Stream Health:
Principles for Phase III Watershed Implementation Plans

Protecting streams for Human Health, Economic Development, and Infrastructure

The Chesapeake Bay watershed has over 100,000 miles of rivers and streams. Streams carry water, life, and pollutants to the Bay. They provide recreational opportunities such as canoeing and fishing, help crops to grow, replenish reservoirs, serve as critical habitat for valuable and endangered species, and provide essential natural services to the environment. Human actions on the land directly influence the health of these valuable parts of the Bay watershed's landscape. Stream health can be improved by utilizing in-stream best management practices (BMPs) which stabilize banks, improve water quality through reduced sediment loading, improve fish and upland habitat, improve biodiversity and restore aesthetic value. The types of BMPs implemented in the riparian corridor, or elsewhere within the watershed are dependent on principal stressors impacting a given stream. Stream bank erosion resulting from increased stormwater runoff related to land use decisions and changes that create increased impervious surfaces (e.g. roads, rooftops, parking lots) are poor management practices and result in significant sources of sediment and nutrients impacting the Bay. Locally, stream erosion and degradation results in the loss of land, habitats and decreases in species abundance and diversity. Degraded stream channels also pose safety hazards and impacts to infrastructure like utilities, roads, and buildings.

Human-impacted streams have altered water movement patterns and do not connect with other groundwater sources, leaving stagnant pools, or preventing pollutants from being removed as the water flows through the soil. Current stream restoration techniques can help remove steep banks which can lead to accidents (i.e. falling and drowning hazards). The implementation of restoration BMPs also help with the purification of water by allowing groundwater reconnection, as well as incorporating floodplain areas that create diverse habitats and foster healthy ecosystem food chains.

Stream restoration projects and naturally healthy streams can become an economic cornerstone for a community. These projects provide an excellent opportunity for development of passive recreational facilities including walking paths, playgrounds and nature centers. Protecting stream valleys and utilizing these areas as parks is a valuable way to use open space. These parks can enhance surrounding property values, create a sense of community, or offer recreational thoroughfares and destinations, and may provide other types of recreational opportunities for hunting or fishing. These activities foster economic growth and development, as well as provide opportunities for individuals to invest in their communities.

Streams that are deeply incised and are disconnected from their floodplain are unable to have normal out-of-bank flow events which disperse the increased volumes and speeds of water. This can be a public safety hazard and result in increased downstream flooding. Current stream restoration techniques highlight the importance of reconnecting a stream to its floodplain. This is accomplished by creating areas where the stream can safely spill over the banks in high water situations. This design helps to provide flood protection for surrounding infrastructure and keeps water away from homes and businesses.

The benefits of functioning streams and adjacent wetlands, while significant on their own, are even more powerful when acting together in wetland/stream complexes on the landscape. Thus, these should be considered inextricably linked for planning and implementation purposes.

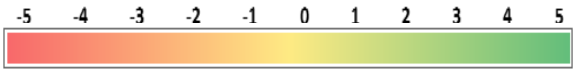
Best Management Practices with Stream Health in Mind

Stream health reflects the biological, chemical and physical conditions of the stream and riparian corridor and watershed. Incorporating the protection or restoration of streams through effective land use policies and stormwater management does not necessarily require a wholesale change in implementation. There are many best management practices (BMPs) that address the Bay TMDL, stream vulnerability, and other Chesapeake Bay Program outcomes. Evaluating projects for stream health vulnerabilities and developing a range of strategies to offset those vulnerabilities will increase effectiveness of BMPs, decrease maintenance costs, and still help to ensure you are meeting the Chesapeake Bay TMDL requirements

into the future. See the table below for BMPs that have several co-benefits* (the goal is to integrate various BMPs that will address the stressors affecting stream health).

Best Management Practice	Stream Health	Co-Benefits: Brook Trout	Healthy Watersheds	Forest Buffers	Flood Control/ Mitigation	Protected Lands
Ag Stream Restoration	**5.0**	3.0	1.0	1.0	0.0	1.0
Alternative Water System	**5.0**	2.0	3.0	1.0	0.0	1.0
Forest Harvesting Practices	**4.0**	2.0	3.0	3.5	2.5	0.5
Forest Conservation	**4.0**	4.0	5.0	3.5	3.5	5.0
Ag Forest Buffer	**4.0**	4.5	4.0	5.0	3.5	3.5
Urban Forest Buffers	**4.0**	*5.0*	3.5	5.0	3.5	3.5
Urban Stream Restoration	**3.5**	*4.0*	4.0	3.0	3.5	3.0

*Values were taken from the Quantification of BMP Impact on the Chesapeake Bay Program Management Strategies study by Tetra Tech and are based on the best professional judgement of subject matter experts. Appendix E. Final Impact Scores evaluates BMP effects on outcomes on a scale of +5 (very beneficial) to -5 (very harmful). **This table shows select BMPs that scored a 3 or higher for the Stream Health Outcome, however, not all of these BMPs would merit the score of +3 for all projects. Closer evaluation of project site designs, including those from BMPs shown in the above table, is warranted when interpreting these scores.** *It is unlikely to find brook trout in urban streams, despite high BMP scoring (indicated by underlining and italics).*



Guiding Principles for Incorporating Stream Health

WIP Development

1. Know where your healthy streams are, and work towards identifying those that are restoration priorities.
2. Capitalize on co-benefits: select BMPs that protect healthy streams, maximize upland treatment, and increase land conservation.
3. Account for and consider existing stressors – select BMPs that will contribute to reducing principal stressors.
4. Consider how future population growth and land-use changes will affect BMPs.
5. Align with existing climate resiliency plans (i.e. hazard mitigation plans, floodplain management programs).
6. Engage Partners – work with government agencies, elected officials, and NGOs to incorporate updated data and conservation efforts into existing WIPs.

WIP Implementation

1. Reduce vulnerability - design BMPs to function with existing and future pollutant loads, land use and disturbances such as floods and wildfires.
2. Maintain in-stream flows by reducing water demand and withdrawals.
2. Build in flexibility and adaptability - allow for adjustments in BMP implementation to consider a wider range of potential uncertainties and a richer set of response options.
3. Adaptively manage - Allow for changes in design, construction, and maintenance over-time as new data regarding stream health and restoration processes becomes available.

Tools and Resources

Chesapeake Progress: Stream Health Outcome
Stream Health Mapper

Chesapeake Bay Program, Scientific and Technical Advisory Committee: Stream Restoration Design Workshop – 2014 Workshop Report

Maryland Biological Stream Survey (MBSS): Probability-based Random Design Stream Surveying

Stressor Identification and Prioritization Tools:
EPA: https://www.epa.gov/caddis

Tier II High Quality Waters Map – Maryland

Relevant Literature:

Harman, W., R. Starr. 2011. Natural Channel Design Review Checklist. US Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD and US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Wetlands Division. Washington, D.C. EPA 843-B-12-005

Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. A Function-Based Framework for Stream Assessment and Restoration Projects. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.

Palmer, M.A., Hondula, K.L. and Koch, B.J., 2014. Ecological restoration of streams and rivers: shifting strategies and shifting goals. *Annual Review of Ecology, Evolution, and Systematics*, *45*, pp.247-269.

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