A Review of Little Hunting Creek Watershed, Paul Spring Segments 1 & 2 (Brickelmaier Park and Goodman Park), Hollin Hills Stream Restoration 100% Plans

By R.H. Simmons, March 2020

An environmental review of the Brickelmaier Park and Goodman Park stream construction projects was prepared pro bono for the Hollin Hills Parks Preservation group to provide a better understanding of the technical aspects inherent in natural channel design stream construction projects and to help residents appreciate the enormous changes that will occur to the natural landscape of the Hollin Hills community and forested stream valleys if these projects proceed as planned.

I visited both sites on November 22, 2019 (a representative of Fairfax County Stormwater Planning Division was also in attendance) and again on December 6, 2019.

In my professional opinion as an environmental scientist and ecological restoration practitioner over the past three decades, including as vegetation ecologist and contributor to the U.S. National Vegetation Classification and one who has performed many hundreds of wetlands and stream assessments, I strongly urge the county not to support the Hollin Hills stream construction projects as currently scoped and planned.

<u>Erroneous assumption that natural channel design is generally inherently good for stream ecosystems</u>

The proposed Brickelmaier Park and Goodman Park projects are way over-engineered and an overkill solution to relatively minor and sporadic stream channel downcutting - particularly as applied to small order, upper headwater seepage streams (one of which is intermittent and the other barely perennial). Moreover, both streams are on private property. Does the county typically spend significant tax dollars, not to mention considerable staff time, on issues more appropriately addressed in the private sector?

On my site assessments, I did not see significant *ongoing* erosion of the stream channels. The “knife-cut” blowout in a section of the channel with especially erodible soils at Goodman Park is largely the result of an isolated event of particularly heavy stormwater runoff - owed to the unfortunate placement of a large culvert outflow between the 1909 and 1911 Martha’s Road properties that drains offsite impervious surface. The very narrow, much-deepened channel now functions as a sort of plunge pool, with stormwater likely not transporting sediments beyond the deep channel cut.

My recommendation for restoring this section of the channel (and elsewhere) is very similar to that proposed by Dr. John Field, a fluvial geomorphologist and stream restoration specialist, in his recent evaluation of the projects: to carefully install long sections of tree trunks (and stumps) within the very narrow and deep channel cut and to use the layers of trunks to trap fallen organic matter and transported sediments. In short, the tree trunks will structurally support the channel banks, restore the floor of the channel closer to a natural grade, effectively slow all stormwater runoff, and filter and trap any sediments. To perform these same functions and fully restore the channel, I would also propose

Fig. 1. A high-quality, joint National Park Service-Department of Defense project to restore a stormwater blowout on a steep slope in old-growth Mesic Mixed Hardwood Forest at Arlington Woods bordering Arlington National Cemetery and Arlington House in Arlington County, Virginia. Natural-to-the-site quartzite sandstone boulders were carefully installed along the blowout, forming a series of plunge steps, and no trees were harmed or removed for the project. Infestations of English Ivy and other non-native invasive plants cover much of the forest, as they do at the Hollin Hills sites, though are slowly being removed here. The effects of sheetflow runoff from impervious surface into the site are also much the same as observed at Goodman Park. Also notice that because the forest community was retained, the site is not planted with a myriad of inappropriate species. Photo by R.H. Simmons.

adding large quartzite sandstone boulders or cobbles to the plunge pool drop-off at the outflow of the culvert (Fig. 1).

Eight years ago, I was requested by Arlington County to present this same best practice solution for an identical blowout on a steep, forested slope at Barcroft Park. It is a much less invasive and costly but highly effective method for controlling and reducing sediments and erosion, while preserving a site's native tree canopy and in situ natural resources.

[*The following three sections are adapted from a series of discussions and essays by a U.S. Army Corps of Engineers stream ecologist and R.H. Simmons regarding the limits of natural channel design projects*]

Unintended consequences of the Clean Water Act

While the Clean Water Act has accomplished many great things and benefited society, of late it has driven some unintended negative consequences by inducing inappropriate stream restoration projects. The driving force behind most geomorphic stream restoration projects in the Chesapeake Bay Watershed in recent years is local jurisdictions seeking to find ways to meet Clean Water Act requirements focused on reducing nutrient and sediment loads - principally Chesapeake Bay and individual river/stream Total Maximum Daily Load (TMDL) requirements, but also Municipal Separate Storm Sewer Systems (MS4) permits. TMDLs for sediment are set based upon what is necessary to reduce phosphorus loading because phosphorus is transported to the Bay in large quantities adsorbed to sediments.

Managing excess phosphorus (P) delivery is probably the greatest concern. The most important measures to curb excess phosphorus sediments are by improved agricultural practices, sanitary sewer rehabilitation, and better urban stormwater runoff management. So-called stream restoration projects, however, do not actually target phosphorus-rich deposits.

The stream bank and channel sediments that geomorphic projects prevent from eroding can be rich in phosphorus if they consist of recent erosion of topsoil (i.e., through inadequate silt fencing around soil disturbance of cropland), erosion of floodplain overbank deposits, and the like. Conversely, eroding geologic materials in upper headwater streams typically have minimal phosphorus in them compared to mid and lower stream reaches that contain floodplain sediments. Yet, headwater streams are often targets for geomorphic restoration work because substantial erosion can occur there.

Not surprisingly, soil samples cited in the Darr (2018) report for the Hollin Hills headwater stream channels and banks show very low levels of phosphorus.

Total nitrogen (TN), rather than various individual nitrogen (N) compounds, is utilized as the Bay and stream TMDL-crediting metric for nitrogen load reductions, probably for consistency with national practices. This has the effect of giving unit loads of nitrogen prevented in any chemical form the same credit, regardless of actual effect on water quality. Most of the total nitrogen contained within erodible channel and bank materials is in nitrogen forms that are poorly available biologically. Conversely, dissolved nitrogen forms in streams are highly bioavailable but only treated by stream restoration projects that increase stream/floodplain interaction or slow flows for instream processing. Thus, we effectively undervalue projects that reduce bioavailable nitrogen forms via instream and floodplain nutrient processing. Because of this, we perpetuate the unintended negative consequence of disfavoring projects that more greatly reduce bioavailable nitrogen load while focusing on the selection of erosion prevention projects that produce less actual nutrient load reductions.

There is growing recognition that total nutrient content of sediments is likely an inadequate means to evaluate the importance of various sediment parcels as nutrient sources to the Bay. Instead, bioavailability needs to be considered by nutrient form. To best help the Bay, we should focus on stream functions that would reduce delivery of biologically available nutrients by rivers to the Bay.

Stressors other than excess sediment

Depending on whether one is focusing on restoring streams or the Bay can lead to somewhat different determinations of what matters most. What is most important to the Bay may not be what is most important to restoring the health of an individual stream. For the Bay, the most important thing is reducing incoming biologically available nitrogen and phosphorus loads. For any given individual stream, the principal stressors vary.

In urban areas, degraded water quality from urban runoff and leaking sanitary sewers is often of greater importance than excess sediment as a stressor to stream aquatic life. Natural channel design projects generally cannot improve degraded water quality adequately to benefit instream life. For urban areas, there is a growing awareness that road salt runoff may be a principal stressor to aquatic life. This also cannot be affected by natural channel design projects.

In urban areas, altered flows from inadequate stormwater management produce high flows with precipitation events that scour out the stream, followed by reduced low flows that are stressful to aquatic life. Thus, altered stream flows are themselves a stressor. Natural channel design projects cannot correct altered stream flows.

Pros and cons of stream construction projects are not being weighed

The large-scale removal of existing, irreplaceable natural features, including mature and old-age trees and forest; rare and specialized plant species and habitats; and wildlife such as box turtles, salamanders, aquatic macroinvertebrates, etc., and their complete replacement with man-made, artificial elements and landscape is never a balanced trade-off, no matter what "natural techniques” are used in rebuilding the stream valley. No man-made landscape in any way compensates for the forever loss of natural elements.

Fig. 2. Red Eft, the orange-colored juvenile form of the Eastern Newt (*Notophthalmus viridescens*) - an example of declining native wildlife associated with interior forested stream valleys and wetlands. Photo by R.H. Simmons.

Natural lands managers, ecologists, engineers, planners, and design and build companies have a responsibility to thoroughly assess and present all irreplaceable natural resources and biota potentially affected by a stream restoration or wetlands project as necessary environmental review prior to construction (Fig. 2). The approach to date has traditionally been a very narrow scope solely through an engineering perspective, with little to no input from conservation biologists.

According to Bill Stack, Professional Engineer, Center for Watershed Protection Deputy Director of Programs, and co-lead in developing the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* with Tom Schueler of the Chesapeake Stormwater Network: “A severe training need exists among local and state governments, NGOs, and practitioners in understanding their application and the appropriate siting of projects. Also, the Expert Panel felt strongly that as a qualifying condition to receive credit, projects have to be part of a comprehensive watershed plan that also addresses the root causes of stream bank erosion: impervious cover. Further, stream restoration projects are supposed to demonstrate "functional lift" or improvement to the ecosystem. Generally, this is not happening, at least not to the extent that it should. Few biologists or ecologists are asked to participate in the design of stream

Fig. 3. A “tree save area” within the stream construction project along the upper headwaters of Winkler Run in the City of Alexandria, Virginia. All trees in the save area soon died following construction of the new stream channel as a result of root damage and destruction of the soil microorganisms necessary in sustaining a healthy forest community. This natural channel design project would be considered high-end by many of today’s standards. Photo by R.H. Simmons.

restoration projects. As a result, municipalities are spending enormous amounts of money on projects that generate the necessary water quality credit but have no real impact on stream function…”

Ground-truthed, science-based data and metrics have not been established or presented by proponents of the Hollin Hills projects supporting the purported need for the projects for improving water quality and reducing sediments. Wildly varying and greatly inflated figures have been presented by Stormwater Planning Division as to levels of sedimentation produced by the channels, only to be later adjusted.

Computer modeling to predict the effects of stream restoration scenarios, while ubiquitous in the industry, is no substitute for actually measuring and collecting data in the field.

Serious concerns for the significant loss of irreplaceable native canopy trees and forest stands

The forested stream valleys of Brickelmaier Park and Goodman Park will be severely denuded and a large number of mature, healthy, native canopy trees that comprise Mesic Mixed Hardwood Forest stands - many of which are old-age - will be forever lost.

The 100% construction plans call for the preemptive removal of at least 79 mature native canopy trees among the two parks, most of which are perfectly healthy. The majority of trees surveyed in both parks are listed in “good” condition by certified arborists who performed the inventories, with a number of trees listed in “excellent” condition. This also accords with my inspection and assessments of the canopy trees.

Many more canopy trees than the above, however, will undoubtedly be lost in constructing these projects. Even though sections of trees are designated for protection, there is no effective way to access either site with heavy construction equipment to perform the extent of digging, hauling, recontouring, and reconstructing of stream channels that is proposed without critically damaging the trunks, roots, soil structure, and soil microorganisms of the trees to be saved (Fig. 3).

It is also worth noting that the presence of non-native invasive vines on the trunks of the canopy trees (mainly English Ivy) was not considered by arborists to be a detriment to the overall good health of the trees. This stands in stark contrast to the erroneous depiction by Stormwater Planning Division that the forest parcels and many of the trees within each are declining, dying, and not worth saving, purportedly because of non-native invasive plant infestations throughout the stream valleys.

This perspective is especially mystifying coming from noted experts in the field of ecological restoration, of which the careful removal of invasive exotic plants to restore habitat is a best management practice. Such a perspective also dismisses the expertise and conclusions of the arborists’ report, which lists the majority of canopy trees in good or excellent condition. Why go to the trouble and expense of conducting a professional tree health inventory if one is simply to ignore it?

Misuse of Floristic Quality Index (FQI) and C-value assessments

Floristic Quality Assessment (FQA) has been identified as a potentially useful tool for wetland assessments because its quantitative outputs - the Floristic Quality Index (FQI), a weighted metric developed for evaluating the quality of native plant communities - are calculated from “Coefficients of Conservatism” (C-values) that are assigned by an independent panel of botanical experts knowledgeable about the flora of a particular region’s natural communities (DeBerry et al. 2015b).

The Hollin Hills Vegetation Monitoring report (Darr 2018) is misusing FQI applications as a means of denigrating the existing forest communities at the parks by speciously trying to infer that stream construction projects in the forested stream valleys will improve the overall vegetative quality of the sites through post-construction plantings of a mixture of “native” species with higher C-values. This misapplication is referred to as "C-value inflation" (DeBerry and Perry 2015a) and is a total perversion of the fundamental concept of floristic quality index, not to mention a gross misunderstanding of the very nature of plant communities.

It is misapplied for several reasons, but certainly because a planting of various species that collectively bears no fidelity to a known natural community, such as Mesic Mixed Hardwood Forest, hardly constitutes a functional natural community at any FQI. In other words, FQIs have no relationship at all to an artificially planted assortment of high C-value species outside their appropriate natural habitats. Furthermore, it has been observed on numerous post-construction sites that planting "late successional" or high C-value species results in a high mortality of the plantings.

Another flaw with the misapplication of FQI in the Hollin Hills Vegetation Monitoring report is that it fails to recognize that the habitat is worth far more than any individual components of such. For example, if a rare plant, say, disappears from a known station but the site is preserved, there is always hope, through preservation of the in situ features and proper stewardship that the species may eventually recover. This is certainly not the case if the soils and habitat are stripped away and replaced by an artificial landscape.

As a fellow environmental scientist practicing in Virginia recently noted regarding the Hollin Hills issue: "So how do we get people to treat these underlying issues without just denuding a site and starting from scratch? Which as you say, and I agree with, eliminates the possibility of restoring a site's true condition in a reasonable time frame. And at what point is starting from scratch the right thing to do? I would say when no natural community is recognizable whatsoever, even the canopy contains no true natives."

<u>The overarching principles of Do No Harm, Keep It Natural, and No Net Loss of natural lands should guide all ecological planning and restoration efforts</u>

Natural channel design projects for small order, interior forested streams and associated seepage wetlands are very much akin to highly destructive modern construction practices, infill development, and gentrification of older, historic communities in that all of a site's in situ, historical, and "landscape memory" features (topography, soils, microorganisms, native seedbanks, etc.) are stripped away and forever lost. None of this is at all necessary, it is merely expedient.

None of the existing features will return - naturally or otherwise - because the living foundation of the habitat, the result of millennia of evolution and complex interactions of organisms and geologic conditions, cannot be replicated. One cannot plant a forest community, one can only plant individual trees and other vegetation. Only nature and very long periods of time can produce diverse, ecologically functioning natural communities.

A good analogy might be that so-called stream restoration projects are like removing the original canvas from a Rembrandt painting, leaving only the frame and surrounding edges of the painting, and fashioning together a completely new canvas and facsimile but still calling it a Rembrandt, albeit a “restored” one. Obviously, such a scenario is greatly misleading - yet it is exactly the sort of reasoning used by government agencies and their partners and contractors in selling these projects.

Best Management Practices and recommendations

Paramount to the future sustainability of the county’s irreplaceable natural resources and biodiversity is the preservation of remaining tracts of indigenous forest communities in their natural state, including natural landforms, wetlands and waterways, native flora, geologic features, and wildlife. An absolute minimum of site disturbance and encroachment, especially to soils and vegetation, is critical in preventing irreparable damage to parkland and should be the overarching concern in determining all activities planned for a site.

Among the largest threats to forested natural areas today is the major damage resulting from stream bank stabilization and watershed improvement projects.

It is critical to keep all plantings natural and in accordance with the in situ native landscape. Introducing species or artificial numbers of a species to a park or natural area where they don’t naturally occur is not an ecological restoration best practice and should be strongly discouraged.

Owing to these and other serious concerns for significant damage that will forever alter and degrade the landscape, forest, and wildlife at the Brickelmaier and Goodman parks, it is strongly urged that proponents of the projects be required to critically evaluate said concerns and weigh them collectively against the purported need for the projects. I think if this is done, we will find that the pros for the project are far outweighed by the cons. It is difficult to imagine moving ahead with projects of this size and expense, especially ones that promise such extensive destruction, without at least rudimentary baseline data supporting the need for projects of this scope.

Numerous problems with the planting plan

The 100% plan specifies a "replacement planting of over 745 native trees and 3,297 native shrubs and ferns"... with "new plantings in logical groupings that would occur as part of an ecological community..." (Kelly and Lardner 2020). A “Riparian Buffer Stabilization” seed mix comprising 36 sundry species of perennial herbaceous plants will also be seeded at the rate of 30 lbs. per acre over 8.31 acres.

Far too many species and numbers of species are specified for these projects. The numbers for both projects need to be pared way down to accord with the existing natural conditions at the parks. High numbers of species and individuals planted do not magically equal a biodiverse, functioning habitat! There are no shortcuts in ecological restoration. (See the aforementioned note regarding the general failure of post-construction plantings of late successional species.)

As previously noted, introducing species and large numbers of such to a habitat where they do not naturally occur is not an ecological restoration best practice and should be strongly discouraged. Of the 81 species specified, a total of 52 are not native to either park.

The following trees are not representative of Mesic Mixed Hardwood Forest, nor do they naturally occur at either park:

Magnolia virginiana, *Styrax americanus*, *Quercus bicolor*, and *Q. michauxii*. A sole specimen of *Amelanchier canadensis* was observed at upper Goodman Park close to the intermittent stream channel. However, this species is not generally a component of Mesic Mixed Hardwood Forest communities. *Quercus palustris* occurs sparingly at both parks, but only in wetter soils near the Paul Spring Branch floodplain. It too is not a typical component of Mesic Mixed Hardwood Forest.

American Snowbell (*Styrax americanus*) is primarily restricted to the southeastern Coastal Plain in Virginia and is not native anywhere north of Richmond.

Pawpaw (*Asimina triloba*) is not a natural component of either park. Eastern Redbud (*Cercis canadensis*), like Serviceberry (*Amelanchier* spp.) and its many hybrids, is widely overplanted.

The following shrubs are not representative of Mesic Mixed Hardwood Forest, nor do they naturally occur at either park:

Alnus serrulata, *Amorpha fruticosa*, *Aronia arbutifolia*, *A. melanocarpa*, *Callicarpa americana*, *Cornus amomum*, *Ilex verticillata*, *Morella cerifera*, *Rhus copallinum*, *Rosa carolina*, *Salix sericea*, *Sambucus nigra*, and *Viburnum nudum*.

American Beautyberry (*Callicarpa americana*) is primarily restricted to the southeastern Coastal Plain in Virginia and is not native anywhere north of Richmond.

European Elderberry (*Sambucus nigra*) is not native to North America and is considered invasive in parts of Europe and the U.S. (CABI 2020, USDA, NRCS 2020).

The following herbaceous plants are not representative of Mesic Mixed Hardwood Forest, nor do they naturally occur at either park:

Asclepias incarnata, *A. syriaca*, *Bidens frondosa*, *Carex grayi*, *C. squarrosa*, *C. vulpinoidea*, *Chamaecrista fasciculata*, *Chasmanthium laxum*, *Conoclinium coelestinum*, *Desmodium canadense*, *Elymus glabriflorus*, *E. hystrix*, *Eragrostis spectabilis*, *Eupatorium perfoliatum*, *Heliopsis helianthoides*, *Hypericum punctatum*, *Osmunda spectabilis*, *Osmundastrum cinnamomeum*, *Panicum anceps*, *P. dichotomiflorum*, *Penstemon digitalis*, *Persicaria pensylvanica*, *Pycnanthemum tenuifolium*, *P. virginianum*, *Rudbeckia hirta*, *Senna hebecarpa*, *Solidago juncea*, *S. nemoralis*, *Schizachyrium scoparium*, *Sorghastrum nutans*, *Symphyotrichum novae-angliae*, and *Zizia aurea*.

Most of the herbaceous plants listed above are light-demanding species of meadows and open areas and do not occur in forested communities. This is yet another telling example of how the landscape at both parks is to be completely altered from closed-canopy forest to open meadow and denuded areas studded with small trees.

Showy Tick-trefoil (*Desmodium canadense*) is listed as “critically imperiled” (S1) in Virginia (Townsend 2019). Assuming the nursery stock is correctly identified, it is considered very poor practice to introduce rare species blindly into habitats, especially habitats where they do not naturally occur, such as the Hollin Hills sites (PRTF 1999).

This plan also proposes to install artificial plantings of “Bottomland Forest” where none naturally exist, particularly adjoining the properties at 1901 and 1909 Paul Spring Road and 7217 Stafford Road at Goodman Park and 2101 and 2103 Pickwick Lane, 7217 Beechwood Road, 2004 and 2005 Bedford Lane, and 2007 Paul Spring Road at Brickelmaier Park.

It is also important to note that because the two parks occupy small, upper headwater seepage stream valleys, very little floodplain naturally exists. The landward edges of the two small streams would perhaps be more appropriately termed “stream banks”. Therefore, the statement for “reconnecting the ecological systems of the streams and their floodplains” being “a primary goal of the restoration project” (Kelly and Lardner 2020), while a worthy pursuit, is misconceived here. The true floodplain in the vicinity of the parks is along Paul Spring Branch, mainly on the north side of Paul Spring Road.

However, both streams are permanently disconnected from their floodplain by the physical barrier of Paul Spring Road. Currently, the outflows of the streams are funneled through small, inadequately sized culverts under Paul Spring Road, resulting in frequent flooding of the road and the threat of the road washing out.

The only way to reconnect these streams to their floodplain is to remove the sections of Paul Spring Road that truncate the stream channels and to replace them with load-bearing, low-water crossings that freely allow stream flow in channels rather than through pipes (Fig. 4).

In conclusion, it is my professional opinion that the proposed Brickelmaier and Goodman projects are incompatible with the preservation and protection of irreplaceable natural resources at each site, as well as the existing landscape as we know it. It is hoped that the county will cease and desist moving forward with these flawed plans to clear forest and reconstruct the stream channels at the parks and instead pursue appropriate best practices to preserve and steward natural resources, not artificialize and further degrade them.

This could be accomplished by redirecting project funding to the publicly owned road-stream crossings and Stormwater Planning Division working with VDOT to restore the channel flows via low-water crossings. It makes no sense at all, and is a mismanagement of public funds, to reconstruct the stream

Fig. 4. An example of an attractive, effective, and flood-resilient road-stream crossing and redesign that reconnects the stream to its floodplain. The project is part of the Climate-Ready Culvert Initiative in the Ausable River watershed. Photo courtesy the Adirondack Almanack.

channels within the parks but to do nothing to mitigate stormwater runoff entering the parks (the root of the problem) or remedy the restricted outflows of the streams at Paul Spring Road.

The Hollin Hills Civic Association and Hollin Hills Parks Preservation could then follow the models, best practices, and expertise of the National Park Service, Dr. Field, those discussed here, and others as to low-impact, relatively inexpensive restoration solutions for sections of eroded channels within the parks. A plan such as this, combined with an affordable, high-quality, invasive exotic plant removal program by industry-best Invasive Plant Control (IPC), will ensure the preservation and sustainability of the Brickelmaier and Goodman parks in perpetuity.

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