RECOMMENDED STREAM RESTORATION BEST PRACTICES

Voluntary guidance for stormwater program managers in the COG region on best practices for implementing stream restoration projects

December 2021

Metropolitan Washington
Council of Governments

RECOMMENDED STREAM RESTORATION BEST PRACTICES FOR THE COG REGION
Prepared by the Stream Restoration Workgroup on behalf of the Water Resources Technical Committee.

ABOUT COG
The Metropolitan Washington Council of Governments (COG) is an independent, nonprofit association that brings area leaders together to address major regional issues in the District of Columbia, suburban Maryland, and Northern Virginia. COG's membership is comprised of 300 elected officials from 24 local governments, the Maryland and Virginia state legislatures, and U.S. Congress.

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EXECUTIVE SUMMARY

This document details a set of practices for how local governments can best implement stream restoration projects, focusing on planning/design, siting and final project selection, public engagement, and construction/assessment/maintenance. These practices go beyond what is required by standard permit requirements and further build upon the recommendations from the Chesapeake Bay Program expert panel reports for stream restoration projects. The following best practices are recommended by members of COG's Stream Restoration workgroup:

Best Practice #1 – Planning and Design: Provide a clear road map for the site selection process that documents how a decision to pursue a stream or outfall and gully stabilization project will be reached and what its goals are.

The road map may include:

- Enumeration of specific project goals: both primary programmatic goals, such as stream stability, pollution reduction, permit compliance, protection of existing infrastructure and public safety; and secondary goals, including improvement of aquatic and terrestrial habitat within the project area, minimization of impact to existing high-quality forest ecosystems or stream habitat, increase in neighborhood amenities, and potential synergies with other public/private projects.
    - This is the phase at which planners need to assess project complexity
    - It needs to be communicated that not every project will have every goal

- Discussion of pros and cons of pursuing the project, including, if relevant, the issue of tree loss. Documentation should provide indication of net benefits. *(See Fairfax County Restoration Recovery Wheel case study under Best Practice #3, particularly Figure #4.)*

- Consideration of whether stream projects can be incorporated into a watershed approach to stream resilience
    - A watershed-based approach may not be feasible for all projects; in particular, the scale, cost, and time it takes to implement sufficient upland source control may exceed what stormwater management programs can sustainably accomplish.
    - There is often a cost to not doing a stream project in terms of damage to infrastructure, threats to public safety and further loss of trees as streams continue to erode.
    - Where feasible, consider coupling stream projects with a "treatment train" approach that includes upland detention/treatment, outfall restoration/stabilization, and riparian corridor restoration
    - Creation of a visual resource map to guide decisions
- Include critical natural resources, roads and other infrastructure, and community resources
- Identify areas that should be avoided during construction to minimize ecosystem impacts, including stable stream reaches, wetlands, seeps, good quality vegetative communities, rare or sensitive species, important cultural features, or specimen trees, etc.
- Identify degraded areas where there are opportunities to significantly improve system function.
- Identify expected tree loss impacts, in terms of both numbers and species diversity

Best Practice #2 – Planning and Design: For each project, consider different restoration priorities, protocols and channel design approaches that best meet site conditions and restoration goals.

- Consider using the four-stage Restoration Priority for incised channels (Rosgen, 1997[i]) or a similar approach
- For each project, consider different restoration priorities, protocols and channel design approaches that best meet site conditions and restoration goals
- Consider using different channel design approaches on a project-by-project basis. These approaches include but are not limited to "natural channel design," "reinforced bed channels," "beaver dam analogs," "regenerative stormwater conveyance," and wood-based designs[ii] [iii] [iv] [v]. All will involve some degree of channel reconfiguration and stream valley disturbance, and the emphasis should be on the approach that best meets the project needs and goals while prioritizing protection of high-quality natural areas and features

Best Practice #3 – Planning and Design: Establish metrics for measuring success of projects, based on the primary and secondary goals set for each individual project.

- Use documentation from previous work to support how these metrics are met.
- Create a restoration planting plan and be able to provide the public with a list of herbaceous/woody perennials to be used:
    - Determine biological goals for the near and long term; include floristic quality and consideration of keystone plant species for community health and biodiversity
    - Build on surrounding system – improve degraded areas, buffer better quality areas where no work is to occur, plant to build on wetlands and wildlife habitat opportunities.
    - Base plant palettes on target communities
    - Specify plant species, sizes, and container types to address site conditions to include deer herbivory
    - Consider biological stabilization with plant materials as critical to project success and long-term performance
    - Incorporate canopy goals, stream shading, allochthonous material and woody debris generation, recovery of soils and long-term community stability into restoration planting plans

Best Practice #4 – Planning and Design: Create a plan for inspection and maintenance of projects over time as tied to project goals.

- Depending on project goals, this is likely to be more than traditional monitoring for stream stability and in-stream habitat and may include ecosystem function in the stream corridor
- Identify all the resources needed to fully implement and maintain the project to meet its priority goals and include them in the planning process. Coordinate the planning process with the budgeting process to ensure that adequate funding is available for all phases of the project

Best Practice #5 – Siting/Final Project Selection - Determine specifications for individual projects based on the set of goals set for each project. In doing so, minimize impacts to high quality aquatic and terrestrial habitat in the stream corridor.

- Projects that must be done to preserve or repair infrastructure or protect public safety will generally occur in portions of the stream and its associated riparian corridor that are degraded and provide only poor-quality habitat.
- Permitting processes at the state and federal level require protection of certain species and habitat, but jurisdictions should consider going beyond permitting requirements to minimize impacts to sensitive habitat and to maximize protection of existing high-quality ecosystems
- Some loss of high-quality trees and disturbance of high-quality habitat may be unavoidable in portions of certain projects, but, overall, projects should strive for net improvement to habitat
- Tree loss can be caused both by construction activities and by the increase in water table associated with reconnecting streams to their floodplains and increasing baseflow, but such losses can be mitigated by new plantings of species that will be better adapted to the restored natural riparian conditions
- Other key factors to consider in siting include accessibility, ownership situation and infrastructure risk

Best Practice #6 – Siting/Final Project Selection: Incorporate DEIJ project siting considerations in overall program management.

- Consider use of demographic index to map areas where projects could benefit different communities
- Incorporate DEIJ in stakeholder engagement process *(see Public Education section for details)*
- Do not rule out needed projects, however, based strictly on DEIJ concerns

Best Practice #7 – Siting/Final Project Selection: During the site identification and selection phase, conduct assessments before the project starts to develop a baseline for the metrics used to measure its success as determined in the 'Planning/design' step above.

- Stream physical conditions
    - Examples include the Bank Erosion Hazard Index (BeHI[vi]) and Bank Assessment for Non-point Source Consequences of Sediment (BANCs[vii])
- Infrastructure conditions
- Aquatic communities
    - Examples include various types of Benthic Index of Biological Impairment (BIBI[viii])
- Riparian vegetative communities
    - Identification of plant communities in accordance with the United States National Vegetation Classification Standard. Community condition should be rated Excellent, Good, Fair or Poor. Rare communities and species should be documented.
    - Projects should be conducted to support high functioning ecosystems by restoring functions that promote ecosystem health and rare species or communities.
    - In general, construction activity should be directed to areas with lower quality systems that can be improved through restoration.
    - Construction activities should avoid communities with a Good or Excellent score and/or any rare communities where there are sensitive species that would not be able to survive construction impacts or secondary effects such as changes in vegetative composition, hydrology, etc.

Best Practice #8 – Public Engagement: Define the stakeholders and develop a process for involving them in planning, site selection, and construction.

- External stakeholders may include: local residents near the site, community groups, NGOs and others in the planning and design process; civic associations, and schools
- Internal stakeholders may include: outreach managers, staff from other departments, and elected officials
- Opportunities exist to receive stakeholder input during development of watershed plans and their overall program management guidelines, which will include consideration of where to do stream projects

Best Practice #9 – Public Engagement: Begin public outreach early in the design phase of individual projects to explain project goals and seek input from stakeholders. Involve stakeholders in the site selection and project design process through advisory groups, participation on the design team or other means.

- Gather public input on proposed program management goals and add community goals based on citizen input.
- Bring a DEIJ focus to the stakeholder process
    - Consider how to involve stakeholders from the community who may not ordinarily provide government input, which may involve new means of communication (such as virtual meetings at different times of the day and translation services) as well as going to where the stakeholders are (such as community activities and events).
- Develop a public outreach process to include some or all the following elements:
    - A flyer to describe the project
    - On-line feedback tools e.g., Survey Monkey
    - Outreach to advisory groups such as civic associations, environmental groups and non-profits, members of local government to maintain engagement, act as a sounding board, and carry messages back to the community.
    - A series of public meetings (for example, at design phases 30, 60, and 90 percent)
        - A town hall or open house, particularly on Fridays or Saturdays when more people can attend.
        - A website with information on what to expect during construction; who to contact with questions and concerns; factsheets.
        - Establishment of a 3-1-1 number for citizens with questions to call.
        - A project completion ceremony such as ribbon cutting or walking tour for citizens and elected officials and members of the media.
        - Use stakeholders as ambassadors for the project

Best Practice #10– Public Engagement Demonstrate need for project through visual evidence and site visits whether in person or virtually; explain what will happen if project is not undertaken.

- Where possible, conduct site walks to show need for sanitary sewers or water main repairs, erosion, or other major drivers for projects
- Demonstrate objectives such as reducing pollution

Best Practice #11 – Public Engagement: Continue to communicate with stakeholders through construction and post-construction periods; highlight where community input was used to make changes or influence the project.

- Potential ongoing communication vehicles include civic association newsletters, social media, and list serves (e.g., Nextdoor)
- Provide a look ahead at what will be happening in the project in the next few weeks

Best Practice #12 – Construction/Assessment/Maintenance – During Construction: Use construction techniques that minimize impact on high quality aquatic and terrestrial habitat, as identified during the Planning/Design phase.

- Minimize tree loss during construction; use felled trees in stream work[ix]Minimize soil disturbance and compaction during construction; protect sensitive areas such as wetlands

Best Practice #13 – Construction/Assessment/Maintenance - During Construction: Adhere to quality control practices in restoration planting.

- Require plant submittals for source of materials well in advance of planting time
- Require adherence to strict planting windows based on plant material types.
- Conduct rigorous plant materials inspections for correct species, root condition, container size and adherence overall to ANSI Z60[x] requirements.

Best Practice #14 – Construction/Assessment/Maintenance -During Construction: Make field adjustments at start of construction.

- Conduct a walk-through with contractor and forester (within the Limit of Disturbance zone) to evaluate additional protection opportunities in the field
- Conduct on-site construction oversight on a regular basis
- Document elevations during construction; don't rely on as built to minimize tree loss during construction, use existing corridors cleared of trees (utility right of ways or trails) if possible, for access and haul roads, use timber mats over a bed of wood chip; use felled trees in stream work
- Minimize soil disturbance and compaction during construction; protect sensitive areas such as wetlands
- Adjust the boundary of avoidance area to provide root zone protection for critical trees
- Relieve soil compaction to the extent possible within the limits of disturbance following construction

Best Practice #15 – Construction/Assessment/Maintenance – Post Construction and Maintenance: Budget for and pursue follow-up assessment and maintenance activities to maximize the project's long-term benefits.

- Meet regulatory requirements for post construction performance at a minimum
- Commit to regular inspection and, where needed, maintenance of restored systems to achieve priority project goals on a long-term basis
- Provide invasive species control pre-construction and up to three years following construction.
- Provide at least three years of inspection and adaptive management so that plantings are established on a stable trajectory[xi][xii]

Best Practice #1 – Planning and Design

Provide a clear road map for the site selection process that documents how a decision to pursue a stream or outfall and gully stabilization project will be reached and what its goals are.

The road map may include:

- Enumeration of specific project goals: both primary programmatic goals, such as stream stability, pollution reduction, permit compliance, protection of existing infrastructure and public safety; and secondary goals, including improvement of aquatic and terrestrial habitat within the project area, minimization of impact to existing high-quality forest ecosystems or stream habitat, increase in neighborhood amenities, and potential synergies with other public/private projects.
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- Discussion of pros and cons of pursuing the project, including, if relevant, the issue of tree loss. Documentation should provide indication of net benefits. *(See Fairfax County Restoration Recovery Wheel case study under Best Practice #3, particularly Figure #4.)*

- Consideration of whether stream projects can be incorporated into a watershed approach to stream resilience
  - A watershed-based approach may not be feasible for all projects; in particular, the scale, cost, and time it takes to implement sufficient upland source control may exceed what stormwater management programs can sustainably accomplish.
  - There is often a cost to not doing a stream project in terms of damage to infrastructure, threats to public safety and further loss of trees as streams continue to erode.
  - Where feasible, consider coupling stream projects with a "treatment train" approach that includes upland detention/treatment, outfall restoration/stabilization, and riparian corridor restoration
  - Creation of a visual resource map to guide decisions
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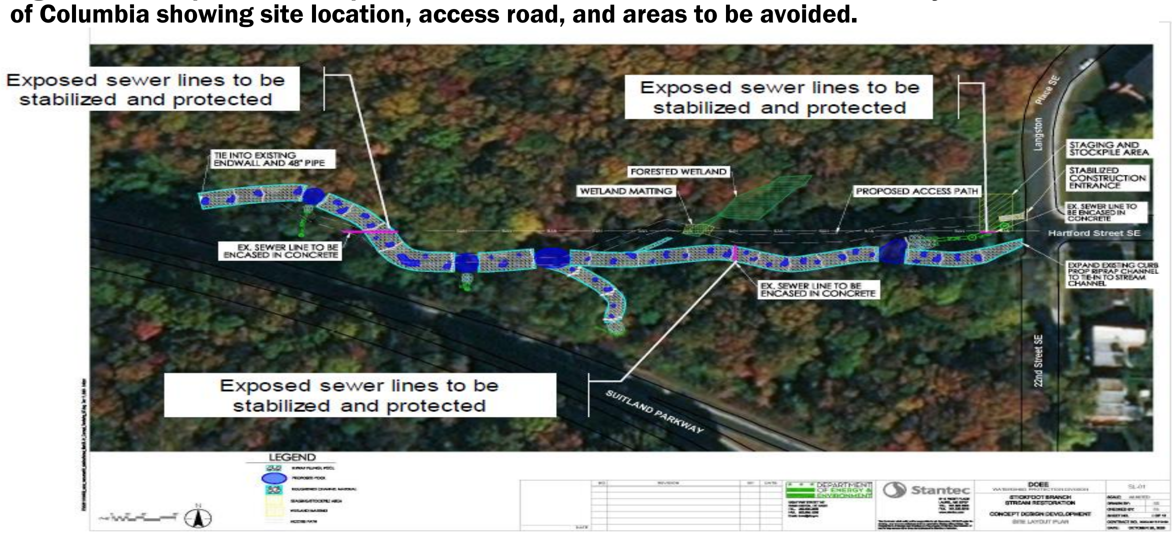
    - Identify areas that should be avoided during construction to minimize ecosystem impacts, including stable stream reaches, wetlands, seeps, good quality vegetative communities, rare or sensitive species, important cultural features, or specimen trees, etc.
    - Identify degraded areas where there are opportunities to significantly improve system function.
    - Identify expected tree loss impacts, in terms of both numbers and species diversity

Figure 1: Example of site map for the Stickfoot Branch Stream Restoration Project in the District of Columbia showing site location, access road, and areas to be avoided.



Source: District of Columbia Department of Energy and Environment

Case Study: Stickfoot Branch Project, District of Columbia

The District Department of Energy and Environment (DOEE) is proposing stream restoration activities in the vicinity of the Garfield Heights neighborhood of southeast Washington, DC. The proposed project involves the restoration of approximately 800 linear feet of Stickfoot Branch, and 140 linear feet of an unnamed tributary, within wooded parkland west of 22nd Street SE near its intersection with Hartford Street SE and Langston Place SE. DOEE is executing this project in partnership with the National Park Service (NPS) and the District of Columbia Water and Sewer Authority (DC Water). The segment of Stickfoot Branch proposed for restoration is experiencing active streambank erosion and channel incision.

Stickfoot Branch is a perennial tributary of the Anacostia River. This proposed project is part of a larger program being implemented by DOEE to achieve District water quality standards for the Anacostia River watershed.

The District has contracted with Stantec to design the stream restoration project and complete all National Environmental Policy Act (NEPA) compliance work. The restoration work (construction of the project) will be bid out separately at the end of the design and NEPA process.

Project Objectives:

- Reduce streambank erosion and channel bed incision to provide long-term stream stability and downstream water quality benefits.
- Manage invasive vegetation in the project area.
- Ensure the long-term protection of existing sanitary and stormwater infrastructure.
- Minimize impacts to natural and cultural resources.

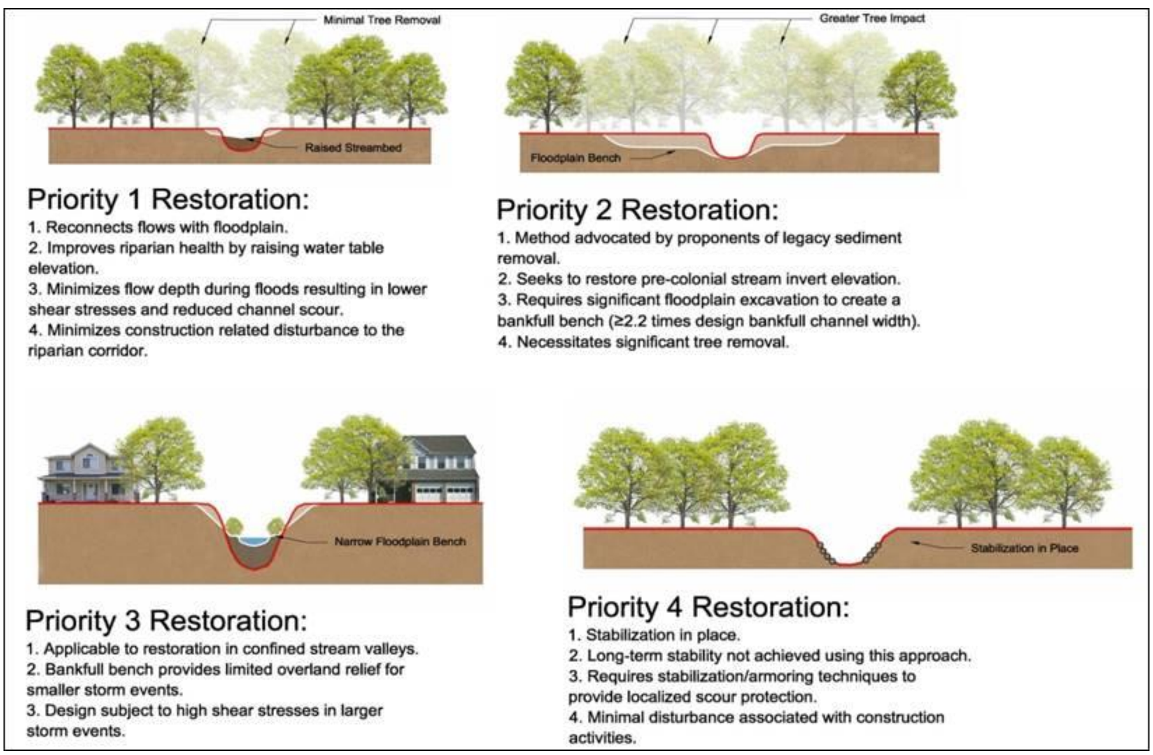
Best Practice #2 – Planning and Design

For each project, consider different restoration priorities, protocols and channel design approaches that best meet site conditions and restoration goals.

- Consider using the four-stage Restoration Priority for incised channels (Rosgen, 1997[xiii]) or a similar approach
- For each project, consider different restoration priorities, protocols and channel design approaches that best meet site conditions and restoration goals
- Consider using different channel design approaches on a project-by-project basis. These approaches include but are not limited to “natural channel design,” “reinforced bed channels,” “beaver dam analogs,” “regenerative stormwater conveyance,” and wood-based designs[xiv] [xv] [xvi] [xvii]. All will involve some degree of channel reconfiguration and stream valley disturbance, and the emphasis should be on the approach that best meets the project needs and goals while prioritizing protection of high-quality natural areas and features

Priority 1 restoration is generally given the highest consideration in urban areas, but priorities 3 and 4 may also be appropriate to limit impacts and costs and preserve both in-stream and riparian habitat features.

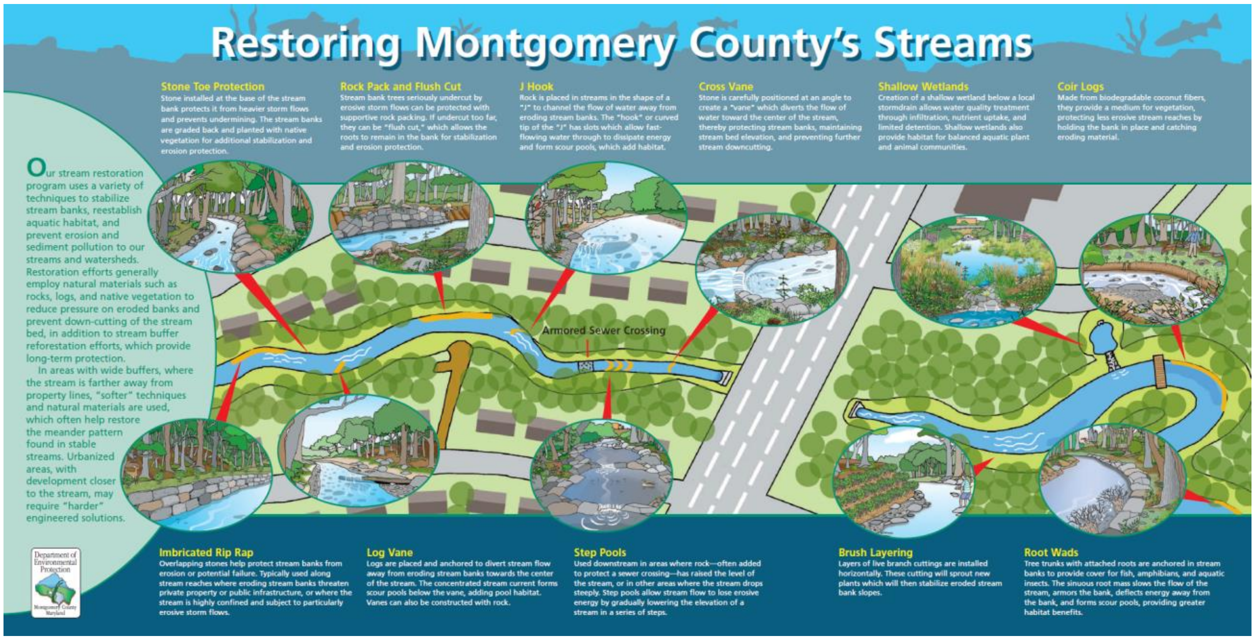
Figure 2: Restoration Priority System



Source: Used with Permission of Wetlands Studies and Solutions, Inc. (based on Rosgen 1997)

Stream project designers should consider multiple approaches and tailor their approach to the individual project conditions.

Figure 3: Restoring Montgomery County's Streams



Source: Montgomery County Department of Environmental Protection

Best Practice #3 – Planning and Design

Establish metrics for measuring success of projects, based on the primary and secondary goals set for each individual project.

- Use documentation from previous work to support how these metrics are met.
- Create a restoration planting plan and be able to provide the public with a list of herbaceous/woody perennials to be used:
    - Determine biological goals for the near and long term; include floristic quality and consideration of keystone plant species for community health and biodiversity
    - Build on surrounding system – improve degraded areas, buffer better quality areas where no work is to occur, plant to build on wetlands and wildlife habitat opportunities.
    - Base plant palettes on target communities
    - Specify plant species, sizes, and container types to address site conditions to include deer herbivory
    - Consider biological stabilization with plant materials as critical to project success and long-term performance
    - Incorporate canopy goals, stream shading, allochthonous material and woody debris generation, recovery of soils and long-term community stability into restoration planting plans

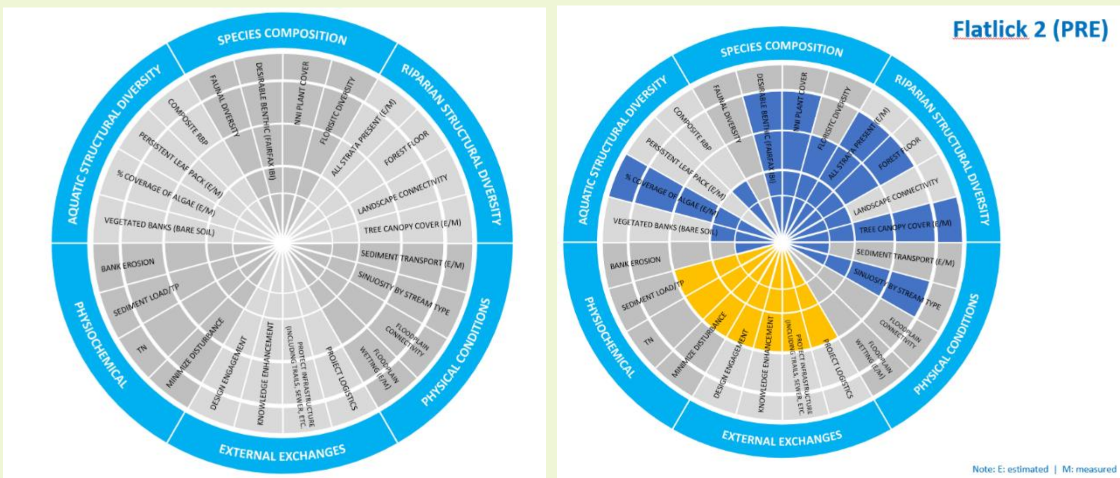
Fairfax County Restoration Recovery Wheel:
A holistic tool for restoration project selection, assessment, and monitoring
Courtesy of Meghan Fellows, Fairfax County

Benefits of stream restoration can be equated with stream stability, stream biota, pollution prevention and/or ecosystem services. Infrastructure protection, flood mitigation and downstream flow can be the primary drivers of the projects. A holistic assessment of the of stream health, restoration potential, and function is an important first step to understanding how ecosystem services can be improved and project drivers corrected. This assessment tool can be used across disciplines for site selection, stream assessment and evaluation of restoration recovery.

Fairfax County evaluates 6 interdisciplinary metrics, each with 4 sub-metrics for a total of 24 metrics. The biological/ecological metrics: riparian structural diversity, aquatic structural diversity and species composition are balanced with physiochemical and physical stream condition as measures of water quality and hydrology. A final category includes the socio-cultural values of restoration including safety, infrastructure, and community involvement. Metrics were chosen from the Ecological Functions Pyramid, published articles on floodplain/riparian assessment, and Fairfax County staff input. Metrics are inherently non-independent, as the system functions as a whole, but each measurement is independent, e.g., vegetated banks are measured separately from bank erosion and riparian strata. Scores range from 1 to 5, with 1 being the worst condition across a metric specific range. For example, for tree canopy cover, a 1 is <40 percent canopy cover and a 5 is >90 percent cover. For other metrics, the value of 1 through 5 is in evenly divided bins. Some metrics have multiple acceptable methods for measurement (e.g., estimated vs. direct counts). This holistic assessment is shown by the county's Restoration Recovery Wheel (Figure 4).

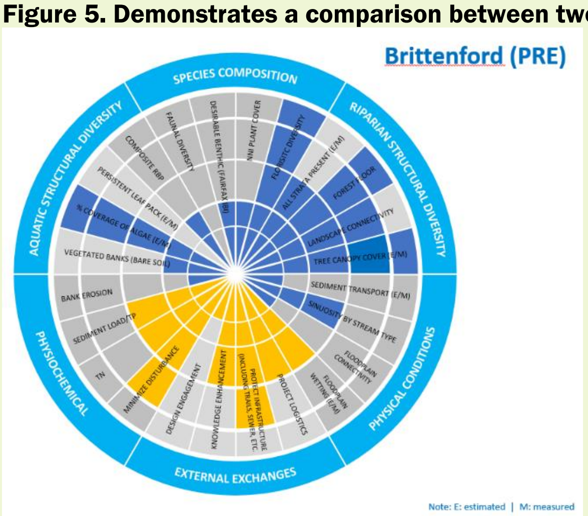
Visually simplistic, the more of the metrics that score closer to a 5, graphically rendered as a more colorful image, would be a stream in a healthier condition. Where restoration effects are predicted, a second color can show design potential (Figure 5). Where restoration success has being evaluated, either a second wheel or second color could depict change through time (Figure 7). This holistic tool can be used to better communicate stream health across multiple disciplines in response to the multi-metric priority of ecosystem health.

Figure 4. Fairfax County restoration recovery wheel.



Based on a recovery wheel created by the Society for Ecological Restoration. The focus is on assessment and monitoring based on 24 metrics of program drivers and ecosystem function. (Gann GD, McDonald T, Walder B, Aronson J, Nelson CR, Jonson J, Hallett JG, Eisenberg C, Guariguata MR, Liu J, Hua F, Echeverria C, Gonzales, EK, Shaw N, Decleer K, Dixon KW. 2019. International principles and standards for the practice of ecological restoration. Second edition. *Restoration Ecology* S1-S46)

Figure 5. Demonstrates a comparison between two projects in design.



Blue highlighted metrics were measured or estimated. Orange highlighted metrics show a potential score from the design specifications. A low level of pre-design metrics, shown in blue, would indicate areas for potential recovery. For Brittenford, elements to improve include bank erosion, floodplain connectivity, benthics and invasive plants. For Flatlick 2, initial benthics were good, so the focus was more on habitat improvement, as well as limiting bank erosion. The relatively higher quality of the floodplain was preserved in a large number of tree save areas.

Best Practice #4 – Planning and Design

Create a plan for inspection and maintenance of projects over time as tied to project goals.

- Depending on project goals, this is likely to be more than traditional monitoring for stream stability and in-stream habitat and may include ecosystem function in the stream corridor
- Identify all the resources needed to fully implement and maintain the project to meet its priority goals and include them in the planning process. Coordinate the planning process with the budgeting process to ensure that adequate funding is available for all phases of the project

PART 3 – EXECUTION

3.1 Watering

A. In accordance with the approved plans, 20-gallon gator bags or an approved equal shall be installed on all upland and steep slope trees. Trees shall be watered weekly during periods with rainfall of <1 inch from installation to One (1) year following the date of substantial completion.

3.2 Tree Shelter Maintenance

A. Tree shelters shall be inspected bi-monthly during the growing season (April to October) and maintained for five (5) years following the date of substantial completion in accordance with Section 02806 Bio-degradable Tree Shelters

3.3 Plant Maintenance and Replacement

A. All plantings shall be inspected annually during the growing season (April to October) starting with the first growing season following substantial completion.

B. Dead, dying and diseased plants shall be replaced. Any plant that is 25% dead or more shall be considered dead and shall be replaced at no charge to the County. A tree shall be considerd dead when the main leader has died back, or 25% of the crown is dead.

C. The Contractor shall submit an inspection report summarizing the inspection findings and proposed replacement species, quantities and schedule to the Project Officer by 10/15 of each year.

D. Live Stakes: A target survival rate of 80 percent shall apply to live stakes, based on the installed quantity from the approved plan. The Contractor shall replace any dead live stakes with bare root plants to account for lost growth, unless otherwise authorized by the Project Officer.

E. Herbaceous Plants: Replace dead or dying herbaceous plants between April 1 and May 15 of each year at no additional cost to the County.

Excerpt from an Arlington County contract specifying need for continual inspection and maintenance of plant materials from project.

Best Practice #5 – Siting/Final Project Selection

Determine specifications for individual projects based on the set of goals set for each project. In doing so, minimize impacts to high quality aquatic and terrestrial habitat in the stream corridor.

Before restoration, streambank erosion in this section of Powell's Creek in Prince William County led to loss of mature trees. *(*Prince William Department of Public Works)

- Projects that must be done to preserve or repair infrastructure or protect public safety will generally occur in portions of the stream and its associated riparian corridor that are degraded and provide only poor-quality habitat

- Permitting processes at the state and federal level require protection of certain species and habitat, but jurisdictions should consider going beyond permitting requirements to minimize impacts to sensitive habitat and to maximize protection of existing high-quality ecosystems

- Some loss of high-quality trees and disturbance of high-quality habitat may be unavoidable in portions of certain projects, but, overall, projects should strive for net improvement to habitat

- Tree loss can be caused both by construction activities and by the increase in water table associated with reconnecting streams to their floodplains and increasing baseflow, but such losses can be mitigated by new plantings of species that will be better adapted to the restored natural riparian conditions

- Other key factors to consider in siting include accessibility, ownership situation and infrastructure risk

Case study: East Longview Project Prince William County, VA

The East Longview stream restoration site was identified as a Stream Corridor Improvement Project in the Farm Creek and Marumsco Creek Watershed Management Plan (Parsons Brinckerhoff, 2009). The stream reach is on Tributary 1 to Marumsco Creek Tributary B and is located east of Jefferson Davis Highway (Rte. 1) near Doris Court, upstream of East Longview Drive.

The reach is approximately 800 linear feet long. The upper limit of the restoration reach is just below the culvert passing under Jefferson Davis Highway (Rt. 1). The lower limit is just above the culvert at East Longview Drive. The total drainage area at the end of the project area is 0.22 square miles.

Project objectives included:

- Stabilization of the channel bed and banks to reduce erosion.
- Floodplain re-connection where feasible to decrease the erosional stresses created by concentrated flows in the main channel.
- Stabilization of the storm-drain outfall entering from the SWM behind Hendrick Automotive parking lot.
- Stabilization of the suspended sewer line associated stream bank and reducing the erosion threat to other portions of sewer line within the reach.
- Use natural stream channel design (or equivalent) techniques where practicable
- Aquatic habitat improvement through the creation of riffle/pool structures

The project design incorporates bankfull floodplain benches, meander pattern, and structural measures to stabilize the existing eroding stream channel. Construction of this project which will result with a stabilized stream channel and bank will in itself facilitate avoidance and minimization of impact to WOUS and Wetlands.

The only alternative option to consider was to not construct this stabilization project. This option was not a viable choice. If the stream bank and channel is not stabilized the erosion threat to both infrastructure and private properties will continue. Proper E&S practices were followed during the construction of this project.

Before and after photos of a portion of Powell's Creek restored by the East Longview Project in Prince William County (Prince William Department of Public Works)

Best Practice #6 – Siting/Final Project Selection

Incorporate DEIJ project siting considerations in overall program management.

- Consider use of demographic index to map areas where projects could benefit different communities
- Incorporate DEIJ in stakeholder engagement process *(see Public Education section for details)*
- Do not rule out needed projects, however, based strictly on DEIJ concerns

Case study: Equity Assessment Map in Montgomery County, MD

Project Website
[Equity Assessment Map]

Location
Countywide.

Status
Initially developed in 2020, the Equity Assessment has been used to analyze the equity of past project implementation and is now being used to help shape outreach and engagement efforts and to guide future project selection.

About the Project
The equity assessment map is a means for the Department of Environmental Protection (DEP) to ensure that equity is factored into both project selection and implementation. The map uses American Community Survey data from the 2019 version of the US EPA EJSCREEN* for census block groups in the County. Data on the percent low income and percent minority (i.e., people of color) are averaged to determine the demographic index percentile of each census block in the County. This index is being used to inform outreach and ensure that future projects are distributed equitably across demographic groups within the county.

For example: Data for a census block group located in the Sligo creek watershed indicates the population in that block group is 54% people of color and 12% low income. Averaging these percentages results in a demographic index of 33%. This percentage is then compared to all the census block groups that exist within Montgomery County. Doing so, places this census block group in the 52nd percentile of the County. This equity assessment is split into 3 categories: low (0-33%), medium (34-66%) and high (67-100%). This provides the ability to cross reference percentiles with project suitability to ensure project targeting is not biased.

Environmental justice (**EJ**) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations, and policies.

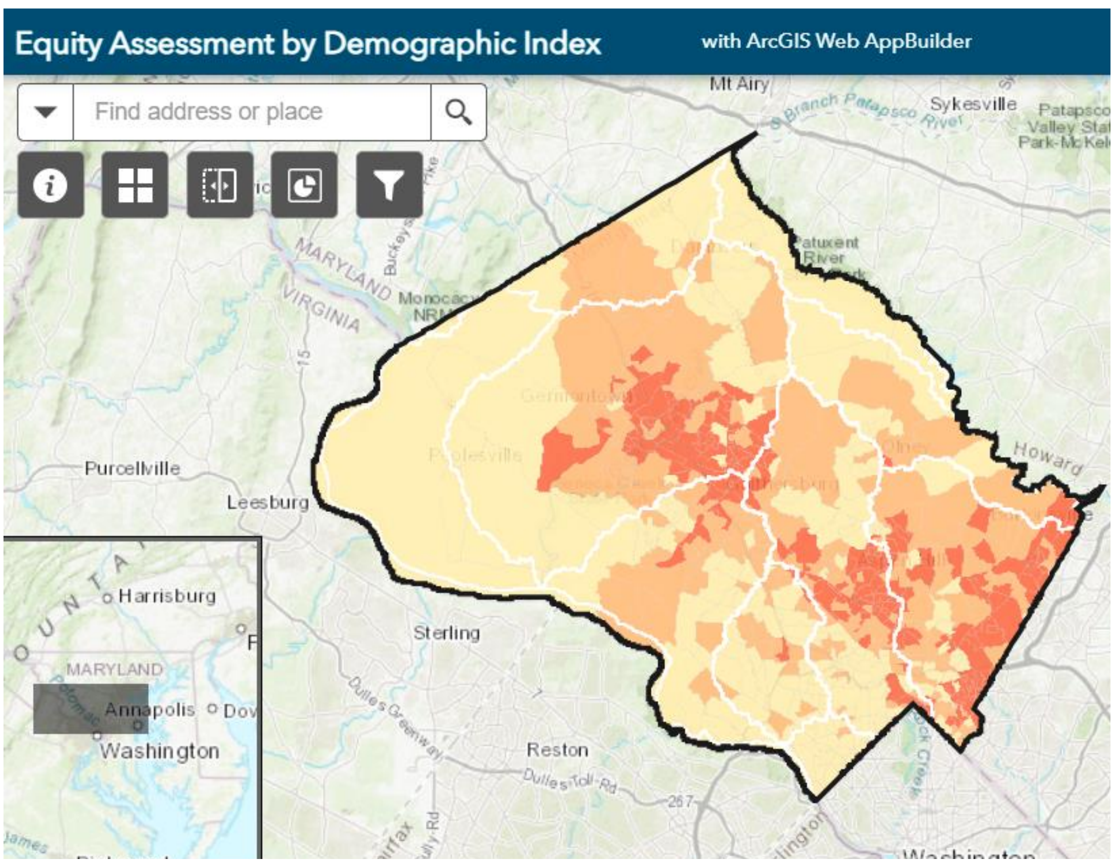
Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies.

Meaningful involvement means:

- People have an opportunity to participate in decisions about activities that may affect their environment and/or health.
- The public's contribution can influence the regulatory agency's decision.
- Community concerns will be considered in the decision-making process; and
- Decision makers will seek out and facilitate the involvement of those potentially affected.

https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

Figure 6: Equity Assessment by Demographic Index: Montgomery County DEP Equity Assessment Map showing different tiers of demographic categories of low income and people of color within the county.



Source: Watershed Restoration Suitability & Equity Mapping Tools

Best Practice #7 – Siting/Final Project Selection

During the site identification and selection phase, conduct assessments before the project starts to develop a baseline for the metrics used to measure its success as determined in the 'Planning/design' step above. Assessments may include but not be limited to:

- Stream physical conditions
  - Examples include the Bank Erosion Hazard Index (BeHI[xviii]) and Bank Assessment for Non-point Source Consequences of Sediment (BANCs[xix])
- Infrastructure conditions
- Aquatic communities
  - Examples include various types of Benthic Index of Biological Impairment (BIBI[xx])
- Riparian vegetative communities
  - Identification of plant communities in accordance with the United States National Vegetation Classification Standard. Community condition should be rated Excellent, Good, Fair or Poor. Rare communities and species should be documented.
  - Projects should be conducted to support high functioning ecosystems by restoring functions that promote ecosystem health and rare species or communities.
  - In general, construction activity should be directed to areas with lower quality systems that can be improved through restoration.
  - Construction activities should avoid communities with a Good or Excellent score and/or any rare communities where there are sensitive species that would not be able to survive construction impacts or secondary effects such as changes in vegetative composition, hydrology, etc.

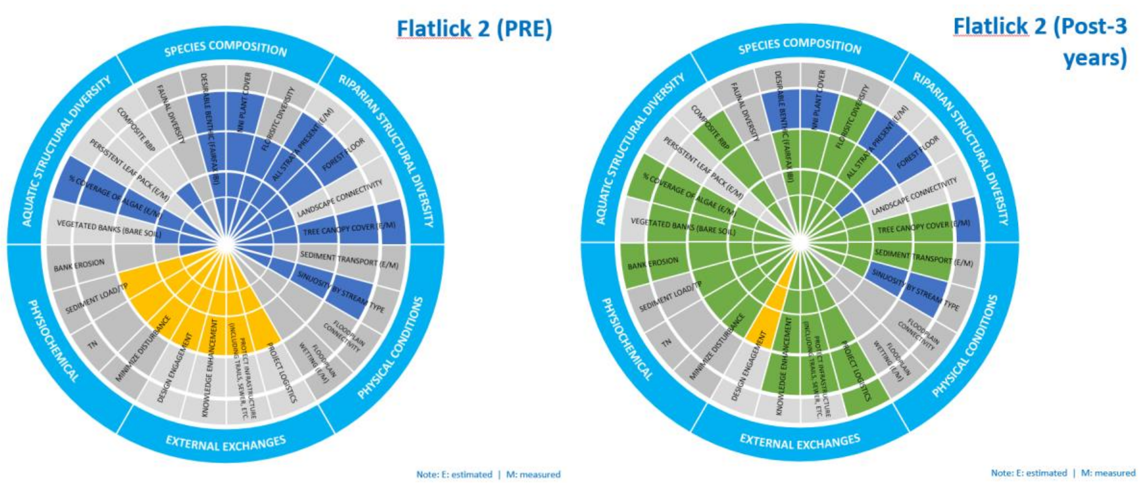


Figure 7. Use of Fairfax County Restoration Recovery Wheel to measure change in pre-project metrics.

Demonstrates a comparison of pre-restoration and conditions three years post-construction for the county's Flatlick Branch project. Blue highlighted metrics were measured or estimated. Orange highlighted metrics show a potential score from the design specifications. Green highlighted metrics show post construction results, including a large increase in benthic habitat and decrease in bank erosion. While physiochemical and physical stream condition has improved, biological factors are at or below pre-condition, but are on trajectory to recover. Overall, the metrics are scoring higher, with a more balanced condition across the entire system.

Best Practice #8 – Public Engagement

Define the stakeholders and develop a process for involving them in planning, site selection, and construction.

- External stakeholders may include: local residents near the site, community groups, NGOs and others in the planning and design process; civic associations, and schools
- Internal stakeholders may include: outreach managers, staff from other departments, and elected officials
- Opportunities exist to receive stakeholder input during development of watershed plans and their overall program management guidelines, which will include consideration of where to do stream projects

Case Study: Gulf Branch Stream Project in Arlington County, VA

Project Website
Gulf Branch Stream Project - Projects & Planning (arlingtonva.us)

Location
Stream sections near Gulf Branch Nature Center, 3608 N Military Rd.

Status
The design phase for the Gulf Branch Stream Project began in 2019.

About the Project
As part of Arlington County's efforts to protect our local streams, Gulf Branch was identified as a high priority for a stream repair and resiliency project because of habitat degradation, active erosion, and infrastructure concerns. Funding for design was allocated through the Capital Improvement Plan in 2018. This project will create a stable stream channel to accommodate storm flows, protect exposed pipes and other infrastructure, address active erosion, and provide habitat. It will also reduce excess sediment and nutrients being transported downstream and help us meet the county's Chesapeake Bay goals. Stream projects are a key strategy identified and adopted as part of the Stormwater Master Plan.

Public Process
County staff sponsored several community meetings and open houses about this project over a period of 10 months. The county also established an advisory group with membership; from 5 separate commissions and organizations and four civic associations. During the public meetings, county staff: Reviewed the draft concept design. Discussed proposed changes and impacts in each stream segment, Received input and feedback from the group.

At the first two meetings of the advisory group, participants reviewed the goals of the project, how natural channel design techniques would be used, and specific challenges and proposed practices in the targeted areas in Gulf Branch. Feedback from the meetings and through an online forum illuminated how the community values and uses the stream valley currently and proposed some desired changes to the project design.

Best Practice #9 – Public Engagement

Begin public outreach early in the design phase of individual projects to explain project goals and seek input from stakeholders. Involve stakeholders in the site selection and project design process through advisory groups, participation on the design team or other means.

- Gather public input on proposed program management goals and add community goals based on citizen input.
- Bring a DEIJ focus to the stakeholder process
    - Consider how to involve stakeholders from the community who may not ordinarily provide government input, which may involve new means of communication (such as virtual meetings at different times of the day and translation services) as well as going to where the stakeholders are (such as community activities and events)
- Develop a public outreach process to include some or all the following elements:
    - A flyer to describe the project.
    - On-line feedback tools e.g., Survey Monkey
    - Outreach to advisory groups such as civic associations, environmental groups and non-profits, members of local government to maintain engagement, act as a sounding board, and carry messages back to the community.
    - A series of public meetings (for example, at design phases 30, 60, and 90 percent)
    - A town hall or open house, particularly on Fridays or Saturdays when more people can attend.
    - A website with information on what to expect during construction; who to contact with questions and concerns; factsheets.
    - Establishment of a 3-1-1 number for citizens with questions to call.
    - A project completion ceremony such as ribbon cutting or walking tour for citizens and elected officials and members of the media.
    - Use stakeholders as ambassadors for the project

Case Study: Breewood Tributary Stream Restoration in Montgomery County, MD

Project Website
Breewood Tributary Stream Restoration Project Blog

Location
1200 linear feet repair along University Boulevard in the Southeast portion of Montgomery County, near Wheaton. Approximately 1200 University Blvd W, Silver Spring, MD.

Status
Breewood was the County's first comprehensive watershed approach to restoration. It was identified as a top priority project for the County's 2010 MS4 permit. Substantial completion of the stream restoration occurred in May 2015 with additional components being completed in July 2018 and a community celebration held in June 2019.

About the Project

As part of the county's efforts to improve water quality and protect our local streams, the Montgomery County Department of Environmental Protection (DEP) identified the Breewood tributary as a small-scale watershed in which to conduct a comprehensive watershed approach to restoration. This included regenerative stormwater conveyance (RSC), roadside BMPs, and public & private property improvements and an extensive outreach component.

Breewood Tributary flowing into Sligo Creek was a heavily eroded and severely damaged stream with little stormwater management, deep head cuts, steep vertical banks, high flow rates and infrastructure concerns from decades of neglect prior to the restoration work. The location drains 57 acres that are 42% impervious. The area is mixed landuse requiring multiple outreach strategies working with multifamily condos, a diversity community with a high rate of renters, a school, and local church all within the drainage area. Funding for the design and construction was allocated through the Capital Improvement Program as well as grant funding.

The Breewood project was designed to improve the entire watershed to stabilize the streambanks, reduce erosion and sediment transport to Sligo Creek, reconnect the tributary to its floodplain, enhance aquatic and riparian habitat and improve water quality while connecting the community to this natural resource and improve its care.

Public Process

County staff's approach to Breewood was to institute an extensive outreach component starting in 2010. Initial outreach included public meetings and presentations to the community with little participation. DEP then began working with the Friends of Sligo Creek and Neighbors of Northwest Branch watershed organizations to make contacts within the diverse community.

Piggybacking on a community grant with the Potomac Appalachian Trail Club to install a nature/cross country running trail in the watershed for the community and school opened the door for DEP to form relationships and better communicate with the community. County staff participated in and hosted cleanups, trailblazing, rain barrel raffles and a County-led race and fun run. Outreach material for the project included door hangers, lawn signs, educational signage, reminder post cards, flyers/mailers.

During public meetings with the various stakeholders, county staff continued to provide presentations, regular progress updates and information on potential design changes, construction, and data results. DEP set up an extensive project specific webpage for updates, several project factsheets, and an open communication strategy for residents to provide feedback and opportunities to get involved. DEP also installed stormwater monitoring stations in the stream and a rain gauge to better examine flow and rainfall trends. The resulting data has been shared with residents and during tours.

Several community meetings, open houses, posters, videos, community and school tours, a 1.4 mile (guided and self-guided) neighborhood walking tour, and events were developed and took place across multiple years. DEP utilized the Audubon Naturalist Society (ANS) to assist in targeted neighborhood assessments for RainScapes practices. DEP staff tried to receive BMP installation approval from at least 30 percent of individual property owners. The goal was not achieved, but through input from one-on-one meetings with property owners, including a resident satisfaction survey, roadside BMPs were ultimately redesigned.

The watershed groups and ANS became advocates for the project and led many outreach opportunities. DEP's involvement in the community and interest to develop strong community partnerships led to a very successful ribbon cutting event with local media to close out the project. A project presentation and video were also presented at the 2020 LID conference and to others like it.

Best Practice #10– Public Engagement

Demonstrate need for project through visual evidence and site visits whether in person or virtually; explain what will happen if project is not undertaken.

- Where possible, conduct site walks to show need for sanitary sewers or water main repairs, erosion, or other major drivers for projects

- Demonstrate objectives such as reducing pollution

Case Study: Dewey's Creek Stream Restoration Project

The Dewey's Creek Stream Restoration Project consists of four reaches of the stream located along the eastern boundary between the Town of Dumfries and Prince William County. Construction of Reach 1(1,380 linear feet) was completed in 2019. Construction of Phase 2 is currently underway.

Prince William County DPW staff conducting a site tour of the Dewey's Creek Stream Restoration Project located along the eastern boundary between the Town of Dumfries and Prince William County.

Dewey's Creek is a tributary of Quantico Creek, a tidal freshwater estuary of the Potomac River that feeds the Chesapeake Bay. The problems associated with this creek have a negative impact on this estuary by transporting large loads of sediment and nutrients that are deposited into Quantico Creek. The excess sediment has created a shallow creek, which has periodic increases in temperature and turbidity. This condition promoted the depletion of dissolved oxygen, resulting in some large fish kills, smothering aquatic habitat, and creating habitat for invasive non-native species. Excess nutrients result in algal blooms and increase invasive plant growth. Controlling and balancing the sediment and nutrient loads from the Creek due to erosion will help resolve this problem. Opening the fish obstructions in the culvert boxes at Possum Point Road will allow eel and shad species to migrate upstream into Dewey's Creek. The project also will protect the residents that live along this road from being stranded due to flooding from major precipitation events.

Based on the results of the Quantico Creek Watershed Management Plan, Dewey's Creek is one of the poorest condition streams in the County and in this portion of the Chesapeake Bay watershed (based on an analysis using the Regional Stream Assessment Technique (RSAT) for assessing stream health. This stream segment is being restored because it has logical termini; it has measurable benefits; and it will solve some of the problems within this sub watershed. The design uses natural channel design methodology as advocated by Rosgen, Newbury, Hey, Leopold and others. The banks will be stabilized using bioengineering techniques as promoted by the Natural Resources Conservation Service. Riparian restoration and tree planting will provide adequate buffer to allow the system to function.

The project's specific objectives are to stabilize the creek, reduce bank erosion, provide infrastructure protection, enhance aquatic and terrestrial habitat, foster the protection of nearby residential and commercial properties, prevent flooding of Possum Point Road at the culvert during extreme weather events, and provide educational opportunities. The project has good community support. All adjacent properties to the project have authorized right of entry to conduct the project.

Best Practice #11 – Public Engagement

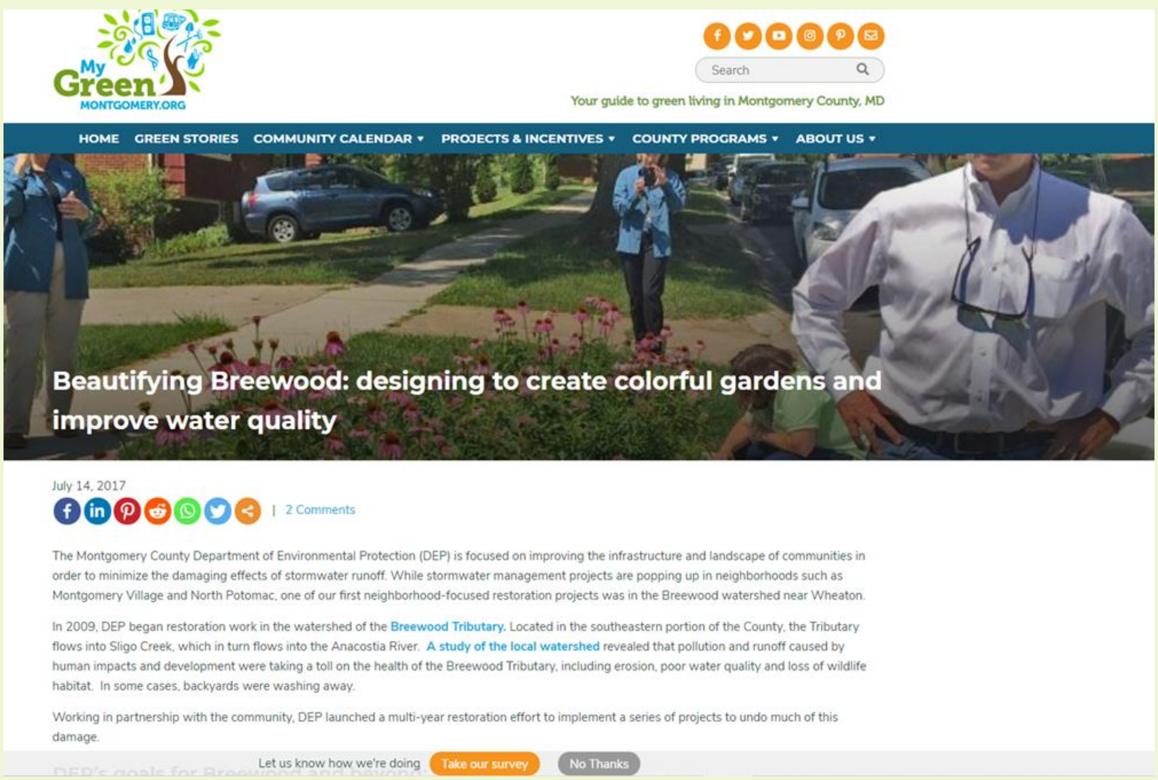
Continue to communicate with stakeholders through construction and post-construction periods; highlight where community input was used to make changes or influence the project.

- Potential ongoing communication vehicles include civic association newsletters, social media, and list serves (e.g., Nextdoor)
- Provide a look ahead at what will be happening in the project in the next few weeks

Case Study: Montgomery County DEP staff established a Project Blog for the Breewood Tributary Restoration

Project to keep nearby residents and the wider community informed of the project as it was being constructed and what is happening since the project was completed.

MORE: Beautifying Breewood



Best Practice #12 – Construction/Assessment/Maintenance – During Construction

Use construction techniques that minimize impact on high quality aquatic and terrestrial habitat, as identified during the Planning/Design phase.

- Minimize tree loss during construction; use felled trees in stream work[xxi]
- Minimize soil disturbance and compaction during construction; protect sensitive areas such as wetlands

Stream Restoration Project in Prince William County. (Prince William County Department of Public Works)

Example of saving trees during construction of the Donaldson Run Tributary B Stream Restoration Project in Arlington County. Access to the site was adjusted to save a tree important to the landowner. (Wetland Studies and Solutions, Inc.)

Best Practice #13 – Construction/Assessment/Maintenance - During Construction

Adhere to quality control practices in restoration planting.

- Require plant submittals for source of materials well in advance of planting time
- Require adherence to strict planting windows based on plant material types.
- Conduct rigorous plant materials inspections for correct species, root condition, container size and adherence overall to ANSI Z60[xxii] requirements.

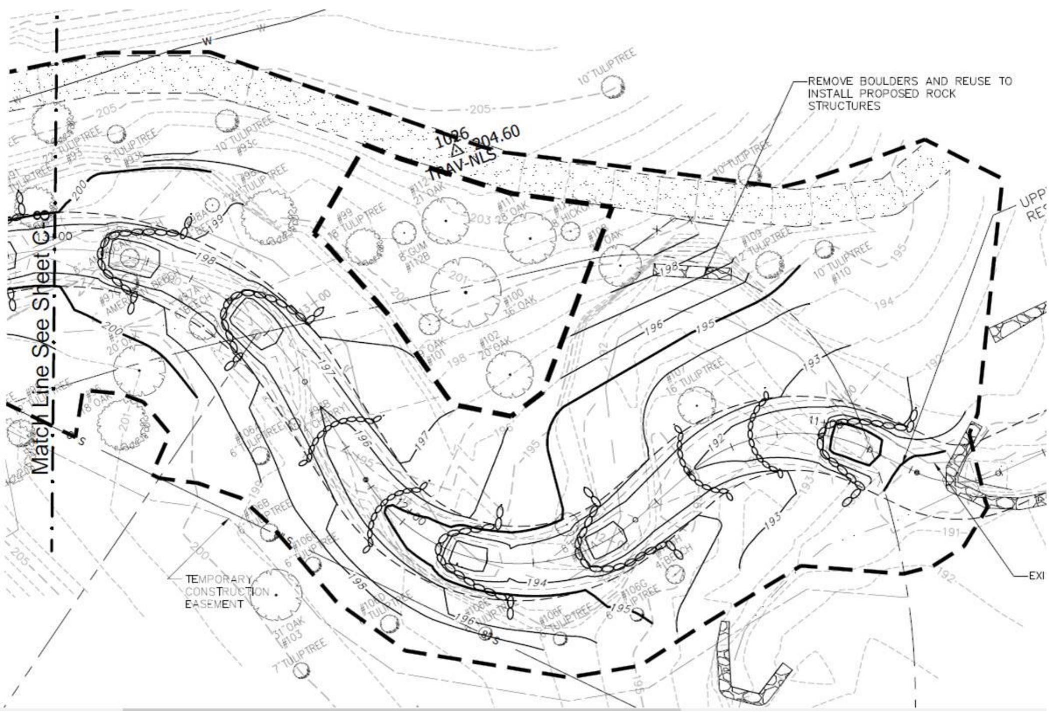
Fairfax County's Plant Specifications, includes plant size, quality, and source.

Best Practice #14 – Construction/Assessment/Maintenance - During Construction

Make field adjustments at start of construction.

- Conduct a walk-through with contractor and forester (within the Limit of Disturbance zone) to evaluate additional protection opportunities in the field
- Conduct on-site construction oversight on a regular basis.
- Document elevations during construction; don't rely on as-built to minimize tree loss during construction, use existing corridors cleared of trees (utility right of ways or trails) if possible for access and haul roads, use timber mats over a bed of wood chip; use felled trees in stream work;
- Minimize soil disturbance and compaction during construction; protect sensitive areas such as wetlands
- Adjust the boundary of avoidance area to provide root zone protection for critical trees
- Relieve soil compaction to the extent possible within the limits of disturbance following construction

Figure 8: Site Map for Donaldson Run Tributary B Stream Restoration Project in Arlington County



Site map for Donaldson Run Tributary B Stream Restoration Project in Arlington County showing efforts to save high quality trees via reduction of the limits of disturbance and establishment of tree save areas (area inside dotted line). The site access shown in the lower left uses an existing trail as the project access for construction.

Best Practice #15 – Construction/Assessment/Maintenance – Post Construction and Maintenance

Budget for and pursue follow-up assessment and maintenance activities to maximize the project's long-term benefits.

- Meet regulatory requirements for post construction performance at a minimum
- Commit to regular inspection and, where needed, maintenance of restored systems to achieve priority project goals on a long-term basis
- Provide invasive species control pre-construction and up to three years following construction.
- Provide at least three years of inspection and adaptive management so that plantings are established on a stable trajectory[xxiii][xxiv]

1.3. Plant Warranty and Replacement

A. Warranty: Guarantee that plants will be alive and in satisfactory growth for a period of five (5) years, beginning the date of substantial completion as determined by the Project Officer.

Excerpt from an Arlington County contract specifying need to maintain plantings for at least five years after construction was completed.

Appendix
Before and After Stream Restoration Images

Alexandria, VA


Strawberry Run, Before Restoration


Taylor Run, Before Restoration

Anne Arundel, MD


Towser's Branch, Before Restoration


Towser's Branch, After Restoration

Arlington County, VA

Windy Run, Before Restoration

Windy Run, After Restoration

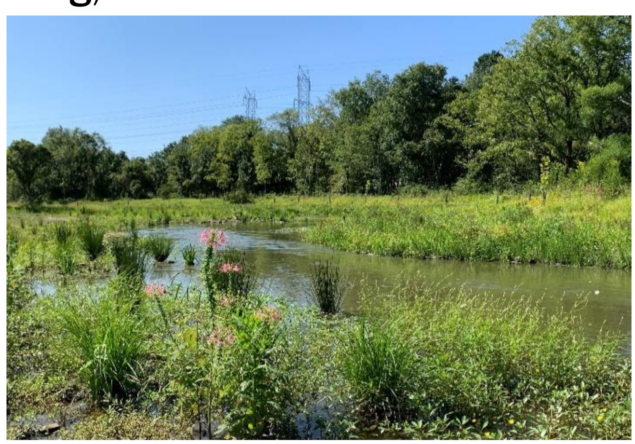
District of Columbia

Nash Run, Before Restoration

Nash Run, After Restoration

Gaithersburg, MD

Blohm Park, Before Restoration



Blohm Park, After Restoration

Prince William County, VA

Dewey Creek, Before Restoration

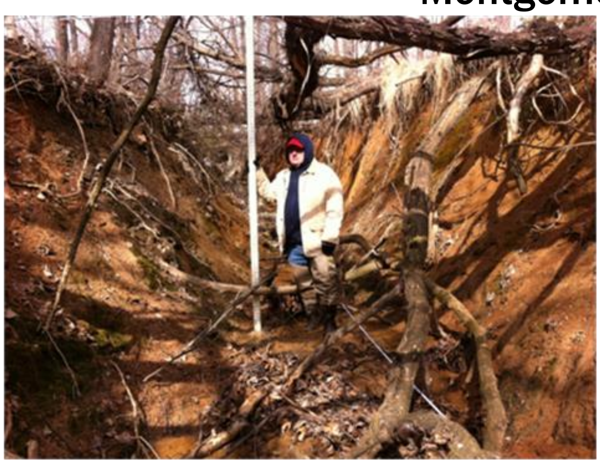
Dewey Creek, After Restoration

Fairfax County, VA

Brittenford, Before Restoration

Brittenford, After Restoration

Montgomery County, MD



Breewood Tributary, Before Restoration

Breewood Tributary, After Restoration

Prince George's County, MD

Briers Mill Run, After Restoration

Endnotes

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[i] EPA, 2018. Fundamentals of Rosgen Stream Classification System | Watershed Academy Web | US EPA

[ii] Rosgen, D. (2021). Natural Channel Design for River Restoration. In Encyclopedia of Water, P. Maurice (Ed.). https://doi.org/10.1002/9781119300762.wsts0100

[iii] Siegfried, Robert. (2015). A framework for understanding stream restoration with reference to stream evolution model. 2015 Mid-Atlantic Stream Restoration Conference. 2015

[iv] Davee, Rachael; Gosnell, Hannah; Charnley, Susan. 2019. Using beaver dam analogues for fish and wildlife recovery on public and private rangelands in eastern Oregon. Res. Pap. PNW-RP-612. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 29 p.

[v] Maryland Department of Natural Resources. Regenerative Stream Conveyance: Construction Guidance. Accessed 10/4/21 at: https://dnr.maryland.gov/ccs/Documents/RSC_Training/RSC-Guidance

[vi] Rosgen, D.L. 2001. A Practical Method of Computing Streambank Erosion Rate. Proceedings of the 7th Federal Interagency Sedimentation Conference, Vol. 2, pp. 9-15, March 25, 2001, Reno, NV. Available on the Wildland Hydrology website at: http://www.wildlandhydrology.com/ html/references_.html

[vii] Rosgen, D. L. (2006). Streambank erosion (BANCS model). In D. Frantila (Ed.), Watershed Assessment of River Stability (WARSSS) (First, pp. 5-53-5–81). Friesens

[viii] Maloney, Kelly O., et al. "Predicting Biological Conditions for Small Headwater Streams in the Chesapeake Bay Watershed." Freshwater Science, vol. 37, no. 37, 2018, pp. 795–809.

[ix] "Stream Restoration Using Engineered Wood Structures Harvested from On-Site: The Past and Future of Streams," *Ecological Restorations*, Vol. 38, No. 4, 2020

[x] American Standard for Nursery Stock; see ANSI Z60.1 American standard for nursery stock, American Horticulture Industry Association - Publication Index | NBS (thenbs.com)

[xi] Stroud Water Research Center "Tips for Successful Riparian Forest Buffer Planting and Establishment" Accessed 10/4/21 at: Watershed Restoration Resources (stroudcenter.org)

[xii] Small-scale-Solutions-to-Eroding-Streambanks. North Carolina State University. Accessed 10/4/21 at: Small-scale-Solutions-to-Eroding-Streambanks.pdf (ncsu.edu)

[xiii] EPA, 2018. Fundamentals of Rosgen Stream Classification System | Watershed Academy Web | US EPA

[xiv] Rosgen, D. (2021). Natural Channel Design for River Restoration. In Encyclopedia of Water, P. Maurice (Ed.). https://doi.org/10.1002/9781119300762.wsts0100

[xv] Siegfried, Robert. (2015). A framework for understanding stream restoration with reference to stream evolution model. 2015 Mid-Atlantic Stream Restoration Conference. 2015

[xvi] Davee, Rachael; Gosnell, Hannah; Charnley, Susan. 2019. Using beaver dam analogues for fish and wildlife recovery on public and private rangelands in eastern Oregon. Res. Pap. PNW-RP-612. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 29 p.

[xvii] Maryland Department of Natural Resources. Regenerative Stream Conveyance: Construction Guidance. Accessed 10/4/21 at: https://dnr.maryland.gov/ccs/Documents/RSC_Training/RSC-Guidance

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[xx] Maloney, Kelly O., et al. "Predicting Biological Conditions for Small Headwater Streams in the Chesapeake Bay Watershed." Freshwater Science, vol. 37, no. 37, 2018, pp. 795–809.

[xxi] "Stream Restoration Using Engineered Wood Structures Harvested from On-Site: The Past and Future of Streams," *Ecological Restorations*, Vol. 38, No. 4, 2020

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