July 16, 2024

Stewart Comstock

Maryland Department of the Environment

Water and Science Administration

1800 Washington Blvd.

Baltimore, MD 21230

Comments on NPDES MS4 Permit for MDOT SHA, NPDES Permit Number MD0068276, MDE Permit Number 24-DP-3313

Dear Mr. Comstock:

My name is Robert Dover, living in Columbia, Maryland. I am a surface water hydrologist and environmental planner with more than 30 years of experience in evaluating surface water hydrology impacts, surface water permitting, and environmental impact assessment under the National Environmental Policy Act (NEPA). I have been acquiring and studying permit applications, post-construction monitoring reports, MS4 annual reports, reports from government and quasi-governmental organizations, and academic literature related to the practice of stream "restoration" for more than a year.

I am writing to state my opposition to the inclusion of stream "restoration" projects as an approved management practice to be used by the Maryland Department of Transportation (MDOT) State Highway Administration (SHA) to receive credits toward their required stormwater pollutant load reductions in their new Municipal Separate Storm Sewer System (MS4) permit. My opposition to the continued practice of stream "restorations" is based on three primary observations:

- The failure of the permitting agencies, including the Maryland Department of the Environment (MDE), to consider the full range of adverse impacts that these projects have on existing ecosystems and residential communities;
- The overwhelming evidence in the academic literature, as well as in project-specific and programmatic monitoring reports submitted to regulatory agencies, that these projects fail to achieve their stated goals of improving water quality, uplifting ecological function, and stabilizing stream banks; and
- The failure of the regulatory agencies to require monitoring to demonstrate that individual projects actually result in environmental improvements or benefits.

As you will see in the comments, these objections are not just generic opposition to stream "restoration" projects in any random location, or conducted by any random MS4 permit holder. Under their current MS4 permit, SHA implemented a very large-scale stream restoration project, titled the Unnamed Tributaries to Little Patuxent River project, and authorized by Permit 2018-61782-M15, in a residential neighborhood near my home in Columbia, Maryland, in 2020. The official completion date of the construction of that project was in February, 2021, meaning that we now have more than three years' worth of observations, data, and monitoring reports on which to judge the adverse impacts of the project on the environment and the community, its technical performance with respect to the

environmental benefits that were required under the permit and were promised to the community, and the manner in which the project has been regulated by MDE and other agencies. The results from that project strongly support a complete cessation of similar projects by SHA and other MS4 permit holders in other locations in Maryland.

The problem is not only that the project has had substantial adverse impacts to adjacent homeowners and others in the neighborhood, and there are no documented environmental benefits to show for it – these, alone, should be enough to demand elimination of these projects from the MS4 permit program for all MS4 permit holders. Instead, the larger problem revealed is that these projects are effectively unregulated by MDE.

The Unnamed Tributaries project is almost completely monitored based on visual inspections alone, without any systematic program of pre-construction and post-construction monitoring to provide a science-based assessment of project performance. There is no evidence that MDE regulators have inspected the project area, or have conducted a thorough, critical review of the monitoring data or reports. Instead, at the three year mark, we have evidence that the MDE regulators:

- Were completely unaware that the re-forestation effort on the project had failed, and had required a new, large-scale re-planting effort as a corrective action;
- Were not familiar with the monitoring requirements of the project they were supposed to have been regulating; and
- Trusted unsupported claims of “well established” vegetation and a “self-sustaining” project area made by SHA in the official monitoring reports, rather than comparing SHA’s claims of success to actual monitoring results.

Thank you for considering these comments in your evaluation of SHA’s proposed MS4 permit.

Robert Dover

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Technical and Regulatory Critique of Stream Restoration Projects

Comments Opposing Some Elements of the Maryland State Highway Administration

Municipal Separate Storm Sewer System Permit

July 2024

Introduction

The practice of stream "restoration" has largely operated with the full encouragement and endorsement of the agencies that regulate actions within watersheds and has, until recently, been almost completely unopposed by residents and the public. However, the public complacency and acceptance of these projects has been changing in recent years, as the scale of the projects has increased, and as they have been implemented directly within residential neighborhoods. Recent examples are:

- In Reston, Virginia, the proposed Phase II of the project in the area called The Glade was vigorously opposed by the local residents, once they saw the extent of destruction done in the adjacent watershed known as Snakeden Branch[1].
- Also in Virginia, the Environmental Council of Alexandria successfully objected to a series of proposed stream restoration projects, citing the stream restoration company for providing "misleading and inaccurate scientific information regarding stream restoration"[2].
- In Baltimore, Maryland, the Chesapeake Bay Foundation filed suit in an unsuccessful attempt to stop the proposed Herring Run project[3], which was strongly opposed by local residents[4].
- In Howard County, Maryland, there was substantial public outcry as trees were removed within the Longfellow neighborhood for the 7,000 foot-long Unnamed Tributaries to Little Patuxent River project[5]. When the nearby Elkhorn Branch project, which would have been 33,000 feet long, was proposed even before construction in Longfellow had been completed, public objection was so vigorous that the contractor withdrew, despite having invested two years and hundreds of thousands of dollars into the permit application for the project[6].
- Also in Howard County, residents successfully opposed the proposed Plumtree Branch project after the Department of Public Works (DPW), under public pressure, agreed to engage a third-party review of the project's permit application[7].

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[1] Save The Glade petition, 2008. Available at https://www.gopetition.com/petitions/save-the-glade.html

[2] Memo from Environmental Council of Alexandria to Environmental Policy Commission, 2021

[3] Fern Shen, Critics Call One Baltimore Stream Restoration "A Debacle" as DPW Pushes Ahead. Baltimore Brew, June 26, 2024

[4] Timothy Wheeler, 2023, Stream Restoration Draws Fire for Plan to Carve up Baltimore Forest, Bay Journal, November 8, 2023.

[5] Social media comments posted by local residents, read out-loud at CA Board meeting on 7/13/2023, available at https://www.youtube.com/live/kOt3zvL0dyc, at timestamp 00:48:00.

[6] Letter from TJ Mascia (Davey Resource Group) to Dennis Mattey (Columbia Association) dated July 20, 2023.

[7] Underwood and Associates, Report to Howard County Department of Public Works on Review of Public Comments on Proposed Plumtree Branch Ecological Restoration, November 29, 2023.

In each case, the objections were based on two primary issues:

- The adverse effects of the proposed project on the ecology and hydrology within the watershed, as well as the immediate and long-term adverse impacts of the project on viewscapes and recreational values in residential neighborhoods; and
- The lack of any documentary evidence that the promised environmental "improvements" were likely to occur.

In some cases, the resident-driven efforts were unsuccessful in stopping projects (The Glade and Herring Run). The residents' efforts were successful in other cases (Elkhorn Branch, Plumtree, and the Alexandria projects). However, the threats continue. There is a strong feeling, among the residents living near the withdrawn projects, that their successful opposition is only temporary, and that the stream restoration companies are only waiting for the more vocal of the opponents to leave the area or lose interest before they can try again. Stream restoration projects are very similar to acts of terrorism, in that the opponents must remain vigilant and win the fight every day, whereas the stream restoration companies can bide their time, and only have to win once. Once a project begins, the destruction of mature forests is immediate, irreversible, and permanent. Therefore, although awareness of these projects, their failures to deliver on their promised benefits, and their destructive effects has been growing since about 2008, it has been growing too slowly. Meanwhile, the destruction has continued, even while the post-construction results from specific projects demonstrate few or no actual improvements in the local watersheds, and even the rosiest assessments of the Chesapeake Bay[8] acknowledge that 20 years of stream restoration has not improved its water quality and ecological conditions.

The regulators of these projects have been of little or no assistance. The individual projects are encouraged by, and are authorized through, various environmental permitting programs managed by the U.S. Army Corps of Engineers – Baltimore District (USACE), the Maryland Department of the Environment (MDE), and the Maryland Department of Natural Resources (DNR). In an ideal world, these agencies would be staffed with qualified and experienced environmental professionals who maintain knowledge of the up-to-date results from past projects within their jurisdictions, as well as the academic research and literature on the science behind the projects. They would also be vigilant, and would conduct rigorous reviews and critiques of project-specific documents, including permit applications and post-construction monitoring reports, submitted by the stream restoration contractors on behalf of their clients.

What has been found by the environmental groups, subject matter experts, and residents involved in opposing the projects discussed above, is an alarming lack of interest and curiosity about these projects among the regulatory agency personnel. In the permit application documents, there is strong evidence showing that the regulators do not bother to double-check whether the studies cited to support the claims of benefits actually say what the application claims that they say. In multiple cases, regulators have accepted permit applications and approved projects that are supported only by a small number of 15 to 20 year old scientific articles, while failing to even acknowledge that there is an enormous body of opposing literature that has been developed since about 2008. Also, the environmental analysis

[8] Scientific and Technical Advisory Committee, Chesapeake Bay Program, 2023, Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response.

documentation developed by these agencies, supposedly to ensure that adverse impacts of the projects are considered, disclosed, avoided, and mitigated, fails to consider numerous adverse impacts that are of interest to the residents, and routinely refers to the adverse impacts of the clear-cutting and grading on tens of acres of mature forest as being “temporary”.

There is also strong evidence that the regulators conduct only cursory reviews of Executive Summary and Conclusion sections of post-construction reports, without bothering to verify whether their claims of successes and benefits are actually supported by field monitoring data. There are projects that have clearly failed to meet any of their required re-forestation objectives or environmental improvements, yet there is no evidence that the regulatory agencies have issued notices of violation, or have required effective remedial actions in a timely manner. Instead, the agencies are easily swayed by unsupported claims made by the stream restoration companies. They also show a concerning level of disdain for the residents who are actually impacted by the projects, considering them to be laypersons with no relevant technical or regulatory qualifications, and to be motivated only by NIMBY (not in my backyard) considerations.

The purpose of these comment is to help put a stop to the thoughtless authorization of destructive stream “restoration” projects by summarizing some of the technical flaws in the theory behind these projects, as well as the programmatic failures of the regulatory agencies who encourage and authorize them.

Technical Analysis

The use of the common name of stream “restoration” implies that the streams in question are no longer in their original condition, and that the proposed projects are intended to return the watersheds to that original condition. While the specific characteristics that are “unoriginal” and are being “restored” vary from project to project, they are usually focused on the amount of erosion and sediment transport associated with the stream and, through the transport of sediment, delivery of nutrients and other pollutants to the Bay. This erosion and sediment is attributed to higher-than-original amounts of stormwater runoff. Through the removal of the evapotranspiration functions of the original forests, and through replacement of pervious surfaces with impervious, the amount of stormwater runoff entering these streams is now substantially higher than it was before Europeans arrived.

This increased runoff has resulted in substantial erosion, leading to what is called channelization, in which the main, axial stream channel of the watershed has eroded deeply into the floodplain. The geomorphological shape of the watershed has been modified, and this changes the locations, volumes, and velocities of stormwater flow, erosion, and sediment deposition. Once the erosion has caused the elevation of the channel to be substantially lowered beneath that of the floodplain, the floodplain and channel are said to be “disconnected”. This disconnection results in less frequent flooding of the floodplain, allowing what were formerly riparian wetlands to be starved of water. When these areas are no longer allowed to flood, the associated riparian wetlands die off, and are replaced by upland vegetation. This eliminates the beneficial aquatic habitat and water quality functions of the wetlands. Meanwhile, the aggressive erosion threatens to erode adjacent properties, threatens to damage infrastructure within the floodplain, and transports sediment that is the primary cause of degraded ecological function within the Chesapeake Bay.

1) The Theory Behind Stream Restoration and Floodplain Re-Connection is False

The theory behind stream "restoration" is to restore the original geomorphology of the watershed, using a technique called "floodplain reconnection". The explanation offered by the stream restoration industry is that, by re-grading the watershed so that the stream channel is no longer channelized below the elevation of the surrounding floodplain, frequent stormwater flow within the floodplain will be restored. This action will spread stormwater flow out over a larger lateral area, so that it is not tightly confined within the stream channel. This will reduce the stormwater velocity within the channel, thus reducing the erosive force within the channel. The stormwater within the floodplain is spread out over a broader area, so it flows through the floodplain slowly, again with limited potential for erosion. The more frequent flow of stormwater into the floodplain will raise groundwater levels, support growth of riparian vegetation, and re-create the original wetlands and their beneficial functions for aquatic ecology and water quality. This not only improves the local conditions for aquatic ecology to thrive, but also reduces the transport of pollutants and sediment into the Chesapeake Bay, allowing ecological recovery to begin.

This theory and its associated benefits are routinely communicated by the stream restoration industry to encourage landowners to implement the projects, to persuade regulatory agencies to approve them, and to encourage the public to accept them without objection. However, when communicating to landowners and the public, the stream restoration companies typically choose to downplay, or completely ignore, a description of the physical activities that are required to achieve this floodplain re-connection, or the adverse impacts of those activities on the community.

By definition, floodplain re-connection can only be accomplished through grade modification, which is changing the elevation of the streambed in the channel, the adjacent floodplain, or both. In turn, grade modification can only be accomplished by removing all trees and vegetation within the project area, including removal of stumps and root balls, and then grading of the exposed soil to raise and lower the associated land areas. The specific areas to be graded, and their ultimate elevations, are designed, in advance, to mimic the geomorphic shape of what the stream restoration company claims to be the "original" shape of the watershed, resulting in the use of the name "restoration". The modification does not just change the elevation of the stream channel and the adjoining floodplain – it also often involves lateral re-location of the channel from one side of the floodplain to another. Once the location, elevation, and shape of the bed and banks of the channel have then modified, the exposed surface is then modified by placement of rocks of various sizes, gravel, and logs to protect soft sediments from erosion, and to allow stream flow to pool, again mimicking the original shape of the streambed surface.

These physical activities are enormously costly, labor-intensive, and destructive to the existing watershed. They remove the existing mature, upland trees, which provide habitat for birds, mammals, insects, bats, amphibians, and a variety of native vegetation. This eliminates the hydrologic functions of those trees, which include removal of excess runoff from the watershed by canopy interception and evapotranspiration, and it stops attenuation of stormwater velocity by removing tree trunks, fallen limbs, and other forest litter from within the channel and the floodplain. Tree removal also removes the shading provided by the canopy, exposing the water in the stream to direct sunlight and, therefore,

elevated temperatures. Elimination of the evapotranspiration function raises the groundwater table, reducing the available amount of stormwater storage, and therefore increasing the frequency and intensity of floods within, and potentially outside of, the floodplain. Removal of stumps, root balls, fallen tree trunks, and other natural forest litter removes materials that are sitting directly on top of soils and sediments, or are otherwise stabilizing the soils, thus allowing them to be more easily eroded. Clearing of trees also reduces property values by modifying the viewscape of adjacent residential properties, exposing those landowners to visual intrusions from highways, commercial areas, and other residents, and removing noise buffers between residences and adjacent commercial activities and highways. The grading disturbs the existing geochemical and biogeochemical functions of the existing soils. The introduction of foreign materials, including soils, rocks, and chipped wood from outside sources modifies the local micro-geochemistry, resulting in mobilization of iron and other naturally-occurring minerals in the local soils and groundwater, causing iron flocculates that smother aquatic life.

2) Actual Results Fail to Meet Promised Results

The primary flaw behind these projects is that, despite all of this damage to the existing environment, the expected benefits of the floodplain re-connection, in terms of stabilizing streambanks, reducing erosion, and restoring aquatic life to the watershed are rarely, if ever, realized. There is an enormous volume of documentation in the academic literature, beginning in about 2007, that evaluates the results from previous projects and finds few, if any, actual environmental benefits[9]. Primary among these is the landmark article by Palmer et al. in 2014[10], which compiled and evaluated the results reported by stream restoration companies in their reports to regulatory agencies for more than 600 individual projects, and found no substantial environmental benefits.

In Virginia, more than 10 years of water quality monitoring in Lake Audubon following the Snakeden Branch stream restoration has shown no reduction in total phosphorus concentrations[11]. In Howard County, Maryland, the annual MS4 Monitoring Reports[12] submitted by DPW for three watersheds in which stream restoration projects have been completed have identified no watershed-wide improvements in water quality, ecological function, or stream stability. Results from one small-scale project (Bramhope Lane[13]) did document that concentrations of nitrogen, phosphorus, and sediment were reduced after a stream restoration there, but these limited-scale results did not translate into any improvements in these parameters in the watershed as a whole.

When pressed to provide documentary evidence of improvements in water quality or ecological function, the proponents of these projects often fall back, and claim that these were never the primary objectives of the projects. Instead, they argue that the only real objective is streambank stabilization and reduction of erosion in order to reduce dredging costs in the downstream lakes, and that any

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[9] Urban Stream Restoration Bibliography, developed by Bob Dover, July, 2024

[10] Palmer, Margaret A., K.L. Hondula, and Benjamin J. Koch. 2014. Ecological Restoration of Streams and Rivers: Shifting Strategies and Shifting Goals. Annual Review of Ecology, Evolution, and Systematics 45:247-69)

[11] Aquatic Environment Consultants, 2001 Environmental Monitoring Program, Lakes Anne, Thoreau, Audubon, and Newport, January 2022.

[12] Howard County DPW NPDES Permit MD0068322 Annual Report for Fiscal Year 2021 and 2022

[13] KCI Technologies, 2020, Brampton Hills Stream Restoration Post-Construction Monitoring: Priority Pollutant Load Reduction, 2019 Annual Report

associated improvements in water quality or local ecological function are just icing on the cake[14]. However, an analysis of the dredging volumes in Lake Audubon in Reston, Virginia, and in Lake Elkhorn in Columbia, Maryland, show no evidence that erosion rates in these streams before "restoration" are increasing, or that "restoration" projects have resulted in reduced erosion rates[15]. Similarly, comparison of as-built streambed elevations to Year Three elevations at the Unnamed Tributaries of the Little Patuxent River project in Columbia shows multiple areas of erosion and engineered structures operating at risk of failure[16], even though there have been no substantial storms since construction was completed[17].

These disappointing project- and watershed-specific results are reflected in the overall results for the Chesapeake Bay, as reported in the 2023 Independent Report from the Scientific and Technical Advisory Committee (STAC) of the Chesapeake Bay Program[18]. The report, commonly called the Comprehensive Evaluation of System Response (CESR) report, found that decades of efforts to improve water quality and ecological function in the Bay through load reductions in TMDL and other programs have not been successful. One particularly relevant statement, from Page 75 of the Findings of that report, is "To date, efforts to reduce nonpoint sources have not produced sufficient levels of BMP implementation to meet the TMDL, and *the implementation that has occurred may not be producing the pollutant reductions expected*" (emphasis added).

This is a critical statement. The entire purpose of this "implementation that has occurred" is to achieve these pollutant reductions. As discussed above, this "implementation" has enormous financial costs, as well as adverse impacts to the ecology and the residents. If it turns out that this implementation is not producing the "pollutant reductions expected", as stated in the Findings of the CESR report, then all of the financial costs and the adverse impacts to ecology and residents has been for naught.

In testimony in favor of the Maryland Whole Watershed Act before the Environment and Transportation Committee of the House of Delegates in January, 2024, representatives of the stream restoration industry, and others who favor stream restoration projects, cited the CESR report in claiming that the reason for the failures to meet the TMDL were entirely due to not having done enough stream restoration projects, and not having done them of a large enough scale[19]. However, if the Findings of the CESR report, that these projects are not delivering the expected pollutant reductions, is correct, then implementation of more and larger projects will only waste money, cause damage to existing ecological systems, and adversely impact property values in residential neighborhoods.

Unsurprisingly, the pressure to do more and larger projects comes from those who profit from implementing stream restoration projects, and were made in order to support legislation that would encourage and fast-track more and larger projects. However, the second part of the statement,

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[14] Columbia Association Board of Directors Meeting, April 25, 2024, Available at https://www.youtube.com/watch?v=ZtPj4afJDE8. Timestamp 1:30:00

[15] Evaluation of Reston and Columbia Dredging Volumes

[16] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023, Table 2

[17] Review of daily precipitation data at BWI Airport, available at https://mesonet.agron.iastate.edu/sites/hist.phtml?station=BWI&network=MD_ASOS

[18] Scientific and Technical Advisory Committee, Chesapeake Bay Program, 2023, Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response.

[19] Arundel Rivers Federation, Testimony in Opposition to House Bill 1284, March 6, 2024

emphasized above, makes the opposite argument. It states that the reason for failure of past projects to meet the TMDL documents is that the load reductions, which are the basis for issuing pollutant reduction credits to MS4 permit holders and others, are over-estimated. In other words, MDE is issuing pollutant reduction credits for projects that are not actually realizing those reductions. Therefore, continuing to include these projects among the list of projects that are eligible for pollutant load reduction credits under MS4 permits and for mitigation banks will only cause more damage to our watersheds without providing any benefits. Ignoring this clear concern about the efficacy of load reduction projects such as stream "restorations", and instead claiming that the failure to meet TMDL goals justifies more and larger projects, may be fraudulent, and calls the entire basis for the USACE and MDE regulatory framework for these projects into question.

3) Technical Reasons for the Failure to Perform as Promised

There are two main technical reasons for the failure of these projects to create localized environmental improvements, or to have contributed to improvements to the Chesapeake Bay. These are a failure to consider the duration of the stream modifications, and the flawed assumption that creating the outward, visual appearance of a healthy hydrologic and ecological system would cause the system to operate in a healthy manner.

First, the topographic modifications made to re-create the geomorphic shape of the original stream are temporary, at best. In the short term, earth-moving equipment can manipulate soils and sediments to create any shape imaginable, and that can include a mimicry of an "original" stream channel and floodplain system. However, a stream and floodplain is a living, four-dimensional system. Over time, the stream will transport and deposit sediments how and where it wants, continuing to act in response to elevated runoff levels and more intense rainfall events due to global climate change. There is an enormous amount of documentation showing that, even when armored by engineered structures, extreme weather events can cause the stream to be re-routed and re-channelized within the course of a single storm. At the Snakeden Branch project in Reston, an extreme storm occurred less than two years after project construction was complete, requiring substantial repairs[20].

Palmer et al. (2014) concluded that "Less than half of these projects showed improvements in channel stability compared with pre-restoration regardless of how stability was measured and even though many of the projects involved the use of large boulders or other materials to hold the banks in place.[21]" The same article concluded that a "major emphasis remains on the use of dramatic structural interventions, such as completely reshaping a channel, despite growing scientific evidence that such approaches do not enhance ecological recovery, and the data we assembled (Table 2) suggest they are often ineffective in stabilizing channels when stability is the primary goal.[22]"

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[20] Wetland Studies and Solutions, Post-Storm Inspections, Northern Virginia Stream Restoration Bank, September 12, 2011

[21] Palmer, Margaret A., K.L. Hondula, and Benjamin J. Koch. 2014. Ecological Restoration of Streams and Rivers: Shifting Strategies and Shifting Goals. Annual Review of Ecology, Evolution, and Systematics 45:247-69)

[22] Palmer, Margaret A., K.L. Hondula, and Benjamin J. Koch. 2014. Ecological Restoration of Streams and Rivers: Shifting Strategies and Shifting Goals. Annual Review of Ecology, Evolution, and Systematics 45:247-69)

Similarly, the Chesapeake Bay Project, which is the source of most data regarding, and support for, stream restoration projects, admitted that the five-year duration of credits for stream restoration projects was shorter than those for other credit-earning projects (ten years) because stream "restoration" projects were "subject to catastrophic damage from extreme flood events[23]".

This is why landowners who manage watersheds, such as the Columbia Association in Howard County, have, in the past, emphasized the need to control runoff levels over the need to perform floodplain re-connection actions. In their 2009 Watershed Management Plan, CA proposed several small-scale, localized stream restoration projects, the biggest being 470 feet long. However, the Plan recommended that large-scale stream restorations not be performed, unless methods to control runoff volumes from upstream areas were first implemented[24]. As recently as the Spring of 2022, CA continued to acknowledge the impact of high runoff levels on channelization and watershed health. As part of the analysis of the spillway design on Sewell's Orchard Pond, CA was asked, by the Howard County DPW, if they would allow DPW to increase the discharge capacity of the spillway of the pond into Elkhorn Branch. CA declined, both in writing and verbally in a CA Board meeting, citing their claim that runoff levels were already too high, had caused channelization, and needed to be reduced rather than increased[25]. CA's stated position on this issue makes sense. It is elevated runoff levels that caused the channelization in the watersheds in the first place. If the morphology of the watershed is artificially modified without any attempt to reduce these elevated runoff levels, then it follows that the channelization will just happen all over again. Any attempt to restore the morphology of the stream and floodplain system without addressing the root cause of the degradation is doomed to failure.

It should be noted that CA later proceeded to violate these recommendations of their Plan, implementing the 7,000 foot-long Unnamed Tributaries to Little Patuxent River, and attempting to construct the 33,000 foot-long Elkhorn Branch project, both without any attempt to control upstream runoff volumes. In both cases, CA simply ignored the Plan recommendations without providing any justification or rationale for having changed course. That means that CA deliberately chose to allow millions of dollars to be spent on a construction project that their own independent environmental contractor had predicted, a few years before, would be vulnerable to flood damage.

These factors would be enough reason to question the wisdom of floodplain re-connection, even if these actions had simply left the currently elevated levels of stormwater runoff unchanged. However, that is not the case. By cutting down mature trees within the watershed, the project owners are deliberately stopping the functions of those trees in removing water from the watershed through crown interception, evaporation, and evapotranspiration. Sanford and Selnick (2012)[26] estimate that, in central Maryland, mature forests remove more than 50 percent of precipitation from the watershed through evapotranspiration. When those trees are chopped down, they no longer absorb water from the groundwater table and release it into the atmosphere. The water table thus rises, eliminating

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[23] Chesapeake Bay Program Stream Restoration Group 1: Verification, Recommended Methods to Verify Stream Restoration Practices by Pollutant Crediting in the Chesapeake Bay Watershed. June 18, 2019.
[24] Versar, Columbia Association Watershed Management Plan, April 22, 2009
[25] Columbia Association Board of Directors Meeting, November 9, 2023, Available at https://www.youtube.com/live/qPafbhVn1EE. Timestamp 02:19:00
[26] Sanford, Ward E., and Selnick, David L. Estimation of Evapotranspiration Across the Conterminous United States Using Regression With Climate and Land-Cover Data. Journal of the American Water Resources Association. March 13, 2013.

stormwater storage capacity in the vadose zone of the soils. When it rains, there is less storage for infiltrating stormwater, so the excess water contributes to even more excess runoff. Thus, the action of removing trees in order to accomplish floodplain re-connection actually exacerbates the excess runoff problem, which is the root cause of the degraded watershed in the first place. There is an enormous volume of literature on this phenomenon, which is called "watering up", as well as other beneficial impacts of trees on watershed hydrology and ecology[27]. Again, by choosing to approve a stream restoration project in Elkhorn Branch that would have eliminated the hydrologic function of tens of acres of trees, CA violated their own policy of prohibiting any actions that could result in an increase in runoff volume. When asked to explain this violation of their policy in an email dated April 20, 2023, CA failed to respond.

The second flaw in the theory of floodplain re-connection is the same as the flaw in the theory of Dr. Frankenstein. Both theories involve trying to create a living system out of inanimate parts that are manipulated to have the outward, visual appearance of the living system. As discussed by Southerland[28] and other researchers, the ability of stream restorations, especially those in the higher order tributaries in the upper reaches of a watershed, to re-create aquatic life is limited because they are only cosmetic in nature. They create the visual appearance of a natural system that supports aquatic life, but they are not connected to an upstream source of living organisms that would allow that aquatic life to grow and thrive. The desired aquatic life will not come into existence spontaneously, and cannot be transported upstream from downstream areas. Just because the system has the outward appearance of the living thing does not mean that it will come to life. Overall, these projects have substantially modified the hydrology, micro-geochemistry, micro-climate, sunlight regime, and a thousand other environmental factors within our watersheds. The suggestion that creation of the macro-scale, outward appearance of a healthy stream could automatically restore all of these other more subtle factors and result in restoring the original water quality and ecological conditions is ludicrous.

4) Project Areas Are Not Properly Restored Following Construction

In addition to the failure to achieve either localized or more wide-ranging environmental improvements, these projects also fail in their promises to rectify the adverse impacts that are inflicted during their construction, specifically in the area of re-forestation. In general, the issue of re-forestation is one of the most visible effects of the project to the local community, and one of the most concern to residents. Although the beneficial effects of trees to hydrology and ecology are innumerable, they are not particularly visible or obvious to local residents, and do not, therefore, attract much attention. However, the viewscape of forested areas within the community, lining the roadways and parkways, and abutting residents' yards is highly visible, and draws intense interest and opposition where it is disturbed. In Reston, following the de-forestation associated with the Snakeden Branch project, residents of The Glade, the adjacent watershed, raised major objections to a similar denudation of their neighborhood. A petition was circulated, and signed by about 250 residents, focusing almost entirely on the destruction of the existing forest and stream. The petition failed, the project was completed and, more than 15

[27] Analysis of Impact of Tree Removal on Surface Water Hydrology, with annotated bibliography

[28] Southerland, Mark, Swan, Chris, and Fortman, Andrea. 2017. Meta-Analysis of Biological Monitoring Data to Determine the Limits on Biological Uplift from Stream Restoration Imposed by the Proximity of Source Populations. September 8, 2017.

years later, there is no indication that a mature forest canopy is ever going to be restored to the watershed.

In Maryland, these projects are exempted from the Forest Conservation Act (FCA), which is intended to protect existing forested lands. However, the permitted parties are required to sign agreements with DNR to re-forest the project area, committing to a standard of a 75 percent survival rate of the re-planted trees after five years. This sounds good in theory, but current indications are that it is not enforced. At SHA's Unnamed Tributaries to Little Patuxent River project, the field-measured survival rate fell to 49 percent in Spring 2022, within 14 months of the completion of construction[29], suggesting that a corrective action, or other regulatory action, would have been immediately triggered. It was not. Instead, the Year Two Monitoring Report made no mention of the survival rate, and instead claimed that the re-planted trees were "well established"[30]. Given that the 75 percent standard is the DNR regulatory definition for determining whether or not the trees are "established", a statement in a regulatory-required report claiming that the trees are well established, when the comparison of the actual data to the standard shows they are not, may constitute fraud, and may violate requirements that formal reports submitted to a regulatory agency be certified by the permittee as complete and accurate.

The situation at SHA's Unnamed Tributaries to Little Patuxent River continued to devolve. The planted trees continued to die, and the survival rate dropped to 45 percent in Fall 2022 (after 22 months), and 36 percent in Spring 2023 (after 28 months)[31]. Meanwhile, the residents continued to notice, and complain, that the project area, which is directly adjacent to residential properties and well-traveled residential roads, was barren of trees. It was only after the 36 percent survival rate result was obtained that SHA began to plan a corrective action. This was eventually implemented in October, 2023, about 18 months after the rate was first documented to have fallen below 75 percent. Even then, the Year Three Monitoring Report[32], submitted two months after more than 700 trees had been re-planted, failed to accurately report the monitoring results. At that time, SHA was aware that the rate had dropped below 36 percent, yet they reported the rate to be 49 percent and, again, claimed that the trees were "well established".

It is illuminating to note that the correspondence between CA (the landowner) and the State Highway Administration (the project owner) regarding the plans for the corrective action failed to discuss any hydrologic or ecological issues that may have been relevant to the types of trees to be planted, or their locations. Instead, they discussed focusing the locations of trees in areas of "high visibility", suggesting that the focus of the effort was to reduce the public outcry about the project, rather than actually fix the damage they had done to the health of the watershed[33]. This discussion occurred in June, 2023, at the exact same time that CA was attempting to overcome public opposition to the proposed Elkhorn Branch project. Given the focus on areas of "high visibility", it is not a stretch to conclude that the entire

[29] FCA Exemption Inspection Checklists, Unnamed Tributaries to Little Patuxent River project
[30] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 2 Monitoring Report, January 2023
[31] FCA Exemption Inspection Checklists, Unnamed Tributaries to Little Patuxent River project
[32] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023
[33] Email exchange between Ryan Cole (SHA) and John McCoy (Columbia Association) dated September 20, 2023

purpose of the corrective action at the Unnamed Tributaries to Little Patuxent River project was to minimize public opposition to Elkhorn Branch.

It is also illuminating to view the reaction of the stream restoration contractor to the post-construction performance of the project. Following the documentation of the 49 percent survival rate on May 4, 2022, the contractor wrote an email to SHA, dated May 13, stating that they did not believe that the report accurately represented the site conditions, because there "is no sign of dead or dying". They proposed to SHA that they do an additional survey in the Fall of 2022 to prove that the Spring survey was inaccurate, only to be reminded, by SHA, that they were under a contractual obligation to do a Fall survey anyway[34]. Ultimately, later monitoring events showed even further decline in the survival rate until, eventually, the contractor was directed to re-plant 700 trees in October, 2023. This shows that the contractor's claims that they did not believe the May 4, 2022 results were incorrect, and the trees really were dead and dying, a fact that was well known to the residents. Finally, the Year Three Monitoring Report, submitted by the same contractor in December, 2023, documented multiple issues of concern, including multiple engineered structures rated as "Functioning at Risk", a high level of invasive plants, multiple areas of erosion, and the fact that a corrective action (re-planting 700 trees) had taken place only two months prior. At the end of that report, the contractor noted that they wished to discuss being released from any further monitoring and repair responsibilities for the project[35].

Regulatory Analysis

5) Impacts to Adjacent Properties are Not Considered or Disclosed

The process for considering whether or not to authorize permits for stream restoration projects violates the National Environmental Policy Act (NEPA) by not considering adverse impacts of the projects on adjacent properties, and by not considering impacts to recreational uses on the permitted property.

The environmental analysis required by the National Environmental Policy Act (NEPA) for stream restoration projects under NWP-27 is provided in a Programmatic Environmental Assessment (EA)[36], and project design data required for the NWP-27 permit is specified in the USACE – Baltimore District Checklist[37]. Similarly, projects are conducted under the TMDL Regional General Permit (RGP)[38]. The SHA has also approved projects, such as the Unnamed Tributaries to Little Patuxent River project, using Federal Highway Administration Programmatic Categorical Exclusions (CXs) established in 23 CFR 771.117[39].

In general, the purpose of nationwide or general permits, Programmatic EAs, or Programmatic CXs is to expedite permitting for small projects that will have few or no adverse impacts. However, that does not

[34] Email exchange between Catherine Hoy (Ecotone) and Noah Chadwick (SHA) between May 13 and May 16, 2022.
[35] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023, Page 13.
[36] Decision Document, Nationwide Permit 27
[37] Checklist and Guidelines for Nationwide Permit (NWP) 27
[38] Department of the Army, Regional General Permit for Chesapeake Bay Total Maximum Daily Load (TMDL) Activities, September 1, 2020, NAB-2019-00527.
[39] SHA Memorandum, Full Delivery Stream Restoration (TMDL) Tribs Little Patuxent Programmatic Categorical Exclusion, July 2, 2019.

mean that simply putting the "stream restoration" label in the title of a project means that the project is small enough, or distant enough from adjacent properties, that it will have few or no adverse impacts. This is especially the case when these projects are done on a large scale, in residential neighborhoods.

A review of the documents above shows that they are focused on three impact issues:

- Temporary impacts during construction;
- Impacts to wetlands due to filling/dredging within wetlands; and
- Impacts to other "regulated" resources, such as T&E species and cultural resources.

Each of these categories of impacts is a concern, and should be included in any environmental analysis of one of these projects. However, these do not represent the full range of long-term, adverse impacts that could occur, and have occurred, to non-regulated ecological and human resource values, especially in residential communities.

Ignoring impacts to adjacent property owners, residents, their standard of living, recreation areas, property values, and potential flooding damage to their properties, is not permissible under NEPA. As long as landowners have implemented small-scale stream restoration projects in areas that are remote from adjacent landowners and population centers, the only adverse impacts of these projects are a waste of taxpayer funds, and localized impacts to non-regulated ecological receptors and general vegetation. However, these projects, such as the Unnamed Tributaries project, are increasingly being done on a much larger scale in heavily populated areas, and right up against the property line of residential properties.

Indirectly, the NWP-27 permit and the TMDL RGP acknowledge that they are generally applicable to, and only appropriate for, small-scale projects. The NWP-27 EA includes a presentation of the range of project sizes for which NWPs were issued in 2020, showing that the vast majority of them (more than 21,000 out of about 30,000 total permits) are less than 0.1 acre in size. The proposed Elkhorn Branch project, in Columbia, would have impacted more than 20 acres of wetlands. This would have been larger than more than 99 percent of the individual permits issued throughout the United States, and it would have cut for six miles directly through a residential neighborhood. The Prospectus for the project made no mention of adverse impacts to residents, although a later letter by the applicant withdrawing part of the project acknowledged that, because of the close proximity of the project to residences, construction impacts might not be "palatable" to residents[40]. Similarly, the TMDL RGP has an extensive discussion of the size limitations for stream restoration projects permissible under the RGP as a whole, and for the "self-verification" program. These issues document agreement, within USACE, that these mechanisms for fast-tracking environmental review of these projects is intended to only address small-scale projects and that, at some point, a project may be large enough to justify more detailed environmental review in order to comply with NEPA.

Not only have permit applicants been able to ignore the size considerations in the environmental review, but they have also stretched any reasonable meaning of the text of the Programmatic CXs. The CXs cited for the Unnamed Tributaries project included "Landscaping" (that is it, just that single word; 23 CFR771.117(c)(7)) and "Installation of fencing" and other items where no substantial land acquisition or traffic disruption will occur (23 CFR771.117(c)(8)). By no stretch of the imagination can a reasonable

[40] Wetland Studies and Solutions, letter to Columbia Association, April 12, 2023

person consider cutting down of ten acres of trees in a residential neighborhood to fit the definition of "landscaping" or "installation of fencing". Citing of these CXs shows that the responsible agency was just checking boxes to make a pro-forma appearance of complying with NEPA, but without actually considering the reality of what was going to happen on the ground, in peoples' back yards. The Programmatic CX document also cited (23 CFR771.117(c)(25)), which directly references stormwater treatment systems, which is at least a minimal attempt at correlating the proposed project with an evaluated activity. However, a CX is still only permissible if the action will have no adverse impacts, and that is not the case with the Unnamed Tributaries project.

Because the regulatory framework for these projects provides such enormous incentives to MS4 permit holders and operators of mitigation banks to implement more and larger projects, they have gone in search of fertile ground, encroaching closer and closer to populated areas, and increasing the scale of their projects. Their focus is not on fixing environmental problems, but on finding large enough contiguous land parcels to make construction financially viable, regardless of whether the area is or is not degraded, impacts to residents and non-regulated resources may or may not occur, and the project may or may not actually result in pollutant load reductions.

6) Failure to Monitor to Demonstrate Achievement of Performance Standards

One of the more concerning features of stream restoration projects is the lack of a well-defined definition of "success", including quantitative performance measures that must be met in order for a project owner to be issued credits, which is supposed to be their motivation to implement the project in the first place. In general, the issuance of credits for these projects is based on a presumption of success, rather than actual demonstration of success. This presumption of success is now called into question by the Findings of the CESR report, which acknowledge that these projects do not actually deliver the pollutant load reductions that they are designed for, yet the stream restoration companies continue to fight any attempt to force them to monitor performance and base credits on demonstrated performance.

In the permit application documents submitted to the regulatory agencies, marketing materials used to persuade landowners to authorize the projects, and presentations made to residents and the public, the stream restoration companies cite a wide variety of purported benefits that they claim can only be achieved through a floodplain re-connection project. These benefits include avoidance of imminent erosion risks and threats to infrastructure and adjacent properties, elimination of safety hazards associated with steep stream banks, improvement of water quality both in the local watershed and in the Chesapeake Bay, replacement of invasive plants with native vegetation, restoration of original wetlands and riparian vegetation, and elimination of sediment erosion and transport that results in future costs for dredging in downstream lakes and ponds.

Everyone in the community wants all of these things, and the theory behind floodplain re-connection is offered by stream restoration companies to explain how they will all be achieved. But are they? How do the regulatory agencies document, with actual, project-specific monitoring, measurements, surveys, and sampling, that these results have been achieved? How do the regulatory agencies ensure that credits are not issued, and claims of success are not publicized and allowed to take root in the community, unless it can be scientifically proven that the objectives have been achieved? What are the objective,

quantifiable standards used to determine whether or not credits can be issued, which is all the project owner really cares about? Or what are the objective, quantifiable standards used to demonstrate to the landowner and the residents that the short-term nuisance of the construction and long-term deforestation of the watershed will actually be justified by long-term cost savings and environmental improvements?

In November, 2023, a CA Staff member announced to the members of the CA Watershed Advisory Committee that the Unnamed Tributaries to Little Patuxent River project had been "successful"[41]. On what basis was he able to make this claim, which should be of interest to the entire community that has to drive past the dead trees every day? This "successful" implementation of the Unnamed Tributaries to Little Patuxent River project was routinely claimed by CA and SHA, and was communicated throughout the community during 2021 to 2023, in order to justify implementing the Elkhorn Branch project, which would have been six times the size of the Unnamed Tributaries project, and in an even more densely populated residential area. Presumably, these claims of success of the Unnamed Tributaries project would need to be demonstrated and verified through actual field measurements before they could be used to justify a second, much larger project, just a few miles away, right?

The answer is that there are almost no quantifiable measurements or monitoring required for these projects. As shown in the project Monitoring Plan[42] and Monitoring Reports[43][44] for the Unnamed Tributaries of Little Patuxent River project, monitoring required by MDE and USACE is limited to visual inspection and photography of the engineered structures, vegetation coverage surveys, and, in Year Three, a streambed elevation survey intended to allow an analysis of erosion rates and stability of the stream. There is no requirement for water quality sampling or ecological surveys, even though improvement of water quality and ecological function are requirements of the Clean Water Act, and are cited as expected benefits of the projects by stream restoration proponents.

Following completion of construction of the Unnamed Tributaries of Little Patuxent River project, MDE's Field Investigation and Environmental Response Program began water quality sampling and macroinvertebrate surveys at stream restoration sites in several locations, including the Unnamed Tributaries of Little Patuxent River site. However, in an email dated September 29, 2023, they acknowledged that the sampling would be of little use in judging the performance of the stream restorations, because there was no pre-construction data to which results could be compared[45].

Separate from the MDE and USACE requirements, DNR conducts semi-annual surveys to determine re-forestation survival rates for compliance with a Forest Conservation Agreement between SHA and DNR. This agreement specifies that SHA is required to maintain 75 percent survivability[46] for a period of five

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[41] Personal notes taken during meeting by Bob Dover. Upon requesting the recording of the meeting, CA claimed that the meeting had been "inadvertently" not recorded, even though they had recorded all previous meetings for more than two years.

[42] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration Monitoring Plan

[43] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 2 Monitoring Report, January 2023

[44] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

[45] Email from Danielle Spendiff (MDE) to Chris Luckett (MDE), 9/29/23, and email from Chris Luckett (MDE) to John McCoy (CA), 9/29/2023.

[46] Email from Ryan Gibson (Ecotone) to Noah Chadwick (MDE), 11/30/23

years, and that the DNR can extend the five year period, as needed to ensure the required survival rate[47]. MDE and USACE are not parties to the Forest Conservation Agreement, and their joint permit does not specify any monitoring of tree survival or density[48], even though, technically, the issues of re-forestation, streambank stability, wetland creation, and water quality are inextricably linked.

With respect to the credit release for the proposed Elkhorn Branch project, which would have removed trees from more than 60 acres of mature forest in a residential neighborhood, the permit applicant proposed to MDE that 70 percent of the credits be issued to them upon completion of construction[49]. Seventy percent of credits that are now a salable commodity, just for completing the construction, without a single day of operation, and without any measurements, monitoring, or surveys conducted to determine whether any of the promised benefits was realized. This means that the project owner could easily be generating a profit just for cutting the trees down and pushing some dirt around, without any intention of actually creating any benefits. This scenario provides literally no incentive to accomplish project objectives, and almost no penalty for project failure.

This lack of requirements for performance monitoring is not an accidental oversight on the part of the regulatory agencies. It is the result of active political intervention by representatives of the stream restoration industry. In testimony to the Environment and Transportation Committee of the Maryland House of Delegates for the Whole Watershed Act in January, 2024, representatives of the industry strenuously objected to any increased monitoring requirements for their stream restoration projects, citing the costs of these efforts[50]. This position is problematic for two reasons. First, it is certainly not true. Stream restoration projects are large-scale, multi-million dollar construction efforts, and their financial viability would not be seriously endangered by requiring a few thousand dollars worth of pre-construction and post-construction surveys and sampling. However, more concerning is the willingness of these organizations to use this excuse to oppose any science-based attempt to demonstrate the performance of their projects. There is only one way to determine whether stream restoration projects do or do not achieve the promised pollutant load reductions and environmental benefits, and that is a professionally-designed monitoring program that includes comparable pre- and post-construction sampling and survey efforts. Without such monitoring, the actual performance of these projects cannot be judged, nor can future projects be designed to improve performance and reduce adverse impacts.

The lack of monitoring, or any direct, quantitative link between project performance and issuing of load reduction credits, has created a class of projects for which the criteria for the “success” cannot be objectively defined, or achievement of those criteria demonstrated. Given the high cost of these projects to taxpayers, and the enormous, long-term damage done by the projects in residential areas and ecologically-vibrant watersheds, it is unconscionable that profit-seeking private companies not only continue to gain permit approvals, but continue to openly lobby state legislators to avoid any science-based monitoring that could possibly show that their projects do not perform as promised.

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[47] Forest Planting and Maintenance Agreement Between State Highway Administration and the Landowner, Stream Restoration Projects, 11/5/2019

[48] Email from Ryan Gibson (Ecotone) to Noah Chadwick (MDE), 11/30/23

[49] DRG/WSSI Maryland Statewide Umbrella Mitigation Bank, Final Prospectus, June 17, 2021, Insert Elkhorn Prospectus, Addendum 1: Lake Elkhorn Stream Mitigation Site, Page 5.

[50] Arundel Rivers Federation, Testimony in Opposition to House Bill 1284, March 6, 2024

7) There is no Accountability for Impacts and Failure

Another consequence of the failure to document performance through quantitative, project-specific monitoring is that it eliminates any potential for holding stream restoration companies or permit holders accountable for poor performance. Like any engineering or construction project, stream restoration projects can be developed by competent, professionally-qualified individuals who have a vested interest in the long-term success of the project, or by incompetent, profit-driven individuals who prioritize short-term profits over long-term performance.

As discussed in the Technical Analysis above, a key feature of floodplain re-connection projects is that they present the outward, visual appearance of success immediately upon completion of construction, but then their performance will degrade over time. The clean, stable in-stream structures will be very photogenic on the day that construction is completed, and those photos, taken in early summer when the project area is filled with lush, green vegetation and flowers, will be used in advertisements for future projects. However, if the hydrologic analysis was not properly performed, the engineering design was flawed, or the construction efforts were sloppy, then these structures will (not may, but will) eventually fall victim to erosion and failure during extreme storm events. The length of time for this failure to occur will depend on how well the structures were designed and constructed, and on the post-construction weather conditions in the project area. Even a poorly constructed project that is not truly stable may continue to appear to be stable for many years following completion of construction, if there have been no extreme weather events to test the system. At the Unnamed Tributaries of Little Patuxent River project, the landowner, CA, continues to repeat claims that the stream has been successfully stabilized[51], even though the Year Three Monitoring report documents multiple areas of erosion[52], and a review of precipitation records shows that there have been no substantial storm events since construction was completed[53].

The same concept applies to the success of the re-forestation effort in the project area. Re-forestation is, at best, a difficult process, and its success or failure can be influenced by how well or how poorly it is designed, implemented, and maintained. Successful re-forestation requires proper ground preparation through de-compaction, planting of larger saplings with established root balls, frequent watering, and protection from deer browse. This costs money. On the other hand, contractors may save money by planting tiny saplings into hard, compacted clay, and then choosing not to protect the saplings or arrange for watering. Upon completion of the planting effort, and for a short time afterward, the visual appearance of these two different re-forestation efforts may be the same. However, eventually, the cost-cutting re-forestation effort is likely to fail. It may take a few years before the failure will be noticed by residents, or detected through field monitoring. This is why the Maryland DNR sets a standard that these projects must maintain a 75 percent survival rate for five years after completion of construction. This standard is intended to provide adequate time to ensure that poorly-implemented re-forestation

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[51] Columbia Association Board of Directors Meeting, April 25, 2024, Available at https://www.youtube.com/watch?v=ZtPj4afJDE8. Timestamp 1:30:00

[52] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

[53] Review of daily precipitation data at BWI Airport, available at https://mesonet.agron.iastate.edu/sites/hist.phtml?station=BWI&network=MD_ASOS

efforts are identified and remediated while the contractor and project owner are still contractually responsible for re-forestation success.

At the Unnamed Tributaries to Little Patuxent River project, all indications are that the initial re-forestation effort was done as cheaply as possible, and that the responsible contractor and SHA attempted to extricate themselves from any ongoing responsibility before the failure would be noticed. Residents report that the project area had been completely compacted by heavy equipment during construction but, instead of decompacting the area, the re-forestation crews used pickaxes to dig small holes in the compacted clay to plant tiny seedlings. These seedlings were then not protected from deer browse, and they were not watered. As discussed above, the survival rate fell to 49 percent in 14 months, 45 percent in 22 months, and 36 percent in 28 months[54].

Meanwhile, the contractor objected to the initial report of a tree survival rate of 49 percent, claiming that, based on their visual inspection, this value could not possibly be correct. At the same time, the contractor "offered" to conduct further monitoring, and had to be reminded by SHA that they were already contractually obligated to do this further monitoring[55].

Later events proved that the survival rate the contractor objected to was, in fact, correct. Eventually, a corrective action did take place, although, at this time, no documents have been acquired that identify who directed the action, or for what reason. However, it is known that the corrective action did not take place until about 18 months after the survival rate had first dropped below 75 percent, and not until six months after the rate had dropped to 36 percent[56]. This suggests that there was no substantial desire on the part of the contractor, SHA, or CA to correct the situation in a timely manner, and no rigorous regulatory enforcement of the 75 percent standard. Also, the Year Three Monitoring Report claimed that the survival rate "prior to" the corrective action was 49 percent[57] when, in fact, the survey results of 45 percent and 36 percent had also been identified "prior to" the corrective action[58]. Similarly, in a presentation to the CA Board on April 25, a CA Staff member disputed that the rate had dropped to 36 percent, claiming that the 36 percent value was not accurate, and the value was actually 49 percent[59]. Somehow, even while admitting that a corrective action had taken place, both SHA and CA were still trying to downplay the magnitude of the failure, ignoring publicly available DNR survey results.

Interestingly, planning for the corrective action did not occur until late Spring 2023, which was a critical time in the CA Staff's efforts to gain CA Board, regulatory, and public approval of the nearby Elkhorn Branch project. The residents were extremely vocal in opposing Elkhorn Branch, citing, among other objections, the visual effects of the de-forestation at the Unnamed Tributaries project. The timing of the planning of the corrective action at the Unnamed Tributaries coincided with the timing of the Elkhorn approval process. The linkage of public objections to Elkhorn to public complaints about the Unnamed Tributaries was made evident during the CA Board meeting at which the Elkhorn Branch easement was

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[54] FCA Exemption Inspection Checklists, Unnamed Tributaries to Little Patuxent River project
[55] Email from Noah Chadwick (SHA) to Catherine Hoy (Ecotone), May 16, 2022
[56] FCA Exemption Inspection Checklists, Unnamed Tributaries to Little Patuxent River project
[57] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023
[58] FCA Exemption Inspection Checklists, Unnamed Tributaries to Little Patuxent River project
[59] Columbia Association Board of Directors Meeting, April 25, 2024, Available at https://www.youtube.com/watch?v=ZtPj4afJDE8. Timestamp 1:30:00

approved. Immediately upon approval, a Board member instructed the CA Staff to "avoid the brouhaha at Harper's Choice" (the location of the Unnamed Tributaries project) by putting the "full schmooze" on the neighborhood at Elkhorn[60]. Also, in email exchanges regarding the planning of the corrective action, SHA ensured CA that the re-planting plan was designed to cover areas that were "highly visible"[61]. This implies that the main focus of the re-planting effort was not to improve the ecological or hydrologic success of the project, but to placate the complaining residents by placing a band-aid over the visual scar caused by the de-forestation.

Ultimately, after filing a Year Three Monitoring Report that documented substantial problems with erosion, invasive plants, and failure of re-forestation efforts, the contractor and SHA concluded the report by asking USACE to release them from any further obligations for monitoring or maintenance[62]. Again, this implies that these parties saw the evidence that the project was failing, and wished to be officially excused from any further responsibility before the landowner, regulators, and residents learned this. At the time this request was made in December, 2023, the majority of the re-planted trees for re-forestation had been planted less than two months prior, in mid-October, 2023. SHA and their contractor literally claimed that the trees were "well established", and the project area was "self-sustaining", and then requested to be excused from any further responsibility, less than two months after most of the trees had been planted.

The current status of the request to be excused from further monitoring events is not known. PIA and FOIA requests sent to DNR and USACE have not been responded to, as of July, 2024. During a presentation to the CA Board on April 25[63], the CA Staff stated that they intended to intervene to ensure that SHA and the contractor continue monitoring for the full five year period, but no documentation has been provided that they did intervene, or what whether there has been resolution. Also, a new field survey was planned for Spring, 2024, but those results have not been obtained, so the success of the corrective action cannot be assessed.

It should be noted that the Unnamed Tributaries to Little Patuxent River project is not unique in its re-forestation challenges. Interestingly, two directly adjacent stream restoration projects in Reston, Snakeden Branch and The Glade, have had markedly different results from their re-forestation efforts. Both projects were conducted in about 2008 to 2009, and photos taken during and after construction show that both areas were substantially de-forested. However, as of 2023, the re-forestation of Snakeden Branch has largely been successful. An observer can clearly see the straight lines delineating the 15 year-old trees from the much higher, original trees, but there is at least a complete canopy over the stream. In contrast, The Glade, at 15 years old, still looks very much like the four year-old Unnamed Tributaries to Little Patuxent River project area. There are no mature trees, and no canopy – only low-lying bushes, clumps of invasive vegetation, and a handful of dead, tall trees that died shortly after the restoration project was completed.

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[60] Columbia Association Board of Directors Meeting, January 28, 2021, Available at https://www.youtube.com/watch?v=PEsU7E7u0L8. Timestamp 0:40:00

[61] Email from Ryan Cole (SHA) to John McCoy (CA), September 20, 2023

[62] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

[63] Columbia Association Board of Directors Meeting, April 25, 2024, Available at https://www.youtube.com/watch?v=ZtPj4afJDE8. Timestamp 1:30:00

These events appear to document that SHA and their contractor tried to save money by doing the minimum necessary during construction, failed to completely and accurately report field monitoring results that showed the project was failing, and made attempts to extricate themselves from any further responsibility for the project before more problems could occur and be noticed by the residents or regulators. However, SHA received their credits, which was their main motivation, and the contractor received their payment for the construction work. Meanwhile, CA and the residents are left with nine acres of dying trees and invasive plants, engineered structures that will eventually fail and require costly repairs, and none of the promised environmental improvements or reductions in dredging costs.

8) Multiple Regulatory Oversight Agencies Allow Permittees to Avoid Accountability

Even though the technical activities used to construct and operate stream restoration projects under the RGP and NWP-27 programs may be exactly the same, the programs are entirely different in how they authorize, regulate, and issues credits to project owners and permit holders. The programs are managed by different technical staffs within MDE and USACE. The permits have undergone different environmental impact analyses, require different baseline and project description data to be submitted by permit applicants, have different public engagement requirements, differ in how and why credits are issued, and require different types of post-construction monitoring and reporting.

In addition, as discussed above, there are also other regulatory programs, operated by different agencies, that come into play. In Maryland, the Department of Natural Resources (DNR) has authority under the Forest Conservation Act to regulate projects that involve removal of mature trees on forested lands. Because floodplain re-connection requires removal of trees on a large scale, the DNR establishes re-forestation agreements with project owners and landowners, and these are administered separately from the requirements of the RGP or NWP-27 permit. Thus, environmental factors that are directly relevant to accomplishing load reduction goals under RGP or NWP-27, such as the success of re-forestation of the project area, are actually under the direct oversight of a different agency, DNR, instead of MDE or USACE.

This myriad of different agencies responsible for oversight of these projects has created a complex situation of overlapping jurisdiction and divergent interests. The stated purpose of the NWP-27 program, overseen by MDE and USACE, is to restore riparian forests. However, the question of whether individual projects actually succeed in growing the trees that comprise those riparian forests is completely outside of MDE and USACE jurisdiction and oversight, and instead rests with DNR. With respect to the Unnamed Tributaries of Little Patuxent River project, when MDE asked SHA for information on the tree replanting corrective action, SHA provided a brief explanation, but also reminded the MDE project manager that SHA was not required to notify or seek approval from MDE for actions related to re-forestation. In other words, when the MDE project manager asked for information regarding whether the project area was being successfully restored to riparian forest, the project owner effectively told him that it was outside of his jurisdiction, with the implication that it was none of his business. Later in the day on November 27, 2023, the MDE project manager agreed that the joint permit under his supervision did not require any such notification or approval[64].

[64] Email from William Seiger (MDE) to Ryan Cole (SHA), 11/27/23

A science-based assessment of the performance of a class of projects, such as stream restorations, cannot be possible when the different environmental factors that work together to contribute to success (water quality, tree survivability, streambank stability, etc.) are each under the jurisdiction of a different agency. This makes it impossible to develop a comprehensive sense of what techniques and approaches are successful, and which are not. For the stream restoration companies, this contributes to their ability to divide-and-conquer, counting on the right hand not knowing what the left hand is doing, and creating enough uncertainty and confusion to leave the project effectively unregulated.

9) Regulatory Framework Incentives Projects that Generate Profits or Credits Instead of Environmental Benefits

Because both the pollutant reduction credits and the construction costs are proportional to the size of the project, the regulatory framework provides financial incentives for construction companies to encourage landowners to implement larger and more destructive projects. This is especially true for mitigation bank projects, in which the mitigation credits are a salable commodity available to the highest bidder. Instead of identifying localized problems and offering limited-scale technical solutions that are customized to have minimal adverse effects on the environment and residents, these companies offer a scorched-earth solution that is aggressively marketed to landowners regardless of whether it is actually needed, will have any demonstrable benefits, or will have adverse impacts on ecology, hydrology, or residents. Because of the financial incentive, the entire stream restoration industry has become a solution in search of problems to fix and, as a result, is making millions of dollars fixing problems that do not exist, or that should be fixed with more natural, smaller-scale, less intrusive, and more incremental solutions.

Although they are not for-profit businesses, the same incentive program operates on the MS4 permit holders. They are required, by their permits, to identify and implement eligible projects, with limited funding, and often with limited land area available to them. The most obvious and effective BMP for reducing stormwater pollution would be to reduce the volume of runoff, which, in developed areas such as Columbia, can only be done with retrofit projects that capture runoff directly, or that promote infiltration, in areas upstream of the forested stream valleys. Because those areas are already developed into residential housing and commercial businesses, MS4 permit holders throw their hands up, claim that such retrofit efforts are not feasible, and focus on stream restorations in the downstream areas. As discussed above, this effort is futile, technically, because the failure to control runoff from the upstream areas will eliminate any effectiveness of the downstream stream restoration efforts. However, because the regulatory system for stream restoration projects does not account for this, the need to acquire credits incentivizes the MS4 permit holders to pursue these projects regardless of whether they are likely to fail. The propensity of these projects to fail is documented on Page 16 of SHA's MEP analysis, where SHA acknowledges that their program will include expenditure of $3 million to repair failing stream restoration projects constructed during the current permit term[65].

An example in which an agency has prioritized acquisition of credits in spite of the environmental damage being inflicted, or valuing acquisition of the credits over actual environmental improvements, occurred in in 2023, with the original design document for Howard County DPW's Sewell's Orchard Park

[65] Maryland State Highway Administration, Maximum Extent Practicable Analysis, March 22, 2024

project. The pond itself is the furthest downstream in a series of four ponds that sequentially settle sediment and filter stormwater from the tiny subwatershed. It is the central focus of a County park, is surrounded by mature trees, houses, and an asphalt trail, is stocked with large-mouth bass, and is one of the most popular sites for birding within this suburban community.

The one, and only, impetus behind that project was the need to replace the pond's corroded steel spillway with a new, upgraded concrete spillway. The County's 2007 Integrated Natural Resources Management Plan for the park[66] did not identify any substantial water quality concerns, or potential needed actions elated to water quality, other than installation of aerators, which was done in 2010. However, despite there being no identified need for substantial water quality improvement efforts, the 2019 design plan for spillway replacement recommended full draining of the pond in order to allow the installation of an aquatic bench. This would have killed all existing wildlife and vegetation associated with the pond. Residents who had lived on the pond since it was constructed in 1999 voiced concern that the existing ecology and mature trees had taken 20 years to develop, and the proposal to drain the pond to install the aquatic bench would restart this process all over from scratch. Residents were also well aware that the replacement of the spillway itself did not require draining of the pond. It could be accomplished by setting up a temporary dam in the downstream end of the pond, allowing the majority of the pond to continue to function. This, ultimately, is what was done.

The relationship of this project to the question of credits for compliance with MS4 permits lies in a statement made in the first paragraph of DPW's design document for the original design of the project. This statement defined the objectives of the project, including "install a safety, maintenance and planting bench around the pond to allow Howard County *to take credit for* the stormwater management treatment that the pond provides"[67] (emphasis added). The wording of this statement is striking. In it, DPW makes no claim that the purpose of the proposed aquatic bench was to improve water quality, that such improvement was needed, or that any improvement would actually have occurred. Instead, the purpose was to install a new BMP which would, in turn, generate pollutant reduction credits to help the County comply with their MS4 permit. Even though the pond was operating properly to settle out sediment and store excess stormwater runoff, these functions had been occurring since 1999 and, therefore, were not contributing any new credits to the current County MS4 permit in 2019. Because DPW was entirely focused on acquiring credits instead of actually improving the environment, they were willing to completely drain and destroy the existing ecology of the majority of this County park in order to push some dirt around and claim that the new pond was somehow treating stormwater that had not previously been treated. It is MDE's flawed regulatory process which incentivizes this destructive behavior.

10) Project Information Provided to Community Members Contains Abundant Misinformation

Similar to the efforts on the part of the stream restoration industry to avoid requirements for performance monitoring, the lack of requirements to notify and engage members of the community and adjacent landowners is not an accidental oversight on the part of the regulatory agencies. It is also the

[66] Integrated Natural Resource Management Plan for Sewell's Orchard Park, Howard County Recreation and Parks, 2007.

[67] Pond Retrofit, Sewell's Orchard Pond 3, 100% Design, Howard County Department of Public Works, August, 2021

result of aggressive political intervention by representatives of the stream restoration industry. In testimony to the Environment and Transportation Committee of the Maryland House of Delegates for the Whole Watershed Act in January, 2024, representatives of the industry objected to any increased public notification requirements for their stream restoration projects, again citing the costs of these efforts[68]. Another commenter objected to proposed requirements for public meetings, claiming that requirements for public notification would draw negative attention and scrutiny for projects proposed on large plots of farmland without any adjacent landowners[69]. At the local level, there was substantial debate at Columbia Association Board meetings in Winter and Spring, 2024, regarding public notification requirements for easements, including for stream restoration projects. The CA Staff strongly objected to any requirement that adjacent residents be notified before CA issues an easement, claiming that putting up signs a few days before construction begins was sufficient public notice.

It is apparent that the real objections to public notification and engagement processes for these projects are designed to allow developers to obtain approval and begin construction before the public, including adjacent landowners, even know that a project is proposed.

The following subsections describe some of the more egregious failures to engage the public and consider public comments in 2021 and 2022, during evaluation of the proposed Elkhorn Branch project. Similar misinformation was spread with respect to the Plumtree Branch project, proposed in 2020 by the Howard County DPW[70]. During the Elkhorn Branch project process, the homeowners association (CA, the landowner) and their contractor did the following:

- Provided a project description and summary of project impacts that failed to disclose the true locations, intensity, and duration of impacts of tree removal;
- Made false claims about the duration of impacts, in a manner that caused residents to believe that impacts to their properties would be temporary and short-term;
- Failed to provide that project description and summary of impacts to all affected stakeholders, including potentially impacted adjacent landowners and dues-paying members of CA; and
- Encouraged the CA Board of Directors to ignore public comments submitted during the official comment period, admitting that the permit application that served as the basis for the public comment period was incomplete.

The misinformation regarding the project description and project impacts was provided in the Prospectus for the project[71]. This misinformation was then used by MDE as the basis for the project description in a public notice of an MDE public comment period mailed to some (but not all) adjacent property owners on August 1, 2021[72]. It was also used as the basis for the project description in a separate notice of a joint MDE/USACE public comment period, again mailed to some (but not all) adjacent property owners on November 4, 2021[73].

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[68] Arundel Rivers Federation, Testimony in Opposition to House Bill 1284, March 6, 2024
[69] Testimony in SUPPORT for HB1165, by ShoreRivers, March 1, 2024
[70] Plumtree Branch Ecological Restoration Design, Final Design Report, developed by Ecotone for Howard County Office of Community Sustainability, May 2022.
[71] DRG/WSSI Maryland Statewide Umbrella Mitigation Bank, Addendum 1: Lake Elkhorn Stream Mitigation Site
[72] Letter from MDE to "Property Owner, Public Official, or Interested Persons" dated August 1, 2021
[73] Joint MDE/Army Corps Notice of Public Comment Period dated November 4, 2021

Failure to Disclose Tree Removal

The most impactful component of floodplain re-connection projects is the need to cut down trees, grade the floodplain, and re-locate the stream within the floodplain. The ecological and hydrologic impacts of these actions within the floodplain itself are discussed in the first section of this critique, Technical Background, and are directly relevant to the question of whether the short-term damage within the floodplain is ever adequately mitigated by short-term re-forestation in the floodplain. USACE recognizes this impact, *within the floodplain*, by requiring that the NWP-27 Prospectus submitted as a permit application include a description of "the amount of tree clearing in forested areas"[74].

However, separate from the impact of these actions within the floodplain, they also impact adjacent property outside of the floodplain. The most visible and concerning impact, when these projects are done in residential areas, is the destruction of the forested viewscape and noise buffer, for which many residents paid premium prices for the homes. The existing forested area also serves as recreation space for these, and other, residents, providing biking, hiking, birding, and environmental education opportunities. When large-scale clearing occurs, these beneficial functions of the watershed are not only diminished, but are eliminated entirely. Less visible is the effect of tree removal on flood frequency and intensity. The entire purpose of floodplain re-connection is to raise the water table and increase the frequency of stormwater flow over a wider area of the floodplain. If residential properties are located near the floodplain, then the project owner has deliberately increased the risk of flooding to those adjacent properties.

These adverse impacts of tree removal to adjacent properties and residents are completely ignored in NWP-27, the TMDL RGP, the Elkhorn Branch Prospectus, the Plumtree Branch Prospectus, and the associated notices of public comment period. The impacts are simply not mentioned or acknowledged. As a result, the environmental analyses of NWP-27 and the TMDL RGP are flawed, and do not meet NEPA requirements to consider and disclose the full range of adverse impacts, including impacts to non-regulated resources, the human environment, and long-term impacts associated with visual resources, noise, and potential for flood damage.

The situation is not just that the adverse impacts of tree removal are not disclosed. This, on its own, would be bad enough, if the actual extent of tree removal was fully disclosed, and the residents were left to consider the impacts on their own. But that is not the case. The failure to disclose the impacts is exacerbated by the failure to even reveal the actual extent. Despite the requirement in NWP-27 to describe "the amount of tree clearing in forested areas", the Prospectus for Elkhorn Branch did not actually do that. It included no discussion, in text or in graphics, that identified or referred to areas of "tree removal", "clearing", or any other synonym that would have communicated, to laypersons, that the trees in their neighborhoods were about to be cut down.

However, MDE and USACE did not reject the Prospectus for this failure to include required information. This is because the Prospectus and notice of public comment period did include "Concept Plans" that graphically described the "Limits of Disturbance (LOD)", totaling about 63 acres on an easement of more than 130 acres. Although the Prospectus and notices did not provide an explanation of what LOD means,

[74] Checklist and Guidelines for Nationwide Permit (NWP) 27

this is a commonly-used term in construction and environmental permitting that generally means that the area within the LOD will be completely denuded of trees, other vegetation, and rocks, and will be graded flat to remove any surface irregularities or obstructions that may serve as a safety risk to site workers. Individuals experienced in environmental planning under NEPA, such as the MDE and USACE regulators, as well as the stream restoration contractor, immediately recognize the term "LOD" as meaning that all trees within will be removed. This appears to be why MDE and USACE accepted the Prospectus as complete, because LOD served as a surrogate for "amount of tree clearing in forested areas" which, in the case of Elkhorn Branch, would have been about 63 acres.

The problem here is that the residents, who are mostly laypersons without construction or environmental planning experience, are not generally familiar with the phrase "LOD". During the public comment period, many residents understandably expressed concern about 63 acres of tree removal in a residential area, citing the LOD, and were directly told by the contractor and the CA Staff that LOD was *not* equivalent to tree clearing, even though MDE and USACE know that it is. Thus, the contractor and landowner tried to use this unfamiliar phrase to play both sides. In communication with the regulators, they were willing to use "LOD" as a surrogate to meet the NWP-27 requirement to disclose "amount of tree clearing in forested areas". However, in communication with the residents who were less familiar with the phrase, they downplayed its meaning, claiming that it did not really mean "tree clearing", and that the residents were exaggerating the impact of the project by equating the two.

This approach was revealed in a letter submitted by the CA Staff to the CA Board, dated February 8, 2022, which was the end of the public comment period[75]. That letter was also used as a basis for later verbal statements made about the relationship between LOD and tree removal at CA Board and Watershed Advisory Committee meetings throughout 2022 and the first half of 2023. In that letter, the CA Staff notified the Board that they could disregard public comments regarding the 63 acre LOD, because the LOD is not equivalent to the area of tree clearing. The letter even stated that "there is currently no conceptual design for the project", even though the LOD maps in the Prospectus and distributed with the notices of public comment period are clearly labelled "Preliminary Concept Map".

In a project flow chart[76] provided by the contractor, and later verbal discussions about the process and the flow chart[77][78], the contractor and CA staff argued that the actual extent of tree removal would be disclosed to the residents at a later time, after the regulatory agencies had approved the Prospectus. Following approval by MDE and USACE, the contractor promised to then provide more detailed information on tree removal to the residents, and to "consider" the residents' comments on the "actual" amount of tree removal. However, based on similar broken promises at The Glade and at the Unnamed Tributaries to Little Patuxent River projects, several residents objected. Once MDE and USACE approve the Prospectus, the project is effectively approved and the residents have no administrative remedy to stop it. At that point, the residents would have been reliant on the goodwill of a profit-seeking company whose profits would be directly proportional to the amount of tree removal. Any reduction in the amount of tree removal from the 63 acres shown on the Preliminary Concept Maps

[75] CA Staff letter to CA Board, 2/8/2022
[76] Lake Elkhorn Stream Restoration Flow Chart, WSSI and CA
[77] Video of June 14, 2023 meeting between CA, WSSI, WAC members, and residents
[78] Columbia Association Board of Directors Meeting, June 8, 2023, Available at https://www.youtube.com/live/ogxblgo1BqI, Timestamp 00:17:00

would have directly, and proportionally, reduced the profit to be accrued by the contractor. Asking the residents to rely on the contractor to voluntarily reduce their profit, knowing that the regulators have already approved a 63-acre project that maximized their profit, was unacceptable to many residents.

By failing to disclose information regarding tree clearing in public presentations and notices of public comment period, the public is robbed of any opportunity to scrutinize whether the project is actually needed, whether it will actually deliver the promised benefits, whether its impacts can be avoided or mitigated, the disruption of the project to them in the short-term (during construction), and the effect that removal of trees and hydrologic modifications will have on their properties and property values for decades to come.

Failure to Accurately Disclose Duration of Impacts

Similar to the failure to accurately disclose the extent of tree removal, or the adverse impacts that tree removal would inflict on the neighborhoods, the Elkhorn Branch Prospectus and associated notices of public comment period failed to accurately disclose the duration of project impacts to residents and other stakeholders. In general, the impact discussion in the Prospectus focused on the impacts of the construction activity itself, which are short-term and temporary. With respect to longer-term impacts of wetland disturbance, the Prospectus and notices assume that the re-creation of new wetlands by the project will be definite and immediate and, therefore, wetland impacts can also be considered to be temporary. Thus, the project information provided to adjacent landowners, residents, and other stakeholders in the Prospectus[79] and public notices[8081] specifically, and solely, referred to any impacts as "temporary". The vast majority of residents who received these notices saw the word "temporary", and then threw the notice in the garbage.

Even if direct wetland impacts would quickly be compensated for by growth of new, larger wetlands, a concept refuted in the Technical Analysis discussion above, the idea that the ecological, hydrologic, and visual impacts of the removal of tens of acres of mature trees is temporary is absurd and, to those who live adjacent to the trees, insulting.

While NEPA does not specifically define durations of impacts, standard practice is as follows:

- "Temporary" means that impacts will occur only during construction, but will cease immediately once construction ceases. An example is increased noise from use of heavy equipment in a residential neighborhood.
- "Short-term" generally refers to impacts that will begin immediately during construction, but which will continue for a limited amount of time (up to a year) after construction as the impacts of construction naturally heal themselves. An example is impacts to viewscapes and wildlife habitat due to clearing and grading of low-lying vegetation. The duration of short-term impacts are often reduced through active restoration, seeding, and plantings in the impacted areas.
- "Long-term" and "permanent" impacts are usually synonymous. Different agencies have different definitions – for instance, the Bureau of Land Management considers 5 years to be a

[79] DRG/WSSI Maryland Statewide Umbrella Mitigation Bank, Addendum 1: Lake Elkhorn Stream Mitigation Site
[80] Letter from MDE to "Property Owner, Public Official, or Interested Persons" dated August 1, 2021
[81] Joint MDE/Army Corps Notice of Public Comment Period dated November 4, 2021

threshold. Impacts that will last for up to 5 years are "long-term", but impacts that will endure longer than 5 years are "permanent".

It is clear that the U.S. Army Corps of Engineers agrees with the application of these definitions to vegetation removal. Here is a quote from the Bureau of Engraving and Printing (BEP) Final EIS by USACE-Baltimore District in 2021[82]:

> *"Construction-related effects, therefore, would be primarily temporary, but some impacts resulting from construction, such as vegetation removal, wetland filling, cultural resource disturbance, and infrastructure construction, would have long-term effects."*

This issue is not just rhetorical. The hydrologic, ecological, and residential impacts of the removal of mature, established upland forest is, by any definition, long-term and, within the context of human lifetimes, permanent. The hydrologic, ecological, recreational, and visual functions performed by mature trees will take decades to be restored. The adverse impacts of tree removal, including removal of habitat, elimination of the canopy that keeps the stream cool, and the hydrologic functions of trees in removing water from the watershed, will continue for decades. By consistently referring to these impacts as "temporary", the regulatory agencies are complicit with the stream restoration companies in providing misleading, and potentially fraudulent, information to stakeholders in order to manipulate public opinion and mollify them into complacency.

Failure to Distribute Project Information to All Potentially Impacted Persons

There was no regulatory requirement for CA, MDE, or USACE to directly notify adjacent property owners or other stakeholders who may be impacted by the Elkhorn Branch project. CA provided no such notifications prior to their approval of an easement and, instead of reaching out to obtain and consider the concerns of residents, the Board, instructed the Staff to avoid the "brouhaha" at the Unnamed Tributaries to Little Patuxent project by putting the "full schmooze on the neighborhood" at Elkhorn[83]. MDE and USACE did eventually allow a public comment period, but only after receiving pressure from neighborhood residents. As discussed above, that public comment period was based on false project description and impact information provided by the contractor and, immediately upon completion of the public comment period, the CA Staff informed the CA Board that they could ignore the public comments[84].

However, even if the notices of public comment period had been complete and accurate, they still were not made available widely enough to allow all affected stakeholders to learn about the project and express their concerns. The mailing list for the notices was limited to adjacent property owners, even though hundreds of other property owners would have been equally subjected to visual and noise intrusion, potential flooding of their properties, and long-term modification of their recreation areas.

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[82] US Army Corps of Engineers – Baltimore District and US Department of the Treasury, Bureau of Engraving and Printing Environmental Impact Statement, Final, June 4, 2021, Page 5-2.

[83] Columbia Association Board of Directors Meeting, January 28, 2021, Available at Board of Directors Meeting (January 28, 2021) (youtube.com), Timestamp 00:44:00

[84] CA Staff letter to CA Board, 2/8/2022

Making this issue even worse is the manner in which the notices were provided to seven multi-family (condo, apartment, and townhouse) communities directly adjacent to the Elkhorn project area. In each case, the notices were sent to the management company responsible for the complex, but not to individual unit owners. Also, in each case, the management companies noted that there was no mention of tree removal and that project impacts were "temporary", and threw the notice in the garbage, without any further distribution to unit owners. When the details of the project were later brought to the attention of the management companies, several stated that they would have made further distribution of the notices if there had been any indication of tree removal, or longer-term impacts.

Contractors, Permittees, and Landowners have Admitted to Distributing False Information

Because of the financial incentives associated with these projects, they are accompanied by an enormous amount of mis-information distributed through aggressive public relations campaigns managed by the stream restoration companies, using landowners, regulatory personnel, and even well-meaning residents as their surrogates. Examples are:

- One stream restoration company developed guidance for their project managers that directed them to accompany their project proposals with a "public relations blitz"[85].
- When approving an easement for the proposed Elkhorn Branch project, the Board of Directors of the Columbia Association (CA) directed their Staff to put the "full schmooze on the neighborhood there"[86].
- In a February 7, 2023 meeting of the Columbia Association Watershed Advisory Committee, the Staff directed the committee members to write letters supporting the project to the Board and to MDE, but that, if anyone asked, say that the letter was their own idea, and was not a result of the Staff "operating in the background"[87].
- In a June 14, 2023 meeting with the CA Staff, Watershed Advisory Committee, and residents, a representative of the stream restoration company proposing the Elkhorn Branch project presented photos and maps of his earlier projects in Reston, claiming that tree removal had been minimal[88]. The residents followed up with site visits and internet research that demonstrated that these claims were false
- At the same meeting, the same representative argued that his 2021 permit application for the Elkhorn Branch project did not need to reveal the existence of any scientific literature about stream restorations from between 2008 and 2021, because he personally disagreed with their conclusions.

All of these actions have served to poison the public discourse about the pros and cons of these projects. Residents and decision-makers are convinced to approve of these projects because they have

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[85] Wetland Studies and Solutions, Northern Virginia Stream Restoration Bank – Wetland Success? Case Study of an Urban Stream Priority 1 Restoration Project Restoring Riparian Wetlands, March 8, 2021. Available at https://media.alexandriava.gov/docs-archives/tes/stormwater/nvsrb-case-study.pdf

[86] Columbia Association Board of Directors Meeting, January 28, 2021, Available at Board of Directors Meeting (January 28, 2021) (youtube.com), Timestamp 00:44:00

[87] Columbia Association Watershed Advisory Committee meeting, February 7, 2022. Timestamp 01:32:00.

[88] Video of June 14, 2023 meeting between CA, WSSI, WAC members, and residents

been convinced, by those who will make the profits, or the innumerable benefits that the projects will deliver. In at least three cases, in Reston, Alexandria, and Columbia, residents came together and successfully opposed a second project in their communities because they had seen first-hand evidence of the destruction wrought by the first project, and believed that the stream restoration companies and agencies were not be open and transparent in their statements supporting the second project.

11) Failure to Provide Project Documents to Public and Residents Upon Request

A major concern about the performance of the Unnamed Tributaries to Little Patuxent River project is the failure of the landowner (CA), and the regulatory agencies (MDE, DNR, and USACE) to provide project documents in response to formal, legally submitted requests from the public. I have wished to review these documents so that I could understand:

- The formal, quantitative performance standards by which the success or failure of the project would be measured, and by which credits are issued;
- The scientific basis, including citations from peer-reviewed journals and articles, for any claims made about the expected benefits of the project;
- The manner in which the permit application considered and disclosed adverse impacts of the project, including post-construction impacts to ecology, recreation, visual resources, noise, and other issues of concerns to adjacent homeowners and other residents; and
- The technical sufficiency of the hydrology analysis regarding potential increase of flooding on adjacent properties, including verification that the input parameters of both the pre-construction and post-construction conditions properly consider the actual amount of impervious surface (runoff curve number) in the watershed, the effects of compaction by heavy equipment, the effects of removal of large woody materials (tree trunks and limbs) from the stream channel and floodplain, and the "watering-up" effect of the removal of mature trees.

I requested the project application documents from the Columbia Association multiple times between November 2023 and January 2024. They did not forget to respond, or misunderstand my request. Instead, they directly informed me that they would not provide the documents to me.

I formally requested the permit application, by name, in a PIA to MDE on December 13, 2023 (PIA 2023-03165). Although MDE did provide the design document, it does not appear to contain any of the information required by USACE for a project under NWP-27, including the extent of tree removal.

I also formally requested the permit application documents in a Freedom of Information Act (FOIA) request to USACE on May 7, 2023, and received a response that my request would be granted on May 13, 2023. However, I never received another response. I sent a follow-up email on June 28, 2023, asking about the status of my request, and have not received a response as of July 10.

I contacted the Department of Natural Resources (DNR) on May 26, 2023, with a series of questions about their regulatory process for projects which, like the Unnamed Tributaries project, fail to meet the requirements of the FCA exemption agreement. There was an exchange on June 10, 2023, in which DNR asked me if I was referring to the Sewell's Orchard Park project. I responded on June 11, 2023, specifying that I was referring to the Unnamed Tributaries project. I received no response to that, or to another email, on June 25, asking about the status of my request.

Through this period, I also have requested documents from SHA and MDE under the PIA, and they have been mostly responsive to those requests. SHA has also have offered to meet with me to discuss my requests, which I appreciate, and may pursue in the future. However, a meeting with the permit holder is not a substitute for receiving documents or answers to questions from the regulators themselves.

When opening a public comment period on a permit renewal such as this, it is obviously in everyone's best interest, including MDE, that the commenters have access to all of the relevant information, so that their comments can be based on accurate and up-to-date information. The failure of the landowner and the regulatory agencies to respond to reasonable requests for access to project documents presents the appearance that those documents contain information that is not supportive of the claims of success, or that otherwise presents an unflattering picture of how the project has performed, or how the agencies have regulated it. MDE must not close the public comment period or re-issue the SHA MS4 permit as long as reasonable requests for project information have not been responded to.

12) Reference to SHA's Past Performance as "Exemplary" is Inappropriate in a Regulatory Document

Page 11 of the MDE Fact Sheet about the SHA permit justifies MDE's acceptance of SHA's proposed treatment of 2,871 impervious acres based on SHA's "exemplary" performance under their current permit.

Use of the word "exemplary" is subjective, and therefore does not belong in an objective analysis of the rationale for issuing a new permit. The use of this hyperbolic word can only serve to divert attention away from the actual adverse impacts of SHA's projects on residential neighborhoods, to obscure the lack of any actual quantitative monitoring of pollutant load reductions, and to improperly influence public opinion in favor of the permit.

The conclusion that SHA's performance has been "exemplary", or that it actually met or exceeded pollutant load reductions, is also not actually demonstrated by any monitoring data from SHA's Unnamed Tributaries to Little Patuxent River project. The pollutant load reductions that were credited to that project were based only on an assumed relationship between linear feet of floodplain re-connected and a modeled value of pollutant load reduced. As discussed above, Page 75 of the CESR report concluded that "the implementation that has occurred may not be producing the pollutant reductions expected". This statement calls into question the entire concept of offering pollutant load credits to individual projects without any actual project-specific monitoring to demonstrate that pollutant loads were actually reduced, or that the effects of impervious surfaces were actually successfully treated. The entire regulatory system is based on a presumption of performance, rather than any required demonstration of performance. Therefore, although the Fact Sheet supports the claim of "exemplary" performance by citing the acreage of impervious acreage treatment done by SHA under their current permit, it fails to consider or disclose the fact that the purported relationship between this treatment and actual pollutant loads reductions has been called into question by the Chesapeake Bay Program in the CESR report.

Also, praising SHA's performance of the Unnamed Tributaries project completely ignores the adverse impacts of the project on the local neighborhood. The project area is surrounded by residential homes, with large areas of the project visible from adjacent streets and greenway trails. Ten acres of trees were

cut down, eliminating the view of trees in residents' backyards, and instead exposing them to views of the backsides and lighting of homes of their neighbors on the other side of the floodplain. The few remaining tall trees within the project area immediately died, leaving a stark, mangled viewscape suitable as the setting for a horror movie.

The praise of SHA's performance also ignores the complete failure of the re-forestation effort at the Unnamed Tributaries project. The entire concept behind the removal of mature trees to implement floodplain re-connection assumes that the loss of canopy, temperature control, habitat, and other benefits of the mature forest will be quickly restored through immediate re-forestation. At the Unnamed Tributaries project, the re-forestation survival rate fell to 49 percent in 14 months, 45 percent in 22 months, and 36 percent in 28 months. Almost the entire project area required a corrective action, planting another 700 trees in October, 2023, about 2½ years after the original construction was "completed". Because those trees were planted less than a year ago, it is too soon to draw any conclusions about whether these trees, too, will die.

MDE's claim that SHA's performance has been exemplary is especially incredible given that there is no evidence that MDE has done any reasonable amount of investigation or verification of the performance of the Unnamed Tributaries project. Despite the re-forestation rate dropping below 36 percent, the authors of the Year Two and Year Three Monitoring Reports chose to not disclose the re-vegetation survival rate. Instead, they made a claim, in text, that the trees were "well established", and that the project area was "self-sustaining". In November, 2023, I contacted MDE for information on the re-forestation corrective action that had occurred less than two months prior, in October. Although the survival rates had fallen below 36 percent more than 18 months prior to the corrective action, and the corrective action had occurred less than two months prior to my inquiry, it turned out that the MDE Project Manager knew NOTHING about a corrective action having occurred. In an email to SHA[89], he expressed surprise, stating that the monitoring reports he had read had not revealed that the re-forestation was failing, or that a corrective action was necessary. In this email, he also noted that he did not even have a copy of the monitoring plan for the project he was supposed to be regulating. He was correct – the monitoring reports had not disclosed that information, because SHA had failed to disclose the information in their report. However, these events also reflect very negatively on MDE's oversight role as a regulator on this project. It is clear that MDE had done nothing except do a cursory read of SHA's reports, without any in-depth review of the supporting data, or even the fine print. It is also apparent that SHA knows that nobody is performing critical reviews of their submittals, allowing them an opportunity to make outrageous claims of success based on no actual data, without any fear of getting caught.

The failure of MDE to consider the re-forestation issues reveals one of the more concerning features of the regulation of these projects. In the email exchange with SHA in November, SHA's immediate response was to remind MDE that SHA was NOT required to request authorization from MDE, or even notify MDE that a corrective action was deemed to be necessary, planned, and implemented. While the reply was politely worded, it effectively told MDE that the re-forestation issues were none of their business. In a response, MDE agreed.

[89] Email from William Seiger (MDE) to Ryan Cole (SHA), 11/27/23

The stream restoration companies have managed to keep these projects exempted from the Forest Conservation Act, but they still must comply with an exemption agreement that is administered by the DNR. Therefore, tree survival surveys, reporting of results, and any needed corrective actions, such as occurred at the Unnamed Tributaries project, are under the purview of DNR. Meanwhile, other monitoring requirements, such as visual surveys of the in-stream structures and vegetation coverage, and issuing of credits based on length of stream "stabilized" are under the purview of MDE.

In the required monitoring reports for the Unnamed Tributaries project, SHA is not even required to disclose or discuss quantitative results from DNR's re-forestation surveys, and they chose not to. However, at the same time, they had the temerity to make qualitative statements about the re-forestation, claiming that the trees were "well established". Technically, they can claim compliance with the permit's monitoring reporting requirements. Functionally, this is a complete farce that allows permittees to make false claims about the success of their projects.

This is a monstrous disconnect in the regulatory framework for stream restoration projects in Maryland. The ultimate factor that determines the success of a project in stabilizing the stream and its floodplain, in improving water quality, and in restoring aquatic habitat and ecological function, is entirely based on whether or not the project area is successfully re-forested or not. The two cannot be viewed as distinct, unrelated performance issues. Failure of the re-forestation WILL result in failure of the entire enterprise. How, then, can MDE be expected to judge and regulate the performance of the stream stabilization, improvement of water quality, and uplift of ecological function if they are not only not a recipient of the quantitative re-forestation data, but the reports actually make untrue claims about the success of the re-forestation?

With respect to other aspects of the performance of the Unnamed Tributaries project, there is nothing that can be considered "exemplary". The assessment of stream stability in the Year Three Monitoring Report has two major problems:

- It identifies multiple areas where erosion has occurred, including identification of six specific areas where in-stream structures were rated as "Functioning at Risk"; and
- It reveals that the as-built survey, which is used to assess long-term stream stability, was flawed.

The elevations of specific features on the as-built survey were found to be incorrect by up to three feet. As a solution, SHA simply re-baselined the entire survey, declaring that the Year Three measurements would now serve as the baseline for future measurements[90].

Similarly, the Year Three report identified concerns regarding takeover of the project area by invasive plants. This issue was of enough concern that the landowner, CA, wrote an email in June, 2023, requesting assistance from SHA in addressing the invasive vegetation problem.

Finally, with respect to water quality, MDE included the Unnamed Tributaries project in a multi-site program for the collection of water quality samples. A report has not yet been finalized a report but, in any case, the MDE personnel administering the program admit that the data will be of limited use

[90] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023, Year Three Notes, Stormwater Outfall 2, First Page of Appendix B: Year Three Plan Set.

because there was no pre-construction monitoring effort for comparison of current water quality to pre-project conditions.

What, among these issues, is exemplary about SHA's performance? The project had major adverse impacts on the neighborhood. The re-forestation effort was obviously done as cheaply and quickly as possible. MDE is unaware of this, because SHA is not required to report this information to MDE, and, instead, made false claims about it. Not only is there no data suggesting that the project is successful, but the as-built survey generated unusable data.

Despite all of these reported concerns regarding performance, apparently none of them noticed by MDE, the Year Three Monitoring report conveniently ended with a request from SHA that they be released from the Year 5 survey and monitoring efforts. The hubris associated with this request is overwhelming. SHA and their contractor took control of the 10-acre property, destroyed the mature trees, made no substantial effort to re-grow the trees, performed an unusable as-built survey, documented multiple incidents of erosion, created conditions for invasive vegetation to flourish, and then asked USACE and MDE to be excused from any further responsibility for the project area. Meanwhile, the landowner, CA, under the spell of the stream restoration company, continues to make unsupported claims that the project was successful in an attempt to implement a similar project six times the size.

Until MDE can demonstrate, through comparison of pre-and post-construction monitoring data, that these projects actually improve water quality, stream stability, AND ecological function, the issuance of credits to MS4 permit holders, as well as to operators of wetland mitigation banks, must cease.

13) Permit Applications Omit and Misrepresent Critical, Recent Science that Contradicts the Claims of Benefits by the Stream Restoration Contractors

My first introduction to the regulatory process for approving stream restoration projects in Howard County began more than a year ago, when a neighbor asked me, as a hydrologist and environmental professional, to review the permit application (Prospectus) for the proposed Elkhorn Branch project[91]. I write and review these types of environmental permit applications for a living, and was shocked at how nonchalant the authors were about making inflated and unsubstantiated claims about the water quality, ecological benefits, and native plant benefits of the proposed project. This was done by misrepresenting statements made in older scientific articles, and ignoring the existence of more recent studies of the actual results of stream restoration projects.

The Elkhorn Branch Prospectus cited three articles to support its claims that the project would improve water quality and ecological function. Those three articles were dated 2005, 2005, and 2008 – all of them at least 13 years old at the time the Prospectus was submitted to MDE. Upon review, it immediately became clear that none of those three articles actually stated what the Prospectus claimed that they stated. Similarly, the Plumtree Branch design report[92] cited only one scientific document, which was dated 2000 and was more than 20 years old. The design report for the Unnamed Tributaries

[91] DRG/WSSI Maryland Statewide Umbrella Mitigation Bank, Addendum 1: Lake Elkhorn Stream Mitigation Site
[92] Plumtree Branch Ecological Restoration Design, Final Design Report, developed by Ecotone for Howard County Office of Community Sustainability, May 2022.

to Little Patuxent River went even further, and did not bother to cite any scientific literature to support its claims that the project would reduce nutrient inputs, reduce the frequency of dredging in downstream lakes, provide diverse habitat, and support native species.

There has been a massive amount of further research, and published, peer-reviewed scientific articles, since 2000. Beginning in about 2005, and continuing to today, the academic scientists who have studied "stream restorations" and published their results have been relentless and unanimous in opposing stream restoration projects. At this point, I have compiled about 30 recent articles that have studied large groups of stream restoration projects, and which uniformly state that these projects do NOT offer any improvement in water quality or ecological function[93]. Ten of the articles, published since 2017, were from studies funded by the Chesapeake Bay Trust, an organization that generally supports and funds stream restoration projects. Several other individuals (Mr. Ken Bawer, Ms. Sharon Boies, Mr. Roger Davis, and others) have developed their own personal libraries of up-to-date, peer-reviewed scientific articles on the subject.

An interesting observation about these articles is that several of them are brutal not only in their rejection of the claims of benefits of stream restoration, but of the practitioners who manipulate the municipalities and other landowners to do it. In peer-reviewed articles in technical journals, they name names and criticize the practitioners as non-scientists driven by profit instead of by science:

- Palmer and others (2014) referred to the practitioners as "charismatic personalities", and "driven by the profit factor."
- Simon and others (2007) said that "Training has empowered individuals that "may have limited backgrounds in stream and watershed sciences to engineer modifications of streams", and "based on 50-year-old technology never intended for engineering design".
- In referring to David Rosgen, the proponent of the Natural Channel Design stream restoration method, in Science Magazine in 2004, J. Steven Kite said that "Dave is creating his own legion of pin-headed snarfs", and "market is being filled by folks with very limited experience in hydrology or geomorphology".
- Simon and others (2005) state that "Practitioners have received 'para-professional training'".
- Finally, Thompson and Smith (2012) lament that "The practice of stream restoration has far outpaced the science. Practitioners base their efforts on their own personal experience, which is not written and not made available for study. Where they have been made available, they are non-quantitative and anecdotal."

This failure to cite any articles or data that contradict the claims of benefits of the stream restoration companies appears to be a general pattern. If these omissions and mis-representations had been accidental, they could be considered evidence of negligence or incompetence on the part of the stream restoration companies that author the documents. However, when confronted with these omissions and mis-representations during a meeting in 2023, the author of the Elkhorn Branch Prospectus acknowledged that he was fully aware of these additional scientific articles[94]. He simply stated that he had left them out of the Prospectus because he, personally, disagreed with them.

[93] Urban Stream Restoration Bibliography, developed by Bob Dover, July, 2024

[94] Video of June 14, 2023 meeting between CA, WSSI, WAC members, and residents

It is acceptable for an environmental professional to use his or her past experience, education, and professional judgment to disagree with the results of one or more other researchers. However, it is not appropriate to ignore the fact that these peer-reviewed articles, which present contrary information and conclusions, exist. Citing studies that are 15 to 20 years old, while refusing to even acknowledge the existence of dozens of more recent peer-reviewed articles in the scientific literature, presents a striking appearance that the omission of information that is contrary to their proposed projects is deliberate, and intended to manipulate the opinions of decision-makers and the public into approving their projects. If deliberate, this may constitute fraud on the part of the authors of these documents.

Because these documents must be signed by Professional Engineers registered in Maryland, the omissions and mis-representations may also violate the Maryland Code of Ethics in COMAR Title 09, Subtitle 23, Chapter 09.23.03. Section 09.23.03.02 states that a licensee may not be "untruthful, deceptive, or misleading" in any professional report. Section III.3(a) of the Code of Ethics of the National Society of Professional Engineers states that engineers "shall avoid all conduct or practice that deceives the public", including that they shall avoid "omitting a material fact"[95]. The existence of dozens of recent, peer-reviewed scientific articles that contradict the claims of benefits of stream restoration projects would seem to be a "material fact", and the omission of any acknowledgement that these articles exist can only serve to deceive the public.

As discussed above, I have made multiple unsuccessful attempts to obtain the permit application documents for SHA's Unnamed Tributaries project, in order to see if it, too, misrepresented the conclusions of older articles and failed to provide any up-to-date sources. However, given that the contractor who developed that application is the same as that which developed the application for Plumtree Branch, it seems highly likely that the promises of environmental benefits in the application for the Unnamed Tributaries project was similarly based on almost no actual peer-reviewed scientific documentation.

Within the Columbia Association, the Watershed Advisory Committee wrote a letter in support of the Elkhorn project, and submitted it to MDE as part of the public comment process. Later, a CA Board member asked the chair of the Watershed Advisory Committee if her committee had conducted this kind of review of the scientific literature before issuing that letter, and she replied that the Watershed Committee had never heard of the existence of these newer scientific articles, and that she would take that information back to the full Watershed Committee[96]. That conversation took place more than two years after the CA Board had authorized the easement for the Elkhorn Branch project, and more than a year after the Watershed Committee sent a letter supporting the project to MDE and other agencies.

This is only three examples, out of what are probably dozens or hundreds of stream restoration projects in Maryland. However, they establish a clear pattern, which is that the stream restoration companies are either grossly incompetent, or are fully aware that they can misrepresent conclusions in older articles and ignore newer articles, and they will not be called out for these practices by MDE or USACE, the MS4 permit holders, or the landowners. There is no indication that MDE or USACE considered the

[95] National Society of Professional Engineers, Code of Ethics for Engineers, available at https://www.nspe.org/sites/default/files/resources/pdfs/Ethics/CodeofEthics/NSPECodeofEthicsforEngineers.pdf

[96] Columbia Association Board of Directors Meeting, May 11, 2023, Available at https://www.youtube.com/live/9x6h2Zdzgyo. Timestamp 00:47:00

accuracy or thoroughness of this scientific background material in their decisions to authorize these projects.

14) Failure of MDE and other Regulators to Critically Evaluate Permit Applications and Post-Construction Monitoring Reports

When proposing stream restoration projects, a frequent argument of those promoting the project is that these projects are "tightly regulated", the implication being that the government agencies would only issue permits for projects that are absolutely needed, have few or no adverse impacts, and have a high degree of likelihood of success. It is claimed that the agencies conduct rigorous, critical reviews of the technical aspects of each project before approving a permit, and only issue the associated load reduction credits if project monitoring results demonstrate actual load reductions and other benefits. However, the documentation associated with three recent projects in Howard County (Unnamed Tributaries to Little Patuxent River, Elkhorn Branch, and Plumtree Branch) shows that the opposite is true.

As shown above, the discussions of benefits of these projects presented in the permit applications mis-represents and omits critical documentation that is directly relevant to the expected performance of the projects. However, there is no evidence that the agencies authorizing the permits conducted any technical review of that documentation. It appears that the applicants simply misrepresented the conclusions of those articles, apparently comfortable in making an assumption that nobody in the regulatory agencies would bother to check. Their assumption was correct – both the Unnamed Tributaries and Plumtree projects were approved and, although both MDE and USACE provided comments that were severely critical of the Elkhorn Branch Prospectus and the project was ultimately withdrawn, none of these comments noted the improper use of the older citations, or the fact that dozens of more recent citations existed.

15) Failure to Evaluate the Impact of Stream Restoration Projects on Flooding

As discussed above, one of the most concerning potential impacts of stream restoration projects is their potential to increase the frequency and intensity of flood damage to adjacent properties, including residences. Stream restoration projects are hydrology modification projects and, any time surface water hydrology is modified, there is a potential for unintended consequences. It is easy to direct water to go in a certain direction but, once you have directed it, it is not nearly as easy to control how far or how fast it goes in the direction.

I have substantial experience in evaluating surface water hydrology impacts associated with construction and development projects, and the analyses routinely take the same form. A stormwater modeling analysis must be done that uses the pre-construction characteristics of the watershed as input parameters to calculate current stormwater flow rates for a variety of storm event types, and then post-construction characteristics as input parameters for predicting the extent, frequency, and intensity of post-construction flooding. Such an analysis is necessary to determine whether any project, including a stream restoration project, has the potential to cause damage to adjacent properties, along with the

resulting potential for human safety, damage to structures, and legal liability for those responsible for the project.

The characteristics, or input parameters, that must be considered include the runoff curve number (RCN), which is based on the soil type, compaction amount, and percent of permeable and impermeable surfaces. Because stream restoration projects involved use of heavy equipment to grade soils within the floodplain, they, by definition, modify the RCN from the pre-construction condition to a new, post-construction condition.

The same is true of the roughness of the forest floor in the floodplain, which is influenced by the amount of small, under-story vegetation, and the presence or absence of tree trunks, limbs, and other forest litter not only on the floor of the floodplain, but within and spanning across the stream channel. The presence of these items will attenuate (slow) stormwater flow, reducing erosion rates and causing sediment to be deposited into the floodplain. In general, stream restoration projects in Howard County have removed these obstructions. This means that the post-construction stormwater flow will be faster, have higher erosion potential, and have a higher potential to damage infrastructure and adjacent properties.

A third important characteristic is the antecedent moisture condition. This is the extent to which the floodplain soils are already saturated with water. With respect to runoff control and potential for flooding, it is desirable to have as much available stormwater storage capacity as possible. If groundwater levels are high and site soils are already saturated, then new precipitation goes directly to runoff instead of infiltrating, increasing the frequency and intensity of flooding. As discussed above, the removal of mature trees interferes with the enormous removal of water from the groundwater by evapotranspiration. The stream restoration companies even present the higher groundwater table in the floodplain as a benefit, claiming that it will support growth of riparian vegetation[97]. However, this in only a benefit if the higher groundwater table does not lead to a higher potential for flooding.

In deciding whether to authorize stream restoration projects, MDE and USACE staff must not only require that such a hydrology analysis be done, but must have the information, experience, and tools to be able to conduct critical reviews of the analyses submitted by permit applicants. In the cases of the Unnamed Tributaries project, Elkhorn Branch, and Plumtree Branch, MDE and USACE failed to adequately perform these reviews.

For the Unnamed Tributaries to Little Patuxent River project, the application was accompanied by a package purporting to show the results of the hydrology analysis. However, that package presents only pre- and post-construction outputs, but does not show any of the inputs. The accuracy of the outputs cannot be evaluated without the reviewers also having access to review the input parameters. I requested a copy of the input parameters as part of my FOIA request to USACE but, as I described above, I have not received a response. Based on the one document that I do have, it seems unlikely that the USACE and MDE reviewers of the permit application had access to the input parameters, so they could not have performed a complete review of the potential for flooding posed by the project.

[97] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

I also reviewed the hydrology package that supported the Plumtree Branch application[98]. Again, I did not have access to the input parameters. However, I identified, in my review, that the output results were physically impossible, meaning that the modeling had not been done properly. The package had been submitted to MDE, and MDE had already issued the permit. Later, MDE apparently learned of this problem from a source other than me, because they withdrew the permit and required that the analysis be re-done. This is solid evidence that the original issuance of the permit was done without a proper technical review of the hydrology analysis within the agency.

For the Elkhorn Branch project, no hydrology analysis was ever completed. The applicant for that project claimed that no such analysis could be performed until their final design was completed, and the final design could not be completed until after they had received their permit. In other words, they wanted to receive their permit, and then do their flooding impact analysis later. However, in their Prospectus, they did present a discussion of the permeable and impermeable areas within the watershed, and misrepresented that information[99]. This misrepresentation was identified in review of the Prospectus by the U.S. Fish and Wildlife Service (USFWS). I have reviewed the USFWS comment, and compared it to the hydrology analysis done of the Elkhorn Branch watershed by the Howard County DPW, and confirmed that the values presented in the Prospectus were not accurate. If a hydrology analysis had been done based on this incorrect information, it would have severely underestimated the flood risk posed by the project.

Overall, these observations imply that MDE and USACE are not conducting a thorough and reasonable verification of the potential for these projects to increase the frequency and intensity of flooding. As long as there were small-scale projects in rural areas, this may not have been a big problem. However, as cited above, these projects have grown much larger in scale, and are situated closer and closer to densely populated residential and commercial areas. Therefore, these project should no longer be authorized until MDE can demonstrate, through detailed guidance, exactly how the hydrology modifications of these projects must be analyzed by the applicants, and those analyses independently confirmed by agency personnel.

16) Failure to Identify Errors and False Statements in Post-Construction Monitoring Reports

The Year Three Monitoring Report for the Unnamed Tributaries of Little Patuxent River,[100] which was reviewed and approved by the regulatory agencies, is riddled with errors, unsubstantiated conclusions, and outright false statements. Some examples include:

- The statement on Page 6, Tributary 1, Bullet 3 reads “Sediment has been transported away from the upstream side of the Hesperus Drive culvert at approximately 24+23 (Photo 35) and shows no signs of accumulation.” First, the cross-reference to the photo is incorrect. The photo of Station 24+23 is Photo 32, not Photo 35. The cross-reference for Photo 39 also appears to be in error. However, the more concerning issue is that the statement is clearly incorrect. The area of

[98] Plumtree Branch Ecological Restoration Design, Final Design Report, developed by Ecotone for Howard County Office of Community Sustainability, May 2022.
[99] U.S. Fish and Wildlife Service, letter to Jack Dinne, U.S. Army Corps of Engineers, August 26, 2021
[100] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

sediment accumulation upstream of the Hesperus culvert was identified and reported on page 8 of the Year Two Monitoring Report, with a photo (Photo 35). Comparison of the Year Two and Year Three photos show no change in the size of the area, making the claim that the sediment "has been transported away" and "shows no sign of accumulation" inaccurate. I have visited this site many times, most recently in mid-January 2024, and there is no support to the claim that there is no sediment accumulation at this location.

- As discussed above, the claims that trees and vegetation are "well established" are not supported by the actual tree survey data. Page 11 of the report references the replanting corrective action that occurred on October 17, 2023, and states that "The survival rate in May, 2022, prior to replanting, was 49%"[101]. This statement is true. Chronologically, May, 2022 is "prior to" October, 2023. However, the manner in which this data are presented in misleading. There were two other survey events between May, 2022 and October, 2023 – both of them also, technically, "prior to" October 2023. The survey in December, 2022, documented a 45 percent survival rate, and the survey on June 12, 2023, documented a 36 percent survival rate. These data were available to the SHA at the time that the Year Three Monitoring Report was written and submitted, yet they apparently chose to provide the less concerning 49 percent value from three surveys ago. This false information masks the ability of the regulators and the public to see just how quickly after construction, and how far, the tree survival rate at the project area had plummeted. This information is highly relevant to the question of whether stream restoration projects should be approved by MDE at all, or whether CA, SHA, and their chosen contractors are competent, and are committed to restoring project areas immediately upon completion of construction.
- The "Conclusion" section of the Year Three Report is not appropriate in any technical or scientific document, and especially not in a formally submitted regulatory report. Appropriate "conclusions" in a technical report can only take one form:
  - Present the objectives, preferably in terms of quantitative standards to be achieved;
  - Present the quantitative results;
  - Compare the quantitative results to the quantitative standards, and make a statement about whether those standard were or were not met.

  This is not difficult. However, the single paragraph presented under "Conclusions" does not do this. Instead, it uses the word "expects" twice, the word "will" twice, and refers to what they expect the site conditions to be twenty years from now. These are not conclusions, and they are not objective comparisons to numerical standards. They are optimistic, unsupported predictions of future conditions. These statements do not belong in a technical document – they are appropriate only in a sales brochure.

Despite these easily-found issues, the Year Three Report was accepted by the regulatory agencies. It is clear that no comprehensive technical review was completed, and that the reviewers of the document did so without actually looking at other project data in order to confirm whether the document's claims of success were supported or not.

[101] Ecotone, Unnamed Tributaries to Little Patuxent River Stream Restoration, Year 3 Monitoring Report, December 19, 2023

17) Referring to Repairs of Failed Projects as "Adaptive Management" is Inaccurate and Inappropriate

The SHA MEP document includes expenditure of $3 million to repair failing stream restoration projects constructed during the current permit term[102].

In environmental management, the phrase "adaptive management" is used to describe a decision-making process in the face of uncertainty. Adaptive management involves an iterative process in which results from one project, positive or negative, are fed into the decision-making process for the next project. A similar phrase used is "lessons learned". Adaptive management is generally considered to be a good thing, that is practiced by any competent engineering or construction program. Seeing this phrase used in a planning document, such as the MEP document, gives the reader a positive feeling about the organization, and how it operates.

That is, unless it turns out that the phrase is used with a completely different meaning, and in a different context. This is the case with the MEP document. As used on Page 16 of that document, the phrase "adaptive management" is not used to describe how lessons learned will be incorporated into future decisions. Instead, it is used to describe a category of repair projects, which are being implemented because the original project, conducted under the current permit, are at risk of failing.

Because the phrase "adaptive management" is commonly used as a positive term used to describe an organization's decision-making process, finding it used as a project category to encompass repairs of past failures in incongruous. It seems as if SHA wishes to divert attention away from the fact that several of their past stream restoration projects are failing, by giving the $3 million funding line item a positive, buzzword-type name.

This appears to be just another example of the proponents of stream restoration projects greenwashing the regulatory agency personnel, and the public, into believing that everything about these projects is positive, with no downside. However, the fact that $3 million worth of repairs need to be made to failing stream restoration projects is highly relevant to the question of whether or not more of these projects should be implemented. Is one of these projects that is failing the Unnamed Tributaries to Little Patuxent River project? What component of it does SHA acknowledge has failed, and why? Have lessons been learned from these failures, and have they been incorporated into a revision of SHA's plans to move forward with more of these projects?

By burying the references to "repairs" and "failing" into the fine print, and instead focusing on the positive-sounding buzzwords of "adaptive management", SHA has obscured the results of their past projects which, in turn, makes it more difficult for MDE and USACE to make proper decisions on their future projects.

Conclusions

In the CESR report, the Chesapeake Bay Program directly concluded that these projects have not delivered the expected reductions of pollutant delivery to the Chesapeake Bay. Watershed-scale results reported by MS4 permit holders identify no watershed-wide improvements in water quality, ecological

[102] Maryland State Highway Administration, Maximum Extent Practicable Analysis, March 22, 2024

function, or stream stability. For most individual sites, no actual post-construction surveys, sampling, or monitoring is even required, but that does not stop the authors of the regulatory-required monitoring reports from claiming that water quality has been improved, ecological function has been uplifted, and streams have been stabilized. Where post-construction results for individual sites are reported, such as the stream stability, invasive plants, and re-forestation success rates for the Unnamed Tributaries to Little Patuxent River project, they are negative.

The technical and environmental reasons for these disappointing results are well documented in the scientific literature. It is no mystery why these projects fail – it is largely because they do not address the root cause of stream degradation, which is elevated runoff levels. In fact, the physical activities associated with these projects, including tree removal, introduction of foreign materials, and removal of large, woody debris that acts as attenuators in the floodplain, serve to increase runoff levels, modify the natural geochemistry of these systems, and allow stormwater to flow rapidly with no obstructions to slow it down.

In addition to failing to make any of the promised improvements on the Chesapeake Bay, watershed-scale, or individual project-scale, these projects are enormously destructive to existing mature forests, ecology, and watersheds. Where these projects are implemented in residential neighborhoods, they have the additional effect of increasing the frequency and intensity of flood damage to adjacent properties, and can reduce property values by destroying residential viewscapes and nearby recreation areas. Because this damage is associated with removal of mature trees, the duration of the impact is decades, meaning the impact on residential property owners is permanent. When a project is implemented with little or no opportunity for public engagement, or over the objections of the residents, as they often are, the impacts are immediate and irreversible. When a stream restoration project is found to not have provided any of the promised benefits, there is no restitution available to the adjacent property owners, and no consequences for the agencies and contractors who inflicted the damage.

The conversation about stream restoration projects has been dominated by the industry representatives for long enough. The entire legislative structure and regulatory framework for these projects is the result of aggressive lobbying by those who can increase their profits by increasing the scale of their destruction. Now that some of the negative monitoring data and associated email correspondence between SHA and MDE regarding the Unnamed Tributaries project is public, I hope that this can be used to educate the public about the misinformation that has been spread, and the unacceptable manner in which MDE has failed to oversee the projects. MDE management should be ashamed at finding that they have been approving permits based on citations from 15+ year-old journal articles, while dozens of more recent studies provide different conclusions. It can now be seen that MDE and USACE cannot possibly have conducted a rigorous technical review of the potential for these projects to cause flooding on adjacent properties, because the modelled hydrology analyses submitted in the permit applications do not contain any of the input information that would need to be reviewed to understand if the analysis was accurate.

Recommendations

1) Rescind all credits issued to SHA for the Unnamed Tributaries project dating back to May, 2022. This is the date on which DNR documented that the re-forestation effort was failing, a situation for which there is no documentation it has been successfully corrected. There can be no presumption that the project is now, or ever will be, successful in improving water quality, uplifting ecological function, establishing wetlands, or stabilizing the stream until SHA can demonstrate that the deforestation of ten acres of mature forest has been reversed.
2) Rescind the acceptance of SHA's Year Two and Tear Three Monitoring Reports for the Unnamed Tributaries project, and require revision to remove the false claims of "well established" trees, a "self-sustaining" project area, and improvement of water quality and ecological function.
3) Reject SHA's request to be excused from Year 5 monitoring for the Unnamed Tributaries project.
4) Extend the permit and continue to require monitoring and, if needed, corrective actions, for the Unnamed Tributaries project until at least October, 2028. This is five years from the date of the corrective action of planting more than 700 additional trees, an action which effectively reset the clock for the entire project. This is also approximately five years after the Year Three stream elevation survey in which SHA determined that the 2021 as-built survey was flawed, and that they needed to use the 2023 survey to re-baseline the elevations. DNR must also extend the term of the FCA exemption agreement to October, 2028.
5) Revise the MDE Fact Sheet to remove blatantly propagandist claims that SHA's performance on their current permit has been "exemplary".
6) Remove "stream restoration" as an acceptable project type for receiving pollutant load reduction credits under the new SHA permit.
7) Require modification of the SHA MEP document, to remove its references to stream restoration projects, and to remove any suggestion that the repair of past, failed projects is classified as "Adaptive Management".
8) Re-issue the MEP and Fact Sheet for an additional round of public comment.
9) Revise MDE's policy to prohibit issuing pollutant load reduction credits for stream restoration projects to MS4 permit holders, and to operators of wetland compensatory mitigation bank operators.

Elkhorn Branch Project

Stream Restoration Bibliography

Compiled and Annotated by Bob Dover

June 2024

Articles, Studies, and Reports Evaluating Results from Past Stream Restoration Projects

Beauchamp, Vanessa, Joel Moore, Patrick McMahon, Patrick Baltzer, Ryan A. Casey, Christopher J. Salice, Kyle Bucher, and Melinda Marsh. 2020. Effects of Stream Restoration by Legacy Sediment Removal and Floodplain Reconnection on Water Quality and Riparian Vegetation. Study funded by Chesapeake Bay Trust Award #13974. December 2020. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

> This report concludes that stream restorations did not have any impact on nitrogen concentrations. Preservation of high-quality forest areas, even if they have invaded previous floodplains, should be considered. The effects of loss of tree canopy should also be considered.

Bender, Shera M., and Ahn, Changwoo. 2011. A Review of Stream Assessment Methodologies and Restoration: The Case of Virginia, USA. Environmental Engineering Research, pgs. 69-79. Accessed at https://www.eeer.org/journal/view.php?doi=10.4491/eer.2011.16.2.69 on July 1, 2024.

> The focus of this study was on the post-construction evaluation methodologies used for stream restoration projects in Virginia. The study documented that most projects do not include post-construction evaluation or monitoring, which are critical to understanding the success and efficacy of stream restoration projects. The report noted that almost all post-construction evaluations or visually-based, and do not include any biological assessments. Of 29 projects that occurred in Fairfax County between 1995-2003, 19 reported streambank stabilization as a primary goal, as opposed to a goal of improving the ecological integrity of the stream. Of these, only 7 projects required any monitoring whatsoever.

Brown, Eden. 2023. Stream "Restoration" of Arlington Streams a Misnomer? The Connection Newspapers. June 6, 2023. Accessed at https://www.connectionnewspapers.com/news/2023/jun/06/stream-restoration-arlington-streams-misnomer/ on 7/1/2024.

> This news article summarizes the rationale provided by resident and expert opponents of the proposed Donaldson Run Tributary B stream restoration project in Arlington. The article summarizes the technical and regulatory failures of the Tributary A project, as well as other recent science, to show why the promised benefits at Tributary B would not have been achieved if it had been approved.

Budelis, Drew, Lauren McDonald, Steve Schreiner, and Donald E. Strebel. 2020. An Evaluation of Forest Impacts Compared To Benefits Associated with Stream Restoration. Study funded by Chesapeake Bay

Trust Award #14833. February 2020. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

This report concludes that:

- There is no compelling evidence that the benefits of floodplain reconnection outweigh the impacts, and Maryland DNR stresses the need to minimize impacts to existing forests.
- While the authors believe that floodplain habitat is of greater value than upland habitat, attempts to convert upland habitat to floodplain habitat are likely to not be successful, especially in areas where habitat is fragmented and has anthropogenic structure, such as Elkhorn Branch.
- Reconnection of floodplains does not increase functional composition or diversity of plant communities.
- Floodplain reconnection may increase presence of invasive species.
- Floodplain reconnection will not affect soil nutrient content.

Center for Watershed Protection. 2021. The Self-Recovery of Stream Channel Stability in Urban Watersheds due to BMP Implementation. Study funded by Chesapeake Bay Trust. March 2021. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

This report concludes that, in a study of a limited number of stream restoration sites, the total suspended sediment load increased after restoration.

Center for Watershed Protection. 2022. Maintaining Forests in Stream Corridor Restoration and Sharing Lessons Learned. Acquired by email from Greg Hoffman, Center for Watershed Protection, on 6/14/2023

This extensive study was intended to respond to the growing observations of massive tree removal and disturbance of riparian area during "stream restoration" projects. The purpose was to review past projects and identify ways to protect riparian buffers and minimize impacts on those buffers, especially healthy, mature trees. The report noted that "there are very few requirements that explicitly focus on protection of existing forests from impacts", meaning that the extent to which these projects remove trees is largely left to the developer.

Key Observations included:

- Some stream restoration sites are not severely degraded and therefore result in significant forest losses that could have been avoided with better site selection.
- Sites where the quality of the riparian community is poor (e.g., invasive species, poor habitat conditions) may be good candidates for stream restoration project design that incorporates native plantings and habitat improvements. The trade-off here is that short-term forest loss may be necessary to achieve longer-term habitat improvement goals.
- Certain stream restoration designs may include extensive removal of riparian vegetation or subsequent tree loss through increased groundwater elevations and/or extended inundation (e.g., floodplain reconnection projects) while others (e.g., legacy sediment removal) may not be intended to include a fully forested riparian area, but instead include a diverse mosaic of herbaceous plants, shrubs, and

water-loving trees that represent pre-development site conditions. The specific project goals, objectives, and design approach therefore have an important bearing on how much forest loss results from the project.

Chesapeake Bay Program. 2023. Achieving Water Quality Goals in the Chesapeake Bay: A Comprehensive Evaluation of System Response. May 2023. Accessed at https://www.chesapeake.org/stac/document-library/cesr/ on July 1, 2024.

The CESR report documented that 40 years of efforts to improve water quality and ecological function in the Chesapeake Bay had achieved limited results. This report cited one reason for this to be a "response gap", in which the actual pollutant load reductions from projects, especially for phosphorus and nitrogen, did not match the modeled expectations. One particularly relevant statement, from Page 75 of the Findings of that report, is "To date, efforts to reduce nonpoint sources have not produced sufficient levels of BMP implementation to meet the TMDL, and *the implementation that has occurred may not be producing the pollutant reductions expected*" (emphasis added).

Cohee, Gabe. 2023. Chesapeake and Atlantic Coastal Bays Trust. Email to Bob Dover regarding mass tree removal as part of stream restoration. June 12, 2023.

In response to a question about funding of stream restoration projects by the Chesapeake and Atlantic Coastal Bays Trust, Mr. Cohee responded that "As a fund source, we are very interested in protecting existing habitat and ecological functioning while supporting the restoration activities based on high levels of degradation. In response to a question about whether they would fund projects that involve up to 60 acres of tree removal, he responded "It is hard to say whether we'd support a project without further information and seeing an engineered design; however, it would be very detrimental to a proposal if this many acres of existing forest is being negatively impacted." Then, he discussed the evolving state of the science about stream removal projects. He said "There are many new, more surgical approaches that can protect existing trees while meeting project goals. For example, if the goal of the project is to actively reconnect the stream to the floodplain, some upland trees that exist now may die overtime as new, more riparian appropriate species take hold. This shift in the regime can happen overtime to protect habitat, stream temperature, etc. while promoting more appropriate ecological functioning."

Crable, Ad. 2024. "Chop and Drop" Tree Felling Aims to Improve Stream Ecosystems in Pennsylvania. Bay Journal. April 25, 2024.

This article describes forest maintenance practices used on land managed by the Western Pennsylvania Conservancy and Allegheny National Forest in Pennsylvania. The practice deliberately places fallen tree trunks and root balls into stream channels in order to attenuate stormwater velocity and force stormwater runoff into the adjacent floodplain, reducing erosion and creating aquatic habitat. Accessed at https://www.bayjournal.com/news/wildlife_habitat/chop-and-drop-tree-felling-aims-to-improve-stream-ecosystems-in-pennsylvania/article_bbb95bae-fe4b-11ee-86ceb73ce8e8f98e.html on June 18, 2024.

Craig, Laura S., Margaret A. Palmer, David C. Richardson, Solange Filoso, Emily S Bernhardt, Brian P. Bledsoe, Martin W. Doyle, Peter M. Groffman, Brooke A. Hassett, Sujay S Kaubal, Paul M. Mayer, Sean M. Smith, and Peter R. Wilcock. 2008. Stream Restoration Strategies for Reducing River Nitrogen Loads. Frontiers in Ecology and the Environment. Vol.6 , Number 10, 529-538. Accessed at https://www.jstor.org/stable/20441018 on 5/7/2023.

> The Elkhorn Branch Prospectus claimed that this article supports the statement "stream restoration WILL improve water quality through the reduction of stream bank erosion and the downstream transport of associated pollutants, improve instream nutrient processing".
>
> The article does not support these claimed "benefits". The use of this article to claim reduction of nitrogen concentrations is moot, since the 2015 CA Watershed Quality Report did not identify nitrogen concentrations to be elevated. Instead, the article says that "stream restoration alone is not appropriate for compensatory mitigation and should be seen as complementary to land-based best management practices"

Ensign, Scott H., and Martin W. Doyle. 2005. In-channel transient storage and associated nutrient retention: Evidence from experimental manipulations. Limnology and Oceanography 50, p. 1740-51. Accessed at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.files/fileID/13937 on 5/7/2023.

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Field, John. 2020. A National Model for Stream Restoration. RMS Journal. Vol. 33, Issue 2. Summer, 2020.

> This article summarizes a stream restoration project conducted in Maine using the "large woody material stream restoration" method. Instead of floodplain reconnection using aggressive, destructive tree removal, site grading, and engineered structures using foreign materials, this method focuses on placement of dead tree trunks, limbs, root balls, and other forest litter within and across the stream channel in order to attenuate stormwater velocities and capture sediment. Within two months, stream flow was returned to the disconnected floodplain for the first time in 40 years, without the need for destructive deforestation.

Groffman, Peter M., Ann M. Dorsey, and Paul M. Mayer. 2005. N Processing within Geomorphic Structures in Urban Streams. Journal of the North American Benthological Society 24: 613-25. Accessed at https://www.jstor.org/stable/10.1899/04-026.1 on 5/7/2023.

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Hawley, Robert J., Kathryn Russell, and Taniguchi-Quan, Kristine. 2022. Restoring Geomorphic Integrity in Urban Streams via Mechanistically-Based Storm Water Management: Minimizing Excess Sediment Transport Capacity. Urban Ecosystems. Vol. 25, p. 1247-1264. Accessed at https://link.springer.com/article/10.1007/s11252-022-01221-y on 5/8/2023.

> This article presented case studies showing that, to reach a goal of geomorphic stability in urban watersheds, stormwater control measures to reduce erosion potential must be implemented.

Hilderbrand, Robert H. 2020. Determining Realistic Ecological Expectations in Urban Stream Restorations. Study funded by Chesapeake Bay Trust Award #15823. July 2020. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

> The study of more than 20 stream restoration projects documented that biological uplift goals were not met.

Hilderbrand, Robert H., Joseph Acord, Timothy Nuttle, and Ray Ewing. Undated, except after 2017. Quantifying the ecological uplift and effectiveness of differing stream restoration approaches in Maryland. Study funded by Chesapeake Bay Trust Award #13141. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

> There is a large amount of information to unpack in this report. In a study of stream restorations on 40 urban streams in the Baltimore/Washington area, this study found no evidence of ecological uplift. The report went on to conclude that the practitioners of stream restoration are aware of this, but the public and regulators are not. With respect to the Elkhorn Branch project, this supports claims that the contractor is deliberately not disclosing any studies or articles that provide any negative observations, because it is damaging to their business model.

Howard County DPW NPDES Permit MD0068322 Annual Report for Fiscal Year 2021.

> The annual update of results from watershed monitoring includes several watersheds in which "stream restorations" had occurred in prior years. The results are as follows:

- Wilde Lake – the report discusses the erosion and sedimentation status of the upstream reach (the location of the Longfellow "stream restoration" project) and the downstream reach. As of 2021, the "upstream reaches are not experiencing the same level of erosion as the downstream reach and have remained relatively stable over 2017-2021 period". Given this observation, it is not clear why a "stream restoration" project was implemented in the upper reach in 2020-21. The report goes on to state that a "newly constructed stream restoration project in the upstream reach should provide increased stability". Since the upper reach was not exhibiting any instability, it is not clear how such a destructive project in that area, removing acres of trees, can be expected to provide "increased stability".
- Red Hill Branch – This area is downstream of the Bramhope Lane stream restoration project done in 2011. The monitoring in 2021 found no improvement in water quality. The biological monitoring results "have not shown any significant improvement after restoration". The results did show a reduction in erosion, but noted that flood damage to an upstream debris dam had contributed sediment into the survey area.
- Dorsey Hall – The post-restoration biological and physical monitoring results showed that "habitat results have been similar throughout the post-restoration period", with the sites falling into the lowest "severely degraded" category. The physical habitat results show that both monitored sites continue to be severely impacted, "with no evidence yet of ecological uplift after restoration".

Howard County DPW NPDES Permit MD0068322 Annual Report for Fiscal Year 2022.

The annual update of results from watershed monitoring includes several watersheds in which "stream restorations" had occurred in prior years. The results are as follows:

- Wilde Lake – The water quality results continued to show elevated total suspended solids concentrations. With respect to biological monitoring, the report states "Overall, the stream system in the Wilde Lake watershed continues to exhibit evidence of the urban stressors affecting it and has not demonstrated measured improvement in either habitat quality or ecological stream health over the seventeen years of monitoring.".

  Most concerning is the geomorphic assessment, conducted long after the Longfellow project was completed. The text states "The main goal of the monitoring is to assess the temporal variability of the geomorphic stability of the stream channels upstream of the lakes as they react to restoration activities. Overall, implementation of projects in the watershed do not appear to have significantly improved the physical habitat in the tributary streams."
- Red Hill Branch – This area is downstream of the Bramhope Lane stream restoration project done in 2011. The monitoring in 2021 found no improvement in water quality. The biological monitoring results show that "post-restoration monitoring results indicate a subwatershed in an overall degraded ecological condition, with little change from the first two years of pre-restoration monitoring." In fact, the BIBI scores in 2022 were "slightly worse results than during 2021". Habitat assessments in 2022 were "nearly identical to

2021 and 2020 results", with all sites rated as "degraded". The text states "The biological community and habitat continue to fluctuate slightly from year-to-year, with 2022 results a slight decrease from 2021, but remain in a degraded condition and have not shown any significant improvement after restoration. The report did note that there had been reductions in erosion.

- Dorsey Hall – The post-restoration biological and physical monitoring results were the same as reported for 2021. The report showed that "habitat results have been similar throughout the post-restoration period", with the sites falling into the lowest "severely degraded" category. The physical habitat results show that both monitored sites continue to be severely impacted, "with no evidence yet of ecological uplift after restoration".

Kaushal, Sujay S., Kelsey L. Wood, Phillippe G. Vidon, and Joseph G. Gallela. 2021. Tree Trade-offs in Stream Restoration Projects: Impact on Riparian Groundwater Quality. Study funded by Chesapeake Bay Trust. March 2021. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

This report concludes that tree removal during stream restoration resulted in long-term degradation of groundwater quality. Shallow groundwater will eventually discharge as surface water runoff, carrying these pollutants into streams and lakes.

Mayer, Paul M., Michael J. Pennino, Tammy A Newcomer-Johnson, and Sujay S. Kaushal. 2022. Long-Term Assessment of Floodplain Reconnection as a Stream Restoration Approach for Managing Nitrogen in Ground and Surface Waters. Urban Ecosystems Vol. 25, p. 879-907. Accessed at https://link.springer.com/article/10.1007/s11252-021-01199-z on 5/8/23.

This article states that stream restoration can be an important component of holistic watershed management "if stream restoration and floodplain reconnection can be done in a manner to resist the erosive effects of large storm events." Since this project will NOT control runoff, the stream will still be subject to the erosive effects of large storm events.

Miller, Jerry R., and Kochel, R. Craig. 2012. Use and Performance of In-Stream Structures for River Restoration: A Case Study from North Carolina (abstract). Environmental Earth Sciences, Vol. 68, pgs. 1563-1574. Accessed at https://link.springer.com/article/10.1007/s12665-012-1850-5.

This study assessed the long-term stability of in-stream structures (cross-vanes, j-hooks, rock vanes, and w-weirs) used to limit bank erosion in river restoration. The study evaluated 558 in-stream structures from 26 sites in North Carolina, ranging from 1 to 8 years in age. The study identified structural damage and failures at 10 of the 26 sites. The final statement was "The data question whether currently used in-stream structures are capable of stabilizing reconfigured channels for even short periods when applied to dynamic rivers."

Myers, Doug. 2023. Chesapeake Bay Foundation. Testimony to the CA Board Meeting on January 12, 2023. Video available at https://www.youtube.com/watch?v=8p8M7ebpl9o, beginning at time stamp 1:50:00.

Mr. Myers repeatedly stressed that it is useless to attempt stream restoration if you do not first address the source of the problem, which is increased runoff. This project will not control runoff. At the end of Mr. Myers presentation, he was asked if, in his expert opinion, it would be better to do the project and see what happens, or if it would be better to do nothing. Mr. Myers stated that the evolving science says that it would be better to do nothing, and let the stream heal itself.

Palmer, Margaret A., Solange Filoso, and Rosemary M. Fanelli. 2013. From Ecosystems to Ecosystem Services: Stream Restoration as Ecological Engineering. Ecological Engineering, Vol. 65, Pgs. 62-70. Accessed at https://pubag.nal.usda.gov/catalog/5378506 on 4/30/2023.

This article concluded that urban stream restoration does not result in net annual benefits in reduction of nitrogen. With respect to retention of sediment, the article concludes that this does occur initially, it will decrease over time. In addition, the article documented that loss or damage of riparian forests and pulses of sediment released during construction may offset other project benefits. Therefore, the article concluded that use of approaches that require substantial ecosystem modification to enhance a limited number of biophysical processes should be limited to the most degraded systems, and then only after less invasive approaches, such as upland reforestation, reduced lawn fertilization, and better stormwater management at the source of runoff generation have been exhausted.

Palmer, Margaret A., K.L. Hondula, and Benjamin J. Koch. 2014. Ecological Restoration of Streams and Rivers: Shifting Strategies and Shifting Goals. Annual Review of Ecology, Evolution, and Systematics 45:247-69. Accessed at https://www.annualreviews.org/doi/10.1146/annurev-ecolsys-120213-091935 on 5/7/2023.

This is probably the key article that documents failures of stream restoration projects to meet almost every metric of success. The study involved an assessment of reported monitoring results in 644 streams. The article documents that the projects usually improve habitat, substrate, and channel form, but this is because these measures have recently been physically manipulated as part of the restoration. These are not measures of the long-term condition of the stream, and others researchers have documented that these manipulations do not last if runoff is not controlled. With respect to stability, the study found that less than half the projects showed improvements in channel stability compared to pre-restoration conditions, even though the projects had used rip-rap and boulders to try to stabilize the streams. Improvements in water quality metrics were only met 7% of time. The projects did improve indicators of hydrologic or biogeochemical processes, but these were not accompanied by any increased aquatic biodiversity or recovery of sensitive species. This was a common finding in other articles – that, although the metrics showed improvements in habitat, channel form, substrate, and velocity, these improvements were not accompanied by improvements in biodiversity. There was also no improvement in taxa richness, except for one area where the increase in taxa was due entirely to the addition of some taxa that are tolerant or urban stream conditions.

Palmer, Margaret. 2023. University of Maryland. Email to Bob Dover regarding NCD Stream Restoration Methodology. May 7, 2023.

> Because Dr. Palmer's article was developed in 2014, Bob Dover contacted her by email in May, 2023, to notify her that he intended to use the article to oppose a proposed project, and to determine whether the statements and conclusions made in the article still reflect her current opinions about the effectiveness of stream restoration. She responded "Yes, they absolutely do."

Simon, A., M. Doyle, M. Kondolf, F.D. Shields, B Rhoads, G. Grant, F. Fitzpatrick, K. Juracek, M. McPhillips, and J. MacBroom. 2005. How Well do the Rosgen Classification and Associated "Natural Channel Design" Methods Integrate and Quantify Fluvial Processes and Channel Response? Abstract from conference paper. DOI publication 10.1061/40792(173)584. Accessed at https://www.usgs.gov/publications/how-well-do-rosgen-classification-and-associated-natural-channel-design-methods on 5/10/23.

> This abstract from a conference presentation challenged the idea, of David Rosgen, that classification of streams and "natural channel design" are equivalent or superior to the science of fluvial geomorphology. The authors lamented that "para-professional training" had empowered individuals and groups with limited backgrounds to re-engineer entire stream systems. The abstract concluded that, while the system makes it easy to communicate between practitioners, but that does not justify its use for engineering design or for predicting river behavior, and its use for designing mitigation was beyond its technical scope.

Simon, A., M. Doyle, M. Kondolf, F.D. Shields Jr., B. Rhoads, and M. McPhillips. 2007. Critical Evaluation of How the Rosgen Classification and Associated ''Natural Channel Design'' Methods Fail to Integrate and Quantify Fluvial Processes and Channel Response. Journal of the American Water Resources Association (JAWRA). Vol. 43, Number 5, Pg. 1117-1131. Accessed at https://naldc.nal.usda.gov/download/7764/PDF on 5/10/23.

> The purpose of the article was to "present a critical review, highlight inconsistencies, and identify technical problems of Rosgen's natural channel design approach to stream restoration." The text states that Rosgen's training business has "empowered individuals and groups that may have limited backgrounds in stream and watershed sciences to engineers modifications of streams whose scientific underpinning is based on 50-year-old technology never intended for engineering design."

Southerland, Mark, Chris Swan, and Andrea Fortman. 2017. Meta-Analysis of Biological Monitoring Data to Determine the Limits on Biological Uplift from Stream Restoration Imposed by the Proximity of Source Populations. Study funded by Chesapeake Bay Trust. September 2017. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

> This report was largely inconclusive, but did conclude by saying that expectations for biological uplift from stream restorations should be tempered, because there is no upstream source of genetic material. The report was mostly setting the stage so that the chief investigator could ask for more funding for more studies.

Thompson, Tess, and Eric Smith. 2021. Improving the Success of Stream Restoration Practices – Revised and Expanded. Study funded by Chesapeake Bay Trust Award #13970. June 2021. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

This report concludes:

- There are few studies that support the supposed benefits of stream restoration.
- Attempting these projects in urban watersheds will limit the potential for biological improvements.
- In-stream improvements to reduce channel erosion, sedimentation, and nutrient reduction will not be effective if excessive runoff is not controlled.
- Efforts to limit channel migration are opposed to the normal functions of streams, and will therefore limit ecosystem health.
- The practice of stream restoration has far outpaced the science. Practitioners base their efforts on their own personal experience, which is not written and not made available for study. Where they have been made available, they are non-quantitative and anecdotal.

Welty, Claire, Andrew J. Miller, and Jonathan M. Duncan. 2021. Quantifying the Cumulative Effects of Stream Restoration and Environmental Site Design on Nitrate Loads in Nested Urban Watersheds Using a High-Frequency Sensor Network. Study funded by Chesapeake Bay Trust Award #15828. 2021. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

This report concludes that stream restorations did not provide any reductions in nitrate loads.

Williams, Michael R., Wessel, Barret M., and Filoso, Solange. 2016. Sources of Iron (Fe) and Factors Regulating the Development of Flocculate from Fe-oxidizing Bacteria in Regenerative Streamwater Conveyance Structures. Ecological Engineering. Vol. 95, pgs. 723-737. October, 2016. Accessed at https://www.sciencedirect.com/science/article/abs/pii/S0925857416304451 on July 1 2024.

This article discusses the sources and impacts of iron-oxidizing bacteria (FeOB) identified in regenerative stormwater conveyances (RSCs) developed as a stream restoration best management practice. The analysis discusses how the flocculate is associated with several environmental changes implemented as part of RSC projects, including the introduction of dissolved organic carbon through the use of natural organic material in the construction, and warmer temperatures due to removal of tree canopy.

Wood, Kelsey L., Sujay Kaushal, Phillippe G. Vidon, Paul M. Mayer, and Joseph G. Galelle. 2022. Tree Trade-Offs in Stream Restoration: Impacts on Riparian Groundwater Quality. Urban Ecosystems. Abstract accessed at https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=CPHEA&dirEntryId=355730 on 5/8/2023.

The article states that “riparian tree removal can lead to significant groundwater quality impacts”, and that “where possible mature trees and soil profiles should be conserved”.

Evaluation of Dredging History

Lake Audubon, Reston, Virginia

Lake Elkhorn, Columbia, Maryland

June 2024

A primary argument used by stream restoration companies to support the implementation of "stream restoration" projects is the purported need to reduce growing costs for dredging in local lakes. The dredge material results from transport of sediment from upland areas in developed cities, and also from erosion within stream channels in the watersheds. The theory is that floodplain re-connection and other stream "restoration" techniques will stabilize the stream banks, thus reducing erosion within the stream channels, and ultimately reducing the volume of sediment transported to the lakes. The proponents of these projects justify the short-term, capital construction costs by claiming that they will be offset by future, long-term savings in dredging costs.

These arguments were used in 2022-23 by Watershed Studies and Solutions (WSSI), a stream restoration contractor, in order to support their proposal to implement the Elkhorn Branch Mitigation Bank project on land owned by the Columbia Association (CA), in Howard County, Maryland. As part of their proposals to CA, WSSI cited their past stream restoration project at Snakeden Branch, in Reston, Virginia, as the model for what they proposed to do at Elkhorn Branch.

Summary of Dredging in Reston

In 2008, in a press release titled Reston Water Myths and Facts, WSSI and the Reston Association argued in favor of a stream restoration in Snakeden Branch, estimating that such a project would reduce dredging costs by half. The project was implemented sometime between 2009 and 2010.

To evaluate this claim, the publicly available dredging data from Lake Audubon, in Reston, were obtained, and are presented in Table 1, below. Unfortunately, the data are sparse, but they document that there was an annualized dredging volume of approximately 1,000 to 1,100 cubic yards per year prior to the 2009 stream restoration. The Reston Water Myths and Facts document also provided an estimate, claiming that the lake was dredged every 6 to 8 years, at a total volume of 10,000 cubic yards. However, given that we know that the 2010 dredging was the fourth that occurred in the 32-year history of the lake, the real frequency is much closer to 8 years than 6 years. Therefore, the average annualized dredging volume based on the Reston Water Myths and Facts data is somewhere between 1,000 and 1,250 cubic yards per year.

In 2019, Lake Audubon was dredged for the first time in 8.5 years, with a volume of 13,500 cubic yards. This is an annualized volume of 1,588 cubic yard per year. Depending on the exact dates of dredging, which affect the annualization calculation, this is an increase in the range of 30 to 60 percent following the stream restoration, as opposed to the promised decrease of 50 percent.

Table 1 – Dredging History in Lake Audubon, Reston, Virginia

Dredging Date	Dredging Volume (cubic yards)	Annualized Volume (cubic yards)
Lake Audubon created - 1979		
1987	8,000[1] (12,000 combined Lake Audubon and Lake Thoreau[2])	1,000 cy/year
1994	8,000[1]	1,142 cy/year
2002-03[3]	?	?
Stream Restoration - 2009		
August, 2010	?	?
February, 2019	13,500	1,588 cy/year

1 – Source Citizen's Advisory Committee for Environment and Ecology, Reston Association, White Paper on Reston's Watersheds, December, 2008

2 – The specific volume for each lake is not reported. However, a later source reports that Lake Thoreau was dredged in 2018, with a volume of 4,200 cy, and Lake Audubon was dredged in 1994 with a volume of 8,000 cy. Therefore, this analysis assumes that the 1987 volume of 12,000 cy was approximately 8,000 cy for Lake Audubon and 4,000 cy for Lake Thoreau. The value for Lake Audubon is supported by the later report of about 1,250 cy/year by WSSI in Reston Water Myths and Facts.

3 – There is no data on the date or volume of this event. However, The Patch article dated August 4, 2021, reports that the 2010 event was the fourth dredging of Lake Audubon. Because the dates of 1987 and 1994 are known, and assuming a relatively consistent frequency, then the third event would have occurred in about 2002-03.

Summary of Dredging in Columbia

Lake Elkhorn in Columbia has only been dredged twice since it was filled in 1974. The first time was in 2012-13, almost 40 years after the lake was constructed. That event removed a total of 59,851 cubic yards, or an annualized volume of 1,535 cy per year. The lake was then dredged again in 2020-21, with a total volume of 12,270 cubic yards, or 1,535 cy per year. Therefore, there is no indication that erosion rates in Elkhorn Branch have increased in recent years, or are currently any higher than they were when Columbia was first developed.

In addition to the unusual choice to not dredge Lake Elkhorn for almost 40 years, the 2012-13 dredging event was marred by mismanagement and controversy. A contract was issued to a contractor in 2009, but that contractor stopped work shortly after beginning. They sued CA for $1,000,000 for non-payment, claiming that CA had failed to properly estimate the volume of material to be removed. Meanwhile, the contractor's equipment remained onsite for several years, while the situation was resolved. Ultimately, the original contractor was either fired or withdrew from the project, and a new contractor was hired to finish the project in 2012.

This event is still a sore spot for many of the Lake Elkhorn residents in 2024. These residents strenuously supported the proposed Elkhorn Branch stream restoration project, citing not only the cost of dredging, but the adverse impact of dredging activities on the local community at the lake. It is easy to understand how the staging of heavy machinery and dredging equipment near the lake for a period of more than three years would have been very disruptive to the local residents, and would leave a sour taste and a desire to minimize the size and frequency of future dredging projects. However, the impact of the 2009-13 event on the residents was not caused by excessive erosion in Elkhorn Branch, and similar events in

the future will not be avoided by implementing a stream restoration project there. Instead, the situation was caused by mismanagement of the dredging project by the CA watershed staff. Either the staff truly failed to accurately estimate the dredging volume, or they hired an incompetent or disreputable contractor.

In any case, the choice to wait almost 40 years before the initial dredging of Lake Elkhorn almost certainly exacerbated the complications associated with that first dredging event. While the local residents are certainly justified in wanting to understand the cause of these complications so that they can be avoided in the future, there is no indication that this situation could have been avoided in the past, or would be avoided in the future, through a stream restoration project.

Conclusion

A need to reduce dredging volumes, and claims that erosion rates in the streams have increased due to development, are one of the primary arguments used by stream restoration companies, and the individual regulators and land managers, to support costly and destructive stream restoration projects on land managed by the Columbia Association. The contractor who proposed the Elkhorn Branch project to CA, WSSI, presented their Snakeden Branch project in Reston as their model for how the Elkhorn Branch project would be constructed, and would operate. In 2008, prior to constructing the Snakeden project, WSSI promised, in writing to the Reston community, that the project would reduce dredge volumes by 50 percent. Instead, the dredge volume in Reston increased by about 30 percent. In addition, dredging data for Lake Elkhorn obtained from CA shows that the annualized dredge volume between 2013 and 2020 was the same as that before 2013. Therefore, claims that erosion rates in the streams are increasing, or that the erosion rates can be reduced through a stream restoration project, are not supported by actual data in either Reston or Columbia.

Analysis of the Impact of Trees on Stormwater Hydrology

Bob Dover

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Introduction

I have had substantial professional experience in surface water hydrology, including multiple projects in which I analyzed the hydrologic effects of either planting fast-growing trees, or of removing trees. There is an enormous body of literature on this subject – it is not complicated, nor is it controversial. Trees perform the following hydrologic functions:

- Trees directly remove stormwater from the watershed through evapotranspiration. Trees remove enormous quantities of groundwater, substantially lowering the elevation of the water table. Also, tree roots are very effective promoters of infiltration pathways. Operating together, these provide substantial storage for stormwater in the unsaturated zone, and active infiltration pathways for surface water to get to that storage. When trees are removed, the groundwater table in the immediate area immediately rises, a process known as "watering-up". This allows the unsaturated zone to become saturated during a storm much more quickly. It is well-established in logging areas that removal of trees immediately increases the frequency and intensity of surface water flooding.
- Watering up also has the effect of killing whatever trees have been left in place. Even if a tree removal project leaves some trees uncut, they will quickly die due to the modification of their hydrologic setting. This can be clearly seen at Longfellow, and at The Glade in Reston. Advocates of stream restoration like to proclaim that these projects do not "clearcut" forests. This depends on the definition of "clearcut". At both Longfellow and The Glade, a small number of mature trees were left uncut by the developer. In both cases, all of those leftover trees died anyway, and still stand there today as ghostly reminders of the mature forest that once thrived in both places.
- Trees also directly remove stormwater from the watershed before it reaches the ground, through evaporation. When it rains, the trunk, branches, and leaves get wet – a process known as canopy interception. Following the rain, much of this water evaporates without reaching the ground. This is a large amount of water. When trees are removed, this water that would have evaporated over time instead reaches the ground immediately, during the most intense part of the storm, and becomes stormwater.
- Much of the water from the branches and leaves that does drip and reach the ground does so in the hours or days following a storm. Although the water enters the watershed, it does so slowly, over a period of hours or days, and thus does not add to the immediacy of a flood during a storm. Removal of trees eliminates this attenuation effect of trees, thus adding to stormwater volumes at the very time that additional water is most destructive.
- The presence of tree trunks and fallen tree trunks, branches, and leaves all add to the roughness of the forest floor. This roughness is another strong attenuation effect on stormwater. It slows the stormwater velocity, reducing its erosive effect. Removal of trees allows stormwater to flow freely, with nothing to hinder its velocity and erosive powers.

- The root structures of trees, as well as fallen trunks and branches, serve to stabilize soils in place and protect them from erosion. Removal of trees removes this stabilizing effect, exposing soils to increased erosion and downstream transport.
- Trees directly reduce nutrient concentrations, such as nitrogen, in groundwater and, by extension, in nearby surface water bodies that receive discharged groundwater.

In all cases, there are some important observations:

1) The effect is highest at the tree, and diminishes with distance from the tree. Therefore, removal of trees within close proximity of surface water bodies has a substantial ability to influence the amount of stormwater that enters the stream.
2) The effect is immediate when a tree is cut down. The hydrologic functions of the tree cease immediately, the groundwater level begins to rise immediately, and adverse effects on nearby streams can be seen to happen within a few weeks.
3) The effect is permanent, unless trees of similar size and evapotranspiration capacity take their place. Where mature trees are removed and attempts to re-establish the forest are made, the hydrologic system can take 10 to 20 years to recover.

Almost all of the discussion regarding stormwater management issues in urban watersheds focuses on the conversion of permeable land surface to impermeable, thus eliminating infiltration and increasing the volume and velocity of stormwater. This is true, but it is the highly visible part that is easy to understand and explain to people. Evaporation and evapotranspiration are invisible. You cannot stand by a tree and watch as it physically removes water from the watershed, as the groundwater table is lowered, and as the water is evaporated into the atmosphere. Nevertheless, this happens, in enormous quantities. By some estimates I have looked at, forests stands in Maryland evaporate more than 50% of the precipitation that falls on them (Sanford, Ward E., and Selnick, David L., 2012). When these trees are removed, this water raises groundwater levels, reducing water storage capacity during a storm. This excess water then becomes stormwater during rainstorms. ***Removal of trees directly, and immediately, increases the frequency and intensity of floods.***

The following paragraphs describe four projects involving the hydrologic impacts of trees with which I have been personally involved:

Morton Grove Remediation Site, Illinois

The Morton Grove facility was the site of contaminated groundwater and soils. Prior to my association with the site, the site owner, in coordination with the Illinois Environmental Protection Agency, had installed a phyto-remediation system to capture and treat groundwater. Phyto-remediation is a common remediation technique that uses trees to remove contaminated groundwater, reverse, the direction of groundwater flow, and metabolize organic contaminants.

My role on the project was to oversee quarterly groundwater monitoring events to verify the continuing efficacy of the system. The principal activity was to measures groundwater levels across the site to verify that the reversal of the groundwater flow direction forced by the planted trees was still in effect. It was this reversal of groundwater flow direction, accomplished entirely by the planting of trees, that stopped contaminated groundwater from flowing onto the adjacent property. In the two years that I was associated with the project, there was never a situation in which the trees failed to keep the groundwater flow direction under control.

Townhouse Condominium Community, Central Maryland

I was on the Board of my condominium association when I owned a townhouse. Our community had a stormwater retention pond, close to two blocks of townhouses, in which there were two mature willow trees. During an inspection, a contractor noted that the trees were diseased and cut them down.

Even though they were diseased, the trees were still alive, and were still removing large amounts of groundwater. Within a period of weeks, residents at the two nearby townhouse blocks reported that their sump pumps were running full time, and that they had to purchase dehumidifiers to stop mold from growing in their basements.

The residents petitioned the Board to immediately replace the removed trees with mature willow trees. The Board approved the planting of two 12-foot willow trees, despite a very high cost. The trees established root systems very quickly, and the residents reported that their sump pumps stopped running within a couple months of the planting.

Application for Cold-Tolerant Eucalyptus Trees, Southeastern United States

A private developer filed an application with the USDA Agricultural Research Service (ARS) to approve the sale of their product, which was cold-tolerant eucalyptus trees, to lumber companies in the southeastern US. Eucalyptus trees are very fast-growing trees, and being able to establish them in the US would allow lumber companies to reduce the growing time before their re-planted trees could be harvested.

My role was to serve as the surface water hydrology expert on the Environmental Report filed with ARS as part of the application. There was a substantial amount of public opposition to the project, due to the well-documented effect of the fast-growing trees on groundwater levels while they were growing, and on flood intensity and frequency once they were harvested. My research showed that there was a large body of literature on these subjects from projects throughout the world. Both depression of groundwater levels during growth, and increase in flood intensity and frequency following harvesting, were well documented in hundreds of locations. In the face of these reports and the public opposition, the applicant withdrew the application before ARS could make a decision on approval.

Construction of Wind Farm, Keyser, West Virginia

I served as the lead Environmental Compliance Inspector for the construction of this wind farm in 2012. The project included the installation of 23 wind turbines along the crest of a ridge, requiring complete tree removal on 23 pads, each approximately two acres in size, as well as along the 2-mile-long road that connected the pads. The only activity in the affected area was tree removal – there was no paving, and no substantial soil compaction.

Immediately after the removal of the trees, the mountain effectively sprung leaks on its slopes. The water table, which had been in stable equilibrium between precipitation and evapotranspiration for millennia, immediately rose several feet once the evapotranspiration ceased. This caused the water table to find outlets through the fractured bedrock to the surface, creating springs and streams where none had previously existed. During rainstorms, these became overwhelmed, causing flooding of homes on the slopes of the mountain. I left the project before I saw the final results, but I was present when one home, which was used as an office by the developer, was flooded as a result. I later heard that the developer ended up purchasing several of the homes, although I have no documentation of this.

Annotated Bibliography on Urban Stormwater, Forestry, and Effects of Tree Removal on Hydrology

Berland, Adam, Sheri A. Shiflett, William D. Shuster, Ahjond S. Garmestani, Haynes C. Goddard, Dustin L. Herrmann, and Matthew E. Hopton. 2017. The Role of Trees in Urban Stormwater Management. Landscape and Urban Planning, Vol. 162, Pg. 167-177. Accessed at www.sciencedirect.com/science/article/abs/pii/S0169204617300464 on 5/23/2023.

> Technical article from Berland and others (2017) stating that "a narrow focus on infiltration overlooks other losses from the hydrologic cycle, and we propose that arborculture – the cultivation of trees and other woody plants – deserves additional consideration as a stormwater control measure. Trees interact with the urban hydrologic cycle by intercepting incoming precipitation, removing water from the soil via evapotranspiration, enhancing infiltration, and bolstering the performance of other green infrastructure technologies."

Cappiella, K., T. Schueler, and T. Wright. 2005. Urban Watershed Forestry Manual: Part 1. Accessed at https://urbanforestrysouth.org/resources/library/ttresources/urban-watershed-forestry-manual-part-I on 5/27/2023.

> This is a manual to be used by USDA Forest Service staff in increasing forest cover in urban environments. In a preliminary discussion of urban forestry, the documents discusses the watershed benefits of tree cover, including reducing stormwater runoff, improving air quality, reducing stream channel erosion, providing habitat for terrestrial and aquatic wildlife, improving soil and water quality, and reducing summer air and water temperatures.

Center for Watershed Protection. 2017. Making Urban Trees Count. Accessed at https://cwp.org/making-urban-trees-count/ on 4/20/23.

> This web-based article included a review of 159 publications to understand the effect of urban trees on reducing runoff, nutrients, and sediment. Then, they used the observations to develop a water balance model and recommendations for tree planting credits that could be used for planting of trees in an urban environment.
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> This article demonstrates that many organizations involved in assessing and restoring urban watershed are focused on the benefits of planting upland trees, instead of undertaking projects that directly remove upland trees.

Center for Watershed Protection. 2022. Using a Novel Research Framework to Assess Water Quality Impacts of Urban Trees. Study funded by Chesapeake Bay Trust. July 2022. Accessed at https://cbtrust.org/grants/restoration-research/ on 6/10/23.

> The study cited another source, in which an expert panel on the Chesapeake Bay recommended BMP credits be offered for planting to increase tree canopies, and for conservation and maintenance of tree canopies, because of the positive effects of the tree canopies in reducing runoff. This observation is based ONLY on the evaporation from the tree canopies – it does not include evapotranspiration by the trees, which other studies have shown to have an even greater effect on runoff.

North Street Neighborhood Association. 2009. Watering-Up: Studies of Groundwater Rising After Trees Cut. Accessed at https://www.northassoc.org/2009/03/09/watering-up-studies-of-groundwater-rising-after-trees-cut/ on June 3, 2023.

This is a compilation of articles that discuss the phenomenon and impacts of "watering-up", which is the increase in the elevation of the water table and consequent increase in runoff after trees are removed.

Sanford, Ward E., and David L. Selnick. 2012. Estimation of Evapotranspiration Across the Conterminous United States Using a Regression with Climate and Land-Cover Data. Journal of the American Water Resources Association. Vol. 49, Issue 1. Accessed at https://onlinelibrary.wiley.com/doi/full/10.1111/jawr.12010 on 5/7/2023.

This is a technical article on the evapotranspiration functions of trees. See Figure 13, which shows that forests in central Maryland are estimated to remove more than 50% of the total rainfall from the watershed through evapotranspiration.

US Environmental Protection Agency. 2023. Soak up the Rain: Trees Help Reduce Runoff. Accessed at https://www.epa.gov/soakuptherain on 4/20/23.

This is an EPA program designed to educate the public about the hydrologic effects of trees. It provides links to a large number of resources, including technical articles and state government-based programs, related to the removal of water from the hydrologic system through tree canopy evaporation and evapotranspiration.