sites in the Chesapeake Bay Watershed.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. Continue to participate in the SRBC Water Resource Management Advisory Committee's work involving ecosystem flow studies, policy development, and implementation.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR)

1. Continue to pursue any appropriate actions through the Federal Energy Regulatory Commission relicensing process. MDNR recently reviewed a number of related Exelon-Conowingo studies in cooperation with the U.S. Army Corps of Engineers, the Pennsylvania Department of Environmental Protection, the U.S. Fish and Wildlife Service, and SRBC.

ACTION NEEDED:
Assess the feasibility of providing recommended flow regimes to the Bay.

Federal Programs and Projects

U.S. Army Corps of Engineers (USACE)

1. Pending availability of funds, begin a reconnaissance study for a comprehensive Chesapeake Bay restoration plan. Part of this effort could include analysis of flow regimes.
2. Scope a Susquehanna Low Flow Phase 2 study effort with SRBC to assess the potential for low flow augmentation from USACE reservoirs and other sources.

U.S. Environmental Protection Agency (USEPA), Region 3

1. If requested, make the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) available to help set up an independent peer review regarding the feasibility of providing recommended flow regimes to the Bay.

U.S. Fish and Wildlife Service

1. Through the Federal Energy Regulatory Commission relicensing activities, coordinate with state and federal partners and hydroelectric plant owners to assess and develop mitigation to meet instream flow needs in the lower Susquehanna River and Chesapeake Bay.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to pursue any appropriate actions through the Federal Energy Regulatory Commission relicensing process. MDNR recently reviewed a number of related Exelon-Conowingo studies in cooperation with the U.S. Army Corps of Engineers, the Pennsylvania Department of Environmental Protection, the U.S. Fish and Wildlife Service, and SRBC.

ACTION NEEDED:
Perform trend analyses for additional sediment and nutrient monitoring sites as sufficient data are accumulated.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Pending availability of funding, perform trend analyses at sediment and nutrient monitoring sites established in 2004 and 2005.

ACTION NEEDED:
Coordinate, encourage and support efforts to manage sediment within the basin, including legacy sediments from mill dams and sediment that has accumulated behind dams on the lower Susquehanna River.

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Continue to support sediment management activities through coordination with the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers for projects that may impact streams within the Susquehanna River Basin.

Natural Resources Conservation Service

1. Reduce excessive erosion and sedimentation associated with agriculture by providing technical and financial assistance to agricultural producers through Farm Bill programs (including the Chesapeake Bay Watershed Initiative) and Conservation Technical Assistance.

U.S. Army Corps of Engineers (USACE)

1. Promote the need for and champion the development of a regional sediment management strategy for the Chesapeake Bay.

2. Continue to identify non-federal partners and develop a scope of work to consider basin-wide sediment issues in a watershed assessment, watershed plan(s), and/or feasibility study.
3. Through the USACE Regulatory Branch, continue to review legacy sediment removal projects in an effort to encourage the restoration of aquatic ecosystems within the Susquehanna River Basin.

U.S. Environmental Protection Agency, Region 3

1. Continue to advance the Legacy Sediment concept for watershed restoration applications, while providing technical assistance to federal, state, and local governments in the development and/or implementation of watershed based restoration/improvement plans. This would include consideration during the review of grant proposals under Section 319 of the Clean Water Act and during reviews of Total Maximum Daily Load (TMDL) implementation plans.
2. Continue to support the Big Spring Run Project, which is a project funded by Pennsylvania's Growing Greener Program in Lancaster County, Pa. The project currently has USEPA's Office of Research and Development collaboration, and may potentially also receive support from USEPA's Regional Applied Research Effort (RARE) Grant Program. Project objectives are to:
    a. Assess ecosystem benefits of restoring a stream adversely impacted by legacy sediments deposited as a function of historic mill dam construction,
    b. Identify stream restoration methods including legacy sediment removal and implementation of wetland restoration best management practices to enhance nitrogen control,
    c. Develop predictive models of stream hydrology and sediment movement, and
    d. Develop ecologically-based guidelines for stream restoration with the goal of advancing the Legacy Sediment concept for watershed restoration applications.

U.S. Fish and Wildlife Service

1. During Federal Energy Regulatory Commission relicensing activities, provide technical expertise to address sediment transport issues in the lower Susquehanna River.

U.S. Geological Survey, Pennsylvania Water Science Center

1. In cooperation with the U.S. Army Corps of Engineers (USACE) and the Maryland Department of the Environment, collect sediment samples from Conowingo Pond and develop and calibrate a HEC-RAS model to account for sediment deposition and erosion in the four lower Susquehanna reservoirs as part of the Lower Susquehanna River Watershed Assessment. Data and results from this effort will assist USACE with its proposed 2D modeling of sediment in the Conowingo Pond.

New York Programs and Projects

Upper Susquehanna Coalition and Member Soil and Water Conservation Districts

1. Reduce erosion of streambanks and channels through implementation of stream channel and stream corridor rehabilitation projects.
2. Implement the Upper Susquehanna Coalition Grazing Initiative that supports prescribed grazing, riparian buffers, and cow exclusion from streams. This initiative addresses sediment and nutrient loading to streams and rivers, and reduces stream erosion problems.
3. Conduct training for highway maintenance practices that reduce erosion of road banks, ditches, and road surfaces.
4. Conduct hydroseeding programs to stabilize road ditches and road banks after maintenance is performed.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation

1. Continue to identify and complete surface mine reclamation projects that will restore abandoned mine lands and reduce sediment loads to receiving streams.

Pennsylvania Department of Environmental Protection, Bureau of Point and Non-Point Source Management

1. Continue to participate in the Chesapeake Bay Non-Tidal Monitoring Program. While legacy sediment issues are not a specific emphasis of non-tidal monitoring, a central priority is to sample sediment loading during storm events, with the derived data being used to support Chesapeake Bay management decisions regarding best management practice and remediation priorities.

Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering and Wetlands

1. Continue to plan, coordinate, conduct, and document meetings of the Legacy Sediment Workgroup as part of Pennsylvania's Chesapeake Bay Tributary Strategy development.
2. Continue to foster partnerships that target legacy sediments and restore natural aquatic resources impaired by legacy sediment storage and erosion.
3. Oversee construction of the Big Spring Run Natural Floodplain, Stream, and Riparian Wetland Restoration Research Project that will implement a new and innovative best management practice that is being developed to address legacy sediment impairments. Continue to work in partnership with the U.S. Environmental Protection Agency, the U.S. Geological Survey, academia, private landowners, consultants, non-profit organizations, and other interested parties to evaluate the benefits and effectiveness of implementing the new best management practice.
4. Assist aquatic resource managers in identifying and targeting resources impaired by legacy sediment.
5. Support research partnerships and the development of techniques, procedures, and databases that identify legacy sediment impairments.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which supports floodplain restoration.

Maryland Programs and Projects

Maryland Resource Agencies

1. Use Maryland's Watershed Implementation Plans to address required sediment reductions and local efforts to manage sediment in the watershed, which may include programs to address legacy sediments in smaller impoundments.
2. Continue to work with the U.S. Army Corps of Engineers (USACE), SRBC, and The Nature Conservancy to develop management options for extending the sediment capacity behind Conowingo Dam. This project is dependent on USACE funding and would include modeling efforts to examine the impacts of beneficial sediment uses in the river below the dam and potential water quality, sediment, and habitat impacts on the Chesapeake Bay in relationship to the Baywide total maximum daily load (TMDL).

ACTION NEEDED:
Support studies to determine the remaining sediment trapping efficiency of dams on the lower Susquehanna River and determine if and how trapping capability may be retained.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue participation in the multi-agency Lower Susquehanna River Watershed Assessment, which is focused on comprehensive forecasting and evaluation of sediment and associated nutrient loads to the system of hydroelectric dams located on the lower Susquehanna River. The assessment will consider structural and non-structural strategies for sediment and nutrient management, and will assess cumulative impacts of future conditions and sediment and nutrient management strategies on the Chesapeake Bay.

Federal Programs and Projects

U.S. Army Corps of Engineers

1. Finalize technical analyses for the Lower Susquehanna River Watershed Assessment, which includes an assessment of sediment movement in the lower Susquehanna River Basin and the impact on Chesapeake Bay. The study will include potential management measures to reduce the amount of sediment delivered to the Bay, including the sediment trapped in reservoirs on the lower Susquehanna River.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Through the Chesapeake Bay Program Office and other USEPA Region 3 activities, support Maryland Department of Natural Resources' Lower Susquehanna River Watershed Assessment and its mission to address sediment accumulation behind Conowingo Dam, as well as the associated potential for storms to affect water quality and aquatic life in the Chesapeake Bay. The goals of the assessment are to:
    a. Evaluate strategies to manage sediment and associated nutrient delivery to the Chesapeake Bay,
    b. Evaluate strategies to manage sediment and associated nutrients available for transport during high flow storm events to reduce impacts to the Chesapeake Bay, and
    c. Determine the effects on the Bay due to the loss of sediment and nutrient storage.

U.S. Fish and Wildlife Service

1. During Federal Energy Regulatory Commission relicensing activities, provide technical expertise to address sediment transport issues in the lower Susquehanna River.

Maryland Programs and Projects

Maryland Resource Agencies

1. Continue to work with the U.S. Army Corps of Engineers (USACE), SRBC, and The Nature Conservancy to develop management options for extending the sediment capacity behind Conowingo Dam. This project is dependent on USACE funding and would include modeling efforts to examine the impacts of beneficial sediment uses in the river below the dam and potential water quality, sediment, and habitat impacts on the Chesapeake Bay in relationship to the Baywide total maximum daily load (TMDL).

ACTION NEEDED:

Promote the installation of best management practices for point and nonpoint sources including stormwater and water quality infrastructure improvement for point sources in the Susquehanna River Basin to benefit local water quality improvement and the Bay restoration effort.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to maintain the SRBC website for the Paxton Creek stormwater project, and to promote infrastructure improvements and best management practices.
2. Throughout FY-2013 and FY-2014: Participate in the Chesapeake Bay Water Quality Goal Implementation Team (WQGIT) (formerly Chesapeake Bay Water Quality Steering Committee) conference calls and meetings regarding Chesapeake Bay restoration efforts.
3. Throughout FY-2013 and FY-2014: Prepare Total Maximum Daily Load studies according to the Pennsylvania Department of Environmental Protection grant schedule to assist in planning and promoting watershed restoration activities.

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Support the installation of best management practices through coordination with the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers regarding erosion and sedimentation controls and stormwater management for projects that may impact streams in the Susquehanna River Basin. This coordination is generally performed during regulatory reviews with the permitting agencies.

National Park Service

1. Implement priority recommendations of the Carr's Creek Watershed Management Plan including non-point source best management practices for agricultural lands along Carr's Creek and Willow Brook.

Natural Resources Conservation Service

1. Address critical agricultural surface and groundwater resource concerns related to soil erosion, sediment, nutrients, organic materials, pathogens, and agri-chemicals by providing technical and financial assistance to agricultural producers through Farm Bill programs (including the Chesapeake Bay Watershed Initiative) and Conservation Technical Assistance.
2. Provide Watershed Program planning assistance to address nonpoint source pollution at the request of local project sponsors, if funded.

U.S. Army Corps of Engineers (USACE)

1. Continue to support the Department of Defense by inventorying point and non-point source best management practices to assist in meeting total maximum daily load requirements for the Chesapeake Bay. USACE provided assistance to Army Installation Management Command – Atlantic Installations, Army National Guard (ARNG), and Reserve facilities in helping to meet the assigned target load reductions for their subwatershed(s) in accordance with applicable state Phase II Watershed Implementation Plans (WIPs). This project included installations and their associated annexes in the Bay watershed including Carlisle Barracks and over thirty ARNG facilities and five Reserve facilities, many of which are in the Susquehanna River Basin.

U.S. Environmental Protection Agency (USEPA), Region 3

1. Under the President's Chesapeake Bay Executive Order, continue to create plans for a number of programs, including stormwater management. Continue to work on permitting and enforcement plans that are supportive of the Executive Order and will likely be living documents. Federal programmatic milestones for water quality restoration are at http://executiveorder.chesapeakebay.net/EO_13508_Water_Quality_Milestones-2012-01-06.pdf.
2. Provide technical assistance for state Watershed Implementation Plans to ensure that the Chesapeake Bay Total Maximum Daily Load (TMDL) Waste Load Allocations can be effectively assigned to stormwater point sources (mainly Municipal Separate Storm Sewer Systems and construction). ChesapeakeStat has a new module for visualizing the TMDL allocations by state,

basin, TMDL segment, and sector (stormwater, wastewater, agriculture, etc.) at http://stat.chesapeakebay.net/?q=node/59&quicktabs_3=2&quicktabs_10=2.

3. Through the Chesapeake Bay Program Office, provide funding to the Upper Susquehanna Coalition, the Commonwealth of Pennsylvania, the State of Maryland, and others to implement commitments made under *Chesapeake 2000*. Much of this funding is provided for nonpoint source best management practices on agricultural lands.
4. Continue to implement the Chesapeake Bay TMDL, which was established for nitrogen, phosphorus, and sediment on December 29, 2010. The TMDL was based in part on Phase I Watershed Implementation Plans (WIPs) developed by each of the Bay jurisdictions of the District of Columbia, Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia. The WIPs detail how and when the jurisdictions will meet pollution allocations. Additional information is provided at http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/BayTMDLFactSheet8_6.pdf and http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/BayTMDLExecutiveSummaryFINAL122910_final.pdf.
5. Continue working with the District of Columbia and the six states in the Chesapeake Bay Watershed to develop and implement Phase II WIPs that:
    a. Make key stakeholders – local governments, conservation districts, famers, builders, and others – aware of their roles in cleaning up the region's waterways. USEPA also will strengthen pollution reduction strategies for any sectors subject to federal enhanced oversight or backstop actions based on the Phase I WIPs and the Chesapeake Bay TMDL issued in 2010,
    b. Provide additional information to facilitate actions by local partners to control nutrient and sediment loads delivered to the Bay,
    c. Provide the location and level of nutrient and sediment controls that will be in place by 2017 to achieve 60 percent reductions necessary to meet Chesapeake Bay TMDL allocations and by 2025 to fully meet the allocations, and
    d. Provide jurisdictions with another opportunity to demonstrate reasonable assurance that they will achieve and maintain Chesapeake Bay TMDL allocations by implementing best management practices on point and nonpoint sources and by accommodating for or offsetting any new or increased discharges.
6. Continue to work with the seven Chesapeake Bay jurisdictions to evaluate and report to the Chesapeake Executive Council whether jurisdictions have achieved their 2009-2011 milestone commitments. These milestones represent the first set of short term commitments that the Bay jurisdictions committed to as a way to demonstrate progress toward the Executive Council's goal of having all practices in place by 2025 necessary to achieve water quality standards. An interim assessment of the milestones was conducted in July 2011, and found that all jurisdictions were generally on track or ahead of schedule toward achieving these commitments.
7. Complete USEPA's assessment of the next set of 2-year milestones for reducing nitrogen, phosphorus, and sediment loads delivered to the Chesapeake Bay and its tidal tributaries. In addition to work performed by the seven Bay jurisdictions, federal agencies also will develop milestones covering pollutant reduction actions in 2012 and 2013. USEPA will evaluate the milestones to ensure that they include the necessary near-term commitments to keep jurisdictions on track to meet their goal of having all practices in place by 2025 to meet water quality standards in the Bay.
8. As Bay jurisdictions develop Phase II WIPs and milestones, USEPA will:
    a. Continue to support WIP development and implementation through USEPA contractor support, implementation grants, coordination, and resources for on-the-ground service providers, and technical assistance to help partners estimate nitrogen, phosphorus, and sediment reductions associated with proposed management actions,

b. Help coordinate federal agency activities to provide input on Phase II WIPs and develop Federal Facility Implementation Plans and 2-year milestones,
c. As requested, work in partnership with Bay jurisdictions and local entities to conduct outreach,
d. Conduct a targeted reasonable assurance review to ensure that TMDL allocations will be achieved and maintained,
e. Provide comments on draft and final Phase II WIPs and 2012-2013 milestones,
f. Conduct oversight of WIP and milestone implementation activities to ensure that jurisdictions are following through with their pollutant reduction commitments, and
g. Take appropriate federal actions if a jurisdiction's Phase II WIP does not meet USEPA expectations.

9. Continue to work with the Bay jurisdictions to address areas of USEPA concern identified in the final reports for offset and trading programs. Letters to the jurisdictions and the trading and offset program reports are found at http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/PortfolioOfTradingLetters.pdf and http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/PortfolioOfReports.pdf, respectively.

U.S. Forest Service

1. Continue to lead and provide technical assistance in restoring riparian forest buffers for water quality improvement in the Susquehanna River Basin. Riparian forest buffers have been reported to be one of the most valuable best management practices for the improvement of water quality.
2. Continue to provide technical assistance for urban and community forest activities. Urban tree planting is a cost-effective best management practice that directly benefits local communities.

U.S. Geological Survey (USGS), Pennsylvania Water Science Center

1. Continue long-term data collection in the Conewago Creek Watershed as part of a larger effort to monitor the effects of agricultural best management practices (BMPs) on water quality in small basins. This watershed is one of three "showcase" watersheds in the Chesapeake Bay drainage area where the effectiveness of BMP implementation will be studied. The U.S. Department of Agriculture's Natural Resources Conservation Service plans to implement a wide variety of BMPs in the Conewago Creek Watershed, and monitoring data are needed to adequately measure the long term impacts of these practices. Within the watershed, BMP implementation is being strategically accelerated to maximize nutrient and sediment reductions. USGS will monitor for a period of 5-10 years to evaluate changes in water quality due to the combination of BMPs.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Protect and improve water quality through permit programs and compliance monitoring for point discharges, stormwater management, and stream and wetland disturbances.
2. Administer chemical and pollution control programs, including those associated with spill response, waste site remediation, chemical and petroleum storage, pesticides, and waste management.
3. Support implementation of agricultural projects through the Agricultural Nonpoint Source Abatement and Control Program (ANSACP).
4. Fund water quality improvement projects.
5. As part of the final Supplemental Generic Environmental Impact Statement, require that well operators obtain coverage under the SPDES General Permit for Stormwater Discharges from High Volume Hydraulic Fracturing and implement appropriate stormwater control measures and

related best management practices whenever proposing to conduct horizontal drilling and high volume hydraulic fracturing.

New York State Department of Environmental Conservation/Upper Susquehanna Coalition/Other Partners

1. Promote the installation of best management practices for point and nonpoint sources, including stormwater and water quality infrastructure improvement to benefit local water quality.
2. Continue to work with the U.S. Environmental Protection Agency to improve watershed modeling and the resulting allocations for Chesapeake Bay restoration.

New York State Department of Environmental Conservation/Environmental Facilities Corporation

1. Provide low interest financing for municipal wastewater treatment and water quality improvement projects through the Clean Water State Revolving Fund.

New York State Soil and Water Conservation Committee

1. Promote water quality protection and improvements (including sediment, nitrogen, and phosphorus reductions) through the Agricultural Environmental Management Program and the Agricultural Nonpoint Source Grant Program.

County Planning Departments/Cornell Cooperative Extension, Schuyler County/ Regional Planning Boards

1. Continue to work with area and regional partners to bring training opportunities to local land use boards, specifically encouraging the use of best management practices in site design.

County Soil and Water Conservation Districts

1. Implement best management practices on farms by identifying and working with those that need conservation plans and ultimately projects (following the state-legislated Agricultural Environmental Management process).
2. Work with municipalities and contractors to meet stormwater requirements and promote additional reductions in sediment, nitrogen, and phosphorus from nonpoint sources.

Regulated Municipal Separate Storm Sewer System (MS4) Operators in the Elmira and Binghamton Urban Areas

1. Educate the public regarding stormwater management.
2. Identify and eliminate sanitary septic overflows and other illicit discharges.
3. Regulate construction and post-construction stormwater runoff from new development.
4. Provide for long-term maintenance of stormwater management facilities.
5. Implement programs and practices that protect and restore stormwater quality, such as good housekeeping practices.

Rural Stormwater Coalition of Chemung, Schuyler and Steuben Counties

1. Continue to promote progressive stormwater management policies and practices in nonurban areas through training, public education, technical assistance, and other efforts.

Southern Tier Central Regional Planning and Development Board

1. Promote funding for and implementation of priority water resource projects identified in the *Susquehanna-Chemung Action Plan*, an ecosystem-based watershed management plan.

Upper Susquehanna Coalition

1. Develop regional projects and grant applications to support and enhance the water quality protection and restoration efforts of member Soil and Water Conservation Districts.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry

1. Throughout FY-2013 and FY-2014: Continue to implement best management practices through the Bureau's *Guidelines for Administering Oil and Gas Activity on State Forest Lands*, which will be periodically updated. These guidelines include measures for stormwater management and erosion and sediment control.
2. Continue to work in partnership with federal and local agencies to supply funding and provide technical assistance for farmers and other private landowners to implement forest riparian buffers.
3. Continue to work in partnership with others to conduct urban tree canopy assessments to determine the amount of existing canopy and the benefits of providing additional canopy to provide benefits such as stormwater reduction. Assistance will continue to be provided to help communities find opportunities and areas where additional trees can be planted. Several cities have performed assessments and are pursing goals to increase tree canopy. The City of Lancaster has a goal of 40 percent canopy and plans to plant about 1,200 trees annually to reach that goal.

Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering and Wetlands

1. Continue to implement and update Pennsylvania's Watershed Implementation Plan.

Pennsylvania Fish and Boat Commission (PFBC)

1. Implement conditions of PFBC's hatchery facility National Pollutant Discharge Elimination System permits which have been redrafted to reflect more stringent nutrient control requirements for Chesapeake Bay.

Trout Unlimited Eastern Abandoned Mine Program

1. Continue to promote the use of mine drainage residuals (MDR) as an economically viable best management practice to reduce the water extractable phosphorus (WEP) of animal manure applied to land. Trout Unlimited intends to 1) collect information necessary to have the use of MDR for WEP management evaluated as a best management practice, 2) conduct MDR characterization surveys, 3) conduct MDR dose/effect relationship investigations, 4) conduct field application of MDR, and 5) provide educational outreach related to this project.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which includes strategies related to improved stormwater management, including the establishment of stormwater best management practice demonstration sites throughout the county.

York County Planning Commission

1. Continue to assist York County Municipalities in adopting stormwater ordinances consistent with the County's newly approved Act 167 Plan which recommends best management practices to handle and infiltrate stormwater runoff onsite.

Maryland Programs and Projects

Maryland Department of the Environment

1. Through Maryland's 2007 Stormwater Management Act, continue to require all new development disturbing 5,000 square feet or more to implement environmental site design (ESD) to the maximum extent practical. ESD integrates natural hydrology, site design, and smaller controls to capture and treat runoff, and provides treatment closer to the source of runoff pollution than conventional stormwater management practices.
2. Enforce provisions of the National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permits issued to Baltimore, Carroll, Harford, and Cecil

Counties. These permits require stormwater management upgrades in developed areas with little or no stormwater management and encourage public participation in residential stormwater management activities including the installation of rain barrels and rain gardens.

3. Through future MS4 permits, require Baltimore, Carroll, Harford, and Cecil Counties to perform urban restoration activities, develop Chesapeake Bay total maximum daily load (TMDL) implementation plans, and to be consistent with any TMDLs approved by the U.S. Environmental Protection Agency.

Harford County

1. Implement the Deer Creek Watershed Restoration Action Strategy developed by Harford County in 2007, using funding obtained under a Conservation Technical Assistance (CTA) Grant from the Natural Resources Conservation Service.

ACTION NEEDED:
Work with municipalities, developers, conservation and sportsmen groups, and others to support wetland establishment and enhancement in the basin to provide downstream benefits to water quality and migratory birds using the Bay.

Federal Programs and Projects

Federal Highway Administration, Pennsylvania Division

1. Continue to work with local metropolitan planning organizations and rural planning organizations to identify possible wetland banking opportunities. In addition, when wetlands are impacted by a project, regulatory requirements often include replacement and/or enhancement as mitigation. The Federal Highway Administration will continue to work with the regulatory agencies and the Pennsylvania Department of Transportation on a project-by-project basis to develop the most appropriate mitigation.

National Park Service

1. Implement priority recommendations of the Carr's Creek Watershed Management Plan including creation of wetlands in sections of Carr's Creek floodplain to enhance wildlife habitat and increase flood attenuation.

National Oceanic and Atmospheric Administration

1. Energize large-scale efforts to restore habitats by: 1) prioritizing and targeting federal wetland and habitat restoration initiatives across agencies and partners, 2) providing technical assistance and targeted funding, 3) protecting investments in both large-scale restoration and treasured landscape conservation, and 4) developing a comprehensive, bay-wide, ecological native oyster restoration strategy.
2. Employ sustainable practices for managing habitat and fish and wildlife populations by: 1) supporting ecosystem-based fisheries management approaches, 2) promoting the protection of key species and their habitat, 3) strengthening water bird and shorebird conservation, 4) protecting valuable land and water habitat through permit reviews and consultation under existing authorities, 5) assessing the impact of environmental contaminants, 6) conducting a socioeconomic assessment, 7) identifying actions that will benefit fish and wildlife resources, 8) supporting science and modeling to advance the public's understanding of the Chesapeake Bay ecosystem, 9) making data easily accessible to resource managers, and 10) establishing long-term, bay-wide strategies to ensure sustainable crab populations.

Natural Resources Conservation Service

1. Protect, restore, and enhance wetlands by providing technical and financial assistance to agricultural producers through Farm Bill programs (including the Chesapeake Bay Watershed

Initiative, Wetlands Reserve Program, and Wildlife Habitat Incentives Program) and Conservation Technical Assistance.

U.S. Army Corps of Engineers (USACE)

1. Through the Regulatory Branch, continue to review and authorize wetland projects supported by state and federal grants to restore aquatic ecosystems in the Susquehanna River Basin.
2. Pending the availability of funds, develop the Section 567 Program, Upper Susquehanna River Basin Ecosystem Restoration Project to restore wetland habitat and improve soil and water conservation practices in the upper Susquehanna River Basin.
3. In the interest of wetland conservation, continue to pursue projects under the Section 510 Program for Chesapeake Bay Environmental Restoration and Protection.

U.S. Environmental Protection Agency, Region 3

1. Through the Chesapeake Bay Program Office, continue to provide funds to the Upper Susquehanna Coalition to implement water quality commitments for the Chesapeake Bay Total Maximum Daily Load. The Coalition is providing a leadership role in the Chesapeake Bay Program in working with groups to support wetland establishment and enhancement.

U.S. Fish and Wildlife Service (USFWS)

1. Develop partnerships with landowners to establish conservation easements, deed restrictions, and other measures to protect high priority habitats.
2. Work with resource agencies to develop appropriate mitigation standards for gas pipeline crossings, including onsite implementation of best management practices and the creation of mitigation banks.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Support wetland restoration activities of the Upper Susquehanna Coalition.

The Wetland Trust

1. Develop an endowment to provide a sustainable source of funding for wetland projects in the Susquehanna River Basin. The Wetland Trust is a nonprofit organization whose mission is to restore and protect wetlands.
2. Partner with the Upper Susquehanna Coalition on wetland mitigation projects.

Upper Susquehanna Coalition and Member Soil and Water Conservation Districts

1. Continue an active wetland restoration and construction program that provides multiple benefits to local and downstream areas.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. During permit reviews, recommend avoidance of wetland impacts as first priority, then mitigation if avoidance is not possible. When possible, maximize wetland enhancement in programs and projects in which PFBC is a partner.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. At Codorus State Park, continue to work with conservation organizations to improve water quality and aquatic ecosystems.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Federal Programs and Projects

NOAA National Ocean Service Coastal Services Center

1. Continue to provide a comprehensive inventory of coastal decision making tools through Digital Coast at http://csc.noaa.gov/digitalcoast/index.html.

NOAA National Integrated Drought Information System Program Office

1. Continue to assess watershed user needs to determine the feasibility of a Regional Drought Emergency Warning System in the Chesapeake Bay Region.

NOAA National Marine Fisheries Service

1. Through Habitat Blueprint, continue to provide a framework for NOAA to plan strategically across programs and with partner organizations to address riverine, coastal, and marine habitat loss and degradation.

U.S. Fish and Wildlife Service

1. Provide technical expertise for a freshwater mussel characterization study below Conowingo Dam.
2. Provide technical expertise for the Maryland Darter Survey to confirm the presence or absence of the Maryland darter in the vicinity of Conowingo Dam.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Expand data collection efforts to support the Chesapeake Bay Non-Tidal Monitoring Network. Six continuous record stream gages and nine water quality monitoring sites will be added to the network.

New York Programs and Projects

New York State Department of Environmental Conservation (NYSDEC)

1. Continue to support Chesapeake Bay Program Goal Implementation Teams through participation in regular conference calls.
2. Submit 2-year milestone implementation reports to the Chesapeake Bay Program.
3. Continue to work with the Chesapeake Bay Program on forest conservation and restoration strategies through grant opportunities as well as bi-monthly phone calls.
4. Continue implementation of an existing project to promote stewardship on private lands within the Chesapeake Bay Watershed through education and outreach.
5. Expand technical assistance for riparian buffer restoration through NYSDEC's Trees for Tribs Program.
6. Assist SRBC with stream sampling associated with the Chesapeake Bay Program nontidal monitoring network.
7. Maintain and update the New York database of stormwater management practices and point sources used for the Chesapeake Bay Model.
8. Continue cooperating with the Natural Resources Conservation Service on the Private Forest Landowner Assistance Program.
9. Conduct limited public outreach, based on funding from the Chesapeake Bay Program.

Southern Tier Chesapeake Bay TMDL Commenting Coalition (a loosely formed coalition representing major New York stakeholders who will be impacted by the Chesapeake Bay Total Maximum Daily Load, or TMDL)

1. Maintain partnerships among New York State agricultural, municipal, and industrial stakeholders regarding the Chesapeake Bay TMDL.

2. Continue to be responsible, environmental stewards within local watersheds and within the larger Chesapeake Bay Watershed.
3. Advocate for TMDL load allocations for New York that are fair, equitable, and cost-feasible.
4. Advocate for funding to achieve Chesapeake Bay nutrient reductions that are required of New York State stakeholders.

Biological Field Station for the State University of New York at Oneonta

1. Participate in an IMAX production regarding connections between the Chesapeake Bay and Otsego Lake, targeted for release in 2013.

Upper Susquehanna Coalition

1. Maintain the "NEIN" data node for entry of New York State data into the Chesapeake Bay Watershed Model.
2. Maintain and update the New York nonpoint source database of agricultural management practices and wetlands used for the Chesapeake Bay Model.
3. Conduct "what if" runs of the Chesapeake Bay Model to help determine the best suite of practices to implement.

Pennsylvania Programs and Projects

York County Conservation District

1. At the county and local level, continue to support Chesapeake Bay restoration activities including sediment management, wetland establishment and enhancement, and the installation of best management practices for point and nonpoint sources.

Maryland Programs and Projects

Harford County

1. In cooperation with the State of Maryland, implement the 2-year milestones for the Phase II Watershed Implementation Plan in compliance with federal mandates for the Chesapeake Bay Total Maximum Daily Load (TMDL).

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Priority Management Area F – Coordination, Cooperation and Public Information

Desired Result: *To maximize available human resources and achieve common and complementary management objectives by the Commission, its member jurisdictions and others; to promote the planning and management of the basin's water resources in the most efficient manner possible; to inform the public on the Commission's water management responsibilities; and to enhance the public's access to the Commission information and decision making procedures.*

The following Actions Needed under Priority Management Area F – Coordination, Cooperation and Public Information are from SRBC's *Comprehensive Plan for the Water Resources of the Susquehanna River Basin*, pp. 68-72. The responses under each Action Needed are those programs and/or projects to be initiated, maintained or completed in SRBC fiscal years 2013-2014 by governmental and non-governmental interests.

ACTION NEEDED:
Consult the Commission's established advisory committees such as the Water Resources Management Advisory Committee and Water Quality Advisory Committee and, as needed, activate ad hoc committees to address special issues or projects.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to consult with SRBC's Water Quality Advisory Committee (WQAC) to coordinate activities among its members, avoid duplication of effort, and develop partnerships in dealing with specific water quality issues.
2. Throughout FY-2013 and FY-2014: Continue to consult with SRBC's Water Resource Management Advisory Committee (WRMAC) regarding the development of policies and procedures related to the Low Flow Protection Policy, water budget analyses, and consumptive use mitigation strategy, especially with respect to implementation of The Nature Conservancy's ecosystem flow recommendations.
3. Throughout FY-2013 and FY-2014: Continue to facilitate interagency and interstate committee activities to deal with selected water management issues.
4. Throughout FY-2013 and FY-2014: Continue to consult with the Susquehanna Flood Forecast and Warning System Interagency Committee regarding sustainability of Susquehanna Flood Forecast and Warning System funding, stream gage funding, and strategic planning.
5. Throughout FY-2013 and FY-2014: Continue to consult with the Susquehanna Flood Forecast and Warning System Mapping Technical Committee, as needed, regarding development of the Flood Inundation Mapping Standards Document, flood inundation mapping reach prioritization, and other flood inundation mapping issues.
6. Throughout FY-2013 and FY-2014: Continue to consult with the Drought Coordinating Committee during drought conditions and in the development of a revised Drought Coordination and Management Plan.
7. Throughout FY-2013 and FY-2014: Continue to consult with the ICEJAMS Committee regarding monitoring, reporting, and operations activities associated with ice cover and ice jams, particularly in the lower Susquehanna River.
8. Throughout FY-2013 and FY-2014: Continue to consult with the Middle Atlantic River Forecast Center Weather Forecast Offices and the U.S. Army Corps of Engineers regarding flood events in the basin.

9. Throughout FY-2013 and FY-2014: Continue to attend meetings of the New York State Department of Environmental Conservation's Water Management Advisory Committee to coordinate activities, avoid duplication of effort, and develop partnerships in dealing with specific water management issues.

ACTION NEEDED:
Facilitate interagency and interstate committees to deal with selected water management topics.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to attend meetings and participate on committees relating to interstate water quality and quantity issues including shale gas development.

ACTION NEEDED:
Keep the Commission-PADEP Memorandum of Understanding (MOU) current to ensure more effective implementation of Commission regulatory standards, and explore possibilities of executing similar MOUs with Maryland, New York and the federal government or establishing an alternative procedure for coordination and exchange of information on project approvals and other work programs.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Improve overall regulatory coordination with New York and Maryland sister agencies, with particular emphasis on the anticipated expansion of natural gas well drilling in the southern tier region of New York.
2. Throughout FY-2013 and FY-2014: Continue coordination with the Pennsylvania Department of Environmental Protection (PADEP) to complete the revision of the current MOU.
3. Work with sister agencies (New York State Department of Environmental Conservation (NYSDEC) and Maryland Department of the Environment (MDE)) to explore development of MOUs.
4. Throughout FY-2013 and FY-2014: Work with sister agencies (NYSDEC, PADEP, and MDE) to compile near real-time databases of water use/approvals and mitigation (passbys, conservation releases, consumptive use mitigation releases) to fill data gaps in SRBC's HYDRA dataset.

ACTION NEEDED:
Determine the need for uniform standards in such areas as instream flows, aquifer testing, water conservation and flood plain management.

Federal Programs and Projects

Federal Emergency Management Agency

1. Provide floodplain management standards to communities participating in the National Flood Insurance program. The standards are an incentive for communities to provide residents with flood insurance premium reductions through the Community Rating System sponsored by the Federal Emergency Management Agency.

U.S. Fish and Wildlife Service

1. Work with other state and federal resource agencies to develop recommendations for the protection of instream flows.

New York Programs and Projects

Cortland County Health Department

1. Work with the New York State Department of Environmental Conservation and SRBC on uniformity in aquifer testing for public water supply wells.

Southern Tier Central Regional Planning and Development Board

1. Propose revisions to the New York State Model Ordinance for Floodplain Management, with optional language for adoption of higher standards that provide increased flood protection.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission (PFBC)

1. Through the activities of PFBC's hydrogeologist, assist with reviews of wells and aquifer tests to promote uniformity of requirements and application of sound science.
2. Continue to work in partnership with The Nature Conservancy, the Pennsylvania Department of Environmental Protection, and SRBC to assess ecosystem flow needs and provide uniform standards to prevent degradation and provide adequate ecosystem protection.

Maryland Programs and Projects

Maryland Department of the Environment (MDE)

1. Through the Watershed Implementation Plan process, include development of 2-year milestones and a mechanism to report, track, and verify implementation. All implementation will need to meet Chesapeake Bay Program requirements and standards for inclusion in the Chesapeake Bay Model. Implementation that requires aquifer testing, floodplain management, and other activities must follow state and federal regulatory requirements as well as local standards.
2. Through the study of water resources in the Fractured Rock Region of Maryland, study the relationship between streamflow and the health of stream ecology, using Maryland Biological Stream Survey data. Funding is currently being sought for this part of the study. MDE has established requirements for aquifer testing that have been required for appropriation permit evaluations for the past fifteen years. During the past year MDE staff worked closely with SRBC, New York State, and the Commonwealth of Pennsylvania to develop new instream flow requirements for permits within the Susquehanna River Basin.

ACTION NEEDED:
As appropriate, assemble special interagency and interstate task force committees to address special water management topics and the development of uniform water management policies or standards.

Susquehanna River Basin Commission Programs and Projects

1. By December 2012: In cooperation with SRBC's Water Resource Management Advisory Committee and representatives of member jurisdictions, finalize the Low Flow Protection Policy containing specifications for headwaters protection and passby flow and conservation release determinations consistent with The Nature Conservancy ecosystem flow recommendations.
2. By December 2012: In cooperation with representatives of member jurisdictions and appropriate nongovernmental organizations, finalize guidelines and recommended practices for the natural gas industry pertaining to the control of invasive species.

ACTION NEEDED:

Organize a consortium of resource agencies with jurisdiction over water at the federal and state level to facilitate the coordination of input into federal licensing and relicensing of hydroelectric and nuclear power facilities in the basin, including new facilities and updates at existing facilities.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Work with project sponsors, agency representatives, and contractors through Federal Energy Regulatory Commission relicensing processes to promote environmental flow protection for the lower Susquehanna River.
2. Throughout FY-2013 and FY-2014: Work with project sponsors, agency representatives, and contractors including the Nuclear Regulatory Commission in the joint permitting process for PPL's proposed Bell Bend Nuclear Power project to provide for environmental flow protection and other appropriate mitigation.

Federal Programs and Projects

U.S. Environmental Protection Agency (USEPA), Region 3

1. Continue to work with the Nuclear Regulatory Commission as part of an interagency team to evaluate environmental impacts associated with the proposed Bell Bend Nuclear Power Plant on the Susquehanna River in Luzerne County, Pa. in compliance with the National Environmental Policy Act (NEPA). A public notice has been issued by the U.S. Army Corps of Engineers in response to receiving a complete application for a Clean Water Act Section 404 permit. USEPA expects that an Environmental Impact Statement will be prepared in 2013. Through the NEPA and Section 404 permit review process, USEPA will work with agencies to ensure that the project avoids and minimizes impacts to aquatic resources, and suggest ways to identify and monitor impacts. USEPA also will recommend and evaluate appropriate mitigation. USEPA also will encourage the protection of flow in the Susquehanna River, advocate for protection of aquatic and terrestrial habitat, recommend protection against invasive species, and advocate the implementation of appropriate stormwater best management practices.

U.S. Fish and Wildlife Service

1. Continue to coordinate with state and federal partners and electric power project owners to assess potential impacts and develop appropriate mitigation plans during Federal Energy Regulatory Commission relicensing activities and other power plant consultations.

U.S. Nuclear Regulatory Commission (NRC)

1. Continue review of the combined license application for construction and operation of the Bell Bend Nuclear Power Plant submitted by PPL Bell Bend, LLC.
2. Continue to inform SRBC of any nuclear plant licensing activities that may impact surface water or groundwater use in the Susquehanna River Basin. Of the three operating nuclear power plants located in the basin,
    a. Peach Bottom Atomic Power Station Units 2 and 3 is scheduled to submit an application for a 12.5 percent extended power uprate in the third quarter of calendar year 2012.
    b. Three Mile Island Unit 1 is planning to submit a future application for a measurement uncertainty recapture power uprate that has the potential to impact river flow by 1-2 percent.
    c. Susquehanna Steam Electric Station has no planned licensing activities that may impact surface water or groundwater.
3. Continue to consult with SRBC when conducting environmental reviews of proposed licensing actions.

Pennsylvania Programs and Projects

Pennsylvania Fish and Boat Commission

1. Participate in the consortium of resource agencies to coordinate input into licensing and relicensing of power facilities in the Susquehanna River Basin.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. Continue to work with other resource agencies as part of relicensing activities for Conowingo Dam and other power facilities in the lower Susquehanna River. The final license application for Conowingo Dam is due to the Federal Energy Regulatory Commission by August 2012.

ACTION NEEDED:
Develop basinwide water conservation standards in cooperation with member states.

Federal Programs and Projects

U.S. Fish and Wildlife Service

1. Promote northeast regional water supply and demand analyses and alternatives to address needs and manage growth.

Maryland Programs and Projects

Maryland Department of the Environment (MDE)

1. Although no specific activities are planned, MDE indicated that it is interested in participating in a regional effort to establish water conservation standards.

ACTION NEEDED:
Facilitate interagency coordination of post-flood actions for the purpose of improving emergency response, technical information and flood damage reduction.

Federal Programs and Projects

Federal Emergency Management Agency

1. Continue to work with the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and others to coordinate post-flood actions.

Natural Resources Conservation Service (NRCS)

1. Participate in flood emergency response, technical assistance, and flood damage mitigation work through the NRCS Emergency Watershed Protection Program.

NOAA National Weather Service

1. Coordinate field office activities with local emergency management agencies and media outlets.
2. Provide education and outreach to promote flood loss reduction.
3. Participate in and support flood inundation mapping coordination meetings.

U.S. Army Corps of Engineers (USACE)

1. Following major flood events, work with resource agencies to identify any deficiencies or areas for potential improvement in providing information on the status of USACE reservoirs during flood events.
2. Actively participate in the Pennsylvania, New York, and Maryland Silver Jackets Flood Risk Management Program.

U.S. Fish and Wildlife Service

1. Under the Partners for Fish and Wildlife Program, provide technical assistance to the New York State Department of Transportation to complete six instream projects that will reduce flooding and improve aquatic habitat.

New York Programs and Projects

New York State Disaster Preparedness Commission (coordinated through the Office of Emergency Management)

1. Coordinate statewide emergency planning and response efforts. Comprised of the 32 state agencies and the American Red Cross, the Disaster Preparedness Commission is responsible for preparation of state disaster plans; the direction of state disaster operations and coordinating those with local government operations; and the coordination of federal, state, and private recovery efforts. Member agencies serve as technical matter experts. For example, the New York State Department of Health provides expertise for human services and drinking water infrastructure.

Emergency Management Offices and Other Local, State, Federal, and Private Organizations in Chemung, Schuyler, and Steuben Counties.

1. Implement recommendations in the After Action Report / Improvement Plan for the State of New York Southern Tier Hurricane David Regional Functional Exercise.

ACTION NEEDED:

Expand leadership role and advocacy for the collection of water quality and quantity data for science, including the maintenance of an effective and sustainable stream and rain gage network.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to expand SRBC's Early Warning System for Public Suppliers to include additional sites and parameters, and make data available to resource agencies and others addressing specific water quality programs.
2. Throughout FY-2013 and FY-2014: Continue to expand and maintain the Remote Water Quality Monitoring Network to assist with maintenance and protection of surface waters in select portions of the Susquehanna River Basin experiencing intense natural gas development.
3. Throughout FY-2013 and FY-2014: Promote the collection of water quality data through coordination with states, local authorities, and citizen groups, and by participating in Chesapeake Bay Program activities, meetings of the Association of Clean Water Administrators, and SRBC's Water Quality Advisory Committee.

Federal Programs and Projects

NOAA National Weather Service

1. Collaborate with interagency partners in developing strategies to support the Susquehanna Flood Forecast and Warning System.

U.S. Army Corps of Engineers (USACE)

1. Continue to work in partnership with local governments, agencies, and stakeholders to initiate investigations, watershed assessments, plans, and projects within USACE authorities and jurisdiction.

New York Programs and Projects

Cortland County Health Department

1. Continue to monitor aquifer water quality. Long-term funding and coordination with municipalities and agencies are needed, and the county is interested in coordinating with SRBC on this issue.

Environmental Emergency Services/Southern Tier Regional Planning and Development Board

1. Advocate for consistent funding for critical stream gages in the Chemung River Basin and nationwide development of a mechanism for reliable funding of the stream gage network.

New York State Floodplain and Stormwater Managers Association

1. Provide information to members, elected officials, and others concerning the benefits of stream gaging stations for flood warning, flood response, floodplain management, flood mitigation, infrastructure design, and other purposes.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue to work in partnership with SRBC on the Remote Water Quality Monitoring Network, which was expanded with funding from PADCNR to include sites in state forests.

Pennsylvania Department of Environmental Protection, Bureau of Safe Drinking Water

1. Continue to collaborate with SRBC and the U.S. Geological Survey regarding the reference stream gage network gap analysis to identify existing gages with high substitution potential and to identify priority areas for establishing additional gages.

Pennsylvania Fish and Boat Commission (PFBC)

1. Coordinate field survey activities with SRBC to maximize the value information obtained with available resources.

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Support an expanded leadership role for SRBC in advocating the collection of water quality and quantity data, including maintenance of stream and rain gage networks.

Maryland Programs and Projects

Maryland Department of Natural Resources (MDNR)

1. Continue to work with Maryland's Statewide Water Monitoring Council, which was developed in 1995 as an umbrella organization that, aligned with MDNR, promotes communication, coordination, and cooperation among water monitoring agencies and organizations throughout Maryland (www.marylandwatermonitoring.org). The Maryland Council advocates its goals through its website and member participation in topical workshops, roundtables, discussions, and a well-attended annual conference. Maryland also has a statewide water monitoring network for streams and groundwater.

ACTION NEEDED:
Evaluate the establishment of a Susquehanna River Basin Monitoring Council.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to coordinate with the U.S. Geological Survey, member jurisdictions, and others to support establishment of a monitoring council for the entire

Susquehanna River Basin, or alternatively, to participate in statewide monitoring councils in each of SRBC's member states, with initial steps to include formulating a central repository of contacts and information.

Federal Programs and Projects

U.S. Geological Survey, Pennsylvania Water Science Center

1. Continue discussions with SRBC and the Pennsylvania Department of Environmental Protection evaluating the establishment of a Statewide Monitoring Council.

New York Programs and Projects

New York State Department of Health

1. Consider participating, contingent on available resources, if a monitoring council were to be established.

Pennsylvania Programs and Projects

Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR)

1. Support further evaluation of the potential establishment of a Susquehanna River Basin Monitoring Council, either as an extension of SRBC's Water Quality Advisory Committee (WQAC), or with members of the WQAC participating.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. If there is interest, the Maryland Water Monitoring Council board members would be willing to assist others in establishing a Susquehanna River Basin Monitoring Council.

ACTION NEEDED:
Periodically evaluate existing and emerging communication technologies and methods to determine their potential application and benefits to the Commission's public information program and strategies.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Consider and, as appropriate, implement improvements to the SRBC website to take advantage of emerging technologies for enhanced communications.

ACTION NEEDED:
Utilize currently available technologies to make information readily available through electronic means, including non-restricted files and records requested by interested parties to eliminate the need to physically visit the Commission's headquarters building.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to enhance SRBC's internet-based databases and continue to make increasing amounts of data available electronically.
2. Throughout FY-2013 and FY-2014: Continue to enhance the SRBC website and continue to make more regulatory program forms and programmatic information available on the website.
3. Throughout FY-2013 and FY-2014: Continue to expand and use SRBC's information technology capabilities to maximize available human resources.

4. Throughout FY-2013 and FY-2014: Continue to offer the RSS Feed option on the SRBC Water Resources Portal.
5. Throughout FY-2013 and FY-2014: Continue to explore options and associated fees for raw data downloads to satisfy information requests related to natural gas development.
6. Throughout FY-2013 and FY-2014: Continue to add water quality data to SRBC's Water Resource Portal (WRP) website, and develop a Water Quality Portal (WQP) website to add water quality data, making both water quantity and water quality data readily available to the public.

ACTION NEEDED:
Identify, assess and consider a range of options for enhancing access to the Commission by the public and stakeholder groups to facilitate input to ongoing and emerging issues and programmatic matters; options for consideration could include holding periodic topical meetings or public forums, forming a general advisory committee, and using the Commission's web site more effectively for direct public input.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to identify and select viable options for consideration to meet the objectives of this "Action Needed."

ACTION NEEDED:
Expand on existing ties to non-governmental organizations to maximize the beneficial use of their resources and expertise in the management of the basin's water resources.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to work in partnership with The Nature Conservancy regarding ecosystem flow recommendations for the Susquehanna River Basin.
2. Throughout FY-2013 and FY-2014: Continue to work in partnership with the Lower Susquehanna Center for Land and Water on stormwater work in the Lower Susquehanna Subbasin.
3. Throughout FY-2013 and FY-2014: Continue to work with monitoring groups active with the Remote Water Quality Monitoring Network project.
4. Throughout FY-2013 and FY-2014: Continue to work with the Western and Eastern Pennsylvania Coalitions for Abandoned Mine Reclamation on AMD projects throughout the Pennsylvania portion of the basin, as well as in performing mine pool mapping and other activities associated with SRBC's Consumptive Use Mitigation Strategy.

Federal Programs and Projects

National Park Service

1. Increase project-specific work with the Otsego Land Trust and Upper Susquehanna Coalition.

U.S. Army Corps of Engineers

1. Continue to work with The Nature Conservancy on projects such as the Susquehanna River Basin Low Flow Management and Environment Restoration Project, and with the Earth Conservancy on projects such as the one on Nanticoke Creek.

Pennsylvania Programs and Projects

Trout Unlimited Eastern Abandoned Mine Program

1. Continue to lead the West Branch Susquehanna Restoration Coalition, a consortium of approximately 60 watershed groups Trout Unlimited Chapters, Conservation Districts, and local businesses that support the cleanup of AMD throughout the West Branch Susquehanna Watershed through the exchange of information, formulation of educational initiatives, and building of widespread public support. In addition, continue to organize and host the West Branch Susquehanna Restoration Symposium and Mini-Symposium and tours that ultimately provide a forum for the exchange of information and ideas related to AMD in the West Branch Susquehanna Watershed.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which calls for the establishment of a county water resources council that would include non-governmental organizations as members.

Maryland Programs and Projects

Maryland Resource Agencies

1. Although no specific activities are currently planned, Maryland's Watershed Implementation Plan will provide opportunities for close involvement with non-governmental organizations in the future.

ACTION NEEDED:
Identify opportunities to collaborate with academic institutions to maximize resources and scientific knowledge.

Susquehanna River Basin Commission Programs and Projects

1. In FY-2013 and FY-2014: Continue planning for a Susquehanna Water Science Forum in collaboration with agencies and research interests in the Susquehanna River Basin, and hold the forum in fall 2013.

Federal Programs and Projects

Federal Emergency Management Agency

1. Continue to collaborate with academic institutions to provide risk-based mapping and flood proximity information to residents.

NOAA-CREST and National Weather Service

1. Complete year three of the 3-year research project "River Ice Monitoring Over the Susquehanna River Basin Using Remote Sensing Data." Principal investigator is NOAA-CREST/The City University of New York.

U.S. Geological Survey, Pennsylvania Water Science Center

1. Collaborate with Penn State University in its efforts to develop a Marcellus Shale environmental database called the Shale Network. The Shale Network is a multidisciplinary project funded by the National Science Foundation to help scientists and citizens collect and store data for water resources that may be affected by shale gas development. The Shale Network is working with the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. to create this database. (http://www.shalenetwork.org/)

New York Programs and Projects

New York State Department of Health

1. Continue to collaborate with academic institutions as opportunities arise.

Cornell Cooperative Extension, Schuyler County

1. Continue to support the Senior Environment Stewards Corps, as funding allows. This program uses connections to Cornell University to identify and monitor areas of environmental concern and to extend the reach and resources of the land grant university system.

Upper Susquehanna Coalition

1. Collaborate with and provide funding for academic research at Cornell University (identify hydrologically sensitive areas; impacts of Marcellus Shale development), Binghamton University (support graduate student research), and the State University of New York College of Environmental Science and Forestry (wetlands research).

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. Continue to collaborate with Misericordia College, which has performed aquatic studies in Lake Jean at Ricketts Glen State Park.
2. At Prince Gallitzin State Park, work with local school districts to obtain grants and establish a lake water quality monitoring program.
3. At Lackawanna State Park, continue to collaborate with Keystone College to perform at least t field trip each year for local school districts.
4. At Salt Springs State Park, receive results of water quality and macroinvertebrate sampling in Silver Creek conducted by researchers from Wilkes University.

Pennsylvania Fish and Boat Commission (PFBC)

1. Continue to work in partnership with academic institutions to sample potential wild trout waters for PFBC's Unassessed Waters Program.

ACTION NEEDED:
Provide opportunities for the involvement of non-governmental organizations in Commission activities and, through coordination efforts, encourage communication on activities/issues of mutual interest.

Susquehanna River Basin Commission Programs and Projects

1. Throughout FY-2013 and FY-2014: Continue to work with non-governmental organizations participating on the SRBC Water Quality Advisory Committee and invite additional organizations to participate during individual meetings as appropriate.

Federal Programs and Projects

Federal Emergency Management Agency

1. Continue to work with businesses to provide short and long-term recovery strategies for flood survivors and their communities.

National Park Service

1. Continue to collaborate with non-governmental organizations in the Chesapeake Bay Gateways and Watertrails Network, and to develop national trails and other collaborative land conservation and public access activities.

2. Continue to support the Susquehanna Greenway Partnership and others to preserve, interpret, and provide information on the cultural and historic resources and stories of the Susquehanna River corridor.
3. Continue to advise the Headwaters River Trail Partnership as it works to complete the Susquehanna River Water Trail System in New York.
4. Continue to provide technical assistance to non-governmental organizations through the Rivers, Trails, and Conservation Assistance Program.
5. Assist local water trail managers in the Susquehanna Water Trail Network in pursuing designation to the newly established National Water Trail System.
6. Continue working with state, local, and non-governmental partners to further the goals of the America's Great Outdoors Lower Susquehanna Conservation Landscape Initiative.
7. Continue to provide technical assistance through the Rivers, Trails, and Conservation Assistance Program to the Lower Susquehanna Heritage Trail Initiative in Maryland.

U.S. Army Corps of Engineers

1. Continue to work with The Nature Conservancy on projects such as the Susquehanna River Basin Low Flow Management and Environmental Restoration Project and the Lower Susquehanna River Watershed Assessment.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. At Codorus State Park, continue to collaborate with the Lake Marburg Fish Advisory Committee, which is involved with water resource issues at the lake.

Maryland Programs and Projects

Maryland Department of Natural Resources

1. If a Susquehanna River Basin Monitoring Council were to be established, the Maryland Water Monitoring Council could provide a model for non-governmental organization involvement and encourage membership and participation by agencies, academia, and non-governmental organizations.

ACTION NEEDED:
Coordinate with trade associations related to the various types of water use in the basin to promote sustainable water use in conjunction with economic development.

Pennsylvania Programs and Projects

Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering and Wetlands

1. Develop and implement innovative approaches for stormwater management including watershed permitting and offset/trading initiatives, and continue to pursue and support legislation for integrated water resources planning.

Pennsylvania Fish and Boat Commission

1. Work with SRBC, the Pennsylvania Department of Environmental Protection, and the oil and gas industry to develop Aquatic Invasive Species Control Plans at natural gas development facilities, which will help achieve compliance with a standard docket condition requiring control of aquatic invasive species.

Lancaster County Planning Commission

1. Adopt the Lancaster County Integrated Water Resources Plan, which calls for the establishment of a county water resources council that will include non-governmental organizations as members.

OTHER KEY PROJECTS AND/OR PROGRAMS

(specific to this Priority Management Area but not captured in the select actions listed above)

Susquehanna River Basin Commission Programs and Projects

1. By December 2013: Prepare an update to the Commission's Comprehensive Plan.
2. Throughout FY-2013 and FY-2014: Continue to work with agencies and organizations to further develop SRBC's research agenda in support of its mission and Comprehensive Plan for the Water Resources of the Susquehanna River Basin.

Federal Programs and Projects

National Park Service

1. Continue to coordinate with resource agencies and others as part of relicensing activities for hydroelectric and pumped storage projects on the lower Susquehanna River.

Natural Resources Conservation Service (NRCS)

1. Continue to support the objectives of SRBC and the Chesapeake Bay Program by participating in meetings and providing technical and program support in partnership with others through NRCS Farm Bill Programs, the Watershed Program, the Emergency Watershed Protection Program, Soil Surveys, the National Resource Inventory, and Conservation Technical Assistance.

NOAA National Weather Service

1. Provide program management for the Susquehanna Flood Forecast and Warning System in coordination with SRBC, U.S. Geological Survey, and other federal and state partners.
2. Conduct flood preparedness briefings with the Federal Emergency Management Agency and state, county, and local emergency managers for operations before, during, and after flood events.
3. Support serving National Weather Service hydrologic information through the Advanced Hydrologic Prediction System web pages, and manage web user requirement implementation activities.
4. Coordinate activities during Flood Safety Awareness Week.

NOAA North Atlantic Regional Collaboration Team

1. Explore opportunities with the North Atlantic Regional Collaboration Team to engage Susquehanna River Basin stakeholders with complimentary operational missions in water science, observation, prediction, and management.
2. Assist in regional assessments of watershed water resource needs and explore pilot opportunities for involvement in the Integrated Water Resources Sciences and Services Initiative.

U.S. Army Corps of Engineers

1. Continue to lead a group of more than 16 federal agencies regarding their role and input to SRBC's Comprehensive Plan and Water Resources Program, facilitate quarterly conference calls, distribute information, and lead the development of "lead" and "support" agency roles for each Priority Management Area.
2. Hold a 2012 Federal Agency Summit as part of a bi-annual schedule to consider issues of mutual importance relative to the Susquehanna River Basin.

U.S. Fish and Wildlife Service

1. Provide technical assistance for studies associated with the Conowingo and Muddy Run hydroelectric projects including a(n): 1) Recreational Inventory and Needs Assessment, 2) Shoreline Management Plan, 3) Visual and Noise Assessment (Muddy Run only), and 4) Archaeological and Historic Cultural Resource Review and Assessment.

New York Programs and Projects

New York State Department of Environmental Conservation

1. Continue to work in collaboration with the Upper Susquehanna Coalition, Finger Lakes Land Trust, the Upper Susquehanna Conservation Alliance, local governments, New York State Association of Regional Councils, and other partners.
2. Coordinate with local water resource professionals through participation in county water quality coordinating committees, the Upper Susquehanna Coalition, the Upper Susquehanna Conservation Alliance, and the New York State Association of Regional Councils.
3. Support activities of New York's regional councils with funding from the Clean Water Act Section 604(b) grant program, based on funding from the U.S. Environmental Protection Agency.

Broome County River Communities

1. With Local Waterfront Revitalization Program funding, develop a regional river corridor plan that expands the Greater Binghamton Greenway, promotes river-related economic development, improves recreational access, and highlights cultural heritage sites.

County Water Quality Coordinating Committees

1. Provide a forum for local coordination of water resource programs among local agencies, watershed associations, and other interested parties.

Friends of the Chemung River Watershed

1. Facilitate implementation of "The Chemung River Comprehensive Master Plan" to promote river-based economic development, river-based recreation, and riverside trails throughout the Chemung River Basin.
2. Work with the City of Elmira and Chemung County to develop the Lackawanna Trail. This 7-mile multi-use recreational trail will be located within the City and along the Chemung River, extending from Wegmans Plaza (in the City of Elmira) to Lowman Crossover (County Route 8 in the Town of Ashland).
3. Conduct river-related education and conservation programs.

Friends of the Chemung River Watershed/Headwaters River Trail Partnership

1. Create a web-based river trail map and guide of the entire Susquehanna River Basin in New York State.

Headwaters Trail Partnership

1. Bring partners together to promote environmentally responsible recreation and establish an "identity" for the Headwaters River Trail, encompassing the Upper Susquehanna, Chenango, Unadilla, Otselic, and Tioughnioga Rivers.
2. Work with the Otsego Land Trust to complete a "blueway" along Oaks Creek (a tributary of the Susquehanna River in Otsego County).

Southern Tier Central Regional Planning and Development Board

1. Working with a multi-organizational advisory committee, promote implementation of the *Susquehanna-Chemung Action Plan.*
2. Assist the New York State Department of Environmental Conservation with local delivery of statewide water resource programs by providing education, training, planning assistance, and

other support for stormwater management, floodplain management, water quality planning, watershed management, and other activities.

3. Foster a regional approach to water resource management and coordination among neighboring communities.
4. Prepare a regional Comprehensive Economic Development Strategy that incorporates water resource issues such as flooding, sewer and water infrastructure, and water quality.
5. Facilitate inter-municipal cooperation to implement the "river vision" for the Chemung River. This will help protect natural resources, generate jobs and revenue for recreational businesses, strengthen community cooperation, and further advance the Chemung River as part of the Susquehanna River Trail and the National Park Service Chesapeake Bay Gateways Network.

Upper Susquehanna Coalition

1. Provide a mechanism for Soil and Water Conservation Districts and other partners in the Upper Susquehanna Region to cooperatively promote and implement the conservation and improvement of natural resources on a watershed basis.

Upper Susquehanna Conservation Alliance (USCA)

1. Provide a forum for regional coordination and collaboration on conservation issues in the Susquehanna and Chemung Watersheds of New York. USCA is an alliance of agencies, organizations, academic institutions, and individuals, with working groups focused on natural resource and flooding issues.

Pennsylvania Programs and Projects

Pennsylvania Department of Conservation and Natural Resources (PADCNR)

1. Continue to participate in activities associated with licensing of the PPL Holtwood Hydroelectric Project, Federal Energy Regulatory Commission Project No. 1881. PADCNR is actively seeking approval of a project amendment that would transfer over 1,200 acres of high value natural, scenic, and culturally significant lands along the lower Susquehanna River outside of the project boundaries. This land exchange would be a prime example of an innovative, new public-private partnership that would result in improved conservation efforts in the basin.

Pennsylvania Department of Conservation and Natural Resources, Bureau of State Parks

1. During FY-2013 and FY-2014: Provide environmental education programs for visitors at Worlds End State Park.
2. During FY-2013 and FY-2014: Provide watershed and environmental education programs for school groups and other visitors at Shawnee State Park.
3. On September 20, 2012: Conduct a sustainable landscape tour at Nescopeck State Park including sites with green roofs, rain gardens, and other sustainable practices. The tour will be conducted in partnership with the Pennsylvania Environmental Council and the Penn State Cooperative Extension.
4. At Nescopeck State Park, conduct several environmental forums for high school students, focusing on conservation of land, water, and energy.
5. At Nescopeck State Park, conduct additional public outreach including kayaking on the Susquehanna River, a visit to Pennsylvania American Water Company's Ceasetown Dam, and a gas drilling site visit.
6. During FY-2013 and FY-2014: Conduct watershed environmental education programs for local groups and other park visitors at Prince Gallitzin State Park.
7. During FY-2013 and FY-2014: Conduct watershed environmental education programs for local school districts at Lackawanna State Park.

York County Conservation District (YCCD)

1. At the county and local level, continue to support interagency coordination and cooperation in managing water resources. YCCD noted that the Watershed Alliance of York performs a major role by expanding ties to non-governmental organizations in York County.