Calculation Methodology of the Chesapeake Bay Program's Brook Trout Resiliency Target of Reducing Identified Threats by 15%

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Background and Context

As per direction of the Chesapeake Bay Program's December 2024 Executive Charge the Brook Trout Workgroup has revised the 2014 Brook Trout outcome of "Restore and sustain naturally reproducing brook trout populations in Chesapeake headwater streams with an eight percent increase in occupied habitat by 2025" to a new outcome with three targets:

Protect and enhance brook trout within the Chesapeake Bay watershed by increasing occupancy, abundance and resilience to changing environmental conditions.

- By 2040, increase brook trout occupancy by 1.5% (233 miles) in watersheds supporting healthy populations while achieving no net loss in other watersheds.
- By 2040, increase abundance at 10 long-term monitoring sites.
- By 2040, **reduce identified threats by 15%** to increase brook trout resilience in watersheds supporting healthy populations.

The new outcome partially focuses on improving the capacity of healthy populations to persist in changing environmental conditions. To do this the Chesapeake Bay Program Partnership set a goal to reduce identified threats by 15%, achieved by completing habitat improvement projects.

Who Will Do This Work?

The Resiliency Target is meant for the Workgroup to work with partners and others in states who are already doing these kinds of BMPs, and direct their effort to areas directly benefiting brook trout. Leveraging existing programs and highlighting priority areas will hopefully minimize additional lift on partners, while setting up our strong brook trout populations to be resilient in a changing system. The following sections describe how the workgroup identified the current extent of each of the five identified threats to set a reasonable threat reduction goal.

Identified Threats

Note: This breakdown shows the numeric association for each threat category with the larger target's 15% threat reduction, but the partnership can overperform in one category to offset underperformance in another and still reach the resiliency target goal. All numeric values were calculated from within watersheds supporting healthy brook trout populations. Therefore progress towards this target will only be counted from work performed within these healthy watersheds.

Averaging all categories: [15% + 15% + 12% + 30% + 1.5%] ÷ 5 = **~15% for 2040**

1 | Reduce Threat of Acid Mine Drainage: Treat AMD

What is the Current State of this Threat?

To calculate the extent of AMD in healthy brook trout watersheds, the 303d listings within EPA Integrated Reports were used for the jurisdictions (Pennsylvania and Maryland) that explicitly address acid mine drainage as a source of impairment, while the ATTAINS dataset was used for the jurisdictions where the source of impairment due to acid mine drainage is not identified. In this case, impaired streams with low pH in addition to the presence of metals other than mercury were used. Impaired streams from the datasets by state were brought into the GIS environment and clipped to the extent of Trout Unlimited's Eastern Brook Trout Conservation Portfolio's conservation strategy of stronghold and persistent patches. The extent of impairment by AMD was then calculated in miles from these characterizations.

Miles of AMD impaired within watershed supporting healthy brook trout populations were
333 miles (PA) + 43 miles (MD) + 18 miles (WV) = 394 miles

Applying 15% our goal would be **60 miles by 2040.**

Why 15%?

The Fish Habitat Outcome AMD target is to improve 270 (15% of the AMD affected miles watershed-wide) miles of AMD-impaired waters by 2040. Therefore the Partnership anticipates being able to direct AMD work at the same rate in areas where it will affect brook trout the most.

Data Sources

- AMD Impairment: EPA Integrated Water Quality Reports and the EPA Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) dataset.
- Watersheds supporting healthy brook trout populations: Trout Unlimited's Eastern Brook Trout Conservation Portfolio.

2 | Reduce Threat of Unforested Land Cover: Plant Riparian Buffers

What is the Current State of this Threat?

To understand the extent of unforested riparian zones, the Workgroup wanted to calculate both unforested stream miles and acres. The buffer zone for this analysis was defined by the Chesapeake Bay Watershed 1:24,000 resolution 35-foot riparian buffer (McDonald et al., 2024). All stream reaches with greater than 65% (Hudy et al., 2008) (Wagner et al., 2013) forest cover were defined as having an intact buffer. Streams that were deemed as not having an intact buffer were counted towards the mileage (2,376.6 miles) and acreage (33,498.4 acres) calculation for the overall restoration potential.

Stream miles & acres without intact buffer (35ft buffer) = 2,376.6 miles or 33,498.4 acres

15% of mileage and acreage = **360 miles / 5000 acres by 2040.**

Why 15%

Note: The "Healthy Forests and Trees" Outcome's Riparian Forest Buffers target is to plant and maintain 7,500 acres of forest buffers annually. To approximate a realistic goal, the percentage of land area of watersheds supporting healthy brook trout populations to total Chesapeake Bay Watershed land area (~13%) was applied to "Healthy Forests and Trees" Outcome's Draft "Forest Buffers" Target of 75,000 acres by 2035. This showed that 9750 acres by 2035 would be realistic assuming the same resources applied to the whole watershed were applied to watersheds supporting healthy brook trout populations. However, being more conservative the restoration goal was set at 15% restoration (360 miles / 5000 acres) of zones without intact buffers by 2040.

Data Sources:

- Land Use / Land Cover: Chesapeake Bay Land Use/Land Cover (LULC) Database 2024 Edition - ScienceBase-Catalog
- Buffer extent: Chesapeake Bay Watershed 1:24k 10, 30 and 90-meter Riparian Buffer Zones - ScienceBase-Catalog
- Watersheds supporting healthy brook trout populations: Trout Unlimited's Eastern Brook Trout Conservation Portfolio.

3 | Reduce Threat of Sediment Runoff from Dirt and Gravel Roads: Improve Unpaved Roads

What is the Current State of this Threat?

The majority of unpaved roads affecting watersheds supporting healthy brook trout populations are within the state of Pennsylvania. Utilizing the dirt and gravel road data maintained by the Penn State Center of Dirt and Gravel Road Studies, the amount of unpaved roads that were improved in the past 10 years within healthy brook trout watersheds were calculated. This number (8%) was used as the rate that we strive to maintain for the next 10 years and was extrapolated out for 2040 to get 12%. This rate was then applied to the number of unpaved roads as of 2025 within healthy brook trout watersheds (2,265 miles) to yield 270 miles by 2040.

Miles of Unpaved Roads within watershed supporting healthy brook trout populations in 2025 = 2,265.

12% of 2,265 miles = **270 miles by 2040.**

Data Sources

- Mileage of unpaved roads: Dirt and gravel road data maintained by the Penn State Center of Dirt and Gravel Road Studies.
- Watersheds supporting healthy brook trout populations: **Trout Unlimited's Eastern Brook Trout Conservation Portfolio**.

4 | Reduce Threat of Fragmented Habitat: Improve Culverts

What is the Current State of this Threat?

Existing barrier data were obtained from the Chesapeake Fish Passage Prioritization Tool (version 3.4.0), which included removal feasibility ratings and upstream functional network miles for each barrier. Barriers were filtered to include only those within watersheds supporting healthy brook trout populations. 500 assessed culverts and six feasibly removable assessed dams matched these criteria. Additionally, the scope was limited to only assessed culverts. Upstream functional miles were then summed for each removal feasibility rating. Further information about the calculation of upstream functional network miles are described in the 2023 Chesapeake Fish Passage Prioritization report.

Focusing on just assessed culverts, there are 500 structures associated with 740 miles of potential habitat reconnection in watersheds supporting healthy brook trout populations. According to practitioner partners, two culverts per state every year was very reasonable and achievable. With New York, Pennsylvania, Virginia, West Virginia and Maryland all having healthy brook trout populations,

2 culverts * 5 states * 15 years = 150 culverts by 2040.

30% of 740 miles/500 culverts = **222 miles / 150 culverts by 2040.**

Data Sources

- Barriers and associated habitat reconnection potential: **Chesapeake Fish Passage Prioritization Tool.**
- Watersheds supporting healthy brook trout populations: **Trout Unlimited's Eastern Brook Trout Conservation Portfolio.**

5 | Reduce Threat of Development: Protect Land

What is the Current State of this Threat?

The protected lands indicator dataset was used to calculate the percent (~43%) and acreage (~2,065,676 acres) of non-protected natural lands within watersheds supporting healthy brook trout populations. To establish the land conservation goal for brook trout, the Workgroup reviewed the protected lands reported in the 2024 GIT Report [add name], which reported 13,881 acres were protected between 2017-2023 (7 years) or 1,983 acres annually. The Brook Trout Workgroup agreed to be slightly more aggressive over the next agreement period and increased our annual goal to 2,000 acres of lands protected within healthy brook trout watersheds, which is a total of 30,000 acres of protected lands in 15 years. This is approximately 1.5% of the total land area currently not protected within healthy brook trout watersheds, estimated to be at 2,065,676.8 acres. For more information on the dataset, its sources, and the Bay Program accepted definition of protected lands see the Protected Lands Indicator Analysis and Methods Document.

1.5% of 2,065,676.8 acres = **~ 30,000 acres by 2040.**

Data Sources

- Protected Lands in the Chesapeake Bay Watershed: **The CBP Protected Lands Indicator dataset**.
- Watersheds supporting healthy brook trout populations: **Trout Unlimited's Eastern Brook Trout Conservation Portfolio**.

References

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