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Water Quality and Habitat Goals for Chesapeake Bay Program

Potential Conflicts and Resolutions

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Chesapeake Bay Restoration

Commitments to meet TMDL Requirements for Nutrient and Sediment Reduction

Commitments for Habitat and Living Resources, including:

- **SAV**
- **Wetlands**
- **Riparian Forest**
- **Healthy Streams**
- **Fish Passage**
- **Anadromous Fish, Brook Trout, Other Fisheries**

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Questions Have Arisen About Tradeoffs Between Creditable BMPs for Nutrient and Sediment Reductions and Other Goals

What are Benefits and Consequences Which Should be Considered to Meet All Relevant Goals and Achieve Net Ecological Uplift?

These are Questions Regulators, Policy Makers and Practitioners Try to Understand and Answer in Decision Making

“Ecological Uplift” Itself May Have Different Interpretations Depending Upon Perspective. A Collaborative Approach is Essential to Avoid or Minimize Adverse Impacts.

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Benefits and Consequences Depend upon Condition of Project Site, Project Design and Implementation, and Upstream and Downstream Areas

Unintended or Adverse Consequences Potentially Greater for Existing Sensitive and Functioning Resources and Critical Infrastructure

For sites with less degradation and high functioning ecological processes …

There is a greater risk of unintended consequences from a design which does not take these considerations into account

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An Understanding and Acknowledgement of Both Benefits and Consequences is Necessary to Avoid and Minimize Adverse Effects

The Following Consequences Do Not Occur at All Sites, But May Occur When the Design Does Not Consider All Functions and Characteristics at the Site

Examples: Shoreline Stabilization and Stream Restoration

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Shoreline BMPs

Eroding shorelines need stabilization practices to prevent shoreline loss and excess sediment from entering tidal waters.

Outcome: Improved water quality; climate change resiliency

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Shorelines- Additional habitat considerations

- Practices for living shorelines typically place material in shallow water, converting shallow water habitat to marsh
- Some erosion is necessary as a sediment source to maintain existing tidal wetlands
- Potential loss of SAV and gain of tidal marsh
- Loss of shoreline trees to allow sunlight to reach planted vegetation

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Potential Conflicts With Other CBP Commitments

- Riparian Forest
- SAV
- Anadromous Fish

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Stream Restoration

Re-connected or Have Increased Connection to Floodplain by Several Methods

- Raising Stream Bed by Fill
- Raising Water Level by Structure
- Excavation of Floodplain
- Combination of Approaches

Outcomes: Stabilized stream channels, reduced nutrient and sediment loads; potential habitat improvement; increased water storage in floodplain

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Stream Restoration Summary Based Upon Published Studies, Monitoring Results, Direct Observations, Anecdotal information, Other Scientific Results, and Modeling Results

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Unintended Consequences for Stream Restoration May Include Undesirable:

- Changes to Water Chemistry
- Loss of Vegetation
- Increase in Invasive Species
- Blockages to Passage of Aquatic Life
- Reduction of Hyporheic Exchange
- Increase is sedimentation/erosion from failed structure

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Unintended Consequences Cont.

- Loss of Baseflow from Failed Structure
- Decline in Wetland Functions, including Denitrification
- Change in Aquatic Resource Type or Decline in Habitat
- Degradation of Soil Processes from Construction
- Finite Capacity for Sediment Retention-Not Self Sustaining
- Damage to Infrastructure, Safety Hazards, Loss of Flood Insurance

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Water Chemistry

- Changes found: lowered DO, increased or lowered pH, Iron flocculation, increased temperature
- Many related to increases in water levels which result in loss of vegetation and shade
- Also disturbance of highly acidic soils – potential pH decrease
- Designs which maintain shade or spring flow, or expose cold water springs may not have temperature increases
- May Result in New Impairment Listings and TMDL Requirements

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Loss/Change in Vegetation from Increased Water Levels

- Plants require oxygen to roots, are stressed by low oxygen and toxins in soil. Most tree species die with prolonged inundation and saturation
- Broad range of tolerance to increased water levels– species specific
- Tree seedlings more sensitive
- N, P uptake by Trees may decrease in wetter soils with lower redox potential
- Changes in plant community type or aquatic resource type and habitats – Decline in macroinvertebrate scores

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Blockages to Passage to Aquatic Life

- **Blockages May be Physical or Chemical**
  - **If there is too great "drop" from top of structure to water in channels, aquatic species movement may be prevented or impaired**

    Structure with openings allowing flow may allow movement

  - **Chemical blockages and/or mortality from temperature increase and possibly DO decrease**

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Reduction in Hyporheic Exchange

Hyporheic exchange depends upon flow; groundwater levels; hydraulic conductivity (heterogeneous sediments and bed complexity and topography; and features such as wood) and permeability in streambed; DOC; residence time; microbial communities

Structures which may slow flow or force more too rapid downwelling may reduce effective instream denitrification

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Increased Sedimentation and Erosion in channel

Loss of Baseflow in Channel Resulting from Failed Structures or Improperly Placed Structures

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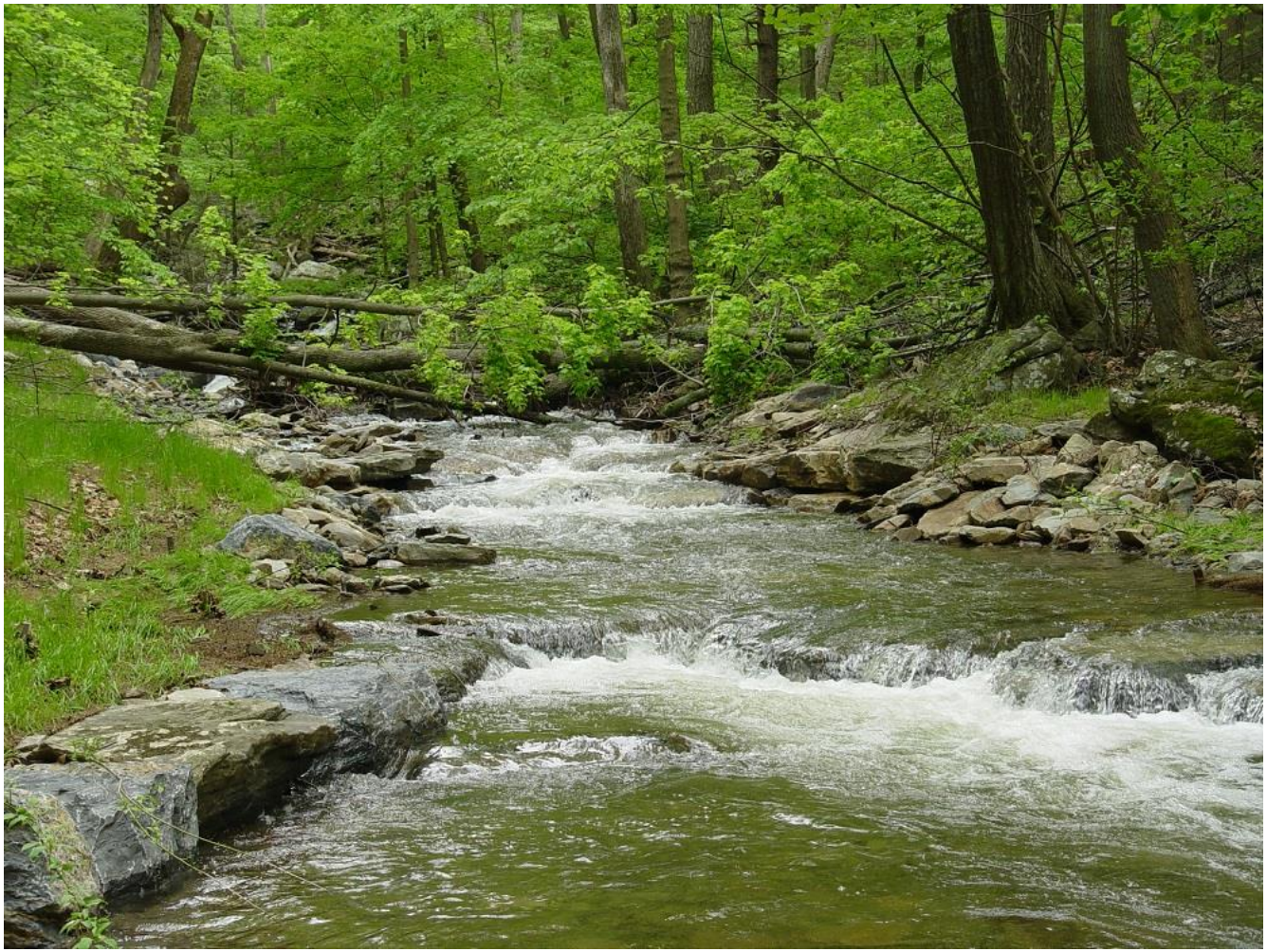
Potential Conflicts With Other CBP Commitments

- Wetlands BMP crediting: Accepted rehabilitation (return to previous condition) rejected enhancement -favors one service over others e.g. water quality
- Stream Health
- Fish/Aquatic life Passage
- Riparian Forest
- Anadromous Fish and Other Fisheries (e.g. Brook Trout)



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Minimizing Unintended Consequences While Maximizing Ecological Uplift

- **Do More than Reduce Adverse Effects and Tradeoffs**
- **"Maximizing Uplift" Means Considering the Range of Ecological Processes and Ecosystem Services Which Could Be Improved by a Restoration Project**

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Minimizing Unintended Consequences While Maximizing Ecological Uplift cont.

Consider existing functions and other factors in site design – additional tools and guidance

Consider adverse effect of increasing water in floodplain

Design and build for specific site conditions and retain natural system and processes where feasible

Re-Design

Collaborative work between Regulators, Policy Makers, and Practitioners

Recognize that more modest alterations may be most beneficial overall

Address problems at source

- **Maximize upland treatment**
- **Properly size culverts and other crossings, if undersized structures resulted in erosive flows**