Blueprint for Building Partnerships and Recommendations for Scaling Brook Trout Restoration in Stronghold and Persistent Patches

STAC Workshop Report
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Abbreviations and Acronyms

ACEP – Agricultural Conservation Easement Program
AMD – Acid mine drainage
AML – Abandoned mine land
AMLD – Abandoned Mine Land Division
AOP – Aquatic organism passage
BAMR – Bureau of Abandoned Mine Reclamation
BMP – Best management practice
BOF – Bureau of Forestry
CF2 – Community Forestry Catalyst Fund
C2P2 – Community Conservation Partnership Program
CAP – Countywide Action Plan
CBP – Chesapeake Bay Program
CBBTRC – Chesapeake Bay Brook Trout Restoration Coordinator
CPA – Conservation Planned Activity
CRC – Chesapeake Research Consortium
CREP – Conservation Reserve Enhancement Program
CRP – Conservation Reserve Program
CSP – Conservation Stewardship Program
DCNR –Department of Conservation and Natural Resources
DEC – Department of Environmental Conservation
DGLVR – Dirt, Gravel, and Low Volume Road (Program)
DIA – Design and Implementation Activity
DNR – Department of Natural Resources
EBTJV – Eastern Brook Trout Joint Venture
EPA – United States Environmental Protection Agency
EQIP – Environmental Quality Incentives Program
ESMP – Environmentally Sensitive Maintenance Practices
FOTG – Field Office Technical Guide
GIS – Geographic Information Systems
GIT – Goal Implementation Team
HFHW – Healthy Forests, Healthy Waters
HUC – Hydrologic Unit Code
IIJA – Infrastructure Investment and Jobs Act
MACS – Maryland Agricultural Water Quality Cost-Share Program
MDE – Maryland Department of the Environment
MDOT – Maryland Department of Transportation
MS4 – Municipal Separate Storm Sewer System
MUCFC – Maryland Urban and Community Forestry Committee
NFWF – National Fish and Wildlife Foundation
NHD – National Hydrography Dataset
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resources Conservation Service
NRCS-FPAC – Natural Resources Conservation Service, Farm Production and Conservation (USDA mission area)
OSMRE – Office of Surface Mining Reclamation and Enforcement

PA DEP – Pennsylvania Department of Environmental Protection
PSU – Pennsylvania State University
RCPP – Regional Conservation Partnership Program
SARP – Southeast Aquatic Resources Partnership
SMCRA – Surface Mining Control and Reclamation Act
STAC – Scientific and Technical Advisory Committee
SWAP – State Wildlife Action Plan
SWCD – Soil and Water Conservation District
SWM – Stormwater management
TMDL – Total Maximum Daily Load
TN – Total nitrogen
TP – Total phosphorus
TSS – Total suspended solids
TNC – The Nature Conservancy
TU – Trout Unlimited
UAW – Unassessed Waters Initiative
USDA – United States Department of Agriculture
USFS – United States Forest Service
USGS – United States Geological Survey
WIP – Watershed Implementation Plan
WLFW – Working Lands for Wildlife
WRE – Wetland Reserve Easements

Executive Summary

Brook trout populations have been greatly reduced from their historic range. Increases in summer temperatures combined with landscape changes create numerous challenges for resource managers to conserve, protect and enhance brook trout populations. One of the primary hurdles for managers is coordinating and planning within and between jurisdictional boundaries where lands are managed and owned by many different parties who all have different resource management goals, objectives and funding priorities. Therefore, the impetus behind the *Blueprint for Building Partnerships and Recommendations for Scaling Brook Trout Restoration in Stronghold and Persistent Patches* STAC Workshop was to provide a framework for resource managers to overcome these challenges and better target and prioritize brook trout restoration and conservation projects in a more effective manner.

Two parallel STAC workshops were held: the first in Pennsylvania with representatives from Clearfield and Potter counties, and the second with representatives from Garrett, Carroll, and Baltimore counties. These sessions convened federal, state, county, and NGO partners who administer funding, land conservation, restoration, and technical assistance programs that can directly or indirectly benefit brook trout.

Programmatic overviews provided workshop attendees with a shared understanding of existing programs, funding mechanisms, and restoration opportunities. Facilitated afternoon discussions then focused on how partners could better coordinate across jurisdictions and increase the scale of localized restoration and implementation. The outcomes of these discussions resulted in the following key recommendations:

- Establish a formal Chesapeake Bay Brook Trout Collaborative to increase the rate and scale of restoration and conservation projects that restore and maintain resilient brook trout populations in the Chesapeake Bay watershed.
- Create a Brook Trout Restoration Coordinator position to facilitate and grow the Brook Trout Collaborative, provide technical assistance to partners, and help maintain momentum across counties and jurisdictions.
- Leverage the Brook Trout Collaborative to improve communications and coordination between stakeholders involved with brook trout restoration and conservation
- Develop a GIS-driven prioritization framework to identify priority brook trout patches, stream reaches, limiting stressors, restoration actions, and funding opportunities most likely to advance brook trout occupancy, abundance, and resilience goals.
- Use this framework to support a fundable project pipeline, including opportunities for brook trout reintroduction or recolonization, aquatic organism passage, riparian forest restoration, acid mine drainage remediation, thermal mitigation, land protection, and other targeted restoration actions.
- Improve project tracking and monitoring to better understand where brook trout restoration is occurring, evaluate biological response, and guide future investment.

Further detail on these findings, along with specific proposed actions, is provided in the Recommendations section later in this report.

Introduction

The Eastern Brook Trout is an iconic coldwater species with a native range from eastern Canada to eastern Minnesota and down the Appalachians as far south as Georgia (Power 2002; Maryland Department of Natural Resources, n.d.). Brook trout inhabit rocky, well-shaded, pristine coldwater environments, making them indicators of ecosystem health as their decline generally signals pollution, warming stream temperatures or habitat degradation (Stranko et al. 2008). With historical connections to native American tribes as well as being a central part of rural and frontier identity for European settlers (McPhee 2002), brook trout remain a symbol in eastern fly fishing culture, particularly in the Blue Ridge and Appalachian Mountains (Halnon 2011), contributing considerable financial resources to rural, local economies throughout the east coast and Chesapeake Bay Watershed (Eastern Brook Trout Joint Venture 2019). While brook trout represent a significant historical, cultural, ecological, and economic value, the species has shown significant declines in abundance throughout its' native range (Hudy et al. 2008).

The Chesapeake Bay Program's (CBP) Brook Trout Workgroup operates as the coordinating body for implementation of the revised Brook Trout Outcome in the 2025 Chesapeake Bay Watershed Agreement, which calls for protecting and enhancing brook trout within the Chesapeake Bay watershed by increasing occupancy, abundance, and resilience to changing environmental conditions (Chesapeake Bay Program 2025). By 2040, the outcome targets a 1.5% increase in brook trout occupancy (233 miles) in watersheds supporting healthy populations while achieving no net loss in other watersheds, increased abundance at 10 long-term monitoring sites, and a 15% reduction in identified threats to increase brook trout resilience in watersheds supporting healthy populations.

In a 2024 Goal Implementation Team funded report developed in collaboration with Trout Unlimited and the Eastern Brook Trout Joint Venture (EBTJV), indicated only a 0.5% increase in occupied brook trout habitat within the Chesapeake Bay watershed between 2016 and 2024 (Rummel et al. 2024). In addition to limited gains in habitat occupancy, trends in brook trout abundance have declined over the past few decades (Hitt et al. 2024; Childress et al. 2024), further highlighting the challenges facing population stability.

These findings reflect multiple anthropogenic and environmental stressors including historical and current land use practices, warming water temperatures (Xu et al. 2010), competition with nonnative fishes (Hitt et al. 2017; Huntsman et al. 2023), fragmentation of habitats by dams and roads, habitat impairment and destruction (e.g., stream channelization, poor riparian management, and sedimentation), and natural stochastic events (Hudy et al. 2008). Many entities are working to mitigate these stressors, including state fish and wildlife agencies, federal programs such as NRCS and the U.S. Forest Service, conservation organizations such as Trout Unlimited and the Eastern Brook Trout Joint Venture, and local conservation districts (Eastern Brook Trout Joint Venture 2019), but the scale and complexity of limiting factors indicate a need for a more coordinated approach.

This effort builds on recommendations from the Scientific and Technical Advisory Committee's (STAC) Rising Temperature Workshop report, which called for accelerating conservation in coldwater streams and protecting native brook trout through actions such as protecting existing

forests, expanding riparian planting, strengthening partnerships to align federal, state, local, and private resources, promoting agricultural stewardship, and engaging private landowners and local conservation organizations (Batiuk 2023). Brook trout conservation also requires decadal planning horizons, since habitat actions that increase riparian coverage occur immediately but canopy development and associated stream cooling can take years to decades to produce measurable benefits.

Pilot counties and patch context

The CBP Brook Trout Workgroup sought support from the Management Board to convene a workshop to develop an actionable, large-scale restoration plan. In response, in December 2024 the Management Board agreed to support the Brook Trout Work Group to initiate a pilot restoration planning initiative in two Chesapeake Bay watershed states, Pennsylvania and Maryland. Priority counties were identified within each state through discussions with each state's brook trout biologists. Counties identified were Potter and Clearfield (PA) and Garrett, Baltimore, and Carroll (MD). The Brook Trout Workgroup submitted a formal STAC proposal to hold two parallel workshops in Clearfield County, Pennsylvania and Carroll County, Maryland, counties with particularly robust brook trout populations. The proposal focused on identifying and synthesizing available science alongside local considerations needed to develop a restoration framework that can be applied across other counties and jurisdictions. The restoration framework targets increases in brook trout occupancy, abundance, and resilience, with emphasis on maintaining strong populations in priority geographies most likely to persist under increasing environmental and anthropogenic stressors.

In this report, "patch" refers to the EBTJV population patch, the basic unit used to summarize brook trout habitat and populations (Fesenmyer et al. 2017). "Stronghold" patches are resilient patches with large, interconnected allopatric brook trout habitat, including a minimum amount of brook trout only stream habitat and at least one larger stream type that supports habitat diversity and recovery following disturbance, while "persistent" patches are redundant patches with sufficient occupied habitat and high habitat suitability to support genetic diversity even when patches are smaller than strongholds (Fesenmyer et al. 2017).

An interactive geospatial planning application was developed in advance of the 2025 Brook Trout STAC Workshop to support workshop planning and discussion. The tool supported comparison of watersheds within the selected counties and helped participants consider where brook trout restoration efforts may be most effectively focused. It covers Potter and Clearfield Counties in Pennsylvania and Baltimore, Carroll, and Garrett Counties in Maryland, and includes map layers used to evaluate patch and watershed conditions such as land cover, riparian condition, and barriers to aquatic organism passage, along with other patch-scale threat indicators. The application also provides access to the mapping layers used for the county map series and patch-scale threat tables in this report (Appendix I). Patch-scale threat metrics for all pilot counties are summarized in Table 1. Stronghold and persistent patch distributions for Clearfield, Garrett, and Potter counties are shown in Figure 1, and state stronghold patch distributions for Baltimore and Carroll counties are shown in Figure 2. Full county maps for pilot counties are provided in Appendix J.

Table 1. Patch-scale threat metrics for participating Pennsylvania and Maryland counties. Summary totals and area-weighted means reported by county and brook trout patch type (stronghold, persistent, and state stronghold). Metrics include stream miles impaired by acid mine drainage (AMD), counts of aquatic organism passage (AOP) barriers, road–stream crossings, and dams, riparian condition (acres and percent not forested within a 30-meter riparian buffer), and percent of patch area in protected lands. Percent values are area-weighted means across patches within each county and patch type.

	Clearfield County (PA)		*Potter County (PA)*		*Baltimore County (MD)*	*Carroll County (MD)*	*Garrett County (MD)*	
Patch Metric	**Stronghold**	**Persistent**	**Stronghold**	**Persistent**	**State Stronghold**	**State Stronghold**	**Stronghold**	**Persistent**
Patches (n)	6	34	5	28	12	10	1	15
Total patch area (acres)	104,468	167,112	129,902	201,938	16,492	12,404	32,543	62,981
AMD-impaired stream miles	28.3	74.1	0	0	0	0	0	39.1
AOP barriers	115	126	251	483	13	20	104	171
Road–stream crossings	111	119	248	479	13	19	103	170
Dams	4	7	3	4	0	1	1	1
Riparian acres not forested	1,620	2,070	1,624	4,496	373	388	266	369
Riparian % not forested	12.7%	11.5%	10.5%	16.1%	44.3%	70.4%	8.0%	7.9%
% protected	56.9%	38.5%	77.1%	61.7%	36.6%	26.6%	56.0%	39.0%

Note: AMD data from PA/MD 303(d) Integrated Reports; AOP barriers from SARP Aquatic Barrier Inventory v3.19.0; riparian land cover from CBP 2021/2022 LULC (30-m buffer); protected lands from CBP 2025 Protected Lands Indicator. Baltimore and Carroll county patches reflect state stronghold designations in the Upper Gunpowder watershed.

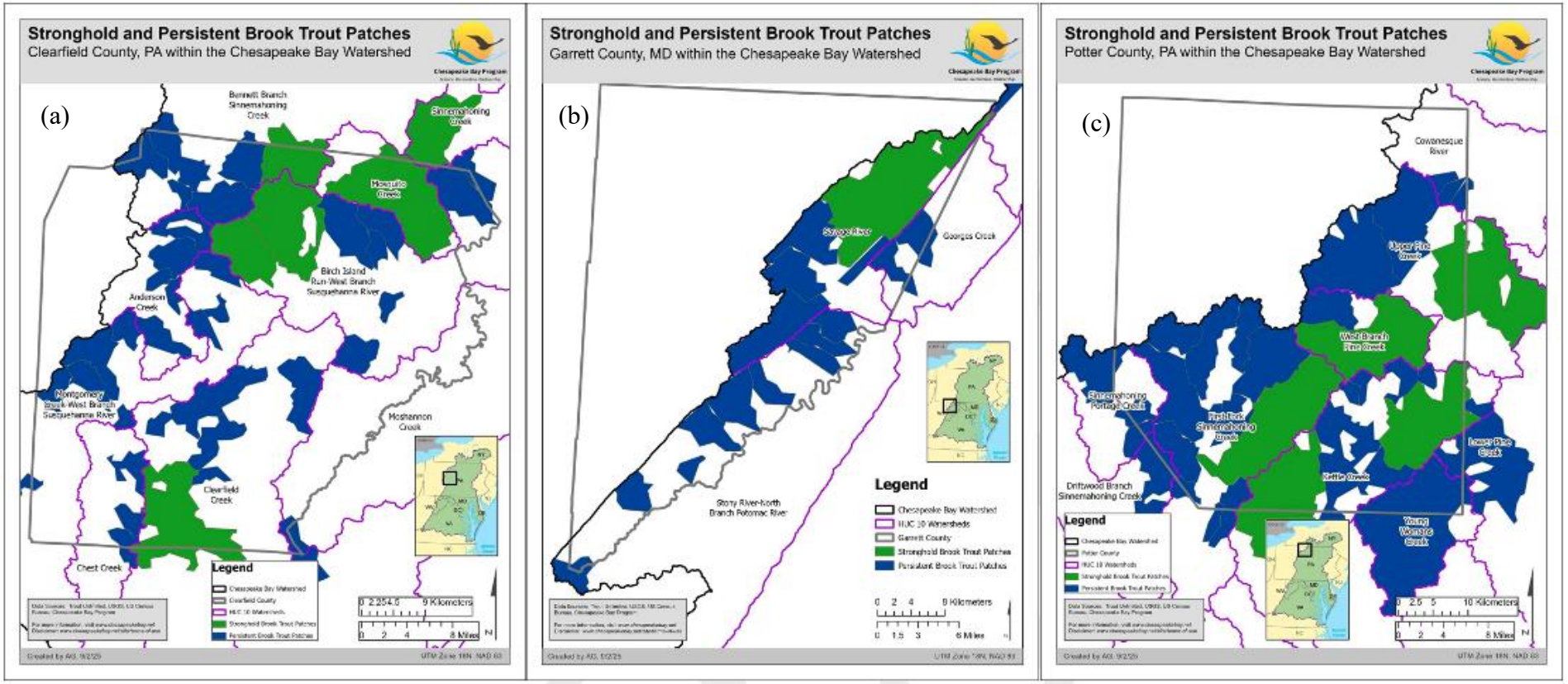

Figure 1. Brook trout patches in the pilot Pennsylvania counties and Garrett County, Maryland within the Chesapeake Bay watershed. Maps show the Chesapeake Bay watershed boundary and 10-digit Hydrologic Unit Code (HUC10) watersheds for (a) Clearfield County, Pennsylvania, (b) Garrett County, Maryland, and (c) Potter County, Pennsylvania. Stronghold patches are shown in green and persistent patches in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

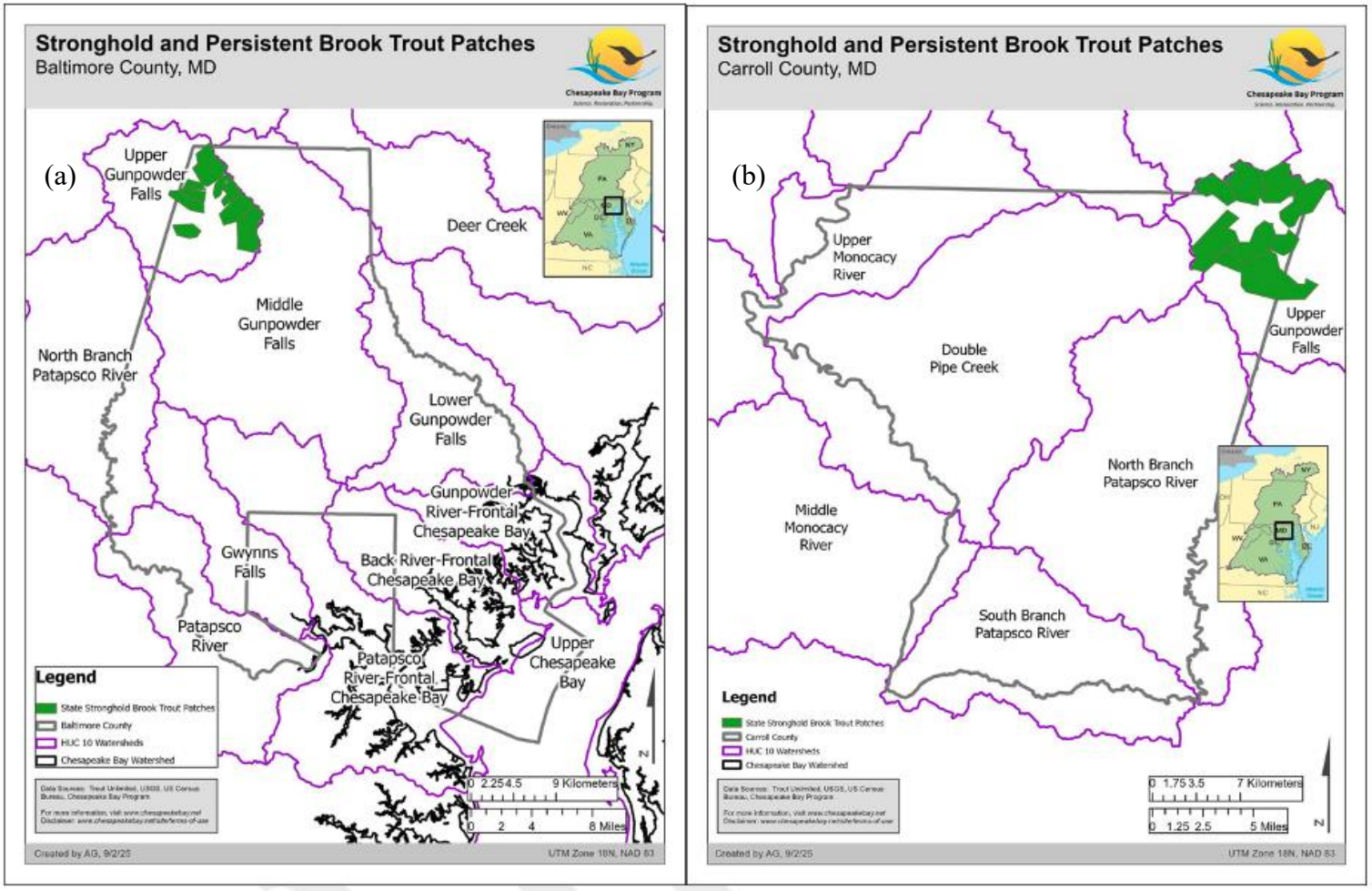

Figure 2. State stronghold brook trout patches in Baltimore and Carroll counties, Maryland. Maps show the Chesapeake Bay watershed boundary and 10-digit Hydrologic Unit Code (HUC10) watersheds for (a) Baltimore County and (b) Carroll County. State stronghold patches in the Upper Gunpowder watershed are shown in green. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

Workshop approach

Two workshops were held, one in Dubois, Pennsylvania (Clearfield County) and the other in Westminster, Maryland(Carroll County). The invitation-only effort convened experts from Chesapeake Bay Program Goal Implementation Teams and Workgroups, conservation organizations, regional coordinators, funding program administrators, and other relevant organizations within Pennsylvania and Maryland.

Workshop objectives

Objectives focused on defining threats, evaluating population status, and developing a repeatable county-scale implementation blueprint.

1. Identify, quantify, and summarize all known current threats (e.g., acid mine drainage (AMD), unforested riparian areas, unrestricted livestock access, passage barriers, etc.) to brook trout populations within and among stronghold and persistent patches in each county, and identify which resource agencies and organizations administer programs to address each stressor directly.
2. Assess current brook trout populations within stronghold and persistent patches and identify where brook trout can successfully recolonize, recover or be repatriated.
3. Develop an implementation strategy and recommendations for priority best management practices, including timelines, costs, funding mechanisms (e.g., grants or specific funding programs), and public engagement. Possible resulting strategies include improving land use planning through local zoning, identifying land conservation priorities, and local government planning to prevent future loss through land conservation.
4. Convene local leaders and resource partners as a steering committee to help guide the process and support representation that reflects community voices, particularly those that are often under-represented. Maintain balance of community, state and federal stakeholders, with priority given to the community. Solicit input from the local steering committee members to help identify and invite participants for the workshop.
5. Formulate a repeatable blueprint for interjurisdictional partnerships to develop a brook trout restoration plan for other Chesapeake Bay watershed counties.

Presentation Summaries

The following section provides summaries of the presentations delivered during the workshop, organized by meeting date. Presentations from the Pennsylvania session are summarized first, followed by those in the Maryland session. These summaries capture the key points shared by invited speakers and are intended to provide context for the breakout discussions and subsequent recommendations.

Threat Assessment and Baseline Metrics (Maryland and Pennsylvania) – Dan Goetz (MD DNR), Shawn Rummel (Trout Unlimited)

The opening presentation provided an overview of how the workgroup is embedded within the Chesapeake Bay Program, and how overarching brook trout outcome goals relate to the local jurisdictions at the county level. The presentation discussed the previous outcome goal of an eight percent increase in brook trout occupied habitat by 2024 and why we fell short. It also discussed the three new outcome goals for beyond 2025 and how partners at the county level need to be included in the process to maximize overall success. The presentation detailed the priority threats related to the resiliency target of the new brook trout outcome goal. Acid mine drainage, road crossing barriers, riparian forest cover, private land protection, and dirt and gravel road pollution were identified as the five primary threats impacting brook trout throughout the Chesapeake Bay Watershed. A Geospatial Planning Tool for Brook Trout STAC Workshop was developed and shared at both workshops detailing the spatial extent of the threats identified for all counties involved in the workshop.

Results from the 2024 GIT report: Facilitating Brook Trout Outcome Attainability highlighted the need for more focused work within stronghold and resilient patches. Only 1.7 % of 5,419 total projects documented in the GIT report were directly linked to brook trout, despite 13.7 % of total watershed area being within stronghold and persistent patches. Two other brook trout collaboratives were identified, the Driftless Area Reserve Program (DARE) and the Delaware Watershed Business Plan, both of which have focused efforts of brook trout restoration at the local level.

The opening presentation served as a segway to identify the problem and why all local, state, federal, and NGO partners were invited to the workshop and how we can all work better to benefit brook trout and make progress towards achieving our outcome goals. The presentation concluded with three overarching workshop goals for the attendees.

1. Agree on a collaborative process to increase brook trout conservation in priority watersheds.
2. Identify stakeholder roles and responsibilities for working together more efficiently and effectively.
3. Provide recommendations on ways to increase awareness of brook trout conservation and increase project prioritization and implementation.

Programmatic Overviews

Both workshop dates included a set of 15-minute programmatic overviews from subject matter experts. Presenters represented Natural Resources Conservation Service (NRCS), abandoned

mine reclamation programs, and county planning offices. Each provided a brief description of current efforts, available programmatic support, and how these resources can be applied to brook trout restoration. The overviews outlined existing initiatives, described mechanisms for funding and technical assistance, and noted challenges such as regulatory requirements and long-term maintenance. These presentations provided participants with a common understanding of the institutional context for brook trout conservation and informed the breakout discussions that followed.

Pennsylvania

Jason Detar (PA Fish and Boat Commission) — linked slides
Wild brook trout historically occurred in most Pennsylvania streams, but from the 1700s through the 1950s environmental degradation from unregulated coal mining, massive deforestation, and industrialization led to significant loss of water quality, habitat, and wild trout. In the 1960s, society began to recognize the value of environmental conservation; forests were recovering, water quality was improving, and wild trout populations improved. States began recognizing the ecological and economic value of wild trout, and the first wild trout management program was established in 1969. Advances in science and technology in the late 1970s allowed effective sampling of streams and a statewide inventory, which led to development of the wild trout biomass classification system in 1983. That system supports a resource-based management framework and a "Resource First" principle for management of both wild and stocked trout programs.

Three primary wild trout management programs are used: Wild Trout Waters (Natural Reproduction), Class A Wild Trout Waters, and Wilderness Trout Streams. Wild Trout Waters are streams where trout populations result from natural reproduction, and tributaries to these waters are also classified because they function as habitat for segments of wild trout populations. This designation includes 17,780 miles of listed wild trout streams and 20,300 miles of tributaries, for a total of 38,080 miles of streams classified as wild trout streams (Figure 3). Class A Wild Trout Waters are streams that support a population of naturally produced trout of sufficient size and abundance to support a long term and rewarding fishery. These streams represent the "best of the best" wild trout waters, defined by minimum biomass thresholds, and include 1,242 sections and about 3,282 miles of streams in 57 of 67 counties (Figure 3). Wilderness Trout Streams are streams that provide a wild trout fishing experience in a remote, natural, and unspoiled environment where human activities are minimal; they comprise about 0.1 percent of flowing waters, with 154 sections and about 496 miles of streams designated.

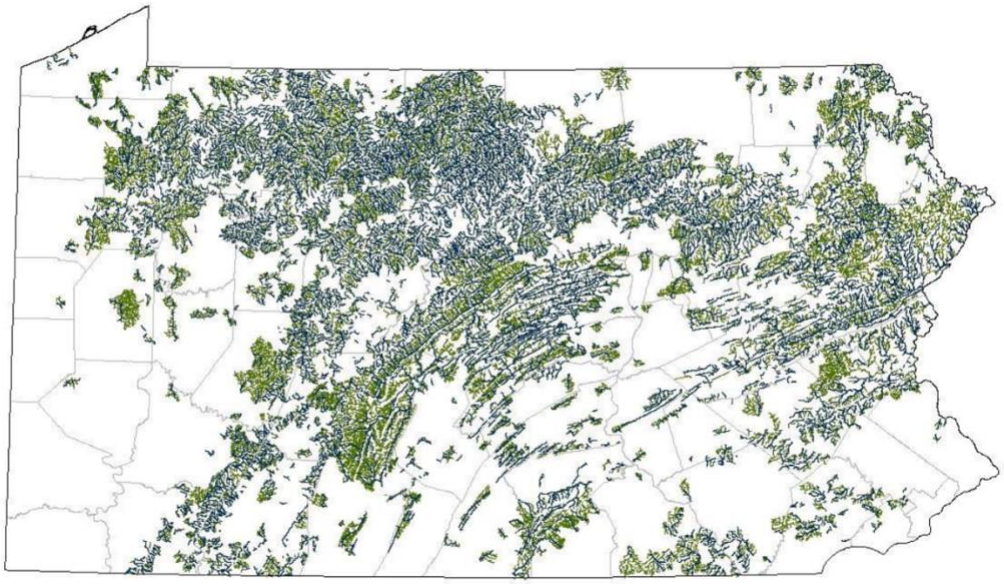

Figure 3. Map of Wild Trout Waters (Natural Reproduction) in Pennsylvania, with blue showing 17,780 miles of listed wild trout streams and green showing 20,300 miles of tributaries to listed wild trout streams, for a total of 38,080 miles of streams classified as wild trout streams. Source: Pennsylvania Fish and Boat Commission.

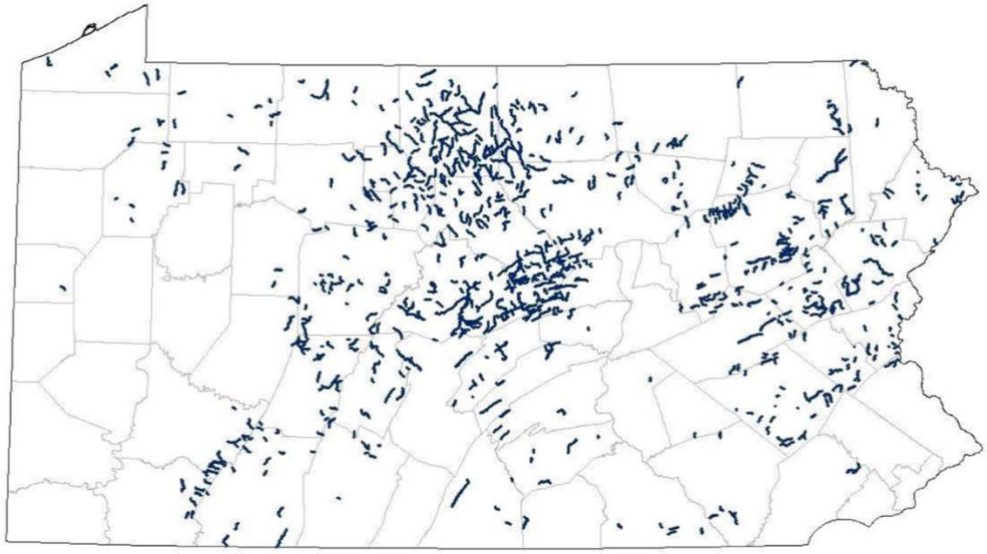

Figure 4. Map of Class A Wild Trout Waters in Pennsylvania, with blue showing 1,242 sections (3,282 miles) of streams designated as Class A Wild Trout Waters; Class A waters occur in 57 of 67 counties. Source: Pennsylvania Fish and Boat Commission.

In addition to these static maps, an ArcGIS Trout Streams online mapping tool provides an interactive view of wild trout designations statewide, allowing users to pan, zoom, and toggle layers to explore these resources.

Current and emerging challenges include climate change, more frequent high intensity rain events, more frequent droughts, warmer air and water temperatures, water quality problems such as acid mine drainage and other contaminants, altered water quantity from stormwater and withdrawals, conversion of forestland to development, impassable culverts, and erosion and sedimentation from roads, development, and agriculture. Work to address these stressors focuses

on stronghold watersheds, including allopatric and sympatric systems, with emphasis on Class A and B wild trout streams, land conservation in priority watersheds, erosion and sediment controls, the Dirt and Gravel Roads Program, and fish passage improvements. Prioritization uses a matrix of factors such as land ownership, funding availability, priority locations for funding sources, public lands, strong Brook trout populations, watersheds that are more than 75 percent forested, and groundwater influenced systems, with biologist consultation at initial and final project screening. Partnerships among conservation agencies, organizations, and the public are highlighted as critical for conservation and wild trout management.

Chris Peters (PA NRCS) — linked slides
Pennsylvania's Natural Resources Conservation Service (PA NRCS) work on private, non-industrial lands is delivered through voluntary conservation that provides financial and technical assistance to landowners to address natural resource concerns and deliver environmental benefits. NRCS identifies its mission as delivering conservation solutions so agricultural producers can protect natural resources and feed a growing world, supported by a vision of clean and abundant water, healthy soils, resilient landscapes, and thriving agricultural communities through voluntary conservation. Assistance follows an inquiry and site visit process that leads into technical assistance and financial assistance, with program goals that include improved water quality, improved air quality, reduced soil erosion, improved or created wildlife habitat, and improved forest health. Farm Bills provide authority for NRCS to apply conservation program funds through the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), Regional Conservation Partnership Program (RCPP), Agriculture Conservation Easement Program (ACEP), and Farm Service Agency programs such as the Conservation Reserve Program and Conservation Reserve Enhancement Program.

EQIP is characterized as the NRCS "workhorse" for addressing existing resource concerns across land uses including forestland, cropland, and pasture, with conservation practices typically implemented through 2 to 5 year contracts and up to 10 year contracts. CSP supports maintaining existing management systems while improving conservation efforts through 5-year contracts that require meeting stewardship thresholds for at least two resource concerns at contract offer and adding at least one additional resource concern by the end of the contract; CSP payments include an annual stewardship component and a second component for new enhancement activities or conservation practices. Forestry contracts require a Forest Management Plan that can be NRCS funded through a technical service provider (CPA 106 (Conservation Planned Activity) or DIA 165 Design and Implementation Activity), a Forest Stewardship Plan meeting national guidelines, a Tree Farm Plan meeting the National Forest Management Plan Template, or another plan approved by the NRCS State Conservationist. Practices highlighted include forest stand improvement, tree and shrub planting and site preparation, riparian forest buffers, and road, trail, and landing closure and treatment, along with non-forestry practices such as access control, fence, stream crossings, critical area planting, bank stabilization, stream habitat improvements, aquatic organism passage, and dam removal.

Brook trout work is linked through watershed targeting rather than direct species management, with key watersheds recognized in NRCS ranking processes and receiving priority for funding and technical assistance. Many practices implemented for broader conservation goals can improve brook trout conditions by reducing sediment and nutrient delivery, stabilizing banks,

improving riparian cover, and improving aquatic organism passage. Opportunities identified for strengthening brook trout outcomes include working closer with partners, using RCPP, dedicated fund pools, and other cooperation to better focus investments in priority watersheds. Example projects highlighted coordinated use of EQIP, CSP, and RCPP in headwater systems, including prescribed grazing operations with stream exclusion fencing, livestock pipeline, watering facilities, and stream crossings, and partnership delivery with Trout Unlimited in headwater landscapes.

Danielle Rihel (PA DCNR) — Recorded Presentation
The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Bureau of Forestry's Watershed Forestry Program offers funding for two watershed forestry practices: Riparian Forest Buffers and Lawn-to-Habitat Implementation. Riparian Forest Buffers are native forests planted within 300 feet of a water body. Lawn-to-Habitat implementation is the intentional transition of a regularly mowed, maintained lawn to either a native, managed meadow or native forest. Both watershed forestry practices help improve water quality by increasing stormwater infiltration, reducing nutrient loads, and mitigating erosion. When federal grants and state discretionary funding are available, PA DCNR contracts pre-qualified landscape and conservation professionals to implement eligible, shovel-ready riparian forest, upland forest, and native meadow plantings on privately and publicly owned lands. Please note that funding levels may vary each year, and availability cannot be guaranteed. Those interested in implementing one of these practices in Pennsylvania, should contact a Regional Watershed Forestry Specialist.

Additionally, the PA DCNR provides the Community Conservation Partnership Program (C2P2) through the Bureau of Recreation and Conservation. This program allows organizations to apply for funding through the Community and Watershed Forestry Grant. These grants last for four years, require a minimum request of $50,000, and necessitate a 20% match. Non-profits, local governments, and educational institutions are eligible to apply. The grant is competitive, typically opening in January and closing at the beginning of April each year. A Regional Advisor in the Bureau of Recreation and Conservation is the contact for more information on this grant.

Jon Smoyer (PA DEP BAMR) —No slides
Pennsylvania Department of Environmental Protection (PA DEP) abandoned mine reclamation work is implemented through the Bureau of Abandoned Mine Reclamation (BAMR), a statewide program established under the federal Surface Mining Control and Reclamation Act (SMCRA) (U.S. Congress, 1977). AMD abatement and treatment is carried out through Pennsylvania's AMD Set-Aside Program, authorized under SMCRA and first authorized in 1990, with the 2006 SMCRA amendments increasing funding limits and removing a prior requirement for Office of Surface Mining Reclamation and Enforcement approval of an AMD plan (Pennsylvania Department of Environmental Protection, 2026).

Up to 30% of eligible annual abandoned mine land grant funds can be deposited into Pennsylvania's Acid Mine Drainage Abatement and Treatment Fund, and Set-Aside funds plus interest are restricted to comprehensive AMD abatement and treatment within qualified hydrologic units affected by coal mining practices; Set-Aside funds are considered state funds and may be used to meet match requirements for other federal grant programs when program goals are comparable (Pennsylvania Department of Environmental Protection, 2026). More

recent federal infrastructure funding under the Infrastructure Investment and Jobs Act (IIJA) increased resources available for abandoned mine land and AMD work nationally, including extension of fee collections and authorization of additional appropriations for the Abandoned Mine Reclamation Fund (Office of Surface Mining Reclamation and Enforcement, 2021).

Kelly Williams & Josh Glace (Clearfield & Potter County Conservation Districts) — linked slides

County conservation districts are described as the local delivery system for conservation in Pennsylvania's portion of the Chesapeake Bay watershed. There are 66 conservation districts, one in every county except Philadelphia, responsible for delegated programs such as Chapter 102 erosion and sediment and National Pollutant Discharge Elimination System (NPDES) reviews, Chapter 105 general permits for in stream work, the Dirt, Gravel, and Low Volume Road Program, Chesapeake Bay and Nutrient Management technicians, Countywide Action Plan (CAP) coordination, the Agriculture Conservation Assistance Program, and the Watershed Specialist Program. Countywide Action Plans function as county level planning and prioritization tools for implementing Pennsylvania's Phase 3 Watershed Implementation Plan. Of the 43 Pennsylvania counties in the Chesapeake Bay watershed, 34 have CAPs and CAP Coordinators who developed and oversee these plans, providing county level planning and prioritization for implementation of Pennsylvania's Phase 3 Watershed Implementation Plan (WIP).

Clearfield County's CAP is described as a 55-page plan with 98 priority initiatives across sectors including agriculture, stormwater, stream restorations, land protection, wetland creation and protection, aquatic organism passage improvements, floodplain reconnection, Dirt and Gravel Road support, education, and AMD and abandoned mine land (AML) remediation. The watershed specialist role covers anything related to protecting and improving the water quality of Clearfield County, including grant writing and management, project and construction oversight, water quality sampling, fisheries sampling, and macroinvertebrate sampling, development and management of restoration and watershed implementation plans, and stream restorations and agricultural best management practice (BMP) implementation. In Figure 5, abandoned mine drainage treatment and abandoned mine land reclamation, AMD impairment versus natural trout reproduction, and AMD remediation success are shown, followed by naturally reproducing trout return.

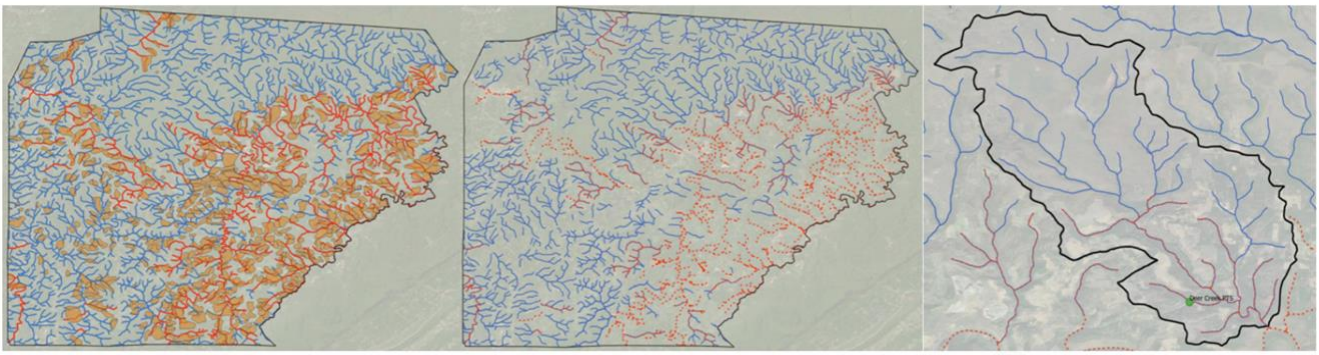

Figure 5. Left: Abandoned mine drainage (AMD) treatment and abandoned mine land (AML) reclamation in Clearfield County. **Middle:** Overlap between AMD impairment and natural trout reproduction. **Right:** AMD remediation success followed by naturally reproducing trout return.

Planning for trout in Potter County's CAP includes instream habitat projects, trout hatchery nutrient reductions, support for fishing opportunities, protection and restoration of watersheds, and aquatic organism passages. CAPs are characterized as varying by county and local initiatives, reflecting rural versus urban settings and issues such as flooding, agricultural impacts, AMD, stormwater, and new development types, with a central focus on water quality and Brook trout as secondary benefactors of projects that address impairments, reconnect habitat, and improve instream conditions. CAPs focus on water quality, with Brook trout as secondary benefactors.

Steve Bloser (Center for Dirt and Gravel Roads, PSU) — linked slides
Pennsylvania's Dirt, Gravel, and Low Volume Road (DGLVR) Maintenance Program provides $35 million in annual funding, split as $7 million through the Department of Conservation and Natural Resources for state forestry and park roads and $28 million through the State Conservation Commission for municipal roads. Work is framed around Environmentally Sensitive Maintenance Practices (ESMPs) and focuses on reducing sediment production and environmental impacts to streams from Pennsylvania's network of more than 20,000 miles of public unpaved roads. Practices target the often overlooked erosion and pollution associated with the rural "road ditch to stream" network by promoting infiltration and dispersion of road runoff. Co-benefits include improved road conditions for users and reduced long term maintenance costs for road owners, consistent with the program slogan "better roads, cleaner streams". Union Creek Road addressed a stream threatening the road by installing a 10-section mud sill to protect the road, as shown in Figure 6.

Figure 6. Union Creek Road project photo documenting installation of a 10 section mud sill to protect the road where a stream was threatening the road. Source: Pennsylvania Dirt, Gravel, and Low Volume Road Maintenance Program.

A second focus area is environmentally sound stream crossing replacements for bridges and culverts. Many of Pennsylvania's 100,000 plus road and stream crossings are severely undersized and create environmental problems that range from erosion and large scour holes to fragmentation of aquatic habitat, barriers to aquatic organism passage, and complete road washouts during high flows. A new standard for stream crossing replacements funded by the program was implemented in 2022, based on Stream Simulation methodology developed by the US Forest Service **(**USDA Forest Service 2008**)**. The standard focuses on stream health and continuity through the road and often requires larger structures and additional in stream work inside and outside the new structure. The goal is to allow the stream to function naturally through the road, resulting in a healthier stream and a crossing that is more resistant to erosion, flooding, and potential catastrophic failure.

Robin Eng (PA DCNR) — linked slides

PA DCNR is the state agency responsible for conserving and maintaining Pennsylvania's natural resources and providing outdoor recreation opportunities. Within PA DCNR, the Bureau of Forestry (BOF) is one of four bureaus and manages the Pennsylvania State Forest System, including about 2.2 million acres and about 5,000 miles of streams. Work is framed around an ecosystem management approach, where no species or system is managed in isolation, and aquatic and brook trout efforts are guided by interrelated management plans and technical guidance used to support land and aquatic resource management across state forest lands. Watershed protection is identified as a key objective in the foundation of the State Forest System.

Two plans are highlighted as the primary tools for brook trout related work on state forests, the Aquatic Resource Management Plan (Pennsylvania DCNR Bureau of Forestry 2018) and the Brook Trout Conservation Plan (Pennsylvania DCNR Bureau of Forestry 2016). The Aquatic Resource Management Plan supports healthy aquatic resources with suitable habitat, functional buffers, good water quality, connectivity, and naturally occurring stream processes, with the broader aim of supporting healthy aquatic communities. The Brook Trout Conservation Plan

guides strategies to sustain and enhance healthy, naturally reproducing brook trout populations on state forest lands and identifies key stressors including increasing water temperatures, sedimentation and erosion, lack of instream habitat, and barriers to fish passage. Current examples of implementation include large woody material additions to improve brook trout habitat, water quality monitoring associated with gas monitoring on state forest land, bridge and culvert redesign to improve aquatic organism passage, and outreach and support for riparian forest restoration and planting on both public and private lands in the commonwealth. Project prioritization draws on tools such as High Quality and Exceptional Value designations and trout biomass classifications, along with internal Geographic Information Systems (GIS) layers, team capacity, and opportunistic alignment with other work, with partnerships emphasized as central to success.

Maryland

Janet O'Meara (Carroll County Department of Planning & Land Management) — linked slides

Carroll County Government's Bureau of Resource Management is organized under the Department of Planning and Land Management and includes a Restoration Division, Water Resources Division, Environmental Review Division, and Environmental Inspection Division. Stream designated uses in the county are identified as Use Class I, Use Class III, and Use Class IV, providing context for stormwater controls and restoration activities based on receiving water classifications.

Municipal Separate Storm Sewer System (MS4) implementation is carried out under the Carroll County MS4 Permit with multiple co permittees, organized around restoration, monitoring and assessment, and stormdrain data management. Restoration targets include treatment of 1,217 acres of impervious surfaces, with an overall goal of restoring impaired waterways locally and regionally. Structural restoration work is framed around impervious area treatment, with project examples including Shiloh Middle School (26 impervious acres treated) and Elderwood or Oklahoma Stormwater Management (SWM) projects (81 impervious acres treated). Project selection and prioritization draws from aging infrastructure or maintenance needs at existing facilities, stream corridor assessments identifying degraded areas, GIS level analyses for retrofit opportunities and new facility construction, dam safety hazard classification, watershed level studies, and local Total Maximum Daily Load (TMDL) attainment progress.

Work tied to water quality and habitat includes overall improvement of total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS), hydrology management through stream and habitat stabilization, thermal mitigation, refinement of large-scale surface sand filters, addition of submerged gravel wetlands, and installation of innovative designs with monitoring of outcomes. Tree planting is implemented as a voluntary, grant assisted initiative at no cost to landowners to reestablish forested corridors along streams, address inadequate streamside buffers, and establish or reestablish forested areas, with approximately 252 acres planted since 2013 on private properties and county or municipal land and counted toward MS4 restoration credit. Monitoring and assessment includes chemical, physical, and biological components, with BMP effectiveness monitoring in the Loch Raven watershed using continuous physical measurements (flow, temperature, pH, dissolved oxygen, conductivity) alongside chemical, biological, and

geomorphological elements, and TMDL watershed assessment that includes county wide macroinvertebrate sampling, targeted bacteria trend monitoring in six of nine watersheds, and targeted chloride monitoring in the headwaters of Liberty Reservoir. Environmental codes referenced include stormwater management, water resources, floodplains, and forest conservation. Long term protection is provided for all retention, reforestation, afforestation, off site reserve, and forest bank areas through an easement recorded during the development process to protect the forested area, with inspections every 3 years or in response to complaints. Easement totals are summarized in Figure 7.

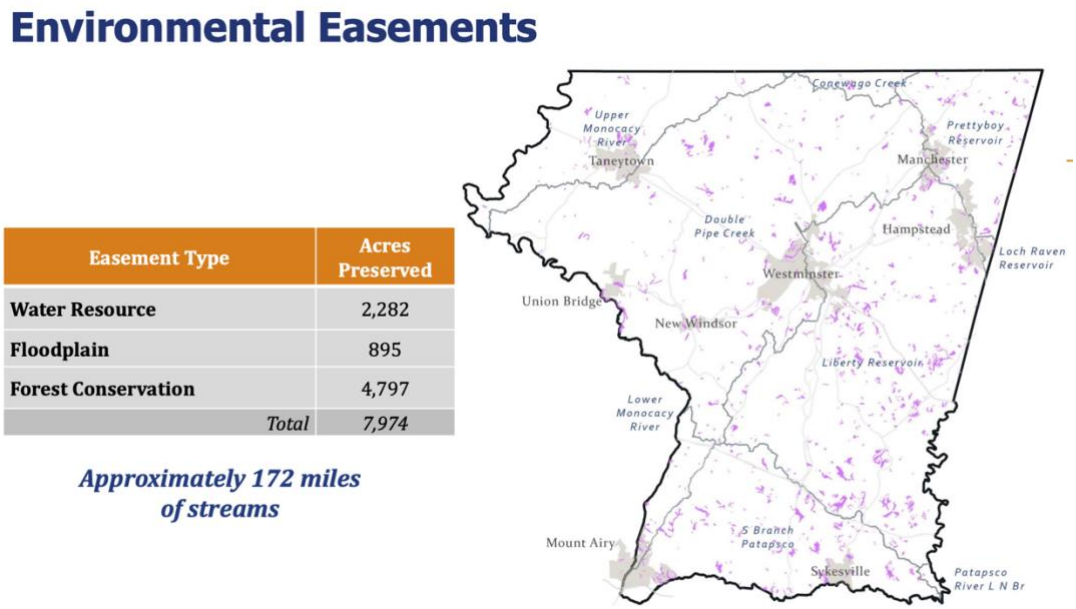

Figure 7. Environmental Easements in Carroll County. Water resource easements total 2,282 acres, floodplain easements total 895 acres, and forest conservation easements total 4,797 acres, for a combined total of 7,974 acres and approximately 172 miles of streams.

Jason Cessna (MD DNR) — linked slides
Brook trout status and conservation in Maryland through the Maryland Department of Natural Resources (MD DNR) integrates statewide status assessment, stronghold patch prioritization, long term monitoring, targeted coldwater surveys, and restoration and reintroduction actions. Eastern brook trout are a coldwater species that is very sensitive to temperature and sediments, with a native range from Canada to the Appalachian Mountains in Georgia. Extirpation is linked to land use practices that reduce forest cover and increase impervious surfaces, and declines in occupancy are documented across the native range, with an estimated greater than 60 percent reduction in Maryland (Hudy et al. 2008). A statewide brook trout assessment at the HUC (Hydrologic Unit Code) 14 scale compared 1987–2013 to 2014–2018 and reported a 27% loss in occupancy statewide and a 49% loss in the Piedmont. The Brook Trout Strategic Plan patch assessment ranks brook trout patches based on allopatry, population size, public land with stream access, private land conservation, and genetic health, with 14 of 141 patches identified as level 1 stronghold resilient patches.

MD DNR population monitoring is organized through a Brook Trout Monitoring Network of 51 long term fixed stations with annual sampling of fish, temperature, and habitat, using pooled

datasets spanning 4 to 33 years and incorporating partner datasets to support basin and patch level evaluations. Coldwater potential surveys conducted from 2022 to 2024 used continuous stream temperature monitoring and fish community, habitat, and benthic data to locate unoccupied coldwater streams with sufficient habitat to support brook trout. These surveys identified 14 previously undocumented brook trout populations, documented novel wild brown and rainbow trout populations, and identified approximately eight candidate streams for potential brook trout reintroduction, with 22 streams submitted to Maryland water quality standards in January 2025 for reclassification to coldwater criteria based on indicators such as multiple year classes of wild trout, benthic coldwater obligates, and a cold thermal regime.

Management and conservation actions referenced include the Brook Trout Fishery Management Plan (Maryland Department of Natural Resources 2006), regulatory changes including zero creel east of I 81 and in the Upper Savage River, listing as a Species of Greatest Conservation Need under the Maryland State Wildlife Action Plan (MD SWAP), a 2024 non-native trout removal policy described as highly protective of allopatric brook trout patches, and application of a Coldwater Resources Mapping Tool during permit review. Reintroduction work includes three translocation attempts in progress, with source stream selection based on source population density, genetic health, habitat similarity and proximity, and an initial transfer of approximately 100 individuals under low density and minimized travel distance, with survival and successful reproduction tracked as outcomes.

Mark Staley (MD DNR) — No slides
Brook trout distribution, abundance, and land use trends in Maryland's northern Piedmont were discussed using the Upper Gunpowder watershed as a focal example, including the Prettyboy Reservoir area in Baltimore and Carroll Counties. Land use and forest cover in rural parts of the Piedmont were characterized as improved relative to conditions roughly a century ago, driven in part by declines in dairy and other farming and the reversion of former pasture and agricultural land to forest, particularly along stream valleys. The Upper Gunpowder was identified as one of the few remaining allopatric brook trout watersheds in Maryland, contrasting with many other northern Piedmont watersheds where brook trout persist in sympatry with brown trout.

Longer-term trends over the past several decades include extirpation of multiple brook trout populations in the region, attributed to increasing temperatures, urbanization-related water quality impacts, and competition from brown trout, including unintended consequences associated with maintaining brown trout fisheries. Threats highlighted for the Upper Gunpowder and surrounding Piedmont watersheds included inadequate riparian cover, agricultural runoff, and cumulative thermal impacts from numerous small ponds distributed across catchments, where a single pond can contribute enough warming to exclude brook trout from portions of a watershed. Despite many populations being small and isolated, the Upper Gunpowder was noted to show indications of interconnected populations and routine use of third-order streams, suggesting opportunities to restore and maintain coldwater habitat connectivity where riparian condition, runoff inputs, and pond-related thermal sources can be addressed.

Shayla Lewis (MDE) — linked slides
The Maryland Department of the Environment (MDE), Abandoned Mine Land Division (AMLD) is responsible for cleaning up and restoring land and waters impacted by coal mining

activities that occurred before 1977. In 1977, SMCRA was enacted (U.S. Congress, 1977). This law established the Office of Surface Mining Reclamation and Enforcement (OSMRE) as an oversight agency and created a set of regulations for active mining and the reclamation of mines abandoned prior to 1977. It also provides a means of funding, through a per ton coal tax levied upon existing coal miners, to be used for the reclamation of abandoned mine features, future problems that may arise due to pre-law coal mining, and AMD remediation. SMCRA also set abandoned mine reclamation priorities. Problem types are categorized as Priority 1, 2, or 3 depending on the level of threat the problem has on public health and safety. Priority 1 problem types are extremely threatening to public health and safety, Priority 2 problem types pose a risk to public health and safety, and Priority 3 problem types may affect the environment. Projects involving mine drainage remediation are usually Priority 3 unless grouped with a different problem type being a Priority 1 or 2.

Mine drainage is found throughout the coal region and significantly degrades stream health, making it difficult for aquatic species to survive in these streams. AMD is formed when surface or ground water comes into contact with rock that contains iron sulfides or other sulfur-bearing materials. This reaction creates acidic water, which can leach iron, aluminum, manganese, and other metals into water sources. When this acidic water comes into contact with oxygen in the air, metals precipitate out. One important thing to note is that not all mine drainage is acidic, and not all mine drainage is orange. In fact, some mine drainage is crystal clear. Sometimes crystal-clear water can have a high acidity and low pH which leaves the metals dissolved in solution therefore, their presence is not visible. Coal mine drainage can be either net acidic or net alkaline. In AMD, the total acidity exceeds the total alkalinity. This type of drainage may contain elevated concentrations of iron, sulfates, aluminum, and/or manganese as well as other contaminates. In alkaline mine drainage, alkalinity equals or exceeds acidity and sulfates, iron, and manganese concentrations are usually elevated. Mine drainage can lower stream pH, which can be lethal to fish and other benthic organisms. Mine drainage can also impact food sources for fish by altering water quality. Aluminum from mine drainage can coat fish gills and body surfaces, making it difficult for them to breathe.

The AMLD operates 64 mine drainage treatment systems in Allegany and Garrett Counties. The AMLD uses both active and passive treatment systems to treat mine drainage. Active treatment involves adding alkaline chemicals directly to the mine discharge or stream. Passive treatment involves the use of ponds, wetlands, ditches, and limestone to treat the mine drainage through biological and geochemical processes. The method AMLD uses to treat the mine drainage is determined by the water quality characteristics and the flow. Passive treatment can require 2 to 10 acres of ground to construct a system to properly treat the mine drainage. Passive treatment is limited to relatively low flows and pH <3.5. Active treatment requires less space and can treat any water quality and greater flows.

AMLD has improved water quality with the construction of active and passive treatment systems. AMLD installed a lime doser and multiple passive treatment systems along Aaron's Run in Allegany County, MD. After the completion of the project, the stream was de-listed in 2015 from the US Environmental Protection Agency (EPA) 303D list for pH impaired streams. Further, in 1944 the North Branch Potomac River was considered virtually lifeless due to AMD caused by pre-law mining. Several dosers (9) and passive treatment systems were installed in the

watershed. Today the river is a high-quality stocked trout stream and a popular destination for anglers, kayakers, rafters, and nature enthusiasts. In 2010, a report was completed by "Downstream Strategies" stating that boaters and anglers spend roughly $3 million annually. Economic impacts of the North Branch alone were 10 times the cost of treatment using the dosers at that time. Finally, the implementation of sand dumps and multiple passive treatment systems have greatly improved brook trout populations in the Casselman River watershed according to fish surveys completed by Maryland DNR Fisheries from 2016 to 2018. In conclusion, it is estimated that approximately 120 miles of AMD impaired streams have been improved.

Anne Hairston-Strang (MD DNR) — linked slides
The Maryland Forest Service offers a wide range of tree planting programs for public and private lands, for restoring riparian forest buffers and beyond. Programs for landowners include cost-share and incentive-based options such as the Conservation Reserve Enhancement Program (CREP), Woodland Incentive Program (WIP), EQIP, and Healthy Forests, Healthy Waters (HFHW), which provide financial and technical support for planting, maintenance, and site preparation. Additional homeowner-focused programs like Backyard Buffers and Marylanders Plant Trees offer free or discounted native trees for smaller-scale planting efforts. Farmers may also benefit from the Maryland Agricultural Water Quality Cost-Share Program (MACS), which funds farm conservation practices to improve water quality.

Community and urban planting efforts are supported through initiatives such as Tree-Mendous Maryland, the Maryland Urban and Community Forestry Committee (MUCFC) Grants Program, and the Community Forestry Catalyst Fund (CF2), which fund plantings on public land and in underserved neighborhoods. County-specific programs like Baltimore County's Turf to Trees and Frederick County's Creek ReLeaf provide comprehensive services, from planning to long-term maintenance, for eligible landowners. Additional resources such as the John S. Ayton State Tree Nursery, Gift of Trees program, and urban-focused grants from Maryland Department of Transportation (MDOT) and the Chesapeake Bay Trust further expand access to planting materials and funding. Together, these programs serve as key tools in Maryland's effort to grow and sustain healthy forests statewide.

Seth Moessinger (MD DNR) — No slides
MD DNR Fishing and Boating Services carries out brook trout conservation work that aligns aquatic organism passage improvements with flood resiliency needs at road–stream crossings. Work focuses on identifying crossings where undersized or failing culverts restrict fish movement and increase flood vulnerability during large storm events, including conditions where flows overtop roads, scour around crossings, and streams jump channels and establish new flow paths. Project goals include restoring connectivity for brook trout and other aquatic species while reducing infrastructure damage risk and improving the ability of roads and crossings to pass high flows safely.

Implementation relies on partnerships and coordinated delivery, including work with Trout Unlimited and the U.S. Forest Service on projects on state lands and coordination with county partners on construction and project delivery. Examples shared included the Wolfden Run road–stream crossing replacement in Garrett County, Maryland, a tributary to the Potomac River on

land incorporated into the Maryland State Park system. The crossing was prioritized because Wolfden Run supports brook trout, multiple culverts and poor crossing condition severely limited fish passage, and the road did not meet emergency vehicle access standards for the state-owned property. Photos from the Wolfden Run road–stream crossing project near Kitzmiller, Maryland show the original multi-pipe culvert and the replacement span bridge that restored stream continuity and fish passage (Figure 8).

Figure 8. Wolfden Run road–stream crossing replacement near Kitzmiller, Maryland. Left: original multi-pipe culvert prior to replacement. **Right:** replacement span bridge following construction. Photo credit: Seth Moessinger, Trout Unlimited.

MD DNR completed survey and design work with U.S. Fish and Wildlife Service guidance, Trout Unlimited served as project manager, and funding was secured through the U.S. Fish and Wildlife Service National Fish Passage Program and National Fish Habitat Partnership via the Eastern Brook Trout Joint Venture. The project removed the barrier to migrating fish, reconnecting brook trout to 2.8 miles of headwater habitat, and replaced the crossing with a stable span bridge capable of conveying emergency vehicles into the park.

Julie Devers (NRCS-FPAC) — linked slides

NRCS assistance for brook trout in Maryland is delivered through Farm Bill (U.S. Congress, 2018) conservation planning and cost share programs administered through local field offices in each Maryland county, typically co-located with Soil Conservation District offices. Conservation planning identifies resource concerns and practice options relevant to coldwater streams, including improving aquatic habitat, reducing elevated water temperature drivers, and addressing bank and gully erosion and related sediment delivery. Practices highlighted for direct brook trout and stream benefits include Aquatic Organism Passage (396), Riparian Forest Buffer (391), Riparian Herbaceous Buffer (390), Stream Habitat Improvement and Management (395), and Streambank and Shoreline Protection (580), along with broader land practices that reduce runoff and improve water quality on cropland, pasture, and farmsteads.

Implementation mechanisms include EQIP, CSP, RCPP, Agricultural Conservation Easement Program Wetland Reserve Easements (ACEP WRE), and Conservation Reserve Program and Conservation Reserve Enhancement Program (CRP and CREP), with EQIP also highlighted through Working Lands for Wildlife (WLFW). Wetland Reserve Easements include permanent easements, with the easement value covered and restoration funded at high-cost share levels, and 30-year easements with lower easement and restoration cost share levels. EQIP assistance is described as generally around 75 percent of estimated practice cost, with reimbursement after practice certification, and payments reported for tax purposes. Eligibility and delivery details

emphasize support for agricultural lands and non-industrial private forest land, with participation by individuals, legal entities, joint operations, and tribes managing land for agriculture, forest, or livestock production.

Additional emphasis is placed on locally led conservation delivered through partners and on projects aligned with Maryland Phase 3 WIP priorities, including grazing for water quality and soil health, nutrient management related work, land protection initiatives, and support for small and urban farms.

Creating a Brook Trout Stakeholder Collaborative

This session explored opportunities to develop a coordinated stakeholder collaborative to advance brook trout conservation across the Chesapeake Bay watershed. Discussion centered on how shared interests could be leveraged to expand the rate and scale of projects and on the importance of establishing clear structures to support collaboration. Participants considered who should be engaged in such an effort (including potential leaders and partners not currently represented) and what roles different organizations might play in sustaining a network over time.

Participants also examined approaches for setting priorities and aligning project selection across agencies and organizations. Key questions included whether a brook trout conservation portfolio could serve as an authoritative tool for prioritization, and how brook trout objectives might be more explicitly incorporated into county WIPs and CAPs. These conversations provided a foundation for identifying next steps in formalizing a stakeholder-driven approach to brook trout restoration.

A collaborative continuum slide (Figure 9) was used at the start of the session to frame discussion. It described the progression from initial connections among partners to alignment of resources and priorities, and ultimately to coordinated production.

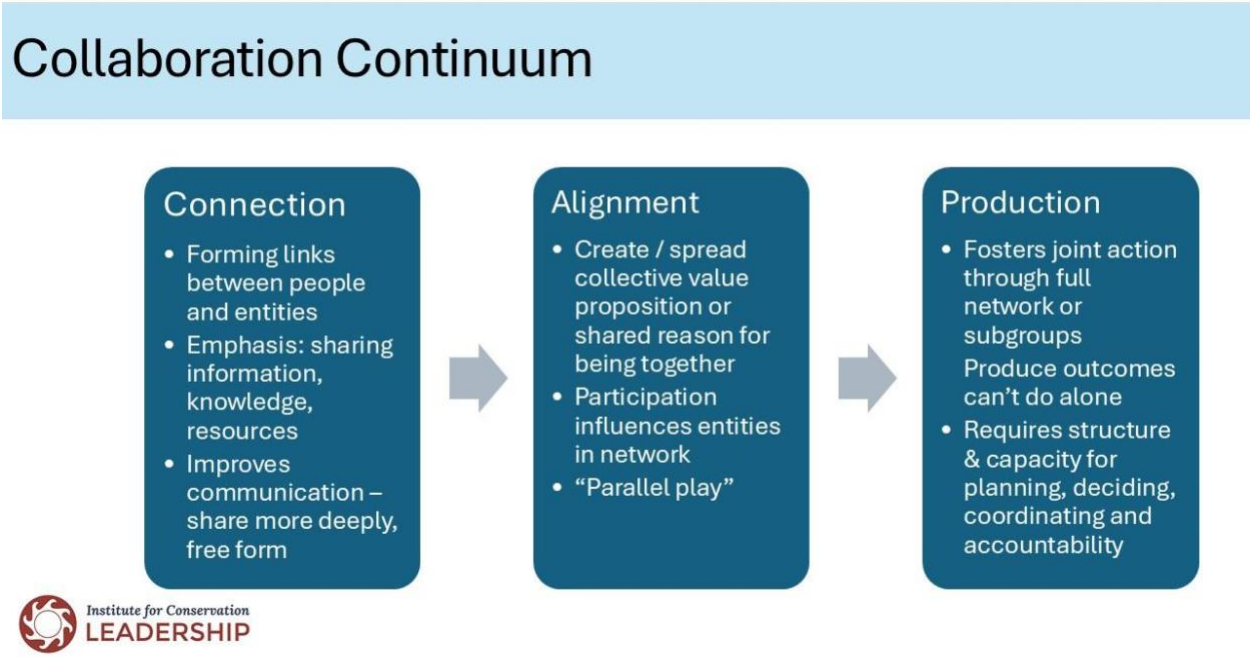

Figure 9. Collaboration Continuum: This continuum can be used as a planning and assessment tool to think about the purpose of your collaboration – identifying where you are, what you want from your collaboration and what is needed at each phase. Note: collaborations (including networks, coalitions, partnerships) can be operating at more than one level of the continuum. Also, there is no "right" or "best" place to be – choose and develop the form that matches your purpose and needs. The Institute for Conservation Leadership supports healthy communities and a healthy Earth, by working to strengthen leaders, organizations, coalitions, and networks.

Common themes emerged across Maryland and Pennsylvania discussions. For example, landowner willingness was consistently identified as the critical factor determining whether

projects advance. Further, participants highlighted the need for consistent, targeted outreach, the value of streamlined messaging across partners, and the utility of geospatial tools to set priorities and avoid duplication. The absence of a dedicated coordinator was viewed as a major barrier to scaling up efforts, and participants pointed to examples from other resource collaboratives that could serve as models.

Pennsylvania
In Pennsylvania, participants described current efforts as occupying the "connection" and "alignment" phases of the collaboration continuum. Multiple projects are ongoing across the state; however, these efforts are largely managed independently, and the absence of a coordinating entity limits progress toward a sustained, production-level collaborative. Key points shared:

- Restoration planning is most effective at the watershed scale rather than parcel by parcel; once a few landowners are engaged, additional neighbors often follow.
    - Private landowners remain the hardest group to reach, and peer-to-peer outreach has been the most effective strategy.
- There is interest in more structured coordination, such as quarterly or semi-annual meetings, with an emphasis on setting dates well in advance and possibly building on existing Conservation District opportunities.
- Tools like the TU Eastern Brook Trout Conservation Portfolio exist but are not widely used; participants recommended more outreach and training and suggested developing an interactive GIS platform to identify gaps and avoid duplication.
    - TU report produced in March 2017: Eastern Brook Trout Conservation Portfolio, Range-wide Habitat Integrity and Future Security Assessment, and Focal Area Risk and Opportunity Analysis
- Capacity limitations such as securing permits, contractor availability, and staffing constrain implementation *even when* funding is available.
- The Allegheny Forest Health Collaborative was highlighted as a model for how agencies, researchers, and industry partners might coordinate more effectively (Hanson et al. 2020).

Maryland
Maryland discussions emphasized aligning brook trout conservation with broader watershed restoration and forest buffer programs while developing tools and structures specific to trout habitat. Key points shared:

- Much of the work on brook trout ties back to existing forest buffer programs. Incentives are already in place ($4,000 vouchers, maintenance pools), and some examples were shared:
    - A project in Manchester where a culvert was failing, and the buffer incentive helped get a willing landowner on board.
    - Another site in the town park that built on earlier conversations; TU brought in funding, added woody debris, and linked small projects together.
- Participants want to use tools like the Cold Water Resource Mapping Tool and other GIS layers. MD DNR fisheries staff already have spatial data covering 100% of catchments

west of I-95. The idea is to make these tools the basis of a conservation portfolio that counties and partners can all point to.
- There are still gaps in long-term data. One suggestion was to establish 10 pilot monitoring sites (e.g., temperature TMDLs in Gwynns Falls) to start linking management actions with in-stream responses.
- Effective collaboratives exist elsewhere and facilitate monthly meetings, have clear goals, and someone in charge of keeping the group organized. There was interest in a coordinator role (whether part-time or full-time) to manage logistics, agendas, and follow-up; although there was concern of funding, many participants see this role as essential.
    - Examples included the Delaware River Watershed Business Plan and the Wisconsin DNR Brook Trout Reserve Program.
- Similar to Pennsylvania, the success of the work depends on landowners. Incentivizing early adopters, linking trout goals into WIPs and CAPs, and showing the recreational/cultural benefits were all suggested. Resources are limited and early adopters will likely get the most support.
- A "network of networks" approach might be needed, linking local, regional, and national partners.
- Drones may be utilized to identify brook trout in streams.
- Outreach to the general public is imperative, not just those living on or nearby a stream with brook trout, as public funding will drive much of the work.

Collaborative Approach to Reforestation — Craig Highfield (Alliance), linked slides
The Alliance for the Chesapeake Bay's forest program operates within a broader regional framework shaped by the 2014 Chesapeake Bay Watershed Agreement and the USDA Forest Service's Chesapeake Forest Restoration Strategy, both of which set ambitious targets for riparian forest buffers and tree canopy across the watershed's 64,000 square miles (U.S. Environmental Protection Agency 2014; Brownson and Claggett 2020). The 2014 Chesapeake Bay Watershed Agreement calls for restoring 900 miles of riparian forest buffer per year until at least 70 percent of riparian areas are forested, and states have collectively proposed an additional 148,000 acres of forest buffers by 2025 (U.S. Environmental Protection Agency 2014). Forests are the most beneficial land cover for water quality in the region, with one acre of riparian forest buffer capable of removing up to 40 pounds of total nitrogen, 1.5 pounds of phosphorus, and 539 pounds of suspended sediment annually (Brownson and Claggett 2020).

Agriculture accounts for roughly 20 percent of the watershed's land area but was responsible for 45 percent of nitrogen loads to Chesapeake waterways as of 2018, making riparian forest buffers on farmland a critical intervention (Chesapeake Progress 2020). The Alliance's Forest Buffer Incentive Program, running in various forms since 2013, addresses this directly by offering landowners a $4,000 conservation voucher per acre of riparian forest buffer installed, designed to layer on top of federal programs like CREP and EQIP. A key design feature is flexibility: vouchers can be applied toward any conservation practice on the farm, including stream crossings and fencing, not just tree planting. All streams on a participating farm must be buffered, and the program builds in a maintenance pool to support long-term establishment.

On the ground, the Alliance implements reforestation through the Healthy Forests, Healthy Waters program, a partnership with Maryland Forest Service, Maryland DNR, and the Maryland Forestry Foundation, funded through the Chesapeake and Atlantic Coastal Bays Trust Fund. This turnkey model handles site planning and planting logistics for landowners. Projects span Carroll County farm fields, urban parcels in Manchester, and stream corridors along the Gunpowder Falls watershed near Prettyboy Reservoir, where the Alliance works with Trout Unlimited, NRCS, and the City of Baltimore on fisheries habitat tied to brook trout recovery. Brook trout require cold, clean water, and stream temperatures across the watershed have risen an average of one degree Fahrenheit between 1960 and 2014, making riparian buffers that provide shading one of the most direct tools for protecting cold-water habitat (Brownson and Claggett 2020).

Breakout Sessions

Breakout discussions provided participants with the opportunity to examine roles and responsibilities needed to support brook trout restoration and to identify challenges and opportunities for coordination. Groups considered the range of stakeholders involved in project identification, prioritization, proposal development, implementation, monitoring, and reporting, and discussed organizational missions as they relate to brook trout conservation. Additional discussion time was given to capacity needs, funding limitations, and timelines for advancing restoration planning and implementation. Main takeaways from both days are summarized below, organized by state. Handwritten notes from two breakout groups during the Maryland session are included in Appendix H.

Guiding Questions:

- What roles are needed to support a long-term restoration plan (e.g., project identifiers, prioritizers, proposal writers, implementers, and those responsible for tracking, monitoring, and reporting)?
- Who is represented in your breakout group, and how does your organization's mission pertain to brook trout restoration?
- How do organizations contribute to collaboration and coordination, project identification and prioritization, landowner outreach, proposal writing, project implementation, and baseline/post-implementation monitoring?
- What are the major roadblocks (e.g., funding limitations, human capacity), and are additional positions or resources needed?

Breakout discussions addressed stakeholder roles, planning and implementation, roadblocks, and ten-year workplan targets with participants split across groups to allow engagement from a wide range of expertise. Organizational missions varied across the room, from targeted brook trout restoration to programs providing indirect water quality and habitat benefits, though participants broadly recognized shared interests and identified opportunities for stronger coordination across programs.

Pennsylvania

Groups agreed that project identification is most effectively carried out by entities with direct field presence, with brook trout-specific prioritization applied as a subsequent filter. No consensus was reached on whether prioritization criteria should differ between public and private lands, and this was noted as a topic for further discussion. A gap identified across groups was the absence of any entity specifically tasked with tracking completed projects, evaluating outcomes, and directing future investment toward areas of demonstrated success. Participants recommended formalizing this role to avoid a dispersed, opportunistic approach to restoration investment. Existing planning resources, including plans developed through the Cold Water Heritage Partnership, which administers grant programs for both planning and project implementation and maintains a GIS layer of plan and project locations, were recommended for explicit incorporation into the restoration planning framework.

Fish passage improvement and AMD remediation were consistently identified as the two strategies with the greatest potential to expand brook trout occupancy, particularly in Clearfield County where AMD is the dominant stressor. Agricultural BMPs were seen as valuable for

strengthening existing populations and potentially facilitating downstream range extension, though recovery was considered unlikely in heavily agricultural watersheds where brook trout have already been extirpated or where source populations are too distant for natural recolonization. The Dirt and Gravel Roads Program was highlighted as one of the most practical tools available, with an estimated $25 million in state match funding that could be leveraged for federal investment in brook trout-related projects.

Participants noted challenges with landowner uptake of traditional riparian buffer programs, particularly in forested landscapes where landowners often prefer to maintain open space along stream corridors. Programs with match requirements and long-term maintenance agreements were reported as barriers to participation, while newer, more flexible program structures have been better received. This finding has direct implications for how buffer programs are designed and marketed in the northern tier counties most relevant to brook trout conservation. Participants also noted a structural issue with CAP coverage; because CAPs in Pennsylvania are only required for counties exceeding certain nutrient loading thresholds, some brook trout priority counties fall outside that planning framework entirely, limiting the degree to which brook trout can be integrated into county-level conservation planning and funding alignment.

Capacity constraints were a consistent theme. Conservation districts were described as stretched thin, engineering expertise is often required but in short supply, and even where funding is available, implementation can stall due to permitting timelines and contractor shortages. Participants called for dedicated coordination positions and longer-term funding to retain staff at districts and NGOs. Long-term post-implementation monitoring was identified as a persistent gap, as typical grant timelines of two to three years are insufficient to detect meaningful brook trout population responses. Universities and PFBC were suggested as partners for sustained monitoring efforts.

Several groups flagged significant investments in public outreach and communications. One specific recommendation was to develop a community vision of what a recovered brook trout fishery looks like, as a way of countering normalized acceptance of degraded conditions in communities where poor water quality has persisted for generations. Additional recommendations included developing a StoryMap to serve as both a public-facing communications tool and a practitioner resource hub, partnering with professional communicators to develop audience-specific messaging, and engaging youth through programs such as Trout in the Classroom and PSU Extension's Master Watershed Stewards. Consistent messaging across partners was emphasized to avoid confusion among landowners. Groups also noted a structural misalignment between the upper watershed distribution of brook trout habitat and the lower watershed focus of much CBP water quality implementation funding, and recommended that future CAP and WIP updates more explicitly incorporate brook trout as a priority. Participants unanimously expressed interest in reconvening to continue building on the workshop's collaborative momentum.

Maryland

Project identification was seen as a distributed responsibility involving counties, MD DNR, local public works, MS4 permittees, and private landowners. Prioritization was described as funder-driven, with NFWF and EBJV identified as primary prioritizers given their existing investment frameworks in the Bay watershed. Some counties, such as Carroll, are not positioned to prioritize

brook trout directly but can redirect landowners and project inquiries to partners better equipped to do so.

Participants repeatedly raised the question of how to more effectively identify when a project is sited within a brook trout area and ensure that benefit is intentional rather than incidental. Early engagement was flagged as critical, as fisheries staff often learn about road or culvert projects after work is already underway.

Groups worked through the relationship between patches, catchments, and watersheds, noting that the patch concept is not widely understood outside of those already familiar with TU's Conservation Portfolio. A demonstration of the Portfolio for Maryland partners and counties was recommended. The general approach favored organizing partners at the watershed level and identifying projects within patches nested inside catchments, drawing on local knowledge to ground-truth spatial tools.

MD DNR's current strategy focuses resiliency work on approximately 14 stronghold patches through tree planting and barrier removal, with protection applied more broadly through advocacy, permit review, and collaboration with MDE, though in practice the work is more opportunistic than strategic. Carroll and Garrett counties were cited as supporting some of the best brook trout habitat in the state. Groups emphasized the cumulative effect of smaller projects over time, noting that removing a single culvert can reconnect miles of stream habitat and that legacy pond removal can produce immediate thermal benefits. A limiting factor analysis was recommended as the appropriate framework for moving from patch identification to project prioritization.

The need for a dedicated coordinator was a consistent theme. Participants discussed the advantages of housing this role within a nonprofit rather than a government agency given greater flexibility, and noted that it is not sustainable for the Bay Program to serve as the primary driver of local engagement. TU was identified as already performing many coordination functions informally and as a potential anchor for a more formal collaborative. The Gunpowder Valley Conservancy, which helped pass the Whole Watershed Act (2024) and is actively developing a collaborative, was also cited as a model. A county-level contact directory and a listserv modeled on EBJV's project board were proposed as practical near-term steps to improve communication across partners.

Current workplan capacity is limited. TU reported two to three barrier removals per year statewide with two staff. MD DNR does not conduct removals directly, completing one in 2024. Forest buffer targets ranged from 40 to 200 acres depending on county. Cattle exclusion was noted as minimal given state law. Groups recommended establishing a baseline of current delivery before setting targets, and suggested starting from what partners can realistically accomplish and assessing whether that pace is sufficient to meet CBP outcome goals.

Conflicting prioritization signals from state and county levels have left some landowners uncertain about what programs to participate in. Some county governments have been unreceptive to AOP improvements, and participants recommended investing in those relationships proactively. Multi-year BMP contracts were raised as a participation barrier, though Carroll County's ten-year maintenance model was noted as an example that also generates MS4

credit. Outreach to plain sect farming communities was identified as an underexplored opportunity in relevant areas.

Pond removal and thermal mitigation were identified as immediate priorities given the direct lethal effects of temperature on brook trout, distinct from the nutrient and sediment reductions that drive most CBP investment. Some Maryland populations may carry thermal adaptations stemming from a genetic bottleneck around 1875, which could have implications for how resilience is assessed and which populations are prioritized for conservation. Groups recommended that local partners engage actively with MD DNR to align monitoring sites with priority patches, which would add institutional pressure for state investment in those locations. NFWF was identified as a near-term funding opportunity, with anticipated RFPs expected in spring 2025 and the STAC report viewed as a potential foundation for that ask. Participants expressed strong interest in continued coordination and recommended establishing a workgroup to maintain momentum beyond the workshop.

Recommendations

The recommendations below reflect discussions from both workshop days, including plenary conversations and breakout report-backs. They are intentionally cross-cutting and designed to support near-term coordination as well as longer-term implementation and learning.

Formalize a Chesapeake Bay Brook Trout Collaborative

- Establish a formal Chesapeake Bay Brook Trout Collaborative to increase the rate and scale of restoration and conservation projects to restore and maintain resilient brook trout populations in the Chesapeake Bay Watershed.
    - Initially convene collaborative with counties involved with STAC workshop. Increase partners/counties as things progress.
    - Determine whether the collaborative should be supported through CBP BTWG or an alternative NGO.
- Conservation districts were frequently named as central conveners, but participants noted the need for cross-county coordination and an entity to sustain momentum and improve communications among brook trout restoration partners.
- Include partners/agencies in attendance at workshops as well as DOTs, county public works, river basin commissions, and municipal planners.
- Hold follow-up partnership meetings virtually 6-12 months, some preference for in person meetings.

Increase Collaborative Partner Capacity and Coordination

- Create a Chesapeake Bay Brook Trout Restoration Coordinator (CBBTRC) position to facilitate and grow the Brook Trout Collaborative and provide technical assistance to partners.
    - Chesapeake Bay Program's Brook Trout Workgroup should identify what agencies or organizations could support a CBBTRC position and available funding opportunities.
- Provide training on GIS mapping applications (e.g., Trout Unlimited's Conservation Portfolio).

Improve Communications

- The new CBBTRC should improve communications between stakeholders involved with brook trout restoration and conservation by advancing the following efforts:
    - Leverage existing communications mechanisms, (e.g., CAP/WIP coordinator communications).
    - Create a communication listserv/distribution list of interested partners.
    - Explore feasibility of an e-newsletter to share relevant brook trout happenings (e.g., successful projects, funding opportunities, general updates, challenges, new partner, etc.).
    - Collate funding opportunities for counties and other partners (include in e-newsletter).
    - Develop outreach tools, materials, and resources.
        - Establish and communicate clear definitions of Stronghold and Persistent patch.

- "Branding" ourselves. Highlight success stories, and tailor messages to values (heritage, recreation, tourism, resilience).
    - Unified message on project types and benefits of brook trout conservation.
    - Develop targeted messaging for reaching out to landowners
        - Holding field days for local communities to showcase/highlight successful projects-post completion. Demonstration sites.
        - Create interactive GIS StoryMap showing project locations, threats, partners, and funding opportunities.
- Identify additional co-benefits of brook trout projects (e.g., source water protection, improved infrastructure, carbon sequestration, improved recreation economies, etc.).

<u>Patch and Project Prioritization</u>

- Task Brook Trout Collaborative, with support from Chesapeake Bay Program GIS staff, with applying patch prioritization to identify reach-scale restoration opportunities and candidate projects.
    - Develop an initial list of priority watersheds and projects to implement, paired with a funding roadmap and anticipated application timelines to support a near-term, fundable project pipeline (e.g., Section 319 where relevant, state AMD programs, transportation/AOP programs, and other complementary sources).
- Identify watershed-level restoration priority areas nested inside county frameworks, with patch-scale priorities guided by the Trout Unlimited Conservation Portfolio and local/state fisheries expertise.
    - Target Stronghold and Persistent patches as defined by Trout Unlimited Brook Trout Conservation Portfolio for prioritization.
    - Evaluate long-term results of Maryland temperature TMDL and consider how sediment-impacted streams, thermal stressors, legacy ponds, and applicable sediment/TMDL drivers may inform project sequencing and funding fit.
- Prioritize projects within priority areas that reduce greatest stressors to brook trout.
    - Acid mine drainage (AMD), aquatic organism passage (AOP), unforested riparian areas, erosion and sedimentation from numerous sources, and unprotected land were identified as the greatest stressors.
    - For AMD and sediment-driven impairments, develop a near-term project pipeline that aligns with funding cycles and lead times (including Section 319 where applicable) so priority patch needs are shovel-ready when opportunities open.
    - Leverage state and federal mineland restoration programs, the Dirt Gravel and Low Volume Road Program, transportation/AOP programs, NRCS programs, NFWF, RCPP, and other state or county implementation programs for project funding and implementation.
    - For AMD remediation, prioritize stream reaches based on expected biological return, connectivity to existing or potential brook trout habitat, feasibility, cost, and available funding.

- Prioritize CAP/WIP practices that co-benefit brook trout in priority patches (e.g., riparian buffers, cattle exclusion fencing, soil health practices, dirt and gravel road improvements, public vs private land benefits, ag BMPs, etc.).
    - Use the prioritization framework to identify where CAP/WIP practices can be sequenced with brook trout-specific actions, such as AOP improvements, riparian restoration, thermal mitigation, AMD remediation, and land protection.
    - Use the framework to evaluate whether targeted implementation across available coldwater resources could meet or exceed bay-wide brook trout restoration goals.

Tracking and Monitoring

- Develop a process for the Brook Trout Workgroup to track project implementation in priority patches through CBP Habitat Tracker, including needed data fields, reporting responsibilities, partner submission processes, and update frequency.
- Establish long-term monitoring sites to track brook trout outcomes (occupancy, abundance, resiliency) and assess biological responses to project implementation over time.

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Appendix A: List of Figures

Figure 1. Brook trout patches in the pilot Pennsylvania counties and Garrett County, Maryland within the Chesapeake Bay watershed. Maps show the Chesapeake Bay watershed boundary and 10-digit Hydrologic Unit Code (HUC10) watersheds for (a) Clearfield County, Pennsylvania, (b) Garrett County, Maryland, and (c) Potter County, Pennsylvania. Stronghold patches are shown in green and persistent patches in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program. 5

Figure 2. State stronghold brook trout patches in Baltimore and Carroll counties, Maryland. Maps show the Chesapeake Bay watershed boundary and 10-digit Hydrologic Unit Code (HUC10) watersheds for (a) Baltimore County and (b) Carroll County. State stronghold patches in the Upper Gunpowder watershed are shown in green. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program. 6

Figure 3. Map of Wild Trout Waters (Natural Reproduction) in Pennsylvania, with blue showing 17,780 miles of listed wild trout streams and green showing 20,300 miles of tributaries to listed wild trout streams, for a total of 38,080 miles of streams classified as wild trout streams. Source: Pennsylvania Fish and Boat Commission. 10

Figure 4. Map of Class A Wild Trout Waters in Pennsylvania, with blue showing 1,242 sections (3,282 miles) of streams designated as Class A Wild Trout Waters; Class A waters occur in 57 of 67 counties. Source: Pennsylvania Fish and Boat Commission. 10

Figure 5. Left: Abandoned mine drainage (AMD) treatment and abandoned mine land (AML) reclamation in Clearfield County. Middle: Overlap between AMD impairment and natural trout reproduction. Right: AMD remediation success followed by naturally reproducing trout return. 14

Figure 6. Union Creek Road project photo documenting installation of a 10 section mud sill to protect the road where a stream was threatening the road. Source: Pennsylvania Dirt, Gravel, and Low Volume Road Maintenance Program. 15

Figure 7. Environmental Easements in Carroll County. Water resource easements total 2,282 acres, floodplain easements total 895 acres, and forest conservation easements total 4,797 acres, for a combined total of 7,974 acres and approximately 172 miles of streams. 17

Figure 8. Wolfden Run road–stream crossing replacement near Kitzmiller, Maryland. Left: original multi-pipe culvert prior to replacement. Right: replacement span bridge following construction. Photo credit: Seth Moessinger, Trout Unlimited. 21

Figure 9. Collaboration Continuum: This continuum can be used as a planning and assessment tool to think about the purpose of your collaboration – identifying where you are, what you want from your collaboration and what is needed at each phase 23

Appendix B: List of Tables

Table 1. Patch-scale threat metrics for participating Pennsylvania and Maryland counties. Summary totals and area-weighted means reported by county and brook trout patch type (stronghold, persistent, and state stronghold). Metrics include stream miles impaired by acid mine drainage (AMD), counts of aquatic organism passage (AOP) barriers, road–stream crossings, and dams, riparian condition (acres and percent not forested within a 30-meter riparian buffer), and percent of patch area in protected lands. Percent values are area-weighted means across patches within each county and patch type. 4

Appendix C: Workshop Agenda - Pennsylvania

Chesapeake Bay Program's (CBP)
Scientific and Technical Advisory Committee (STAC)
Blueprint for Building Partnerships and Recommendations for
Scaling Brook Trout Restoration in Stronghold and Persistent Patches (PA)
May 29, 2025
Lakeview Lodge in DuBois, PA
Workshop Webpage

Workshop Goal: Identify and synthesize the science needed, and local/county considerations and needs, to develop an actionable large-scale restoration plan to increase brook trout occupancy, abundance and resiliency within and among stronghold and/or persistent patches in priority geographies in PA and MD. These rural communities are vulnerable in a number of ways including income, social resilience, and accessibility. See table 1 for demographic information.

Workshop Objectives:

1. Identify, quantify, and summarize all known current threats (e.g. acid mine drainage (AMD), unforested riparian areas, unrestricted livestock access, passage barriers, etc.) to brook trout populations within and among stronghold and persistent patches in each county.
    a. Identify which resource agencies and organizations that administer programs to address each stressor directly.
2. Assess current brook trout populations within stronghold and persistent patches and identify where brook trout can successfully recolonize, recover or be repatriated.
3. Develop an implementation strategy and recommendations for priority BMPs including; timelines, costs, funding mechanisms (e.g., grants or specific funding programs), and public engagement. Possible resulting strategies that will be explored include improving land use planning through local zoning; identify land conservation priorities; and local government planning to prevent future loss through land conservation.
4. Convene local leaders and resource partners as a steering committee to help guide the process and ensure representation that reflects community voices, particularly those that are often under-represented. Ensure balance of community, state and federal stakeholders, with priority given to the community. Solicit input from the local steering committee members to help identify and invite participants for the workshop.
5. Formulate a repeatable blueprint for interjurisdictional partnerships to develop a brook trout restoration plan for other Chesapeake Bay watershed counties

May 29, 2025

8:45 am **Coffee & Light Breakfast (Provided)**

9:00 am **Welcome and Introductions**
Overview of workshop objectives and structure; the WHY

9:10 am **Presentation: Threat Assessment** – *Dan Goetz (MD DNR), Shawn Rummel (Trout Unlimited)*
- Threats and Current Habitat Assessment: Presentation of county-level threats to brook trout habitat
- Defining a Healthy Brook Trout Population: What metrics and conditions define health and resilience in brook trout populations.

9:40 am **Programmatic Overviews from Experts**
Short (15 min) overviews from Program Matter Experts, including representatives from NRCS, abandoned mine reclamation, and county planning. Each expert will discuss current efforts and

programmatic support available for brook trout restoration.

9:40 am *Jason Detar (PA Fish and Boat Commission)*
Also presenting for *Tyler Wagner (USGS Coop-PSU)*
10:10 am *Chris Peters (NRCS)*
10:25 am *Danielle Rihel (PA DCNR)*

10:40 am **15-minute Break**

10:55 am **Programmatic Overviews from Experts (continued)**
10:55 am *Jon Smoyer (PA DEP BAMR))*
11:10 am *Kelly Williams & Josh Glace (Clearfield and Potter County Conservation Districts)*
11:30 am *Steve Bloser (Center for Dirt and Gravel Roads, PSU)*
11:45 am *Robin Eng (PA DCNR)*

12:00 pm **Lightning Talks Q&A**

12:20 pm **Lunch (Provided)**

1:20 pm **Creating a Brook Trout Stakeholder Collaborative**
The goal of this session is to identify a process and strategies to collaboratively work together to increase the rate and scale of brook conservation projects.

- What plans are driving brook trout conservation projects?
- Who are the people that need to/can be involved in a brook trout collaborative?
  - Is there interest in STAC workshop attendees?
  - Who/what are the major funding agencies/sources?
  - Who are the primary implementers?
- Should we/how can we establish brook trout conservation portfolio as the authoritative project prioritization tool ?
- Should we/how do we insert brook trout into county WIP/CAP plans?
  - Should they be?

2:00 pm **15-minute Break**

2:15 pm **Breakouts: Recommendations and Strategies for Large-Scale Restoration and Planning and Implementation (*See Draft Outline and Questions*).**
Goal: Outline an operational restoration plan to achieve the new brook trout outcome goals.

3:00 pm **Breakout Group Report-out and Discussion**

3:30 pm **15-minute Break**

3:45 pm **Group Plenary: Synthesis of Findings and Recommendations**
Led in a facilitated discussion by steering committee members, participants will prioritize key findings from the workshop and breakout sessions.

4:15 pm **Closing Remarks and Next Steps**
Summary of key takeaways, actionable steps, and discussion of June 3, 2025 Maryland-specific workshop date.

4:25 pm **Workshop Adjourns**

Appendix D: Workshop Participants - Pennsylvania

Participant	Affiliation
Amanda Murdock	Natural Resources Conservation Service
Ben Lorson	PA Fish and Boat Commission
Bobby Hughes	Eastern PA Coalition for Abandoned Mine Reclamation
Caroline Arantes (v)	West Virginia University
Chris Peters	Natural Resources Conservation Service
Dan Goetz	MD Dept of Natural Resources
Danielle Rihel (v)	PA Dept of Conservation and Natural Resources
Dave Keller	Private Consultant
Eli Long	Western Pennsylvania Conservancy
Ella Malogrino	Potter County Conservation District
Eric Chapman	Western Pennsylvania Conservancy
Greg Moyer	Commonwealth University of Pennsylvania
Jason Childs	Potter County Conservation District
Jason Deter	PA Fish and Boat Commission
John Clune (v)	National Park Service
John Jackson	Stroud Water Research Center
Jon Smoyer	PA Dept Environmental Protection - Bureau of Abandoned Mine Reclamation
Joseph Cocco	PA Dept Environmental Protection - Bureau of Abandoned Mine Reclamation
Josh Tryninewski	PA Dept Environmental Protection - Bureau of Abandoned Mine Reclamation
Joshua Glace	Larson Design Group
Katie Ombalski	Woods and Waters Consulting
Kelly Williams	Clearfield County Conservation District
Lori Maloney (v)	Eastern Brook Trout Joint Venture
Mark Sausser	PA Fish and Boat Commission
Matt Keefer	PA Dept of Conservation and Natural Resources - Bureau of Forestry
Matt Marusiak	Western Pennsylvania Conservancy
Morgan Jones	Potter County Conservation District
Nick Staten	Chesapeake Research Consortium
Robin Eng (v)	PA Dept of Conservation and Natural Resources - Bureau of Forestry
Scott Koser	Trout Unlimited
Shawn Rummel	Trout Unlimited
Steve Bloser	PSU Center for Dirt and Gravel Roads
Tyler Wagner (v)	USGS-PSU Coop Unit

(v) = virtual

Appendix E: Workshop Agenda - Maryland

Chesapeake Bay Program's (CBP)
Scientific and Technical Advisory Committee (STAC)
Blueprint for Building Partnerships and Recommendations for
Scaling Brook Trout Restoration in Stronghold and Persistent Patches
June 3, 2025
Carroll County Agriculture Center in Westminster, MD
Workshop Webpage

****Exact Times Are Subject to Change****

Workshop Goal: Identify and synthesize the science needed, and local/county considerations and needs, to develop an actionable large-scale restoration plan to increase brook trout occupancy, abundance and resiliency within and among stronghold and/or persistent patches in priority geographies in PA and MD. These rural communities are vulnerable in a number of ways including income, social resilience, and accessibility. See table 1 for demographic information.

Workshop Objectives:

1. Identify, quantify, and summarize all known current threats (e.g. acid mine drainage (AMD), unforested riparian areas, unrestricted livestock access, passage barriers, etc.) to brook trout populations within and among stronghold and persistent patches in each county.
    a. Identify which resource agencies and organizations that administer programs to address each stressor directly.
2. Assess current brook trout populations within stronghold and persistent patches and identify where brook trout can successfully recolonize, recover or be repatriated.
3. Develop an implementation strategy and recommendations for priority BMPs including; timelines, costs, funding mechanisms (e.g., grants or specific funding programs), and public engagement. Possible resulting strategies that will be explored include improving land use planning through local zoning; identify land conservation priorities; and local government planning to prevent future loss through land conservation.
4. Convene local leaders and resource partners as a steering committee to help guide the process and ensure representation that reflects community voices, particularly those that are often under-represented. Ensure balance of community, state and federal stakeholders, with priority given to the community. Solicit input from the local steering committee members to help identify and invite participants for the workshop.
5. Formulate a repeatable blueprint for interjurisdictional partnerships to develop a brook trout restoration plan for other Chesapeake Bay watershed counties

June 3, 2025

8:30 am **Coffee & Light Breakfast (Provided)**

9:00 am **Welcome and Introductions**
Overview of workshop objectives and structure; the WHY

9:10 am **Presentation: Threat Assessment** – *Dan Goetz (MD DNR), Shawn Rummel (Trout Unlimited)*

- Threats and Current Habitat Assessment: Presentation of county-level threats to brook trout habitat
- Defining a Healthy Brook Trout Population: What metrics and conditions define health and resilience in brook trout populations.

9:40 am **Programmatic Overviews from Experts**
Short (15 min) overviews from Program Matter Experts, including representatives from NRCS, abandoned mine reclamation, and county planning. Each expert will discuss current efforts and

programmatic support available for brook trout restoration.

9:40 am	*Jason Cessna (MD DNR)*
9:55 am	*Janet O'Meara (Carroll County Department of Planning & Land Management)*
10:10 am	*Tracy Kelly (Garret County Department of Public Works)*
10:25 am	*Shayla Lewis (MDE)*

10:40 am **Lightning Talks Q&A**

10:55 am **15-minute Break**

11:10 am **Programmatic Overviews from Experts (continued)**

11:10 am	*Anne Hairston-Strang (MD DNR)*
11:25 am	*Morgan Kaumeyer (Baltimore County DEPS)*
11:40 am	*Julie Devers (NRCS-FPAC)*

11:55 am **Lightning Talks Q&A**

12:20 pm **Lunch (Provided)**

1:20 pm **Creating a Brook Trout Stakeholder Collaborative**

The goal of this session is to identify a process and strategies to collaboratively work together to increase the rate and scale of brook conservation projects.

- How might we advance our common interests to conserve Brook Trout?
- Who are the people that need to/can be involved in a brook trout collaborative?
  - Potential Collaborative Leaders?
  - Who are the key partners? Are there individuals who aren't in the room that should be?
- How do we prioritize projects?
  - Should we/how can we establish brook trout conservation portfolio as the authoritative project prioritization tool?
- How do we elevate brook trout in county WIP plans?

2:10 pm **10-minute Break**

2:20 pm **Breakouts: Recommendations and Strategies for Large-scale Restoration Planning and Implementation (See Draft Outline and Questions)**

Goal: Outline an operational plan that helps achieve the new brook trout outcome goals.

3:20 pm **Breakout Group Report-out and Discussion**

3:45 pm **Group Plenary: Synthesis of Findings and Recommendations**

Led in a facilitated discussion by steering committee members, participants will prioritize key findings from the workshop and breakout sessions.

- What recommendations to the Bay Program to facilitate, increase, incorporate brook trout conservation into large scale planning efforts?
- Are there key messages to relay to key Chesapeake Bay leadership at the state level?

4:15 pm **Closing Remarks and Next Steps**

Summary of key takeaways, actionable steps, and discussion of the recent May 29, 2025 Pennsylvania-specific workshop date.

4:25 pm **Workshop Adjourns**

Appendix F: Workshop Participants - Maryland

Participant	Affiliation
Adam Nabors	AMT Engineering
Adam Eschleman	MD Dept of Natural Resources
Anne Harston-Strang	MD Dept of Natural Resources
Ben Harris	Trout Unlimited
Brian Bernstein	Trout Unlimited
Brian Wade Jamandre	National Fish and Wildlife Foundation
Bruce Michael	Garrett County Government
Byron Madigan	Carroll County Government
Caroline Arantes	West Virginia University
Chris Guy	U.S. Fish and Wildlife Service
Claire Hirt	Carroll County Government
Craig Highfield	Alliance for the Chesapeake Bay
Dan Goetz	MD Dept of Natural Resources
Gina Hunt	MD Dept of Natural Resources
Jake Reilly	National Fish and Wildlife Foundation
Jamie Weaver	Maryland Forest Service
Janet O'Meara	Carroll County Government
Jason Cessna	MD Dept of Natural Resources
John Wolf	U.S. Geological Survey
Joseph Love	MD Dept of Natural Resources
Julie Devers	U.S. Dept of Agriculture - Natural Resources Conservation Service
Karen Stupski	Gunpowder Valley Conservancy
Karli Rogers	U.S. Geological Survey - Eastern Ecological Science Center
Katie Brownson	U.S. Forest Service
Katie Ombalski	Woods and Waters Consulting
Lori Maloney	Eastern Brook Trout Joint Venture
Mark Staley	MD Dept of Natural Resources
Matt Lawrence	MD Dept of Natural Resources
Melinda Cutler	MD Dept of the Environment
Mike Lagua	National Fish and Wildlife Foundation
Michell Masser	Carroll County Bureau of Resource Management
Molly Ramsey	Garrett County Government Watershed Management
Morgan Kaumeyer	Baltimore County Dept of Environmental Protection and Sustainability
Neal Eshleman	MD Dept of Natural Resources
Seth Moessinger	MD Dept of Natural Resources
Scott Lowe	Trout Unlimited
Shawn Rummel	Trout Unlimited
Shayla Lewis	MD Dept of the Environment
Simon Arendt	Catoctin Land Trust
Stan Pennington	Carroll Soil Conservation District

Appendix G: Restoration Plan Outline

STAC Workshop: Blueprint for Building Partnerships and Recommendations for Scaling Brook Trout Restoration In Stronghold and Persistent Patches

Instructions: Please consider the questions below as it pertains to formalizing a long-term brook trout restoration plan. Provide your answers below and expand on the rough outline. Please use bullet points.

Questions:

- What does a long-term large-scale brook trout restoration plan look like?
  - Strategies for increasing local awareness and engagement;
  - Identifying roles for stakeholders for long-term restoration plan implementation; Who are the:
    - Project Identifiers
    - Project Prioritizers
    - Project Proposal Writers
    - Project Implementers
    - Project Tracking, progress monitoring, project reporting

DRAFT Outline:

Background

- **Problem:** What are the Threats and BMPs?
  -
- **Project Outcomes?**
  - To Restore…
- Mapping-Threats Assessment and TU Conservation Portfolio. How can they be used to prioritize projects?
  -
- Existing organizational plans with focus on brook trout
  -

Planning and Implementation

- Stakeholders and their Mission
  - Who is present in your breakout group? Affiliation, Mission and how does it pertain to Brook Trout?
- Stakeholders, please list organizations and their potential roles as it pertains to:
  - Collaboration Coordination
  - Project identification and prioritization:
  - Landowner Outreach:
  - Proposal Writing
  - Project management and implementation
  - Baseline and post-implementation monitoring of brook trout response
  - Project progress monitoring and reporting to Bay Program

- Local community awareness and landowner engagement strategies
    - How do we make brook trout conservation a local priority?
        -
- Roadblocks
    - Funding limits
    - Human Capacity
        - Are more/new positions needed?

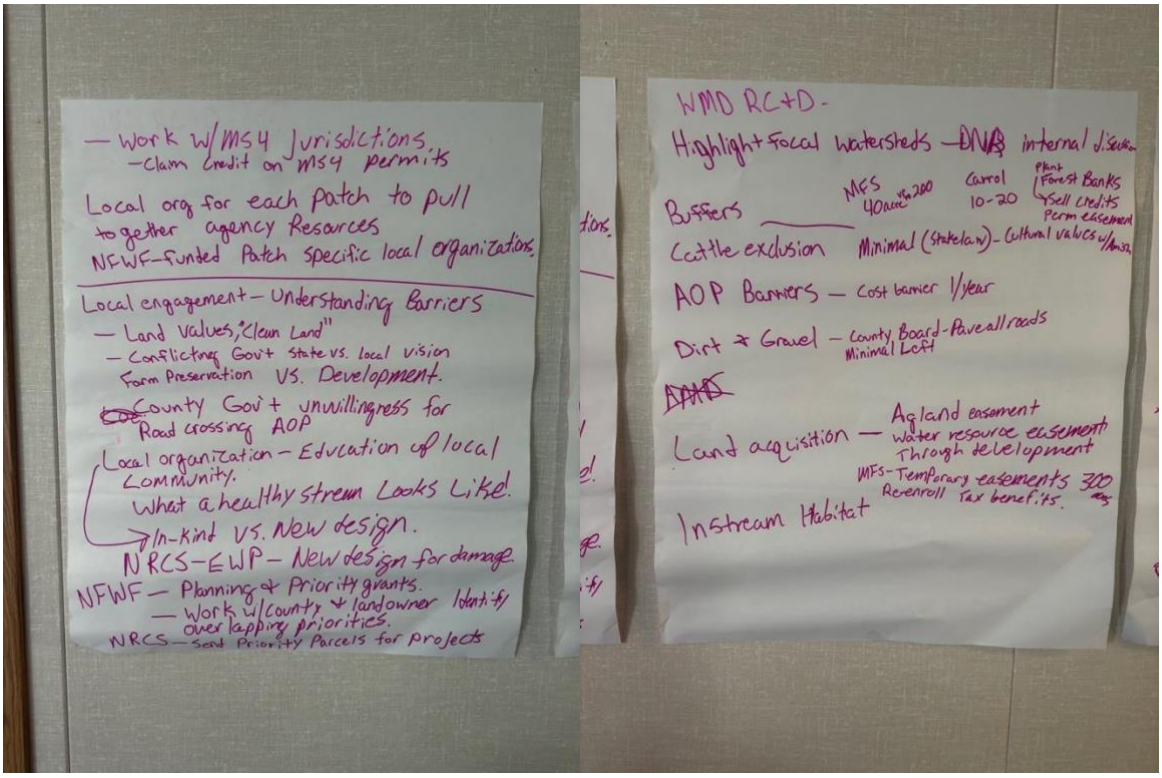
Timelines

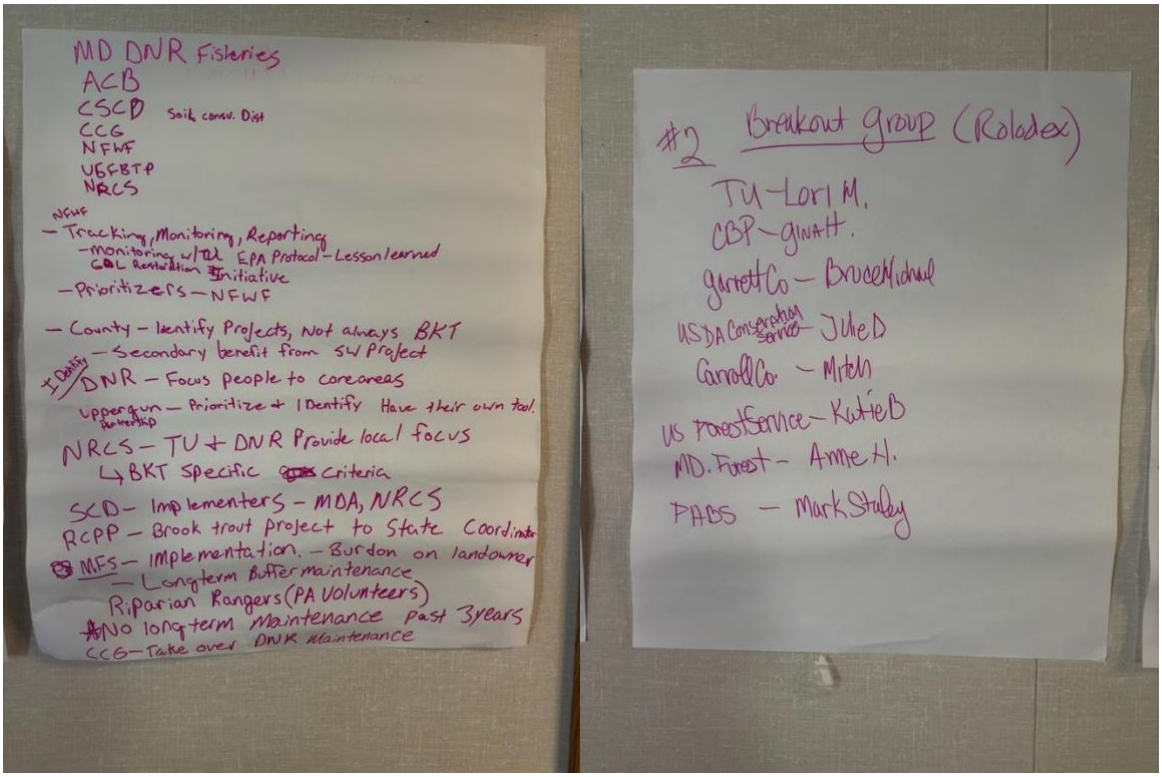
- How much can get done in 10 years? (i.e. acres of forest buffers, AMD projects, AOP projects etc…)
    - Creating annual and 10 year BMP implementation targets (see Resiliency outcome).

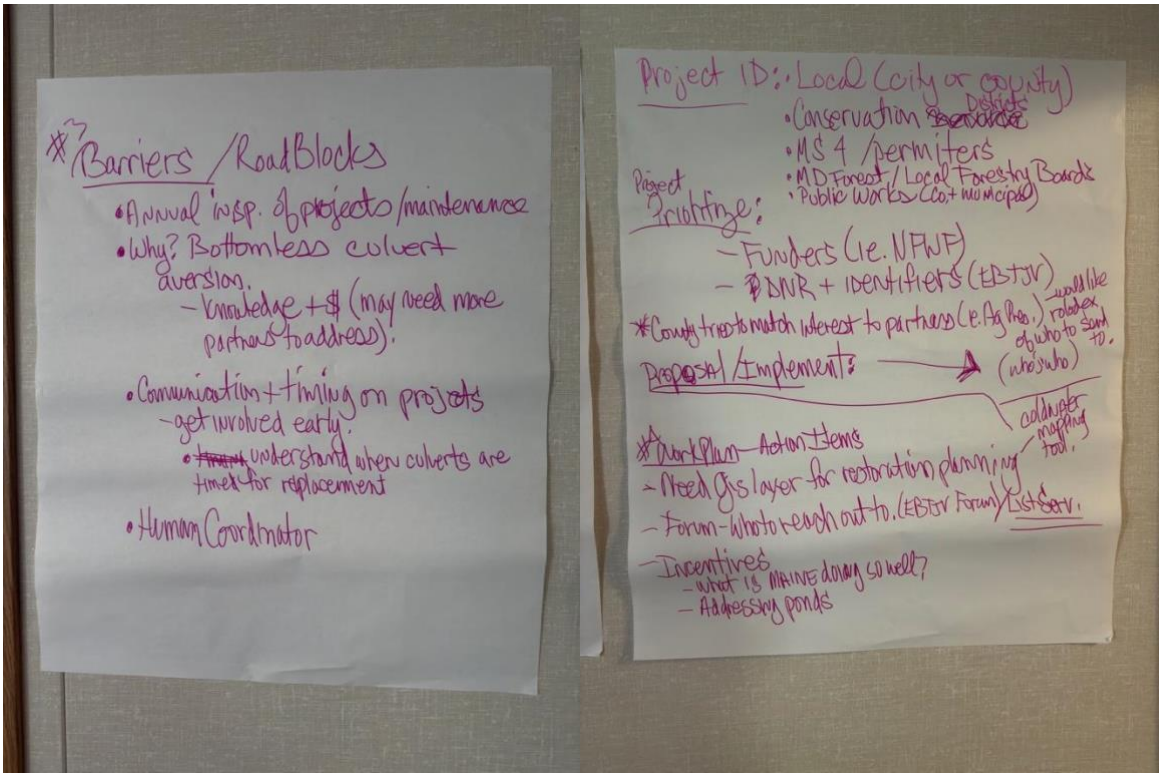
BMP Type	1 Year Target	10 Year Target	County specific if applicable	Who are the primary implementers?
Forest Buffers (acres)				
Cattle Exclusion (miles of stream)				
AOP Barrier Removals				
Dirt and Gravel Road Miles restored				
AMD Stream Miles Restored				
Land Acquisition or Conservation Easement (acres)				
Instream Habitat (i.e. woody debris, stabilization, or other habitat types				
Other_____ _____				

- What recommendations to the Bay Program to facilitate, increase, incorporate brook trout conservation into large scale planning efforts?
    - Ex. Can brook trout be included into CAPs? If so, how?
    - Ex. TMDL/Crediting?
    -
    - Other?

Appendix H: Handwritten Breakout Group Notes






#3 Barriers / RoadBlocks
• Annual insp. of projects / maintenance
• Why? Bottomless culvert aversion.
– knowledge + $ (may need more partners to address).
• Communication + timing on projects
– get involved early.
• understand when culverts are timed for replacement
• Human Coordinator
Project ID: Local (city or county)
• Conservation Districts
• MS 4 / permitters
• MD Forest / Local Forestry Boards
• Public Works (Co + municipal)
Project Prioritize:
– Funders (i.e. NFWF)
– DNR + identifiers (EBTJV)
*County trees to match interest to partners (i.e. Ag Res.) – would like roadsex of who to send to.
Proposal / Implement: (who's who)
*Work Plan – Action Items
– Need GIS layer for restoration planning – coldwater mapping tool.
– Form – who to reach out to. (EBTJV Forum) / Listserv.
– Incentives
– what is MAINE doing so well?
– Addressing ponds

Appendix I: Mapping Tools and Materials Shared

Chesapeake Bay Watershed Wide

- Geospatial Planning Tool for Brook Trout STAC Workshop
    - This application was designed to support the planning of the 2025 Brook Trout STAC Workshop. It is intended to be used as a decision support aid when choosing which watersheds to focus restoration efforts on within each of the selected counties.
- Trout Unlimited
    - Brook Trout Conservation Portfolio and Range-wide Assessment Web Mapping Application
- Chesapeake Bay Program Brook Trout Workgroup
    - 2025-2035 Brook Trout Outcome Management Strategy

Maryland

- Chesapeake Bay Trust July 2024 Report: Facilitating Brook Trout Outcome Attainability through Coordination with CBP Jurisdictions and Partners
- MD DNR Freshwater Fisheries - Coldwater Resources Mapping Tool
- USDA Field Office Technical Guide (FOTG)

Pennsylvania

- Recorded presentation: Implementing Watershed Forestry Practices Across Pennsylvania, submitted by Danielle Rihel (PA DCNR) and publicly available via the provided link.
- PA DCNR
    - Flourishing Landscapes: Planting Forests and Meadows Across Pennsylvania
    - Bureau of Recreation and Conservation Regional Advisors 2025
    - Watershed Forestry Specialist Map 2024
    - Watershed Forestry Funding Opportunities for Professionals
- PA Fish and Boat Commission Trout Stream Web Mapping Tool
- Susquehanna River Basin Commission Water Quality Portal
- Datashed is a free, GIS-enabled web application for monitoring and managing acid mine drainage (AMD) treatment systems and watershed restoration projects. Developed by Stream Restoration Incorporated.

Appendix J. County Map Series

This appendix provides county-level maps showing the Chesapeake Bay watershed boundary, 10-digit Hydrologic Unit Code watersheds, and Eastern Brook Trout Joint Venture population patches classified as stronghold or persistent for the counties referenced in this report. Figure I-1 provides a screenshot of the geospatial planning application interface developed for the 2025 Brook Trout STAC Workshop.

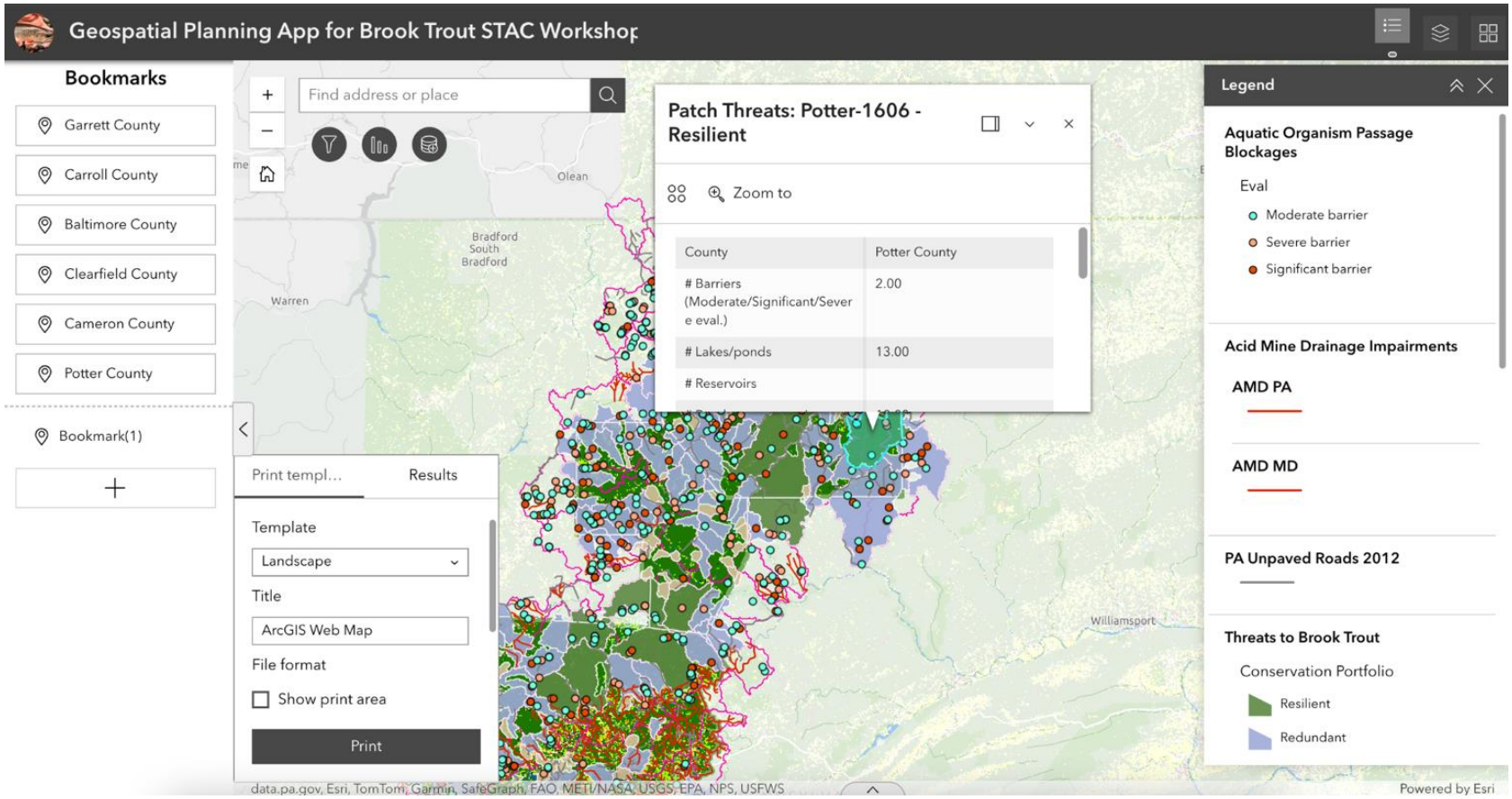


Figure J-1. Geospatial planning application interface for the 2025 Brook Trout STAC Workshop. Screenshot shows county bookmarks, map layer controls and legend for patch-scale threat indicators (e.g., aquatic organism passage blockages and acid mine drainage impairments), and a patch pop-up summary used to compare watershed and patch conditions across the selected counties.

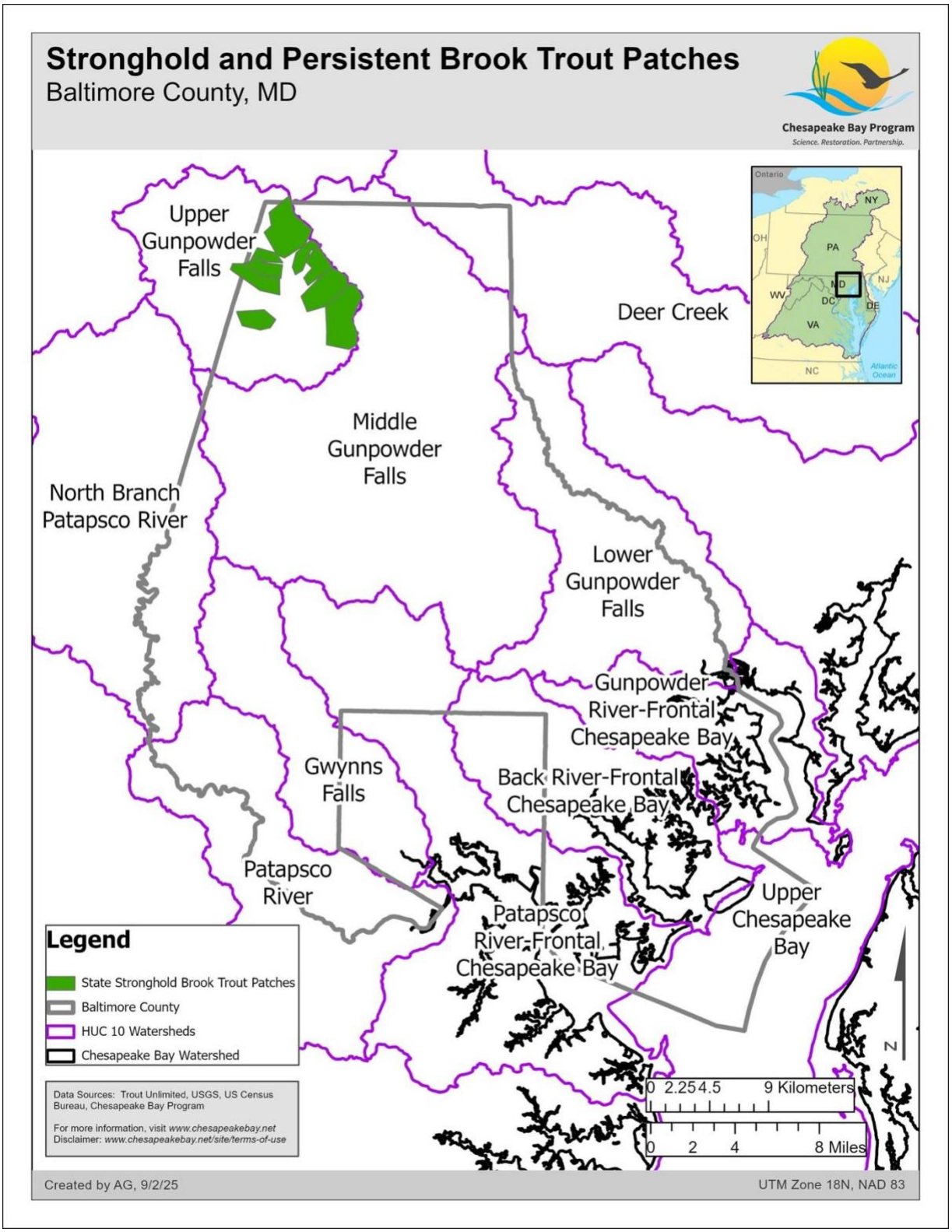


Figure J-2. Stronghold and persistent brook trout patches in Baltimore County, Maryland. Map shows Baltimore County boundary, the Chesapeake Bay watershed boundary, and 10-digit Hydrologic Unit Code (HUC10) watersheds. State stronghold brook trout patches are shown in green. Data sources include Trout Unlimited, U.S. Geological Survey (USGS), U.S. Census Bureau, and Chesapeake Bay Program.

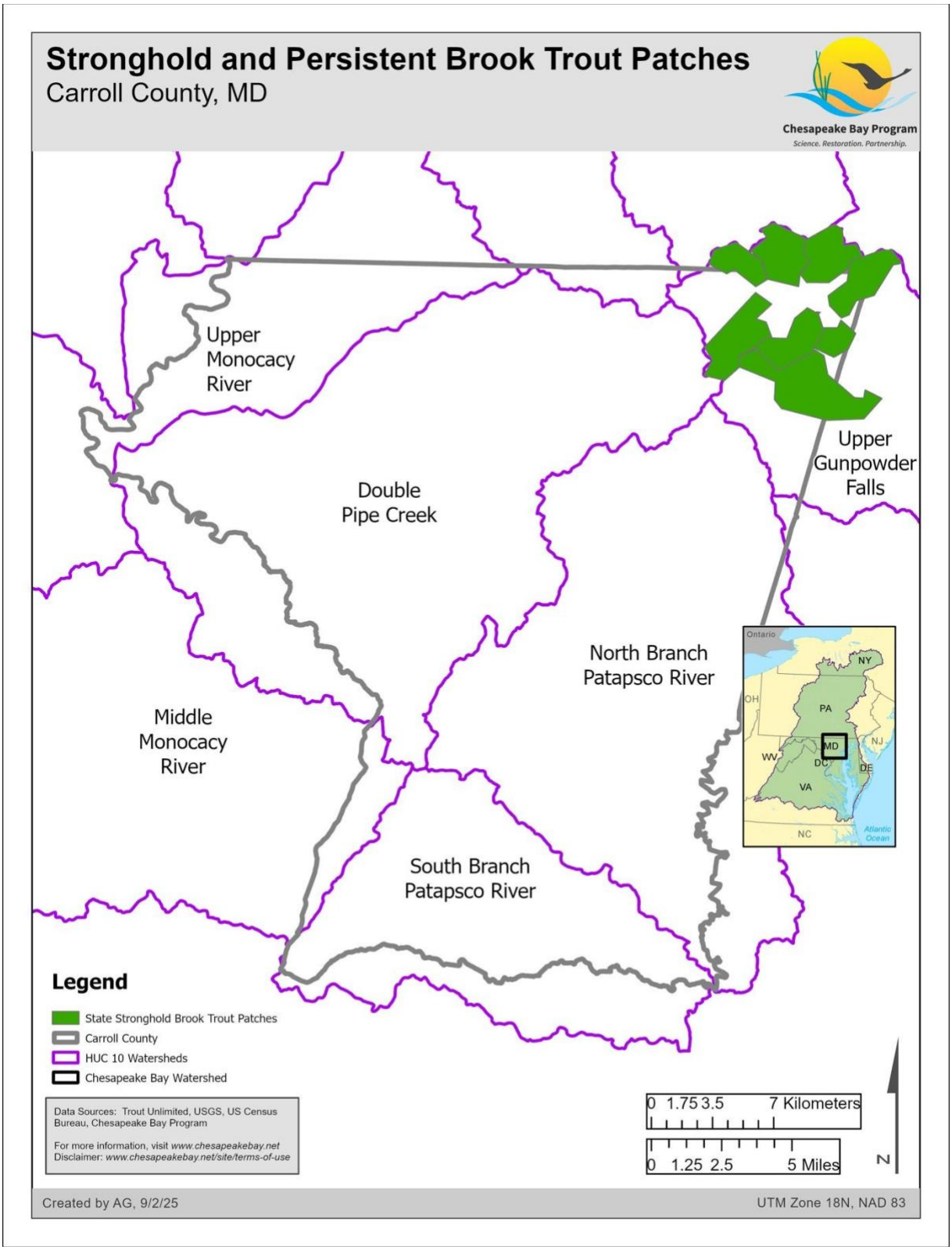


Figure J-3. Stronghold and persistent brook trout patches in Carroll County, Maryland. Map shows Carroll County boundary, the Chesapeake Bay watershed boundary, and HUC10 watersheds. State stronghold brook trout patches are shown in green. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

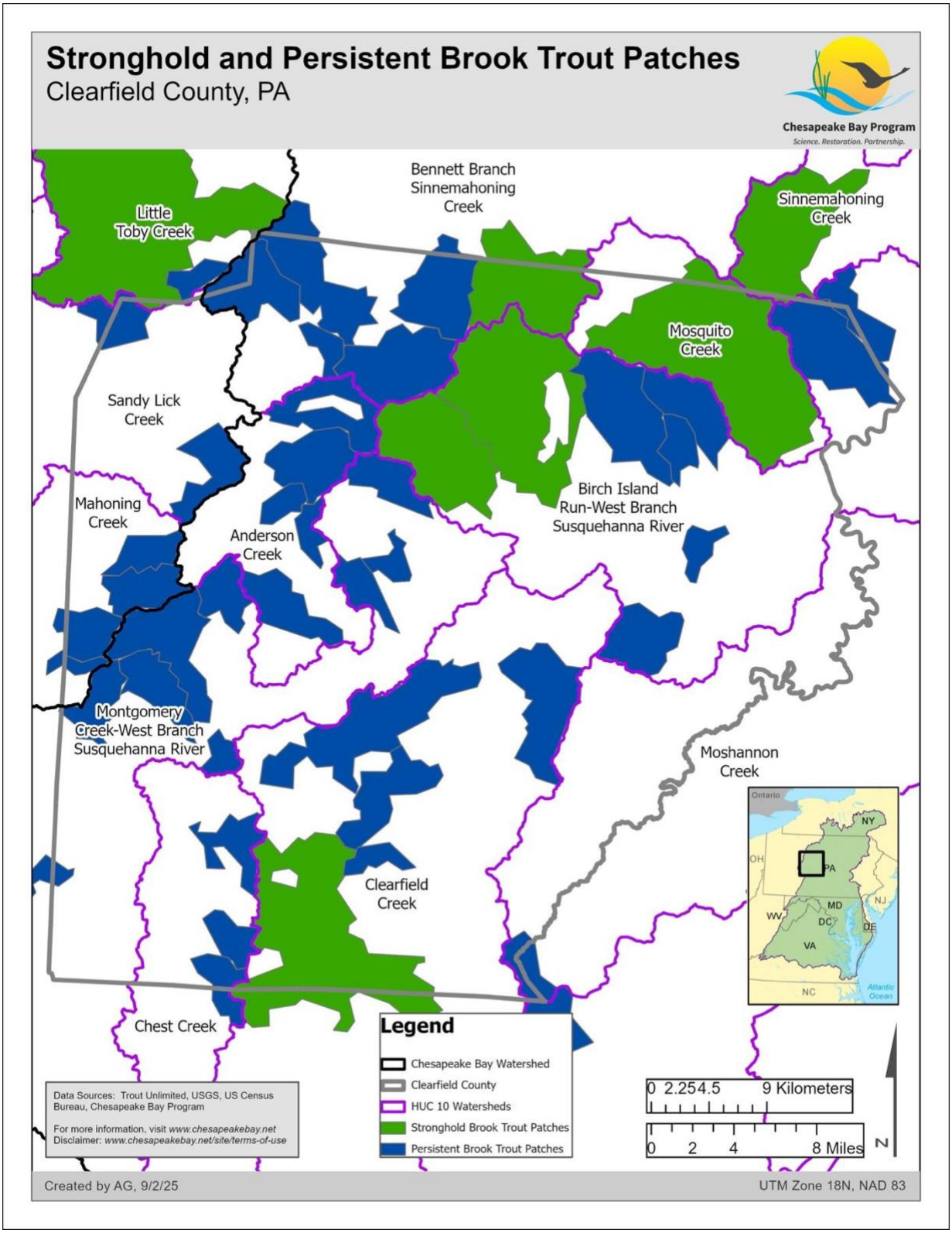


Figure J-4. Stronghold and persistent brook trout patches in Clearfield County, Pennsylvania. Map shows Clearfield County boundary, the Chesapeake Bay watershed boundary, and HUC10 watersheds. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

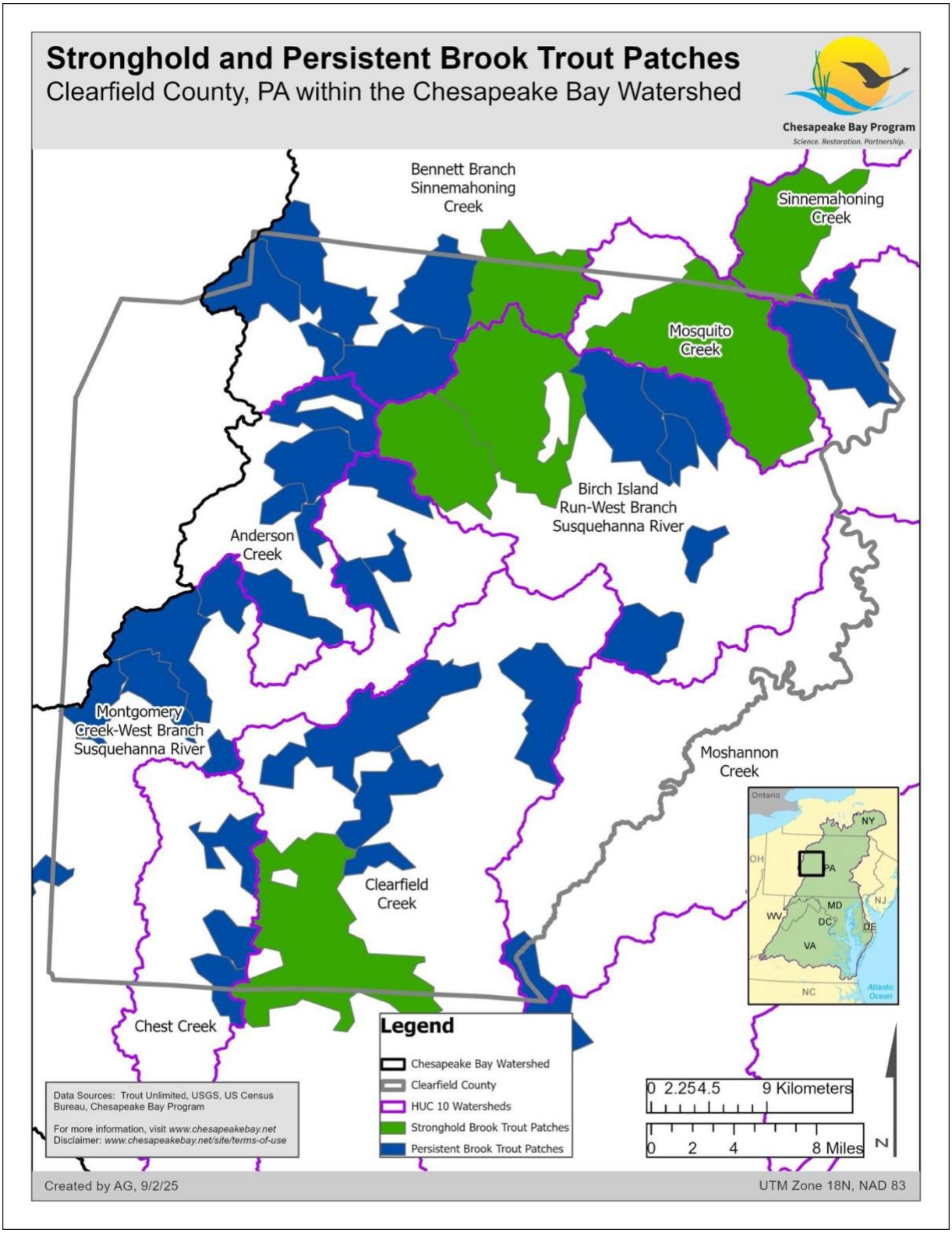


Figure J-5. Stronghold and persistent brook trout patches in Clearfield County, Pennsylvania within the Chesapeake Bay watershed. Map shows the portion of Clearfield County within the Chesapeake Bay watershed, with the Chesapeake Bay watershed boundary and HUC10 watersheds shown for context. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

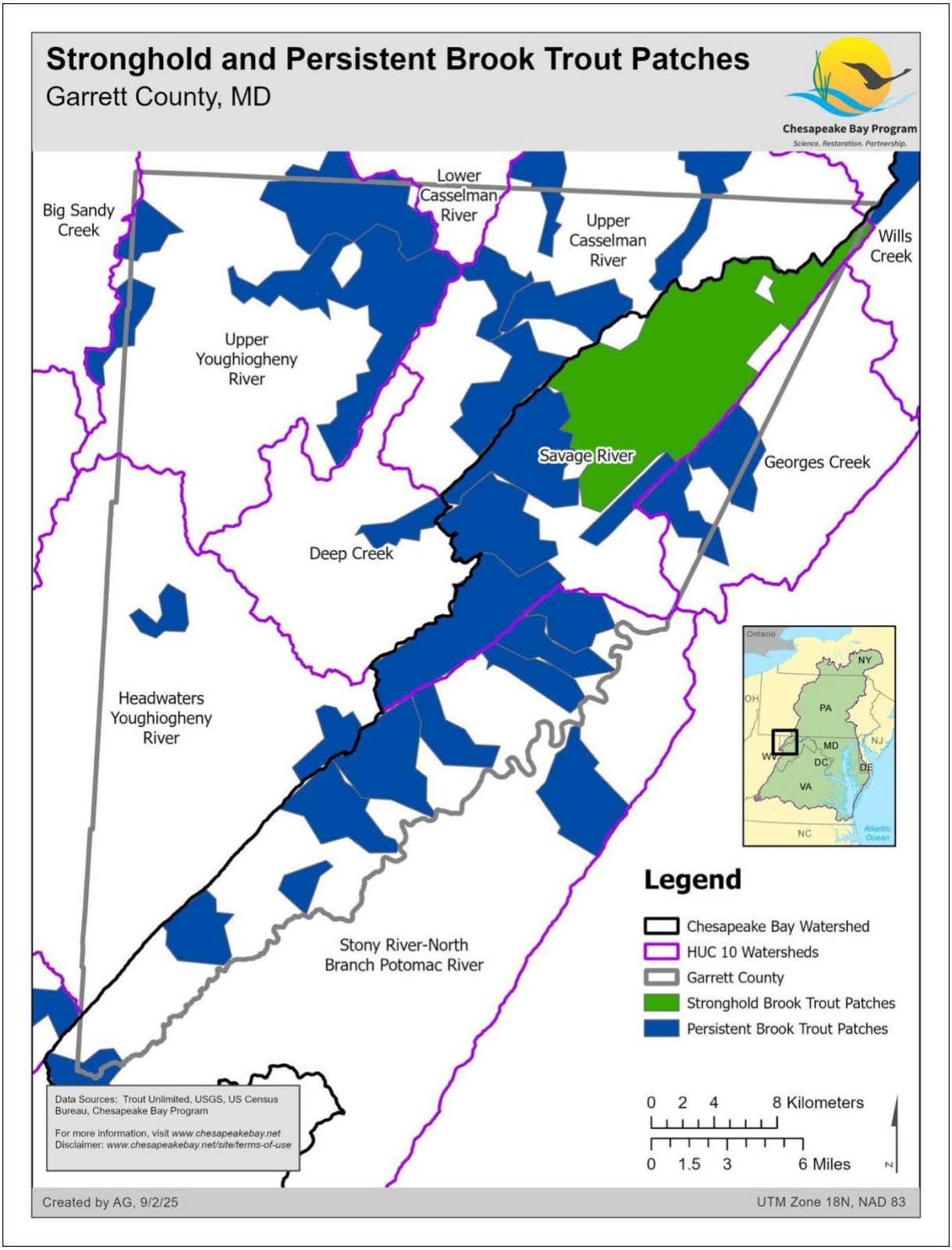


Figure J-6. Stronghold and persistent brook trout patches in Garrett County, Maryland. Map shows Garrett County boundary, the Chesapeake Bay watershed boundary, and HUC10 watersheds. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

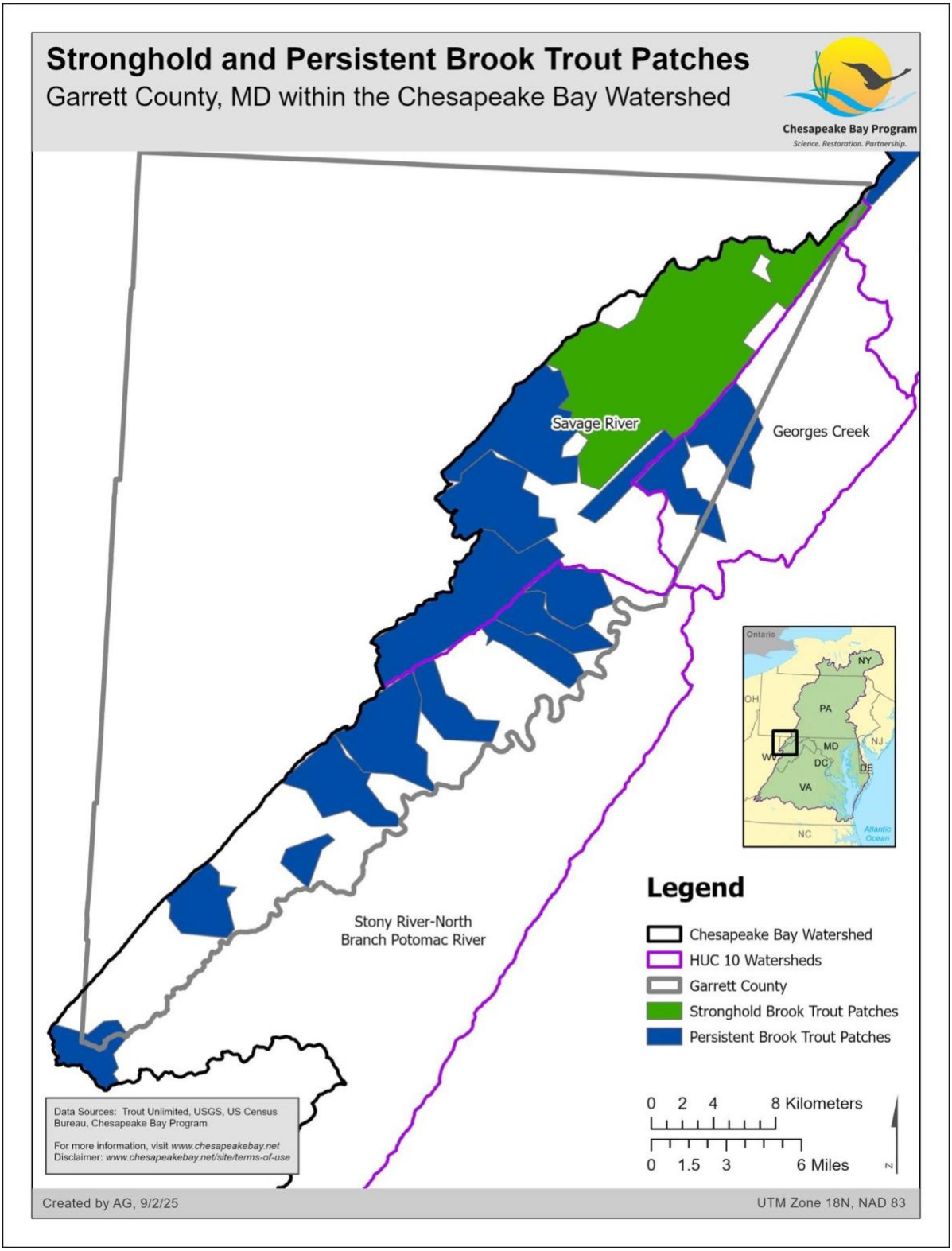


Figure J-7. Stronghold and persistent brook trout patches in Garrett County, Maryland within the Chesapeake Bay watershed. Map shows the portion of Garrett County within the Chesapeake Bay watershed, with the Chesapeake Bay watershed boundary and HUC10 watersheds shown for context. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

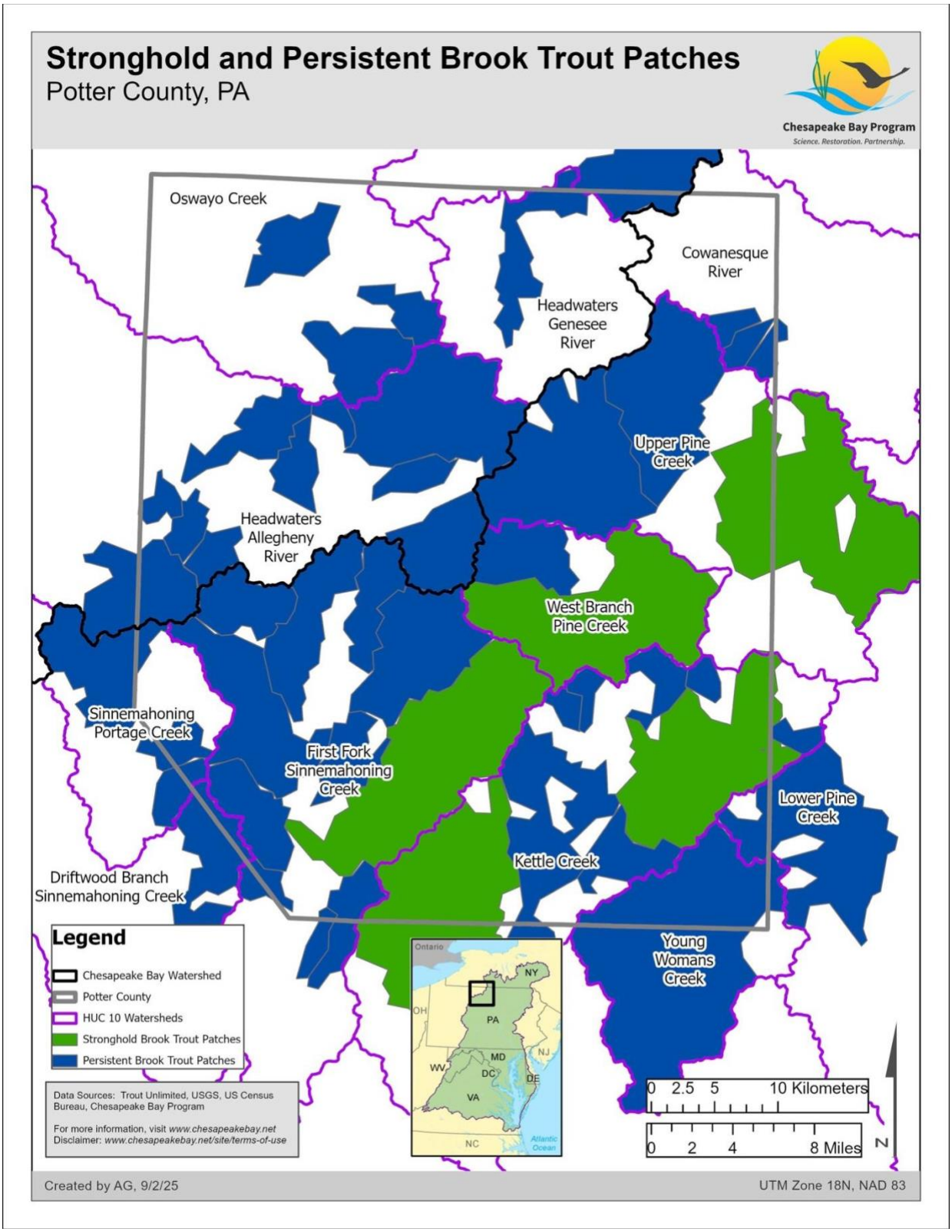


Figure J-8. Stronghold and persistent brook trout patches in Potter County, Pennsylvania. Map shows Potter County boundary, the Chesapeake Bay watershed boundary, and HUC10 watersheds. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.

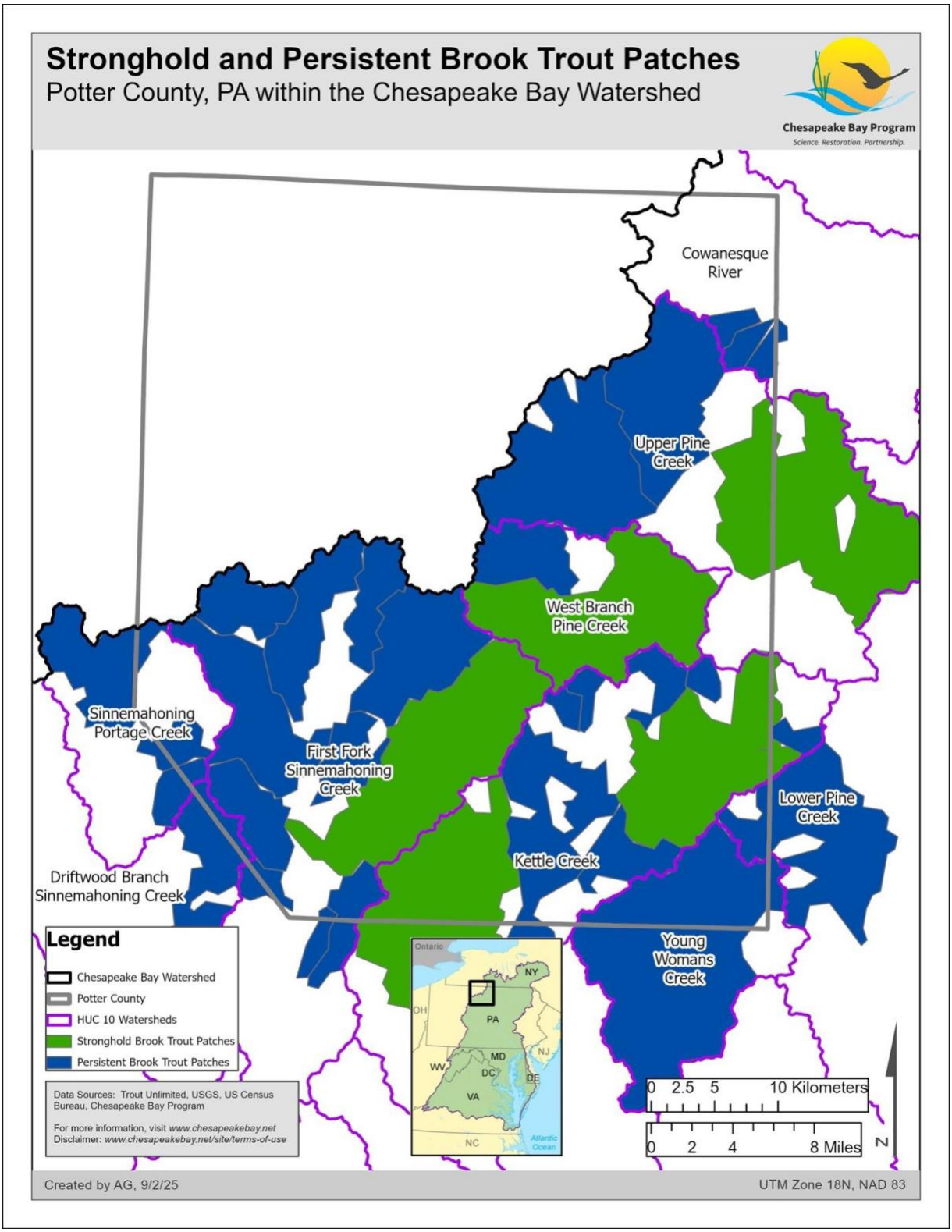


Figure J-9. Stronghold and persistent brook trout patches in Potter County, Pennsylvania within the Chesapeake Bay watershed. Map shows the portion of Potter County within the Chesapeake Bay watershed, with the Chesapeake Bay watershed boundary and HUC10 watersheds shown for context. Stronghold patches are shown in green and persistent patches are shown in blue. Data sources include Trout Unlimited, USGS, U.S. Census Bureau, and Chesapeake Bay Program.