Chester County Watersheds 2045
AN INTEGRATED WATER RESOURCES PLAN
Watersheds 2045 Vision

In 2045, we envision sustainable Chester County water resources that provide clean water, support healthy aquatic and wildlife habitats, enable thriving communities, and offer abundant and accessible recreational opportunities for all.

DISCLAIMER

The Chester County Board of Commissioners officially adopted Watersheds 2045 on January 24, 2024. Neither the content nor the design of this plan is to be considered final until the plan is accepted by the Pennsylvania Department of Environmental Protection and the Pennsylvania Department of Conservation and Natural Resources.

The maps, data, and information presented herein were compiled by the Chester County Water Resources Authority for the County of Chester, PA. These data and information are provided for reference and planning purposes only. This document is based on and presents the best information available at the time of its preparation.
RESOLUTION OF THE CHESTER COUNTY COMMISSIONERS ADOPTING
WATERSHEDS 2045 AS AN UPDATED VERSION OF THE 2002 WATERSHEDS, AN
INTEGRATED WATER RESOURCES PLAN FOR CHESTER COUNTY, PA AND ITS
WATERSHEDS, AND TO SERVE AS THE UPDATED COUNTY-WIDE ACT 167
STORMWATER MANAGEMENT PLAN IN ACCORDANCE WITH ACT 167 AND AS
THE COUNTY-WIDE RIVERS CONSERVATION PLAN

WHEREAS, Watersheds, An Integrated Water Resources Plan for Chester County, PA
and Its Watersheds ("Watersheds") has served as the County’s integrated water resources plan
since its adoption by the Chester County Board of Commissioners in 2002 in accordance with
the Pennsylvania Municipalities Planning Code, 53 P.S. §10301 et seq. ("Act 247"); and

WHEREAS, the Pennsylvania Stormwater Management Act of 1978, 32 P.S. §680.1 et
seq. ("Act 167"), requires that each county prepare and adopt a watershed stormwater
management plan for each designated watershed and provides for the regulation of land and
water use for flood control and stormwater management; and

WHEREAS, the Chester County Board of Commissioners adopted the County-wide Act
167 Stormwater Management Plan Addendum to Watersheds, An Integrated Water Resources
Plan for Chester County, PA and Its Watersheds ("Addendum") in 2013 to fulfill the
requirements of Act 167 which contained a County-wide Act 167 Stormwater Management
Model Ordinance ("Original Model Ordinance") and included standards for stormwater
management in Chester County; and

WHEREAS, the Chester County Board of Commissioners amended the Addendum to
incorporate the updated County-wide Act 167 Stormwater Management Model Ordinance
("Updated Model Ordinance") in 2022; and

WHEREAS, the Commonwealth of Pennsylvania, Department of Conservation and
Natural Resources, Bureau of Recreation and Conservation maintains the Pennsylvania Rivers
Conservation Registry on which the County’s watersheds are listed, and Watersheds was
prepared to serve as a County-wide Rivers Conservation Plan, including recommendations for
implementation throughout Chester County; and

WHEREAS, the Chester County Board of Commissioners recognizes that the
conservation and restoration of the quality and quantity of water resources in the County’s 21
watersheds, 2,300 stream miles, and 780 square miles of groundwater aquifers are of critical
importance to the quality of life in the County and acknowledges the current and potential
impacts that factors such as climate change, continuing growth pressures, and changes in land
use may have on water resources; and

WHEREAS, the County of Chester prepared Watersheds 2045 to address these present
and future needs with assistance from the Watersheds 2045 Steering Committee, the public, and
other stakeholders of the County’s watersheds, and thereby represents the interests of the
constituents of Chester County;
WHEREAS, the Chester County Board of Commissioners held a public hearing regarding the adoption of Watersheds 2045 on January 24, 2024 pursuant to 53 P.S. § 10302.

NOW, THEREFORE, BE IT RESOLVED, the Chester County Board of Commissioners adopts Watersheds 2045 as an updated version of the 2002 Watersheds plan, which shall serve as the updated County-wide Act 167 Stormwater Management Plan in accordance with Act 167, and as the County-wide Rivers Conservation Plan and, further, directs that the Chester County Water Resources Authority submit Watersheds 2045 to the Pennsylvania Department of Environmental Protection for its approval as required by Act 167 and to the Pennsylvania Department of Conservation and Natural Resources for its approval to comply with all grant funding requirements.

THIS RESOLUTION, adopted this 24th day of January, 2024, by the Board of Chester County Commissioners.

COMMISSIONERS:

Josh Maxwell, Chair

Marina Moskowitz, Commissioner

Eric M. Roe, Commissioner

ATTEST:

Robert J. Kagel, Chief Clerk

RESOLUTION BOC-05-24
Chester County Watersheds 2045

AN INTEGRATED WATER RESOURCES PLAN

Chester County’s County-wide Act 167 Stormwater Plan & County-wide Rivers Conservation Plan

Adopted by the Chester County Board of Commissioners on January 24, 2024
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Acknowledgements

The County of Chester and the Chester County Water Resources Authority (CCWRA) gratefully acknowledge the engagement and support of the many individuals, County staff, agencies, organizations, and stakeholders who participated in the development of the Watersheds 2045 plan.

Funding Partners

Chester County and the Chester County Water Resources Authority express their appreciation to those entities who provided financial support for this planning effort.

In addition to support from the Chester County Commissioners, the development of this plan was financed in part by a grant from the Community Conservation Partnerships Program, Keystone Recreation, Park and Conservation Fund, under the administration of the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation.

Watersheds 2045 Steering Committee Members

Adam Mowery  Mowery Environmental
Andrew Dehoff  Susquehanna River Basin Commission
Andrew Gavin  Susquehanna River Basin Commission
Anita Martin  Chester Water Authority
Beth Sassaman  Natural Resources Conservation Service
Beth Uhler  Center for Watershed Protection
Brian Winslow  Brandywine Red Clay Alliance
David Arscott  Stroud Water Research Center
Denis Newbold  Stroud Water Research Center
Drew Reif  U.S. Geological Survey
Eden Ratliff  Kennett Township
Grant DeCosta  Brandywine Conservancy
Greg Newell  Homebuilders Association of Chester County
John Schable  Oxford Borough
Krista Brown  PA Department of Environmental Protection
Krista Seng  Aqua Pennsylvania
Kristen Bowman Kavanagh  Delaware River Basin Commission
Kristi English  Pennsylvania American Water
Martin Helmke  West Chester University Department of Geology
Mary Frances McGarrity  Chester County Economic Development Council
Rachel Roberts  American Mushroom Institute
Ron Barchet  Victory Brewing
Rupert Rossetti  Octoraro Watershed Association
Sara Wozniak  DE Department of Natural Resources and Environmental Control
Stephen Burgo  Tredyffrin Township
Stephen Castellan  Pactiv Evergreen
Stephen Williams  DE Department of Natural Resources and Environmental Control
Tiffany Bell  West Nottingham Township
Todd Pride  Legacy Land and Water Partners
Tony Scheivert  Upper Uwchlan Township
Victoria Laubach  Green Valleys Watershed Association
Subwatershed Stakeholder Input Committee Members

Amanda Obesenko  Aqua PA
Andrew Kirkpatrick  Willistown Conservation Trust
Anita Martin  Chester Water Authority
Carol Armstrong  Valley Creek Restoration Partnership
Chotty Sprenkle  Octoraro Watersheds Association
Cori Trice  Chester County Conservation District
Dan Miloser  Chester County Conservation District
David Ross  Oxford Regional Environmental Advisory Council
Karl Russek  French & Pickering Creeks Conservation Trust
Lauren McGrath  Willistown Conservation Trust
Maggie Reilly  Aqua PA
Pete Goodman  Trout Unlimited
Rachael Griffith  Chester County Planning Commission
Shane Morgan  White Clay Wild & Scenic

Watershed Plan Advisory Committee

Representatives from each of the County’s 73 municipalities were represented on the Watershed Plan Advisory Committee (WPAC). Details of WPAC engagement are available in Appendix E.

Planning Team

Chester County
Water Resources Authority:
Seung Ah Byun, PE, PhD – Executive Director
Craig Thomas – Field Operations and Engineering Manager
Kate Hutelmyer – Water Resources Planner
Mark Chegwidden – Water Resources Specialist
Teresa Greenawalt – Fiscal and Office Coordinator
Jan Bowers, PG (formerly with CCWRA)
Cory Trego (formerly with CCWRA)

Consultants:
CDM Smith
Cedarville Engineering Group
Gaadt Perspectives, LLC

County Departments:
Chester County Conservation District
Chester County Department of Emergency Services
Chester County Parks + Preservation
Chester County Planning Commission
Chester County Solicitors Office

Technical Assistance and Design Support:
Al Park, Chester County Planning Commission
Brian O’Leary, Chester County Planning Commission
Carol Stauffer, Chester County Planning Commission
Colin Murtoff, Chester County Planning Commission
Diana Zak, Chester County Planning Commission
Ian Mix, Chester County Planning Commission
Paul Fritz, Chester County Planning Commission
Rachael Griffith, Chester County Planning Commission

Chester County Water Resources Authority Board of Directors

Denny L. Howell, Chair
Robert G. Struble Jr., Secretary
A. Sidney Brookes Jr.
Denis Newbold, PhD
Mark Lucas

Tony Fernandes, Vice Chair
Caren Andrews, Treasurer
Lisa Donlon
Kevin Gore
Important Acronyms

**BMP**: Best Management Practices  
**BOD**: Biologic Oxygen Demand  
**CBTF**: Christina Basin Task Force  
**CCATO**: Chester County Association of Township Officials  
**CCCD**: Chester County Conservation District  
**CCDES**: Chester County Department of Emergency Services  
**CCP+P**: Chester County Department of Parks + Preservation  
**CCPC**: Chester County Planning Commission  
**CCWRA**: Chester County Water Resources Authority  
**CERCLA**: Comprehensive Environmental Response, Compensation, and Liability Act  
**CCHD**: Chester County Health Department  
**COD**: Chemical Oxygen Demand  
**COG**: Council of Governments  
**CREP**: Conservation Reserve and Enhancement Program  
**Cu**: Copper  
**CWF**: Cold Water Fishery  
**CWMP**: Christina Watersheds Municipal Partnership  
**CCDCD**: Chester County Department of Community Development  
**DNREC**: Delaware Department of Natural Resources and Environmental Control  
**DRBC**: Delaware River Basin Commission  
**DVRPC**: Delaware Valley Regional Planning Commission  
**EAC**: Environmental Advisory Council  
**EEAB**: Energy and Environmental Advisory Board  
**EPA**: U.S. Environmental Protection Agency  
**ET**: Evaporation/Transpiration  
**EV**: Exceptional Value  
**FEMA**: Federal Emergency Management Agency  
**GWPA**: Groundwater Protection Area  
**HQ**: High Quality  
**IBI**: Index of Biotic Integrity  
**IDD&E**: Illicit Discharge Detection and Elimination  
**IWRP**: Integrated Water Resources Planning  
**MCM**: Minimum Control Measure  
**MDE**: Maryland Department of the Environment
MDNR: Maryland Department of Natural Resources
MS4: Municipal Separate Storm Sewer System
NO2/NO3: Nitrate/Nitrite
NOAA: National Oceanic and Atmospheric Administration
NPDES: National Pollutant Discharge Elimination System
NPS: Nonpoint Source Pollution
NRCS: Natural Resources Conservation Service
OSWC: Octoraro Source Water Collaborative
PA DCNR: Pennsylvania Department of Conservation and Natural Resources
PADEP: Pennsylvania Department of Environmental Protection
PAFBC: Pennsylvania Fish and Boat Commission
Pb: Lead
PCB: Polychlorinated Biphenyls
PCSM: Post Construction Stormwater Management
PEMA: Pennsylvania Emergency Management Agency
PennDOT: Pennsylvania Department of Transportation
PSATS: Pennsylvania State Association of Township Supervisors
PUC: Public Utilities Commission
SRBC: Susquehanna River Basin Commission
TDP: Total Dissolved Phosphorus
TKN: Total Kjeldahl Nitrogen
TMDL: Total Maximum Daily Load
TN: Total Nitrogen
TP: Total Phosphorus
TSF: Trout Stocking Fishery
TSS: Total Suspended Solids
USGS: U.S. Geological Survey
WMM: Watershed Management Model
WWF: Warm Water Fisheries
Zn: Zinc
Chapter 1: A Watershed Moment

Water is necessary for the survival of all living organisms. It both influences and is influenced by how we grow and thrive as a society. Unfortunately, water, specifically freshwater, is becoming one of the scarcest resources in the world. Events such as droughts, floods and pollution significantly affect our lives and cause harm to the environment. As such, it is critical to protect, sustain and enhance the quality and quantity of our water resources to ensure the health, safety, and welfare of our citizens and protect the natural environment.

Watersheds, Chester County’s integrated water resources plan, was first adopted by the County Commissioners in 2002 as a tool to better understand, evaluate, and plan for how we manage our water resources.

• What is a watershed?
• How do streams function?
• What is groundwater?
• How much water do we have?
• How does it move across our landscape?
• In what ways do we use water?
• How much do we need?

The original plan used the answers to these questions as a roadmap to a future that balances what nature provides with what society needs.

Watersheds 2045 continues the County’s planning legacy. In the years since the original plan was adopted, Chester County has continued to grow – more businesses, more homes, and more demands on our water resources. In some cases, the projections from twenty years ago mirror our current reality fairly closely. In other cases, the world as we know it today requires significant adjustments to strategies laid out in the past. This updated plan evaluates where we are now and what we need to do to best manage our water resources for future generations.
The Waters of Chester County

Chester County is home to an abundance of water resources, with more than 2,300 miles of streams that flow through 21 distinct watersheds (which are discrete areas of land that drain into a particular waterway). Those 21 watersheds, many of which originate within the County’s borders, feed into four of the region’s largest waterways: the Schuylkill River to the north, the Delaware River to the east, and the Susquehanna River and Chesapeake Bay to the west.

The analyses and recommendations for this plan were developed using local watersheds as the basic planning unit. They also take into account the robust network of groundwater resources beneath our feet, and the municipal boundaries that define our communities. Because the flow of water is governed by gravity and not political borders, our study area extends beyond Chester County to include portions of Lancaster, Berks, Delaware, Montgomery, and Philadelphia counties in Pennsylvania, as well as parts of New Castle County, Delaware, and Cecil County, Maryland. In total, the study area includes all or portions of 144 municipalities, 8 counties, 3 states, 21 watersheds, and 78 subbasins spread over 1,408 square miles.

Millions of years and powerful natural forces shaped the landscape of Chester County. Rolling hills and gentle valleys were formed by geologic uplift and erosion by wind and water. Our study area ranges in elevation from approximately 1,200 feet (above mean sea level) at the Welsh Mountains along the boundaries between Chester, Lancaster and Berks counties, to near sea level along the lower Christina River at Wilmington. Dominant regional features in this view include the Chester Valley (or Great Valley), a carbonate valley that extends throughout southeast PA and continues through Maryland; the Welsh Mountains in the northwest corner; and the “fall line”, where the Piedmont Province ends and the Coastal Plain Province begins in the southern extreme end of the study area near the Christina River. These topographical features determine the way that water moves across our landscape.

Human activity has shaped the land too, altering the terrain and the natural hydrology to allow for development, farming, and other community uses. The area’s rich soils and relatively mild climate made it an attractive region for agriculture, which is still a dominant land use in the County today. Over time, the landscape shifted to accommodate industrialization and suburbanization. Today, Chester County is roughly 30% farmland, 30% wooded or natural areas, and the remainder is developed.

As with the landscape itself, the characteristics of, uses for, and impacts to our waterways varies greatly. Almost half of the County’s land area drains into State designated Exceptional Value (EV) or High Quality (HQ) waterways. Approximately 266 miles of stream corridor belong to the Pennsylvania Scenic Rivers or Federal Wild and Scenic Rivers program. About 70% of the County drains into sources of drinking water supplies for residents across southeastern Pennsylvania and northern Delaware. These designations, as well as the broader importance of our streams and waterways for habitat, recreation, and other ecosystem services, highlight the incredible value of our shared waters.
Figure 1.1: Watersheds of Chester County

Legend

1. Chester Creek
2. Christina River
3. Conestoga Creek
4. Crum Creek
5. Darby Creek
6. Elk Creek
7. French Creek
8. Lower Brandywine Creek
9. Northeast Creek
10. Octoraro Creek
11. Pequea Creek
12. Pickering Creek
13. Pigeon Creek
14. Red Clay Creek
15. Ridley Creek
16. Schuylkill River Drainage
17. Stony Run
18. Trout Creek
19. Upper Brandywine Creek
20. Valley Creek
21. White Clay Creek

County Boundary
Study Area Streams
Major River Basins
Figure 1.2: Municipalities and Watersheds of Chester County

Legend
- Study Area Watersheds
- County Boundary
- Municipalities
Understanding Present Conditions and Future Concerns

The original Watersheds plan provided a clear snapshot of the use and conditions of Chester County’s water resources at the time of its adoption. Collecting the data, obtaining stakeholder input, completing the analyses, and developing recommendations was a substantial, multi-year collaborative effort. The planning principles and guidance derived from this information have been pivotal in shaping the management of our streams, lakes, rivers, and groundwater resources over the past two decades. However, water resources challenges are continually evolving. Therefore, current and projected conditions must be periodically reevaluated, and prior planning approaches must be revisited to effectively meet the County’s needs today and in the future.

In Chester County and across the nation, there have been dramatic improvements in water quality since the passage of the Clean Water Act in 1972. Direct discharges of pollution into local streams have been reduced significantly. Rivers that once flowed dark and turbid from a cocktail of industrial and wastewater effluent now support diverse aquatic ecosystems. New wastewater treatment technology has resulted in major water quality improvements downstream of treatment plant discharges. Improvements in erosion and sediment control through modern stormwater management technologies and regulations have reduced sediment loads to local streams. 100% of Chester County municipalities with floodplains have adopted floodplain management ordinances designed to limit development in those areas to reduce risk and improve resilience. Chester County also continues to prioritize the preservation of open space and natural areas; as of 2022, 30% of Chester County is permanently preserved as protected open space. Furthermore, the protection of sensitive natural resources, such as wetlands, riparian areas, steep slopes, and woodlands, has greatly improved through the adoption of sound planning practices and municipal natural resources protection standards.

Chester County is fortunate to be home to a strong public conservation ethic. Nowhere is this more apparent than in the abundance of watershed and conservation organizations, land trusts, community groups, and municipal boards and commissions that are actively working to improve our natural and water resources. Among other things, these organizations lead stream clean-ups, implement best management practices (BMPs), conduct cutting edge research, host educational events, sponsor summer camps and school outreach programs, encourage municipalities to update ordinances and planning documents, coordinate citizen-science monitoring efforts, and leverage state, regional, and national funding to benefit water resources efforts here in Chester County. Residents from across the County have engaged in these activities, educated themselves as watershed stewards, and contributed to efforts that protect and restore our water resources. The progress made toward many of the goals and objectives of the original Watersheds plan would not have been possible without such robust community involvement and support.

While great strides have been made in improving the management of the County’s water resources, new and evolving challenges require adaptive and innovative planning strategies. Chester County’s unique blend of rural countryside, historic landscapes, and proximity to growing employment centers has continued to attract residents and businesses and fuel rapid growth over the past two decades. In fact, the County’s population grew from 433,501 in the 2000 census to 534,413 in the 2020 census, ranking it among the fastest growing counties in Pennsylvania.

Population growth leads to changes to our local landscapes, which results in increased residential and commercial needs from (and pressures on) our water resources. In 1995, roughly 25% of the County was considered “developed” (either for residential, commercial, or industrial uses). Today, that number is up to approximately 40%, as farmland and unpreserved open space have been converted.
into residential neighborhoods or commercial corridors. If not carefully managed, growth patterns like this can impact water resources by altering hydrologic flows, creating additional stormwater runoff, increasing pollution, and degrading or destroying habitat for native plant and animal species.

Changing climate and shifting precipitation patterns are also impacting local water resources. The northeastern United States has experienced a gradual rise in temperature and annual precipitation over the past century, and this trend has become increasingly acute over the last several decades. These regional trends align with the patterns we have observed locally. Our study area averaged approximately 46 inches of annual rainfall between 1978 and 1998; between 2000 to 2020, rainfall has averaged almost 50 inches per year. And it isn’t just more water overall, there are also changes in the intensity of the storms that deliver it. Across the northeastern U.S., there has been a dramatic increase in the frequency and intensity of precipitation events. Here in Chester County, rainfall from Tropical Storm Isaias in August 2020 and the remnants of Hurricane Ida in September 2021 resulted in some of the worst flooding in decades, along with the highest stream flows ever recorded in several communities along the Brandywine and Valley creeks.

Water quality at many locations across the County has also changed over the past two decades. Despite the gradual increase in stream health (measured by biotic integrity, or IBI, scores that analyze the quantity and quality of key aquatic insect indicators) in watersheds across the County, the percentage of stream miles included on the Pennsylvania Department of Environmental Protection’s (PADEP) listing of impaired streams (“303(d) list”) has increased from 21% in 2000 to 72% in 2022. While that significant increase is primarily due to an increase in the total number of streams assessed by PADEP (and the number of parameters for which assessments have been completed), updated strategies for reducing the sources of stream impairments are needed to improve water quality in the future. A more detailed overview of the County’s water resources and a summary of landscape, population, and water quality and use changes can be found in Chapter 3.

Changing environmental, social, and climatic conditions are catalysts to reevaluate and update the goals, objectives, and strategies focused to better address current issues and concerns the County is facing today and in the future. Watersheds 2045 provides an opportunity to accomplish the following:

- Evaluate progress towards achieving the goals, objectives, and strategies of Watersheds and identify where an increase in or change in approaches to implementation is needed;
- Assess changes in land use, development and growth patterns, water use and wastewater treatment, and policy and regulatory structures;
- Evaluate the prevalence and impacts of contaminants of emerging concerns, including strategies and recommendations to specifically address these contaminants;
- Incorporate the potential impacts to local water resources from a changing climate, such as increased precipitation fluctuations, more frequent intense storms, and rising temperatures;
- Develop goals and objectives that support the implementation of the County’s most recent comprehensive plan, Landscapes3; and,
- Obtain valuable input from our residents and stakeholder groups on water resources concerns.
A Comprehensive Planning Effort

Watersheds 2045 has deep roots in previous planning efforts. The original plan – Watersheds, an Integrated Water Resources Plan for Chester County, Pennsylvania – was released in 2002 as the water resources element of the County’s comprehensive plan, Landscapes. Watersheds and its companion document, the Chester County, Pennsylvania Water Resources Compendium, built upon decades of planning efforts and data collection dating back to 1952, when the Workplan for the Brandywine Creek Watershed was completed. These two plans represented the culmination of several years of stakeholder input, data collection, and analyses that resulted in a list of scientifically-sound goals, objectives, and implementable strategies designed to protect, sustain, and enhance the quality and quantity of the County’s water resources. The water resources information, analyses, and planning principles in Watersheds have helped to guide the County’s water resources decisions ever since, and have formed the foundation for this new plan.

Watersheds 2045 supports the implementation of Chester County’s most recent comprehensive plan, Landscapes3, adopted by the Chester County Board of Commissioners in 2018. Landscapes3 builds upon the County’s award-winning Landscapes comprehensive planning program with a holistic approach to planning that incorporates smart growth principles and programs that build community and environmental resiliency.

As the name of this new plan implies, Watersheds 2045 embraces the same 2045 planning horizon as Landscapes3.

Watersheds 2045 serves as Chester County’s official integrated water resources plan and the County-wide Act 167 Stormwater Management Plan (including the 2022 updated County-wide Model Stormwater Ordinance, provided in Appendix F). The plan promotes a scientifically-sound framework to protect, conserve, and manage the County’s streams, lakes, wetlands, and groundwater resources. Local land use changes, population growth, development, water supply needs, and methods of wastewater treatment and disposal all have a profound impact on the quality and quantity of our local water resources. The planning principles and strategies used here are designed to help guide County and local decision-making to protect and improve water resources for everyone.

Watersheds 2045 serves as an updated County-wide Rivers Conservation Plan under the Pennsylvania Rivers Conservation Program. This program, administered by the Pennsylvania Department of Conservation and Natural Resources’ (PA DCNR) Bureau of Recreation and Conservation, is designed to “protect and enhance the conservation and recreational values of Pennsylvania’s waterways.”

Water resources management is an ever-evolving challenge that demands adaptive management and creativity to continually assess where we are and where we want to be. As such, Chester County will review this plan at least once every five years and revise it as necessary in order to best achieve our water resource goals.

Landscapes3 Vision

In 2045, Chester County abounds with healthy natural areas, robust farms, cherished historic sites, diverse housing, thriving businesses, quality education, accessible transportation, and vibrant communities for all.
Creating the New Plan

Like the original plan, Watersheds 2045 incorporates a systems-based approach to assess the complex, interrelated relationships between natural watershed systems and the built environment. It is important to recognize the interconnectedness of our water resources and develop a better understanding of how land use and policy decisions impact them. Watersheds 2045 also embraces the concept of Integrated Water Resources Planning (IWRP) to assess current and future water supply needs. IWRP is a holistic approach to water resources management and planning that recognizes the interconnectedness of water systems, including water supply, water demand, water quality, natural resources protection, watershed economics, and public engagement. IWRP promotes more cost-effective solutions to water resources challenges by promoting collaborative, multidisciplinary responses and emphasizing preventative planning.

Collaboration was a central component in the development of this plan. County staff worked closely with the Watersheds 2045 steering committee, which was formed at the beginning of the public outreach process to guide and inform plan preparation. Members included local conservation leaders, municipal officials and staff, members of the business community, water resource scientists and engineers, water utilities, agency partners, and more. Input from a variety of stakeholder groups was collected through more than forty public and stakeholder meetings, as well as online and in-person surveys, idea boards, and open discussion forums.

The process for developing Watersheds 2045 utilized a strategic planning approach summarized in Figure 1.3.

Figure 1.3: Strategic Planning Approach

1. **Assessing Where We’ve Been**
   - This process included an assessment of the degree to which the goals, objectives, and strategies of Watersheds were implemented and achieved (Chapter 2).

2. **Understanding Where We Are**
   - We evaluated current water resource conditions, including water quality, quantity, and community uses, and assessed projections of potential future conditions (Chapter 3).

3. **Identifying the Challenges**
   - Data was integrated with stakeholder input to identify and prioritize the major challenges facing our water resources (Chapter 4).

4. **Setting the Course**
   - A steering committee of stakeholders and technical experts developed key goals for the plan, along with objectives, strategies, and indicators to help achieve them (Chapter 5).

5. **Tailoring the Approach**
   - Priority actions for each of the County’s 21 major watersheds were developed to address the unique issues, opportunities and needs of each watershed (Chapter 6).
Maintaining Momentum

The original *Watersheds* plan was adopted to support the County in its efforts to balance the impacts of growth in our communities while sustaining the integrity of our natural water resources. Success has been achieved in multiple areas identified by that plan over the past twenty years. Some of those accomplishments are summarized below (and more are outlined in greater detail in Chapter 2):

**Water quality has improved in many places across Chester County**

- Since 2002, PADEP has recorded approximately 11.5 miles of Chester County streams as restored (i.e., removed them from the Impaired Waters List for specific impairments) through their Integrated Water Quality Reports, including sections of Beaver Creek, Bennetts Run, Buck Run, Big Elk Creek, Pocopson Creek, and French Creek.
- County-wide water quality data on biotic integrity scores (which are based on the presence and abundance of certain aquatic species in a stream) from 1998 through 2021 show that our average annual high scores remain steady, while our annual average low scores show a gradual increase over time. Generally, this means that our high performing streams continue to do well, and some streams that have historically received lower scores are showing signs of improvement.

**Streams, floodplains, wetlands, and riparian areas are better protected through improved local environmental and stormwater management planning**

- Approximately 82% of municipalities have ordinances protecting riparian buffers
- Over 90% of the County’s municipalities have adopted wetland and woodland protection ordinances
- More than 730 acres of riparian area have been enrolled in the Conservation Reserve Enhancement Program (CREP) to protect and restore stream corridors
- More than 2,000 agricultural BMPs were installed between 2008 and 2020 with assistance from the Chester County Conservation District
- More than 42,000 acres of open space has been protected since 2002 through Chester County’s Open Space Municipal Grant Programs, and 30% of the County is permanently preserved
- Nearly $3.5 million has been awarded to Chester County municipalities through the Chester County Planning Commission’s Vision Partnership Program to help update their comprehensive plans, natural resources and open space plans, and ordinances to be consistent with the recommendations included in Watersheds and the *Landscapes* plan series

**Flood planning and preparedness expanded**

- 100% of Chester County municipalities with floodplains (which includes 72 out of the County’s 73 municipalities) have adopted floodplain protection standards
- Two regional flood control facilities in the Brandywine Creek watershed, Hibernia Dam and Beaver Creek Dam, were rehabilitated to comply with the latest PA DEP Dam Safety Standards
Watersheds 2045 reflects on where we are today and challenges us to continue to protect our water resources for generations to come. This plan provides the best opportunity for coordinating county efforts and working with stakeholders to secure a safe and abundant water future for all.

Water supply and wastewater planning have improved

- 1,200 minor and 75 major sewage facility plans have been reviewed by the Chester County Planning Commission for consistency with the County’s comprehensive plans
- Detailed water budgets and assessments of current and future water demands were completed for all watersheds in Chester County

Watershed stewardship education and engagement programs have expanded

- Penn State Extension established a Master Watershed Stewards Program in Chester County; participants in this program have volunteered over 6,000 hours completing projects and hosting educational events
- 19 Watershed Roundtable information and collaborative events have been hosted by the Chester County Conservation District and Chester County Water Resources Authority
- An average of 300-400 students participate in the annual Chester County Envirothon each year
- The Christina Watershed Municipal Partnership (CWMP) hosts quarterly meetings designed to facilitate municipal MS4 implementation and improve water quality throughout the Christina Basin in Chester County

Water-based recreation opportunities have increased

- Two dams have been removed on the East Branch and the main stem of the Brandywine Creek to facilitate safe boating and angling opportunities
- Access points along the Brandywine Creek, Schuylkill River, and Octoraro Creek have been improved
- The Brandywine Water Trail Feasibility Study was completed

Stormwater management planning and erosion and sediment control practices have improved

- 100% of municipalities have adopted stormwater management standards consistent with the County’s Act 167 Plan
- The Conservation District has conducted over 18,000 erosion and sediment control site inspections and reviewed over 8,000 erosion and sediment control plans
Chapter 2
How Far We've Come
Chapter 2: How Far We’ve Come

Looking Back to Look Ahead

It’s impossible to plan for the future without taking a good look at the past. For as long as humans have inhabited the landscape of Chester County, they have been intertwined with its water resources. This region is part of the ancestral homelands of the Lenape and other Native American tribes, who stewarded these lands and streams for thousands of years before European colonization. By the time of the American Revolution, communities built around agriculture and industry were thriving in the County, thanks in large part to its ample natural resources. The landscape was rich in iron ore, timber, and fertile soils, while streams provided an abundant source of power for mills. Much of the County’s original woodlands were cleared to provide lumber or to create farmland. Dams and mill raceways were constructed along streams to supply power to growing industries. Roads, bridges, and eventually railroads were built to move people and goods across the region. These activities supported the growth and economy of Chester County, as well as major metropolitan areas like Philadelphia, Wilmington, and Baltimore during the Industrial Revolution and beyond.

In the decades after World War II, Chester County experienced the building boom of suburban developments, commercial centers, and highways, which eventually contributed to the growth pattern known as suburban sprawl. Industrial and agricultural uses shifted in response to both regional and global market forces. Local communities expanded to keep pace with a rapidly growing population, which increased from approximately 159,000 residents in 1950 to more than 534,000 in 2020.

While ample water resources played a significant role in attracting farms, industry, and residents to Chester County, several hundred years of growth took a toll. Clearing forests for farmland, settlements, and lumber accelerated soil erosion and exacerbated flooding. A dramatic increase in hard surfaces, like roofs, parking lots, and roads, amplified those impacts. Dams built for mills and industries to harness waterpower disrupted fish migration. Industrial chemicals and waste materials were used as fill or discarded in landfills, sometimes ending up as sources of groundwater contamination. Toxic agricultural pesticides and excessively-applied fertilizers were washed off of fields and into streams during storms, causing major negative impacts on aquatic life. Until the mid-20th century, untreated industrial and municipal waste was often discharged directly into waterways.

These water resource challenges were by no means exclusive to Chester County. The cumulative impacts of modern society on water and natural resources garnered national attention during the second half of the 20th century. Regulations like the Clean Water Act, along with major technological upgrades and greater public awareness, resulted in substantial water quality improvements. This was evident when the original Watersheds plan was published in 2002. The plan cited results from the County’s cooperative stream monitoring program with the U.S. Geological Survey (USGS), noting that “the quality of Chester County streams has greatly improved since 1970.
Over the past two decades, partners across Chester County have made great strides in implementing the original Watersheds plan to protect and improve our water resources. These efforts have taken place against a backdrop of shifting weather and storm patterns, rapid technological advancement, and dramatic changes in the ways people connect and consume information. All of this has had an impact, directly or indirectly, on our rivers, lakes, streams, and aquifers. A key component of this planning process was to look back at the progress that has been made since 2002 toward the goals and objectives of the original Watersheds plan, and what that means for the state of Chester County waters today. More than just a trip down memory lane, this assessment set out to answer the following questions:

• How well have we done in the last 20 years to preserve and improve the County’s water resources?

• What should we change or how can we do better going forward?

Each of the 8 goals, 50 objectives, and 227 strategies identified in the 2002 plan was reviewed to determine the degree to which it has been accomplished, where progress is still needed, and how implementation could be improved in the future. In some instances, progress has been significant and continued success is simply a matter of staying the course; other objectives have faced a steeper uphill climb toward implementation and may require new strategies to achieve their intended outcomes.

A high-level summary of this analysis is provided here, broken out by the 8 original goals. For each, we’ve highlighted areas that have been smooth sailing (where substantial accomplishments have been made), and what’s around the bend (what needs to be done to improve implementation going forward). Greater detail on the analysis and a complete list of identified accomplishments is available in Appendix B.
Chapter 2
How Far We've Come

Engage & Educate Individuals, Communities, & Governments in Watershed Stewardship

Engage the public at all levels to accept individual responsibility for implementing watershed stewardship and good housekeeping practices on private, commercial, industrial, institutional, and public lands and roads.

Expand and sustain public education at all levels to achieve widespread public understanding of the inter-relationship of human activities and natural resources, and the economic, public health, environmental, and community benefits of preserving the integrity of the natural watershed ecosystems.

Engage governments at all levels to implement appropriate Watersheds goals and strategies in their regulations, programs and activities.

Around the Bend

Unsurprisingly, continuing to make progress with educating and engaging people in Chester County will require improved partnerships and outreach efforts across the board. Additionally, new approaches may be needed to diversify educational opportunities and materials to reach new audiences in the County.
Smooth Sailing

We’ve done well with engaging the public in watershed stewardship and good housekeeping on public and private lands and roads. We’ve also been successful in encouraging all levels of government to incorporate watershed management strategies into their policies and practices. Highlights in this area include:

• Since 2016, the Penn State Extension’s Master Watershed Stewards of Chester and Delaware Counties (one program for both Counties) have put in over 6,000 hours to plant 20+ riparian buffers, install three live stake nurseries, organize six stream cleanups, and monitor a dozen Mayfly EnviroDIY water quality sensor stations.

• Since 1989, the annual Chester County Envirothon each year has engaged local students in educational programming about the natural world. Each year, an average of 300 to 400 students participate in the event.

• Since 2002, the Chester County Planning Commission’s Vision Partnership Program has awarded nearly $3.5 million in grants and $1.6 million in technical assistance to 64 municipalities to support updates to their comprehensive plans, natural resources and open space plans, and ordinances that improve consistency with the recommendations included in the County’s Watersheds and Landscapes series plans.
Unfortunately, progress has been slower around supporting the preservation, re-use, and revitalization of historic waterfronts. Two global economic recessions and historic flooding in some of the County’s more urbanized riparian communities are two of many factors that may have contributed to the difficulty of fully implementing these objectives.

More information and more robust partnerships are needed to assess, expand, and or create new water-based recreational opportunities in Chester County. We need to develop new strategies for protecting and revitalizing historic waterfront districts, especially given new climate change projections and flood patterns.
Overall, Chester County has made substantial progress toward supporting water-based recreational opportunities for County residents. Highlights in this area include:

- Chester County has facilitated numerous trail improvements that link people to local waterways, including on the Struble Trail, Chester Valley Trail, and Schuylkill River Trail. The County has also opened two County Parks (Black Rock Sanctuary in 2003 and Wolf Hollow in 2010) with access to local streams.

- The Downing Ridge Dam on the East Branch Brandywine Creek and the Lenape Cabin Club Dam on the mainstem of the Brandywine were removed to promote safer water-based recreation and better stream access.

- The City of Coatesville’s River Walk opened in 2012. Chester County’s Department of Community Development (CCDCD) provided more than $1 million in funding for the project, which included the cleanup of contaminated soil and installation of a community trail, splash pad, benches, trash receptacles, safety fencing, and bike racks.

- Since 2002, Chester County’s Open Space Municipal Grant Programs have allocated nearly $179 million to protecting and preserving more than 42,000 acres of open space, which represents approximately 30% of all land in Chester County. This milestone was achieved even before the launch of the national “30 by 30” Initiative in 2021, which aims to conserve 30% of U.S. land and water resources by the year 2030.

- The Chester County Health Department (CCHD), in partnership with the USGS and CCWRA, maintains the Healthy Stream Recreation website that provides estimated levels of bacteria at five locations in Chester County to empower residents to safely enjoy local waterways.
Preserve Natural Resources

- Protect and enhance ground water.
- Protect and enhance the natural instream resources of streams.
- Protect and enhance first order perennial streams.
- Protect and enhance streams supporting "sensitive resources."
- Protect wetlands for their hydrologic and ecological functions.
- Create and enhance a network of protected forested riparian buffers.
- Consider the cumulative impacts on and benefits of proposed land development.
- Prioritize riparian buffers, floodplains, first order streams, and wellhead protection areas for land preservation efforts.

Recommendations for Improvement:
- Improve partnerships
- Revise strategies or metrics
- Collect additional information
Smooth Sailing

Chester County has made significant progress over the last twenty years when it comes to protecting and enhancing groundwater resources and wetlands. Some accomplishments related to this goal include:

- Since 2008, CCCD and the Natural Resources Conservation Service (NRCS) have enrolled over 736 acres in CREP, reducing approximately 73,600 pounds of nitrogen, 5,800 pounds of phosphorus, and 1.8 million pounds of sediment annually.

- Roughly 82% of Chester County municipalities have adopted riparian corridor protection ordinances, over 90% have wetland and woodland protection ordinances, and all municipalities with floodplains have floodplain protection standards.

- Since 2002, PADEP’s Growing Greener funding program has provided nearly $11 million in funding assistance to implement more than 65 environmental projects in Chester County.

- The Brandywine Red Clay Alliance’s “Red Streams Blue” program, which grew out of the original Watersheds planning effort, has restored more than 6.5 miles of streams in Chester County.

Around the Bend

Ongoing data collection and partnerships are critical to protecting natural resources in Chester County. Developing a higher resolution understanding of where our most sensitive natural features are will allow better prioritization and targeting of efforts to preserve and enhance those resources for generations to come. Beyond that, more robust data will provide greater opportunities for municipal protection strategies, including policy enhancements, public education, and land set-asides.
Since 2002, substantial progress has been made in protecting surface and groundwater from pollution. Related accomplishments include:

- Between 2008 and 2020, CCCD helped local farmers install more than 2,000 BMPs to reduce the amount of nutrients, sediment, pathogens, and other contaminants from entering our waterways.

- PADEP has removed approximately 11.5 miles of Chester County streams from the Impaired Waters List for specific impairments, including sections of Beaver Creek, Bennetts Run, Buck Run, Big Elk Creek, Pocopson Creek, and French Creek. Most of these stream segments were delisted for siltation impairments, while a handful were removed because of improvements in nutrients, flow regime modification, and mercury pollution.

- Several stream reaches have successfully been upgraded to Exceptional Value designations by PADEP, including the West Branch Crum Creek, Beaver Run, and additional sections of the French Creek watershed.

- Substantial water quality improvements (measured through improved Index of Biotic Integrity, or IBI, scores) have been achieved in streams that are sources of public drinking water, including the East Branch Brandywine Creek, the East Branch Octoraro Creek, Crum Creek, and the East Branch Chester Creek.
Although water quality continues to improve in Chester County, moving forward it will be important to set more incremental targets around lofty goals like achieving state designated uses in all streams and eliminating all unnecessary pollution. Data collection is also critical, especially as new threats to water quality (like PFAS and other emerging contaminants) appear on the horizon. Additional municipal protection strategies, such as developing model ordinance standards for wellhead protection, should be pursued.
Since 2002, Chester County and its municipalities have made great strides in creating, updating, and implementing comprehensive stormwater management policies and plans. Key highlights include:

- Since 2013, 100% of Chester County municipalities have adopted the model ordinance from the County-wide Act 167 Stormwater Management Plan, which contains provisions addressing many of the recommendations from the original Watersheds plan. An updated version of the County-wide model ordinance was released in 2022, and municipalities have begun adopting it in ways that best serve their own communities.

- County floodplain maps and ordinance were updated in 2017. All County municipalities that have floodplains have adopted ordinances that restrict or regulate development and disturbance within the Federal Emergency Management Agency (FEMA) Flood Hazard Zones, and nearly 1,600 acres within FEMA designated Special Flood Hazard Areas have been permanently protected.
When it comes to stormwater and flooding, we’ll need to rely on new models and data to show us what we can expect from future storm events, and which design, construction, and preservation strategies can best help us adapt. We’ll need to continue to encourage municipalities to modify their ordinances to encourage better site design that reduces the generation of stormwater. Then, we’ll need to build and expand partnerships to implement those strategies, especially in communities with limited capacity to address these challenges alone.

### Recommendations for Improvement:
- Improve partnerships
- Revise strategies or metrics
- Collect additional information

### Degree of Accomplishment:
- Substantial
- Partial
- Minimal

### Around the Bend

When it comes to stormwater and flooding, we’ll need to rely on new models and data to show us what we can expect from future storm events, and which design, construction, and preservation strategies can best help us adapt. We’ll need to continue to encourage municipalities to modify their ordinances to encourage better site design that reduces the generation of stormwater. Then, we’ll need to build and expand partnerships to implement those strategies, especially in communities with limited capacity to address these challenges alone.
While the County and its partners have made progress toward protecting water balances at the watershed scale over the last two decades, it is difficult to say that any of the original Watersheds objectives under this goal were substantially accomplished. However, it’s worth noting that:

- Landscapes3 made recommendations for integrating water, sewer, and land use planning which included limiting the expansion of water supply and wastewater utilities to areas of planned growth. CCPC reviews act 537 plans and modifications for consistency with Landscapes3.
- Water releases from Marsh Creek Dam (managed by PA DCNR) and Hibernia Dam (managed by CCWRA) are strategically managed to protect downstream flows that support aquatic life and drinking water withdrawals.
- The County supports the USGS’s Pennsylvania Drought Conditions Monitoring program and helps to fund one of the most robust county-wide observation-well networks in Pennsylvania.
Implementing net cumulative groundwater withdrawal targets and strategically siting water withdrawal/wastewater effluent disposal infrastructure proved to be the greatest challenges in achieving Watersheds' sixth goal. We recognize there's more work ahead to better understand the full picture of how surface and groundwater are used in Chester County, and to encourage coordination among all parties to protect those invaluable resources for generations to come. This is particularly true during drought conditions or in cases of potentially competing uses.
Involving municipalities in the planning of new water and wastewater facilities has been limited over the past two decades. While there has been some coordination of planning efforts between municipalities, County departments, and utilities, these groups most frequently come together in response to a specific issue or project rather than as part of a sustained collaboration. Continued partnership-building is the name of the game when it comes to better integrating utility (both water and wastewater) and municipal planning efforts for the purpose of addressing shared goals. Additionally, more data is needed about how people are projected to need/use water in the future, what kind of infrastructure upgrades are needed to meet those uses, and how climate change may impact all of this.

Around the Bend

Involving municipalities in the planning of new water and wastewater facilities has been limited over the past two decades. While there has been some coordination of planning efforts between municipalities, County departments, and utilities, these groups most frequently come together in response to a specific issue or project rather than as part of a sustained collaboration. Continued partnership-building is the name of the game when it comes to better integrating utility (both water and wastewater) and municipal planning efforts for the purpose of addressing shared goals. Additionally, more data is needed about how people are projected to need/use water in the future, what kind of infrastructure upgrades are needed to meet those uses, and how climate change may impact all of this.

Recommendations for Improvement:

- Improve partnerships
- Revise strategies or metrics
- Collect additional information

Degree of Accomplishment:

- Substantial
- Partial
- Minimal
Smooth Sailing

Coordination and collaboration have been critical to the water quality and quantity successes realized since 2002. However, when it comes to an integrated approach to water resources planning, none of the original Watersheds objectives under this goal are considered to have been substantially accomplished. However, it’s worth noting that:

- The calculations of net groundwater balances by subbasin that were completed for the original Watersheds plan helped to identify subbasins where withdrawals are approaching target values (% of 1 in 25-year baseflow). This affords those areas additional protections under the Delaware River Basin Commission (DRBC) Southeast Groundwater Protected Area program.
- Since 2002, substantial water quality improvements (measured through improved IBI scores) have been achieved in streams that are sources of public drinking water, including the East Branch Brandywine Creek, the East Branch Octoraro Creek, Crum Creek, and the East Branch Chester Creek.
- Landscapes encouraged the expansion of community water supply and wastewater facilities to support planned growth in Urban and Suburban landscapes and Suburban Centers.
- The Octoraro Source Water Collaborative was established to facilitate source water protection communication and planning in the Octoraro Creek watershed upstream of the Octoraro Reservoir. This partnership effort involves coordination between government agencies, nonprofit organizations, and concerned citizens to address local water resource issues at the watershed scale.
Building on Successes, Learning from Challenges

Much has been done to protect and restore water resources in Chester County since the original Watersheds plan was released in 2002. Evaluating that work has provided us with a strong framework on which to build a new plan for the future. It highlighted where our strategies have been successful, and where they may require some rethinking. These lessons, along with the thorough analysis of current water quality conditions and trends (provided in the following chapter), directly informed the revised goals, objectives, and strategies laid out here in Watersheds 2045.
Chapter 3: Where We Stand

Answering the question “how well are Chester County’s water resources doing?” is no simple task. Each of the sections presented in this chapter offers a different lens through which to understand current conditions in the County’s watersheds. When viewed holistically, we can develop a comprehensive picture of the many factors that influence (or are influenced by) local water quality and quantity. This snapshot in time provides us with the perfect vantage point to assess how we can be better stewards of our shared water resources.

Figure 3.1: Study Area Watersheds and Subwatersheds

Legend

1. Chester Creek
2. Christina River
3. Conestoga Creek
4. Crum Creek
5. Darby Creek
6. Elk Creek
7. French Creek
8. Lower Brandywine Creek
9. Northeast Creek
10. Octoraro Creek
11. Pequea Creek
12. Pickering Creek
13. Pigeon Creek
14. Red Clay Creek
15. Ridley Creek
16. Schuylkill River Drainage
17. Stony Run
18. Trout Creek
19. Upper Brandywine Creek
20. Valley Creek
21. White Clay Creek

County Boundary
Study Area Streams
Major River Basins
No matter where you are, you’re in a watershed. Watersheds include the streams and land area, bounded by ridges or hills, that drain to a common waterway. They also include the underground aquifers and groundwater systems that contribute to our streams. They come in all shapes and sizes, with borders determined by topography rather than political jurisdictions. Watersheds can be assessed at various scales, as small watersheds flow together to form larger watersheds and river basins. From smallest to largest, the terms used to generally describe watersheds of different sizes in this plan are: subwatersheds, watersheds, and river basins.

Watershed management involves the collective strategies, tools, and coordination efforts across these different scales to steward our water resources in a manner that supports our communities and the environment.
Population Growth and Trends

Chester County is one of the most rapidly growing counties in the state. In 1970, the County was home to approximately 278,000 people. By 2020, the number of residents had nearly doubled. This trend is expected to continue, driven by development pressure expanding outward from Philadelphia and by the many natural and economic amenities available within the County. By 2045, the total population is expected to climb above 634,000. While growth is likely to affect a majority of the County, the most significant growth is anticipated around Downingtown, Great Valley, the Route 1 corridor, and in communities bordering Montgomery County.

Figure 3.3: Population Growth in Chester County since 2000
Figure 3.4: Projected Population Growth in Chester County Municipalities by 2045

Legend
Projected Population Growth
- Less than 10% Increase
- 10 to 20% Increase
- 20 to 30% Increase
- Greater than 30% Increase

Watersheds 2045

Watershed 35
This level of population growth requires careful planning to ensure that our communities grow in alignment with, rather than at the expense of, our natural resources. Chester County’s comprehensive plan, Landscapes3, outlines appropriate areas to accommodate projected growth as well as environmentally sensitive areas where disturbance should be minimized. However, given historic patterns of development, including the locations of major transportation corridors and urban/suburban centers, there’s likely to be some overlap between areas targeted for future development and our more sensitive water resource (first order streams, wetlands, high quality/exceptional value watersheds, etc.). Figure 3.5 illustrates those potential intersections.

*Figure 3.5: County Planned Growth Areas and Sensitive Environmental Features*
Land Use

Population trends go hand in hand with land use and development patterns, which are often the greatest drivers of impacts to local water resources. According to 2015 data from the Delaware Valley Regional Planning Commission, agriculture is the largest land use in Chester County (roughly 35%), followed by wooded or undeveloped lands (31%), residential areas (20%), and non-residential development (about 12%), which includes office parks, road networks, shopping centers, and industrial uses. The remaining 1% of total lands in the County are covered by streams or other waterbodies.

Trends in population growth over the past twenty years are also reflected in the landscape. A comparison of current land use data with the statistics from 1995, which were presented in the original Watersheds plan, particularly highlights the conversion of farmland to other uses. In the early 2000s, the Chester County Planning Commission estimated that the County was losing about 5,000 acres of agricultural lands and open space to development each year. This spurred significant efforts within the County to address suburban sprawl and increase open space preservation, and the pace of development on open land has subsequently slowed. Nevertheless, as the population continues to grow, we must take care to ensure that future development or any type supports the needs of our communities without compromising the integrity of our waterways and natural resources.

As this plan extends beyond the County’s borders to address issues at the watershed scale, land use was also analyzed for the entire study area, as shown in Figures 3.6 and 3.7.

Figure 3.6: Current land use statistics in the study area

- **Agricultural**: 1%
  - Chester County has a rich agricultural history that is still evident in the landscape today. Many farms across the County have been permanently preserved.
- **Residential**: 30%
  - From dense urban centers to rural villages and everything in between, more than a quarter of the County’s land has been developed as housing.
- **Other Developed Lands**: 28%
  - Beyond residential areas, office parks, industrial complexes, transportation corridors, and other developed lands support thriving communities.
- **Wooded/Undeveloped**: 26%
  - Preservation efforts over the years have protected significant woodlands and natural open spaces that sustain wildlife, protect water quality, and contribute to the natural character of the County.
- **Water**: 14%
  - While 1% of the County’s land area might not seem like much, Chester County is home to an abundance of streams, lakes, wetlands, and other waterways.
Figure 3.7: Land use in the study area watersheds

Legend
- Agricultural
- Developed (Non-Residential)
- Residential
- Water and Wetlands
- Wooded or Undeveloped
- County Boundary
- Study Area Watersheds
Beyond evaluating how land is being used, understanding the makeup of the land’s surface can be helpful in assessing the health of a watershed. Specifically, we often want to know the ratio of impervious surfaces (hardscapes like pavement, roofs, etc. where water is unable to seep into the ground) to pervious surfaces (typically more natural surfaces that allow water to soak into the soil). In 2015, approximately 10% of Chester County was covered by impervious surfaces.

Excessive impervious cover presents a variety of challenges for the natural hydrologic processes of a watershed. It can prevent water from soaking into the ground to recharge aquifers and groundwater supplies during precipitation events. Without the ability to infiltrate, water from those storms ends up as runoff, flowing over the surface of the land to find its way to the nearest stream. This runoff can pick up pollution and carry it into our waterways, and it can also lead to flooding that impacts people and property.

Impervious cover can even affect the temperature of water in a stream. Imagine rainwater running over hot pavement on a summer day. That runoff will heat up through its contact with the impervious surface, and can be much hotter than it would be naturally by the time it washes into a stream. This type of “thermal pollution” can be incredibly harmful to aquatic life that relies on cold instream temperatures to survive.

Generally speaking, where there is less impervious cover, watersheds tend to be healthier. As the percentage of impervious surface area rises above 10%, impacts to both water quality and quantity begin to show. Watersheds with more than 20% of their land area covered by impervious surfaces often show flow patterns and water quality results that indicate degradation and impairment. Figure 3.8 presents the estimated percent of impervious cover in each of the study watersheds based on current land use data.
Figure 3.8: Existing Impervious Cover as a Percentage of Total Land Area by Subwatershed

Legend

Existing Impervious Cover
- Less than 10%
- 11-20%
- 20-50%
- Greater than 50%

Watersheds
County Boundary
As the population grows, it’s reasonable to expect that impervious cover will increase to accommodate new homes, roadways, and other hardscaped infrastructure for new residents. While we can’t say exactly where new impervious cover will be added in the future, by overlaying population projections and landscape types, we can come up with general estimates of what is possible in different communities across Chester County. Using the landscape types from the Landscapes3 plan, Figure 3.9 compares existing impervious coverage in 2015 to projected coverage in 2045.

Figure 3.9: 2015 vs. 2045 Impervious Cover Projections across Chester County’s Landscapes

<table>
<thead>
<tr>
<th>Landscape Type</th>
<th>Existing Acres (2015)</th>
<th>Projected Acres (2045)</th>
<th>Projected Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Center</td>
<td>6,043 acres</td>
<td>7,064 acres</td>
<td>+16.9%</td>
</tr>
<tr>
<td>Suburban Center</td>
<td>5,335 acres</td>
<td>6,553 acres</td>
<td>+22.8%</td>
</tr>
<tr>
<td>Suburban Landscape</td>
<td>23,299 acres</td>
<td>27,176 acres</td>
<td>+16.6%</td>
</tr>
<tr>
<td>Rural Center</td>
<td>534 acres</td>
<td>715 acres</td>
<td>+33.9%</td>
</tr>
<tr>
<td>Rural Landscape</td>
<td>9,229 acres</td>
<td>10,095 acres</td>
<td>+9.4%</td>
</tr>
<tr>
<td>Agricultural Landscape</td>
<td>3,841 acres</td>
<td>4,053 acres</td>
<td>+5.5%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>48,281 acres</strong></td>
<td><strong>55,656 acres</strong></td>
<td><strong>+15.3%</strong></td>
</tr>
</tbody>
</table>

By 2045, the study area as a whole could add 30.8 square miles of new impervious cover (an 8.6% increase from what exists today). For context, that’s almost double the size of the City of Wilmington, Delaware. Figure 3.10 illustrates potential increases in impervious cover, based on population growth projections, by subwatershed over the next two decades.

Because of the negative impacts of impervious cover on watershed health, careful planning is needed to ensure that we install as little new impervious cover as possible to meet the needs of our growing communities.
Geology

While understanding what’s happening on the surface of our landscape can tell us about some aspects of the state of our water resources, understanding what’s happening below ground is just as important. Groundwater is the water located in the subsurface spaces between particles of sand, gravel, silt or clay, or the water filling the crevices or fractures in rock formations. It may be less than ten feet from the surface or occur at depths of several hundred feet. The underground rock units where groundwater is found are called aquifers, and they are major sources of water for residential, agricultural, and other uses in our region.

Groundwater and surface water are interconnected. Aquifers closely interact with waterways, often releasing water to or receiving water from the streams, wetlands, or lakes above them. In fact, groundwater is largely responsible for maintaining the hydrologic balance of our stream networks. This connection means that contamination or overuse of surface waters can directly impact aquifers, and vice versa.

The location and productivity of groundwater aquifers is determined by geology. Chester County’s geology is predominantly crystalline (diabase, etc.), with pockets of Triassic sedimentary rock (including Brunswick, Hammer Creek, Lockatong, and Stockton Formations) and carbonate rock (including limestone and marble). The USGS maintains 24 groundwater observation wells in Chester County, displayed in Figure 3.11, that provide regular data on normal conditions and seasonal variations related to groundwater in various geologic formations.

In terms of water supply, carbonate geology forms some of the most productive aquifers in the plan’s study area. Groundwater flows through a network of fractures, fissures, and caves in the rock that are enlarged as water dissolves the carbonate rocks around it. For this reason, well yields in these areas tend to be higher than yields in other geologic groups. However, carbonate geology presents its own challenges as well, including the potential for sinkhole formation where dissolving rock leads to a collapse on the surface.

Portions of Chester County are covered by the DRBC Southeastern Pennsylvania Groundwater Protected Area (GWPA). This designation was established in 1980 in order to prevent aquifer depletion by overuse, and to protect groundwater resources for both community and ecological uses. Regulations regarding groundwater withdrawals are more stringent in this area than in other parts of the Delaware River basin. New or expanded well projects within the GWPA that withdraw on average more than 10,000 gallons per day during any consecutive 30-day period must obtain a special Protected Area Permit. The portion of the study area covered by the GWPA is illustrated in Figure 3.12, while the chart in Figure 3.13 lists the Chester County municipalities covered by the GWPA.
Figure 3.11: Generalized Geology and USGS Groundwater Monitoring Wells
Figure 3.13: Chester County Municipalities in the Groundwater Protection Area

<table>
<thead>
<tr>
<th>Birmingham</th>
<th>Easttown</th>
<th>Thornbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlestown</td>
<td>Elverson</td>
<td>Tredyffrin</td>
</tr>
<tr>
<td>East Bradford</td>
<td>Malvern</td>
<td>Warwick</td>
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<td>East Coventry</td>
<td>North Coventry</td>
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<td>East Goshen</td>
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</tr>
<tr>
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<td>South Coventry</td>
<td>West Whiteland</td>
</tr>
<tr>
<td>East Whiteland</td>
<td>Spring City</td>
<td>Westtown</td>
</tr>
</tbody>
</table>
Stream Water Quality

The Clean Water Act requires all states to develop water quality standards that identify the desired condition for a waterway and how to either protect or restore that condition. These “designated uses” vary between states, but they typically include categories related to aquatic life, public water supply, recreational contact, and agricultural/industrial water uses.

Pennsylvania uses four major designated use categories, as identified in Figure 3.14 below. These uses are outlined in Pennsylvania’s Chapter 93 “Water Quality Standards,” which has roots in both the Federal Clean Water Act and the Pennsylvania Clean Streams Law.

All waterways in the Commonwealth are designated at a minimum as warm water fisheries for aquatic life uses, and for all uses under the water supply and recreational use and fish consumption categories. On a case-by-case basis, streams may be designated as cold water fisheries or trout stocking fisheries, and high performing streams may receive “special protection” designations as either a High Quality (HQ) or Exceptional Value (EV) waterway.

HQ streams are those which have been identified as exceeding the standards for water chemistry and support high quality aquatic communities. These may include Class A wild trout streams as identified by the Pennsylvania Fish and Boat Commission. Once a stream has been designated as HQ, activities or actions that would negatively impact water quality are prohibited, unless it is the result of necessary social or economic development that will not disrupt the stream’s ability to meet water quality criteria and its existing uses. These rules are part of the anti-degradation policy in the water quality standards.
EV streams share the same traits as HQ waterways, and must also meet at least one of the following criteria:

- The water is located in a National wildlife refuge or a State game propagation and protection area.
- The water is located in a designated State park natural area or State forest natural area, National natural landmark, Federal or State wild river, Federal wilderness area or National recreational area.
- The water is an outstanding National, State, regional or local resource water.
- The water is a surface water of exceptional recreational significance.
- The water achieves a score of at least 92% (or its equivalent) using the biological assessment methods used to identify HQ waters.
- The water is designated as a “wilderness trout stream” by the PA Fish and Boat Commission (PAFBC) following public notice and comment.

To be designated as EV, the waterway must also be considered “a surface water of exceptional ecological significance.” Once it receives EV status, the stream has regulatory protection from any activity or action that would negatively impact water quality. For these streams, because they have met more stringent criteria, there is no exception for necessary social or economic development.

The use designation shown in Pennsylvania’s water quality standards is for aquatic life, which is reflected on the map in Figure 3.15. Also shown are the relevant designated uses for study area streams in Maryland and Delaware.

The presence or absence of certain species of stream insects, called benthic macroinvertebrates, is often used as an indicator of water quality and aquatic habitat. Bugs such as caddisflies, mayflies, and stoneflies have unique tolerances for pollution and other water quality stressors. This means that the variety and abundance of species found in a stream can help tell the story of what’s happening in the water.

Since 1969, Chester County has partnered with USGS on a cooperative monitoring program to gather data on the County’s water resources. As part of that program, benthic macroinvertebrates are sampled each year at 18 fixed locations (shown in Figure 3.17), with nine flexible sites sampled on a rotating basis. Those samples are translated into biotic integrity scores, ranging between 1 and 100, where higher scores indicate higher water quality. Chester County’s Index of Biotic Integrity (IBI) was specifically calibrated by USGS scientists using samples collected within the County.

Data from that program indicate that over the past twenty years, there have been positive trends in water quality across the board. This is most apparent in the steady improvement for sites with the lowest biotic integrity scores. In 2020, the annual minimum score at County monitoring sites was in the mid-40’s, compared with scores in the mid-20’s in 1999 and 2000.
1 Applies to freshwater segments only

2 Applies in the Brandywine Creek from March 15-June 30 on Beaver Run from PA/DE line to Brandywine and on Wilson Run Route 29 thru Brandywine Creek State Park; Red Clay Creek year round from the PA/DE line to the concrete bridge above Yorklyn; White Clay Creek year round on the White Clay from PA/DE line to Curtis Paper and from March 15-June 30 on Mill Creek from Brackenville Road to Route 7, Pike Creek from Route 72 to Henderson Road; and in the Christina River from March 15-June 30 from the MD/DE line through Rittenhouse Park.

Note: Additional designations Waters of Exceptional Recreational or Ecological Significance (ERES) for Brandywine Creek from the PA/DE line to the Wilmington City line, and for White Clay Creek from the PA/DE line to the dam at Curtis Paper.
Figure 3.16: Chester County Biotic Integrity Trends from 1998 to 2020

Biotic Integrity
Overall County-wide trends from 1998 - 2020
Combined County-wide maximum, minimum and average Biotic Integrity scores from 18 fixed sampling sites in Chester County (since 1998)

Where We Stand
Chapter 3
Watersheds 2045
Figure 3.17: Chester County-USGS Cooperative Monitoring Program Fixed Sites with Fall 2020 IBI Scores
Despite generally positive trends in stream health since 2000, many streams in the County and the broader study area still do not meet the water quality standards necessary to support their designated uses. The Clean Water Act requires states to regularly assess waterways within their jurisdiction, and streams that do not meet standards must be listed as impaired in annual water quality reporting.

As of 2022, about 2,023 out of 3,450 miles of streams in the watersheds of our study area had been assessed by PADEP. Of those stream miles, 1,587 (roughly 78%) were listed as impaired for one or more of their designated uses on the Pennsylvania Section 303(d) list. The largest sources of those impairments were agriculture (specifically, siltation) and urban runoff/storm sewers. Other causes of impairment include excess nutrients like nitrogen and phosphorus, flow regime modification (i.e., changing the natural flow or water level in a waterbody), pathogens, and legacy contaminants like mercury and polychlorinated biphenyls (PCBs).

PADEP also includes lakes in their water quality assessment. In 2022, two lakes were listed as impaired:

- Marsh Creek Reservoir (impaired for nutrients from agricultural and urban runoff, mercury, invasive aquatic plants, and habitat modifications)
- Octoraro Reservoir (impaired for nutrients from agriculture and other sources)

Once states have identified impairments and their sources, strategies must be developed to help the streams reach water quality standards. In some cases, this comes in the form of a Total Maximum Daily Load (TMDL) plan. A TMDL is essentially a calculation of how much pollution a stream can receive while still meeting standards to protect public health and natural ecosystems. Once those calculations are complete, the plan identifies load reduction targets and distributes them among the dischargers or sources of pollution.

There are 14 TMDL plans within the study area, as shown in Figure 3.18 and Figure 3.19.

Figure 3.18: TMDLs in the Study Area

<table>
<thead>
<tr>
<th>TMDL Plan</th>
<th>Contaminants of Concern</th>
<th>TMDL Plan</th>
<th>Contaminants of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chesapeake Bay TMDL</td>
<td>Nitrogen, Phosphorus, Sediment</td>
<td>Pequea Creek Watershed Revised TMDL</td>
<td>Phosphorus, Sediment</td>
</tr>
<tr>
<td>Christina River Basin High Flow TMDL</td>
<td>Nutrients, Low Dissolved Oxygen, Bacteria, Sediment</td>
<td>Red Clay Creek Basin PCB Watershed TMDL</td>
<td>PCBs</td>
</tr>
<tr>
<td>Christina River Basin Low Flow TMDL</td>
<td>Nutrients, Low Dissolved Oxygen</td>
<td>Schuylkill River PCB TMDL</td>
<td>PCBs</td>
</tr>
<tr>
<td>Conestoga Headwaters TMDL</td>
<td>Phosphorus</td>
<td>Trout Creek TMDL</td>
<td>Chiorine, Nitrogen</td>
</tr>
<tr>
<td>Goose Creek Nutrient TMDL</td>
<td>Phosphorus</td>
<td>Unnamed Tributary to Schuylkill River TMDL</td>
<td>Phosphorus</td>
</tr>
<tr>
<td>Lower Brandywine Creek Chlordane TMDL</td>
<td>Chlordane</td>
<td>Valley &amp; Little Valley Creeks TMDL</td>
<td>PCBs</td>
</tr>
<tr>
<td>Octoraro Creek TMDL</td>
<td>Nitrate</td>
<td>West Branch Brandywine Creek TMDL</td>
<td>Chiorande, PCBs</td>
</tr>
</tbody>
</table>
Figure 3.19: 2022 Impaired Streams and Total Maximum Daily Load (TMDL) Watersheds

Legend
- Chesapeake Bay TMDL
- Christina River Basin High-Flow and Low-Flow TMDLs
- Conestoga Headwaters TMDL
- Goose Creek Nutrient Watershed TMDL
- Lower Brandywine Creek Chlordane TMDL
- Octoraro Creek Watershed TMDL
- Pequea Creek Watershed Revised TMDL
- Red Clay Creek Basin PCB Watershed TMDL
- Schuylkill River PCB TMDL
- Trout Creek TMDL - does not affect Chester County
- Unnamed Tributary (Trib 01622) to Schuylkill River TMDL
- Valley and Little Valley Creeks TMDL
- West Branch Brandywine Creek TMDL
- Impaired
- Supporting

Watersheds 2045

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The impacts of pollutants included in standard stream assessments and TMDL plans have been studied for decades. As such, we generally have a good understanding of the sources of most of those pollutants and the steps we can take to reduce or eliminate them (even if it’s not always easy to do so). However, these aren’t the only contaminants that pose a threat to our water resources.

“Contaminants of emerging concern” (also known as “emerging contaminants”) is an umbrella term to describe potentially harmful chemical compounds that have been found in our waterways but aren’t yet regulated. They come from a variety of sources, including personal care products, pharmaceuticals, household cleaning products, pesticides, and even cookware. Many wastewater treatment plants are not equipped with the advanced technologies required to remove these contaminants, which means that they can pass through the system and end up discharged into streams and rivers. Once they’ve entered the environment, some have the potential to bioaccumulate up the food web and cause harm to plants, animals, and human health.

Per- and polyfluoroalkyl substances, commonly referred to as PFAS, are an example of an emerging contaminant that has garnered significant attention in recent years. Information on the health concerns regarding these trace chemicals continues to evolve, as does the science on understanding their sources and best methods for remediation. In Pennsylvania, PADEP and USGS have partnered on efforts to identify areas with elevated surface water PFAS levels, and many partners across the region are actively working together to develop strategies for dealing with this contamination in impacted areas.

Other contaminants of emerging concern include endocrine disruptors from pharmaceuticals and personal care products, micro and nanoplastics, and chlorides from excessive road salt application. While we may not have all the answers to these problems yet, research and monitoring efforts are ongoing. As new scientific guidance emerges, it will help inform strategies to remediate these chemicals once they’ve entered the environment, and to prevent future releases.
Natural and Cultural Resources

Water quality in Chester County’s streams and watersheds is often directly related to the conditions of other natural resources. For example, intact woodlands and riparian buffers can help keep water temperatures cool for aquatic species, filter out pollutants before they reach the stream, and mitigate flooding by increasing infiltration into the soil. Preservation of open space, farmland, and historic resources helps maintain the County’s bucolic character, while also providing ample opportunities for recreation. On the other hand, poor water quality can compromise delicate ecosystems, and changes in a watershed’s natural hydrologic character can degrade habitat. Understanding the interplay between our natural resources helps us to develop holistic strategies to protect and restore them. The map in Figure 3.20 highlights some of the County’s natural resource priority protection areas, including:

- Conservation corridors – corridors of woodlands or other naturalized areas that improve wildlife migration and link critical habitats that might otherwise be isolated due to surrounding development
- Natural trout fisheries – flowing waters that support naturally reproducing trout populations (although these streams may also be stocked with hatchery trout by PAFBC)
- Sources of water supplies – streams utilized by drinking water utilities for raw water supplies
- Special terrestrial resources – areas of regional or even global ecological significance, including the Serpentine Barrens in the southern portion of the County, as well as the Great Marsh and the Hopewell Big Woods
- Natural Habitat Inventory Core Habitat Area – areas that support rare plants or animals, exemplary ecological communities, and Pennsylvania’s native species biodiversity, as documented by the Pennsylvania Natural Heritage Program
- Protected open space clusters – areas of concentrated land preservation efforts where habitat fragmentation is reduced and naturalized areas are more interconnected
Waterways have always played a significant role in the siting of important cultural resources. This includes many of Chester County’s historic structures, like covered bridges and mill buildings. It also includes the siting of public parkland, preserves, and recreational areas, where waterways serve as an amenity for visitors.

*Figure 3.21: Cultural, Recreational, and Historical Resources*
Chester County has a long history of conservation, and as of 2022 more than 30% of the County’s land area is permanently preserved as open space or farmland. Permanently protected lands limit development pressure on critical resources and often provide for public access offering people of all ages a place to connect to streams, woodlands, and wildlife. In addition to the County’s preserved lands, Figure 3.22 shows potential preservation opportunities with undeveloped parcels of ten or more acres, and currently unpreserved farms of 25 or more acres.

Figure 3.22: Preserved Lands and Preservation Opportunities in Chester County

Legend
- Protected Open Space
- Unprotected Parcels 10+ Acres
- Unprotected Farms 25+ Acres
- Streams_Study_Area
- Watersheds
- County Boundary
Vegetated stream buffers (either forested or herbaceous) contribute greatly to the health of our watershed ecosystems, and especially to water quality in headwater streams. They protect streams from direct sunlight and elevated water temperatures, provide detritus that serves as food and shelter for aquatic species, and stabilize stream banks, channels, and floodplains from the erosion and scour of high velocity floods. The root systems of riparian vegetation soak up excess water and nutrients, while above ground vegetation can help filter and slow the transport of sediment and pollution from stormwater. These buffers also serve as links between terrestrial wildlife and their source of food, water, and cover.

While there isn’t necessarily a one-size-fits-all solution for optimum riparian buffer widths, there are general guidelines about the range of minimum buffer widths recommended to achieve certain ecological functions, as illustrated in Figure 3.23.

![Figure 3.23: Minimum Recommended Buffer Width for Desired Buffer Functions](image)

Identifying and protecting existing vegetated stream buffers is critical to preventing water quality degradation. Figure 3.24 shows the existing woodland cover within the 50-foot riparian buffer zone for streams in the study area. It also identifies potential opportunities for riparian buffer planting and restoration, using information from We Conserve PA's Riparian Planting Prioritization GIS dataset (showing sites with scores greater than 1 on the 0-3 prioritization scoring scale). Because this is a Pennsylvania-focused dataset, buffer planting prioritization information is not available for the portions of the study area in Delaware or Maryland.
Figure 3.24: Current Wooded Riparian Buffers and Buffer Restoration Opportunities
Environmental and Community Concerns

Impairment listings and TMDLs tell us about water quality problems in our streams, but there are other environmental and community issues related to water resources that are happening above the water’s edge. Some of these challenges are directly related to current or historical land uses, like contamination at former industrial sites. Others, like sinkholes, are driven more by underlying natural conditions. And some occur because of the intersection between land use and natural forces, as is the case with increased flooding caused by more frequent, more intense rain events coupled with the conversion of natural landscapes to impervious surfaces.

The map in Figure 3.25 provides an inventory of problems and potential water resource concerns within our study area. These include:

- Pennsylvania Act 2 contaminated sites – Locations listed under the PA Land Recycling Program as contaminated commercial and industrial sites (surface and groundwater contamination sites are shown here)
- Active Superfund sites – sites listed on the National Priorities List for contaminated site remediation under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, informally known as the Superfund program
- Active and inactive landfills – sites presently or historically used for the disposal of waste, as tracked by PADEP, that may become environmental hazards if improperly contained or managed
- Industrial mining operations – sites within the study area are non-coal surface mining operations (i.e., rock quarries)
- Karst features and documented sinkholes
- Sewage treatment discharge locations
- Major dams – large dams that serve flood control and/or public water supply functions within Chester County
Figure 3.25: Known Hazards and Potential Water Resource Concerns

Legend

- ▲ Act 2 Contaminated Surface Water Sites
- ▲ Act 2 Contaminated Groundwater Sites
- ✱ Active Superfund Sites
- ○ Active Landfill
- ◊ Abandoned/Inactive Landfill
- ❀ Industrial Mining Operations
- ● Karst Features
- ● Sewage Treatment Discharge Locations
- ▲ Major Dams (ChesCo only)
- ~ Streams
- □ Watersheds
- □ County Boundary
Flooding is one of, if not the most prevalent natural hazard in Chester County and the broader study area. Floods have the potential to endanger lives, disrupt economic activities, and cause physical damages that are incredibly expensive to restore. According to the National Oceanic and Atmospheric Association (NOAA) Storm Event Database, between 2000 and 2022 there were 129 individual flooding events (including tropical storms, hurricanes, and flash floods) reported in the County. Collectively, these resulted in one death and an estimated $54.2 million in damages.

All but one of Chester County’s 73 municipalities contain flood-prone areas along riparian corridors (Honey Brook Borough is the lone exception). The County’s greatest flood risks are along the Schuylkill River and Brandywine Creek, although flooding can and has occurred in all of the study area watersheds. Floodplains are shown in Figure 3.26, using FEMA’s Flood Zone Designations. Zone X is considered to be a relatively low risk flood area, while areas with labels that start with A are considered to be higher risk. The percentages shown on the map represent the likelihood of that area flooding in any given year. They also correspond to recognizable terms like “100 year flood” (aka: a flood with a 1% chance of occurring in any given year) and “500 year flood” (aka: a flood with a 0.2% chance of occurring in any given year). This can help us explain why a “100 year storm” may occur twice in 10 years.

Figure 3.27 highlights the number of critical infrastructure facilities located within the 100-year floodplain (which are areas with a 1% chance of flooding in any given year), as identified by the 2021 Chester County Hazard Mitigation Plan.
Figure 3.26: Chester County Floodplains and Flood Hazard Areas

Legend:
- Zone X - Area of 0.2% Annual Chance of Flood
- Zone AO - Area of 1% Annual Chance of Shallow Flooding
- Zone A, AE - Area of 1% Annual Chance of Flood
- Zone AE - Area within Floodway

Streams
- County Boundary
- Watersheds
Although flooding is most commonly expected in floodplain areas directly adjacent to waterways, it can occur elsewhere. In fact, according to the Pennsylvania Emergency Management Agency (PEMA), between 1993 and 2021, approximately 90% of flooding reported to the National Weather Service in Pennsylvania occurred outside of the 100-year floodplain (although it is important to note for context that not every stream has a delineated 100-year floodplain). Figure 3.28 outlines the different types and characteristics of flooding in our region, while the map in Figure 3.29 shows reported locations of flooding for Chester County.
### COMMON TYPES OF FLOODS IN PENNSYLVANIA

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| **RIVERINE FLOODING**   | - Most common type  
- Occur along the stream channel when water overtops the banks and inundates adjacent low-lying areas  
- Often caused by rain or snowmelt                                                                                                            |
| **FLASH FLOODING**      | - Rapid & extreme flow of high water into normally dry area, or rapid rise in a stream above a predetermined flood level  
- Very dangerous  
- Can be caused by intense storms, dam failure, etc.                                                                                         |
| **STORMWATER FLOODING** | - Caused by local drainage issues and/or high groundwater levels  
- May cause flooding outside of riparian areas and floodplains  
- Urban areas at higher risk with more impervious cover                                                                                   |

Figure 3.28: Common Types of Flooding in Pennsylvania
Figure 3.29: Reported Flooding Hotspots in Chester County

Legend

- Reported Flooding or Flood Damage Hotspots
- Streams
- Watersheds
- County Boundary

Concentration of Flood Reports
- Sparse
- Dense
To be genuinely useful, strategies to assess and mitigate future flood risks must take into account climate change projections. Chester County is committed to taking action to address climate change, including reducing greenhouse gas emissions and using climate science to guide planning efforts. In 2021, the Chester County Climate Action Plan was adopted by the Commissioners as the guiding vision for local climate change mitigation efforts. The plan, created by CCPC in coordination with the County’s Environmental and Energy Advisory Board (EEAB), outlines strategies that County departments and partner organizations can implement to reduce our contributions to global climate change. These actions complement the adaptation measures outlined in this plan, as well as the County’s Hazard Mitigation Plan, to build resiliency to current and future climate challenges.

While warmer temperatures can lead to or exacerbate droughts, they also increase the amount of moisture the air can hold, which can lead to increases in precipitation. According to PADEP, the average amount of annual precipitation in Pennsylvania has increased by 10% since the early 20th century, and that trend is projected to increase into the future.

Beyond overall wetter conditions, climate change is increasing the frequency and intensity of extreme storms. Figure 3.30, created by the U.S. Environmental Protection Agency (EPA), shows the percentage of land area in the contiguous United States where a much greater than normal portion of total annual precipitation has come from extreme single-day storms between 1910 and 2020. Although the frequency of these events remained relatively steady through the 1980s, recent years have shown a more significant upward trend. Nine out of the top ten years for one-day extreme precipitation events have occurred since 1996.

Figure 3.30: Extreme One-Day Precipitation Events in the Contiguous 48 States, 1910–2020


For more information, visit U.S. EPA’s “Climate Change Indicators in the United States” at www.epa.gov/climate-indicators.
Recent research* from Mark Maimone and Tim Adams of CDM Smith has estimated that the Mid Atlantic Coastal Region (HUC 0204) could see a 9.5% increase in precipitation from extreme storm events by 2050, compared to baseline data from 1986-2005. When factoring in general land use and impervious cover, the region could experience a 16.2% increase in total runoff. These projections have real-world implications for how we should plan resilient stormwater and flood control infrastructure to protect communities well into the future.

Stormwater runoff from developed areas can play a significant role in both localized flooding issues and water quality degradation if not properly managed. This runoff is often carried into streams through Municipal Separate Storm Sewer Systems (MS4s). Unlike sanitary sewer systems, which collect and convey waste to a wastewater treatment plant, MS4s are designed to move runoff away from impervious surfaces through storm drains, pipes, and ditches without passing through a major treatment facility. This means that, more often than not, what ends up in the storm drain ends up in our streams.

The Federal Clean Water Act includes regulations for stormwater management under the National Pollutant Discharge Elimination System (NPDES) program. NPDES MS4 permits are required for many municipalities within U.S. Census Bureau-defined urbanized areas to ensure discharges from those systems are properly monitored and managed. In some cases, non-municipal entities like university campuses or prisons may also be required to obtain these permits. Permittees are required to develop a stormwater management plan that reduces the discharge of pollutants from the system and addresses specific programmatic criteria. Under Pennsylvania’s MS4 program, managed by PADEP, those criteria are referred to as “minimum control measures” (MCMs) and include the following six categories:

- Public education and outreach on stormwater impacts
- Public involvement/participation
- Illicit discharge detection and elimination (IDD&E)
- Construction site runoff control
- Post-construction stormwater management (PCSM)
- Pollution prevention and good housekeeping

In 2022, Chester County adopted a resolution to amend the County-wide Act 167 Stormwater Management Plan to include an updated model stormwater ordinance. This was the result of nearly three years of collaboration between Chester County, its municipalities, residents, and key stakeholders. The ordinance was designed to meet the needs of Chester County’s municipalities, fulfill the standards set forth in the Pennsylvania Storm Water Management Act (“Act 167”), and comply with the regulatory requirements of PADEP’s NPDES MS4 program. The updates incorporated into the Model Ordinance were also designed to comply with the provisions included in PADEP’s 2022 Model Stormwater Management Ordinance. The full Model Ordinance is provided in Appendix F.

The vast majority of municipalities within the study area have active MS4 permits, as shown in Figure 3.31. Municipalities that fall outside of the defined urbanized areas are not required to obtain permits. In some cases, municipalities within the urbanized area may qualify for a waiver depending on their population size (total population and/or population within the urbanized area) and whether or not their stormwater systems discharge into impaired or TMDL waters.
Of course, water isn’t just a potential liability in our communities; it’s also a valuable asset, and that’s certainly true when it comes to recreational access. In 2019, PA DCNR partnered with WeConservePA and the Trust for Public Lands on a “Recreation Access and Need” assessment to analyze who does and does not have access to outdoor recreational opportunities within 10 minutes of their home. The study looked at how many people lived within a 10-minute walk to parks, trails, and open spaces. It also assessed how many people lived within a 10-minute drive of trailheads and fishing and boating access points.

For Chester County, the study found that approximately 31% of the population lives within a 10-minute drive to water access points (boat launches, public fishing sites, water trails, etc.). It also dug deeper into access opportunities for different demographics, some of which are summarized in Figure 3.32.

Figure 3.32: Access to Water Recreation in Chester County

WHO LIVES WITHIN A 10 MINUTE DRIVE OF WATER ACCESS POINTS IN CHESTER COUNTY?

- **31%** of total population
- **35%** of low-income households
- **41%** of no vehicle households
- **30%** of people of color

Source: Access to Pennsylvania’s Outdoor Recreation Areas (Trust for Public Land, 2019)
For the areas of the County that fall outside of the 10-minute drive zone, the study assigned a level of access need based on a calculation of population density, density of children aged 19 and younger, and the density of households with income less than 75% of the County median household income. Areas identified as having the highest need for expanded water access are included on the map in Figure 3.33. Some of these zones overlap with PADEP’s 2015 environmental justice areas (defined as any census tract where 20% or more individuals live at or below the federal poverty line, and/or 30% or more of the population identifies as a non-white minority), which are also included on the map.

Understanding proximity to water access is important for informing decisions about where new access points might be most valuable. However, it is important to keep in mind that meaningful access includes more than a physical proximity to a resource; it also includes access to information about our water resources and how to use them, the availability of recreational equipment and gear, and a sense of security and safety in taking advantage of recreational opportunities. Holistic efforts to increase water-based recreational access should take all of these factors into account.

Expanding recreational access is a high priority for Chester County, and for many of our public and conservation partners. However, in areas with existing water quality impairments, a more phased approach may be necessary. Especially for streams impaired for recreational uses (e.g., pathogens) or fish consumption (e.g., PCBs or mercury), focusing on addressing impairments first helps ensure that the public can safely access and enjoy recreational opportunities on and around our waterways.
Figure 3.33: Recreational Access Needs and Challenges

Legend

- Streams Impaired for Recreational Uses
- Streams
- PADEP Environmental Justice Areas (2015)
- High Need: Recreational Water Access*

*Source: Trust for Public Land’s Recreation Access and Needs Assessment (2019), in partnership with PA DCNR and WeConservPA
Current and Projected Pollution Modeling

There are two types of pollution that threaten our waterways. The first is known as point source pollution, which comes from a single, specific source, like a pipe from an industrial facility or sewage treatment plant that discharges into a stream. The Clean Water Act prohibits discharges from point sources into waters of the United States without a permit through the NPDES program, which is the same program under which MS4 permits are issued. Point source discharges are closely regulated and regularly reported to state and federal agencies.

The other type of pollution is known as nonpoint source (NPS) pollution. Anything carried by runoff over the land’s surface and into a waterway is considered NPS. This can include a variety of pollutants like nutrients from farm fields, bacteria from animal waste, sediment from erosion, and anything else that finds itself swept up during a rainstorm. NPS has no single, easily definable source, which makes it difficult to regulate or track.

Fortunately, modern technology provides us with a suite of tools to better quantify existing and potential future pollution. One of the tools used to characterize surface water impacts across the study area in both this plan and the original Watersheds plan is a pollutant loading model called the Watershed Management Model (WMM). WMM was used to establish a framework for assessing relative runoff and pollution loadings under current land use and climate conditions. Also factored into the model were data on existing water quality, rainfall, NPDES discharge concentrations, and stream flows from local gages. Surface runoff was modeled in inches per year (in/yr) at the subwatershed level, while the following parameters were modeled for pollutant runoff and water quality impacts in pounds per year (lbs/yr): surface runoff in inches per year (in/yr); biological oxygen demand (BOD); chemical oxygen demand (COD); total suspended solids (TSS); total kjeldahl nitrogen (TKN); nitrate-nitrite (NO2/NO3); total nitrogen (TN); total phosphorus (TP); total dissolved phosphorus (TDP); copper (Cu); lead (Pb); and zinc (Zn).

In addition to current conditions, WMM was used to assess potential loadings for the same parameters under future conditions based on projections about:

- Estimates of population growth at the municipal level
- Assumptions of changes in land use and impervious cover related to population increases
- Potential increases in annual rainfall based on existing climate models
- Estimates of runoff and streamflow resulting from changes in precipitation and land use

It’s important to note that none of the numbers produced by the model should be considered absolute, as the numbers are most useful when compared within the context of the model results (i.e., one modeled watershed’s output to another). Additionally, beyond the model’s general calibration with observed water quality at the County’s monitoring stations, neither the current or future results consider existing or planned BMPs. When used as a planning tool, these results can help us understand where and how to focus our efforts for the benefit of water resources over the next two decades.

Technical documentation and methodologies for the WMM modeling work are provided in Appendix C. The results of the modeling effort were used to develop conceptual approaches and identify priority areas for controlling pollution within each of the study area’s watersheds, subwatersheds, and municipalities.
As one might expect, the modeling results indicated that if no BMPs are installed and the study area continues to develop as expected, pollutant loadings will generally increase by the year 2045. Figures 3.34 through 3.36 highlight the current modeled land use loadings for three common pollutants: TN, TP, and TSS. They also depict the projected percent change in each pollutant respectively, given estimates of future landscape and precipitation changes. The data is shown at a scale called a WMM “element,” which is the intersection between subwatershed boundaries and municipal boundaries. Across these three pollutants, the greatest increases are projected for the following watersheds:

- Upper Brandywine Creek
- Valley Creek
- Pickering Creek
- French Creek
- Upper White Clay Creek
- Upper Red Clay Creek
- Valley Creek
- Schuylkill River Tributaries
- Upper Chester Creek
- Lower Northeast Creek

Most contaminants will increase in the future as land is developed, although there are subwatersheds where certain pollutants are projected to stay relatively the same or even decrease slightly, assuming that agricultural land without BMPs is converted to a more suburban land use.
Figure 3.35: WMM Results for Total Phosphorus in 2020 and 2045
By combining our knowledge of local land uses with these pollutant loading estimates, we can more easily target BMPs that will directly address the sources of pollution. In more agricultural settings, this could include the installation of barnyard runoff controls or the use of cover crops, while more urbanized settings may benefit from naturalized stormwater management structures or the replacement of impervious cover with pervious materials or more natural groundcover/landscaping.

Figure 3.36: WMM Results for Total Suspended Solids in 2020 and 2045
Water Use and Supply

Water is used in almost every facet of our daily lives, from filling our bathtubs to keep our industries running smoothly. Rising populations, changing land uses, and shifting weather patterns all have the potential to impact water availability. In 2020, the estimated water demand for Chester County was approximately 52.5 million gallons per day (approximately 19.2 billion gallons annually). That year, a total of 12.5 billion gallons were withdrawn from seven surface water sources within the County to provide water for local residents and businesses, while the remainder of the demand was supplied by public and private groundwater wells. Protecting the streams and aquifers that feed our water supply is critical to ensuring that our communities continue to thrive for generations to come.

Figure 3.37: Major Public Surface Water Withdrawals in and around Chester County
Approximately 40% of Chester County residents rely on private wells for their water consumption needs, while the other 60% rely on public water supplies. Figure 3.38 shows which parts of the study area are covered by public water service, as well as public sewer.

The main elements of a water budget include:

- Precipitation – the total rain and snowfall that occurs in a watershed
- Stream baseflow/recharge – the portion of precipitation that soaks into the soils to refill underground aquifers, reemerging in streams as baseflow driven by groundwater
- Runoff – the portion of precipitation that flows over land to reach streams or other low lying points
- Evaporation/transpiration (ET) – the portion of precipitation that either evaporates into water vapor and returns to the atmosphere (evaporation) or water taken up by plants and returned to the atmosphere by water loss through stems and leaves

Figure 3.39 shows the study area-wide results of the water budget analysis performed for this planning effort as compared to the results from 2002. Precipitation averages 49 inches per year, which is two to three inches higher than it was in 2002. The budget’s distribution has shifted as well. Surface runoff accounts for 17 of the 49 inches that fall during the year, while stream baseflow averages 19 inches and ET is estimated at 13 inches. In 2002, more than half of the rain that fell evaporated or was transpired by plants, while stream baseflow averaged 12 to 14 inches, with only 7 to 8 inches per year estimated to end up as runoff. Some of these shifts are likely attributable to changes in precipitation, as well as significant increases in impervious cover from decades of development.

Figure 3.39: Average Water Budget for Chester County’s Watersheds

WATER BUDGET

presented as a portion of total annual precipitation

- Surface Runoff: 17%
- Stream Baseflow: 26%
- Evaporation/Transpiration: 35%
- Water Loss: 26%
Chester County has abundant surface and groundwater resources that have historically been resilient to drought conditions. However, water budget analyses at the subwatershed scale identified a handful of areas of potential water stress that could result from high demand, drought conditions, or a combination of the two. Figure 3.40 shows estimates of 2020 net water withdrawals as a percent of the volume of the stream’s ten-year average low flow estimate. Also called out are the areas where withdrawal projections for 2045 indicate the potential for new or exacerbated supply stress. For each subwatershed, the estimate is calculated using the historical lowest 7-day average flow that occurs roughly once every 10 years.

In areas where water withdrawals could impact in-stream flows during dry weather or drought conditions, extra care should be taken to make sure that the withdrawals don’t threaten ecosystem health or public water supplies. Coordination between State and local agencies, municipalities, water utilities, and the general public is critical to preventing stress to our water resources.
Figure 3.40: 2020 Withdrawals as a Percentage of 10 Year Average Low Flows

**Legend**

Withdrawals as % of 10yr Low Flows
- Insufficient Data
- <1%
- 1-10%
- 10-25%
- 25%+

Study Area Streams
Study Area Watersheds
County Boundary

- **East Branch Brandywine/Shamona Creek:**
  - 32% in 2020
  - 40% in 2045

- **Lower Octoraro Creek:**
  - 36% in 2020
  - 44% in 2045

- **Valley Creek:**
  - 36% in 2020
  - 41% in 2045

- **West Valley Creek:**
  - 19% in 2020
  - 24% in 2045

[Map showing water withdrawals percentages for different streams and watersheds]
Chapter 4
What Matters to Us
Chapter 4: What Matters to Us

*Watersheds 2045* is fundamentally about the interconnectedness of people and water here in Chester County. That's why it was critical to supplement data and trend analyses with direct participation from the County's residents, businesses, and community and conservation organizations. Significant efforts were made to provide a variety of opportunities for the public and stakeholders to express their water resources concerns and their thoughts on what should be emphasized in this plan. Altogether, more than 1,110 people were engaged in the planning process through:

- 6 interactive public listening sessions
- 40+ presentations with stakeholders, including County staff, community groups, watershed and conservation organizations, agricultural producers, engineering firms, water supply and wastewater purveyors, homebuilder groups, chambers of commerce, and government representatives
- 3 online surveys (available in English and Spanish) soliciting feedback on general water resource concerns, water-based recreation, and stormwater management
- 4 targeted watershed committees, organized around the County's four major river basins, to provide input on current conditions and management needs in each individual watershed

Responses about what types of water quality/quantity issues were most pressing varied by stakeholder group (as shown in Figure 4.1), but across the board, there was consensus that protecting water resources should be a top priority in Chester County.

*Figure 4.1: Top 3 Water Resource Issues by Stakeholder Group*

<table>
<thead>
<tr>
<th>Chester County Resource Concerns Identified by Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Public</strong></td>
</tr>
<tr>
<td>Soil and groundwater contamination</td>
</tr>
<tr>
<td>Increasing development and its implications for runoff and habitat loss</td>
</tr>
<tr>
<td>Flooding and the potential impacts of climate change</td>
</tr>
<tr>
<td><strong>Municipalities</strong></td>
</tr>
<tr>
<td>Regulatory compliance with programs like MS4</td>
</tr>
<tr>
<td>Community impacts/disruption from stormwater and flooding</td>
</tr>
<tr>
<td>Funding and capacity for infrastructure upgrades and maintenance</td>
</tr>
<tr>
<td><strong>Conservation Organizations</strong></td>
</tr>
<tr>
<td>Impacts of climate change on hydrology and storms</td>
</tr>
<tr>
<td>Conflict between development and critical water resources</td>
</tr>
<tr>
<td>Need for stronger language in and enforcement of natural resource protection ordinances</td>
</tr>
<tr>
<td><strong>Water/Wastewater Utilities</strong></td>
</tr>
<tr>
<td>Aging infrastructure and the need for upgrades</td>
</tr>
<tr>
<td>Protecting surface and groundwater supply sources</td>
</tr>
<tr>
<td>Addressing emerging contaminants</td>
</tr>
</tbody>
</table>
Cataloguing and Prioritizing Issues

Throughout the engagement process, a number of readily recognizable topic areas emerged. The Watersheds 2045 Steering Committee played a key role in synthesizing and organizing stakeholder feedback into seven major themes. From there, they streamlined and prioritized key issues under each theme, taking into account principles of efficient use, equitable access, ecological impacts, and sound land use and growth planning.

Figures 4.2 through 4.8 outline the issues and concerns shared during the public engagement process, as categorized and prioritized by the Steering Committee.

Figure 4.2: Key Issues around Education, Engagement, and Implementation

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Integration of water resources into municipal comprehensive plans and ordinance protection standards to protect riparian buffers, wetlands, floodplains, first order streams, and other sensitive natural features.</td>
</tr>
<tr>
<td>2</td>
<td>Multiple-municipal coordination opportunities for stormwater management and water resource protection</td>
</tr>
<tr>
<td>3</td>
<td>Funding mechanisms and partnership opportunities to support watershed restoration</td>
</tr>
<tr>
<td>4</td>
<td>Science-based stewardship of residential properties, public facilities, and open spaces</td>
</tr>
<tr>
<td>5</td>
<td>Public, municipal, and business community engagement, training, and educational materials</td>
</tr>
<tr>
<td>6</td>
<td>Expansion of citizen science and watershed monitoring opportunities</td>
</tr>
</tbody>
</table>
### Figure 4.3: Key Issues around Recreation and Culture

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expanded interconnected trail networks, water trails and biodiverse greenways</td>
</tr>
<tr>
<td>2</td>
<td>Equal access to and information on water-based recreational opportunities for all County residents</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of historic waterfronts and the interface between developed areas and stream corridors in the County’s boroughs and Coatesville City</td>
</tr>
<tr>
<td>4</td>
<td>Safety/hazard awareness specific to recreational and cultural uses, such as those posed by abandoned dams and water quality issues</td>
</tr>
<tr>
<td>5</td>
<td>Promotion of water-related recreational opportunities to sustain water tourism</td>
</tr>
<tr>
<td>6</td>
<td>Past and future trends in the County’s water culture: recreation, use, and access</td>
</tr>
</tbody>
</table>

### Figure 4.4: Key Issues around Water Quality

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural runoff impacts: nutrient loading, pathogens, bacteria, pesticide, sediment</td>
</tr>
<tr>
<td>2</td>
<td>Urban runoff impacts: sediment, metals, nutrients, VOCs, chlorides, lawn care and maintenance</td>
</tr>
<tr>
<td>3</td>
<td>Riparian buffer networks along headwater, Exceptional Value, and High Quality streams</td>
</tr>
<tr>
<td>4</td>
<td>Impacts of changing climate on water quality</td>
</tr>
<tr>
<td>5</td>
<td>Impact of emerging contaminants, such as PFAS, VOCs, and pesticides</td>
</tr>
<tr>
<td>6</td>
<td>Migration of contaminants in groundwater away from sites of known contamination</td>
</tr>
<tr>
<td>7</td>
<td>Cumulative impact of septic discharge/land application of wastewater</td>
</tr>
<tr>
<td>8</td>
<td>Water quality impacts from pipeline construction</td>
</tr>
</tbody>
</table>
### STORMWATER AND FLOODING

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilization of green infrastructure, conservation design, and low impact development for stormwater management and designing stormwater infrastructure for ecological benefits</td>
</tr>
<tr>
<td>2</td>
<td>Increased stormwater runoff from developed areas and the resulting increase in localized flooding, sedimentation, nutrient inputs, streambank erosion, and degradation of habitat quality.</td>
</tr>
<tr>
<td>3</td>
<td>Operation and maintenance of existing infrastructure and the impacts of aging systems.</td>
</tr>
<tr>
<td>4</td>
<td>Disproportionate flooding impacts on marginalized communities</td>
</tr>
<tr>
<td>5</td>
<td>Agricultural outreach to reduce soil and nutrient loss from stormwater runoff, especially during intense precipitation events</td>
</tr>
<tr>
<td>6</td>
<td>Improved floodplain management and coordination to reduce flood losses</td>
</tr>
<tr>
<td>7</td>
<td>MS4 implementation challenges</td>
</tr>
<tr>
<td>8</td>
<td>Private and municipal property damage caused by stormwater runoff</td>
</tr>
<tr>
<td>9</td>
<td>Improvement of flood warning systems</td>
</tr>
</tbody>
</table>

### WATER SUPPLY AND WASTEWATER MANAGEMENT

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Source water protection and well head protection strategies and coordination</td>
</tr>
<tr>
<td>2</td>
<td>Risks of failure of aging infrastructure to streams and biota</td>
</tr>
<tr>
<td>3</td>
<td>Nitrate, phosphorus, chlorides, pathogens/bacteria, and emerging (PFAS, pesticides) and legacy contaminants in raw public and private water sources and the associated treatment costs</td>
</tr>
<tr>
<td>4</td>
<td>Sustainable water supply in a changing climate</td>
</tr>
<tr>
<td>5</td>
<td>Expansion of water supply infrastructure and the loss of local control of natural resources/land use decisions</td>
</tr>
<tr>
<td>6</td>
<td>Recommendations about methods to dispose of effluent (stream, spray irrigation, septic systems) and the impacts of each on water quality and quantity</td>
</tr>
<tr>
<td>7</td>
<td>Municipal and water/wastewater utility coordination and planning</td>
</tr>
</tbody>
</table>
### INTEGRATION OF WATER RESOURCES IN LAND USE PLANNING

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expanded collaboration with PennDOT, municipal public works departments, County departments, and local conservation organizations to reduce the impacts of transportation corridors on water quality and reduce stormwater runoff</td>
</tr>
<tr>
<td>2</td>
<td>Impact of municipal zoning and subdivision and land development ordinance on implementing green infrastructure, low-impact development, and other conservation design techniques</td>
</tr>
<tr>
<td>3</td>
<td>Increases in impervious cover depleting groundwater supply and reducing recharge</td>
</tr>
<tr>
<td>4</td>
<td>Development and land conversion adjacent to headwater streams and sensitive natural resources</td>
</tr>
<tr>
<td>5</td>
<td>Insufficient green space, trail networks, and open space in new development</td>
</tr>
<tr>
<td>6</td>
<td>Lack of consistent zoning between adjacent municipalities</td>
</tr>
<tr>
<td>7</td>
<td>Impact of regional transportation/commercial corridors and expansion of targeted economic development areas</td>
</tr>
</tbody>
</table>

### NATURAL RESOURCES

<table>
<thead>
<tr>
<th>Rank</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Protection, restoration, and management of riparian corridors and existing woodlands</td>
</tr>
<tr>
<td>2</td>
<td>Preservation of species diversity and restoration of diversity in impaired streams</td>
</tr>
<tr>
<td>3</td>
<td>Implications of climate change for stream habitat and biota</td>
</tr>
<tr>
<td>4</td>
<td>Habitat loss from instream scouring and sedimentation</td>
</tr>
<tr>
<td>5</td>
<td>Incised stream channels and floodplain disconnection</td>
</tr>
<tr>
<td>6</td>
<td>Instream flow needed to support aquatic habitats and the cumulative impact of groundwater withdrawals</td>
</tr>
<tr>
<td>7</td>
<td>Impacts of thermal impairment from increased impervious surface runoff and denuded stream corridors, particularly in coldwater fisheries and wild reproducing trout streams</td>
</tr>
<tr>
<td>8</td>
<td>Encroachment by aquatic and riparian invasive species</td>
</tr>
<tr>
<td>9</td>
<td>Impediment of aquatic organism movement by low head and abandoned dams and other channel modifications</td>
</tr>
<tr>
<td>10</td>
<td>Management of off-channel ponds and lakes and the impacts to stream water quality</td>
</tr>
</tbody>
</table>
Creating Actionable Paths Forward

When combined with the assessment of previous efforts (in Chapter 2) and current water resource conditions (in Chapter 3), these lists of prioritized issues allowed us to develop a new suite of goals and objectives to protect the County’s water resources well into the future. This involved further categorizing, refining, and adding specificity to the priority issues listed above to create actionable paths forward in each major theme. The rest of this plan will focus on those actionable paths, both at the County-wide level and at the scale of each of the County’s 21 watersheds.

While the stakeholder feedback gathered as part of this planning effort was thorough and comprehensive, it still only represents a snapshot in time of what people think of the County’s water resources. Moving forward, continued dialogue and collaboration with all stakeholders will be key to achieving our shared water resource goals for Chester County in the years to come.
Chapter 5
Where We're Headed
Chapter 5: Where We're Headed

A Shared Vision

Central to the Watersheds 2045 planning process was the development of a shared vision to guide future efforts to protect and preserve Chester County’s water resources. Together, our partners created the following vision statement:

**Watersheds 2045 Vision**

*In 2045, we envision sustainable Chester County water resources that provide clean water, support healthy aquatic and wildlife habitats, enable thriving communities, and offer abundant and accessible recreational opportunities for all.*

This statement serves as the foundation for both this plan and its implementation going forward.

New Goals, Objectives, and Strategies

While the vision statement paints a picture of where we’re going, the goals, objectives, and strategies listed below are the roadmap for how we’ll get there. Building on public and stakeholder feedback, Steering Committee review, and current and historical trends analyses, seven primary goals were developed to drive water resource protection through 2045. As in the original Watersheds plan, these goals are broad and interdependent to allow for creativity in balancing human activities and natural resource protection. Each goal is accompanied by objectives designed to refine and target our efforts, as well as implementation strategies to guide our actions in addressing the County’s water resource challenges and opportunities.
Stakeholder Roles and Measuring Success

The vision can only be achieved through a shared responsibility for the sustainability of our water resources. As such, the goals, objectives, and strategies listed in this plan can be implemented by a range of stakeholders. This includes local governments, conservation groups, landowners, developers, utilities, residents, and anyone else whose actions impact (or could impact) water resources in Chester County. There is an opportunity for everyone to help implement this plan.

Lastly, this section identifies examples of potential metrics we'll use to track progress over the coming years. The results of data collection for these indicators will be published annually and include recognition of projects and accomplishments advanced during the year. While not all of the plan's objectives and strategies lend themselves to easily quantified metrics, those included here will serve as the baseline for understanding progress toward our goals.
Goal 1:
Engage and educate individuals, communities, businesses, and governments to promote scientifically-based watershed stewardship

Objectives:

1.1 Promote the community, environmental, and economic value of protecting and restoring water resources and integrating land use and water resources planning to residents, schools, municipalities, and local businesses.

1.2 Provide relevant and timely information on the state of the County’s water resources, including current water conditions and the impacts of climate change.

1.3 Expand education and outreach opportunities to engage diverse audiences across the County.

1.4 Promote and help to facilitate science-based watershed stewardship and property management in all watersheds across the County.

1.5 Promote involvement with local watershed, conservation, and community organizations to expand water resources literacy among County residents, civic organizations, and businesses.

Protecting and improving Chester County’s water resources begins with the people managing and interacting with the lands that drain into those waters. As emphasized in the 2002 plan, watershed management is largely about changing behavior to better protect natural resources for the public good. Success depends on direct interaction with, and active participation from, the public and those who work, live, and recreate within the watersheds of the County. While education alone won’t directly impact water quality or quantity, it is a critical tool to empower our communities (from decision makers to business owners to local residents) with the information they need to be better stewards of our shared lands and waterways.
**Strategies for Implementation**

- Strengthen existing **multi-municipal and non-profit partnerships** and develop new partnerships to improve and expand the reach of water resources and stormwater education and outreach programs.
- Convene regular events to **foster collaboration and information sharing** among local watershed and conservation organizations.
- Publish **annual water status reports** that summarize water quality, quantity, and use data for the County’s watersheds and provides information on emerging water resources challenges.
- Partner with local Environmental Advisory Councils, Penn State Extension, local watershed and conservation organizations, schools, and other community groups to create and distribute informational material on **watershed-friendly property management**.
- Facilitate or participate in community events and educational engagement opportunities and develop informational materials targeted to municipalities, schools, residents, and real-estate professionals that **promote the economic value of ecosystem services** provided by local water resources.
- Create **culturally-aligned and inclusive water resources education** and outreach materials, including multilingual educational products, for the public, civics organizations, and for use in schools.
- Support and facilitate the **development of education and outreach programs** to both socio-economically disadvantaged and geographically marginalized communities.
- Facilitate inter-departmental collaboration between Chester County Department of Facilities, Chester County Parks + Preservation (CCP+P), CCWRA, and CCCD to **enhance watershed stewardship practices** on County-owned properties.
- Facilitate collaboration among municipalities, municipal authorities, County agencies, state agencies, and federal agencies to **identify and address water resources challenges**.
- Maintain a County webpage with updated information on local watershed and conservation organizations and regularly **advertise their educational and volunteer activities**.
- Encourage residents and businesses to **participate in programs designed to reduce stormwater runoff and pollution, conserve water, and improve wildlife habitat**, such as Penn State Extension’s Watershed Friendly Property Certification and the Homegrown National Park initiative.
- Promote and expand **community science water monitoring programs** to engage County residents and increase the spatial coverage of water quality data.
- Identify opportunities to publicly **promote and celebrate progress** toward water quality and watershed goals.
- Promote place-making activities to **foster individuals’ relationships with fresh water** and natural resources.
Stakeholder Roles

County

- Coordinate internally among county agencies (CCWRA, CCPC, CCHD, CCP+P, CCCD)
- Gather public feedback and data, develop and distribute informational resources
- Cultivate partnerships across sectors (examples: CWMP, Christina Basin Task Force (CBTF), Councils of Governments (COGs), regional planning participants, municipalities, local watershed and conservation groups, etc.)
- Provide technical assistance as appropriate to support watershed stewardship initiatives.

Municipalities

- Distribute information and educational materials to the public (including residents, schools, real-estate professional, civic organizations, and private businesses, among others)
- Demonstrate good watershed stewardship techniques on municipal properties
- Coordinate with adjacent municipalities and consider collaborative community events, educational opportunities, and partnerships as needs arise.

Conservation and Community Organizations

- Develop and distribute informational resources
- Coordinate public outreach events and campaigns
- Cultivate partnerships across sectors
- Promote stormwater management practices, flood prevention practices, and other watershed management practices successfully installed on private or conserved lands.
Goal 1

Engage and educate individuals, communities, businesses, and governments to promote scientifically based watershed stewardship

Utilities

- Collaborate with municipalities, county agencies, state agencies, and federal agencies to identify and address water resource challenges
- Develop and distribute informational resources to municipalities and the public
- Communicate utility efforts aimed at conservation and watershed stewardship
- Participate in government led efforts to develop and distribute water status reports that engage and educate the public about water resource issues and emerging challenges

Residents/Local Businesses

- Attend community events and educational opportunities to learn more about watershed stewardship and the value ecosystem services provide
- Engage with government, for-profit, and non-profit institutions and agencies to better understand watershed stewardship issues and priorities
- Seek opportunities to work with local watershed and conservation organizations on local stewardship efforts
- Integrate good watershed stewardship techniques on private property.

Indicators of Progress

- # of general members in local watershed/conservation organizations
- # of volunteers participating in litter cleanups, plantings, or other related activities through local watershed/conservation organizations
- # of volunteer hours worked in Chester County by Master Watershed Stewards (current trainees and active Stewards)
- # of County events/workshops/presentations focused on watershed stewardship, stormwater management, & flood prevention
- # of individuals reached with annual County water conditions reports
- # of youth and adults participating in local watershed educational programming within the County
- # of Chester County properties certified as Watershed Friendly through the Master Watershed Stewards certification program
Goal 2: 
Expand water-based recreational opportunities and access to local water features

Objectives:

2.1 Expand and improve access to trail and water trail networks, biodiverse greenways, and water-based recreational opportunities for all County residents.

2.2 Promote safe water-based recreation by facilitating the distribution of information on local water quality, flooding hazards, and other water recreation safety hazards.

2.3 Promote sustainable and flood-resilient improvement to historic water fronts, water-based historic features, and the interface between developed areas and stream corridors to connect residents to their local water ways.

2.4 Build public awareness and affinity for local water and natural resources through opportunities for direct connections to those resources.

We know that time spent in nature is good for our health and wellbeing. Access to local waterways provides Chester County residents with incredible recreational opportunities, connects us with our water-rich history, and enhances our sense of place. Additionally, engaging with our lakes and streams helps to foster a sense of connectedness and care for these resources. The objectives and strategies listed for this goal strive to enhance the public’s access to and recreational use of our watersheds and natural resources, especially in communities where it has historically been more limited.
Strategies for Implementation

• Prioritize and implement the recommendations from existing feasibility studies, such as those for the Brandywine Creek Greenway, Brandywine Creek Water Trail, Southern Chester County Circuit Trail, and Northern Struble Trail.
• Seek public input to identify primary barriers to participation in water-based recreational activities, such as lack of ADA-compliant access, limited parking, or lack of information on available opportunities, and collaborate with municipalities, non-profit organizations, businesses, and other community organizations to reduce these barriers.
• Inventory public stream access points and parking areas adjacent to the County’s major stream networks and identify gaps in access.
• Identify and pursue funding to establish new stream access points and improve degraded facilities.
• Develop and improve online resources, including interactive and mobile-friendly web maps, that provide information on local stream access points and advertise these resources through social media, County newsletters, and County Department websites.
• Promote the incorporation of stream and riparian area access points and trail linkages in development and redevelopment projects located adjacent to waterways.
• Collaborate with community and watershed organizations, PAFBC, and PA DCNR to develop and distribute educational materials on water recreation safety, etiquette, and regulations.
• Update municipal historic resources inventories to identify water-based historic features and identify areas suitable for restoration or for re-use objectives.
• Identify economic development programs and funding opportunities for rehabilitation and re-use of water-based historic features.
• Promote land development that is sensitive to the existing aesthetics of the surrounding area, incorporates access to local water features, and protects and preserves sensitive natural areas.
• When expanding recreational access along streams with existing impairments related to instream recreational uses and/or fish consumption, consider implementing non-contact access opportunities (e.g., trails along waterways, scenic viewpoints, etc.) in the short term until safer water quality conditions are restored to allow for greater contact with the stream.
Stakeholder Roles

County

- CCPPD (lead), in conjunction with CCWRA and CCPC, develop opportunities for collaboration with municipalities and non-profits to expand and improve access to trail networks (local, regional and county interconnections), water trails (including access and parking), and biodiversity greenways (as separate corridors and in conjunction with other trail planning).
- Gather public feedback and data about accessibility (general availability, ADA-compliant access, etc.) through surveys and community engagement.
- Identify and pursue funding to establish stream access points; develop and maintain online resources that provide user-friendly information on stream access.
- Identify economic development programs to restore and enhance water-based historic and recreational resources.
- Help prioritize and implement recommendations from existing feasibility studies looking at these issues.

Municipalities

- Coordinate with adjacent municipalities, non-profits, watershed organizations and the County and consider collaborative community events that promote recreational opportunities.
- Encourage the incorporation of stream access opportunities and trail linkages into development and redevelopment projects.
- Update historic resource inventories to address water-based resources.
- Promote land development that is sensitive to water-based features and preserves sensitive natural areas.

Conservation and Community Organizations

- Collaborate with county agencies and municipalities to expand outreach to trail networks, preserve biodiversity greenways, and improve stream access.
- Improve organizational online resources and public outreach to communicate the important role of conservation organization properties.
- Assist in developing and distributing information on water recreation safety and etiquette.
Goal 2
Expand water-based recreational opportunities and access to local water features

Utilities

- Collaborate with municipalities, county agencies, state agencies, and federal agencies to identify and address water access issues and water-based recreation opportunities
- Educate all parties about utility locations and limitations to access where appropriate (work with all parties, where feasible, to find workarounds to access and trail interconnectivity)
- Work with all parties to identify existing stream impairments that limit access opportunities currently (until water quality conditions improve or safe conditions are restored)

Residents/Local Businesses

- Attend community events and educational opportunities to learn more about access issues and locations
- Seek opportunities to work with local watershed and conservation organizations on local stewardship efforts
- Respond to surveys about access issues
- Utilize online resources and mobile-friendly web mapping to locate stream access points

Indicators of Progress

- # of annual canoe/kayak/boat rentals
- $ of County, State, and Federal funding for projects that improve water access and recreational opportunities
- # of new/improved web and print resources on water access points & recreational opportunities
- # of annual visitors to park facilities with water-based recreational opportunities/prominent water features
- # of projects that improve access to or recreational opportunities on waterways [periodic]
- # of trout and warm water fisheries stocking activities and events
Goal 3: Conserve and protect the County’s natural resources for clean water

Objectives:

3.1 Preserve lands that support critical hydrologic functions and aquatic ecosystems, including first order streams, wetlands, floodplains, riparian buffers, fisheries, and sustainable baseflows.

3.2 Prioritize the protection and stewardship of existing tree canopies and woodlands, steep slopes, karst geology, wildlife corridors, and other sensitive natural resources.

3.3 Promote policies and land management practices that protect natural in-stream channel processes, groundwater recharge, and healthy water quality.

3.4 Evaluate and implement strategies to address the potential impacts of climate change on water quality, water quantity, and aquatic communities.

If we want clean, abundant water resources in Chester County, we must protect the landscapes and ecological systems that support healthy waters. This includes critical natural resources like woodlands, wetlands, riparian corridors, headwater streams, steep slopes, karst geology, connected floodplains, fisheries, and sources of drinking water. Preserving these natural processes allows nature to provide a whole host of co-benefits we may seldom think about. For example, forested stream buffers help moderate water temperature for cold-water loving trout; floodplains store floodwater and reduce storm damage; and wetlands filter water and provide critical habitat for wildlife. Historically, there have been times when protecting water resources has taken a back seat to expanded economic growth and development. However, safe, clean water is critical for thriving communities, and we will need to continue efforts to manage community growth in ways that support, rather than compromise, the water resources we rely on. We will also need to continue to assess the impact that emerging threats like climate change could have on our waterways and the landscapes that support them.
Strategies for Implementation

- Promote **ecologically sensitive management** of existing riparian buffers, woodlands, and open space to reduce the spread of invasive species.
- Identify streams **supporting unique or vulnerable aquatic populations** that warrant additional protection and promote petitioning for stream designation upgrades.
- Encourage and incentivize new development and redevelopment projects to **minimize impacts** to sensitive natural resources and hydrologic processes through the implementation of green infrastructure, conservation design, and low impact development practices.
- Support investments in ongoing **open space preservation initiatives** and prioritize the protection of existing woodlands, wetlands, stream and wildlife corridors, floodplains, and other sensitive natural areas.
- Incorporate the potential **impacts of climate change** on precipitation patterns, stream baseflows, and local ecological communities in decisions regarding preservation and land management (based upon best available data).
- Identify streams with aquatic communities most at risk to potential stream temperature increases from climate change or development and prioritize mitigation, land preservation, and restoration strategies to **limit in-stream temperature increases**.
- Identify and prioritize floodplains, wetlands, and other natural areas with **flood storage potential** for permanent preservation, especially upstream of flood prone communities.
- Promote the creation of **“no mow zones”** at least 15 feet in width along headwater streams on public, residential, and commercial properties throughout the County.
Stakeholder Roles

County

- Coordination among county departments (CCWRA and CCPC in lead positions) to inventory landcover data and provide GIS-based tools for identifying and expanding riparian buffer networks
- Collaborate with municipalities to expand and improve code provisions for natural resource protection (woodlands, steep slopes, wetlands, floodplains, riparian areas)
- Encourage the use of green infrastructure and conservation design/low impact development to protect sensitive natural features and minimize disruption of natural hydrologic processes (including reductions in impervious cover requirements, where appropriate, such as roadway widths, double sidewalks, curbs, impervious parking areas, and building setbacks)
- Support development and implementation of regional and local watershed management plans
- Support municipal on-lot septic system management programs
- Support municipal efforts to convert lawn areas to native meadow conditions
- Work with agricultural producers to limit livestock access to streams
- Continue appropriate county actions to preserve open space and prioritize the preservation of natural resources
- Evaluate the potential impacts of climate change on precipitation patterns, stream base flows, and stream temperatures
- Identify streams supporting unique conditions which warrant stream designation upgrades

Municipalities

- Consider expanding and improving both the provisions and enforcement of codes for natural resource protection (woodlands, steep slopes, wetlands, floodplains, riparian areas)
- Consider the use of green infrastructure and conservation design/low impact development to protect sensitive natural features and minimize disruption of natural hydrologic processes (including reductions in impervious cover requirements, where appropriate, such as roadway widths, double sidewalks, curbs, impervious parking areas, and building setbacks)
- Be a participant in or undertake, where appropriate, watershed management plans and/or regionally consistent codes
- Develop a municipal on-lot septic system management program
- Develop code provisions permitting the conversion of lawn areas to native meadow conditions
Goal 3
Conserve and protect the County’s natural resources for clean water

Conservation and Community Organizations

- Collaborate with county agencies and municipalities to inventory landcover data for incorporation into GIS-based tools for identifying and expanding riparian buffer networks
- Participate in, where appropriate, regional and local watershed management plans
- Work with agricultural producers to limit livestock access to streams
- Continue appropriate actions to preserve open space and prioritize the preservation of natural resources

Utilities

- Collaborate with municipalities, county agencies, state agencies, and federal agencies to minimize impacts to natural resources and stream health
- Collaborate with county agencies and municipalities to provide appropriate landcover data for incorporation into GIS-based tools for identifying stream resources and riparian areas
- Support county and municipal efforts for stream designation upgrades where warranted

Residents/Local Businesses

- Consider periodic maintenance of on-lot septic systems and pump routinely in order to maintain operational efficiency and prevent system failures
- Consider converting lawn areas to native meadows to reduce mowing and better manage rainfall and runoff
- Consider no-mow zones along stream and ponds
- Support investments in ongoing open space preservation

Indicators of Progress

- # of linear miles of stream buffered (total)
- # of acres of permanently protected sensitive natural features (using CCPC’s “significant natural landscapes” data as reference)
- $ of County and municipal funding for projects that permanently protect sensitive natural features
Goal 4: Improve surface water and groundwater quality

Objectives:

4.1 Reduce or eliminate the transport of sediment, nutrients, salts, herbicides, pesticides, and other pollutants into the County’s waterways.

4.2 Restore and steward vegetated riparian buffers across the County to improve water quality, promote stable stream channel processes, and expand high quality wildlife habitat.

4.3 Improve water quality through strategic implementation of best management practices (BMPs) across all land uses.

4.4 Protect water quality and stream baseflows by promoting sound land management practices designed to infiltrate stormwater runoff, promote groundwater recharge, and minimize the direct flow of overland runoff into streams.

4.5 Support robust water quality and stream monitoring efforts to assess the effectiveness of on-the-ground restoration efforts.

4.6 Reduce pollutant loadings from treated effluent of land applied wastewater disposal systems, on-lot septic systems, and other point sources.

Improving water quality is at the heart of Watersheds 2045. The Commonwealth of Pennsylvania identifies water quality standards for streams based on the ways in which people commonly interact with those waterbodies. Streams that do not meet their designated standards are considered “impaired,” and often require restoration practices to address the cause of their impairment. Groundwater can also be impacted by the same pollutants that lead to surface water impairments. Treating stormwater runoff for nutrient and sediment pollution, eliminating illicit discharges, reducing land-applications of certain chemicals, restoring vegetated riparian buffers and floodplains, and using improved site design and stewardship techniques can all help improve water quality above and below ground. Addressing these impairments is not just critical within Chester County; it also benefits our downstream neighbors who rely on these streams to meet their own water resource needs.
Strategies for Implementation

- Identify areas of high priority for accelerating the implementation of BMPs and coordinate appropriate training and planning to facilitate implementation of these practices.
- **Prioritize investment in restoration** practices based on evaluations of land use and pollutant loading estimates.
- Educate residential, commercial, and recreational landowners on property management techniques that **reduce pesticide and fertilizer application**.
- Provide educational trainings and technical assistance to public and private salt applicators to **reduce the amount of de-icing chemicals** applied to roadways, parking areas, and sidewalks.
- Collaborate with state and federal agencies to **identify areas with elevated levels** of emerging contaminants, determine strategies to reduce the concentration and spread of these contaminants, and promote long-term monitoring of these areas.
- Promote regular inspection of erosion and sediment control practices on construction sites and help to facilitate improved effectiveness of **erosion and sediment control practices**.
- **Promote best practices** for siting and designing infiltration practices to protect groundwater while reducing runoff.
- Continue Chester County’s longstanding partnership with the USGS to **monitoring water** quality, flow, ground water levels, precipitation, and biotic diversity across the County.
- Evaluate the impact of land application of wastewater on local groundwater quality and cooperate with utilities to **reduce pollutant loadings** that may impair the quality of drinking water supplies.
- **Promote regenerative agricultural practices**, such as no-till, cover crops, managed grazing, and agroforestry that improve soil health, decrease erosion, reduce water use, and sequester carbon.
- Facilitate the creation and implementation of **conservation plans and nutrient management plans** designed to conserve soil and water resources and minimize fertilizer application by all agricultural operators.
- Continue outreach to agricultural producers to **limit livestock access to streams** and riparian areas.
- Promote the **reestabishment of vegetated (ideally forested) riparian buffers** 100 feet from the top of bank on each side of the stream.
- Prioritize the reforestation of **riparian corridors along headwater streams** based on the designation of the stream (i.e., Exceptional Value, High Quality, cold-water fisheries, naturally reproducing trout fisheries, etc.) and their impairment statuses.
- Develop a tool that uses landcover data to identify parcels where riparian buffer establishment will **bolster and expand existing riparian buffer networks**, and coordinate with landowners, conservation organizations, CCCD, and NRCS to implement vegetated buffers in these areas.
- **Work with homeowners associations and age-restricted communities** to remove barriers to, and support the implementation of, property management practices that improve water quality, reduce impervious surfaces, and promote dispersed infiltration of stormwater runoff.
- Promote **planting of street trees** in all new development, redevelopment, and retrofit projects, as well as participation in community tree management programs, such as PA DCNR’s TreeVitalize.
Stakeholder Roles

County

- Coordinate internally among county agencies (CCWRA, CCPC, CCHD, CCP+P, CCCD)
- Use technologies available and evaluate pollution loadings, land use, sediment loads, etc. to identify areas of high priority for implementation of nonpoint sources BMPs
- Collaborate with state and federal agencies to further understand, identify, monitor, and reduce elevated levels of emerging contaminants
- Continue the county’s association with the USGS to monitor water quality, flow, ground water levels, precipitation, and biotic diversity across the county
- Work with conservation and community organizations to promote the continuation of citizen science water quality monitoring programs
- Coordinate with municipalities and consider collaborative community events and educational opportunities to reduce pesticide and fertilizer applications, as well as reduce the amount of de-icing chemicals and salts applied to impervious surfaces
- Promote regenerative agricultural practices in order to improve soil health, reduce erosion, reduce water use, and sequester carbon

Municipalities

- Collaborate with the county to hold community events to reduce pesticide and fertilizer applications, as well as reduce the amount of de-icing chemicals and salts applied to impervious surfaces
- Institute regular inspections of erosion and sediment control practices on construction sites
- Work with homeowners associations and age-restricted communities to follow open space management plans and remove barriers to property management practices that improve water quality, reduce impervious surfaces, and promote distributed infiltration of stormwater runoff
- Adopt code requirements and promote the use of street trees and other reforestation and tree management practices
- Adopt on-lot septic system maintenance programs

Conservation and Community Organizations

- Educate landowners on property management techniques that reduce pesticide and fertilizer applications
- Promote regenerative agricultural practices to improve soil health, reduce erosion, reduce water use, and sequester carbon
- Encourage agricultural producers to limit livestock access to streams and riparian areas
- Promote and undertake establishment of vegetated/forested riparian corridors along streams corridors
Improving surface water and groundwater quality

Utilities

- Collaborate with county, state and federal agencies to further understand, identify, monitor, and reduce elevated levels of emerging contaminant.
- Cooperate with county, state and federal agencies in the collection of water quality, streamflow, and biotic diversity data where appropriate.

Residents/Local Businesses

- Participate in collaborative community events and educational opportunities to reduce pesticide and fertilizer applications, as well as the reduce the amount of de-icing chemicals and salts applied to imperious surfaces.
- Consider periodic maintenance of on-lot septic systems and pump routinely in order to maintain operational efficiency and prevent system failures.
- Consider converting lawn areas to native meadows to reduce mowing and better manage rainfall and runoff.
- Plant trees.

Indicators of Progress

- # of acres of new riparian buffer established
- # of trees planted through local, State, and regional initiatives
- # of agricultural BMPs installed
- # of new or updated conservation/nutrient management plans in place
- Average Index of Biotic Integrity Scores across 18 Chester County long-term sampling sites
- Nitrogen, phosphorus, chlorides, streamflow, and groundwater data (annual County water quality conditions report)
- # of sites in progress vs. # of sites completed in the PADEP Land Recycling Program
- # of active Superfund/CERCLA National Priorities List sites
### Goal 5: Reduce stormwater runoff and mitigate the impacts of flooding

**Objectives:**

5.1 Evaluate present and potential future flood risks to inform community flood prevention and mitigation projects.

5.2 Evaluate methods to provide long-term funding for implementing, maintaining, and enhancing stormwater infrastructure.

5.3 Identify opportunities for watershed-based, multi-municipal coordination on stormwater management, MS4 pollution reduction permit requirements, and flood mitigation projects.

5.4 Promote the use of green infrastructure, conservation design, low impact development principles, and other strategies to minimize and manage the total footprint of impervious cover in new development and redevelopment projects.

5.5 Promote the greening of urban and suburban areas across the County through the revitalization of parks, planting of street trees, and the strategic conversion of existing grey stormwater infrastructure into green practices.

5.6 Protect stream corridors, FEMA 100-year and 500-year floodplains, and adjacent wetlands to allow for natural management and storage of floodwaters.

5.7 Promote and help to facilitate compliance with required inspections and routine operation and maintenance activities for stormwater BMPs and erosion and sediment control measures to reduce the risk of failure.

5.8 Maintain existing flood control dams to comply with state and federal standards.

The original Watersheds plan of 2002 recognized the need to accommodate, to the maximum extent practicable, planned growth in ways that protect public safety and the natural hydrologic characteristics of our watersheds. Two decades later, flooding remains the nation’s most frequent and most costly natural hazard. Even runoff and nuisance flooding from smaller storm events can create extensive problems for our waterways. As we plan for the future, it will be important to identify long-term funding for stormwater infrastructure, increased multi-municipal coordination and cooperation, and mitigation efforts to address increases in flood frequency and magnitude.
**Strategies for Implementation**

- Coordinate with municipalities, businesses, and residents to accelerate the implementation of flood and flash [flood-related strategies from County’s Hazard Mitigation Plan](#), including floodplain restoration and property buyouts in areas with significant repetitive losses.
- Facilitate coordination with local, regional, and Federal human services agencies to support residents and [communities impacted or displaced by flooding events](#), especially in communities with more vulnerable populations.
- Evaluate the potential impact of climate change on future precipitation patterns, flood frequency, and flood magnitude to [identify potential areas of increased flood risk](#).
- Collaborate with municipalities to [update the County-wide inventory](#) of developed flood prone areas and identify potential mitigation actions to reduce flooding and improve the safety of residents in these areas.
- Review operation and maintenance practices of the Brandywine Creek Watershed flood control facilities and ensure [compliance with modern dam safety standards](#).
- [Facilitate regular dam safety trainings](#) and workshops with local Emergency Management Coordinators.
- Evaluate existing and innovative mechanisms to [increase funding for municipal stormwater management](#), including stormwater fee feasibility studies.
- Promote [improved stormwater management on redevelopment](#) and infill development projects to reduce the need for impervious cover and improve the capacity of existing development to manage stormwater onsite.
- Develop evaluation criteria to [identify and prioritize opportunities for retrofits](#) of existing stormwater control measures to improve infiltration and evapotranspiration, reduce impacts on water quality, and reduce flooding in developed areas.
- Continue to host [annual Municipal Stormwater Summits](#) to provide a forum for information sharing and municipal collaboration on stormwater management issues.
- Support assessments and [maintenance of municipal storm sewer infrastructure](#) to ensure its capacity to effectively manage stormwater under present and future conditions.
- Facilitate collaboration between Pennsylvania Department of Transportation (PennDOT), PA Turnpike Commission, and municipal public works departments by hosting annual meetings or workshops to explore the [intersection of stormwater management and road maintenance](#).
- [Incentivize compliance](#) with routine inspections and maintenance of stormwater BMPs owned by businesses, homeowners, and community associations by providing informational materials, hosting regular training opportunities, and identifying options for ongoing maintenance funding.
- [Review municipal minimum development standards](#) such as road widths, commercial parking requirements, cul-de-sac dimensions, and curbing and sidewalk requirements to identify and revise requirements that minimize impervious cover for proposed land development projects.
- In areas with karst or carbonate geology, [promote innovative stormwater management](#) techniques on existing and new development sites to supplement traditional infiltration systems.
Stakeholder Roles

County

- Coordinate among county agencies and with municipalities, businesses, and residents to implement the county’s Hazard Mitigation Plan, specifically those actions prioritizing flood mitigation projects, floodplain restoration, property buyouts, and areas of repetitive losses
- Help facilitate and support initiatives that address those displaced by flooding events
- Develop criteria to identify and prioritize stormwater system retrofits to improve infiltration, improve water quality, and reduce flooding
- Continue to host Municipal Stormwater Summits
- Facilitate collaboration between PennDOT, PA Turnpike Commission, municipal public works departments by hosting annual meetings or workshops exploring the intersection of stormwater management and road maintenance

Municipalities

- Collaborate with the county residents to implement the county’s Hazard Mitigation Plan, specifically those actions prioritizing flood mitigation projects, floodplain restoration, property buyouts, and areas of repetitive losses
- Support initiatives that address those displaced by flooding events
- Promote improved stormwater management on redevelopment and infill development projects
- Undertake assessments and inspections of stormwater infrastructure to ensure proper functioning
- Attend county sponsored outreach events, such as the Municipal Stormwater Summit
- Review and update development standards that result in unnecessary impervious cover for proposed development (roadway widths, commercial parking requirements, double sidewalks, curbs, building setbacks, and cul-de-sac dimensions)

Conservation and Community Organizations

- Collaborate with the county to implement the county’s Hazard Mitigation Plan; attend county sponsored outreach events, such as the Municipal Stormwater Summit
- Undertake establishment of vegetated/ forested riparian corridors along streams corridors and promote the planting of trees
- Work with the county and others to install green stormwater infrastructure.
Goal 5
Reduce stormwater runoff and mitigate the impacts of flooding

Utilities

• Collaborate with the county to implement the county’s Hazard Mitigation Plan
• Attend county sponsored outreach events, such as the Municipal Stormwater Summit
• Consider appropriate actions to reduce the impacts of flooding on utility operations (floodproofing, emergency management plans, etc.)
• Seek training opportunities that address issues such as flood abatement, emergency operations, and flood event preparation
• Perform self-inspections and audits to ensure compliance with emergency management plans

Residents/Local Businesses

• Participate in collaborative community events and educational opportunities geared towards an understanding of flood events and available emergency services
• Participate in events with the county to implement the county’s Hazard Mitigation Plan
• Consider converting lawn areas to native meadows to reduce mowing and better manage rainfall and runoff
• Plant trees

Indicators of Progress

☐ # of repetitive flood loss claims
☐ # of urban/suburban stormwater BMPs installed through PRP implementation and/or by conservation partners
☐ Estimated # pounds of sediment and nutrients, and/or # of gallons of stormwater runoff reduced through BMP implementation
☐ # of flood mitigation projects
☐ # of flood-related water rescues conducted by Emergency Services
Goal 6:
Promote the integration of water resources, natural resources protection, and land use planning

Objectives:

6.1 Incorporate water resource protection principles into municipal comprehensive plans, zoning ordinances, and subdivision and land development ordinances to protect and restore stream corridors, floodplains, wetlands, groundwater resources, and other sensitive natural features.

6.2 Enhance protection of natural resources through the adoption and revision of municipal ordinances and ensure consistent natural resource protection standards across watersheds.

6.3 Reduce the impacts of transportation corridors on water quality and quantity by expanding collaboration with PennDOT, PA Turnpike Commission, municipal public works departments, County departments, and local conservation organizations to reduce and manage stormwater runoff.

6.4 Integrate green stormwater infrastructure, common green spaces, greenways, biodiversity corridors for wildlife migration, and accessible and interconnected trail networks in new development and redevelopment projects.

It’s often said that an ounce of prevention is worth a pound of cure, and good planning is one of the most effective forms of preventing problems with our water and natural resources. The intentional inclusion of water resource and environmental considerations in land use planning highlights the interconnectedness of the natural and built environment. Our actions can make for a more just and livable planet, and over time, reduce the need for costly interventions to restore habitat, expand water treatment systems, manage stormwater, reduce flooding, safeguard biodiversity, protect natural resources, and provide ample opportunities for recreation and interaction with nature. Future land use planning should consider growth in the context of natural and water resources and strive to balance the needs of all beneficiaries.
Strategies for Implementation

- Evaluate and revise municipal ordinances to facilitate the use of green infrastructure, low impact development, and conservation design practices in all new development and redevelopment to enhance onsite stormwater management systems, expand greenways, and maintain the natural hydrology of the landscape.

- Identify and benchmark opportunities to facilitate coordination among municipalities, such as through regional Environmental Advisory Councils (EACs) or through multi-municipal planning committees, to promote complementary natural resource protection standards within and across watersheds.

- Facilitate intermunicipal cooperative agreements that expand capacity, identify cost efficiencies, and increase access to the necessary tools/resources/expertise to implement water protection policies and programs.

- Review, adopt, and/or amend municipal ordinances to remove barriers to implementing property management practices that improve water quality, limit impervious surfaces, and promote dispersed infiltration of stormwater runoff.

- Coordinate with municipalities to strengthen existing riparian buffer ordinances to protect at least 100 feet from the water’s edge for all streams, 150 feet from the edge of water for Exceptional Value and High Quality Streams, and 50 feet from wetlands edges from future encroachment or degradation.

- Promote coordinated municipal and County policy and planning to address landscape factors that decrease watershed health and result in stream channel and bank degradation, restricted aquatic species passage, degraded water quality and aquatic communities, and lower stream baseflows.

- Promote the adoption of municipal programs for on-lot septic system maintenance to achieve cleanout every two to three years.

- Encourage the submission of sketch plans with stormwater management information in the land development process and incentivize discussions with municipal planning commissions and municipal engineers prior to preliminary/final plan submission.

- Promote the incorporation of incentives into municipal subdivision and land development ordinances to encourage development proposals that provide robust protection for water resources, open space, and sensitive environmental areas.

- Promote the adoption and enforcement of municipal floodplain protection ordinances that restrict development and grading within FEMA 100-year and 500-year floodplains.

- Coordinate with County and municipal planners on reviews of subdivision and land development plans and provide comments that emphasize the preservation of natural hydrologic processes and sensitive environmental resources.

- Continue and expand programs that regularly coordinate with and offer educational opportunities to elected officials, local boards and commissions, Environmental Advisory Committees, and municipal staff to support local water resource management and decision making.
Stakeholder Roles

County

- Encourage municipalities to revise their ordinances to facilitate the use of green infrastructure and conservation design/low impact development to enhance onsite stormwater management systems, expand greenways, and maintain natural hydrologic systems
- Seek opportunities for collaboration and coordination among municipalities to enact complementary natural resource protection standards within and across watersheds;
- Facilitate and consider grant opportunities for intermunicipal cooperative agreements for water protection strategies that share services and provide regional solutions in a cost efficient manner
- Coordinate with municipalities to strengthen existing riparian buffer ordinances; support municipal on-lot septic system management programs
- Promote improved stormwater management on redevelopment and infill development projects
- Encourage municipal development standards that reduce unnecessary impervious cover for proposed development (roadway widths, commercial parking requirements, double sidewalks, curbs, building setbacks, and cul-de-sac dimensions)
- Coordinate with County and municipal planners to provide robust comments on subdivision and land development plans that support the preservation of natural hydrologic processes and sensitive environmental resources

Municipalities

- Consider revising and updating municipal ordinances to facilitate the use of green infrastructure and conservation design/low impact development to enhance onsite stormwater management systems, expand greenways, and maintain natural hydrologic systems
- Seek opportunities for municipal collaboration and coordination to enact complimentary natural resource protection standards within and across watersheds
- Consider intermunicipal cooperative agreements for water protection strategies that share services and provide regional solutions in a cost efficient manner
- Strengthen existing riparian buffer ordinances to protect at least 100 feet from the water edge for all streams, 150 feet from the edge of water for Exceptional Value and High-Quality Streams, and 50 feet from the edge of wetlands
- Enact municipal on-lot septic system management programs; consider code revisions that improve stormwater management on redevelopment and infill development projects
- Consider municipal development standards that reduce unnecessary impervious cover for proposed development (roadway widths, commercial parking requirements, double sidewalks, curbs, building setbacks, and cul-de-sac dimensions)
- Encourage the submission of sketch plans with stormwater management information in the land development process and incentivize discussions with municipal planning commissions and municipal engineers prior to preliminary/final plan submission
- Consider code incentives (increases in density, streamlined review process, cost savings, etc.) that increase natural resource and water quality incentives)

Where We’re Headed

Chapter 5
Conservation and Community Organizations

- Consider regional, watershed-based outreach to municipalities to accomplish multi-municipal planning and complementary natural resource protection standards within and across watersheds
- Promote and educate constituencies about property management strategies that improve water quality, reduce impervious surfaces, increase tree planning, and promote distributed infiltration of stormwater runoff
- Educate constituencies about the value in managing on-lot septic systems

Utilities

- Participate in intermunicipal cooperative agreements to help implement water protection policies and programs
- Coordinate with municipalities and support efforts to strengthen riparian buffer protections
- Coordinate with municipalities and support efforts to prevent stream channel and bank stabilization, reduce impacts to aquatic communities, and improve water quality and stream baseflows
- Support municipal programs for on-lot septic system maintenance
- Promote municipal floodplain ordinances that restrict activities within FEMA 100-year and 500-year floodplains

Residents/Local Businesses

- Participate in efforts to update municipal ordinances that facilitate green infrastructure, low impact development, conservation design, natural resource protection, stormwater management, riparian buffer protection, and floodplain protection
- Comment on development proposals and support municipal efforts to preserve natural hydrologic processes and sensitive environmental resources
- Participate on boards and commissions that work to improve local environmental conditions

Indicators of Progress

- % of municipalities with active EACs, Green Teams, or similar municipal committees
- % of municipalities that have adopted comprehensive natural resource ordinance regulations
- % of municipalities with a dedicated open space tax or funding program
Goal 7: Ensure Safe, Sustainable Water Supply and Wastewater Disposal Systems

**Objectives:**

7.1 Ensure safe and reliable water supplies for all County residents, agricultural operations, and businesses.

7.2 Implement measures to reduce the impact of nitrogen, phosphorus, chlorides, pathogens, and other contaminants on surface and groundwater withdrawals.

7.3 Coordinate planning between utilities, municipalities, and the County for new, upgraded, or expanded water/wastewater treatment facilities, distribution/collection systems, and other critical infrastructure.

7.4 Protect aquifers and stream baseflows from excessive withdrawals during periods of low flow and drought events by reducing water use.

7.5 Support facility upgrades to reduce the discharge of nitrogen, phosphorus, and contaminants of emerging concern into County waterways.

7.6 Identify areas impacted by emerging contaminants, such as PFAS, and evaluate and implement strategies to facilitate their removal at the source, rather than downstream at water or wastewater treatment facilities.

On a daily basis, a person’s most frequent interaction with water resources is likely to be when they turn on the tap or flush a toilet. Our communities rely on interconnected infrastructure systems to clean and deliver water directly to us, and then carry it away once it’s dirty to be cleaned again. Water and wastewater utilities are often on the front lines of pollution prevention and treatment. As such, it is critical to maintain open lines of communication between utilities and local governments in order to protect the sources of our water supplies, maintain and upgrade water and wastewater infrastructure, and manage the expansion of that infrastructure to prevent negative impacts on environmentally sensitive areas.
Strategies for Implementation

- Improve public access to information on residential well maintenance, well water testing, and water provider consumer confidence reports.
- Develop and maintain coordination strategies between water and wastewater utilities to ensure that any projected expansion is consistent with the County’s planned growth areas, water supply availability, and municipal comprehensive plans.
- Consider immediate and long-term impacts to water quality, quantity, and natural resources when planning water/wastewater infrastructure expansion projects, including the effects of future development associated with such expansion.
- Promote agreements between utilities and municipalities, to be filed with the Public Utilities Commission (PUC), that implement the municipality’s designated planned service areas and establish a process for coordination, planning, approval, and limitations for extension of service or infrastructure.
- Support the development and implementation of source water protection plans by local water suppliers.
- Establish clear methods of communication between water suppliers, first responders, and emergency services to improve notification of hazardous spill events upstream of surface water intakes or in proximity of wellhead areas or groundwater supplies.
- Promote the development and implementation of management plans for water supply reservoirs to address water quality problems and sources of potential pollutants.
- Inventory municipalities with existing wellhead protection standards and identify communities where adopting such standards would be beneficial to protect sources of public water supply.
- Continue to support collaborative efforts between Chester County and the USGS to support programs, such as the Chester County Observation Well Network, to maintain robust drought monitoring and management capabilities.
- Develop methods to clearly communicate drought watches and drought warnings to municipalities, residents, businesses, agricultural producers, and community organizations.
- Develop current and long-term water use projections to assess the sustainability of future water supplies, including projections of the impacts of climate change on these supplies.
- Help connect wastewater treatment facilities in need of system upgrades with funding opportunities to support those needs.
- Expand groundwater and surface water monitoring efforts to identify areas impacted by emerging contaminants, such as PFAS, and assess alternative water supply options to ensure compliance with PADEP maximum contaminant levels.
Stakeholder Roles

County

- Assist municipalities in compiling information on residential well maintenance, well water testing and water provide consumer confidence reports
- Coordinate with municipalities and utility providers to ensure that projected water and wastewater expansions are consistent with the county’s planned growth areas, municipal planning, and utility availability
- Coordinate with municipalities and utility providers to ensure that infrastructure expansions minimize impacts to water quality, quantity and natural resources
- Promote agreements between utilities and municipalities that implement the municipality’s designated planned service areas and establish a process for coordination, planning, approval, and limitations for extension of service or infrastructure
- Support the development and implementation of source water protection plans by local water suppliers
- Establish clear methods of communication between water suppliers, first responders, and emergency services to improve notification of hazardous spill events upstream of surface water intakes or in proximity of wellhead areas or groundwater supplies
- Promote the development and implementation of lake management plans for water supply reservoirs to address water quality problems and sources of potential pollutants
- Inventory municipalities with existing wellhead protection standards and identify communities where adopting such standards would be beneficial to protect sources of public water supply
- Work with PADEP to develop methods to clearly communicate drought watches and drought warnings to municipalities, residents, businesses, agricultural producers, and community organizations
- Work with PADEP and utility providers to develop current and long-term water use projections to assess the sustainability of future water supplies, including projections of the impacts of climate change on these supplies
- Work with PADEP and utility providers to identify wastewater treatment facilities in need of system upgrades funding opportunities to support those needs
- Work with the USGS and PADEP to expand groundwater and surface water monitoring efforts to identify areas impacted by emerging contaminants, such as PFAS, and assess alternative water supply options to ensure compliance with PA DEP maximum contaminant levels
Municipalities

- Collaborate with the county to improve public access to information on residential well maintenance, well water testing, and water provider consumer confidence reports.
- Collaborate with the county and utility providers to ensure that projected water and wastewater expansions are consistent with the county’s planned growth areas, municipal planning, and utility availability.
- Coordinate with the county and utility providers to ensure that infrastructure expansions minimize impacts to water quality, quantity and natural resources.
- Promote agreements with utilities that respect municipal designated planned service areas and establish a process for coordination, planning, approval, and limitations for extension of service or infrastructure.
- Support the development and implementation of source water protection plans by local water suppliers.
- Consider wellhead protection standards and collaborate on the county’s intended inventory of such standards and their usefulness.
- Support the development and implementation of source water protection plans by local water suppliers.
- Collaborate with the county and PADEP to disseminate information on drought watches and drought warnings.

Conservation and Community Organizations

- Support municipal and county efforts to improve public access to information on residential well maintenance, well water testing, and water provider consumer confidence reports.
- Support the development and implementation of source water protection plans by local water suppliers.
- Promote the development and implementation of lake management plans for water supply reservoirs to address water quality problems and sources of potential pollutants.
- Provide guidance to municipalities on the value of wellhead protection standards.
- Support collaborative efforts between Chester County and the USGS to support programs, such as the Chester County Observation Well Network, to maintain robust drought monitoring and management capabilities.
- Participate in drought watch and drought warning communications programs.
- Support groundwater and surface water monitoring efforts to identify areas impacted by emerging contaminants, such as PFAS.
Stakeholder Roles (continued)

Utilities

- Coordinate with municipalities and the county to ensure that projected water and wastewater expansions are consistent with the county’s planned growth areas, municipal planning, and utility availability.
- Coordinate with municipalities and the county to ensure that infrastructure expansions minimize impacts to water quality, quantity, and natural resources.
- Engage in agreements with municipalities, to be filed with the PUC, that implement the municipality’s designated planned service areas and establish a process for coordination, planning, approval, and limitations for extension of service or infrastructure.
- Undertake the development and implementation of source water protection plans.
- Establish clear methods of communication with first responders and emergency services to improve notification of hazardous spill events upstream of surface water intakes or in proximity of wellhead areas or groundwater supplies.
- Undertake development and implementation of lake management plans for water supply reservoirs to address water quality problems and sources of potential pollutants.
- Work with PADEP and the county to develop current and long-term water use projections to assess the sustainability of future water supplies, including projections of the impacts of climate change on these supplies.
- Work with PADEP and the county to identify wastewater treatment facilities in need of system upgrades funding opportunities to support those needs.

Residents/Local Businesses

- Become educated on issues related to residential well maintenance and well water testing.
- Participate in local planning to protect local water supplies.
- Enact wellhead protection, and ensure proper wastewater management.
- Support municipally designated planned service areas and participate in the public process regarding the coordination, planning, approval, and limitations for extension of service or infrastructure.
- Implement water conservation measures regularly and cooperate with restricted water use guidance during droughts.

Indicators of Progress

- # of major water suppliers that have active source water committees
- Total volume of groundwater withdrawals compared to 1 in 25-year stream baseflows
- # of new (constructed) development units connecting to public sewer and water services in designated growth areas
- # of square miles of new sewer service area
- $ of funding contributed by water utilities to local source water/watershed restoration projects
- % reductions in annual water loss for public and community water supplies
- $ invested in upgrades (technological or procedural) to address emerging contaminants at water treatment facilities
Chapter 6
How We Get There
Chapter 6: How We Get There

The seven goals outlined in this plan are big picture, inter-related, and inter-dependent. Each goal involves aspects of water quality, water quantity, resource management, and community involvement. However, regardless of a watershed plan’s scale, most of the implementation work occurs at the local level.

Each of Chester County’s 21 watersheds has a unique combination of characteristics and challenges. Priority goals and strategies were developed for each watershed to guide efforts where they are most needed. This was done through extensive stakeholder engagement and analysis of current and projected conditions of each watershed, assessed through the lenses of:

- **Existing USGS Cooperative Water Quality Monitoring Program data, where available**
  - IBI scores, nitrate + nitrite, orthophosphate, and chlorides
- **Critical natural resources**
  - stream designations, fisheries, 1st order streams, preserved lands, woodland buffer coverage, karst geology
- **Existing water quality concerns**
  - stream impairments, TMDLs, fish consumption advisories, PA Act 2/CERCLA Superfund contaminated sites, emerging contaminant concerns
- **Water use and availability**
  - DRBC Southeastern PA GWPA coverage, importance for source water supply, existing and projected water balance concerns under 10-year average low flow drought conditions
- **Stormwater and flooding**
  - historical reports of flooding in Chester County, communities with MS4 permits or waivers, major flood control facilities
- **Growth and Development**
  - population centers, PADEP 2015 Environmental Justice Areas in Chester County, areas of potential conflict between projected growth and critical water or natural resources
These goals and strategies, along with the list of potential stakeholders (aka: prospective implementers), represent critical priorities for each watershed as determined by subcommittees of local partners during the Watersheds 2045 planning process, and should be seen as a launching point rather than a limit on water resource protection efforts over the next two decades. Furthermore, they are primarily targeted at the Chester County portions of these watersheds, although many apply broadly throughout. Efforts by all partners, including the work undertaken by neighboring counties and states, will be critical to achieving our shared goals at both local and regional scales.
Chester Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Improve stormwater management to increase infiltration and protect baseflow
2. Restore vulnerable stream channels and vegetated riparian corridors
3. Address legacy and emerging contaminants
4. Reduce nutrient pollution in streams, lakes, and reservoirs
5. Promote source water protection methods for water supply intakes, reservoirs, and wells

Watershed Area: 66.3 sq mi
Stream Miles: 160 mi

- Agriculture: 6%
- Developed (Non-Residential): 31%
- Residential: 19%
- Water/Wetlands: 1%
- Wooded/Undeveloped: 43%
Highlighted Strategies and Potential Stakeholders

**Provide educational resources and technical assistance** on watershed management issues for local municipal officials and staff

**Potential Stakeholders:**
Chester County Water Resources Authority, Chester County Planning Commission, Chester County Conservation District, Conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Goose Creek Alliance), Chester County Association of Township Officials (CCATO), Pennsylvania State Association of Township Supervisors (PSATS)

**Enhance coordination** among upstream and downstream municipalities and stakeholder groups around water resource issues

**Potential Stakeholders:**
Municipalities, conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Darby Creek Valley Association, Goose Creek Alliance), Chester County Water Resources Authority

**Identify, assess, and address contaminated sites** and their downstream impacts

**Potential Stakeholders:**
PADEP, municipalities, conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Darby Creek Valley Association)

**Improve public education** around stormwater management, land management strategies, road salt application, and other activities that can have a direct impact on water quality

**Potential Stakeholders:**
Conservation organizations (Chester Ridly Crum Watersheds Association, Willistown Conservation Trust, Darby Creek Valley Association), Chester County Water Resources Authority, Chester County Planning Commission, Chester County Conservation District

**Support implementation of the Goose Creek TMDL plan** to reduce total phosphorus loads

**Potential Stakeholders:**
Municipalities, conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Darby Creek Valley Association, Goose Creek Alliance), Chester County Water Resources Authority, wastewater utilities
Current and Projected Conditions

The majority of streams designated as Trout Stocking Fisheries. Natural trout fisheries in Rocky Run.

Water Quality

100% of PADEP-assessed streams (132.7 miles total) are impaired for one or more of their State-designated uses

• **Aquatic life**: entire watershed  
  (urban runoff/storm sewers – habitat modification, flow regime modification, organic enrichment)

• **Recreation**: impairments in Chrome Run, Crum Run, Goose Creek, Green Creek, and Webb Creek, portions of the East and West Branch and lower main stem  
  (pathogens or fecal coliform – source unknown)

• **Fish consumption**: mouth of the watershed  
  (PCBs – source unknown)

**Additional known water quality concerns**

• **Fish consumption advisories**  
  For channel catfish and American eel from the confluence of the West Branch to the mouth related to mercury levels

• **PA Act 2 contamination sites** (66 groundwater sites, 2 surface water sites)  
  Primarily around West Chester, Lima, and Concordville

• **Contaminants of emerging concern**  
  USGS sampling shows elevated levels of PFAS in the East Branch Chester Creek at Westtown
Chester Creek

Water Use and Availability

Source water for public and community water systems
Chester Creek is a source of drinking water supplies for Aqua PA

DRBC Southeastern PA Groundwater Protection Area covers upper portions of the watershed

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability

Stormwater and Flooding

Reported flooding hotspots in Chester County
Several locations in West Chester Borough; along Chester Creek in East Goshen, Westtown, and Thornbury

21 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Chester Creek watershed
West Chester, Lima, Chester Heights, City of Chester

Projected growth areas
Along the north side of Route 926 overlap many 1st order streams and their drainage areas

PADEP Environmental Justice Areas in Chester County
Portions of West Chester Borough
Christina River

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect vegetated riparian corridors
2. Promote agricultural and residential land stewardship to protect water quality
3. Preserve and enhance water-based recreational opportunities and access
4. Reduce stormwater runoff, especially in the more developed portions of the lower watershed

Watershed Area: 78 sq mi
Stream Miles: 129 mi
Highlighted Strategies and Potential Stakeholders

Provide educational resources and opportunities to landowners to improve stewardship practices

**Potential Stakeholders:**
Conservation organizations (Christina Conservancy, Delaware Nature Society, Brandywine Conservancy), Chester County Conservation District, New Castle County Conservation District, Cecil County Conservation District

Coordinate across agencies and organizations to implement the Christina Basin TMDL Plan

**Potential Stakeholders:**
State agencies (PADEP, DNREC, MDE), municipalities, New Castle County, conservation organizations (Christina Conservancy, Delaware Nature Society, Brandywine Conservancy), Christina Basin Task Force, wastewater utilities
Current and Projected Conditions

Stream designations by state:
- PA – Warm Water & Migratory Fishes
- MD – Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life
- DE – Public Water Supply (fresh water segments only); Industrial Water Supply; Primary & Secondary Contact Recreation; Fish, Aquatic Life, & Wildlife; Cold Water Fish (put-and-take, March 15-June 30 from the MD/DE line through Rittenhouse Park)

Water Quality

No streams listed by PADEP as impaired (out of 4.85 miles assessed) of their designated uses
- Christina River Basin Low Flow Conditions TMDL (nutrients, dissolved oxygen)
- Christina River Basin High Flow Conditions TMDL (nutrients, dissolved oxygen, bacteria, sediment)

Additional known water quality concerns
- Fish consumption advisories
  For all finfish and stocked trout from the MD/DE state line to the mouth of the creek related to PCBs, dioxins, dieldrin, pesticides, and chlordane
- 3 National Priorities List Superfund sites
  Delaware near Brookside, Newport, and Wilmington
Water Use and Availability

Source water for public and community water systems
The Christina River serves as a source of drinking water supplies for Veolia Delaware

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability

Stormwater and Flooding

Reported flooding hotspots in Chester County
Along streams above White Horse Pike
2 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Christina River watershed
Newark, Glasgow, Wilmington

Projected growth areas
No areas of significant conflict between projected growth and critical natural resources anticipated in Chester County
Portions of West Chester Borough
Conestoga Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and steward forested headwaters
2. Restore water quality in impaired streams
3. Protect groundwater resources

Watershed Area: 49.2 sq mi
Stream Miles: 69.6 mi
Highlighted Strategies and Potential Stakeholders

**Implement nutrient management plans and agricultural BMPs** on farmland in the watershed

**Potential Stakeholders:**
Farmers/agricultural landowners, Chester County Conservation District, Lancaster County Conservation District, Berks County Conservation District, NRCS, conservation organizations (Alliance for the Chesapeake Bay, Lancaster Clean Water Partners, Chesapeake Bay Foundation)

**Implement strategies from the Conestoga Headwaters TMDL** for total phosphorus and the **Chesapeake Bay TMDL** for nitrogen, phosphorus, and sediment

**Potential Stakeholders:**
Berks County, Lancaster County, municipalities, wastewater dischargers, farmers/agricultural landowners, Susquehanna River Basin Commission, conservation organizations (Alliance for the Chesapeake Bay, Lancaster Clean Water Partners, Chesapeake Bay Foundation)

**Focus land preservation efforts** on headwater woodlands and riparian corridors in areas with unmanaged stormwater issues through retrofits and upgrades during redevelopment

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership)
Current and Projected Conditions

Streams in Conestoga Creek watershed designated as Warm Water Fisheries.
Karst/carbonate geology present in most of the watershed

Water Quality

99% of PADEP-assessed streams (65.4 miles out of 65.8 total assessed miles) are impaired for one or more of their State-designated uses

- **Aquatic life**: throughout the watershed
  - (nutrients and siltation from agriculture and grazing activities)
- **Recreation**: throughout the watershed
  - (pathogens from agriculture, urban stormwater runoff, and unknown sources)

*Conestoga Headwaters TMDL (total phosphorus)*
*Chesapeake Bay TMDL (nitrogen, phosphorus, and sediment)*

Additional known water quality concerns

- **PA Act 2 contamination sites** (25 groundwater sites)
  - Predominantly in the upper watershed around Morgantown and the PA Turnpike
Water Use and Availability

Current and projected concerns regarding water availability during drought

No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

8 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Conestoga Creek watershed

Elverson, Morgantown

Projected growth areas cover most of the watershed

No areas of significant conflict between projected growth and critical natural resources anticipated in Chester County
Crum Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. **Improve stormwater management and reduce runoff from developed areas**
2. **Maintain and protect woodlands and tree canopies**
3. **Protect and restore stream banks, riparian buffers, and in-stream habitat conditions**
4. **Continue and expand source water protection efforts for water supply intakes and reservoirs**

![Image of Crum Creek Watershed Area: 38.3 sq mi Stream Miles: 85.7 mi]

- **Agriculture**: 45%
- **Developed (Non-Residential)**: 30%
- **Residential**: 15%
- **Water/Wetlands**: 8%
- **Wooded/Undeveloped**: 2%
Highlighted Strategies and Potential Stakeholders

Identify opportunities to align water quality restoration efforts with fish habitat restoration to sustain stocked/native trout populations

**Potential Stakeholders:**
Conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Natural Lands), angling groups/fishing clubs

Promote and support the use of conservation/low-impact design principles for new developments and redevelopment

**Potential Stakeholders:**
Chester County Planning Commission, Delaware County Planning Commission, municipalities, conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Natural Lands)

Provide educational resources and opportunities to landowners to improve stewardship practices

**Potential Stakeholders:**
Conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Natural Lands), Chester County Conservation District, Delaware County Conservation District
Current and Projected Conditions

Exceptional Value designation in the Upper West Branch
High Quality designation in the East Branch to approximately the Chester/Delaware County line
Cold Water/Migratory Fishes designation in from below the County line to East Bishop Hollow Road
Warm Water Fishes designation in the lower watershed;
Natural trout fisheries from the headwaters to the Springton Lake Reservoir
2 PA Natural Diversity Index (PNDI) critical habitat sites.

Water Quality

99% of PADEP-assessed streams (68.5 miles out of 69.3 total assessed miles) are impaired for one or more of their State-designated uses

- **Aquatic life**: throughout the watershed
  (urban runoff/storm sewers – siltation, flow regime modification, habitat modification)

- **Recreation**: impairments in the upper West Branch, from the County line to Springton Lake Reservoir, Hunter Run, Trout Run, Little Crum Creek, and the main stem from Yale Avenue to the confluence with Little Crum Creek
  (pathogens – source unknown)

- **Fish consumption**: impairment in a small tributary of the upper East Branch below Paoli
  (PCBs – source unknown)

Additional known water quality concerns

- **PA Act 2 contamination sites** (21 groundwater sites)
  Located primarily below Baltimore Pike
**Water Use and Availability**

Source water for public and community water systems

Crum Creek serves as source of drinking water supplies for Aqua Pennsylvania

**DRBC Southeastern PA Groundwater Protection Area** covers upper portions of the watershed to the County line

Current and projected concerns regarding water availability during drought

No significant current or projected future concerns regarding water availability

**Stormwater and Flooding**

18 PA municipalities with MS4 permits

**Growth and Development**

Major population centers in the Crum Creek watershed

- Malvern, Paoli, Swarthmore

Projected growth areas cover most of the watershed

- Around Malvern overlap headwater drainage areas as well as EV/HQ stream sections

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**USGS Cooperative Monitoring Program - Sampling Data Averages**

Chloride (Cl) data average from 2015-2019, all other data averages from 2010-2019

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Darby Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Reduce stormwater runoff to mitigate local and downstream flooding
2. Restore floodplain connectivity and vegetated riparian corridors
3. Address legacy and emerging contaminants
4. Preserve and enhance habitat for sensitive aquatic species

Watershed Area: 77.2 sq mi
Stream Miles: 119 mi
Highlighted Strategies and Potential Stakeholders

Identify and pursue opportunities to restore riparian buffers and floodplain connectivity

**Potential Stakeholders:**
Chester County Conservation District, Delaware County Conservation District, municipalities, conservation organizations (Darby Creek Valley Association, Willistown Conservation Trust)

Promote and support the use of conservation/low-impact design principles for new developments and redevelopment

**Potential Stakeholders:**
Chester County Planning Commission, Delaware County Planning Commission, municipalities, conservation organizations (Darby Creek Valley Association, Willistown Conservation Trust, Natural Lands)

Provide educational resources and opportunities to landowners to improve stewardship practices

**Potential Stakeholders:**
Conservation organizations (Willistown Conservation Trust, Darby Creek Valley Association, Natural Lands), Chester County Conservation District, Delaware County Conservation District

Assess and identify opportunities to address sources of legacy and emerging contaminants including PCBs and chloride

**Potential Stakeholders:**
PADEP, USGS, conservation organizations (Willistown Conservation Trust, Darby Creek Valley Association), water utilities (Aqua PA)
Current and Projected Conditions

Current and Projected Conditions

Cold Water/Migratory Fishes designation in the upper Darby Creek above Route 3
Trout Stocking/Migratory Fishes designation along the river corridor from Route 3 to the mouth
Warm Water/Migratory Fishes designation in the remainder of the watershed
Natural trout fisheries in Ithan Creek

48% of total stream miles are 1st order streams
16% of Chester County portion of watershed preserved
42% woodland coverage within 50ft riparian buffer zone

Water Quality

100% of PADEP-assessed streams (121.4 miles total) are impaired for one or more of their State-designated uses

- **Aquatic life**: throughout the watershed
  - (urban runoff/storm sewers – flow regime modification, habitat modification, municipal point sources, cause unknown)
- **Recreation**: impairments in the headwaters south of Daylesford, Stony Run, Cobbs Creek, upper Ithan Creek, Meadowbrook Run, Muckinipattis Creek, and Darby Creek from below Sawmill Road to the mouth
  - (pathogens – source unknown)
- **Fish consumption**: entire watershed
  - (PCBs – source unknown)

Additional known water quality concerns:

- **PA Act 2 contamination sites** (125 groundwater sites, 1 surface water site)
  - Clustered along major transportation corridors, including Route 30, Route 3, and the major SEPTA/AMTRAK train lines, as well as in the areas adjacent to south Philadelphia
- **4 National Priorities List Superfund sites**
  - Near Oakmont, Landsdowne, and the John Heinz National Wildlife Refuge
- **Fish Consumption Advisories**
  - For channel catfish throughout the watershed related to PCBs
Water Use and Availability

DRBC Southeastern PA Groundwater Protection Area covers the upper portions of the watershed above the County line

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County
- Outside of Berwyn in Easttown Township

33 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Darby Creek watershed
- Ardmore, Broomall, Drexel Hill, Springfield, south Philadelphia

Projected growth areas cover the entire watershed above the County line
- Future development may overlap with headwater drainages and 1st order streams
Elk Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore headwater streams and vegetated riparian corridors
2. Reduce agricultural and urban nonpoint source runoff
3. Protect groundwater resources
4. Restore water quality in impaired streams
5. Create and enhance water-based recreational opportunities

Watershed Area: 96.2 sq mi
Stream Miles: 271.6 mi

- Agriculture
- Developed (Non-Residential)
- Residential
- Water/Wetlands
- Wooded/Undeveloped
Highlighted Strategies and Potential Stakeholders

**Promote and support the use of conservation/low-impact design principles** for new development, especially in the headwaters and along the Route 1 corridor

**Potential Stakeholders:**
Chester County Planning Commission, Cecil County Land Use and Development Services, municipalities, conservation organizations (Elk Creeks Watershed Association, Elk & Northeast Rivers Watershed Association, Alliance for the Chesapeake Bay, Chesapeake Bay Foundation)

**Work with agricultural landowners**, including Plain Sect farmers, to implement BMPs that reduce nutrient and sediment pollution related to farm activities

**Potential Stakeholders:**
Chester County Conservation District, Cecil County Conservation District, NRCS, conservation organizations (Elk Creeks Watershed Association, Elk & Northeast Rivers Watershed Association, Stroud Water Research Center, Alliance for the Chesapeake Bay, Chesapeake Bay Foundation)

**Restore vegetated riparian buffers**, with an emphasis on reforesting the riparian corridor, where possible

**Potential Stakeholders:**
Chester County Conservation District, Cecil County Conservation District, conservation organizations (Elk Creeks Watershed Association, Elk & Northeast Rivers Watershed Association, Stroud Water Research Center, Alliance for the Chesapeake Bay, Chesapeake Bay Foundation)

**Support water-based recreational opportunities** and restoration at key locations in the watershed, including the new Big Elk Creek State Park

**Potential Stakeholders:**
PA DCNR, conservation organizations (Elk Creeks Watershed Association, Elk & Northeast Rivers Watershed Association), angler groups
Current and Projected Conditions

Designations by state:
- PA – Exceptional Value designation in Jordan Run; High Quality designation in the rest of the watershed above the PA/MD state line
- MD – Water Contact Recreation and Protection of Nontidal Warm Water Aquatic Life in Little Elk Creek; Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply in the Big Elk Creek

4 PA Natural Diversity Index (PNDI) critical habitat sites

Water Quality

97% of PADEP-assessed streams (104.4 miles out of 107.4 total assessed) are impaired for one or more of their State-designated uses
- Aquatic life: throughout the watershed above the PA/MD state line
  - (agriculture – siltation, cause unknown; urban runoff/storm sewers – siltation, cause unknown; habitat modification)

Additional known water quality concerns:
- PA Act 2 contamination sites (9 groundwater sites)
  - Around Oxford and along Baltimore Pike
- 1 National Priorities List Superfund sites
  - Near Andora, MD
Elk Creek

Water Use and Availability

Source water for public and community water systems
Big Elk Creek is a source of drinking water supplies for the Elkton Maryland Public Water System

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County
Along the East Branch Big Elk Creek and Forest Manor Road in Upper Oxford, and along the West Branch at Penns Grove Road

5 PA municipalities with MS4 permits
3 with permit waivers

Growth and Development

Large population centers in the Elk Creek watershed
Oxford, Jennersville, Cherry Hill

Projected growth areas
Around Oxford and Atglen, overlapping with some 1st order streams and their drainage areas

PADEP Environmental Justice Areas in Chester County
Greater Oxford area

USGS Cooperative Monitoring Program - Sampling Data Averages
Chloride (Cl) data average from 2015-2019, all other data averages from 2010-2019

<table>
<thead>
<tr>
<th>Big Elk Creek at Maple Grove</th>
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<td>IBI Score</td>
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French Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. **Address causes of stream impairments**
2. **Maintain existing water quality in high performing and critical habitat streams**
3. **Continue momentum with land preservation efforts, especially along 1st order streams and riparian corridors**
4. **Restore and enhance the function of vegetated riparian buffers**
5. **Restore and enhance floodplain connectivity and function**

![Pie chart showing land use percentages: Agriculture 49%, Developed (Non-Residential) 27%, Residential 18%, Water/Wetlands 5%, Wooded/Undeveloped 1%]

<table>
<thead>
<tr>
<th>Land Use</th>
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<tr>
<td>Agriculture</td>
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<td>Water/Wetlands</td>
<td>5%</td>
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<tr>
<td>Wooded/Undeveloped</td>
<td>1%</td>
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![Map of French Creek watershed with highlighted area]

- **Watershed Area:** 70.2 sq mi
- **Stream Miles:** 204.8 mi
Highlighted Strategies and Potential Stakeholders

Create and/or strengthen incentives for proposed land preservation projects that protect vegetated riparian corridors and floodplain connectivity

**Potential Stakeholders:**
Chester County Parks + Preservation, municipalities with local open space programs, DCNR, other open space funding partners

Incorporate anticipated impacts of climate change into planning restoration and stewardship efforts (changing precipitation patterns destabilizing buffers, shifts in quality and composition of tree canopy, etc.)

**Potential Stakeholders:**
Municipalities, land trusts (French and Pickering Creeks Conservation Trust, Natural Lands, Green Valleys Watershed Association), DCNR, private landowners

Incorporate anticipated impacts of climate change into designs for future agricultural and urban/suburban stormwater BMPs

**Potential Stakeholders:**
Chester County Water Resources Authority, Chester County Conservation District, NRCS, PADEP, conservation organizations (French and Pickering Creeks Conservation Trust, Natural Lands, Green Valleys Watershed Association, Berks Nature),

Provide educational resources and technical assistance on watershed management issues for local municipal officials and staff

**Potential Stakeholders:**
Chester County Water Resources Authority, Chester County Conservation District, conservation organizations (French and Pickering Creeks Conservation Trust, Natural Lands, Green Valleys Watershed Association, Berks Nature, Schuylkill Action Network, Pennsylvania Environmental Council), CCATO, PSATS

Strengthen the language and enforcement of ordinances to protect water quality and natural resources

**Potential Stakeholders:**
Municipalities (with support from Chester County Planning Commission, Chester County Water Resources Authority, conservation organizations, and PADEP)
## Current and Projected Conditions

### Exceptional Value designation in the Upper Watershed

High Quality Trout Stocking designations in unnamed tributaries to the main stem in the middle of the watershed

Trout Stocking/Migratory Fishes designation from just above East Pikeland Elementary School to Phoenixville

### Water Quality

34% of PADEP-assessed streams (36.9 miles out of 108.3 total assessed) are impaired for one or more of their State-designated uses

- **Aquatic life:** South Branch French Creek, Pine Creek and unnamed tributaries to French Creek near Cooks Glen Park in West Vincent Township
  
  (agriculture – siltation, cause unknown; habitat modification)

- **Recreation:** impairments in Birch Run, South Branch French Creek, and French Creek below Schuylkill Road in East Pikeland
  
  (pathogens – source unknown)

### Additional known water quality concerns:

- **PA Act 2 contamination sites** (29 groundwater sites, 2 surface water sites)
  
  Predominantly located in the lower third of the watershed in the greater Phoenixville area

- **1 National Priorities List Superfund sites**
  
  Kimberton
French Creek

USGS Cooperative Monitoring Program - Sampling Data Averages

Chloride (Cl) data average from 2015-2019, all other data averages from 2010-2019

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Water Use and Availability

DRBC Southeastern PA Groundwater Protection Area covers municipalities in the northern portion of the watershed

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability

Stormwater and Flooding

Reported flooding hotspots in Chester County

- Along the lower French Creek at Phoenixville, Rapps Dam Road, and Hares Hill Road

12 PA municipalities with MS4 permits

- 3 with permit waivers

Growth and Development

Major population centers in the French Creek watershed

- Phoenixville, Kimberton

Projected growth areas

- Projected impervious cover increases of more than 20% in East Pikeland and East Vincent
- Overlapping some 1st order streams (including EV and HQ streams) and their drainage areas
Lower Brandywine Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Address water quality impairments
2. Identify and implement flood mitigation strategies
3. Promote active stewardship of preserved open space
4. Protect and restore vegetated riparian buffers and floodplain connectivity
5. Promote and increase water-based recreational opportunities
Highlighted Strategies and Potential Stakeholders

Work with farmers to implement nutrient management plans and BMPs that address pollution related to agricultural activities

**Potential Stakeholders:**
Chester County Conservation District, NRCS, conservation organizations (Brandywine Red Clay Alliance, Brandywine Conservancy)

Evaluate and implement flood control strategies to reduce risks to public safety, especially in vulnerable and/or historically marginalized communities

**Potential Stakeholders:**
Chester County Water Resources Authority, University of Delaware Water Resources Center, City of Wilmington, New Castle County, Christina Basin Task Force, municipalities, conservation organizations (Brandywine Conservancy, Christina Watersheds Municipal Partnership), FEMA, PEMA, DEMA, community organizations

Prioritize riparian corridors, 1st order streams, and floodplains in land preservation efforts

**Potential Stakeholders:**
Conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Natural Lands, Delaware Nature Society, Brandywine River Restoration Trust), Chester County Parks + Preservation

Provide educational resources and opportunities to landowners and residents to improve environmental awareness and natural resource stewardship

**Potential Stakeholders:**
Conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Natural Lands, Christina Watersheds Municipal Partnership, Delaware Nature Society, Partnership for the Delaware Estuary, Brandywine River Restoration

Identify opportunities to promote and improve recreational access along the Brandywine Creek

**Potential Stakeholders:**
Conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Natural Lands), Delaware State Parks, municipalities, City of Wilmington, recreational outfitters

Support holistic, multi-jurisdictional efforts to address shared water quality issues across municipal and state lines

**Potential Stakeholders:**
Municipalities, County agencies, City of Wilmington, PADEP, DNREC, Christina Basin Task Force, University of Delaware Water Resources Center, conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Christina Watersheds Municipal Partnership, Brandywine River Restoration Trust)
Current and Projected Conditions

Designations by state:
- PA – Exceptional Value designation in Jordan Run; High Quality designation in the rest of the watershed above the PA/MD state line
- MD – Water Contact Recreation and Protection of Nontidal Warm Water Aquatic Life in Little Elk Creek; Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply in the Big Elk Creek

PA Scenic River designation
3 PA Natural Diversity Index (PNDI) critical habitat sites
Natural trout fisheries in Ring Run and along the main stem from the confluence of the East and West Branches to Chadds Ford:

44% of total stream miles are 1st order streams
17% of Chester County portion of watershed preserved
65% woodland coverage within 50ft riparian buffer zone

Water Quality

61% of PADEP-assessed streams (66.5 miles out of 109 total assessed) are impaired for one or more of their State-designated uses
- Aquatic life: impairments in Harvey Run, Radley Run, Pocopson Creek, Plum Run, Craigs Mill Run, and along sections of the main stem and unnamed tributaries to the Lower Brandywine Creek
  (agriculture – siltation; urban runoff/storm sewers – siltation, flow regime modification)

Additional known water quality concerns:
- PA Act 2 contamination sites (5 groundwater sites)
  Predominantly along Route 202 corridor

Christina River Basin Low Flow Conditions TMDL (nutrients, dissolved oxygen)
Christina River Basin High Flow Conditions TMDL (nutrients, dissolved oxygen, bacteria, sediment)
Lower Brandywine Chlordane TMDL (chlordane)
Water Use and Availability

Source water for public and community water systems
The Lower Brandywine Creek is a source of drinking water supplies for the City of Wilmington.

DRBC Southeastern PA Groundwater Protection Area covers municipalities in the northeast section of the watershed.

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County
Around Chadds Ford, and at multiple locations along Creek Road and Route 52.

14 PA municipalities with MS4 permits
1 municipality with a permit waiver.

Growth and Development

Large population centers in the Lower Brandywine Creek watershed
Chadds Ford, Wilmington.

Projected growth areas
Along Route 52 overlap with some 1st order streams and their drainage areas.
Northeast Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore headwater streams and vegetated riparian corridors
2. Address water quality impairments and nonpoint source pollution
3. Protect groundwater resources

Subwatershed Plans

Watershed Area: 55.9 sq mi
Stream Miles: 105 mi
Highlighted Strategies and Potential Stakeholders

**Improve coordination between municipalities, state agencies, and key stakeholders** to address pollution related to stormwater runoff from major roadways and developed areas

**Potential Stakeholders:**
- Municipalities, PennDOT, MDOT, Cecil County Stormwater Management Division, Oxford Region Planning Committee, conservation organizations (Elk & Northeast Rivers Watershed Association)

**Identify and pursue opportunities to work with farmers**, including members of the Plain Sect community, to implement conservation plans and BMPs on agricultural lands

**Potential Stakeholders:**
- Chester County Conservation District, Cecil County Conservation District, NRCS, conservation organizations (Alliance for the Chesapeake Bay)

**Prioritize riparian corridors, 1st order streams, and floodplains in land preservation efforts**

**Potential Stakeholders:**
- Conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Natural Lands, Delaware Nature Society, Brandywine River Restoration Trust), Chester County Parks + Preservation

**Restore vegetated riparian buffers**, prioritizing reforestation of the riparian corridor where feasible

**Potential Stakeholders:**
- Chester County Conservation District, Cecil County Conservation District, conservation organizations (Alliance for the Chesapeake Bay)
Current and Projected Conditions

Designations by state:
- PA – Trout Stocking/Migratory Fishes
- MD – Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply in the main stem; Water Contact Recreation and Protection of Nontidal Warm Water Aquatic Life in the unnamed tributary to the southwest

Water Quality

100% of PADEP-assessed streams (15.8 miles total) are impaired for one or more of their State-designated uses

- Aquatic life: throughout the watershed
  - (agriculture – siltation, cause unknown; urban runoff/storm sewers – cause unknown; habitat modification)

Additional known water quality concerns:
- Fish consumption advisories
  - For American eel, brown bullhead, channel catfish, bass, hatchery-raised trout, spot, and perch related to PCBs from the PA/MD state line to the mouth
- 1 National Priorities List Superfund site
  - Mechanic Valley, MD

Chesapeake Bay TMDL
(nitrogen, phosphorus, sediment)
Northeast River Tidal Freshwater PCBs TMDL
(PCBs)
Water Use and Availability

Source water for public and community water systems
Northeast Creek is a source of drinking water supplies for the public water system in North East, MD

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

1 PA municipalities with MS4 permit
2 municipality with permit waivers

Growth and Development

Large population centers in the Northeast Creek watershed
Nottingham, North East

Projected growth areas
No areas of significant conflict between projected growth and critical natural resources anticipated in Chester County
Octoraro Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Improve water quality in impaired streams and groundwater
2. Reduce sediment and nutrient-laden runoff from agricultural and developed lands
3. Implement comprehensive stormwater management
4. Protect and restore vegetated riparian corridors
5. Implement source water protection for water supply intakes, reservoirs, and wells

Watershed Area: 187.2 sq mi
Stream Miles: 420.3 mi
Highlighted Strategies and Potential Stakeholders

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**Continue relationship-building and coordination with farmers**, including Plain Sect communities, to accelerate the implementation of BMPs on agricultural lands

**Potential Stakeholders:**
Chester County Conservation District, Lancaster County Conservation District, NRCS, conservation organizations (Octoraro Watershed Association, Octoraro Source Water Collaborative, Alliance for the Chesapeake Bay)

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**Expand stormwater management in developed and developing areas**, with an emphasis on expanding green stormwater infrastructure projects

**Potential Stakeholders:**
Chester County Conservation District, Lancaster County Conservation District, Chester County Water Resources Authority, Oxford Region Planning Committee, municipalities, conservation organizations (Octoraro Watershed Association, Octoraro Source Water Collaborative, Alliance for the Chesapeake Bay)

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**Assess options to expand public water and wastewater services** in areas that would benefit current residents without compromising natural resources or encouraging future sprawl

**Potential Stakeholders:**
Water and wastewater utilities (including Chester Water Authority), PennVEST, PADEP, Oxford Region Planning Committee

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**Leverage new and ongoing regional water quality initiatives in the broader Chesapeake Bay watershed** to bring additional funding, expertise, and resources to the Octoraro Creek watershed

**Potential Stakeholders:**
Susquehanna River Basin Commission, NRCS, PADEP, U.S. EPA, Chester County Water Resources Authority, Chester County Conservation District, Lancaster County Conservation District, conservation organizations (Octoraro Watershed Association, Octoraro Source Water Collaborative, Alliance for the Chesapeake Bay)

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**Support inter-municipal efforts to implement wellhead protection strategies**

**Potential Stakeholders:**
Municipalities, water utilities (Oxford Borough Water Department), Chester County Planning Commission, Chester County Water Resources Authority

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**Advance the priorities and strategies outlined in the Chesapeake Bay Countywide Action Plans**

**Potential Stakeholders:**
Chester County Conservation District, Lancaster County Conservation District, NRCS, Lancaster County Planning Commission, Chester County Water Resources Authority, PADEP
Current and Projected Conditions

Designations by state:
• PA – Exceptional Value in Black Run and an unnamed tributary to Octoraro Creek below Red Pump Road; High Quality designation in Annan Run, Knott Run, West Branch Octoraro Creek, McCready Run, and Reynolds Run; Trout Stocking/Migratory Fishes designation in the East Branch Octoraro Creek and most of the tributaries to the main stem in Chester County; Warm Water/Migratory Fishes along the main stem below the Octoraro Lake Reservoir
• MD – Non-tidal Cold Water and Public Water Supply designation in Stone Run; Recreational Trout Waters and Public Supply along the main stem

PA Scenic River designations for the West Branch, East Branch below Atglen, and main stem to the State line

Natural trout fisheries in the East Branch Octoraro Creek, Knott Run, and McCreary Run

Narrow band of karst/carbonate geology in the northern portion of the watershed

Water Quality

92% of PADEP-assessed streams (276.4 miles out of 301 total assessed) are impaired for one or more of their State-designated uses

• Aquatic life: throughout the watershed
  - (agriculture – nutrients, siltation, cause unknown; habitat modification; urban runoff/storm sewers – cause unknown)
• Potable Water Supply: impairments along the main stems of the East and West Branch Octoraro Creeks above the Octoraro Lake Reservoir
  - (agriculture – nutrients)
• Octoraro Lake Reservoir has Aquatic Life and Potable Water Supply impairments
  - (agriculture – nutrients)

Additional known water quality concerns:
• 15 PA Natural Diversity Index (PNDI) critical habitat sites
• PA Act 2 contamination sites (6 groundwater sites)
  - Several near Atglen, others along Route 10 farther south

Octoraro Creek Watershed TMDL (nitrogen, phosphorus, sediment)
Chesapeake Bay TMDL (nitrogen, phosphorus, sediment)
**Octoraro Creek**

**USGS Cooperative Monitoring Program - Sampling Data Averages**

Chloride (Cl) data average from 2015-2019; all other data averages from 2010-2019

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<th>Location</th>
<th>IBI Score</th>
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<th>PO4 as P</th>
<th>Cl</th>
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**Water Use and Availability**

Source water for public and community water systems

Octoraro Creek is a source of drinking water supplies for Chester Water Authority

Current and projected concerns regarding water availability during drought

- Current and projected future concerns regarding water availability during drought conditions in the Lower Octoraro Creek watershed below the reservoir (although the reservoir itself could provide some protection against ecological and community water stress).

**Stormwater and Flooding**

Reported flooding hotspots in Chester County

- Multiple locations along Rattlesnake Run east of Glenville Road, and along Catamount Road

- 6 PA municipalities with MS4 permits
  - 7 municipality with permit waivers

**Growth and Development**

- Large population centers in the Octoraro Creek watershed
  - Atglen, Christiana, Oxford, Rising Sun

- Projected growth areas
  - Around Oxford and Atglen overlap some 1st order streams and their drainage areas

- PADEP Environmental Justice Areas in Chester County
  - Greater Oxford area
Pequea Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore vegetated riparian corridors and aquatic habitats
2. Protect 1st order streams and their drainage areas
3. Restore water quality in impaired streams

Watershed Area: 33.6 sq mi
Stream Miles: 53.3 mi
Highlighted Strategies and Potential Stakeholders

Advance the priorities and strategies outlined in the Pequea Creek Watershed Restoration Plan and the Chesapeake Bay Countywide Action Plans

Potential Stakeholders:
Chester County Conservation District, Lancaster County Conservation District, Lancaster County Planning Commission, NRCS, Chester County Water Resources Authority, PADEP, PA DCNR, Susquehanna River Basin Commission, municipalities, conservation organizations (Chesapeake Bay Foundation, Lancaster Clean Water Partners, Pequea Creek Watershed Association, Lancaster Farmland Trust, Chesapeake Bay Conservancy, Alliance for the Chesapeake Bay)

Work with farmers, including Plain Sect communities, to implement BMPs on agricultural lands that address nutrient and sediment pollution

Potential Stakeholders:
Chester County Conservation District, Lancaster County Conservation District, NRCS, conservation organizations (Chesapeake Bay Foundation, Lancaster Clean Water Partners, Pequea Creek Watershed Association, Lancaster Farmland Trust, Chesapeake Bay Conservancy, Alliance for the Chesapeake Bay)

Prioritize areas that include riparian buffers, wetlands, and woodlands for land preservation

Potential Stakeholders:
Land trusts (Lancaster Farmland Trust, Chesapeake Bay Conservancy), Chester County Parks + Preservation, Lancaster County Agricultural Preserve Board, municipalities, PA DCNR

Educate and engage with local communities to encourage environmental stewardship across the watershed

Potential Stakeholders:
Chester County Conservation District, Lancaster County Conservation District, Lancaster County Planning Commission, Chester County Water Resources Authority, conservation organizations (Chesapeake Bay Foundation, Lancaster Clean Water Partners, Pequea Creek Watershed Association, Lancaster Farmland Trust, Chesapeake Bay Conservancy, Alliance for the Chesapeake Bay)
Current and Projected Conditions

Exceptional Value designation in upper branch Indian Spring Run
High Quality designation in middle branch Indian Spring Run and Pequea Creek above Route 897
Cold Water/Migratory Fishes designation below the confluence of the upper and middle branches of Indian Spring Run, and in the unnamed tributary of Pequea Creek in Salisbury Township
Warm Water/Migratory Fishes designation in White Horse Run and Pequea Creek below the confluence with White Horse Run
Natural trout fisheries in the upper and middle branches of Indian Spring Run
Karst/carbonate geology, predominantly on the Lancaster County side of the watershed

Water Quality

86% of PADEP-assessed streams (39.2 miles out of 45.6 total assessed) are impaired for one or more of their State-designated uses

- Aquatic life: throughout the watershed
  (habitat modification; agriculture – nutrients, organic enrichment, siltation)
- Recreation: throughout the watershed
  (pathogens – source unknown)

Additional known water quality concerns:

- PA Act 2 contamination sites (7 groundwater sites)
  Scattered throughout the watershed
- 1 National Priorities List Superfund site
  Along Kings Highway in West Caln Township

Pequea Creek Watershed Revised TMDL (phosphorus, sediment)
Chesapeake Bay TMDL (nitrogen, phosphorus, sediment)
Water Use and Availability

- Current and projected concerns regarding water availability during drought
  - No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

- Reported flooding hotspots in Chester County
  - Along Indian Spring Run at Cambridge Road
- 6 PA municipalities with MS4 permits

Growth and Development

- Major population centers in the Pequea watershed
  - Gap
- Projected growth areas
  - No significant areas of potential conflict between projected growth and critical natural resources in Chester Countys
Pickering Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore vegetated riparian buffers, 1st order streams, and floodplain connectivity
2. Reduce stormwater runoff and mitigate flooding
3. Address sources of stream impairments
4. Implement source water protection measures for water supply intakes and reservoirs
5. Encourage holistic planning to reduce potential conflict between future development and natural resources

![Pie chart showing land use percentages]

- Agriculture: 38%
- Developed (Non-Residential): 24%
- Residential: 30%
- Water/Wetlands: 7%
- Wooded/Undeveloped: 1%

Watershed Area: 38.8 sq mi
Stream Miles: 106 mi
Highlighted Strategies and Potential Stakeholders

Implement modern stormwater controls in areas with unmanaged stormwater issues through retrofits, upgrades during redevelopment, and green infrastructure installation

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Green Valleys Watershed Association, Natural Lands, Schuylkill Action Network, Valley Forge Trout Unlimited)

Promote and support the use of conservation/low-impact design principles for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Natural Lands)

Prioritize land preservation and water quality restoration efforts upstream of Pickering Creek Reservoir to protect drinking water supplies

**Potential Stakeholders:**
Municipalities, water utilities (including Aqua PA), conservation organizations (Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Natural Lands, Schuylkill Action Network, Valley Forge Trout Unlimited)

Improve public education around stormwater management, land management strategies, road salt application, and other activities that can have a direct impact on water quality

**Potential Stakeholders:**
Municipalities, Chester County Conservation District, Chester County Water Resources Authority, conservation organizations (Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Natural Lands, Schuylkill Action Network, Valley Forge Trout Unlimited)
Current and Projected Conditions

- High Quality designation covers the entire watershed
- Natural trout fisheries in Pine Creek, Pigeon Run, and the main stem Pickering Creek
- 1 PA Natural Diversity Index (PNDI) critical habitat site

Water Quality

73% of PADEP-assessed streams (46.3 miles out of 63.6 total assessed) are impaired for one or more of their State-designated uses

- Aquatic life: impairments in the upper Pickering Creek and in Pine Creek
  - (urban runoff/storm sewers – cause unknown; agriculture – siltation, cause unknown)
- Recreation: impairments in upper Pickering Creek near Chester Springs and in unnamed tributaries along Art School Road and Merlin Road
  - (pathogens – source unknown)

Additional known water quality concerns:

- PA Act 2 contamination sites (8 groundwater sites)
  - Primarily in the upper watershed near the PA Turnpike, Route 100, and Route 113
Pickering Creek

Water Use and Availability

Source water for public and community water systems

- Pickering Creek is a source of drinking water supplies for Aqua PA

DRBC Southeastern PA Groundwater Protection Area covers municipalities in the lower half of the watershed

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County

- Along Pickering Creek at Horseshoe Trail Road, Route 29 and Creek Road, and around Pickering Creek Reservoir

- 9 PA municipalities with MS4 permits
  - 1 PA municipality with a permit waiver

Growth and Development

Major population centers in the Valley Creek watershed

- Lionville, Eagle, Phoenixville

Projected growth areas

- Along Routes 100 and 113 overlap 1st order streams, portions of the watershed's headwaters, and HQ stream segments
Pigeon Creek

Priorities, Strategies, and Potential Stakeholders

**Key Management Priorities**

1. **Protect forested headwaters, 1st order streams, and vegetated riparian corridors**

2. **Encourage holistic planning to reduce potential conflict between future development and natural resources**

3. **Address stormwater runoff and causes of water quality impairments**

![Pie chart showing land use distribution with percentages:
33% Agriculture, 26% Wooded/Undeveloped, 5% Residential, 1% Developed (Non-Residential), 35% Water/Wetlands.]

![Map of Pigeon Creek watershed with highlighted area and stream miles.]
Highlighted Strategies and Potential Stakeholders

Promote and support the use of conservation/low-impact design principles for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Natural Lands)

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Improve public education around stormwater management, land stewardship, and other activities that can have a direct impact on water quality

**Potential Stakeholders:**
Municipalities, Chester County Conservation District, Chester County Water Resources Authority, conservation organizations (Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Natural Lands, Schuylkill Action Network)

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Target land preservation efforts in forested headwater areas and along riparian corridors

**Potential Stakeholders:**
Chester County Parks + Planning, municipalities, land trusts (French & Pickering Creeks Conservation Trust, Natural Lands)

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Identify and coordinate with farmers to implement BMPs and conservation plans that address sources of water quality impairments

**Potential Stakeholders:**
Chester County Conservation District, NRCS, conservation organizations
Current and Projected Conditions

High Quality designation covers the entire watershed
1 PA Natural Diversity Index (PNDI) critical habitat site

- 47% of total stream miles are 1st order streams
- 17% of Chester County portion of watershed preserved
- 65% woodland coverage within 50ft riparian buffer zone

Water Quality

54% of PADEP-assessed streams (12.5 miles out of 23.1 total assessed) are impaired for one or more of their State-designated uses

- Aquatic life: impairments in portions of the middle and lower watershed (agriculture – siltation, habitat modification)

Additional known water quality concerns:

- PA Act 2 contamination sites (1 groundwater site)
  East of North Coventry Elementary School
**USGS Cooperative Monitoring Program - Sampling Data Averages**

Chloride (Cl) data average from 2015-2019; all other data averages from 2010-2019

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**Water Use and Availability**

DRBC Southeastern PA Groundwater Protection Area covers the entire watershed

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability.

**Stormwater and Flooding**

Reported flooding hotspots in Chester County

- Along Pigeon Creek at Saylors Mill Road, Zeiber Road, and Route 724

- 4 PA municipalities with MS4 permits

**Growth and Development**

Projected growth areas

- Growth areas along Route 724 overlap some 1st order streams and HQ segments
Red Clay Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore vegetated riparian corridors and 1st order streams
2. Reduce stormwater runoff
3. Address sources of water quality impairments
4. Assess and develop strategies to address legacy contaminants and contaminants of emerging concern
5. Protect and expand water-based recreational opportunities and access

Watershed Area: 54.4 sq mi
Stream Miles: 155.9 mi
Highlighted Strategies and Potential Stakeholders

**Implement nutrient management plans and BMPs on farms**, including mushroom farms and their associated operations, to mitigate agricultural runoff

**Potential Stakeholders:**
Chester County Conservation District, NRCS, farmers/agricultural producers, conservation organizations (Brandywine Red Clay Alliance, Brandywine Conservancy, Stroud Water Research Center)

**Identify opportunities to expand water access and recreational opportunities**, taking into consideration existing water quality impairments that may not be compatible with direct water contact or fish consumption

**Potential Stakeholders:**
Chester County Parks + Preservation, PA DCNR, municipalities, conservation organizations/land trusts (Brandywine Conservancy, Natural Lands, Brandywine Red Clay Alliance, Delaware Nature Society)

**Utilize the latest scientific data to develop mitigation strategies** for PCBs, PFAS, and other contaminants of concern in the Red Clay Creek and its tributaries

**Potential Stakeholders:**
USGS, PADEP, Chester County Water Resources Authority, DNREC, conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Stroud Water Research Center)

**Support holistic, multi-jurisdictional efforts** to address shared water quality issues across municipal and state lines

**Potential Stakeholders:**
Municipalities, Chester County Water Resources Authority, Chester County Conservation District, New Castle County Conservation District, PADEP, DNREC, Christina Basin Task Force, University of Delaware Water Resources Center, conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Christina Watersheds Municipal Partnership, Delaware Nature Society)
### Current and Projected Conditions

#### Designations by state:
- **PA** – Trout Stocking/Migratory Fishes designation in the majority of the watershed; Cold Water/Migratory Fishes designation in Burrows Run and in the lower Red Clay at the PA/DE state line
- **DE** – Public Water Supply; Industrial Water Supply; Primary & Secondary Contact Recreation; Fish, Aquatic Life, and Wildlife; Cold Water Fish (put-and-take fishery year-round from the PA/DE line to the concrete bridge above Yorklyn); Fish Consumption

#### 6 PA Natural Diversity Index (PNDI) critical habitat sites
- Minor pockets of karst/carbonate geology around the Kennett Oxford Bypass

#### Water Quality

100% of PADEP-assessed streams (74.2 miles total) are impaired for one or more of their State-designated uses:
- **Aquatic life**: impairments in the East Branch Red Clay Creek and the West Branch Red Clay Creek below the Kennett Oxford Bypass
  - (agriculture – siltation, nutrients, organic enrichment; urban runoff/storm sewers – flow regime modification; municipal point source discharges)
- **Fish consumption**: entire watershed
  - (PCBs – source unknown)

#### Additional known water quality concerns:
- **Fish consumption advisories**
  - For all species throughout the watershed related to PCBs, DDT, dioxins, and chlorinated pesticides
- **PA Act 2 contamination sites** (9 groundwater sites, 1 surface water site)
  - In and around Kennett Square
- **Contaminants of emerging concern**
  - USGS sampling shows elevated levels of PFAS in the East Branch Red Clay Creek near Five Points

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**Red Clay Creek Basin PCB Watershed TMDL (PCBs)**

**Christina River Basin Low Flow Conditions TMDL (nutrients, dissolved oxygen)**

**Christina River Basin High Flow Conditions TMDL (nutrients, dissolved oxygen, bacteria, sediment)**
Red Clay Creek

Water Use and Availability

Source water for public and community water systems

Red Clay Creek feeds the Hoopes Reservoir, which supplies drinking water to the City of Wilmington.

Current and projected concerns regarding water availability during drought

No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County

In Kennett Square around Kennett Community Park and along the West Branch at Route 1.

5 PA municipalities with MS4 permits.

Growth and Development

Major population centers in the Valley Creek watershed

Kennett Square, Stanton.

Projected growth areas

Greater than 20% increases in impervious cover projected for portions of the watershed north of Route 1 overlap 1st order streams, source water streams, and protected open space cluster zones.

PADEP Environmental Justice Areas in Chester County

Kennett Square.
Ridley Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Prioritize stormwater management to reduce runoff and localized flooding
2. Protect 1st order streams and vegetated riparian corridors
3. Expand water-based recreational opportunities and access

![Pie chart showing land use percentages: Agriculture (36%), Developed (11%), Residential (12%), Water/Wetlands (12%), Wooded/Undeveloped (1%)]

Watershed Area: 37.9 sq mi
Stream Miles: 97.7 mi
Highlighted Strategies and Potential Stakeholders

**Promote and support the use of conservation/low-impact design principles** for new development to reduce potential impacts to water resources, especially in the headwaters

**Potential Stakeholders:**
- Chester County Planning Commission, Delaware County Planning Commission, Chester County Conservation District, Delaware County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (CRC Watersheds Association, Willistown Conservation Trust, Natural Lands)

**Implement modern stormwater controls** in areas with unmanaged stormwater issues through retrofits, upgrades during redevelopment, and green infrastructure installation

**Potential Stakeholders:**
- Municipalities, land developers, Chester County Conservation District, Delaware County Conservation District, conservation organizations (Willistown Conservation Trust, Natural Lands)

**Improve public education** around stormwater management, deicer/road salt application, land stewardship, and other activities that can have a direct impact on water quality

**Potential Stakeholders:**
- Municipalities, Chester County Conservation District, Delaware County Conservation District, Chester County Water Resources Authority, conservation organizations (Willistown Conservation Trust, Natural Lands)

**Identify opportunities to expand water access and recreational opportunities**, taking into consideration existing water quality impairments that may not be compatible with direct water contact or fish consumption

**Potential Stakeholders:**
- Chester County Parks + Preservation, Delaware County Parks and Recreation, PA DCNR, municipalities, conservation organizations/land trusts (Willistown Conservation Trust, Natural Lands)

**Prioritize riparian corridors, 1st order streams, and sensitive/vulnerable species habitats** for land preservation efforts

**Potential Stakeholders:**
- Chester County Parks + Preservation, Delaware County Parks and Recreation, PA DCNR, municipalities, conservation organizations/land trusts (Willistown Conservation Trust, Natural Lands)

**Utilize the latest scientific data** to develop mitigation strategies for chlorides, PFAS, and other contaminants of concern

**Potential Stakeholders:**
- USGS, PADEP, Chester County Water Resources Authority, conservation organizations (Willistown Conservation Trust, Stroud Water Research Center)
Current and Projected Conditions

High Quality designation above Baltimore Pike
Trout Stocking/Migratory Fishes designation from below Baltimore Pike to the mouth
Natural trout fisheries in Dismal Run
5 PA Natural Diversity Index (PNDI) critical habitat sites

Water Quality

95% of PADEP-assessed streams (78 miles out of 81.7 total assessed) are impaired for one or more of their State-designated uses

- **Aquatic life**: throughout the watershed
  (agriculture – siltation, cause unknown; habitat modification; urban runoff/storm sewers – eutrophication, siltation; cause unknown)
- **Recreation**: impairments in Schoolhouse Run, several unnamed tributaries, and sections of Ridley Creek in the headwaters and lower end of the watershed
  (pathogens – source unknown)

Additional known water quality concerns:

- **PA Act 2 contamination sites** (14 groundwater sites)
  Scattered throughout the watershed
- **Contaminants of emerging concern**
  USGS sampling shows elevated levels of PFAS in Ridley Creek at Route 3 near Willistown
Ridley Creek

**Water Use and Availability**

- **Source water for public and community water systems**
  - Ridley Creek is a source of water supplies for Aqua PA

- **DRBC Southeastern PA Groundwater Protection Area** covers the upper portions of the watershed in Chester County

- **Current and projected concerns regarding water availability during drought**
  - No significant current or projected future concerns regarding water availability.

**Stormwater and Flooding**

- **Reported flooding hotspots in Chester County**
  - Along the East Branch at Line Road, at Greenhill Road and Hershey Mill Road, and at Garrett Mill Road above Route 3

- **18 PA municipalities with MS4 permits**

**Growth and Development**

- **Major population centers in the Valley Creek watershed**
  - Willistown, Media, Eddystone, Chester

- **Projected growth areas cover most of the watershed**
  - No significant areas of potential conflict between projected growth and critical natural resources in Chester County

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**USGS Cooperative Monitoring Program - Sampling Data Averages**

Chloride (Cl) data average from 2015-2019; all other data averages from 2010-2019

<table>
<thead>
<tr>
<th>Ridley Creek at Rte. 3 near Willistown</th>
<th>IBI Score</th>
<th>NO2 as N</th>
<th>PO4 as P</th>
<th>Cl</th>
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<tr>
<td></td>
<td>53.6</td>
<td>2.52 mg/L</td>
<td>0.058 mg/L</td>
<td>75.4 mg/L</td>
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Schuylkill River Tributaries

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Address causes of stream impairments
2. Implement comprehensive stormwater management
3. Protect vegetated riparian corridors and 1st order streams
4. Expand water-based recreational opportunities and access

- Watershed Area: 39.8 sq mi
- Stream Miles: 104.3 mi
Highlighted Strategies and Potential Stakeholders

**Continue and expand land preservation efforts** that prioritize vegetated riparian corridors, 1st order streams, woodlands, and other natural areas that benefit water quality

**Potential Stakeholders:**
Chester County Parks + Preservation, PA DCNR, municipalities, conservation organizations/land trusts (Natural Lands, Schuylkill Highlands Conservation Landscape Initiative)

**Promote and support the use of conservation/low-impact design principles** for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (Natural Lands, Green Valleys Watershed Association, Schuylkill Action Network)

**Implement modern stormwater controls in areas** with unmanaged stormwater issues through retrofits, upgrades during redevelopment, and green infrastructure installation

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Natural Lands, Schuylkill Action Network)

**Expand and promote safe, broadly accessible water-based recreational opportunities** in and around the Schuylkill River

**Potential Stakeholders:**
Chester County Parks + Preservation, PA DCNR, municipalities, conservation organizations (Schuylkill River Greenways National Heritage Area, Schuylkill Highlands Conservation Landscape Initiative), local outfitters
Current and Projected Conditions

Trout Stocking/Migratory Fishes designation in the portions of the watershed adjacent to the Pigeon Creek and Stony Run watersheds
Warm Water/Migratory Fishes designation in the remainder of the watershed
PA Scenic River designation for the main stem Schuylkill River above the Fairmount Dam in Philadelphia
Natural trout fisheries in Mill Creek in Berks County
3 PA Natural Diversity Index (PNDI) critical habitat sites
Karst/carbonate geology concentrated around the Route 30 and Route 202 corridors

Water Quality

83% of PADEP-assessed streams (69.4 miles out of 83.5 total assessed) are impaired for one or more of their State-designated uses
- **Aquatic life**: throughout the watershed west of the Chester/Berks County line (agriculture – nutrients, siltation, habitat alterations, source unknown; habitat modification; urban runoff/storm sewers – siltation, flow regime modification, source unknown; rural residential – siltation; municipal point source discharges)
- **Recreation**: impairments in the main stem Schuylkill River (PCBS – source unknown)
- **Potable Water Supply**: impairments in an unnamed tributary northwest of Spring City (agriculture – siltation)

Additional known water quality concerns:
- **Fish consumption advisories**
  For carp, American eel, catfish, and suckers in the main stem Schuylkill River from Black Rock Dam to Fairmount Dam related to PCBs
- **PA Act 2 contamination sites** (20 groundwater sites)
  Some concentrated around Phoenixville, others scattered across the watershed
- **1 National Priorities List Superfund sites**
  In Douglassville

83% of PADEP-assessed streams (69.4 miles out of 83.5 total assessed) are impaired for one or more of their State-designated uses

Schuylkill River TMDL (PCBs)
Water Use and Availability

Source water for public and community water systems
The Schuylkill River is a source of drinking water supplies for multiple communities along its banks, including the City of Philadelphia.

DRBC Southeastern PA Groundwater Protection Area covers the entire watershed.

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability.

Stormwater and Flooding

Reported flooding hotspots in Chester County
North Coventry along Riverside Road and at East Schuylkill Road and Vaughn Road; Wells Road above Route 724; in Phoenixville at Bridge Street; along Pawlings Road.

20 PA municipalities with MS4 permits.

Growth and Development

Major population centers in the Valley Creek watershed
Spring City, Phoenixville

Projected growth areas
Around Pottstown, Spring City, and Phoenixville overlap some 1st order streams and their drainage areas.
Stony Run

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore vegetated riparian corridors and 1st order streams
2. Incorporate water resource priorities into planning for future growth areas
3. Address sources of water quality impairments

Watershed Area: 6 sq mi
Stream Miles: 19.5 mi
Highlighted Strategies and Potential Stakeholders

**Continue open space and agricultural preservation efforts**, prioritizing areas along riparian corridors and headwater streams

**Potential Stakeholders:**  
Chester County Parks + Preservation, municipalities, conservation organizations/land trusts  
(French & Pickering Creeks Conservation Trust, Natural Lands)

**Promote and support the use of conservation/low-impact design principles** for new development to reduce potential impacts to water resources

**Potential Stakeholders:**  
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (Natural Lands, Green Valleys Watershed Association, French & Pickering Creeks Conservation Trust, Schuylkill Action Network)

**Work with farmers** to expand the implementation of conservation plans and BMPs that address agricultural runoff

**Potential Stakeholders:**  
Chester County Conservation District, NRCS, conservation organizations (Green Valleys Watershed Association)
Current and Projected Conditions

High Quality designations cover the entire watershed

- 49% of total stream miles are 1st order streams
- 17% of Chester County portion of watershed preserved
- 58% woodland coverage within 50ft riparian buffer zone

Water Quality

100% of PADEP-assessed streams (8.9 miles total) are impaired for one or more of their State-designated uses

- **Aquatic life**: all assessed streams
  - (agriculture – siltation, habitat modification; urban runoff/storm sewers – cause unknown; municipal point source discharges)

- **Recreation**: all assessed streams
  - (pathogens – source unknown)
Water Use and Availability

**DRBC Southeastern PA Groundwater Protection Area** covers the entire watershed

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability

Stormwater and Flooding

6 PA municipalities with MS4 permits

Growth and Development

- **Major population centers in the Valley Creek watershed**
  - Spring City

- **Projected growth areas**
  - Around Spring City overlap with 1st order and HQ designated streams
Trout Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore 1st order streams and vegetated riparian buffers
2. Restore water quality to reduce impairments and support native aquatic species, including trout
3. Implement comprehensive stormwater management

Watershed Area: 8.8 sq mi
Stream Miles: 17.7 mi
Highlighted Strategies and Potential Stakeholders

Plan and implement stormwater restoration projects that reduce runoff, streambank erosion, and aquatic habitat loss

**Potential Stakeholders:**
Municipalities, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association)

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Implement modern stormwater controls in areas with unmanaged stormwater issues through retrofits, upgrades during redevelopment, and green infrastructure installation

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association, Open Land Conservancy of Chester County)

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Provide educational resources and opportunities to landowners and residents to improve environmental awareness and natural resource stewardship

**Potential Stakeholders:**
Chester County Water Resources Authority, Chester County Conservation District, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association, Open Land Conservancy of Chester County, Schuylkill River Greenways National Heritage Area)
Current and Projected Conditions

Warm Water/Migratory Fish designations cover all streams in the watershed
Natural trout fisheries north of Route 202
Karst/carbonate geology in the lower half of the watershed around and below Route 202

Water Quality

100% of PADEP-assessed streams (14.7 miles total) are impaired for one or more of their State-designated uses
- **Aquatic life**: all streams in the watershed
  - (urban runoff/storm sewers – siltation, flow regime modification, cause unknown; habitat modification)

Additional known water quality concerns:
- **PA Act 2 contamination sites** (5 groundwater sites, 1 surface water site)
  - Concentrated around major transportation corridors, including Route 202, Route 23, and the PA Turnpike

**Trout Creek TMDL** *(ammonia nitrogen and instream residual chlorine)*
Water Use and Availability

DRBC Southeastern PA Groundwater Protection Area covers the entire watershed

Current and projected concerns regarding water availability during drought

- No significant current or projected future concerns regarding water availability

Stormwater and Flooding

Reported flooding hotspots in Chester County
  Along Trout Creek at Walker Road

3 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Valley Creek watershed

- King of Prussia

Projected growth areas

Cover most of the watershed, including 1st order streams and their drainage areas (although increased impervious cover projections for this watershed are relatively low)
Upper Brandywine Creek
Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore 1st order streams, riparian corridors, floodplain connectivity, and woodlands
2. Reduce stormwater runoff through comprehensive stormwater management
3. Mitigate localized and regional flood risks
4. Implement source water protection measures for water supply intakes, reservoirs, and wells
5. Promote and expand water-based recreational opportunities and access

![Diagram showing land use percentages]

- Agriculture: 34%
- Developed (Non-Residential): 32%
- Residential: 24%
- Water/Wetlands: 9%
- Wooded/Undeveloped: 1%

Watershed Area: 258.3 sq mi
Stream Miles: 758 mi
Highlighted Strategies and Potential Stakeholders

**Identify and implement flood mitigation strategies** that incorporate climate change projections to protect vulnerable upstream and downstream communities

**Potential Stakeholders:**
Chester County Water Resources Authority, Chester County Department of Emergency Services, municipalities, FEMA, PEMA, University of Delaware Water Resources Center, conservation organizations (Brandywine Conservancy, Brandywine Red Clay Alliance, Stroud Water Research Center), community groups

**Identify opportunities to promote and improve recreational access** along the Brandywine Creek

**Potential Stakeholders:**
Municipalities, conservation organizations (Brandywine Red Clay Alliance, Brandywine Conservancy), local outfitters

**Work with farmers, including those in Plain Sect communities,** to implement BMPs that reduce pollution and runoff from agricultural lands

**Potential Stakeholders:**
Chester County Conservation District, NRCS, conservation organizations (Brandywine Red Clay Alliance, Brandywine Conservancy, Stroud Water Research Center)

**Promote and support the use of conservation/low-impact design principles** for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, Christina Basin Task Force, conservation organizations (Christina Watersheds Municipal Partnership, Natural Lands, Brandywine Conservancy, Brandywine Red Clay Alliance)

**Implement modern stormwater controls** in areas with unmanaged stormwater issues through retrofits, upgrades during redevelopment, and green infrastructure installation

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Brandywine Red Clay Alliance, Brandywine Conservancy, Natural Lands)

**Provide educational resources and opportunities** to landowners and residents to improve environmental awareness and natural resource stewardship

**Potential Stakeholders:**
Chester County Conservation District, conservation organizations (Christina Watersheds Municipal Partnership, Brandywine Red Clay Alliance, Brandywine Conservancy, Natural Lands)
Current and Projected Conditions

Current and Projected Conditions

Exceptional Value designations in an unnamed tributary east of Embreeville and in Broad Run in West Bradford

High Quality designations in the East Branch Brandywine Creek above Hibernia County Park, the West Branch Brandywine Creek above the Route 30 Bypass, and Broad Run near Exton

Cold Water/Migratory Fishes designations in Beaver Creek, West Valley Creek, and unnamed tributaries of the West Branch in West Bradford

Trout Stocking/Migratory Fishes designation in Birch Run, Doe Run, Rock Run, Taylor Run, and Blackhorse Run

Warm Water/Migratory Fishes designations cover the remainder

PA Scenic River designation for portions of the Brandywine Creek, including Doe Run, Broad Run (West Branch), Pocopson Creek, and riparian corridors along the East and West Branches south of Route 30

Natural trout fisheries in Buck Run, Birch Run, Doe Run, Beaver Creek, Broad Run, Culbertson Run, Dennis Run, Indian Run, Shamona Creek, Blackhorse Run, and some unnamed

8 PA Natural Diversity Index (PNDI) critical habitat sites

Karst/carbonate geology in a band along the Route 30 corridor

Water Quality

48% of PADEP-assessed streams (213.2 miles out of 447.7 total assessed) are impaired for one or more of their State-designated uses

• **Aquatic life**: impairments in the headwaters around Honey Brook, along the Route 30 corridor, and in the southern and eastern portions of the watershed
  
  (agriculture – habitat alterations, siltation, nutrients, organic enrichment; urban runoff/storm sewers – flow regime modification, siltation; habitat modification; municipal point source discharges)

• **Recreation**: impairments in Beaver Creek and the East Branch near Glenmoore, Dowlin Forge Road, and Telegraph Road
  
  (pathogens – source unknown)

• **Fish consumption**: impairments in the West Branch from Coatesville to the confluence with Buck Run
  
  (PCBs – source unknown)

Additional known water quality concerns:

• **Fish consumption advisories**
  
  For American eel from Route 30 in Coatesville to the confluence with Buck Run

• **PA Act 2 contamination sites** (77 groundwater sites)
  
  Concentrated around the Route 30 corridor between Coatesville and Exton, others near West Chester and the headwaters area near the Berks/Chester County line

• **6 National Priorities List Superfund sites**
  
  Predominantly in the upper West Branch and around Exton

• **Contaminants of emerging concern**
  
  USGS sampling shows elevated levels of PFAS in the West Branch Brandywine Creek at Modena

West Branch Brandywine Creek TMDL (PCBs)

Christina River Basin Low Flow Conditions TMDL (nutrients, dissolved oxygen)

Christina River Basin High Flow Conditions TMDL (nutrients, dissolved oxygen, bacteria, sediment)
Water Use and Availability

Source water for public and community water systems

Upper Brandywine Creek is a source of drinking water supplies for PA American, Downingtown Municipal Water Authority, and downstream utilities (including the City of Wilmington)

DRBC Southeastern PA Groundwater Protection Area covers portions of the East Branch Brandywine and West Valley Creeks

Current and projected concerns regarding water availability during drought

Future concerns in Shamona Creek and the East Branch Brandywine Creek between Marsh Creek Lake Reservoir and Downingtown (although releases from the reservoir could help alleviate potential water stress)

Projected 2045 water availability concerns also exist for West Valley Creek during potential future drought conditions

Stormwater and Flooding

Reported flooding hotspots in Chester County

Numerous locations, including along the Route 30 corridor between Parkesburg and Downingtown, along Route 322 below Downingtown, at Harvey’s Bridge Road, along Broad Run, above Crump Road in Lionville, and at Beaver Dam and Birdell Road

28 PA municipalities with MS4 permits

5 municipality with a permit waivers

Growth and Development

Large population centers in the Lower Brandywine Creek watershed

Coatesville, Downingtown, Exton

Projected growth areas

Along the Route 30 corridor overlap 1st order streams, EV and HQ designated stream segments, floodplains, and historical flooding hot spots
Valley Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Reduce stormwater runoff and mitigate flooding
2. Address water quality impairments and emerging contaminants
3. Restore riparian corridors and cold water fish habitat
4. Implement source water protection measures for groundwater wells

Watershed Area: 23.4 sq mi
Stream Miles: 46.4 mi
Highlighted Strategies and Potential Stakeholders

Plan and implement stormwater restoration projects that reduce runoff, streambank erosion/scouring, and the degradation of cold water fisheries

**Potential Stakeholders:**
Municipalities, PennDOT, PA Turnpike Commission, PAFBC, conservation organizations
(Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership)

Promote and support the use of conservation/low-impact design principles for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership)

Implement modern stormwater controls that are compatible with carbonate geology in areas with unmanaged stormwater issues through retrofits and upgrades during redevelopment

**Potential Stakeholders:**
Municipalities, land developers, Chester County Conservation District, conservation organizations (Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership)

Utilize the latest scientific data to develop mitigation strategies for PCBs, PFAS, chlorides, and other contaminants of historic and emerging concern

**Potential Stakeholders:**
USGS, PADEP, Chester County Water Resources Authority, conservation organizations
(Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership, Stroud Water Research Center)

Provide educational resources and opportunities to landowners and residents to improve environmental awareness and natural resource stewardship

**Potential Stakeholders:**
Municipalities, Chester County Conservation District, conservation organizations
(Valley Forge Trout Unlimited, Green Valleys Watershed Association, Valley Creek Restoration Partnership, Valley Forge National Historic Park)
Current and Projected Conditions

Entire Valley Creek watershed is designated as Exceptional Value
Natural trout fisheries are present in the main stems of Valley and Little Valley Creeks
6 PANatural Diversity Index (PNDI) critical habitat sites
Dominated by karst/carbonate geology

Current and Projected Conditions

Water Quality

100% of PADEP-assessed streams (36.8 miles total) are impaired for one or more of their State-designated uses

- **Aquatic life**: entire watershed
  (urban runoff/storm sewers – siltation, flow regime modification, cause unknown; habitat modification)
- **Recreation**: impairments in the headwaters in East Whiteland Township, in Little Valley Creek along Route 202, main stem south of Church Road
  (pathogens – source unknown)
- **Fish consumption**: entire watershed
  (PCBs – source unknown)

Additional known water quality concerns:

- **PA Act 2 contamination sites** (24 groundwater sites, 2 surface water sites)
  Concentrated in the upper watershed around major transportation corridors, including the PA Turnpike, Route 30, and Route 202
- **2 National Priorities List Superfund sites**
  Around Paoli; along Phoenixville Pike in East Whiteland Township
- **Contaminants of emerging concern**
  USGS sampling in 2019 showed elevated levels of PFAS in Valley Creek at the Turnpike Bridge near Valley Forge
Source water for public and community water systems

Valley Creek Watershed is a source of groundwater supplies for Aqua PA

DRBC Southeastern PA Groundwater Protection Area covers the entire watershed

Current and projected concerns regarding water availability during drought

Concerns exist throughout the watershed

Water conservation methods should be prioritized during prolonged dry weather conditions to minimize stress on water supply sources

Reported flooding hotspots in Chester County

Along Church Rd below Conestoga Rd; along the creek at Old Morehall Rd; along Little Valley Creek at Mill Rd

7 PA municipalities with MS4 permits

Major population centers in the Valley Creek watershed

Malvern, Chesterbrook, Paoli

Projected growth areas cover most of the watershed

Including Exceptional Value and 1st order streams and their drainage areas
White Clay Creek

Priorities, Strategies, and Potential Stakeholders

Key Management Priorities

1. Protect and restore riparian corridors and 1st order streams
2. Address sources of water quality impairment
3. Reduce stormwater runoff and mitigate flooding
4. Promote and expand water-based recreational opportunities and access

Watershed Area: 107.8 sq mi
Stream Miles: 295.5 mi
Highlighted Strategies and Potential Stakeholders

**Assess and improve local ordinances** to mitigate the impact of future development on water quality and flood risks

**Potential Stakeholders:**
Municipalities, Chester County Planning Commission, Chester County Water Resources Authority, conservation organizations (White Clay Creek Wild & Scenic River Program, The Water Center at the University of Pennsylvania)

**Implement flood mitigation strategies** to protect vulnerable flood-prone communities in Avondale and other parts of the watershed

**Potential Stakeholders:**
Municipalities, Chester County Water Resources Authority, U.S. Army Corps of Engineers, conservation organizations (White Clay Creek Wild & Scenic River Program, The Water Center at the University of Pennsylvania)

**Implement nutrient management plans and BMPs on farms**, including mushroom farms and their associated operations, to mitigate agricultural runoff

**Potential Stakeholders:**
Chester County Conservation District, NRCS, farmers/agricultural producers, conservation organizations (Brandywine Conservancy, Stroud Water Research Center)

**Promote and support the use of conservation/low-impact design principles** for new development to reduce potential impacts to water resources

**Potential Stakeholders:**
Chester County Planning Commission, Chester County Conservation District, Chester County Water Resources Authority, municipalities, conservation organizations (White Clay Creek Wild & Scenic River Program, Natural Lands, Christina Watersheds Municipal Partnership)

**Provide educational resources and opportunities** to local officials, homeowners associations, and residents to improve environmental awareness and natural resource stewardship

**Potential Stakeholders:**
Municipalities, Chester County Conservation District, Chester County Water Resources Authority, conservation organizations (White Clay Creek Wild & Scenic River Program, Brandywine Conservancy, Stroud Water Research Center)

**Leverage the watershed’s National Wild and Scenic River designation and existing public parkland** to offer expanded water-based recreational opportunities

**Potential Stakeholders:**
Chester County Parks + Preservation, Delaware State Parks, National Park Service, municipalities, conservation organizations (White Clay Creek Wild & Scenic River Program, Delaware Nature Society), local outfitters
Current and Projected Conditions

Designations by state:
- **PA** - Exceptional Value in the East Branch White Clay Creek above Avondale; Cold Water/Migratory Fishes in the East Branch to the PA/DE line; Trout Stocking/Migratory Fishes in the West Branch to the PA/DE line
- **DE** - Public Water Supply; Industrial Water Supply; Primary & Secondary Contact Recreation; Fish, Aquatic Life, and Wildlife; Cold Water Fish (put-and-take from PA/DE line to Curtis Paper and from March 15-June 30 on Mill Creek from Brackenville Road to Route 7, Pike Creek from Route 72 to Henderson Road); Fish Consumption

Federal Wild & Scenic River designation covering the entire watershed
17 PA Natural Diversity Index (PNDI) critical habitat sites
Karst/carbonate geology in a band along the Kennett Oxford Bypass

Water Quality

98% of PADEP-assessed streams (106.2 miles out of 108.1 total assessed) are impaired for one or more of their State-designated uses

- **Aquatic life**: impairments throughout the watershed
  - (agriculture – nutrients, siltation, organic enrichment, TSS, habitat alterations; urban runoff/storm sewers – siltation, flow regime modification, organic enrichment; construction – siltation; municipal point source discharges – nutrients; golf courses – habitat alteration; pesticides – source unknown)

- **Recreation**: impairments throughout the watershed
  - (pathogens – source unknown)

- **Fish consumption**: impairments throughout the watershed
  - (mercury – source unknown)

Additional known water quality concerns:

- **Fish consumption advisories**
  For American eel across the entire watershed related to mercury

- **PA Act 2 contamination sites** (12 groundwater sites, 1 surface water site)
  Primarily along Route 41

- **2 National Priorities List Superfund sites**
  Near Newark and Stanton
Water Use and Availability

Source water for public and community water systems
White Clay Creek is a source of drinking water supplies for the City of Newark, Delaware

Current and projected concerns regarding water availability during drought
No significant current or projected future concerns regarding water availability

Stormwater and Flooding

Reported flooding hotspots in Chester County
In Avondale Borough and along the Route 41, Route 841, and Baltimore Pike corridors

11 PA municipalities with MS4 permits

Growth and Development

Major population centers in the Valley Creek watershed
West Grove, Avondale, Pike Creek, Newark

Projected growth areas
Around Avondale and West Grove overlap a section of EV streams, 1st order streams, and in areas where flooding has been reported

PADEP Environmental Justice Areas in Chester County
West Grove, Avondale
Glossary
Glossary of Terms

A

**Algae**
Simple, rootless plants that grow in bodies of water in relative proportion to the amounts of nutrients available. Blue-green algae are primitive algae, typically found in water high in phosphorus that form scum blooms that congregate at the water’s surface. Diatoms are algae that have silica in their cell walls.

**Algal Bloom**
An unusual or excessive abundance of algae.

**Aquifer**
A geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield useful quantities of ground water to wells and springs.

B

**Bacteria**
Single celled organisms having no cellular nucleus. Pathogenic bacteria are capable of causing disease. Coliform bacteria are prolific in the intestines of warm blooded animals and are used as an indicator of fecal waste pollution.

**Bankfull Depth**
The mean water depth that occurs during a bankfull stream flow event.

**Bankfull Discharge**
The volume of stream flow that over time creates and/or maintains the shape, geometry, gradient and sinuosity (i.e. meander pattern) of the stream channel.

**Bankfull Width**
The mean water width that occurs during a bankfull stream flow event.

**Baseflow**
Portion of stream discharge derived from ground water; the sustained discharge that does not result from direct runoff or from water diversion, reservoir releases, piped discharges, or other human activities.

**Benthic**
Bottom terrain (generally submerged under water) of a surface water body, from shoreline to greatest depths.

**Best Management Practices (BMPs)**
Methods, measures or practices to prevent or reduce surface runoff and/or water pollution, including but not limited to, structural and nonstructural controls, operation and maintenance procedures, other requirements and scheduling and distribution of activities.

**BGY**
Billion gallons per year.

**Bioengineering**
An applied science that combines structural, biological, and ecological concepts to the design, engineering and restoration of streams, lakes, and wetlands.

**Biota**
Animal, insect and plant life, collectively including flora and fauna of a specific habitat or region

**BOD**
Biological oxygen demand
Buffer
An area maintained in permanent vegetation and managed to reduce the impacts of adjacent land use.

C

CCCD
Chester County Conservation District

CCDDC
Chester County Department of Community Development

CCDES
Chester County Department of Emergency Services

CCHD
Chester County Health Department

CCPC
Chester County Planning Commission

CCP+P
Chester County Parks + Preservation

CCWRA
Chester County Water Resources Authority

CERCLIS
Comprehensive Environmental Response Compensation and Liability System

cfs
Cubic feet per second

Channelization
The practice of straightening a waterway to remove meanders in order to increase the volume and/or rate of discharge. Sometimes concrete is used to line the sides and bottom of the channel.

Clean Water Act
The Federal Water Pollution Control Act of 1948, amended beginning in 1956 to become the Federal Water Pollution Control Act of 1972. Congress passed the original Clean Water Act in 1972 and amended it with the Water Quality Act of 1987. The major impact of the 1987 amendments was to include a permitting process and requirements for municipal storm water discharges.

COD
Chemical oxygen demand

Cone of Depression
The depression of the water table or potentiometric surface caused by pumping from a well, wellfield, or surface water body within its area of influence.

Confluence
The point at which two streams join or intersect to form one single larger stream.

Conjunctive Use
Use of ground water and surface water supplies together to meet the water needs of an area to avoid over-reliance or over-withdrawal of either resource.

Cu
Copper

CWA
Clean Water Act
D

**DE**
Delaware

**DE-DNREC**
Delaware Department of Natural Resources and Environmental Control

**Detention/Retention Basin**
Impoundment constructed to detain/retain stormwater for extended periods of time and allow for the retention of pollutants in the pond through deposition of sediments and attached pollutants.

**Discharge**
1) Release of water at a given point into a water body. 2) The rate and volume of flow of water such as in a stream, generally expressed as cubic feet per second.

**DMWA**
Downingtown Municipal Water Authority

**DO**
Dissolved oxygen

**Downcutting**
Process of the stream channel bottom being rapidly and excessively eroded creating a deeply incised stream channel.

**DRBC**
Delaware River Basin Commission

**DVRPC**
Delaware Valley Regional Planning Commission

E

**Ecosystem**
The system formed by the interaction of a community of organisms with their environment.

**Ecosystem Management**
The careful and skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired uses, products, and services over the long term.

**EIA**
Environmental impact assessment

**EIS**
Environmental impact statement

**Ephemeral Stream**
A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources. Its channel is at all times above the water table. The term may be arbitrarily restricted to streams which do not flow continuously during periods of one month.

**Erosion**
The wearing away of land surface by water or wind which occurs naturally from weather or runoff, but is often intensified by human activities.

**EV**
Exceptional Value
**Eutrophic**  
Habitats, particularly soils and water, that are rich in nutrients and plant growth. Eutrophic waters generally have high sedimentation at their bottoms. The lower levels of eutrophic waters have very low levels of dissolved oxygen.

**Eutrophication**  
The aging process by which lakes, estuaries, or water bodies are fertilized with nutrients. Natural eutrophication changes the character of a lake or water body very gradually. Cultural eutrophication is the accelerated aging of a lake or water body resulting from human activities. The process by which nutrients increase in the water body, increasing algal growth. Then as algal blooms die off and fall to the bottom, their decay depletes the water body of dissolved oxygen, which in turn reduces the ability of the water body to support fish and other aquatic life.

**Evapotranspiration (ET)**  
The total loss of water to the atmosphere by evaporation from land and water surface and by transpiration from plants.

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**Filter Strip**  
A linear strip of land maintained to slow the velocity of runoff and filter sediment.

**First Order Stream**  
Upper-most perennial tributary in a watershed that has not yet come together with or drained into another perennial stream. The confluence of two first order streams forms a “second” order stream.

**Flooding**  
Occurs when the total volume of surface water runoff and baseflow entering a stream channel exceeds the capacity of the channel resulting in out-of-bank flow, or when water collects in an undesirable area without sufficient drainage capacity.

**Floodplain**  
That portion of a stream valley adjacent to the channel that is created by erosion and sediment deposited from the stream and covered with water when the stream overflows its banks at flood stage. Also, the nearly level land situated on either side of a channel that is subject to overflow flooding.

**Fluvial Geomorphology**  
The scientific study of the evolutionary processes of streams and the physical relationships between watershed runoff, streamflow, erosion, sedimentation, soils, geology, topography, and climate over time.

**Forest**  
A descriptive classification of land type predominated by trees and woody vegetation and characterized by high structural diversity, greater than 25% canopy shading, and by the significant accumulation of organic duff on the soil surface.

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**Geomorphology**  
(See Fluvial Geomorphology)

**GIS**  
Geographic information system

**gpd**  
Gallons per day

**Groundwater**  
Water that occurs in the subsurface and fills or saturates the porous openings, fractures and fissures of underground soils and rock units.

**GWPA**  
Groundwater Protected Area
Habitat
A place where the physical and biological elements of ecosystems provide a suitable environment and the food, cover, and space resources needed for plant and animal livelihood.

Headwaters
The uppermost tributaries of a stream or river; often refers to first order streams.

HQ
High Quality

Hydrogeology
The science dealing with the relationship of subsurface water (or ground water) and geologic materials.

Hydrologic Function
The capacity of a stream to move or to store water, bedload material, and suspended sediment. Stream gradient, the resultant stream power and size of material are critical factors.

Hydrology
The study of the properties, distribution, circulation, and effects of water on the Earth’s surface, soil, and atmosphere.

Impaired Stream
A stream or other surface water body determined by field assessment to no longer meet the state water quality standards for its designated protected use.

Impervious Surface
Ground cover that does not allow, or minimally allows, for infiltration of water (e.g., roofs, paved parking lots, and roads) and which increases the volume and speed of runoff after a rainfall.

Impoundment
Any lake, reservoir, pond or other containment of surface water occupying a bed or depression in the Earth’s surface and having a discernible shoreline.

Infiltration
Movement of surface water into the soil, where it is absorbed by plant roots, evaporated into the atmosphere, or percolates downward to recharge ground water.

Intermittent Stream
A defined channel in which surface water is absent during a portion of the year, as ground water levels drop below the channel bottom.

Invasive Species
A species that is out of its naturally occurring range and environment, occupying the habitat of native species, and causes (or could cause) economic or environmental harm.

in/yr
Inches per year

IWRP
Integrated Water Resources Plan

Karst
An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns.
**L**

**Large Woody Debris**
A term used to describe logs, tree boles, rootwads, and limbs that are in, on, or near a stream channel.

**lbs/yr**
Pounds per year

**Level Spreader**
A low earthen berm constructed perpendicular to the direction of slope and extending across the width of the slope for the purpose of intercepting surface runoff and spreading it behind the berm to enhance infiltration and reduce erosion and runoff from the slope.

**Loading**
The total amount (generally measured in pounds or kilograms per acre per year) of material (sediment, nutrients, oxygen-demanding material, or other chemicals or compounds) brought into a lake, stream or water body by inflowing streams, runoff, direct discharge through pipes, ground water, the air (aerial or atmospheric deposition) and other sources over a specific period of time (often annually).

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**M**

**MCL**
Maximum contaminant level

**MD**
Maryland

**Meander**
A circuitous winding or bend in the river.

**MGD**
Million gallons per day

**mg/L**
Milligrams per liter

**mg/yr**
Million gallons per year

**MPC**
Municipalities Planning Code

**MTBE**
Methyl Tert-Butyl Ether

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**N**

**National Pollutant Discharge Elimination System (NPDES)**
Created in 1972 under the Clean Water Act to authorize discharges to local receiving waters only pursuant to government permits, in an effort to reduce point source and nonpoint source pollutants.

**Native Species**
A naturally occurring plant or other organism that is within its range and normal environment.

**NO2**
Nitrite

**NO3**
Nitrate
Nonpoint Source
Nutrient and pollution sources not discharged from a single point, e.g. runoff from agricultural fields, feedlots, residential lawns, septic leach fields, or urban streets, etc.

NPS
Nonpoint source

NRCS
Natural Resources Conservation Service (USDA)

Nutrient
Elements or compounds essential to growth and development of living things (e.g., nitrogen, potassium, phosphorus).

O&M
Operation and maintenance

One in 25 (1 in 25) Year Average Annual Baseflow
Statistical value of the baseflow (or low flow conditions) of a stream averaged over a 12-month period that is expected to occur once in every 25 years.

PA
Pennsylvania

PA DCNR
Pennsylvania Department of Conservation and Natural Resources

PADEP
Pennsylvania Department of Environmental Protection

PAFBC
Pennsylvania Fish and Boat Commission

Parts Per Million (ppm)
A common basis of reporting water analysis. One part per million (ppm) equals one pound per million pounds of water. One part per billion (ppb) equals one pound per billion pounds of water.

PAWC
Pennsylvania American Water Company

Pb
Lead

Perennial Streams
A defined channel containing surface water throughout the year.

PFAS
Per- and polyfluoroalkyl substances

PNDI
Pennsylvania Natural Diversity Index

Point Source
Originating from a discrete identifiable source or conveyance structure (i.e., pipe).

Pollution
The process of contaminating air, water and land with impurities to a level that is undesirable and results in a decrease in usefulness of the environment for beneficial purposes.
**Polychlorinated Biphenyls (PCBs)**
A group of at least 50 widely used compounds containing chlorine. PCBs can accumulate in food chains and are thought likely to produce a variety of harmful side effects, particularly during the reproductive cycle of plants and animals. Many are non-biodegradable.

**Pool**
Deeper areas of a stream with slow-moving water, often used by larger fish for cover.

**Potable Water**
Drinking water. Water whose chemical constituents do not exceed the limits set forth in state water quality standards for human consumption.

**Potentiometric Surface**
A surface which represents the pressure head in a confined or unconfined aquifer and is defined by the levels to which water will rise in a well that fully penetrates the aquifer.

**ppb**
Parts per billion

**PUC**
Pennsylvania Public Utilities Commission

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| **Q 7 - 10**
Statistical value of baseflow (or low flow condition) of a stream averaged over a period of 7 consecutive days that is expected to occur once in every 10 years.|

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| **Recharge**
The replenishment of ground water through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

**Recharge Area/Zone**
An area (or zone) that, due to its pervious ground cover, karst topography, or permeability, contributes significantly to ground water recharge.

**Retention**
The prevention of direct discharge of stormwater runoff into receiving waters by temporary containment in a pond or depression; examples include systems which discharge by percolation to ground water, exfiltration, and/or evaporation processes and which generally have residence times of less than three days.

**Retention Time**
The length of time that water, nutrients, or other chemical substances remain in a lake, impoundment or standing pool.

**Riffle**
Shallow section of a stream or river with rapid current and a surface broken by gravel, rubble, or boulders.

**Riparian**
Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.

**Riparian Forest Buffer**
An area of trees, usually accompanied by shrubs and other vegetation, adjacent to a body of water and managed to maintain the integrity of stream channels and shorelines to 1) reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals, and 2) supply food, cover, and thermal protection to fish and other wildlife.
**Riprap**
Stones of varying size used to dissipate energy or stabilize a soil surface.

**Runoff**
Surface water (usually rainfall) that is not evaporated, transpired, used, or infiltrated into the ground water system, and thus flows over land to a surface water body.

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**Satellite System**
A community water or wastewater system that serves a localized development or small community from a nearby or onsite source or disposal site, and does not rely on inter-connection to a larger regional system.

**Scour**
Local removal of soil, sediment, or other channel material from a streambed by flowing water.

**Sediment**
Fragmented material that originated from weathering rocks and decomposing organic material that is transported by, suspended in, and eventually deposited in the streambed.

**Sedimentation**
Occurs when sediment particles that have been suspended within flowing water are deposited on the stream bottom or floodplain.

**Sheetflow**
A flow process associated with broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

**Spring**
A point where ground water emerges (or seeps out) onto the surface of the ground, often forming the beginning of a stream.

**sq. mi.**
Square mile(s)

**SRBC**
Susquehanna River Basin Commission

**Stormwater**
Runoff water that results from a storm (usually rainfall) event.

**Stream**
Includes all rivers, creeks, brooks, tributaries and other flowing surface waters within a natural channel. More specifically, a perennial, intermittent, or ephemeral watercourse having a defined channel (excluding man-made ditches) which contains flow from surface and/or ground water sources during at least a portion of an average rainfall year.

**Stream Discharge**
Quantity of stream flow per unit of time, generally expressed as cubic feet per second (cfs).

**Stream Order**
A numerical system (ranking from headwaters to river terminus) used to designate the relative position of a stream or stream segment in a drainage basin.

**Streambank**
The portion of the channel cross-section that restricts lateral movement of water at normal water levels.

**Swale**
A depression or wide shallow ditch used to temporarily store, route, infiltrate, filter, or convey runoff.
### T

**TDP**  
Total dissolved phosphorus

**TKN**  
Total Kjeldahl Nitrogen

**TMDL**  
Total maximum daily load

**TN**  
Total nitrogen

**Total Maximum Daily Load (TMDL)**  
A regulatory process that determines the volume or quantity of a given pollutant, calculated by watershed computer modeling, that can be assimilated by a receiving stream or water body on an average daily basis while maintaining the state designated water quality standard and designated use of the water body. Where existing pollutant loads to the receiving water body are in excess of the calculated tmdl, the responsibility for reducing the excess pollutant loads is allocated among existing sources of the pollutant to achieve the reductions necessary to re-attain the designated use of the water body.

**TP**  
Total phosphorus

**Trophic State Index (tsi)**  
The trophic state index was developed in 1977 to provide a convenient measure of water quality. The scale is 1 to 100 and uses the three parameters of total phosphorus, chlorophyll-a and Secchi disk depth to categorize lake water quality.

**TSS**  
Total suspended solids

**THM**  
Trihalomethanes

**Turbidity**  
Murkiness or cloudiness of water, indicating the presence of suspended sediments, dissolved solids, natural or man-made chemicals, algae, etc.

### U

**USDA**  
U.S. Department of Agriculture

**USEPA**  
U.S. Environmental Protection Agency

**USGS**  
U.S. Geological Survey

### V

**VOC**  
Volatile organic compounds

**VPP**  
Vision Partnership Program
**W**

**Water Budget**
An accounting of the movement of water through the components of the hydrologic cycle in a watershed, including precipitation, evapotranspiration, surface runoff, ground water recharge, and ground water discharge to stream baseflow.

**Water Quality**
A state of water represented by a combination of productivity, chemistry, cleanliness and recreational potential.

**Water Table**
The upper-most level of saturation of pore space or fractures by subsurface water in an aquifer.

**Watershed**
1) An area of land that drains into a particular river or body of water; usually divided by topography or ridgelines.
2) The total area of land above a given point on a waterway that contributes surface runoff and ground water to the flow at that point.
3) A drainage basin or a major subdivision of a drainage basin.

**Watershed Management**
Coordinated assessment and characterization of watershed conditions, and planning and implementation of strategies, approaches, tools, and techniques to protect and enhance the quality and quantity of water resources while achieving desired land and water uses.

**Wetlands**
Low-lying areas inundated or saturated by water at a frequency and duration sufficient to support wetland vegetation (e.g. wetlands include such areas as swamps, marshes and wet meadows). Wetlands remove pollutants through a series of chemical, physical, and biological mechanisms.

**WMM**
Watershed Management Model

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**Z**

**Zn**
Zinc

**Zoning**
The practice of dividing land into regions or parcels pertaining to its use or activities within it.
Summary of Data Sources
Summary of Data Sources

This section contains a general summary of the origins of much of the data and information included in this plan. Additional information on data sources related to the water budget and pollutant load analyses can be found in Appendix C.

Many of the Geographic Information Systems (GIS) data layers utilized in the plan’s maps are publicly available through the Pennsylvania Spatial Data Access website maintained by Penn State University. For information regarding other GIS data layers included in the plan, or for more details on data sources, contact the Chester County Water Resources Authority.

- **Baseflow** - U.S. Geological Survey (Stream Stats)
- **CERCLA Superfund Sites** - U.S. Environmental Protection Agency
- **Chester County hydrography** - Chester County Water Resources Authority
- **Chester County major dams** - Chester County Water Resources Authority
- **Chester County protected open space** - Chester County Planning Commission
- **Conservation corridors** - Chester County Planning Commission
- **Discharge quality data** - U.S. Environmental Protection Agency, PA Department of Environmental Protection (Electronic Discharge Monitoring Report, or eDMR)
- **Floodplains & special flood hazard areas** - U.S. Federal Emergency Management Agency
- **Generalized geology** - PA Department of Conservation and Natural Resources
- **Groundwater quality** - U.S. Geological Survey, U.S. Environmental Protection Agency (STORET), Chester County Health Department, Cecil County Health Department
- **Historic districts, structures, & landmarks** - Chester County Planning Commission
- **Industrial mining operations** - PA Department of Environmental Protection
- **Karst features** - PA Department of Conservation and Natural Resources
- **Land use & land cover** - Delaware Valley Regional Planning Commission, Lancaster County Planning Commission, Bucks County Planning Commission, Cecil County Government, University of Delaware Water Resources Center, Chesapeake Conservancy
- **Landfills** - PA Department of Environmental Protection
- **MS4 permittees** - PA Department of Environmental Protection, MD Department of the Environment, DE Department of Natural Resources and Environmental Control
- **National Wetlands Inventory** - U.S. Fish and Wildlife Service
- **Natural trout fisheries** - PA Fish and Boat Commission
- **PA High Quality & Exceptional Value streams** - PA Department of Environmental Protection
- **Pennsylvania Act 2 contaminated sites** - PA Department of Environmental Protection
- **Pennsylvania 2015 environmental justice areas** - PA Department of Environmental Protection
- **Pennsylvania Natural Diversity Inventory** - PA Department of Conservation and Natural Resources
- **Permitted water withdrawals** - PA Department of Environmental Protection
• **Population (current & projected)** - U.S. Census Bureau, Delaware Valley Regional Planning Commission

• **Public parks, preserves, & game lands** - PA Department of Conservation and Natural Resources, WeConservePA, Chester County Planning Commission, New Castle County, Cecil County


• **Reported flooding hotspots** - Chester County Water Resources Authority, Chester County Department of Emergency Services

• **Riparian buffer restoration opportunities** - WeConservePA

• **Sewage treatment & other permitted discharges** - PA Department of Environmental Protection (Electronic Discharge Monitoring Report, or eDMR), ModelMyWatershed

• **Sources of drinking water supplies** - PA Department of Environmental Protection

• **Southeastern PA Groundwater Protection Area** - Delaware River Basin Commission

• **State & Federal waterway designations** - PA Department of Conservation and Natural Resources, U.S. Fish and Wildlife Service

• **Stream gage data** - U.S. Geological Survey

• **Stream use designations** - PA Department of Environmental Protection, MD Department of the Environment, DE Department of Natural Resources and Environmental Control

• **Surface & groundwater monitoring sites** - U.S. Geological Survey, Chester County Water Resources Authority

• **Total Maximum Daily Loads** - U.S. Environmental Protection Agency, PA Department of Environmental Protection, Chester County Water Resources Authority

• **Water & sewer service areas** - Chester County Planning Commission, Delaware Valley Regional Planning Commission, Lancaster County Planning Commission, Bucks County Planning Commission, Cecil County Government, FirstMap (Delaware)

• **Water quality impairments** - U.S. Environmental Protection Agency, PA Department of Environmental Protection

• **Waterway access points** - PA Fish and Boat Commission
Appendices

Appendix A
PA Act 167 Regulatory Requirements Crosswalk

Appendix B
Detailed Accomplishments and Gaps Analysis since 2002

Appendix C
Water Budget and Pollutant Load Analyses Technical Documentation

Appendix D
2020 vs. 2045 Water Budget and Pollutant Loading Data Summaries

Appendix E
Summary of WPAC, Public, and Stakeholder Engagement

Appendix F
Chester County 2022 County-wide Model Stormwater Ordinance