Pocopson Creek and Browning Barn Tributary Watersheds Restoration Plan

Pocopson Township, East Marlborough Township, Newlin Township, Pennsbury Township, and Kennett Township, Chester County, Pennsylvania

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TABLE OF CONTENTS

1.0 INTRODUCTION

Brandywine Red Clay Alliance (BRC), a leader in watershed restoration and environmental education for over 80 years, has identified Pocopson Creek, an impaired stream, as a sub-watershed area that needs focused, holistic restoration. An unnamed tributary (UNT) to West Branch Brandywine Creek that borders Pocopson Creek and originates by the Browning Barn located on BRC's Myrick Conservation Center has also been identified as a target for restoration and is included as a sub-watershed area in this plan. To aid in identifying the areas within the watershed where restoration work would be most effective, BRC partnered with Clauser Environmental, LLC to complete a detailed watershed assessment (Clauser and Clauser, 2025). Water quality sampling was conducted at 10 sample sites throughout the watershed. Samples were taken along both the mainstem of Pocopson Creek and its major tributaries. All but one of the samples were impaired for habitat and/or macroinvertebrate life. Water quality data are presented in detail in the Pocopson Creek and Browning Barn Tributary Assessment Report that is a companion to this restoration plan (Clauser and Clauser, 2025). With the reach level scientific knowledge of the watershed from the watershed assessment available to serve as a foundation, this detailed restoration plan for the Pocopson Creek and Browning Barn Tributary Watersheds was prepared to address the specific areas of impairment. As the solutions outlined within this restoration plan are implemented, substantial progress will be made in restoring this sub-watershed of the Brandywine-Christina Basin.

The Pocopson Creek has a Pennsylvania Code, Title 25, Chapter 93 water quality designation of Trout Stocked Fishery/Migratory Fishery (TSF/MF) and is not listed by the Pennsylvania Fish and Boat Commission as a stream that supports the natural reproduction of trout (PFBC, 2024). The Browing Barn Tributary has a Pennsylvania Code, Title 25, Chapter 93 water quality designation of Warm Water Fishery/Migratory Fishery (WWF/MF) and is also not listed by the Pennsylvania Fish and Boat Commission as a stream that supports the natural reproduction of trout (PFBC, 2024).

Within the study area, the main forms of land use include residential developments, agricultural areas, commercial businesses, forested corridors, and open space. Recreation areas located within the watersheds are the Myrick Conservation Center (including the BRC headquarters) and Pocopson Park. Agricultural operations within the watersheds include livestock operations and crop production. Over 250 cows and 100 horses reside within the watersheds, many of which still have access to streams (Stroud Water Research Center, 2025). Though much of the stream stretches within the watersheds have a forested corridor, there are many places where the banks of the stream and its tributaries lack a riparian buffer or are mowed to the edge.

The Pocopson Creek and Browning Barn Tributary Watersheds study area includes approximately 9.79 square miles of watershed and 13.11 miles of stream. The Pocopson Creek Watershed encompasses the origin points of Pocopson Creek and its tributaries to Pocopson Creek's confluence with the Brandywine Creek just east of where Pocopson Creek passes under Pocopson Road. The Browning Barn Tributary Watershed includes all of the drainage area to the tributary to its confluence with the Brandywine Creek. The Pocopson Creek is listed by the Pennsylvania Department of Environmental Protection

(PA DEP) on its 303(d) list of impaired stream reaches (PA DEP 2025). Listed aquatic life impairments to Pocopson Creek and its tributaries include agricultural siltation and habitat alterations and urban runoff/storm sewers (siltation, water/flow variability) (PA DEP, 2024). In March of 2024, PA DEP identified recreational impairments of urban runoff/storm sewers – *Escherichia coli* (*E. coli*) and agriculture - *Escherichia coli* (*E. coli*) to the Pocopson Creek Watershed as part of the 2024 Integrated Report. (PA DEP 2024). At the same time, PA DEP identified a recreational impairment of agriculture - *Escherichia coli (E. coli)* to the Browning Barn tributary. From the fall of 2024 to the spring of 2025, BRC collaborated with Clauser Environmental, LLC, to develop an assessment report that determined baseline conditions and identified targeted sources of impairment within the watershed. The watershed assessment determined that restoration projects should focus first on the headwater areas, the most impaired section of the watershed, and then move downstream. Best Management Practices (BMPs) that are suggested for installation within the watershed include wetland creation, floodplain restoration, stormwater management structures, streambank stabilization, invasive species removal, lawn to meadow conversion, riparian buffer plantings, and agricultural improvements.

The Pocopson Creek is a tributary to the Lower Brandywine Creek, which in the Chester County Watersheds 2045 Plan, has five identified management priorities. These priorities are: address water quality impairment, identify and implement flood mitigation strategies, promote active stewardship of open space, protect and restore vegetated riparian buffers and floodplain connectivity, and promote and increase water-based recreational opportunities (Chester County Water Resources Authority, 2024). The Browning Barn Tributary is included in the Upper Brandywine Creek Watershed, which has the following identified management priorities: identifying and implementing flood management strategies, promoting and improving recreational access, implementing modern storm water controls, providing educational resources and opportunities, and supporting the use of conservation design principles (Chester County Water Resources Authority, 2024). The projects identified in this restoration plan align with all of the priorities for the Upper and Lower Brandywine Creek Watersheds.

2.0 Pre-Assessment Outreach

As part of the initial outreach for this project, concerns from municipalities, landowners, and conservation organizations were heard before completing field observations. BRC's Watershed Conservation Director, Brian Winslow, arranged these meetings and was often accompanied by Dr. Aaron Clauser and Kora Clauser of Clauser Environmental, LLC. Meetings were held with the four municipalities that compose the watershed, Newlin Township, Pocopson Township, Pennsbury Township, and East Marlborough Township. The meetings focused on common concerns about road flooding, erosion and sedimentation around road culverts, stormwater detention basin operation and maintenance, streambank erosion along roadsides, and potential projects that may reduce sediment pollution. Each of the municipalities expressed a strong desire to collaborate with BRC and other conservation organizations to coordinate projects in riparian zones, retrofit detention basins, and protect roadways. Implementing best management practices such as installing green stormwater infrastructure, reconnecting

floodplains, and stabilizing streambanks will help to protect public infrastructure and minimize sediment pollution.

Meetings were also held with conservation organizations including Brandywine Conservancy, Chester County Conservation District, Chester County Water Resources Authority, and BRC's Land Preservation Department. In these meetings, information on planned projects in the watershed, areas of concern for water quality, and priorities for land preservation were shared. The Conservation District noted landowners who were interested in converting their lawns to meadows. As a substantial portion of the watershed is mowed lawn, converting some of that open space to meadow would help to increase biodiversity, improve wildlife habitat, capture stormwater runoff to reduce flooding, and filter nutrients from yards and agricultural operations. Brandywine Conservancy provided information about preserved properties in the watershed and contributed funding for the present assessment and planning project. The Conservation District has partnered with BRC and the Keystone 10 Million Trees Initiative to distribute free trees to landowners in Chester County to help improve riparian buffers. Many landowners within the watershed have already planted trees received from this program. Water quality data was shared by the Chester County Water Resources Authority through their work at USGS sampling sites in the watershed.

The key recommendations from the pre-assessment outreach meetings include:

1. Coordinate with interested landowners to implement a riparian buffer and lawn-to-meadow conversion plan to improve riparian buffers.
2. Prioritize land preservation and stewardship practices on key parcels.
3. Work with municipalities and landowners to install green stormwater practices and inspect and retrofit existing systems, especially detention basins, to improve water quality where applicable.
4. Support landowners in adopting agricultural best management practices (BMPs) and implementing conservation plans that reduce runoff and protect water quality.
5. Collaborate with landowners and municipalities to restore areas identified as medium and high priority for stream restoration and floodplain reconnection.
6. Work with conservation partners, county agencies, and state agencies to continue monitoring water quality and revise the restoration plan accordingly.

3.0 METHODOLOGY

To determine the areas within the Pocopson Creek and Browning Barn Tributary Watersheds in need of the most attention, Brian Winslow of Brandywine Red Clay Alliance and Aaron Clauser, PhD and Kora Clauser of Clauser Environmental, LLC, conducted stream walks on March 27, and April 1, 2, and 14, 2025. Photographs, field notes, and GPS coordinates were collected at areas identified as points of interest. Where access was not permitted, impacted areas were identified by conducting windshield

surveys from roadways and reviewing ESRI aerial imagery. Sources of impairment were identified at the parcel level.

On March 27, April 1, and April 2, Clauser Environmental, LLC located the points of interest within the watershed using a Trimble Geo7X Global Positioning System (GPS) receiver with H-Star and Floodlight enabled decimeter accuracy configuration during the site visits. The instrument's smart settings were used per the manufacturer's recommendation. The logging interval was set at 1 second, with typically a minimum of 30 readings collected at each point. Data collected in the field was downloaded to a personal computer for differential correction using GPS Pathfinder Office software (Version 5.6). Correction files were obtained from dedicated base stations located in Coatesville, Philadelphia, and Warminster, Pennsylvania; Loyola, Maryland; and Wilmington, Delaware. Mission planning, parameter settings, and post-processing typically allow an accuracy of less than 10 centimeters (Trimble Navigation 2014). On April 14, Clauser Environmental, LLC, located the sample points using a Geode GNS3H Global Navigation Satellite System (GNSS) receiver with Galileo High Accuracy Service during the site visit. Data was collected and exported using Unita Data Collection Software. The Geode receiver and Unita software were used in tandem per the manufacturer's recommendations (Juniper Systems, 2025). The precision of GPS collected data is subject to variation caused by canopy cover, atmospheric interference, time of day, and satellite geometry.

Cost estimates were prepared based on recent projects completed by Clauser Environmental, LLC. The included cost estimates provide an order-of-magnitude idea of the potential costs to implement the proposed watershed solutions.

4.0 WATERSHED PROBLEMS AND SOLUTIONS

This section focuses on the sources and causes of impairment within the Pocopson Creek and Browning Barn Tributary Watersheds and potential restoration practices that can be completed to address the noted impacts. High, medium, and low priority restoration projects are identified within the GPS point descriptions included in Appendix B. Each impacted segment identification number can be cross-referenced with its approximate location on the field investigation map in Appendix A. High and Medium priority projects are additionally described within this section of the report.

4.1 High Priority Projects:

Riparian Buffer Enhancements Throughout Watershed:

Throughout the watershed, there are significant stretches of stream that lack healthy riparian buffers (Appendix F). Riparian buffers play a large role in water quality by creating natural filtration for water runoff into the streams, stabilizing streambanks, shading streams, absorbing floodwaters, and providing vital habitat for wildlife. Within the Pocopson Creek and Browning Barn Tributary Watersheds, streamside forests historically provided leaf litter that served as the foundation of the food chain for the bulk of the aquatic community. As forests were cleared and replaced with fields, pastures, mowed lawns, and impervious areas, water quality and the aquatic community suffered. Throughout the watershed, invasive plant species including multiflora rose (*Rosa multiflora*), Japanese hops (*Humulus japonicus*), Japanese stilt grass (*Microstegium vimineum*), common privet (*Ligustrum vulgare)*, reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*) and tree of heaven (*Ailanthus altissima*) have become established within the riparian zone and have provided substantial competition for the native plant species that are necessary for the diverse wildlife that rely on the watershed.

Solution:

Throughout the watershed, approximately 8.10 stream miles are identified as potential locations for riparian buffer enhancement projects. Within those areas, mowing and grazing should be stopped or at least limited to minimize impacts to the stream community. The application of fertilizers and pesticides should be limited. Landowners within the identified areas should be encouraged and assisted in the planting of native trees and shrubs. Invasive species should be managed. While the wider the riparian buffer, the better for the environment, the first thirty-five feet from the edge of the stream is typically considered the most crucial for maintaining water quality.

Impacted Stream Segment #7-10:

Along this stretch, there is an equine pasture with direct access to the stream. Throughout this stretch, streambanks are undercut and actively eroding 2 to 4 feet high. Nutrients from horse manure are carried downstream with the eroded sediment. The entire stretch lacks a riparian buffer, with the few remaining trees threatened by the ongoing erosion. The lack of a riparian buffer to shade the stream results in the warming of the water as it flows through the pasture, further impairing water quality and benthic habitats.

Solution:

The most effective way to restore this area is to address the eroding streambanks while reducing future impacts. Fencing the horses out of the stream and installing equine crossings will ensure livestock safety and prevent further bank degradation. Grading the streambanks to a stable slope would minimize additional erosion. Instream structures such as log vanes and root wads should be installed to create fish habitat and reduce near-bank friction during vegetation establishment. Planting native riparian buffers within the fenced stream corridor will help stabilize the banks, provide shade to cool the water, enhance biodiversity, and create valuable wildlife habitat. As the landowner for this stream section expressed interest in partnering with BRC to complete restoration work within the pasture during the site visit, it is recommended that this high priority project be one of the first to be pursued.

Impacted Stream Segment #10-11: This section of the mainstem of Pocopson Creek runs through an active cattle pasture. The cattle have access to the channel and are contributing nutrients to the stream and further exacerbating erosion of the 2 to 4 feet high banks. The active erosion is contributing sediment to the stream system, degrading the aquatic habitat and water quality on the site and downstream. There is little to no riparian buffer, and some of the few large trees along the stream are threatened by the active erosion.

Solution:

This stream section requires a holistic approach to stream restoration. Fencing cattle out of the stream and installing stable livestock crossings will help reduce the input of harmful nutrients entering the stream and streambank degradation. The streambanks should be graded to a stable slope of 4:1 or flatter and planted with native vegetation within the fenced area. The use of instream structures such as rock and log structures will increase the diversity of microhabitats in the stream and protect the restored streambanks as the vegetation becomes established.

Impacted Stream Segment #25-27, 78:

The Haines Grist and Saw Mill dam was located within this stream segment and has left a legacy of sediment deposited in the dam's backwater. The stream cut through the sediment and currently has actively eroding 4 to 5 feet high streambanks. The erosion is exacerbated by mowing to the top of the banks that limits the establishment of stabilizing vegetation. The ongoing erosion is adding sediment to the stream bed, which negatively impacts the aquatic habitat and water quality both at this site and downstream. The riparian buffer is limited along this stretch of the stream, reducing the available habitat within the corridor.

Solution:

This stream reach would benefit from a legacy sediment removal project where the post colonial sediment is removed and the stream is reconnected to a floodplain at it's historic elevation. Floodplain wetlands, a forested riparian zone, and upland meadow's should be integrated into the design if permitted by the landowner. The creation of wetlands, floodplain reconnection, tree and shrub plantings, and stream channel improvements that include natural restoration design elements would help to mitigate future flooding, improve water quality, create better aquatic habitat, and protect the stream channel from future erosion. The creation of upland pollinator meadows in these mowed fields would help to increase biodiversity, create habitat, and improve the natural filtration of contaminants, sediment, and nutrients from the water entering the stream.

Impacted Stream Segment #32-34:

Along this segment of the stream, the riparian zone has been mown to the top of the streambank. A tree planting has been completed within the riparian zone, but the young trees are threatened by the advancing eroding banks. The streambanks are actively eroding legacy sediment and are 2-5' high throughout the reach.

Solution:

The restoration of this stream section should focus on floodplain reconnection and stabilizing the channel. The accumulation of legacy sediment from upstream past agricultural activities has left the streambanks unnaturally high. Reconnecting the Pocopson Creek to its floodplain will help to moderate storm flows and improve the infiltration of water, filtering out pollutants before water enters the stream. A bankfull floodplain bench should be installed and the streambanks should be stabilized with native vegetation. The incorporation of in-stream features, such as rock and log structures, will enhance fish habitat and help safeguard the restored streambanks as vegetation establishes and previously planted trees mature. The creation of floodplain wetlands should be incorporated into the project design. The riparian buffer should be enhanced through additional native plantings and the elimination of mowing when the planted trees are established. In the summer of 2025, Pocopson Township completed a stream restoration on 618 linear feet of stream at GPS Point 32 as part of their MS4 plan. This section is considered high priority in part because of the opportunity it presents to expand on this prior restoration work.

Impacted Stream Segment #39-40:
This stretch is within an active livestock pasture where animals have direct access to the stream. The pasture is mowed to the top of the 2-3' high eroding streambanks. The eroding streambanks discharge nutrients and sediment to the stream channel, which, in addition to nutrients from livestock waste, impacts water quality on the site and downstream. A breached dam breast is evident in the stream segment. The backwater from the dam likely contributed to the legacy sediment that is currently eroding on this site.

Solution:
Restoration of this stream segment should focus on creating and protecting the riparian buffer within the livestock pasture. The streambanks should be pulled back to a stable slope and planted with native vegetation. Instream structures such as log vanes, rock deflectors, and root wads should be installed to create fish habitat and protect the streambanks during vegetation establishment. The native plantings should include native grasses and forbs, live stakes from the water's edge to the top of the streambank, as well as trees and shrubs throughout the riparian zone to improve the stream buffer. Stabilized livestock crossings and streambank fencing should be installed to minimize the impact of the livestock on the stream.

Impacted Stream Segment #42-43:

In this stretch, the streambanks are incised 5 to 8 feet and are actively eroding in many areas. In some parts of the segment, the riparian zone is mowed to the top of the streambank. The high banks in this stretch are likely due to the accumulation of legacy sediment upstream of the historic Denton's Mill dam, which was located directly downstream of this reach for over 200 years before being breached in 1935. Over time, legacy sediment deposited in the dam's backwater area upstream of the dam. After the dam was breached, the stream downcut through the sediment, creating the 5-8 feet high eroded banks that are present today. These high banks have left the stream disconnected from its floodplain, contributing to a larger volume of water moving down the channel during storm events.

Solution:

Restoration of this stream segment should focus on removing legacy sediment to reconnect the floodplain, stabilizing the stream channel, and establishing native trees and shrubs within the riparian zone. The combination of floodplain reconnection and streambank stabilization will help to manage storm flows and improve water quality by providing a place for sediment and contaminants to settle out, where they can be broken down by the sun and ecological processes. The implementation of structures such as mudsills and rock vanes will help improve the aquatic habitat for fish, including the trout that are stocked in this area.

Impacted Stream Segment #49-51:

This stretch of Pocopson Creek, which is often fished for trout, flows through an active cattle pasture just upstream of where it meets its confluence with the Brandywine Creek. Within the pasture, cattle have access to the stream, and there is little to no riparian buffer. Throughout the downstream portion of this section, streambanks are actively eroding and are 2 to 5 feet high. The cattle are contributing nutrients to the stream while ongoing streambank erosion washes legacy sediment into the stream.

Solution:

Streambank stabilization and riparian buffer enhancement will significantly improve this

stream segment. Streambank fencing can be used to keep cows out of the stream. A healthy riparian buffer will help to capture nutrients before they enter the stream and provide sediment and contaminants a place to settle out where they can be broken down by the sun and ecological processes. Streambank stabilization structures, including rock deflectors, root wads, and log vanes, would help to create fish habitat and protect the streambanks while vegetation within the fenced area becomes established.

Impacted Stream Segment #69:
This point identifies a barnyard where many cattle are fed. Rainwater flows through the barnyard, washing nutrients and bacteria from the cattle into a swale that carries it under Unionville Wawaset Road and into an unnamed tributary to Pocopson Creek. This runoff can degrade water quality, contribute to algal blooms, and harm the already impaired aquatic life.

Solution:
Barnyard enhancements could be added to protect downstream water quality. Rerouting the rainwater coming off of the barn roof to bypass the cattle enclosure would prevent the nutrients and bacteria from the manure from being carried into the stream. Barnyard surface enhancements, such as adding gravel to high-traffic areas, planting vegetated buffers to capture and filter runoff, grading swales to manage the flow path of runoff, and covering the barnyard with a roof, could all be explored as possible improvements to this site.

Impacted Stream Segment #80-81: Along this stream section, there is an equine operation with a manure storage pile directly upslope of the stream. Drainage from the barnyard and horse pasture goes into the stream with minimal riparian buffer. The horses have direct access to the stream and its surrounding wetland areas throughout this reach. The pasture is immediately adjacent to an online dam. The streambanks are stable, but lack a riparian buffer in many areas.

Solution:

A top priority for this section of stream is to work with the landowner to create and implement a manure management plan, a barn gutter plan, and streambank fencing to keep horses out of the stream and wetland areas. After these items are addressed, riparian buffer enhancement should be done along the stream section. The floodplain wetland pockets located along this section are key for filtering contaminants, retaining floodwaters, and recharging the groundwater. These wetland areas should be protected from horse access.

Impacted Stream Segment #100-102:

Within this stream segment, both banks of the stream are eroded. From point 100 to point 102, approximately 75% of the reach has actively eroded legacy sediment on the 2 to 4 feet high streambanks. In addition to the problem of erosion, invasive species, including Japanese stilt grass (*Microstegium vimineum*) and multiflora rose (*Rosa multiflora*), dominate the riparian zone in the areas that are not mown to the top of the bank.

Solution:

Stream restoration with a natural design approach would restore the integrity of the stream channel, reconnect the floodplain and should include a combination of streambank grading and natural fish habitat structure implementation.

Removal of invasive species and planting native trees and shrubs will help to restore the riparian buffer.

Impacted Stream Segment #109-110:

This stream section includes a small unnamed tributary that flows through an active cattle pasture. Cattle have direct access to the channel, contributing nutrients and sediment to it. The stream channel is grazed to the stream edge, and the stream is exposed to direct sunlight for over 900 feet before crossing under Lenape Road.

Solution:

Restoration of this stream section should begin with collaborating with the landowner to install streambank fencing within the pasture to keep the cows out of the stream and allow for the establishment of a riparian buffer. The riparian buffer should be planted with native vegetation, including trees and shrubs, to shade the stream and create habitat. Stable cattle crossings should be installed to allow cattle to safely cross the tributary without degrading the stream.

4.2 Medium Priority Projects:

Impacted Stream Segment #27-28:

This stream reach includes the former location of Haines Grist and Sawmill. While the dam for the mill was in place, legacy sediment from upstream agriculture accumulated in the backwater of the mill dam. Upon breaching, excessive sedimentation to this stream reach began. Today, the streambanks are actively eroding and are 1 to 3 feet high and the sediment has reduced the available habitat within the stream channel. The north side of the stream lacks a riparian buffer and is mowed to the edge of the channel.

Solution:

Restoration of this stream segment should include streambank stabilization with a natural design approach. Fish habitat structures such as root wads and mudsills should be installed to improve fish habitat as part of the project design. Additionally, the riparian zone should be planted with native vegetation to shade the stream, strengthen streambanks, and address stormwater runoff into the stream.

Impacted Stream Segment #29-30:

In 2023, a streambank fencing project completed by BRC fenced 80 cows out of the Pocopson Creek and included the installation of three livestock crossings. Throughout this now fenced section, approximately 40-60% of the streambanks are eroded 2-4' high.

Solution:

Work within this stream section should focus on stabilizing the streambanks now that they are protected from the cattle. Stabilizing streambanks by grading them to a stable slope, installing natural stream design structures to create fish habitat and protect the streambanks during the establishment of native vegetation, and reconnecting the stream to its floodplain will help to restore this section. After grading is completed, additional riparian buffer plantings would help to shade the stream and improve the biodiversity and ecological function of the riparian zone.

Impacted Stream Segment #44-45:

The north side of this stream section is mowed to the top of the streambank. The lack of vegetative cover on this side allows erosion to continuously carry away bank material from the north side of the stream. The northern streambanks are eroded 2 to 3 feet high.

Solution:

The streambanks should be graded to a stable slope of 4:1 or flatter and planted with native vegetation. Instream structures, such as rock and log structures, could be installed to improve fish habitat and protect the restored streambanks as the vegetation becomes established. Enhancement of the riparian buffer on the north side should be accomplished through the elimination of mowing and planting native tree and shrub species.

Impacted Stream Segment #53-54:
Within this stream segment, the streambanks are actively eroding and are approximately 3 to 4 feet high. The stream segment is disconnected from the floodplain. The combination of streambank erosion and floodplain disconnection in this headwaters section of the watershed has likely negatively impacted the water quality of the stream both in this stretch and downstream.

Solution:
Along this stretch of stream, a regenerative stormwater channel should be established. The regenerative channel should include grade breaks such as rock structures that will allow water to collect within pockets that are planted with native vegetation and filled with sand and compost. The stormwater discharging through the upgraded conveyance will be filtered to aid in pollution reduction. A portion of the retained water will infiltrate into the groundwater while some of the stormwater slowly seeps out of the sand and compost mixture into the channel over an extended time. When established, the regenerative stormwater channel will improve water quality, decrease flood flows, and aid in recharging the groundwater.

Impacted Stream Segment #60-62: Within this stream segment, the streambanks are eroding 4 to 5 feet high. This erosion has led to the accumulation of substantial amounts of sediment within the streambed. At the downstream point of this stream segment, a stormwater basin is in need of maintenance as there are trees growing on the basin berm and erosion around the barrel that carries the stormwater through the basin berm is evident.

Solution:

A holistic approach of retrofitting the stormwater basin and restoring the stream channel would work well in this area. Reconnecting the channel to the floodplain by installing floodplain benches and stabilizing the streambanks with grading to a stable slope and planting native vegetation is critical to the restoration of this stream segment. The floodplain bench and surrounding riparian zone should be planted with native vegetation. The retrofit of the stormwater basin should focus on adding water quality and volume controls, removing the trees and shrubs from the basin berm, and maintaining the discharge structure.

Impacted Stream Segment #82:

At this point on the tributary, cattle have access to the stream. Runoff from the barnyard area has eroded out a small channel, creating a muddy ditch from under the pasture fence to the stream. Multiple large trees in this area are at risk of dying if erosion continues. Downstream of this point, streambank fencing and livestock crossings have been installed to keep cattle out of the stream and allow plantings in the riparian zone to grow.

Solution:

Stabilizing this area and providing a safe water access point for the cows will enhance water quality and promote livestock safety. Grading the area to create a stable drainage pathway for the barnyard runoff will help to prevent additional erosion in this area and protect the trees.

Impacted Stream Segment #87-89: The streambanks along this section of the stream are between 2 and 3 feet high and are undergoing active erosion. There are multiple abandoned stream crossings in this section. In the upstream portion of this stretch, on property owned and maintained by Longwood Gardens, the riparian buffer is lightly planted with trees and shrubs. Just downstream of Point 88, there is a short stretch dominated by invasive bamboo on both sides of the stream. Downstream of the bamboo, streambanks are eroded 2 to 3 feet high, and dead ash trees and floodplain wetlands compose the riparian zone.

Solution:

Stream restoration with a natural design approach should be used to address the ongoing erosion throughout this section. The abandoned road crossings over the stream should be removed. Targeted streambank grading and the addition of riparian buffer plantings will help to address the problem areas in this section. The invasive bamboo should be removed, and the area should be replanted with native species. New plantings should be completed with a long-term maintenance plan in place to limit the resurgence of the bamboo.

Impacted Stream Segment #94-95:
In this stretch of the stream, the south side is mown to the top of the bank. Approximately 30% of the south bank is eroded 2 to 3 feet high. The north side of the stream is forested with wetlands in the riparian zone.

Solution:
This area would benefit from the cessation of mowing within the riparian zone on the south side of the stream. Streambank restoration with a natural design approach, including the implementation of bank-protecting log and rock structures, native vegetation, and streambank grading to a stable 4:1 slope, would help to restore this section. Tree and shrub plantings would help to further protect the streambank and improve both in-stream and riparian zone habitat.

Impacted Stream Segment #C-D:
Along this stretch of the stream, significant legacy sediment has accumulated since colonial times, causing the stream to become disconnected from the floodplain. The streambanks in this section are between 1 and 7 feet high and are actively eroding. Throughout this section of the stream, a thick mat of Japanese stilt grass (*Microstegium vimineum*) has suppressed the growth of native vegetation within the riparian zone.

Solution:
The most effective approach to restoring this section of the stream would likely involve reconnecting the floodplain through removing legacy sediment to create an active floodplain bench. Within the reconnected floodplain, wetland pockets could be established to help retain floodwaters and filter pollutants. Grading the streambanks to a stable slope will reduce further erosion and provide a foundation for planting native vegetation to stabilize the banks. Instream structures, such as log vanes and root wads, should be installed to provide fish habitat and reduce near-bank friction while vegetation is being established. Enhancing the riparian buffer through native plantings, and invasive species removal along the stream will strengthen the streambanks and boost biodiversity in the surrounding area.

5.0 RESTORATION IMPLEMENTATION

Restoring the Pocopson Creek and Browning Barn Tributary Watersheds will require a strategic combination of continuing environmental education of watershed stakeholders, conserving areas already contributing to enhanced water quality, and implementing best management practices (BMPs) specifically designed to enhance the aquatic health of streams running through both the agricultural and residential areas. Appendix D provides information related to the implementation of each of the proposed restoration BMPs. The format is such that each of the individual BMP sheets may be selected as needed for a particular property/project and provided to the individual landowner. In addition to the handouts, the following sections describe the implementation of priority restoration initiatives in the Pocopson Creek and Browning Barn Tributary Watersheds.

5.1 Land Preservation

With over 30% of the land in Chester County already protected from development, land preservation has been demonstrated as one of the best methods of protecting water quality. Undeveloped lands naturally infiltrate stormwater at a higher rate than developed lands with higher levels of impervious cover. Avoided capital costs for stormwater infrastructure due to preserving land are estimated at $263 million according to the Return on Environment Report prepared by the Chester County Planning Commission (2019). Additionally, an estimated 36,000 gallons of runoff is avoided each year for every acre of protected land, which helps improve water quality by preventing pollutants from entering the streams (Chester County Planning Commission 2019).

Though land preservation can include land acquisition, a more common and cost-effective method is through conservation easements. The landowner maintains ownership of the land that is under a conservation easement while agreeing to restrictions limiting future development and often implementing specific conservation practices, such as enhancing riparian forested areas, etc. Easements are held by a third party responsible for enforcing the restrictions in perpetuity. Similarly, agricultural easements can prevent future development on farms while allowing the continuation of agricultural operations. Within the Pocopson Creek and Browning Barn Tributary Watersheds, there are over 60 parcels held in conservation easements. These easements have proven to be immensely valuable for the conservation of natural areas and water quality protection in Pocopson, Newlin, East Marlborough, and Pennsbury Townships. Landowners interested in learning more about these tools may contact the Land Preservation staff at BRC.

Despite the many benefits of preserved lands, they sometimes lack rich biodiversity and habitat for native species. As native biodiversity is beneficial for both water quality and wildlife habitat, enriching the native plant diversity of preserved lands is often an important aspect of restoration. With that, native plantings are typically incorporated into riparian buffer enhancement projects. Landowners may be able to remove invasive plants and incorporate forested riparian buffers and/or native plant meadows on their properties to benefit water quality. Agricultural lands requiring conservation plans under the PA Clean Streams Law develop plans to address concerns such as erosion and sedimentation control in fields, manure management, barnyard stormwater runoff,

riparian buffer fencing, and livestock stream crossings for improved water quality. BRC and its conservation partners may be able to provide technical assistance and assist with applications for grant funding to implement these practices.

5.2 Green Stormwater Infrastructure and Detention Basins

The Pocopson Creek and Browning Barn Tributary Watersheds Restoration Plan Map identifies over 40 existing stormwater basins marked in green (Appendix A). Many of these basins are over 20 years old and could be retrofitted to better infiltrate water and improve water quality. While not all detention basins in the watershed were inspected as part of the watershed assessment, and many that were inspected require some level of maintenance, most appeared to be functioning as designed. Municipalities should work with homeowners' associations (HOAs) and landowners to regularly inspect and monitor these basins to ensure they are working as designed and address any issues as they arise. Preventive maintenance can protect the function of the basins, save significant funds, and reduce downstream impacts from development.

Managing stormwater flow before it enters the stream channel is the best way to address water quality and stormwater volume that can impair the stream. All municipalities within Chester County fall under the Commonwealth's Act 167 stormwater ordinance requirements. Ordinances adopted under Act 167 require new developments and renovations to meet current stormwater best practices. The ordinances encourage the use of green stormwater infrastructure that is designed to infiltrate stormwater wherever possible to reduce peak stormwater flow to streams and build groundwater reserves. BRC, along with Brandywine Conservancy, produced a "Green Stormwater Guide", featuring over 16 practices such as permeable paving, rain gardens, bio-swales, and many more that can help protect stream channels. Incorporating these practices in new developments, renovations, and existing infrastructure should be a priority. In some cases, technical assistance and grant funding may be available to help landowners and municipalities implement these best practices.

5.3 Riparian Forested Buffers, Meadows, and Floodplains

The riparian zone is the area bordering the banks of streams. Healthy streams typically have forested riparian buffers that are a minimum of 35 feet (100 feet or more is even better) in width that provide shade for streams, filter pollutants from stormwater runoff, provide organic material such as leaves and wood that serves as a foundation for the aquatic food chain, and stabilize stream banks. Mowing lawns to the top of stream banks provides none of these benefits and can accelerate stream bank erosion. A primary recommendation of this report is to improve riparian buffers throughout the watershed. Examples of this range from planting a few trees in a backyard and enhancing an existing buffer lacking full forest canopy to a substantial new riparian buffer planting along a stretch of impaired stream. In locations where a forested buffer is not appropriate, such as under utility lines and near intersections where trees would block the sight distance of drivers pulling onto a roadway, mowed lawns can be converted to native grass and wildflower meadows that only require mowing once a year.

Field observations taken as part of this project determined that adequate, healthy riparian buffers are missing along over 8.1 miles of stream within the study area. In many of these cases, the riparian buffers are mown as lawn to the top of the bank or within 35 feet of the stream. Many of the riparian zones that do have vegetative cover are dominated by invasive plants including multiflora rose (*Rosa multiflora*), poison hemlock (*Conium maculatum*), Japanese hops (*Humulus japonicus*), Japanese stilt grass (*Microstegium vimineum*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis*), and tree of heaven (*Ailanthus altissima*). Some buffer areas contain dead and dying ash (*Fraxinus* sp.) trees, which have been parasitized by the emerald ash borer (*Agrilus planipennis*). In multiple places throughout the watershed, tree and shrub plantings have been completed within the riparian zone. Overall, these plantings are doing quite well, which is attributable to consistent maintenance during buffer establishment. A comprehensive riparian buffer planting and lawn-to-meadow conversion plan is recommended for the areas lacking sufficient riparian buffers in the Pocopson Creek and Browning Barn Tributary Watersheds (Appendix F). Significant grant funding will be necessary, including funding for bi-annual buffer maintenance for the first four to five years to protect trees from invasive plant pressure and deer and meadow vole predation.

5.4 Stream Restoration and Bank Stabilization

Sediment pollution is the main cause of aquatic life impairment in Pocopson Creek (PA DEP, 2025). The primary source of sediment within the watershed is legacy sediment that was originally eroded from hillsides when they were denuded of forests and left bare before the implementation of conservation farming. The eroded sediment is deposited in valleys, behind the numerous mill dams, and on floodplains. The deposited soils are highly erodible and continue to erode into the streams, filling the interstitial spaces in the gravel and cobble stream bottoms. This reduces space for aquatic invertebrates to live thereby reducing the biodiversity throughout the ecosystem. Field observations documented eroding streambanks as high as seven feet above the streambed and poorly vegetated riparian zones with active stream bank erosion contributing new sediments to the stream channel (Appendix B). Streambank stabilization and restoration employ several practices, including grading stream banks back to a stable slope and placing in-stream rock and log structures that minimize friction along the streambank to reduce future erosion. Floodplains and wetlands along streams also play an important role in reducing stream bank erosion and relieving downstream flooding by absorbing flooding flows and allowing excess sediment to have a place to settle out naturally. Often, the floodplains are disconnected from the adjacent stream due to high streambank erosion and channelization through several feet of legacy sediment. Stream restoration should be completed in a holistic fashion and go beyond streambank stabilization. Where possible, stormwater should be managed, floodplains should be reconnected, and wetlands should be created.

BRC has completed over 30 stream restoration projects within the Brandywine Creek and Red Clay Creek Watersheds. These projects continue to reduce instream erosion, increase riparian buffers, and support aquatic and wildlife habitats. Several 15+ year-old projects have withstood numerous flooding events. BRC works closely with landowners,

municipalities, funders, and conservation partners to create comprehensive plans for future projects to strategically prioritize these projects with the goal of aggregating multiple projects in targeted watersheds for greater impact.

To learn more about stream restoration, see the Restoration BMP Handouts in Appendix D and visit http://www.brandywineredclay.org/watershed-conservation/ to learn more. A booklet, *Stream Restoration for Improved Water Quality*, and the related *Stream Restoration: A Holistic Watershed Approach for Improved Water Quality* video are worthwhile related resources that are available from BRC's Watershed Conservation Department.

6.0 COST ESTIMATES

As the restoration of the Pocopson Creek and Browning Barn Tributary Watersheds moves from the assessment and planning stages into the funding and implementation stages, it is imperative that an understanding of both the benefits and costs of completing each project is held by the partnering agencies and landowners. In the previous sections, the benefits of stream restoration are described. In this section, the design and implementation costs for each high and medium priority restoration project are estimated.

Clauser Environmental, LLC prepared a preliminary construction cost opinion based on its experience in the field and costs for various best management practices to serve as a general guideline for the approximate project costs. For each project, a maximum and minimum estimated cost is presented.

Costs associated with stream restoration are quite variable depending upon the overall restoration goals, landowner objectives, project funding requirements, availability of building materials and rock, site conditions, volunteer hours, level of detail required for survey and design, and permitting costs.

The total estimated cost to implement all of the high and medium priority projects within the watershed is $6,370,000 to $9,995,000. These costs include design, permitting, construction, and professional services.

To set each project in motion, the project partners will need to seek out interested landowners and funding opportunities. As the identified projects are located on a mix of privately and publicly owned parcels, landowner support and objectives will need to be at the forefront of every decision during the design, permitting, and construction stages of the projects. After reviewing the proposed project on the ground with the landowner, a more refined cost opinion should be developed and utilized as a guide to seek funding for the project. Important considerations should include access to the project site, locations of resources of special concern (wetlands, endangered and threatened species, etc.), funding limitations, volunteer matches available, and permitting requirements. After the project is funded and design and permitting are complete, a set of bid documents is typically required for use in selecting a qualified contractor. The bidding process must be conducted following accepted practices, and at least three bids should be sought. The selection of a contractor should be based on experience with the type of project being

conducted, a check of references, capacity to complete the project within the desired timeline, and cost.

7.0 OBTAINING SUPPORT AND MONITORING PROGRESS

Community outreach and attaining landowner support are often the most challenging steps in restoring a watershed. Developing a positive relationship with landowners is particularly critical. As the BRC office is located within the Pocopson Creek and Browning Barn Tributary Watersheds, many landowners have existing relationships with BRC or some of its partnering conservation organizations. Many landowners have attended BRC programs, received trees to plant, enjoyed visiting a public preserve, and/or seen previous restoration projects completed by the organization. These trusting relationships are the most important resource BRC has for implementing the projects identified in this restoration plan. Many of the landowners found the stream assessment phase of the project to be particularly of interest and have indicated that they would be interested in learning the results of the study. An important next step is to provide a forum to disseminate information to the community. Possible outreach activities include an open forum-type presentation or a watershed science fair festival where families may attend and not only hear about the results from the study but also become engaged through activities and exhibits targeting the watershed.

Within the Pocopson Creek and Browning Barn Tributary Watersheds, many parcels are held in some form of land preservation easement held by BRC or another conservation organization (Appendix G). BRC needs to nurture and support these relationships as collaborative partners. On-the-ground projects have been completed by Chester County Conservation District, Brandywine Conservancy, and others. Some of the key teaming partners for the watershed include:

- Pocopson Township, East Marlborough Township, Newlin Township, Pennsbury Township, Kennett Township, and Chester County Planning Commission (Project implementation and regulation)
- Stroud Water Research Center (Project development, research, and monitoring)
- Brandywine Conservancy (Project leadership, land preservation, and implementation)
- Chester County Agricultural Preservation Board (Farmland preservation)
- Chester County Conservation District (Agricultural BMP design, soil conservation, nutrient management, and watershed consultation)
- Chester County Water Resources Authority (Leadership and management)
- Chester County Solid Waste Authority (Funding assistance)
- Chester County Emergency Services (Flooding assistance and emergency planning)
- Natural Resources Conservation Service (Conservation plans for individual farms and agricultural best management practices)
- Pennsylvania Department of Environmental Protection (Water quality grant opportunities)

- Pennsylvania Department of Conservation & Natural Resources (Land preservation, resource management, and grant funding)
- Pennsylvania Fish & Boat Commission (Fisheries protection, resource management, and aquatic habitat improvement)
- Pennsylvania Game Commission (Wildlife protection and habitat improvement)
- National Fish and Wildlife Foundation (Grant funding opportunities)
- United States Geological Survey (Research and monitoring)
- Ducks Unlimited (Volunteers and funding assistance)
- Trout Unlimited (Volunteers and funding assistance)
- Local Scout and Civic Groups (Riparian buffer planting and litter cleanup volunteers)

The effectiveness of installed restoration projects should be monitored within the watershed. The background data collected during the assessment phase of this project provides a baseline by which to compare data collected with the same standard methodologies. Monitoring will aid in not only understanding what best management practices are having the greatest impact and guiding future projects, but will also provide crucial supporting data to demonstrate success and leverage funding for future projects. With continued progress in the watershed, the water quality of Pocopson Creek, its tributaries, and the Browning Barn Tributary will one day be restored.

8.0 LITERATURE CITED

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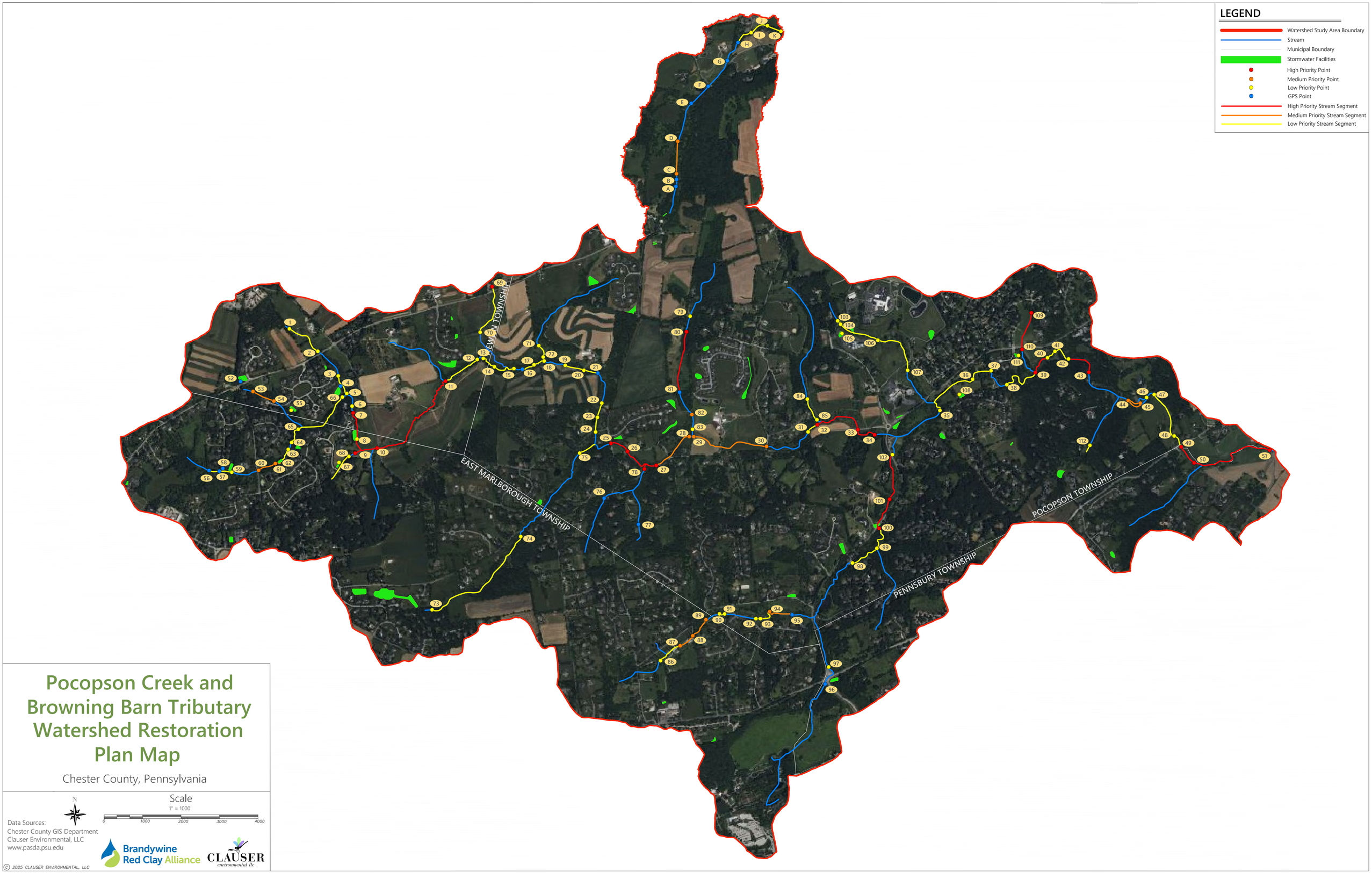
APPENDIX A
FIELD INVESTIGATION MAP



Pocopson Creek and Browning Barn Tributary Watershed Restoration Plan Map

Chester County, Pennsylvania

N

Scale
1" = 1000'
0 1000 2000 3000 4000

Data Sources:
Chester County GIS Department
Clauser Environmental, LLC
www.pasda.psu.edu

Brandywine Red Clay Alliance

CLAUSER environmental llc

APPENDIX B
GPS POINT DESCRIPTIONS AND ACTION ITEMS

Point #	Description	Action Item	Key Partners	Priority
1	Downstream of this point is mowed to the edge of the stream on both sides, and the riparian zone is recently cleared.	Riparian buffer plantings	Landowners, Conservation District, BRC, Newlin Township	Low
2	The stretch upstream of this point is mowed to the edge of the stream on both sides and has recently been cleared.	Riparian buffer plantings	Landowners, Conservation District, BRC, Newlin Township	Low
3	Downstream of this point, invasive bamboo dominates the riparian buffer of the mainstem. Upstream of this point, the riparian zone consists of dead ash and an invasive understory.	Riparian buffer enhancement and invasive species removal	Landowners, Conservation District, BRC, Newlin Township	Low
4	This point marks a wet detention stormwater basin.	Basin retrofits with naturalized plantings	Landowners, Conservation District, BRC, Newlin Township	
5	Upstream of this point, the riparian zone on the east side of the stream is mowed to the top of the bank.	Riparian buffer plantings	Landowners, Conservation District, BRC, Newlin Township	Low
6	The area downstream of this point is mowed to the edge of the stream.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Newlin Township	Low
7	Downstream of this point, stream banks are eroding 2-4' high and horses have direct access to the stream. Upstream of this point, the channel is incised with 3' high banks that are mostly healed over.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Newlin Township	High
8	This point marks the outfall from a stormwater basin that is full of *Phragmites australis* .	Invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Low

Point #	Description	Action Item	Key Partners	Priority
9	This point marks where an UNT flows into a horse pasture and into its confluence with Pocopson Creek. Downstream of this point, the horses have direct access to the stream.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, East Marlborough Township	High
10	Upstream of this point, there is active erosion of the 2-4' high streambanks. The horses have access to the stream throughout the pasture, further contributing to the erosion.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, East Marlborough Township	High
11	The area upstream of this point is an active pasture where cattle have direct access to the stream. The streambanks are actively eroding and are 2-3' high upstream of and 3-4' high downstream of the farm lane that crosses the stream in this section.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Newlin Township	High
12	Upstream of this point, the riparian buffer is sparse and the channel is incised approximately 2-3' high. The riparian zone is dominated by reed canary grass (*Phalaris arundinacea*) which would make buffer establishment challenging in this area.	Riparian buffer enhancement, invasive species removal	Landowners, Conservation District, BRC, Newlin Township	Low
13	Downstream of this point, the channel is actively eroding and the incised streambanks are over 3' high. Substantial floodplain wetlands drain to the channel in this area. Access to the stream would require significant wetland impacts that likely outweigh the benefit of working in this area. Upstream, the channel is stable with healthy riparian buffers.	Streambank stabilization	Landowners, Conservation District, BRC, Newlin Township	Low
14	Downstream of this point, the buffer is sparse, and the channel is incised 1-2' high. Upstream, the buffer is wider, but the streambanks are incised 3' and higher.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
15	This point marks the stream crossing of an existing farm lane. The crossing is gravel and dirt and stormwater discharges directly to the stream. Upstream, the channel has 2' high streambanks, and the buffer is sparse.	Install stormwater diversions along farm lane, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
16	Upstream of this point, the channel is stable with a wide riparian buffer.			

Point #	Description	Action Item	Key Partners	Priority
17	Upstream, the channel is incised with 2-3' high banks. The south side buffer upstream is less than 10' wide in some places.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
18	Upstream of this point, the buffer is narrower than downstream with 2-3' high eroding banks.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
19	Upstream of this point, the buffer is wider on both sides than on the downstream segment. The channel is incised about 2' high.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
20	This point marks an existing agricultural crossing that has been stabilized with stone. Stormwater draining along the farm lane drains directly to the stream.	Install diversions along the access to crossing	Landowners, Conservation District, BRC, Pocopson Township	Low
21	Upstream of this point, the streambanks are mowed to the edge of the stream on the north side. The streambanks are primarily stable with a few areas of 1-2' high eroding banks.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	
22	The area upstream of this point has a great buffer and stable banks. Downstream, the eastern side is mowed to the top of the streambank, with 3' high eroded streambanks.	Streambank stabilization, riparian buffer enhancement,	Landowners, Conservation District, BRC, Pocopson Township	Low
23	The area upstream of this point is mowed to the top of the eastern streambank. Downstream, there is vegetation on both sides of the bank and a small patch of bamboo.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
24	Upstream of this point, a online dam is slowing the water flow and impeding fish passage. The vegetated riparian forest is narrow in this area.	Riparian buffer enhancement, restore fish passage	Landowners, Conservation District, BRC, Pocopson Township	Low
25	Downstream of this point, the field is mowed to within 10' of the stream on the south side. The streambanks are 4-5' high and actively eroding. The mowed field could be converted into a meadow and floodplain wetland areas if landowners are willing.	Riparian buffer enhancement, streambank stabilization, floodplain wetlands and upland meadow creation, fish habitat structures	Landowners, Conservation District, BRC, Pocopson Township	High

Point #	Description	Action Item	Key Partners	Priority
26	This point marks a township culvert that appears to have an undersized waterway opening.	Engineering study, possible culvert replacement	Pocopson Township	High
27	This point is likely where the breast of Haines Mill dam was located. Upstream of this point, the streambanks are 3-5' high and actively eroding legacy sediment from the backwater conditions that were created by the Mill Dam. The field in this area is routinely mowed so that little vegetative growth is able to stabilize the stream channel.	Legacy sediment removal, riparian buffer enhancement, streambank stabilization, floodplain wetlands creation, upland meadow plantings, fish habitat improvement	Landowners, Conservation District, BRC, Pocopson Township	High
28	Upstream of this point, the streambanks are eroded 1-3' high. There is a lack of riparian buffer on the north side of the stream. This stream segment appears to have been heavily impacted from sediment from the upstream breached mill dam.	Riparian buffer enhancement, fish habitat improvement, streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Medium
29	Downstream of this point to GPS point 30, BRC completed a streambank fencing project in 2023. Approximately 40-60% of the reach has 2-4' high eroding banks. There are few trees along the eroding streambanks.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Medium
30	This point marks the downstream end of an active cattle pasture. Cattle are fenced out of the stream, but 2-4' high eroding streambanks remain in some sections of the fenced in area.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Medium
31	Upstream of this point on the mainstem, the channel is incised 2-3' high but is not actively eroding. The segment upstream of this area has a healthy forested buffer. Downstream of this point, the southern streambank has a 20' wide riparian buffer that could potentially be expanded.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
32	Downstream of this point, the streambanks are eroded 2-5' high and are actively eroding. Upstream, the riparian zone has a planted buffer that could be expanded. Pocopson Township has implemented a 618' stream restoration at the upstream end of this section.	Floodplain reconnection, wetland creation, bank stabilization, expand buffer planting	Landowners, Conservation District, BRC, Pocopson Township	High
33	The segment downstream of this point has some areas where the streambanks are actively eroding 2-5' high and lack a riparian buffer on the north side of the stream.	Floodplain reconnection, wetland creation, bank stabilization, expand buffer planting	Landowners, Conservation District, BRC, Pocopson Township	High
34	Upstream, the streambanks are eroded 2-5' high and are actively eroding. Downstream of this point, streambanks are stable and within a forested riparian buffer.	Floodplain reconnection, wetland creation, bank stabilization, expand buffer planting	Landowners, Conservation District, BRC, Pocopson Township	High

Point #	Description	Action Item	Key Partners	Priority
35	Upstream, the streambanks are incised 3-4' high in some areas, but are primarily stable within a forested riparian zone. Downstream, the streambanks are incised 3-5' high, with less than 10% of the areas in active erosion. The riparian buffer downstream is less than 15' wide. Downstream, there is the potential to create a floodplain reconnection project to store floodwaters in floodplain wetlands.	Riparian buffer, lawn to meadow conversion, floodplain reconnection	Landowners, Conservation District, BRC, Pocopson Township	Low
36	Upstream, the streambanks are incised 3-5' high, with less than 10% of the stretch in active erosion. The riparian buffer is less than 15' wide upstream. Downstream, streambanks are eroding 3-4' high in a lightly stocked equine pasture.	Streambank fencing, riparian buffer planting, streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Low
37	This point marks the downstream edge of equine access to the stream.	Streambank fencing, riparian buffer planting, streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Low
38	Downstream of this point, the mainstem flows through a primarily forested area. The banks on the outside of the meander bends are 3-4' high and actively eroding.	Streambank stabilization, fish habitat enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
39	Downstream of this point, livestock have access to the stream, and the streambanks are eroding in some areas. The stream channel is incised 2-3' high. An old dam breast was breached in this area.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
40	Upstream of this point, livestock have access to the stream. Downstream of this point, the northern side of the stream is mowed to the top of bank.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
41	Upstream of this point, the channel incised 3-5' high and is mowed to the top of the streambanks.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
42	Upstream of this point, the channel is incised 4-5' high, and there is a lack of in-stream habitat.	Fish habitat enhancement, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low

Point #	Description	Action Item	Key Partners	Priority
43	This point is taken at the Denton's Mill dam breast that was breached in 1935. The dam was originally constructed before 1720. Upstream of this point, the channel is incised 5-8' and is actively eroding in multiple places. Downstream of this point, the channel is in excellent condition.	Floodplain reconnection, legacy sediment removal, streambank stabilization, fish habitat enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
44	Upstream of this point, the streambanks are stable, and the stream is connected to the floodplain. The riparian buffer is 15-20' wide. Downstream, the area is mowed as lawn to the northern streambank with 2-3' high eroding streambanks.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Medium
45	Upstream of this point, the northern side of the stream is mowed to the top of the streambank with 2-3' high eroding banks. Downstream, both sides of the stream are mowed to the top of banks, but streambanks are stable.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Medium
46	Downstream of this point, the section has a wider riparian buffer with stable streambanks.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
47	The area downstream of this point is mowed as a meadow within 10-15' of the channel on the western bank. The channel bottom and banks are stable.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
48	Downstream, the area is mowed to the top of the streambanks with 2-3' high eroding banks for a 150' stretch.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
49	Downstream of this point, cattle have access to the stream, streambanks are stable at 1-2' high, and there is very little riparian buffer.	Streambank fencing, stabilize livestock crossings, riparian buffer enhancement	Landowners, Conservation District, BRC, Pennsbury Township, Pocopson Township	High
50	Downstream and upstream of this point, cattle have access to the stream. Upstream, the banks are 1-2' high and stable. Downstream, the banks are 2-5' high and actively eroding in some areas.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pennsbury Township, Pocopson Township	High

Point #	Description	Action Item	Key Partners	Priority
51	Upstream of this point, the cattle have access to the stream. The streambanks are eroding 2-5' high in some areas.	Streambank fencing, stabilize livestock crossings, streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pennsbury Township, Pocopson Township	High
52	This point marks an extended retention basin that could be enhanced with native plantings.	Naturalize with native vegetation	Landowners, Conservation District, BRC, Newlin Township	Low
53	Downstream of this point, streambanks are actively eroding and are 3-4' high. The stream is disconnected from the floodplain.	Regenerative stream channel design	Landowners, Conservation District, BRC, Newlin Township	Medium
54	Upstream of this point, the streambanks are eroded 3-4' high with a forested buffer.	Regenerative stream channel design	Landowners, Conservation District, BRC, Newlin Township	Medium
55	This point marks a conventional rate control stormwater basin.	Stormwater retrofit	Landowners, Conservation District, BRC, Newlin Township	Low
56	This point marks the upstream end of a stretch that would be improved by riparian buffer planting.	Riparian buffer planting, litter clean up on south side of stream	Landowners, Conservation District, BRC, East Marlborough Township	Low
57	In this area, there is an adequate buffer on the south side of the stream. The north side is mowed to the edge of the stream for approximately 20' upstream to point 56.	Riparian buffer planting, invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Low
58	This point marks a mowed stormwater basin. The basin would benefit from native plantings to increase filtration times and create habitat.	Naturalize stormwater basin with native vegetation	Landowners, Conservation District, BRC, East Marlborough Township	Low

Point #	Description	Action Item	Key Partners	Priority
59	Upstream to point 56, 50% of the streambanks are 3' high and actively eroding with a forested buffer. Downstream of this point, streambanks are primarily healed over. A stormwater basin discharges to the stream in this location.	Streambank stabilization	Landowners, Conservation District, BRC, East Marlborough Township	Low
60	Downstream of this point, streambanks are eroded 4-5' high, and the riparian zone is forested.	Streambank stabilization with creation of a bankfull bench	Landowners, Conservation District, BRC, East Marlborough Township	Medium
61	Upstream of this point, the 4-5' high eroding streambanks are causing substantial amounts of sediment to accumulate in the streambed.	Streambank stabilization with creation of a bankfull bench	Landowners, Conservation District, BRC, East Marlborough Township	Medium
62	This point marks a stormwater basin with active erosion around the barrel.	Repair or retrofit stormwater basin, remove vegetation from basin berm	Landowners, Conservation District, BRC, East Marlborough Township	Medium
63	Upstream of this point, 30% of banks are approximately 2' high. Downstream, there is *Ailanthus altissima* within the forested riparian zone.	Streambank stabilization, invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Low
64	The stormwater basin that drains to the creek at this point is a rate control structure. Streambanks are eroded 2-4' high downstream of this point.	Stormwater basin retrofit, invasive species removal, streambank stabilization	Landowners, Conservation District, BRC, East Marlborough Township	Low
65	Upstream of this point to point 64, streambanks are 2-4' high on approximately 50% of the reach. The area is forested with a substantial riparian buffer.	Streambank stabilization	Landowners, Conservation District, BRC, East Marlborough Township	Low

Point #	Description	Action Item	Key Partners	Priority
66	There are many dying ash trees upstream to point 65. The riparian zone is thick with invasive *Rosa multiflora*	Invasive species removal, replant riparian zone	Landowners, Conservation District, BRC, Newlin Township	Low
67	The stormwater basin at this point is full of *Phragmites australis* .	Invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Low
68	Upstream and Downstream of this point, the area is mowed to the edges of the stream and a pond.	Riparian buffer enhancement	Landowners, Conservation District, BRC, East Marlborough Township	Low
69	This point marks a barnyard where many cattle are fed. Rainwater flows through the barnyard and picks up substantial nutrients before being conveyed offsite through a swale. Downstream, the tributary lacks a riparian buffer. Rerouting the water to bypass the cattle enclosure would greatly reduce the nutrients draining into the tributary.	Barnyard enhancements	Landowners, Conservation District, BRC, Newlin Township	High
70	Upstream of this point, the tributary lacks a riparian buffer.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Newlin Township	Low
71	Downstream of this point, the field is mowed for hay to the top of the streambanks. Upstream, the riparian buffer is forested, and the channel is stable.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
72	Upstream of this point, the field is mowed for hay to the edge of the stream.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
73	This point marks the upstream end of a stream segment that is mowed to the edge of the streambank.	Riparian buffer planting	Landowners, Conservation District, BRC, East Marlborough Township	Low

Point #	Description	Action Item	Key Partners	Priority
74	This point marks the downstream end of an area that is well-suited for a riparian buffer project. Downstream of this point, the streambanks are stable, and there is invasive bamboo along a 200' stretch of the stream.	Riparian buffer enhancement, invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Low
75	Downstream to the mainstem, the channel has 1-2' high eroding streambanks with some bamboo within the riparian zone. Upstream of this point, the channel is stable with a forested riparian buffer.	Riparian buffer enhancement, streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Low
76	This section of the tributary is stable with a forested riparian zone.			
77	This section of the tributary is stable with a forested riparian zone.			
78	Downstream of this point on the unnamed tributary, the streambanks are 3-5' high and actively eroding.	Streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	High
79	Upstream of this point, the channel is mostly stable with a forested buffer. A small number of additional trees could be added to the parcel immediately upstream.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
80	This point marks an equine operation with pasture immediately adjacent to an online pond. The manure from cleaning out the stalls is upslope of the stream. The streambanks are stable.	Manure management plan, barn gutter plan, streambank fencing, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
81	This point marks the downstream end of the equine access to the stream. Downstream of this point, the channel is stable with a thick riparian buffer.	Streambank fencing, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
82	At this point, cattle have access to the stream in an unstable area.	Create stable water access	Landowners, Conservation District, BRC, Pocopson Township	Medium
83	At this point, there is a swale that drains from the barnyard towards the stream.	Barnyard enhancements	Landowners, Conservation District, BRC, Pocopson Township	Low

Point #	Description	Action Item	Key Partners	Priority
84	Upstream of this point, the channel is stable with a forested riparian buffer. Downstream, the riparian buffer is 10-15' wide on average. The surrounding open area on the Pocopson Township property is mowed.	Expand downstream riparian buffer, convert mowed field to pollinator meadow	Landowners, Conservation District, BRC, Pocopson Township	Low
85	Upstream of this point, the tributary has a riparian buffer that is 10-15' wide on average. Downstream, there is an established riparian buffer on the mainstem.	Expand the riparian buffer, convert mowed field to pollinator meadow	Landowners, Conservation District, BRC, Pocopson Township	Low
86	Upstream of this point, the channel is stable and within a healthy riparian buffer. Downstream, the channel is stable, but additional plantings could expand the buffer.	Riparian buffer enhancement	Landowners, Conservation District, BRC, East Marlborough Township	Low
87	Upstream of this point, the stream channel is stable, with several old road crossings remaining. Downstream of this point, the streambanks are eroded 2-3' high, and the riparian buffer is lightly planted.	Stabilize streambanks, remove abandoned stream crossings, riparian buffer enhancement	Landowners, Conservation District, BRC, East Marlborough Township	Medium
88	This area has 2-3' high actively eroding streambanks. The area downstream of this point has invasive bamboo on both sides of the stream.	Stabilize streambanks, invasive species removal	Landowners, Conservation District, BRC, East Marlborough Township	Medium
89	Upstream of this point, the streambanks are eroded 2-3' high with dead ash and floodplain wetlands along the stream. Downstream, the streambanks are mostly stable, and the buffer is wider.	Streambank stabilization, riparian buffer planting	Landowners, Conservation District, BRC, East Marlborough Township	Medium
90	Upstream of this point, there is a healthy riparian buffer. Downstream, the area is mowed close to the channel on the south side. The north side has substantial wetlands.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
91	The area downstream of this point has invasive *Phragmites australis,* stable banks, and a wide riparian buffer.	Invasive species removal	Landowners, Conservation District, BRC, Pocopson Township	Low

Point #	Description	Action Item	Key Partners	Priority
92	Downstream of this point, the area is mowed to within 15' of the channel on the south side of the stream.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
93	This point marks an abandoned stream crossing that is partially eroded at the abutment.	Remove abandoned crossing, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
94	Downstream of this point, the streambanks are 2-3' high and actively eroding on the south bank in about 30% of the section. The south side of the stream is mowed to the top of the bank. There are wetlands on the north bank.	Riparian buffer planting, streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Medium
95	Downstream has a substantial riparian buffer and 2-3' high streambanks throughout 10-20% of the reach. There are wetlands on both sides of the stream, continuing to the confluence with the other tributary.			
96	Upstream of this point is stable with a large riparian buffer maintained by Longwood Gardens			
97	The stream channel is stable and forested in this area. A small litter cleanup behind the business would be beneficial.	Litter cleanup	Landowners, Conservation District, BRC, Pennsbury Township	Low
98	Upstream of this point, the channel is stable with a forested riparian buffer. Downstream, the streambanks are 2-3' high and are actively eroding. The riparian zone is mowed to the stream edge.	Streambank stabilization, riparian buffer enhancement	Landowners, Conservation District, BRC, Pennsbury Township	Low
99	Downstream of this point, the streambanks are eroding 2-3' high. The stream section is surrounded by floodplain wetlands and dead ash trees.	Riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	Low
100	Downstream of this point, 75% of the reach has 3-4' high eroding streambanks and is mowed to the top of the bank.	Riparian buffer enhancement, streambank stabilization, floodplain reconnection	Landowners, Conservation District, BRC, Pocopson Township	High

Point #	Description	Action Item	Key Partners	Priority
101	Downstream of this point, the segment is mowed to the top of the streambank with 2-3' high eroding streambanks.	Riparian buffer enhancement, streambank stabilization, floodplain reconnection	Landowners, Conservation District, BRC, Pocopson Township	High
102	Upstream of this point, the segment is mowed to the top of the streambank with 2-3' high eroding streambanks. Downstream, the landowner did not grant access. The downstream area is mowed to the top of banks with some animal pastures.	Riparian buffer enhancement, streambank stabilization, floodplain reconnection	Landowners, Conservation District, BRC, Pocopson Township	Low
103	Upstream, the area is forested with riparian wetlands. Downstream, the area is mowed to the edge of the stream on both sides.	Riparian buffer planting	Chester County Prison, Conservation District, BRC, Pocopson Township	Low
104	This point marks a culvert that has a 1' drop at the downstream end.	Restore fish passage	Chester County Prison, Conservation District, BRC, Pocopson Township	Low
105	This point marks a mowed stormwater basin. The basin would benefit from native plantings to increase filtration times and create habitat.	Naturalize stormwater basin with native vegetation	Chester County Prison, Conservation District, BRC, Pocopson Township	Low
106	The segment upstream of this point is mowed to the stream edge with 1-2' high eroding streambanks. Downstream, there is a forested riparian buffer. The downstream riparian buffer is sparse and would benefit from additional plantings.	Expand downstream riparian buffer, convert mowed field to pollinator meadow	Chester County Prison, Conservation District, BRC, Pocopson Township	Low
107	Upstream of this point, the riparian buffer is sparse. Downstream, the streambanks are stable, and the riparian zone is forested.	Riparian buffer plantings	Chester County Prison, Conservation District, BRC, Pocopson Township	Low
108	This point marks a conventional stormwater basin that is mowed.	Naturalize stormwater basin with native vegetation	Landowners, Conservation District, BRC, Pocopson Township	Low

Point #	Description	Action Item	Key Partners	Priority
109	Downstream of this point, livestock have access to the stream and there is a lack of riparian buffer.	Streambank fencing, stabilized livestock crossings, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
110	Upstream of this point, livestock have access to the stream. Downstream, the tributary has stable streambanks and a forested riparian buffer.	Streambank fencing, stabilized livestock crossings, riparian buffer enhancement	Landowners, Conservation District, BRC, Pocopson Township	High
111	This point marks a stormwater basin that is maintained as a mowed lawn.	Stormwater basin retrofits with natural buffers	Landowners, Conservation District, BRC, Pocopson Township	Low
112	Downstream of this point is stable with a forested buffer. Upstream is one parcel with lawn to the top of the streambank.	Riparian buffer plantings	Landowners, Conservation District, BRC, Pocopson Township	Low
A	At this point, a riparian buffer planting has been completed on the Brandywine Red Clay Alliance Property. Upstream of this point, regenerative step pools were installed by BRC in 2019 to address stormwater that was forming a gully on their property.	Maintain the riparian buffer plantings	BRC	
B	This is the downstream end of the riparian buffer planting.	Maintain the riparian buffer plantings and step pools	BRC	
C	The stream reach upstream of this point is stable. The reach downstream of this point has 1-7' high eroding banks. The downstream area has a healthy riparian buffer and wetlands along the stream.	Streambank stabilization with creation of a floodplain bench, wetland creation	Conservation District, BRC, Pocopson Township	Medium
D	The area upstream of this point has 1-7' high eroding banks. There is an opportunity for stream stabilization and floodplain reconnection in this stretch of stream.	Streambank stabilization with creation of a floodplain bench, wetland creation	Conservation District, BRC, Pocopson Township	Medium
E	Upstream of this point, the stream channel is stable with a densely forested riparian buffer. The area downstream of this point has been cleared and planted with native plantings. Downstream, there are a few scattered areas with 2' actively eroding banks.	Maintain the riparian buffer plantings	Landowners, Conservation District, BRC, Pocopson Township	

Point #	Description	Action Item	Key Partners	Priority
F	Upstream is a new riparian buffer planting. Downstream of this point is a Brandywine Conservancy implemented riparian buffer that is over 8 years old. The channel is stable in this area.	Maintain the riparian buffer plantings	Brandywine Conservancy. Landowners, Conservation District, BRC, Pocopson Township	
G	This point marks the downstream end of the Brandywine Conservancy riparian buffer planting. Streambanks are stable in this area.	Maintain the riparian buffer plantings	Brandywine Conservancy. Landowners, Conservation District, BRC, Pocopson Township	
H	Upstream of this point, the streambanks are stable with 10-12' wide riparian buffers. Downstream of this point, streambanks are stable with a good riparian buffer. Additional buffer plantings would improve this section.	Supplemental tree plantings within the riparian buffer	Landowners, Conservation District, BRC, Pocopson Township	
I	The area upstream of this point is stable but lacks an adequate riparian buffer. Downstream, the area is mowed to the top of the bank on the north side in multiple places. Other sections in this area have 20' of riparian buffer.	Riparian buffer plantings	Landowners, Conservation District, BRC, Pocopson Township	Low
J	Downstream of this point, stream banks are 4' high and eroding due to routine flooding from the West Branch Brandywine Creek. The area has a healthy riparian buffer.	Streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Low
K	This point marks the confluence of the Browning Barn Tributary with the West Branch Brandywine Creek. Upstream, the tributary cuts through the floodplain of the Brandywine Creek and has resultingly high eroding streambanks that average 4' high.	Streambank stabilization	Landowners, Conservation District, BRC, Pocopson Township	Low

APPENDIX C
POINT LOCATION DATA

Pocopson Creek and Browning Barn Tributary Watersheds
Point Location Data

Point #	Latitude (°N)	Longitude (°W)
1	39.90717	75.71463
2	39.90546	75.71203
3	39.90370	75.71030
4	39.90297	75.71009
5	39.90244	75.70956
6	39.90152	75.70908
7	39.90102	75.70898
8	39.89921	75.70866
9	39.89816	75.70891
10	39.89847	75.70685
11	39.90317	75.70037
12	39.90466	75.69735
13	39.90473	75.69680
14	39.90410	75.69579
15	39.90392	75.69399
16	39.90387	75.69321
17	39.90419	75.69211
18	39.90444	75.69118
19	39.90409	75.68921
20	39.90373	75.68750
21	39.90348	75.68623
22	39.90132	75.68591
23	39.90030	75.68631
24	39.89926	75.68656
25	39.89843	75.68517
26	39.89782	75.68364
27	39.89679	75.68101
28	39.89879	75.67786
29	39.89878	75.67747
30	39.89797	75.67074
31	39.89892	75.66683
32	39.89943	75.66600
33	39.89904	75.66225
34	39.89863	75.66069
35	39.90025	75.65460

Point #	Latitude (°N)	Longitude (°W)
36	39.90240	75.65147
37	39.90289	75.64984
38	39.90194	75.64833
39	39.90277	75.64566
40	39.90380	75.64450
41	39.90427	75.64381
42	39.90369	75.64257
43	39.90270	75.64069
44	39.90063	75.63713
45	39.90040	75.63602
46	39.90082	75.63539
47	39.90100	75.63472
48	39.89799	75.63294
49	39.89722	75.63234
50	39.89611	75.63113
51	39.89683	75.62414
52	39.90348	75.71937
53	39.90272	75.71824
54	39.90201	75.71632
55	39.90134	75.71472
56	39.89713	75.72246
57	39.89710	75.72152
58	39.89729	75.72120
59	39.89698	75.72028
60	39.89711	75.71788
61	39.89757	75.71632
62	39.89762	75.71594
63	39.89857	75.71508
64	39.89904	75.71476
65	39.89998	75.71412
66	39.90222	75.70993
67	39.89752	75.71040
68	39.89793	75.70948
69	39.90982	75.69581
70	39.90659	75.69705

Pocopson Creek and Browning Barn Tributary Watersheds
Point Location Data

Point #	Latitude (°N)	Longitude (°W)
71	39.90554	75.69162
72	39.90472	75.69124
73	39.88686	75.70206
74	39.89195	75.69372
75	39.89779	75.68809
76	39.89451	75.68589
77	39.89259	75.68278
78	39.89657	75.68213
79	39.90738	75.67756
80	39.90626	75.67797
81	39.90196	75.67870
82	39.90037	75.67760
83	39.89931	75.67757
84	39.90127	75.66689
85	39.89976	75.66604
86	39.88287	75.68105
87	39.88387	75.67919
88	39.88455	75.67797
89	39.88567	75.67672
90	39.88602	75.67549
91	39.88604	75.67498
92	39.88569	75.67211
93	39.88569	75.67168
94	39.88612	75.67084
95	39.88591	75.66875
96	39.88091	75.66582
97	39.88211	75.66551
98	39.88949	75.66303
99	39.89052	75.66077
100	39.89190	75.66049
101	39.89397	75.65948
102	39.89714	75.65908
103	39.90681	75.66387
104	39.90655	75.66359
105	39.90589	75.66354

Point #	Latitude (°N)	Longitude (°W)
106	39.90538	75.66016
107	39.90314	75.65752
108	39.90135	75.65274
109	39.90705	75.64587
110	39.90444	75.64687
111	39.90400	75.64720
112	39.89750	75.64078
A	39.91669	75.67855
B	39.91716	75.67851
C	39.91760	75.67850
D	39.91992	75.67831
E	39.92258	75.67695
F	39.92377	75.67534
G	39.92557	75.67353
H	39.92684	75.67252
I	39.92755	75.67123
J	39.92798	75.66973
K	39.92757	75.66844

APPENDIX D
RESTORATION BMP HANDOUTS

Riparian Buffer Enhancement

Mowing and grazing stream corridors to the stream edge impacts water quality and the community of creatures that live within the stream. Streams lacking a healthy riparian buffer are exposed to high levels of sunlight and lack a filter to minimize sediment and nutrients from discharging into the stream. As sunlight warms the water, it cannot hold as much dissolved oxygen, which is essential for a healthy stream community.

Riparian buffers provide shade, helping moderate daily stream temperature changes during both winter and summer months. Pollutants can be successfully filtered and trapped by the physical structure of the vegetation itself and be taken up through the root systems and stored in the tree and shrub's wood. In addition, healthy riparian buffers provide a home for a diversity of wildlife and function as a corridor to allow wildlife to move from one pocket of habitat to another. Funding is often available to implement riparian buffer plantings.

For more information please contact:
Brandywine Red Clay Association
1760 Unionville-Wawaset Road
West Chester, PA 19382
Phone: (610) 793-1090

Brandywine Red Clay Alliance

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Streambank Stabilization

Within the Pocopson Creek and Browning Barn Tributary Watersheds, some stream segments are impaired by erosion and sedimentation within the stream itself. When streambanks erode, sediment that is discharged to the stream channel smothers the small nooks and crannies between the rocks on the streambed that provide micro-habitat areas for the instream community. Sediment discharges are often partnered with the release of soil-bound nutrients. Within these areas, stream restoration and stabilization are often effective tools to improve in-stream habitat and water quality. Stream restoration within the watershed should focus on the long-term stability of the stream by looking at the stream's pattern, profile, and dimension. Where streambanks are actively eroding, stabilization that focuses on establishing native vegetation is often the best long-term option. As the vegetation becomes established, a combination of rip-rap and instream structures are often implemented to provide stabilization. The use of well-positioned in-stream deflectors, cross-vanes, j-hooks, and straight vanes can help to hold the streambanks in place as the vegetation becomes established. These structures, when utilized effectively, minimize streambank erosion by reducing the force of water that is scouring the bank surface and provide habitat for many types of aquatic life.

For more information please contact:

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Floodplain Restoration

In many areas of the Pocopson Creek and Browning Barn Tributary Watersheds, past human activities have placed fill in or caused extensive sedimentation within the riparian zone. The excess material along the edge of the stream channel has disconnected the stream from the floodplain. Floodplain restoration projects are designed to remove excess soil from the floodplain so that the stream is reconnected to an active floodplain. Active floodplains are important to not only reduce the volume and velocity of floodwaters but also to filter nutrients and pollutants from floodwaters and to provide habitat for a diverse riparian community. The restored streambanks and floodplain area can be planted with native wildflowers, grasses, shrubs, and trees to help stabilize the riparian zone and promote the use of the area by a diversity of native wildlife. Floodplain restoration projects can range from establishing a small bankfull bench to help disperse flows to large-scale excavation projects that uncover the historic valley floor.

For more information please contact:

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Brandywine Red Clay Alliance

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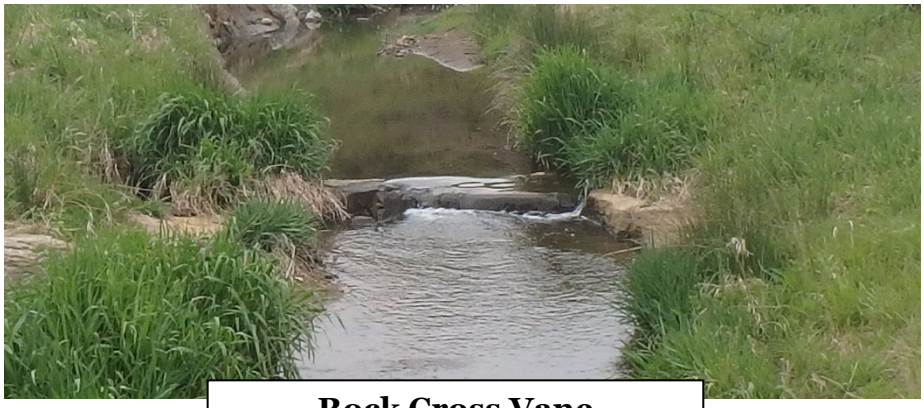
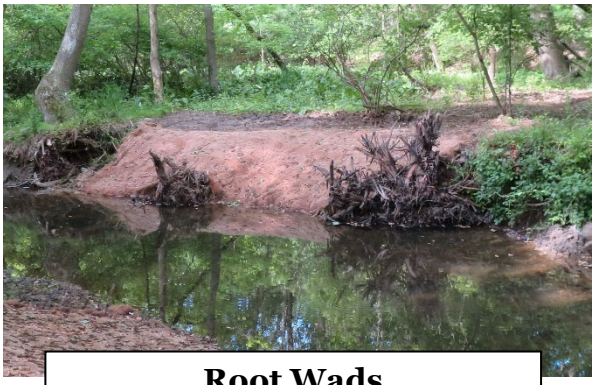
In-stream Restoration Structures

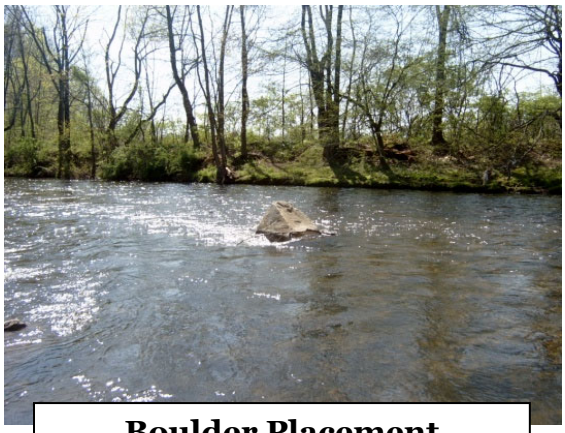
In-stream rock and log deflectors, cross-vanes, j-hooks, and boulder placements are effective tools for creating in-stream fish habitat and aiding in the stabilization of streambanks. The structures are typically constructed based on what materials are available on the site or are locally available. Root wads from clearing operations may be anchored into the streambanks to slow the flow of water in the stream and create habitat for fish and aquatic life. Log sections may be used to create vanes and deflectors to protect banks and create in-stream habitat. Where needed, boulders can be placed either randomly for fish habitat and to disperse flows or aligned to roll the stream flow away from the bank and into the center of the channel. In-stream structures are typically designed to manage low to moderate flow conditions and help shape and maintain a natural stream configuration. During high flow events, the structures are designed to stay in place beneath the floodwaters. These structures are often included in comprehensive stream restoration designs.



Rock Cross Vane



Root Wads



Boulder Placement

For more information please contact:
Brandywine Red Clay Association
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Streambank Fencing

Grazing livestock in and around streams has the potential to negatively affect water quality. Livestock trample the streambanks and contribute to accelerated erosion and produce manure that gets into the stream system. Manure that is within the stream contains bacterial pathogens that make the water unsafe for drinking and greatly increase the chances of infection for those with cuts or scrapes that come in contact with the water. The nutrients contained within the manure, while an important resource for crop fields, can cause algal blooms within streams. When the algae die, they decay and use up oxygen within the water, which often leads to fish kills and a shift to less desirable insects that live within the water. With unrestricted access to streams, wetlands, and ponds, livestock are at increased risk of injury, black leg, mastitis, and other ailments.

Restricting livestock access to streams and wetlands contributes to herd health, improves wildlife habitat, improves water quality, and makes the water safer for those being exposed to it. Streambank fencing typically consists of either single strand (adult cattle only) or double strand electric fencing. The fence is located as far back from the streambank as practical and installed parallel to the flow of the stream. Funding assistance is often available. The landowner is typically responsible for maintaining the fence. While livestock often graze the area under the fence, it is sometimes necessary to mow to control vegetation from shorting the fence.

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Stabilized Livestock Stream Crossing

Where livestock have unrestricted access to streams, they typically find a few favorite crossing areas and use those sites repeatedly. The resulting crossing locations begin to erode and become slippery and unstable. In these locations, livestock are at risk of injury, and the stream is subjected to high levels of sedimentation.

In combination with any streambank fencing project where quality pastureland exists on both sides of the stream, stabilized crossing areas are a necessity. Installation of the crossings typically requires a general permit registration to be sent to the Pennsylvania Department of Environmental Protection (PA DEP) and the conservation district. In Pennsylvania, the most common installation technique is to place concrete hog slats across the bottom of the stream and maintain slopes on the approaches that are no greater than 4:1. The crossings may easily be equipped with gates to create paddocks that aid in rotational grazing. Routine maintenance of the crossing locations should include inspection after high water events to ensure that the fencing with dropper wires utilized to guide livestock through the crossing remains serviceable. Funding is often available for this agricultural best management practice.

For more information please contact:
Brandywine Red Clay Association
1760 Unionville-Wawaset Road
West Chester, PA 19382
Phone: (610) 793-1090

Brandywine Red Clay Alliance

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Constructed Wetlands

Throughout the Pocopson Creek and Browning Barn Tributary Watersheds, many areas lack connections to wetlands. The creation of constructed wetlands in the watershed will have multiple positive impacts on the watershed. Foremost, constructed wetlands can serve to remove contaminants and pollutants caused by human activity from the water supply through the same processes as naturally occurring wetlands. These processes help to remove and break down contaminants. Constructed wetlands not only offer the benefit of water quality improvements through a natural and holistic process but also provide a variety of niche habitats for local plants and wildlife. Wetlands are considered to be one of the most productive ecosystems on Earth and provide habitat for birds, mammals, amphibians, and reptiles, as well as diverse plants and fungi in the area. Constructed wetlands can help to reduce the impacts caused by erosion as the complex root systems of wetland species help to anchor soils. Additionally, wetlands can mitigate the impacts of flooding and aid in groundwater recharge. This phenomenon occurs because of the ability of wetlands to hold significant amounts of water, which otherwise might pose a threat to urban areas nearby and downstream.

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Invasive Species Removal

Throughout the Pocopson Creek and Browning Barn Tributary Watersheds, invasive species pose a threat to the ecosystem and native species. Of particular concern in the watershed are Japanese hops (*Humulus japonicus*), common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), Asiatic bittersweet (*Celastrus orbiculatus*), mile-a-minute (*Persicaria perfoliate*), and multiflora rose (*Rosa multiflora*). Invasive species wreak havoc on ecosystems by dominating niches belonging to native plants. This results in changes in the populations of all types of creatures, changes in soil and water quality over time, and eventually a reduction in native biodiversity.

Control of most invasive plant species over large areas typically requires selective herbicide application on multiple occasions. It is crucial that soil containing invasive plant roots and seeds is appropriately managed and that tires and tracks from construction equipment are cleaned in such a way as to minimize the risk of the plants spreading to other areas.

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Litter Cleanup

Throughout the watershed, the impact of human activity is noticeable through the litter laying along the streambanks and streambed. In some parts of the watershed, larger pieces of litter (such as old construction materials and pieces of metal) line the banks of the stream. Litter can change public perception of stream ecosystems, resulting in reduced interest in keeping the stream healthy for both wildlife and human use. This litter not only takes away from the aesthetic value of the stream but can also be detrimental to the stream ecosystem and water quality.

Volunteer litter cleanups may be used to collect litter that is small and easily carried. Large litter will require a more involved effort to remove safely. Community groups such as religious organizations, scout troops, and civic organizations can be great sources of volunteers for litter cleanups. Every year BRC coordinates the Brandywine Valley clean-up in late April with cleanup sites in the Pocopson Watershed.

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Lawn to Meadow Conversion

There are many opportunities throughout the watershed to convert lawn areas into meadows. Meadows greatly increase the biodiversity of an area, creating a haven for native species and providing native wildflowers for pollinators. Meadows provide the hydrologic benefit of slowing and reducing stormwater runoff by acting as a sponge to absorb and hold runoff as it drains towards the stream. Meadows also help to capture pollutants before they enter the stream and provide sediment and contaminants a place to settle out where they can be broken down by the sun and ecological processes.

The right native plant mix for lawn to meadow conversion depends on the location of the meadow in the watershed. Species can be selected for pollinator benefits, flower color, and drainage of soil. Funding may be available to assist landowners in implementing meadow plantings.

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Stormwater Management Retrofits

As the amount of developed land increases within the watershed, the landscape is altered by an increase in impervious cover. Impervious areas shed runoff and increase stormwater discharges to the streams. Increased stormwater flows contribute to flooding, degrade water quality, and accelerate in-stream erosion.

To decrease the impacts of stormwater on the watershed, effective best management practices should be installed with new construction. Where existing stormwater structures exist, they should be evaluated for effectiveness and retrofitted where necessary.

Common stormwater retrofits focus on improving the function of existing structures so that they more closely reflect the natural hydrological cycle. Within existing stormwater basins, native species may be planted or allowed to become established. Minimizing mowing and labor in this way provides for additional wildlife habitat, reduces nutrient discharges to the stream, and allows for the vegetation to return more of the stormwater to the atmosphere through evapotranspiration. Other strategies for stormwater retrofits include installing cisterns to allow for water reuse and infiltration trenches to increase the return of stormwater to the groundwater.

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APPENDIX E
PRELIMINARY PROBABLE CONSTRUCTION COST OPINION

Pocopson Creek and Browning Barn Tributary Watersheds
Probable Construction Cost Opinion

Site	Priority	Min Cost	Max Cost
Buffer Enhancements	High	$1,000,000	$1,500,000
7-10	High	$375,000	$475,000
10-11	High	$450,000	$600,000
25-27, 78	High	$575,000	$700,000
27-28	Medium	$175,000	$275,000
29-30	Medium	$300,000	$475,000
32-34	High	$425,000	$625,000
39-40	High	$85,000	$175,000
42-43	High	$450,000	$725,000
44-45	Medium	$85,000	$135,000
49-51	High	$525,000	$925,000
53-54	Medium	$315,000	$610,000
60-62	Medium	$225,000	$375,000
69	High	$150,000	$250,000
80-81	High	$85,000	$110,000
82	Medium	$25,000	$35,000
87-89	Medium	$225,000	$300,000
94-95	Medium	$95,000	$120,000
100-102	High	$525,000	$1,150,000
109-110	High	$40,000	$85,000
C-D	Medium	$240,000	$350,000
		$6,370,000	$9,995,000

Clauser Environmental, LLC is not a construction contractor and therefore probable construction cost opinions are made on the basis of Clauser Environmental, LLC's experience and qualifications as an environmental consultant and represent the consultant's best judgment as experienced and qualified design professionals generally familiar with the industry. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; contractors' techniques in determining prices and market conditions at the time, and other factors over which Clauser Environmental, LLC has no control. Given these assumptions which must be made, Clauser Environmental, LLC states that the above probable construction cost opinion is a fair and reasonable estimate for construction costs but cannot and does not guarantee that actual construction costs will not vary from the Probable Construction Cost Opinion.

APPENDIX F
POTENTIAL RIPARIAN BUFFER ENHANCEMENT AREAS MAP

Pocopson Creek and Browning Barn Tributary Potential Riparian Buffer Enhancement Areas

Chester County, Pennsylvania

N

Scale
1" = 1000'
0 1000 2000 3000 4000

Data Sources:
Chester County GIS Department
Clauser Environmental, LLC
www.pasda.psu.edu

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APPENDIX G
PRESERVED LANDS MAP

Pocopson Creek and Browning Barn Tributary Preserved Lands Map

Chester County, Pennsylvania

N

Scale
1" = 1000'
0 1000 2000 3000 4000

Data Sources:
Chester County GIS Department
Clauser Environmental, LLC
www.pasda.psu.edu

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APPENDIX H
HISTORICAL MAP OF POCOPSON TOWNSHIP

HISTORIC POCOPSON TOWNSHIP

Northbrook Post Office + Railroad Station

Marshall's Northbrook Grist and Sawmill

VILLAGE of NORTHBROOK

Marshall House

Marshall's Northbrook Grist + Sawmill

Northbrook Chapel

Northbrook Covered Bridge

VILLAGE of NORTHBROOK

Northbrook Railroad Station

Northbrook Chapel

Baker's Schoolhouse

Seeds-Wawaset Covered Bridge

Wawaset Railroad Station

Log House

CORINNE POST OFFICE

General Store and Post Office

Blacksmith Shop

VILLAGE of LOCUST GROVE

Baily Farm

BRANDYWINE RIVER

Locust Grove Schoolhouse

Lenape, Wistar's, Sager's Covered Bridge

Lenape Train Station

Eusebius Barnard House - Station on Underground Railroad

Brandywine Hounds

Springhouse

Pocopson Schoolhouse

Eusebius Barnard House Station on Underground Railroad

VILLAGE of LOCUST GROVE

Locust Grove Schoolhouse

Denton Hollow, Pocopson Mills (grist, saw, woolen and cotton mills)

W.J. Pratt Sweet Feed Mill

Painter's Covered Bridge

House on Davidson Road

William Barnard House Station on Underground Railroad

Haines' Grist and Sawmill

POCOPSON CREEK

AME Church and Cemetery

Pocopson Railroad Station

Pocopson Creek Covered Bridge

Pocopson Railroad Station

Baker Barn

Denton Hollow Pocopson Mills

Webb's Grist Mill

Seeds-Wawaset Covered Bridge

Allen House

Nineteenth Century Pocopson Township, Pennsylvania

Longmeadow Farm

Legend

- Stone House
- Frame House
- Brick House
- Log House
- Stone Barn
- Frame Barn
- Brick Barn
- Railroad Tracks

Map produced by Pocopson Township Historical Committee, 2003©

artwork by M.J. Ciganek

APPENDIX I
PROFESSIONAL QUALIFICATIONS

Aaron S. Clauser, PhD, CPESC
At Clauser Environmental, LLC, he serves as Vice President and the technical/production lead on scientific projects. Dr. Clauser has his bachelor's degree in Biology and Environmental Studies from East Stroudsburg University of Pennsylvania and a doctorate in Environmental Science from Lehigh University. Dr. Clauser is a Certified Professional in Erosion and Sediment Control. He has experience as an environmental regulator with the Berks and Schuylkill Conservation Districts where he has served at both the technician and managerial levels. Dr. Clauser began consulting as a Senior Environmental Scientist and Project Manager for RETTEW Associates, Inc. He has given oral presentations at conferences held by the Ecological Society of America, American Society of Limnology and Oceanography, Coldwater Heritage Partnership, Partnership for the Delaware Estuary, Delaware Riverkeeper, Pocono Comparative Lakes Program, and Schuylkill and Berks Conservation Districts and has collaborated on an article published about Pacific Northwest amphibians in a peer-reviewed journal. Dr. Clauser has completed numerous training courses including PA DEP-sponsored NPDES, Chapter 102 and 105 technical seminars, Applied Fluvial Geomorphology for Engineers (FGE) by Wildland Hydrology, Inc., and Environmentally Sensitive Maintenance of Dirt and Gravel Roads Training. Dr. Clauser served in the PA Air National Guard where he attained the rank of Staff Sergeant. His doctoral dissertation entitled "Zooplankton to Amphibians: Sensitivity to UVR in Temporary Pools" includes quantitative optical and organismal level models that are extended to landscape-level variations in pool optical properties and population-level sensitivity to Ultraviolet Radiation.

Kora Clauser Quesenberry, M.B.A.
Kora works as a biologist with Clauser Environmental, LLC. She has experience with stream and watershed studies, wetland delineation, scientific field investigations, and project delivery. She completed her bachelor's degree in Biological Science with a minor in Psychology at Rowan University and has her Master of Business Administration degree from Lehigh University.

Krista S. Clauser, Ed.D.,
Dr. Krista S. Clauser serves as President of Clauser Environmental, LLC, where she oversees client satisfaction, quality assurance, educational outreach, and project management. She earned her EdD in Leadership and Management with a concentration in Creativity and Innovation from Drexel University. Dr. Clauser also holds a bachelor's degree in Special Education and Elementary Education from Kutztown University of Pennsylvania and a Master of Education in Learning, Leadership, and Organization Development from the University of Georgia. Her teaching background includes positions as a special education instructor at the Schuylkill Intermediate Unit and as a homeschool educator at the elementary, middle, and high school levels. Dr. Clauser is a certified yoga teacher, breathwork coach, reiki teacher, and qi gong teacher. She specializes in incorporating environmental and outdoor curricula into diverse educational settings, reflecting her commitment to holistic learning experiences.