Regional Water Resources Committee Material

Delaware

Specific Regional Priorities

The Delaware region is the most populous region with over 5.5 million (43% of Pennsylvania's population) people calling it home and contains the only estuary in the state, which runs alongside Philadelphia. The large and growing population is going to require holistic coordination between all users to ensure the availability and quality of water as well as addressing stormwater and flooding. These varying and complex needs are partly addressed by entities like the Delaware River Basin Commission and the National Estuaries program but a unified approach to land use and water management is a critical piece of the puzzle.

Strengthen the Link Between Land Use and Water Resources Management

Linking land use decisions and water resources management to sustain and enhance the quality of life in the Delaware River basin is a top priority of the committee. The development and distribution of water resource information and data will help strengthen the link between land use, soil, and water resources management among multiple stakeholders. These educational initiatives would improve how water resources management, soil and vegetation conservation, flood controls, stormwater management, and sewage management relate to land use decisions, infrastructure funding, construction decisions, and grant decisions. The goal of these efforts is to preserve, protect, restore, and enhance the quality, quantity, and availability of clean, sustainable water supplies for the people, businesses, and ecological needs of this Commonwealth.

Regional Planning and Land Use Coordination and Collaboration

"Think regionally and act locally" is a priority for the committee. The committee's solutions to the region's water issues focus on developing regional coordination and planning to address stormwater management, climate change, water quality, water availability, water diversion, aquifers, healthy soils and vegetation, protecting fish and wildlife habitats, and protecting recreation areas. Solutions are developed through regional planning efforts, education and outreach with policy makers and the community, along with adequate funding. Water planning should be considered on a holistic watershed basis considering both droughts and floods. A One Water concept can further educate the community and increase collaboration among stakeholders for integrated water resources planning. Growth in rural, urban, and suburban areas continues to place stress on water infrastructure; replacement and retrofitting of existing infrastructure and development of new infrastructure can be a challenge in both urban and suburban communities. Larger scale coordination efforts between local, state, and federal entities can help ensure more of the region's needs are being accounted for during the planning phase and available resources can be maximized.

Region's Uniqueness

What are the Delaware region's unique characteristics that are important considerations in the state's water planning?

- This is the most populated region in this Commonwealth and features a diverse population living in urban, suburban, and rural locations.
- The Delaware region has a large amount of impervious surfaces, leading to a greater potential for polluted runoff.
- The region boasts abundant and varied natural and recreational resources.
- The main stem of the Delaware River remains undammed.
- The Delaware basin discharges into the Atlantic Ocean via the Delaware Estuary, which is comprised of a unique ecosystem and a variety of stakeholders, including federal programs like the National Estuary Program, water suppliers, and industrial users. This also means that tidal influences are a consideration in planning efforts for the basin.
- The basin is challenged by the demands of four states and multiple jurisdictions. In 1954, the United States Supreme Court entered a Decree that established certain rights and obligations for New York City and New Jersey concerning diversions of water out of the Delaware River basin. Delaware, New Jersey, New York, Pennsylvania, and New York City are all parties to the Decree.
- The Delaware River Basin Commission plays a significant role in the management of water resources in the basin.
- Philadelphia's port is a large freshwater port and is an economic hub of great value but also yields challenges to water resources.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- Increased flooding can occur when floodplains are saturated by repeated storms, as well as during acute high-intensity events.
- Stormwater management infrastructure often lacks proper maintenance, especially aging infrastructure.
- Strengthen regional planning or watershed-scale planning of water resources to support and enhance recommendations and requirements laid out in the Department of Environmental Protection's Stormwater Best Management Practices Manual and updates thereto.
- Regional authorities should ensure that Act 167 plans and resulting model ordinances do not propose to alleviate flooding on tributaries at the expense of main-stem flooding in accordance with the act's provisions.
- Stakeholders should continue to actively support source water projects that minimize impacts downstream. It's vital that the connection between potential sources for pollution upstream and resultant water quality downstream are understood by the public.
- Water should be considered from a holistic perspective as with the "One Water" movement.
- Storm surge may become an issue in the lower Delaware River as winds and long fetches draw higher waters upstream into the Delaware Estuary Coastal Zone.
- Schuylkill headwaters have coal mine refuse piles that need to be properly managed or removed to minimize the potential for coal tailings runoff into the system.
- Encourage projects that enhance stormwater management on previously developed land.

- Educate the public about stormwater impacts, including the difference between localized flooding versus regional flooding.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- Encourage regional authorities to assess the ability of aging infrastructure to handle high-intensity storm events, which are increasingly likely to occur in face of a changing climate, and implement infrastructure maintenance, as necessary, to mitigate flooding impacts.
- There is an increased risk that droughts will lower the water table and damage upper soil layers; as a result, we must continue to promote healthy soil and groundwater infiltration to maintain aquifers and manage reservoir systems to abate these potential effects on water quality and quantity. Healthy soils absorb more water and are critical to reducing runoff and mitigating the effects of drought.
- Encourage stakeholders to mitigate impacts of sea-level rise, including the impact on port facilities and the economic benefit they provide to the region, and to protect drinking water sources and infrastructure from salt front intrusion in the Delaware Estuary.
- Encourage development of additional scenario models so municipalities can proactively plan for potential outcomes of climate change, which is resulting in significant amounts of riverine and localized flooding. Promote data showing changes in rain frequency and intensity and focus on climate resiliency. Recognize that the increased precipitation and storm frequency will have effects on land use planning.
- Stakeholders should make use of all potential bodies of research and resources such as the Delaware River Basin Commission's Advisory Committee on Climate Change, which recently formed to develop ideas and tools.
- Climate change can have a number of water quality impacts including thermal impacts affecting dissolved oxygen and water use designations, an increase in both terrestrial and aquatic invasive species, increased erosion due to higher-intensity storms resulting in higher turbidity, and changes in vegetation types affecting stream buffers.

Great Lakes

Specific Regional Priorities

Pennsylvania is fortunate to be a part of the Great Lakes region. The Great Lakes form the largest surface freshwater system in the world, containing 90% of North America's supply of freshwater that provides vital habitats to native species and supports diverse ecosystems and robust biodiversity. It provides drinking water to 40 million people in the U.S. and Canada and sustains a thriving $6 trillion regional economy. Lake Erie directly connects northwestern Pennsylvania to this resource, underpinning the social identity of the region and fueling the tourism, recreation, port, and maritime sectors of its economy. Also, the headwaters of the Genesee River flow through the forests and agricultural lands of northern Potter County into New York on their way to Lake Ontario. Many demands are placed upon the waters of the Great Lakes which require thoughtful protections to assure sustainability for future generations. Pennsylvania works intently with the other U.S. states, Canadian provinces, and the two federal governments to eliminate the possibilities of major diversions of water outside of the Great Lakes basin, improve water quality, enhance biodiversity and ecosystems, and provide cooperative, sturdy governance systems for the resource.

Protect Water Quality and Quantity in the Basin

Lake Erie is vitally important to the prosperity of northwestern Pennsylvania, serving regional domestic, commercial, agricultural, and industrial needs. The Great Lakes supply power generation, offer world-class recreational opportunities, and provide transportation and trade access to the entire Great Lakes – St. Lawrence Seaway system. As a result, the committee believes that Pennsylvania should not only maintain current participation in interstate and international governance venues, but have a larger role in federal legislation and other policy measures that may impact Lake Erie and Lake Ontario such as invasive species, pollution management, agricultural management, and stormwater management. Northwestern Pennsylvania should have a larger role in state legislation that impacts Lake Erie and Lake Ontario.

Only approximately 1% of Lake Erie water is renewed by precipitation in any given year. Water quantity in the Great Lakes basin can best be protected by coordinating with the other states and provinces to uphold the interstate compact and international agreement that prohibit the diversion of water out of the basin, regulate water withdrawals and consumptive use, and encourage increased conservation and efficiency measures within the jurisdictions.

Additionally, the committee recognizes that the region is not composed solely of Lake Erie and Lake Ontario, so efforts must be made to protect water quality throughout the larger region's watersheds. This can be accomplished by assessing biology, identifying contaminants, and evaluating the impacts of stormwater management and agricultural best management practices throughout the region. This will also help inform how Pennsylvania and Great Lakes communities can build resiliency to the impacts of a changing climate in this unique watershed.

Coordinate with Partners

The best way to achieve the larger goals of the committee is for this Commonwealth to actively engage with partners along multiple political strata. This includes other states, provinces, federal government agencies, and other stakeholders including governmental and non-governmental. On a local level, counties and municipalities should collaborate toward regional approaches to water challenges with

support from the Pennsylvania Department of Environmental Protection (DEP), whose role would be to encourage open and continual communication and incentivize cooperation through grant funding. Coordination should begin with education and outreach to communicate the impacts of land use to property owners and implement best management practices to better maintain the hydrologic integrity of the region.

Region's Uniqueness

What are the Great Lakes region's unique characteristics that are important considerations in the state's water planning?

- Lake Erie has a vast, but not unlimited supply of water. Only approximately 1% of Lake Erie water is renewed by precipitation in any given year.
- Despite its relatively small land area, the Lake Erie region is a vital economic asset to this Commonwealth.
- Lake Erie's quality and quantity are impacted by Canada and other U.S. states which border the Great Lakes.
- The region's economy is reliant on tourism and recreation. To help safeguard and continue those activities, the county government is working toward Lake Erie waters receiving a national marine sanctuary designation.
- The Great Lakes are utilized as navigational waters associated with business and industry. Ship traffic can potentially lead to the transportation and introduction of invasive species which can impact the distribution of other species and nutrient cycle processes.
- Agriculture, especially vineyards, play an important role in the local economy.
- Localized sources of nutrients and nonpoint source pollutants can negatively impact the Great Lakes tributaries and open waters and contribute to harmful algal blooms.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- Municipal stormwater management is critical in the region due to associated impacts on water quality and potential effects on ravine and bluff erosion and recession. Best management practices will help control the volume, flow, and quality of stormwater coming from developed areas.
- Evaluate Act 167 plans to determine their long-term feasibility and consider potential funding sources for counties to update Act 167 stormwater management plans and for both large and small municipalities to update stormwater management ordinances. This activity should include an evaluation of municipal subdivision and land development ordinances, hazard mitigation plans, and integrated water resources management.
- Encourage regional solutions such as municipal authorities to assess and, where possible, repair/retrofit aging infrastructure for high-frequency or acute severe storm events, water quality and erosion control, and infiltration.
- Digitalizing municipal and private stormwater infrastructure and utilizing geographic information systems (GIS) would be helpful in the development of asset management and capital improvement plans. DEP has provided grant funding to Erie County to

conduct a Municipal Separate Storm Sewer System (MS4) assistance program which could be leveraged to help digitize this data in both urbanized and rural communities.
- Highlight the role of public education and outreach to achieve community stormwater knowledge.
- Continue work toward the elimination of remaining municipal combined sewer overflows as part of an overarching stormwater plan.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- Consider the implications of flash flooding and potential decreased groundwater recharge on waterway flow. With the risk of more severe droughts brought on by climate change, continuing to promote groundwater infiltration and recharge to maintain aquifers should be a high priority.
- Participate in interstate efforts to identify regional climate stressors and plan for economic and environmental resiliency actions.
- Stakeholders should assess the implications of climate change on water supply vulnerability, availability, and reliability to build resiliency.
- Stakeholders should investigate impacts of extreme lake levels (either higher or lower than normal) of Lake Erie and the associated impact on tourism, commercial, and industrial activities, bluff and beach erosion, and residential communities. Recent data indicates the lake level cycles are shorter in length than previously understood.
- Municipalities should take a regional approach to evaluate aging stormwater infrastructure and its current capacity, and develop mitigation strategies for increased storm intensity and frequency due to climate change.
- Maintain focus on science and explicit data to follow demonstrable trends on climate change.

Lower Susquehanna

Specific Regional Priorities

The Lower Susquehanna basin is the hydrological gateway to Maryland where the mouth of the river system connects to the Chesapeake Bay. Rapid expansion of logistics centers and a quickly growing population in the region leads to increased risk to waterways. There is a need for the most critical areas to be identified and prioritized in order to minimize the potential for impact to these resources.

Identify and Target Solutions for Potential Protection Priority Water Resources to Reduce or Prevent Point and Nonpoint Source Pollution with a Focus on Currently Impaired Water Resources

Identify “protection priority” water resources that may be trending towards impairment for any use, through the collection and analysis of data. Priorities may be determined by looking specifically at emerging contaminants, declining water quality and/or quantity, evolving land use impacts, and flooding issues. Improve the region’s protection priority water resources through identified targeted solutions that may include education and outreach, asset management, resource improvement, and others.

Reduce existing point and nonpoint source pollution in the region’s significant number of impaired water resources. Focus added attention on currently impaired water resources. Prevent new water pollution throughout the region from all sources. Implement active solutions to reduce pollution by forming public-private partnerships (P3), engaging willing landowners, targeting funding, and others. Broaden support and advocacy for our water resources through enlisting stakeholders, enhancing partnerships, and coordinating efforts. Improved water quality sustains drinking water supplies, preserves a healthy ecosystem that supports recreational use, and enables a viable economy.

Definition of "Protection Priority" - water resources prioritized for protection based on potential threats to water quality, for the purpose of setting long-term priorities where focused efforts towards restoration, best management practices, and protection would provide the most benefit to the watershed.

Enable Continued Responsible Economic Growth by Ensuring Adequate Water Resources

The challenges associated with this region are water availability, flooding, aging stormwater infrastructure, water quality, and drought. Prioritized resiliency solutions to address increased stormwater and flooding that include restoration and expansion of green infrastructure to capture runoff would be beneficial to the region. Strategies may also include proactively managing land development and land management by expanding programmatic and policy flexibility to watershed boundaries to maximize effectiveness of multi-benefit best management practices. Broad support can be provided to local governments and municipalities through training and model ordinances to manage stormwater and flooding and by enlisting the cooperation of non-governmental organizations, watershed groups, and riverkeepers.

Region’s Uniqueness

What are the Lower Susquehanna region’s unique characteristics that are important considerations in the state’s water planning?

- The Susquehanna River is a unique feature of the region, which is shared with the Upper/Middle Susquehanna region.
- The basin is home to one of the fastest growing populations in Pennsylvania.
- This region has the highest concentration of agricultural land uses in the state, particularly in York and Lancaster counties. The plain sect communities in Lancaster and York counties require unique communication strategies.
- Due to the intersection of highways running through the basin and additional cargo shipping coming by land from the recently dredged ports along the Delaware River, the region has experienced much growth and development, resulting in an abundance of logistics centers. This growth and development has facilitated the need to preserve more open space and agricultural land.
- This region hosts a large concentration of manufacturing in Pennsylvania. Manufacturing industries tend to consume more water than logistics and warehousing industries.
- Three large run-of-river hydropower dams exist within the region, making the region a center for power production. Listed from north to south along the Lower Susquehanna River are the Safe Harbor Dam (1931), Holtwood Dam (1910), and Conowingo Dam (1928).
- There are many historical impacts to the region such as legacy sediments, mill dams, and other water resource impairments linked to past land uses as well as collected sediment from more contemporary dam structures that impact water quality.
- There are National Heritage Areas in lower York and Lancaster counties.
- The Susquehanna River contributes one-half of the freshwater flow to the Chesapeake Bay. Being a hydrological gateway into Maryland, the region faces the challenge of coordinating with multiple state entities, stakeholders, legal frameworks, and working to accommodate their differing objectives.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- Improvements to stormwater management on a watershed scale could, via groundwater recharge and appropriate direction to surface water sources, increase access to fresh water in higher quantities throughout the region.
- Develop regional or watershed-scale planning of water resources, ensure management of stormwater at the source, enhance groundwater recharge, and work toward a more long-term strategic approach.
- There is a need for regional authorities to assess aging infrastructure for high-frequency storm events through monitoring and inspection. The first step would be to create an inventory of stormwater infrastructure including location and ownership.
- More floodplain restoration and removal of legacy sediment would be beneficial to the region.
- An enhanced water quality monitoring network could drive strategic investment in best management practices. Data sharing coordination could facilitate an enhanced water quality monitoring network throughout the watershed, targeting strategic locations for the most critical metrics.

- Stormwater compliance could be improved at the local level by providing education and outreach and increased financial resources.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- Flooding is the top hazard that municipalities are mitigating in the region. Municipal development of floodplain management ordinances along with providing education and outreach would be beneficial.
- With the potential for increased storm frequency and intensity, encourage enhancement of structural and non-structural strategies to reduce environmental impacts of these storm events.
- Engage stakeholders on the implications of intense rain events, degrading soil health, and increased temperatures and how these conditions not only cause flooding, but can also lead to micro-droughts.
- Develop a map of areas most likely to be affected by climate change showing the nature and potential of those impacts.
- Stakeholders should develop a more effective approach to floodplain restoration projects by emphasizing the benefits of flood mitigation. Some of these strategies may include the removal of obstructions and encroachments such as buildings, legacy sediment, or undersized bridges and culverts.
- Drought management for reservoir systems should be enhanced to account for a changing climate and plan for resiliency with an amplified drought of record to facilitate protection and conservation of water resources.
- Encourage continued coordination amongst agencies (state, federal, and local) and non-government organizations to help leverage resources to reduce the impacts of climate change.
- Continue to promote economic incentives in order to be more proactive than reactive, creating long-term resiliency. Climate change can cause increased surface water temperatures that can impact the ecosystem (e.g., harmful algal blooms) and destroy habitats, leading to treatment challenges for public water suppliers.

Ohio

Specific Regional Priorities

The Ohio region is geologically distinct from the other water planning regions. It is marked by varied elevations, cliffs, landslides, and high-relief areas. This watershed contributes to the larger Mississippi basin and, as such, requires the involvement of several stakeholders in order to maintain water quantity and quality.

Interagency Water Resource Planning

The committee supports a holistic approach to water quality, quantity, and availability. They believe interagency water resources planning can address many water priorities. Organizations that should be involved in interagency water planning include federal, interstate, and state agencies, local municipalities, conservation districts, watershed districts, watershed authorities, nonprofit environmental organizations, and the U.S. Army Corp of Engineers. Plans should identify water resources needed to promote and facilitate economic development while maintaining watershed integrity and recreation benefits. They should also evaluate impacts of resource extraction from the Marcellus Shale on water quality, emerging contaminants in water systems, reclaiming of water resources impaired by abandoned mines, and inter-basin transfers of water. Act 167 stormwater planning at the county level is an initial step toward interagency water resource planning.

Water Quality and Quantity

Regional solutions depend upon an integrated approach to water quality and quantity challenges. Water quantity can be defined as a spectrum from too much to too little. Quantity can also vary over time and location. Quality, which is defined by water usage, can be impacted by quantity - either too high or too low. Increased data collection can inform community input and watershed planning. Planning will help to prioritize natural systems, man-made infrastructure, and water treatment to include creative, diverse, and strategic solutions that can maximize water supply and the quality of our drinking water.

The largest hazard to our communities is flood water. Excessive amounts of stormwater runoff can cause flooding and damage the quality of the waterways through agricultural runoff, combined sewer overflows (CSOs), and Municipal Separate Storm Sewer System (MS4) overflows. Stormwater is significantly impacted by climate change and aging infrastructure. Priority should be given to multi-municipal planning and funding projects that include best management practices referenced in the Pennsylvania Stormwater Best Management Practices Manual, and updates thereto, that use integrated approaches to maximize pollution reduction and mitigate flooding.

In addition to stormwater management, planning efforts need to address acid mine drainage and orphaned wells, inter-basin transfers, agricultural activities, sanitary sewer overflows, CSOs, MS4s, unsustainable forest management, and the introduction of larger-scale industrial water users, all of which have implications on both quality and quantity.

Region's Uniqueness

What are the Ohio region's unique characteristics that are important considerations in the state's water planning?

- The basin contains the headwaters of the Ohio River, having an impact on 1,000 miles of river downstream through multiple states. Water drains north from West Virginia and south through Ohio and New York before contributing to the larger Ohio River basin.
- The Ohio River basin contains organizations that are unique to the region with a focus on water quality: The Ohio River Basin Alliance (ORBA) and The Ohio River Valley Water Sanitation Commission (ORSANCO).
- Universities, colleges, municipalities, and local foundations within the basin often work together towards solutions to water resource related issues.
- The Ohio River basin is a municipally dense region which can lead to difficulties in coordinating zoning and planning activities.
- The region contains the tribal lands of the Seneca Nation of Indians.
- The Allegheny National Forest is located in the basin; these protected lands provide conservation and recreation.
- There are many locks and dams within the region including 16 multipurpose flood control dams and 23 navigable locks and dams.
- Rivers are used for recreation and transportation with inland ports for sand, gravel, coal, and other commodities. The Port of Pittsburgh is the fourth largest inland port in the United States.
- The region is geographically distinct from the rest of the state due to the Appalachian Mountains. Geologically the Appalachian Mountains are an incised plateau which leads to the appearance of synclines and anticlines from glacial activities. Varying elevations, such as cliffs and high-relief areas, can be prone to landslides. This necessitates different planning and treatment requirements based on location.
- Hydraulic fracking and coal-fired power plants in the region create additional water demands.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- Stormwater management infrastructure often lacks proper maintenance, partly due to confusion about ownership and the associated responsible parties. Some agreements have been in place since the 1960s, but these can be difficult to enforce, especially as facilities change ownership, leaving some older facilities without maintenance for decades.
- Education and outreach are needed to tie the concept of stormwater management more closely to flooding, as poor stormwater management can lead to downstream flooding.
- Aging stormwater infrastructure should be assessed by regional authorities for high-frequency, as opposed to high-intensity storm events. Retrofitting aging best management practices and providing groundwater recharge areas for large impervious areas such as parking lots from vacant shopping malls would be beneficial.
- Contaminants from large impervious areas can be transported by stormwater, which can contribute to water quality issues.
- Planning should be completed on a watershed basis and priority should be given to planning upstream and/or at the headwaters.

- CSOs are common in the Ohio River basin and their removals are ongoing. Impacts occur only during rain events, which makes CSOs both a stormwater concern and a water quality problem.
- Rivers, with their proximity to raw materials (lumber, coal, etc.) and easy transportation served as an ideal location for development. This not only obstructed the floodplain but constrained the gradual geomorphic development of the waterway. Therefore, the redevelopment of older structures on floodplains, which were built prior to local ordinances that would have prevented their original construction, are a concern for the region.
- State guidance on floodplain development is released whenever a new Flood Insurance Rate Map (FIRM) is provided by the Federal Emergency Management Agency (FEMA). FIRMs are then enacted via municipalities (through floodplain ordinances and collaboration with neighboring communities) and could benefit from regional planning.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- Flooding due to large amounts of impervious surfaces will continue to cause problems as precipitation intensity increases.
- Stakeholders should investigate climate change implications on water supply vulnerability, availability, and reliability.
- Climate change will likely increase the intensity of storms in Pennsylvania but could also extend dry periods. Stakeholders should investigate the implications of flash flooding and potential decreased groundwater recharge.
- Capturing water during high-intensity storm events and continuing to promote ground water recharge will help reduce drought events. Regional authorities should provide incentives for homeowners to utilize rain barrels or route downspouts to swales.
- The U.S. Army Corps of Engineers owns and operates locks and dams within the region which may help with resiliency, provided they are properly maintained. This will require additional infrastructure planning to enhance resiliency.
- There is a need to maintain riparian buffers, particularly in communities at the headwaters of the basin.

Potomac

Specific Regional Priorities

The Potomac region is comparatively small and each county in the region is split with at least one other watershed. Being composed of mostly smaller watersheds, the region is at risk from changing precipitation patterns due to climate change and groundwater recharge issues related to land use practices; these issues represent a primary focus of the regional committee.

Promote Programs and Practices that Protect Water Quality and Quantity and Preserve the Ecological Integrity of Groundwater and Surface Water

A major priority of the regional committee is to develop land use programs that protect water quality and quantity while preserving the ecological integrity of groundwater and surface water, including springs, streams, lakes, and wetlands. To ensure adequate water resources for present and future generations in the Potomac River basin, the committee recommends an approach that encourages municipal programs to collaborate and plan regionally, address land use planning and growth, provide domestic water well construction standards, and implement best management practices to protect water quality and quantity. Completing Countywide Action Plans to support Pennsylvania's Phase 3 Chesapeake Bay Watershed Implementation Plan is also a high priority under this objective.

Climate Change Resiliency Especially with Regard to Stormwater Management, Flooding, and Drought

From a water resources perspective, climate change impacts stormwater management, flooding, and drought. Large, intense precipitation events and longer-duration storms are increasing stormwater runoff and creating or exacerbating erosion issues. Areas in this region have low infiltration rates, leading to less groundwater recharge and increased flooding. Varied storm frequencies may also lead to an increase in droughts. Promoting stormwater management with the use of riparian buffers, rain gardens, and stream restoration will reduce erosion and improve groundwater recharge.

As they would specifically relate to documented climate change, identify protection priority water resources that may be trending towards impairment for any use, through the collection and analysis of data. Priorities may be determined by looking specifically at declining water quality and/or quantity, and flooding issues. Improve the potential protection priority water resources through identified targeted solutions that may include education and outreach, asset management, resource improvement, and others.

Region's Uniqueness

What are the Potomac region's unique characteristics that are important considerations in the state's water planning?

- This region forms the headwaters to the Potomac River, which makes interstate coordination crucial, as the majority of the basin is located within Maryland.
- This region borders the Susquehanna and Delaware River basins. Each county in this region is split between at least two planning regions.
- Local geology and topography limits groundwater storage and recharge; water does not infiltrate into the soil well and may lead to flooding.

- Unique location along the I-81 corridor with a high amount of development, particularly warehouse expansion.
- The geography is unique in that it is predominantly farmland that is densely populated, but also has rugged mountains that are more sparsely populated.
- There has been increased residential growth throughout the basin as a result of urban sprawl from the Baltimore, Harrisburg, and Washington DC metropolitan areas, which will change the dynamics of water needs.
- Adams County within the region has, in conjunction with local well drilling contractors, developed a set of standards for well construction. They are the only county in the region to have accomplished this thus far.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- As part of Pennsylvania's Phase 3 Chesapeake Bay Watershed Implementation Plan, promote Countywide Action Plans which are beneficial for facilitating coordination and addressing stormwater.
- Consider water quantity and quality when performing cost/benefit analysis for land development and infrastructure.
- Regional authorities should assess aging stormwater infrastructure for high-frequency, as opposed to high-intensity storm events. Retrofitting aging best management practices and providing groundwater recharge areas for large impervious areas such as parking lots from vacant shopping malls would be beneficial.
- The region's unique geology that limits groundwater recharge and storage should be taken into account for regional planning of stormwater and flooding events.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- With the potential for increased storm frequency and storm intensity, stakeholders should find ways to reduce safety risks, environmental impacts, and generally be more prepared for these types of storm events.
- Increasing resiliency for flash flooding events should be considered in regional planning. Riparian buffers and conveyance structures can help reduce the effects of flash flooding and promote groundwater recharge.
- Extremes in water availability requires regional authorities to plan for both flooding and drought, which creates difficulty in planning and coordination. Integrated water resource planning (IWRP) can help coordinate these efforts.
- Since there is increased risk of more severe droughts brought on by climate change, there needs to be greater resilience of water resources. Protection and conservation of groundwater sources can be accomplished through increased infiltration and aquifer maintenance.
- Stakeholders should investigate climate change implications on water supply and water quality. This can be accomplished by collecting data on both the high and low precipitation events.

- Stakeholders should explore ways to communicate climate change that won't alienate potential allies.
- Where possible, use “on the ground” data collection, science, and regional data as opposed to global datasets. This data will provide more accurate forecasting, attract more stakeholders, and help with localized decisions. Additional types of data and sources would be beneficial in finding the best way to analyze and track local changes (CoCoRaHS network).

Upper/Middle Susquehanna

Specific Regional Priorities

The Upper/Middle Susquehanna region operates as a headwaters region for the Susquehanna River basin and contains the West Branch Susquehanna River watershed. The region's challenges include a history of legacy mining, aging infrastructure, and a relatively low population making broad regional coordination and ecosystem protection critical.

Protect Important Headwater Habitats, Enhance Recharge Areas, and Minimize Stormwater Runoff of the Upper/Middle Susquehanna River Basin

To care for the water resources in the Upper/Middle Susquehanna River basin and ensure a sustainable supply of quality water, important headwater habitats and groundwater recharge areas must be protected. Because much of the basin is forested, the approach should focus on forested land use practices and their effect on area water supplies. Minimizing large-scale forest cutting is a priority to mitigate downstream flooding, preserve forested ecosystem services, and reduce sedimentation. Addressing legacy infrastructure, including point source outfalls, in acid mine drainage areas is also critical to protecting important headwaters and streams. The Upper/Middle Susquehanna regional committee strongly encourages reuse of degraded/abandoned land such as available industrial or commercial lands. Marcellus Shale is a large resource for natural gas in the basin that can require large quantities of water for hydraulic fracturing and has potential impacts to the headwaters, wetlands, and the overall groundwater and surface water quality and quantity of the region. Committee members recognize a different approach must be taken to address water quantity and quality issues between rural and urban/suburban areas within the region. Rural areas strive to protect forest lands, preserve recreation areas and greenways, and protect critical habitat areas. Stormwater quality and quantity concerns in suburban and urban areas may be addressed with green infrastructure through zoning ordinance changes for underutilized and/or vacant commercial property, as well as their associated parking and paved areas.

Working collaboratively with stakeholders including state, county, and municipal government, municipal authorities, conservation districts, and watershed associations through education and outreach efforts is essential to advancing sound land use practices that are protective of these headwater areas. As part of a strategy to accomplish this, local governments can promote appropriate municipal ordinances in public water supply recharge areas, which is particularly important in areas with limited availability of quality water. The committee also recommends that statewide water well construction standards be implemented, particularly related to residential well drilling and geothermal bore holes, which will protect and sustain groundwater quality and availability.

Multi-Municipal Planning and Coordination

Land use planning and development are critical to protect headwater habitats, enhance recharge areas, and minimize stormwater runoff. Planning needs to expand with county-wide action plans and integrated water resources management throughout a watershed. A regional approach of education and outreach to water resource stakeholders, emphasizing the value of coordinated water quality and quantity planning among municipalities, is critical to protecting all communities. Continue to prioritize upgrading existing aging water and sewer infrastructure to maintain water quality and quantity, recognizing that parts of the region have experienced a decline in population and, as a result, many

communities are challenged economically. Multi-municipal planning coordination enhances success in preserving water quality and quantity and optimizes the use of funding dollars.

Region's Uniqueness

What are the Upper/Middle Susquehanna region's unique characteristics that are important considerations in the state's water planning?

- This region encompasses a large portion of the headwaters for the Susquehanna River.
- The Upper/Middle Susquehanna region has complex geology and substantial topographical variation.
- Legacy mining in the region presents water quality problems such as source water contamination but also provides opportunities through mineral recapture and recycling.
- There is a vast number of diverse hydrologic features in the basin including wetlands, streams, lakes, and ponds as well as peatlands.
- The Upper/Middle Susquehanna River basin is densely forested, which helps to filter groundwater.
- With a large number of state forests, state game lands, and public lands, recreation plays a big role in this region's economy.
- Marcellus Shale is a large resource for natural gas in the basin.

Stormwater and Flood Management

What are the region's concerns and recommendations for stormwater and flood management to preserve water quality?

- Good forestry practices should be continued in order to support headwaters, as healthy forests help mitigate flooding downstream.
- Incorporate green measures, such as green streets and green roofs, into municipal plans to better capture precipitation in urbanized areas.
- Retrofitting existing stormwater facilities, promoting groundwater infiltration and recharge areas with a focus on smaller-scale granular solutions instead of large basins would be beneficial. With consideration of climate projections and future changes in the regional climate, local authorities should assess aging infrastructure for high-frequency storm events, erosion control, and filtration.
- Vacant shopping malls and corporate properties designed parking lots for maximum occupancy, which can lead to excessive runoff. Since the advent of virtual workspaces and online shopping, there is less demand for such large parking lots. Methods to modify or reuse these parking lots by retrofitting them with new stormwater best management practices should be investigated first by accurately determining responsibility. Transferring development rights might be a tool to achieve stormwater improvements on these properties.
- Stakeholders should provide education and outreach to homeowners on the impacts of stormwater, including the differences between pervious and impervious surfaces and various mitigation techniques, such as rain gutters and rain barrels, etc.
- Stormwater best management practices should be properly maintained; pervious pavements vacuumed regularly, streets swept, and algae controlled. Maintenance

provisions in Municipal Separate Storm Sewer System (MS4) requirements and credits can help ensure continued functionality of best management practices.

- Connecting multiple municipalities within counties to create MS4 or stormwater consortiums so communities can discuss how best to apply the regulations would be beneficial.
- Stormwater ordinances need to be kept up to date with stormwater infrastructure improvements considered alongside redevelopment projects.

Climate Change Adaptation for Water Resources

How are water resources within the region being impacted by climate change and what could we do to adapt?

- Increased storm frequency and high-intensity events will create issues with groundwater recharge and flash flooding. With droughts having a more severe impact on groundwater, continue to promote groundwater recharge to increase water availability.
- An in-depth study of climate change implications on water supply, vulnerability, availability, and reliability would be beneficial.
- Stakeholders should promote flexibility and incremental practical steps in response to the changing climate, especially in smaller communities that may lack the necessary budgets.
- Stakeholders should provide education and outreach focusing on resiliency and scientific data to help guide climate change discussions.
- Emphasizing the benefits and co-benefits of climate adaptation projects to the public and stakeholders would be beneficial, such as general resiliency and health of the ecosystem.