

A Brief History of Quittapahilla Creek Watershed Restoration Efforts

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I. Background Information

The seventy-seven square mile Quittapahilla Creek Watershed is situated in the Ridge and Valley physiographic region in Lebanon County, Pennsylvania. Quittapahilla Creek is a tributary to Swatara Creek and is part of the Susquehanna River Basin. Its headwaters begin just southeast of Lebanon, Pennsylvania and it enters the Swatara Creek near North Annville, Pennsylvania.

The major land use in the watershed is agricultural. There are significant areas of urbanization along the Route 422 corridor in the City of Lebanon, West Lebanon, Cleona, and Annville. In addition, new development in the watershed is replacing farms with suburban communities. Past and current land use and land management practices in the rural areas, suburban communities, and urban centers have resulted in degraded water quality, stream bank and bed erosion, sedimentation, flooding, and the loss of riparian and in-stream habitat throughout the Quittapahilla Creek Watershed.

The Pennsylvania Department of Environmental Protection (PADEP) conducted studies in the 1980's and 1990's that indicate impairment of aquatic resources in the Quittapahilla Creek Watershed. In fact, the mainstem as well as all of the major tributaries to the Quittapahilla Creek were listed as impaired in the 303(d) listings. The 2000 305(b) Report prepared by DEP indicated that there are 88.9 miles of stream in the Quittapahilla Creek Watershed. Only 1.82 miles of stream (2%) were found to support designated aquatic life uses. The identified land use activities contributing to impairment include agriculture, crop related agriculture, urban/storm sewers, and bank modification. Sources of impairment include nutrients, siltation, suspended solids, organic enrichment/low dissolved oxygen concentrations, flow alteration, and other habitat alterations.

The Total Maximum Daily Loads (TMDLs) Report (PADEP, 2000) cites excessive sediment and nutrient levels as a major water quality problem in the Quittapahilla Creek Watershed. The report indicates that these pollutants are causing increased algae growth, large accumulations of fine sediments on the streambed, and degradation of in-stream habitat. Although the report attributes the excessive sediment and nutrient levels principally to agricultural activities, these pollutants are also associated with other upland sources (e.g., urban runoff) as well as in-stream sources (e.g., stream bed and bank erosion).

Since 1997, the Quittapahilla Watershed Association (QWA) and their partners, the Swatara Watershed Association (SWA), Lebanon Valley Conservancy (TLVC), Doc Fritchey Chapter Trout Unlimited (DFTU), Lebanon Valley College and the Lebanon County Conservation District (LCCD) have been working with private landowners and a number of private organizations and public agencies to improve the water quality and aquatic habitat of Quittapahilla Creek.

However, until 2001 there had been no comprehensive assessment, nor coordinated effort to identify and prioritize water quality, habitat and stream channel stability problems throughout the watershed. As a consequence, targeting of stream reaches for improvements had been on a project-by-project basis.

The QWA believed that their best chance for resolving the existing problems and avoiding future problems was to step back from the project-based approach and develop a comprehensive plan of action based on an assessment of the entire watershed. They believed that this approach would serve to focus funding and restoration and management efforts where they are most needed. They also believed that it is the approach that has the greatest chance for long-term success.

Accordingly, in 2001 the QWA sponsored by the Swatara Watershed Association (SWA) contracted Clear Creeks Consulting to conduct an assessment of Quittapahilla Creek Watershed and develop a restoration and management plan focused on addressing the problems identified by the assessment. In cooperation with the QWA, Clear Creeks formed an interdisciplinary team that included Skelly & Loy, Inc.; U.S. Fish & Wildlife Service, Chesapeake Bay Field Office; Penn State Institutes of the Environment, Pennsylvania State University; Lebanon Valley College Department of Biology; and U.S. Geological Survey, New Cumberland Field Office. Supported by Growing Greener Grants received from PADEP in 2001 and 2003, the Assessment Phase of Quittapahilla Watershed Project was completed between 2001 and 2005 and the Planning Phase between 2005 and 2006.

The objectives of this project were:

1. Establish benchmarks for evaluating and documenting changes in the watershed by assessing current hydrologic, water quality, in-stream habitat, and channel stability conditions.
2. Identify and prioritize restoration and management strategies to address existing hydrologic, water quality, in-stream habitat, and channel stability problems.
3. Determine the potential for future hydrologic, water quality, in-stream habitat, and channel stability problems.
4. Develop recommendations for management and protection strategies that will prevent and/or minimize future problems.

The major components of the Assessment Phase included analysis of natural and man-made watershed characteristics and their influence on the hydrologic and sediment regime of the watershed; geomorphologic stream assessment; subwatershed reconnaissance and analysis; ecological assessment of habitat and biological communities; water quality modeling; water quality monitoring; and problem identification and prioritization. The Planning Phase of the project focused on identifying and prioritizing Best Management Practices (BMPs) to address the problems identified in the subwatersheds and along the main stem of Quittapahilla Creek. This

included a comprehensive evaluation and prioritization of general, as well as site specific BMPs for controlling agricultural and urban runoff; and a comprehensive evaluation of general, as well as site specific restoration measures to correct stream stability and habitat problems. In addition, county, city and township land use, land development, environmental, and resource protection policies and programs were evaluated. Recommendations were developed for policies and programs focused on stream, wetland and floodplain protection and management.

The results of the assessment determined the following

- Upper Quittapahilla Creek, the Unnamed Tributary draining South Lebanon, and Brandywine Creek have been severely affected by channel alterations. A significant length of the channels in this area have been piped or converted to concrete or gabion-lined flumes. These flood mitigation works have created channels that are devoid of habitat.
- Conditions along the mainstem Quittapahilla Creek from the downstream end of the Hazel Dike to its confluence with Swatara Creek are generally characterized by overwide channels with lateral erosion, high sediment supply, and vertical instability (i.e., aggradation). Lateral and mid-channel bars, riffles embedded with fine sediments, debris jams, poor water quality and in-stream habitat are common along the creek.
- The runoff from the high percentage of impervious surfaces in the urban areas has contributed to increased water temperatures and high levels of nitrate-nitrogen, conductivity, suspended and dissolved solids, turbidity, total nitrogen, total Kjeldahl nitrogen, total phosphorus, ortho-phosphate, alkalinity, hardness, copper, and lead. The extremely high levels of these constituents are indicative of pollution caused by urban runoff from the City of Lebanon, the Towns of Cleona and Annville, discharges from the Lebanon WTP,
- The most significant impacts in the subwatersheds are associated with agricultural practices. In particular, unrestricted livestock grazing along the tributaries has directly impacted channel morphology by trampling of the banks, widening of the channel, and increasing sedimentation. More than 25% of the channel lengths along Bachman Run, Beck Creek, Gingrich Run and Killinger Creek have been impacted by livestock grazing. In addition historic vegetation control practices have contributed to the loss of much of the woody vegetation from the banks and riparian zone along the creeks.
- Additional impacts are associated with runoff from cropland. The water quality modeling showed that the total annual sediment loadings are highest for those subwatersheds with a higher percentage of cropland, ranging from 1,214,073 to 3,909,466 lbs/year.
- Streambank erosion is a major contributor to sediment loadings in the subwatersheds with Snitz Creek – 208,400 lbs/year, Upper Quittapahilla Creek – 187,00 lbs/year, Killinger Creek – 148,100 lbs/year, Bachman Run – 72,900 lbs/year and Beck Creek – 72,700 lbs/year, ranking first through fifth, respectively.
- The significant runoff from urban and agricultural land, high sediment supply, lack of riparian vegetation, and channel alteration have resulted in increased water temperature, shallow pools,

embedded riffles and a general lack of in-stream habitat. This is reflected in the water quality monitoring results, in-stream habitat evaluation and the survey of biological communities along the mainstem Quittapahilla Creek and its tributaries.

As noted, the Quittapahilla Watershed Restoration and Management Plan (2006) included BMPs identified for controlling runoff from urban land and agricultural land, as well as projects focused on streambank stabilization and riparian buffer plantings along unstable stream reaches of the mainstem Quittapahilla Creek and its major tributaries. However, the QWA was working under the assumption that they would spearhead the stream/riparian restoration efforts while the City of Lebanon and the other Townships in the watershed would move forward with implementation of the urban BMPs. They also assumed that USDA-NRCS and the Lebanon County Conservation District would take the lead on implementing agricultural BMPs.

At the time the Restoration and Management Plan was prepared, deadlines for meeting MS4 requirements were still years away for the City of Lebanon and the other Townships in the watershed. Undeterred, the QWA resolved to move forward with implementation of the stream restoration projects identified in their Restoration and Management Plan. Utilizing Growing Greener and Fish and Boat Commission Grants, the QWA proceeded with designing, permitting and construction of restoration projects and stormwater BMPs along the mainstem Quittapahilla Creek. As they moved forward they found that the competition for limited statewide funding was the major obstacle hindering their restoration efforts. The QWA determined that they would seek other funding sources. In order to qualify for 319 funding, they decided to prepare the USEPA required Watershed Implementation Plan (WIP).

Funded by a 2016 Growing Greener Grant, the first steps in developing the USEPA Approved WIP were initiated in March 2017 and involved bringing the QWA members and representatives of local municipalities up to speed on what was involved in the original Quittapahilla Creek Watershed Assessment, what had been accomplished since the completion of Quittapahilla Watershed Restoration and Management Plan, and what remained to be done to prepare a Watershed Implementation Plan. In addition, the QWA formed working committees for each WIP task.

Utilizing the original list of restoration projects from the Restoration and Management Plan, a preliminary projects list was prepared for the Prioritization Committee to review. Each project reach within the four major tributary subwatersheds was evaluated relative to its contribution to pollutant loadings from streambank and streambed erosion based on the results of the original 2003/2004 water quality modeling and monitoring, as well as observations recorded during the field reconnaissance surveys conducted at that time. Projects that fell outside of the QWA's ability to control the outcome, such as those involving removal of concrete flumes, bank stabilization in quarries and on golf courses were dropped from the list.

The Committee prioritized the four tributary subwatersheds in descending order, with Snitz Creek being the highest priority, Killinger Creek second, Beck Creek third and Bachman Run

fourth. It was agreed that projects would be completed by priority subwatershed starting at the top of the watershed and working in a downstream direction. Projects representing severe conditions and contributing high sediment loadings would warrant moving out of order.

The WIP also includes a detailed monitoring plan to evaluate the success of the projects in meeting the water quality and habitat objectives of the WIP. QWA and DFTU agreed to assume responsibility for maintenance of individual restoration projects. The WIP also outlines how the QWA will track projects and continue their current public outreach and education efforts to enlist support for and promote public participation in the restoration of the Quittapahilla Creek Watershed.

The WIP document was submitted for USEPA and PADEP review and approval on September 7, 2018. USEPA and PADEP comments were received in September 2020. Minor revisions to the document were made to address their comments and the Updated WIP was submitted on January 27, 2021. PADEP informed the Watershed Association and their partners that the WIP had been approved by USEPA on March 3, 2021.

II. Implementation Progress

A. Successes

1. Stream and Floodplain Restoration Projects

The attached Table 1 shows the projects that have been completed as well as current projects. The Quittie Creek Nature Park Project along the mainstem Quittapahilla Creek was the first project. Implemented in two phases it was completed in 2015 and 2016. Pre and Post Construction monitoring by the PA Fish and Boat Commission documented that the project significantly improved the over stability and in-stream habitat along the 3,440 feet of creek in the Park. Successfully functioning for eight years, it was recently highlighted in Spring 2023 during a tour by participants attending the 78th Annual Northeast Fish & Wildlife Conference in Hershey, PA.

In 2019, over 1,100 feet of highly degraded stream channel along lower Snitz Creek was successfully restored. Another 1,600 feet along the mainstem Quittapahilla Creek was restored in 2023.

Between 2018 and 2024 another 6,625 feet of Beck Creek, Killinger Creek and Snitz Creek stream channel and floodplain restoration projects have been designed and permitted. Construction on these project will begin in 2025. An additional 5,275 feet of restoration projects along Snitz Creek, Bachman Run and Quittapahilla Creek are currently in the restoration design and permitting phase. All together these projects will result in 18,240 feet of restored stream channel. In addition, 10.87 acres of wetlands and more than 25 acres of riparian buffers will have been established.

Water Quality and Biological Monitoring Program

Chemical Monitoring -- Six fixed-station monitoring locations (Fig 1) have been equipped with staff plates and pressure transducers for measuring water depths. Bi-monthly water-quality samples are collected using PADEP protocols at each of these six stations and the samples are analyzed by the PADEP laboratory for nutrients, metals, major ions, hardness, total dissolved solids, and total suspended solids. The results are posted on QWA's water-quality monitoring portal at <http://147.185.239.141/qwa/>.

Biological Monitoring -- At the same fixed stations, macroinvertebrate samples are collected in the fall of each year using a modified PADEP collection protocol. The samples are picked in the field and identified by students at Lebanon Valley College.

The biological data are housed with Lebanon Valley College (Dr. Urban) and QWA does not have these data. At present, QWA's only access to the biological data is through the student reports from Dr. Urban's students. These reports are produced about once a year, but on an irregular schedule depending on when Dr. Urban has a student that wants to work on a special project.

2. Watershed Reconnaissance Surveys

As noted a major component of the overall Quittapahilla Creek Watershed Assessment conducted between 2003 and 2004 was Field Reconnaissance Surveys of 65 miles of the five major tributaries to Quittapahilla Creek. The data collected during these surveys was utilized to identify problem areas and potential restoration projects in the subwatersheds. That data is now twenty years old.

In 2017, the Quittapahilla Watershed Association began conducting Field Reconnaissance Surveys of the subwatersheds to document current stream reach conditions and determine the continued need for restoration/stabilization along the subwatershed reaches.

These surveys have been conducted by college students serving as summer interns funded by grants secured by the QWA and more recently funded by the Lebanon County Conservation District and trained by Clear Creeks Consulting. The focus of the 2017 assessments was the stream reaches in the Snitz Creek subwatershed. Similar assessments were conducted during summer 2018 and 2019 along Beck Creek and Bachman Run subwatersheds, respectively. COVID prevented internships for 2020 and 2021. Funding was not available in 2022. Summer of 2023 the interns surveyed Gingrich Run and Killinger Creek subwatersheds. Later in the Summer the survey was expanded to include the Snitz Creek subwatershed. This Summer the survey focused on the Beck Creek and Bachman Run subwatershed stream reaches..

B. Factors Slowing Progress

As noted, the Snitz Creek subwatershed was identified as the highest priority based on the results of water quality modeling, water quality monitoring and observations recorded during the subwatershed reconnaissance surveys conducted as part of the original watershed assessment. Implementation of the Snitz Creek Projects Schedule outlined in the approved WIP has been slowed by a number of factors.

1. Landowner Participation

In the process of implementing the prioritized projects over the last several years, the partners have found that not all landowners want to participate in the restoration effort. Unfortunately, this has left gaps, at least for now, in the logical implementation sequence they intended to follow.

While some landowners have recognized the benefits of having the stream along their property restored and participated eagerly. Other landowners have required compensation to allow a project on their property. For example, in the case of Snitz Creek 2 Stream and Floodplain Project, negotiations between Cornwall Borough and the landowner took two and one half years to complete before the project could move forward.

2. Slipping Back Into the Project By Project Approach

A number of landowners along downstream reaches in the Snitz Creek subwatershed, as well as landowners from other subwatersheds have expressed an interest in participating in the restoration effort. Sticking with the WIP implementation schedule would mean some landowners would be waiting for many years before the Partners would actually reach their property. After consulting with Jineen Boyle and Scott Carney, PADEP the Partners were encouraged to continue following the WIP implementation schedule, but not to discourage or turn away landowners interested in participating, provided they were in a priority subwatershed, and their property included a prioritized stream reach.

Unfortunately, this has resulted in a project implementation pattern similar to the old project-by-project approach. In addition, it has caused some of DEP's grant coordinators to complain that the Partners are not following the WIP implementation schedule. This can and has affected the competitive advantage of otherwise worthwhile projects.

3. Funding Sources and Competition

As noted, the Partners were initially working with funding from PA DEP Growing Greener and PA Fish and Boat Commission Grants. In 2018 funding for projects became available from onetime Water Quality Improvement Project (WQIP) along the Mariner East 2 Pipeline Corridor grants. With the approval of the WIP in 2021, funding became available from PADEP/USEPA 319 grants.

In the last several years the State and Federal agencies have provided additional funding sources to assist Pennsylvania in meeting its obligations to the Interstate Pact targeting pollutant reductions for the Chesapeake Bay. These have included Countywide Action Plan (CAP) and Agricultural Conservation Assistance Program (ACAP) grants through LCCD, and Watershed Restoration and Protection grants through the PA Department of Community and Economic Development (DC&ED). Some additional funding is periodically available through the National Fish and Wildlife Foundation and The Conservation Fund. Partnering with municipalities, such as Cornwall Borough, seeking to meet their MS4 credit requirements has supplemented the funding from other sources.

This increase in funding sources would seem to provide more than adequate funding for reaching the Quittapahilla Creek Watershed restoration goals in a reasonable timeframe. However, competition for the funding has increased exponentially over the last decade as other watershed organizations and municipalities have developed and begun to implement their Restoration Action Plans, TMDL Implementation Plans, Pollutant Reduction Plans and Alternate Restoration Plans.

Funding from PA DEP Growing Greener, US EPA 319 and DC&ED Watershed grants is distributed across the entire state. Competition for specific grants from National Fish and Wildlife Foundation funding is usually on a regionwide basis. Because each Conservation District receives an allotment of money each year, competition for CAP and ACAP grants is restricted to projects in Lebanon County. However, those funds are split between Agricultural BMPs and Watershed Restoration Projects, that is stream and floodplain restoration. The funds may also be split between any projects proposed in any one of the twenty five subwatersheds in Lebanon County.

4. Evaluating Project Implementation Costs

When reviewing funding requests, experience has shown that not all PA DEP and US EPA grant reviewers evaluating our projects have a firm understanding of project costs or the project elements that drive those costs..

Stream and river restoration refers to a broad spectrum of activities. With increasing levels of complexity and work effort these activities can include riparian buffer plantings, in-stream habitat improvements, streambank stabilization, stream channel reconfiguration to reestablish meanders along previously channelized reaches, stream channel relocation/reconfiguration and floodplain restoration.

We have found that most grant reviewers evaluate project costs on a per linear foot basis. I don't think anyone would argue that the work effort and costs for design, permitting and construction would vary considerably over the range of restoration activities presented above. Still, it is worth considering that evaluating more complex projects on an overall cost per linear foot basis does not, cannot, take into account the work effort and costs associated with the various design elements incorporated into a channel relocation/reconfiguration, floodplain restoration and

wetland creation type of project. If considered on a cost per linear foot basis, typical construction costs for these types of projects in neighboring Maryland run between \$300 and \$450 per linear foot.

A more appropriate method to evaluate the overall cost of projects would involve determining the work items associated with a particular project element and comparing the cost of a given work item with the cost of that same work item for other restoration projects. For example, what is the contractor charging per cubic yard of Class 1 Excavation to construct a wetland area or Class 5 Excavation to construct a new stream channel. The cost per cubic yard multiplied by the total cubic yards moved is a straight forward and reasonable way to compare project costs. Doing that for each element and its associated work items eliminates the guesswork associated with the overall cost per linear foot method, providing a comparative analysis based on standard, industry-wide construction cost estimating methods.

Another aspect of the cost of project implementation that is often overlooked is the effect of inflation. The Beck Creek 6 Project provides an excellent example of how this can affect our projects. In June 2022 DFTU submitted a funding request through the 319 grant program. The grant was denied based on the high cost. When contacted about the funding denial letter our PADEP Grant Coordinator, Scott Heidel indicated that an analysis of other similar projects conducted by PADEP and USEPA staff concluded that this project could be completed for \$140,000 or \$70 per linear foot. He further stated that the Project should have been competitively bid to Construction Contractors, such as, Aquatic Resource Restoration Company (ARRC) and Ecotone because PADEP believes they submit reliable construction costs.

In fact, DFTU had put the project out for competitive bids. The following Construction Costs were based on the bids submitted by the Construction Contractors competing for this project.

- Resource Restoration Group, LLC - \$716,894 (Selected Contractor)
- Aquatic Resource Restoration Company (ARRC) - \$838,247
- Ecotone Ecological Restoration - \$989,429
- Baltimore Pile Driving and Marine Construction, Inc - \$1,379,727

When confronted with these facts he had no response.

In June 2023 DFTU submitted a second funding request through the 319 grant program. Due to inflation the construction costs for the exact same Beck Creek 6 Project had jumped to \$874,935. An increase of \$158,041 or 22%.

C. Final Thoughts

Some important takeaways include:

1. Project costs are increasing significantly.
2. Funding is limited and competition is intense.
3. Identifying additional funding sources is critical.

4. Worthwhile projects that do not follow the implementation schedule In their approved plans are at a competitive disadvantage.
5. Implementation schedules represent a multi-year effort. Alternating between subwatersheds will significantly extend the time necessary to realize observable and quantifiable benefits of the restoration efforts in any given subwatershed.
6. With partners working in multiple watersheds, it is imperative that a strategy for funding and implementing projects in all of these watersheds be developed and agreed upon by all parties.