VALLEY CREEK
RESTORATION PLAN

August 2004

Prepared for the
Valley Creek Trustee Council:

Valley Forge National Historic Park
National Park Service
Valley Forge, PA

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EXECUTIVE SUMMARY

NOTE: This *Restoration Plan* presents restoration strategies and projects that can be implemented in the Valley Creek watershed to enhance the Valley Creek fishery and restore the natural resources in the watershed, with the ultimate goal of renewed uses, such as angling of the water resources that were once provided by Valley Creek. This plan is the direct result of the *Valley Creek Restoration Plan* / *Environmental Assessment* (RP/EA) March 2004 document and becomes the operative version of that document for describing and implementing this restoration work throughout the watershed. The RP/EA, along with the subsequent Finding of No Significant Impact (FONSI) document that was signed by the NPS Northeast Regional Director in August 2004, fulfill the requirements of the *National Environmental Policy Act* (NEPA), as implemented by the National Park Service (NPS) in accordance with NPS *Director's Order 12* and Handbook 12, for this *Restoration Plan*.

BACKGROUND

Between the years 1951 to 1988, polychlorinated biphenyls (more often referred to as PCBs) were released into the environment at the Paoli Rail Yard Site (hereafter referred to as "rail yard site" or "site"). PCBs can be harmful if released into the environment and are classified as "probable human carcinogens." The PCBs that were released at the rail yard site resulted in concentrations in fish tissue further down in the Valley Creek Watershed to exceed U.S. Food and Drug Administration action levels for human consumption. This resulted in the issuance of a consumption advisory in 1985 and termination of fish stocking, both resulting in a dramatic decrease in use of the Valley Creek fishery by anglers. This "lost use" of the recreational services provided by the fishery was the primary basis of a 1999 Consent Decree that settled part of a natural resource damage claim made by state and federal trustees.

RESPONSIBILITY FOR RESTORATION

Preparation of this *Restoration Plan* is mandated by the terms of the 1999 Consent Decree and the 1999 Memorandum of Agreement between the Commonwealth of Pennsylvania and the Department of the Interior. The Memorandum of Agreement defines "restoration" as

> . . . any actions undertaken by the Trustees pursuant to CERCLA Section 107
> . . . which serve to restore, replace, acquire the equivalent of, or provide substitutes for natural resources or natural resource services injured, destroyed or lost as a result of the release of hazardous substances from the Site.

The Pennsylvania Fish and Boat Commission, appointed by the Commonwealth of Pennsylvania, and the National Park Service, appointed by the U.S. Department of Interior, are co-trustees for the affected natural resources and make up the Natural Resources Trustee Council (the "Trustee Council") for Valley Creek.

THE RESTORATION PLAN

This *Restoration Plan* presents those restoration projects that the Trustee Council believes would best restore the injured natural resources and compensate for the loss of past uses of the watershed due to PCB contamination. Specific projects and types of projects are proposed for implementation in a recommended order and schedule throughout the watershed.

The Trustee Council believes that there are five broad categories of projects that are likely to compensate for past lost uses of Valley Creek Watershed by attracting anglers back to its streams by enhancing the fishery through improvements in habitat, water quality, and flow regime and also by improving public access to them. However, to be effective, many of them—particularly the fishery enhancement projects—must be implemented in a certain order throughout the Valley Creek Watershed. The Trustee Council has identified a top-of-watershed down strategy in order to maximize cumulative project benefits and minimize any negative effects. Project categories are:

Stormwater Management. Managing stormwater helps reduce stormwater runoff that erodes stream banks and causes the greatest amount of sediment buildup in Valley Creek Watershed. By permitting greater amounts of precipitation to enter the soil and supplement the base flow to Valley Creek, the volume and velocity of flow in Valley Creek would diminish and result in a corresponding reduction in both eroded streambanks and flooding. There are three project categories for managing stormwater; retrofits of detention basins, infiltrating on lands suitable for infiltration (LSI), and infiltration using low-impact technology projects on small parcels of developed land (LID).

Stream Channel Stabilization. Poor fish cover, bank stabilization, riparian vegetation zone, and excessive sedimentation are four issues that would be addressed by stream channel stabilization projects. Two types of stream channel stabilization are generally possible: stream improvements and streambank stabilization. Stream improvements consist of creating pools to provide deeper cool spots for fish when waters warm up during summer, providing cover for fish to escape natural and human predation, narrowing stream channels to keep waters deeper and cooler and to provide sediment transport that removes excess sediment bars. Streambank stabilization reduces or prevents erosion and sediment generation by redirecting the energy of the stream away from the bank or minimizing its impact This could mean planting vegetation on the bank slope, placing boulders in the stream in specific patterns, hardening the bank surface with rocks, or protecting the toe of the bank and planting appropriate vegetation above the toe.

Greenways Methods. Project categories to achieve greenways include:

- purchased land to preserve from development or activities that would cause increased runoff or pollution in the stream
- conservation easements on private lands – includes the placement of easements on lands in order to prevent the use of impervious surfaces on that land
- stream buffers in riparian corridors that have a variable range depending on type of growth

Increased Public Access. This category would make it easier for anglers and other visitors to access or view the streams. Methods include

- reducing the amount of posted (no trespassing) land unavailable to anglers
- creating more fishing points and increase parking availability (without increasing runoff) for stream visitors and anglers
- creating trails that would enhance access to streams

Fish Restoration on Crabby Creek. Crabby Creek (Unnamed tributary to Little Valley Creek in Pennsylvania Fish and Boat Commission records) had, as of 1995, held a wild brook trout population. On October 2, 2002, surveys of two 150 meter stretches of Valley Creek produced no brook trout. The Pennsylvania Fish and Boat Commission believes the brook trout population has been extirpated

primarily due to scour. Hurricane Floyd in September 1999 may have had a significant impact on the brook trout population. The Pennsylvania Fish and Boat Commission recommends reintroduction of wild brook trout upstream from S.R. 252 as an appropriate restoration goal.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES OF THIS RESTORATION PLAN

As determined by the RP/EA and shown in table ES-1, the environmental consequences of implementing this *Restoration Plan* will result in negligible to moderate *adverse* effects and moderate to major *beneficial* effects, resulting in a net environmental benefit. There is one potential major impact of sinkhole development from infiltrating stormwater. However, the mitigation measures that are available from pre-construction soils, geologic and groundwater testing, along with design approaches would reduce the adverse impact from major to moderate. Table ES-1 summarizes the impacts of implementing this *Restoration Plan*.

TABLE ES-1: IMPACT SUMMARY CHART FOR THE RESTORATION PLAN

Effects on Natural Resources	Effects on Cultural Resources	Effects on Socioeconomic Factors	Cumulative Effects
Retrofitted Basins: Moderate benefit of reduced stormwater runoff, reduced flood levels, and reduced sediment in streams. Major adverse impact if sinkholes develop. Testing and design can mitigate the chances of sinkholes. Lands suitable for infiltration projects would have moderate beneficial effects on stormwater infiltration and decreased runoff, reduced flood levels, but could involve minor amounts of changes to natural vegetation. Major adverse impact if sinkholes develop. Testing and design can mitigate the chances of sinkholes. Low impact development projects would have minor beneficial effects in reducing runoff, flooding, and sediment erosion from stream channels. No to negligible adverse effects. Stream Channel Stabilizations: Moderate short-term adverse effects from sedimentation likely until bank permanently stabilized by vegetation. Disruption of normal fish movements during construction. Moderate adverse effects on hardening of banks and encroachment by stabilization methods. Major beneficial effects from reduced erosion and sediments in streams. Improved fishery would result in reduced sediment loads and improved water quality. Major benefits to spawning areas and macroinvertebrates. Mitigation measures include no construction during trout spawning season, natural stream channel design to mitigate adverse effects of encroachments and hardening of banks.	All projects, except in-channel projects, proposed for implementation will be done in consultation with the Pennsylvania Bureau for Historic Preservation to ensure concurrence or no adverse effect to historic, archeological, or other cultural resources. Historical and archeological surveys will be performed on each project selected in accordance with a plan submitted to Pennsylvania Bureau for Historic Preservation. Numerous proposed projects are retrofits of basins already built. No impact on cultural resources. Lands suitable for infiltration projects would create minor adverse or beneficial change in landscape. Low impact development projects would have no to negligible adverse effects on the landscape. Cultural landscapes would be improved moderately by stream channel stabilization projects that eliminate eroded banks and increase vegetation. Use of excessive hardening materials for bank stabilization would have moderate adverse impacts on the cultural landscape. Natural stream design concepts will be designed into stabilization projects. Cultural resources would also be maintained in quality through property purchases and easements to prevent development. Vegetated buffers will have moderate beneficial impacts on cultural landscape. Projects to increase access through trails and access areas could have minor adverse effect on cultural landscape from litter, compaction of soils, and eroded banks where anglers climb down to the stream from the banks.	Major beneficial effects on angling because of reduced stormwater runoff, fewer eroded banks and less sediment that can affect fish, spawning and macroinvertebrates. Would have moderate beneficial impact on increased angling by making more areas available for fishing and by enhancing the fishery. Local economy expected to recover some of the deleterious economic effects from PCB pollution. Visitor enjoyment could improve moderately from presence of more wildlife, presence of brook trout, and increased use and appearance of the improved riparian areas. Adverse minor disturbance during construction of projects to adjacent landowners. Possible intermittent but permanent disturbance at a minor level to landowners adjacent to areas where visitor use increases. Litter might be left along trails or in angling areas and have a minor adverse impact. Increased danger of small children entering impounded water unsupervised. Will be mitigated by avoiding residential areas and requiring rapid infiltration of impounded water. Increased chance of sinkholes if too much water is collected in basin. Mitigation measures include soils, groundwater and geologic testing before construction, plus frequent post-construction monitoring.	Preferred projects would be implemented in a sequence to improve conditions in the watershed by progressively improving stormwater management from headwaters to bottom of the watershed. By doing this, the benefit is cumulative and major. Cumulative impacts would cause minor short-term adverse construction impacts for many projects and major long-term benefits to water resources. Indirectly, Valley Forge National Historical Park's resources would improve moderately via the individual and cumulative impacts of upstream projects aimed at reducing flood levels, and reducing sediment loads in Valley Creek. No cumulative impacts on threatened and endangered species because surveys would precede each project's implementation in order to avoid impacts. No cumulative impacts likely on archeological and historical resources since detention basin retrofits are performed on already existing and approved structures. All lands suitable for infiltration and other construction projects will require surveys for wetlands, threatened and endangered species, and archaeological and historic resources. The overall cumulative effects would result in major benefits from an enhanced fishery, increased angler use and an enhanced aesthetic experience for recreational users.

Greenways: Moderate long-term benefit of preserving land from addition of impervious surfaces. Moderate long-term beneficial effects from adding buffers along streams for food source and temperature protection, wildlife, pollutant control, reduction of runoff and erosion of streambanks. Minor adverse effect from emergence of invasive plants in newly vegetated areas. Access: Minor loss of vegetation where trails, and parking spaces are created. Minor adverse effects of annoyance to neighbors and possible litter. Temporary minor adverse effects on wildlife when anglers are in wildlife habitat. Moderate benefits to angling experience and an increased number of anglers. All projects implemented will be subject to consultation with state and federal agencies on threatened and endangered species. All projects will be designed and located to not have adverse effects on such species. No changes in geology. All projects will be designed and located to avoid wetland impacts. Minor adverse effects on land use and floodplains. Brook Trout Restoration: Amount of fish taken from nearby stream will not exceed sustainable levels. Strain of trout selected will be similar to that which existed in Crabby Creek. Minor improvement to water quality through natural recovery processes following PCB remediation.		Lands suitable for infiltration projects could cause a mosquito- breeding problem but will be minimized or avoided through biological controls and rapids infiltration of stormwater. Anticipate some increase in angler use when PCB remediation is complete and the advisory is lifted; this is the same as the no action alternative.	Moderate adverse effect from the necessary hardening of streambanks in certain high impact areas (adding to previous hardening). Use of hard materials necessary in some places because of combination of runoff velocity and ease of erosion of some bank soils. Moderate adverse effects from encroachments on streams from these and past channel stabilization projects. These effects will be mitigated to minor effects by applying natural stream design methods. County and townships trail additions might compliment trails added in this plan for increasing access for anglers. Brook trout restoration and accompanying stabilization projects for Crabby Creek would also improve brown trout spawning near confluence with Little Valley Creek by reducing downstream sediment loads.

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CHAPTER 1 – PURPOSE OF AND NEED FOR THE PLAN

INTRODUCTION

BACKGROUND

Between the years 1951 and 1986, polychlorinated biphenyls (also known as PCBs) were released into the environment at the Paoli Rail Yard Site (hereafter referred to as "rail yard site" or "site"). The Paoli Rail Yard is a 28-acre maintenance, storage, and repair facility. The site is located north of the town of Paoli in Chester County, high in the Valley Creek Watershed in southeastern Pennsylvania (see "Figure 1: Regional Map"). This rail yard site lies centrally within the southern boundary of the 23.4 square mile Valley Creek Watershed (see figure 2). Valley Creek has the highest protected stream-use classification (Exceptional Value) of the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission's highest trout population classification ("class A").

PCBs are a group of man-made chemicals that were once widely used as coolants and lubricants in transformers, capacitors, and other electrical equipment. PCBs can be harmful if released into the environment and are classified as "probable human carcinogens" (USDHH 1997). The PCBs that were released at the rail yard site resulted in concentrations in fish tissue that exceeded U.S. Food and Drug Administration action levels for human consumption. The Pennsylvania Department of Health, Pennsylvania Fish and Boat Commission, and Pennsylvania Department of Environmental Protection issued a joint consumption advisory in 1985 for fish caught in the watershed, and as a result, trout stocking was stopped, and a "no-harvest" rule (that is, catch-and-release only) was issued throughout the watershed for all fish species. This resulted in a dramatic decrease in use of the Valley Creek fishery by anglers (Hay et al. 1996; PFBC 1996). This "lost use" of the recreational services provided by the fishery was the basis of a 1999 Consent Decree that settled part of a natural resource damage claim brought by state and federal trustees. The Consent Decree (contained in the Administrative Record for this project) was entered into by three of the four responsible parties. [1]

The rail yard site is drained by three tributaries that flow into Little Valley Creek, which flows 1.7 miles into Valley Creek. From this confluence, Valley Creek flows 3.2 miles before entering the Schuykill River. The first mile or so of Valley Creek after the confluence with Little Valley Creek is under the jurisdiction of the Commonwealth of Pennsylvania. The Pennsylvania Fish and Boat Commission is acting as the natural resource Trustee for the Commonwealth of Pennsylvania for the Paoli Rail Yard site. The next 2.5 miles of Valley Creek are under the jurisdiction of the National Park Service (NPS), Valley Forge National Historical Park ("the National Park"). The Commission has worked with the National Park in managing the area of the fishery within the park's boundary (see figure 3 for a map of Valley Forge National Historical Park).

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[1]. The three settling responsible parties are rail companies that operated the Paoli Rail Yard at various times since 1915. They are Southeastern Pennsylvania Transportation Authority (SEPTA), National Railroad Passenger Corporation (Amtrak), and Consolidated Rail Corporation (Conrail). The fourth responsible party, Penn Central, currently known as American Premier Underwriters, Inc., did not participate in settlement negotiations regarding the Environmental Protection Agency's remediation of the site or the Trustees' natural resource damage claim related to the site.

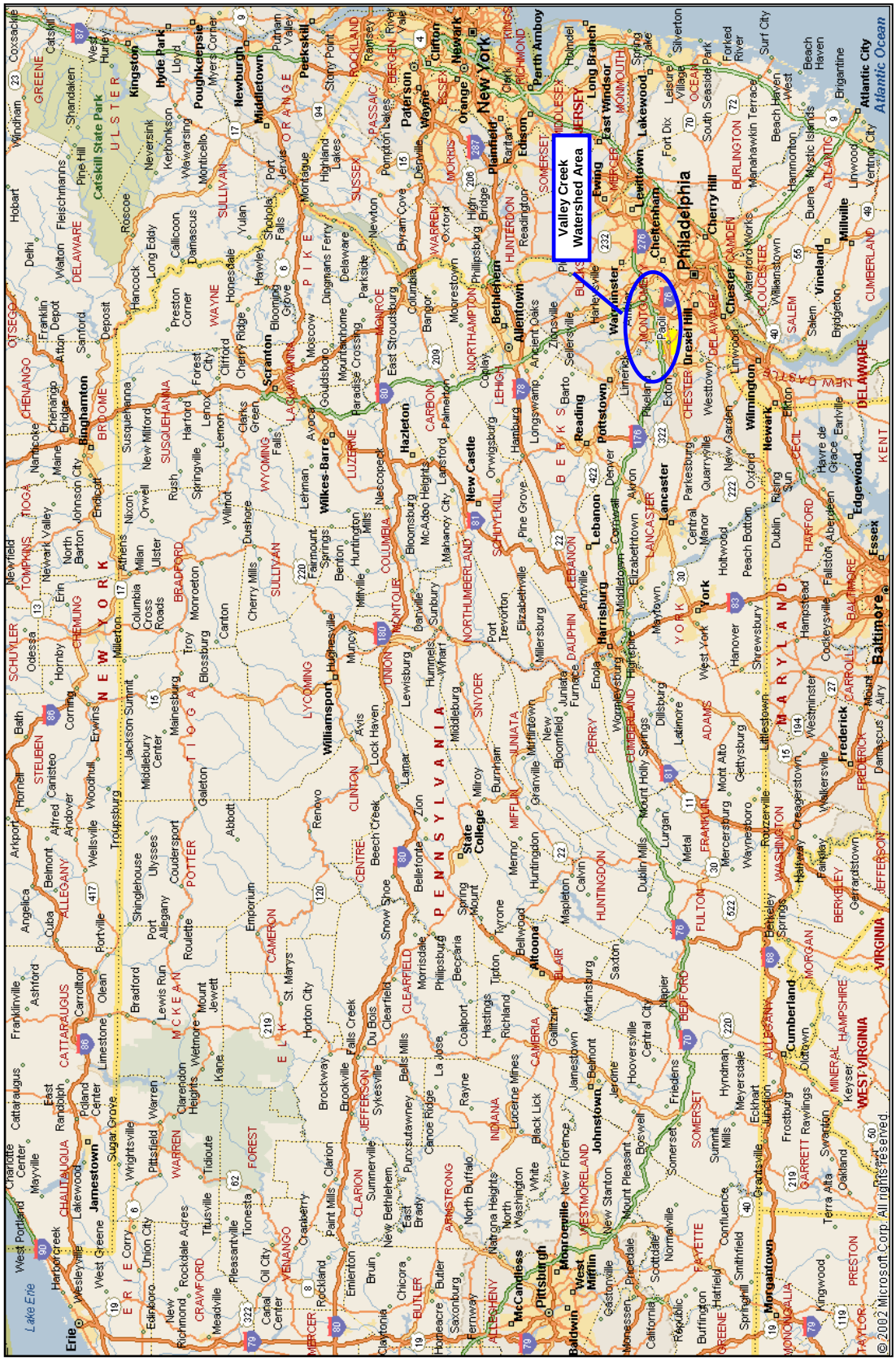

FIGURE 1: REGIONAL MAP

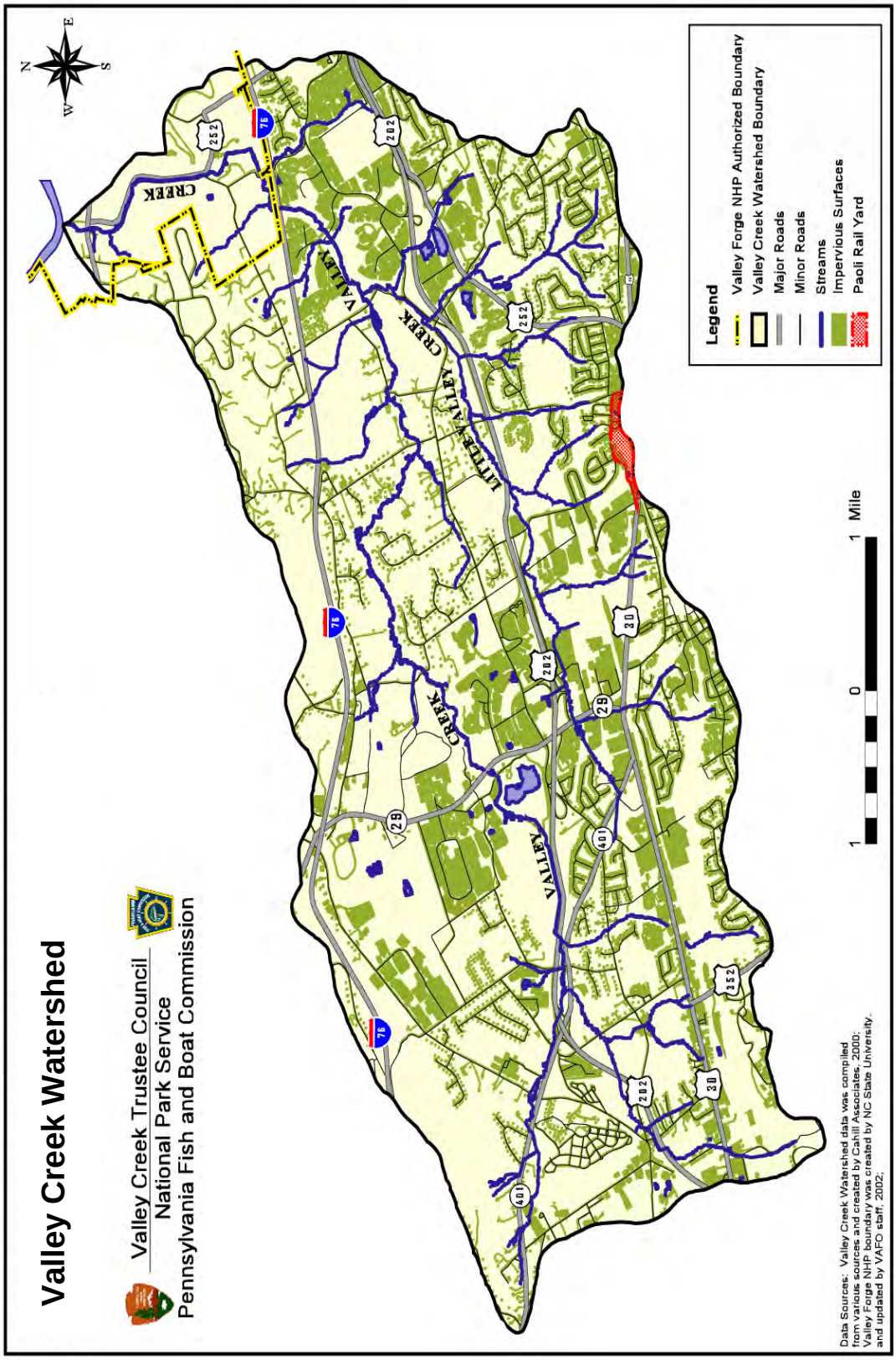

FIGURE 2: VALLEY CREEK WATERSHED 2000

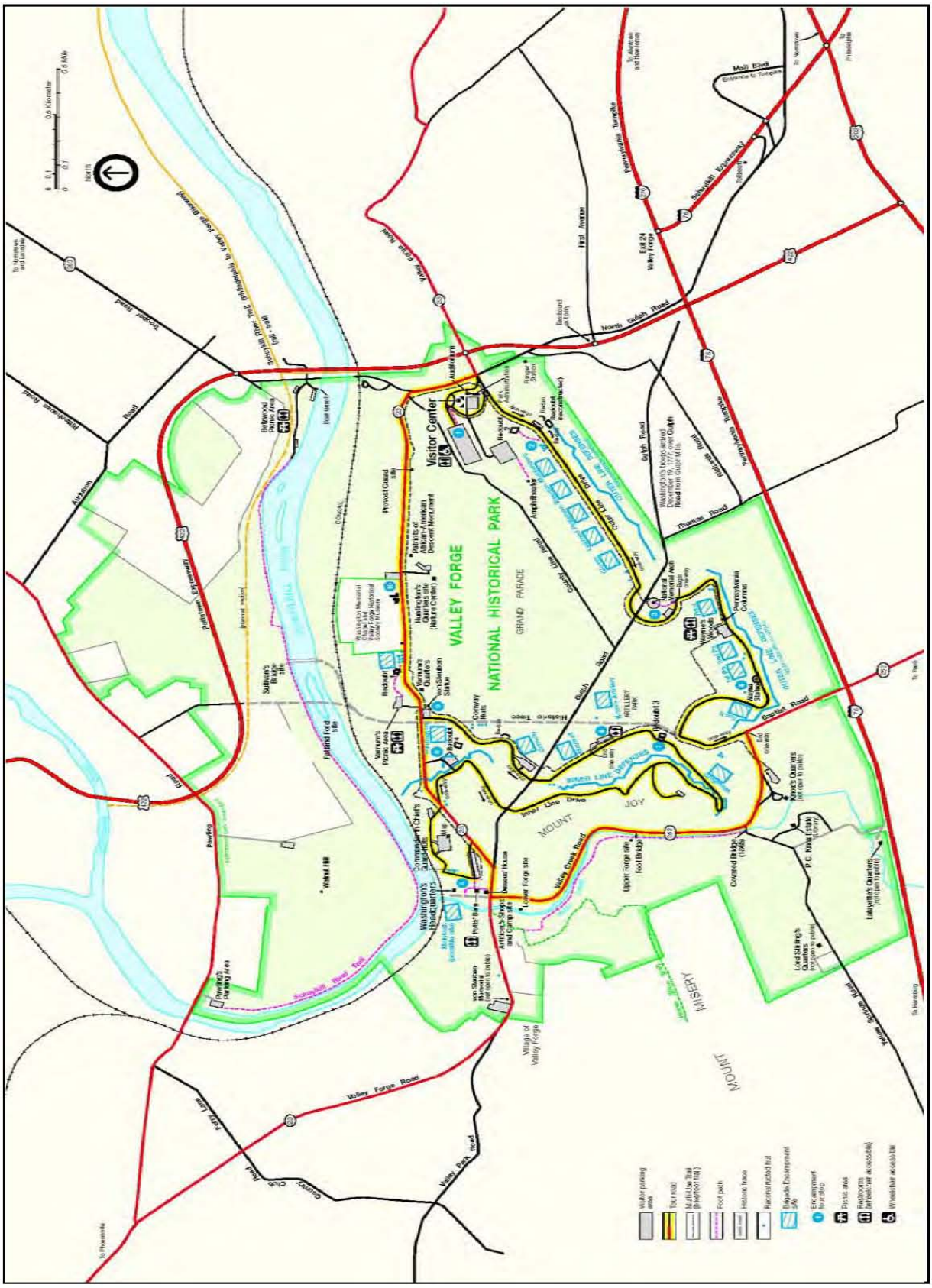

FIGURE 3: VALLEY FORGE NATIONAL HISTORICAL PARK 2002

Pursuant to 40 CFR 300.600 and Executive Order 12580, the Secretary of the Interior designated the National Park Service, through the Superintendent of Valley Forge National Historical Park, to represent the natural resource trustee interests of the Department of the Interior. The Pennsylvania Fish and Boat Commission and the National Park Service are co-trustees for the affected natural resources and make up the "Trustee Council."

Since 1915, the Paoli Rail Yard was used for general maintenance and repair support for rail cars. Environmental samples collected in 1984 indicated severe PCB contamination at the rail yard. The contamination was attributed to releases of PCB-laden transformer oil over the years during maintenance and repair activities. The entire affected area was added to the Superfund National Priorities List in August 1990. The U.S. Environmental Protection Agency (EPA) issued its final Record of Decision (EPA 1992) on the Paoli Rail Yard site in July 1992 that required the following remedial actions (with EPA oversight):

excavating and on-site treatment of (a) soil with PCB concentrations of 25 milligrams per kilogram (mg/kg) (parts per million, or ppm) or greater (equals approximately 28,000 cubic yards of soil); (b) previously excavated residential soil with PCBs greater than 2 mg/kg (ppm) (approximately 3,000 cubic yards of soil); and (c) stream sediment with PCB concentrations greater than 1 mg/kg (ppm)

decontaminating surfaces on rail yard site buildings and structures

implementing on-site erosion controls to manage sediment and storm water run-off

pumping and on-site treatment of fuel oil contaminated groundwater

backfilling and revegetating excavated areas

monitoring soil, sediment, and groundwater

Pursuant to the April 1999 Consent Decree, the three settling defendants agreed to pay $500,000 total to the U.S. Environmental Protection Agency and $100,000 total to the Pennsylvania Department of Environmental Protection for their prior removal activities at the site, and to also perform all remaining response actions at the site. The status of Paoli Rail Yard Superfund Site Cleanup, as of October 2003 was summarized as follows:

Rail Yard Property — The cleanup of the Rail Yard property, which began in May 2001, is being performed by the Rail Companies (SEPTA, Amtrak, and Conrail). To date, more than half of the contaminated Rail Yard soils have been excavated, treated, and placed in the on-site containment cell. The majority of old rail and ties have been removed from the Rail Yard and other than the old maintenance car shop all Rail Yard, buildings have been decontaminated, demolished and disposed of at an off-site disposal facility. In addition, erosion of soils and run-off of storm water has been controlled with the construction of a retaining wall on the northern boundary of the Rail Yard along with construction of three new storm water basins. However, cleanup of the Rail Yard has been delayed recently due to various problems associated with the Rail Companies' contractors. The Rail Companies are currently in the process of awarding a new contract to complete the cleanup of the Rail Yard. Although a new construction schedule must be developed once a contractor is on board, it is anticipated that the majority of the Rail Yard cleanup will be completed by the end of 2004.

Summary of recent activities — In January 2002, the Rail Companies, informed the Environmental Protection Agency that they had terminated their contract with IT Corporation (IT) because IT was failing to perform its obligations under the contract. IT was the contractor responsible for managing the ongoing construction activities at the Rail Yard on behalf of the Rail Companies. Shortly after receiving a notice of termination from the Rail Companies IT filed for bankruptcy. IT left the Site in February 2002 and

cleanup activities at the Rail Yard came to a stop while the issue of IT's bankruptcy and termination were before the bankruptcy court.

In April 2002, the bankruptcy court accepted the Rail Companies' decision to terminate their contract with IT. The Rail Companies secured an interim contractor to provide emergency and maintenance services and to complete certain critical activities until a permanent cleanup contractor could be selected.

On September 12, 2003, the Rail Companies issued a Notice to Proceed to Sevenson Environmental Services, Inc. to complete the cleanup of the Rail Yard Property.

On September 16, 2003, the low bidder filed a bid protest and petition for a preliminary injunction to stop the contractor from conducting any work.

The cleanup of the Rail Yard Property remains on hold. The matter is now before the courts. The Environmental Protection Agency will let the public know when the issues associated with selection of a contractor have been resolved and will provide an update regarding the new schedule for completion of the cleanup.

Residential Properties and Tributaries/Stream Areas — American Premier Underwriters, Inc., successor to Penn Central Railroad, is performing the cleanup of soils and sediments outside the Rail Yard. In November 2001, the Environmental Protection Agency approved American Premier Underwriters, Inc.'s plan for cleanup of residential properties with PCB soil concentrations above EPA's cleanup standard. The cleanup of residential properties is nearly completed. The design for the cleanup of the stream areas is expected to be completed shortly. Upon approval of the stream design, American Premier Underwriters, Inc. will proceed with the cleanup of the streams portion of the remedy.

Summary of recent activities — In January 2002 the Rail Companies informed American Premier Underwriters, Inc. that no residential soils or steam sediments could be accepted at the Rail Yard until a new contractor could be obtained. The Environmental Protection Agency worked with the Rail Companies and American Premier Underwriters, Inc. to make the necessary arrangements to allow for the acceptance of soils at the Rail Yard so that the clean up of non-rail yard properties could proceed. Cleanup of residential properties resumed in September 2002.

To date, American Premier Underwriters, Inc.'s contractor, Unicorn Management Consultants (UMC), has remediated approximately 20 residential properties and most of the right-of way along Central Avenue. Due to problems in obtaining access from owners, several properties have not yet been sampled and/or remediated. Assuming access is granted, the Environmental Protection Agency expects the residential cleanup to be completed in 2004.

Beginning in June 2001, as part of the design for the cleanup of streams and tributaries associated with the Site, UMC, conducted extensive sampling of the soil and sediments located in and around the Hollow Road Tributary; Cedar Hollow Road Tributary; North Valley Road Tributary; Little Valley Creek and Valley Creek. Representatives from the Environmental Protection Agency, the U.S. Fish and Wildlife Service and UMC walked the tributaries and streams to identify depositional and floodplain areas that should be sampled. In accordance with a sampling plan, approved by the Environmental Protection Agency, soil/sediment samples were collected and evaluated for the presence of PCBs.

The results associated with samples indicated many locations in the Hollow Road and Cedar Hollow Road tributaries and a few locations in Little Valley Creek where PCB concentrations exceeded EPA's cleanup standards. All results from the North Valley Road Tributary and Valley Creek were below EPA's cleanup standards. Significant concentrations were detected at the head of the Hollow Road Tributary.

This area had been previously fenced to prevent exposure to contaminated sediments detected during earlier sampling efforts. Although the design for the cleanup of the stream areas is not complete, the Environmental Protection Agency and American Premier Underwriters, Inc. agreed that in order to prevent the possible spread of PCBs to downstream locations, the contaminated sediments at the head of the tributary should be removed as soon as possible.

As a result, in December 2001 approximately 500 cubic yards of contaminated PCB contaminated soil/sediment were removed from the fenced area at the head of the tributary. At that time the Environmental Protection Agency also approved a plan to remove soil/sediment from several other locations where PCB concentrations >25 ppm. These areas were small, which allowed the removal to be conducted by hand, thereby, minimizing the impact to the tributaries. In addition, UMC performed a pilot test that involved the use of a vacuum truck to remove wet sediments from a portion of the Hollow Road Tributary.

VALLEY CREEK: INJURY AND SETTLEMENT

PCB contamination was also detected in streams downgradient of the rail yard and outside the site's boundary. When released into the environment, PCBs bind to soil particles. When PCB-contaminated soil particles get carried away by stormwater runoff, contamination can occur a distance away from the originally contaminated area. Bottom sediments of nearby streams are often a major environmental sink, or repository, for PCBs. This was the presumed mode of PCB contamination in the Valley Creek Watershed and is supported by early and mid 1980s data showing PCBs in stream sediments outside the site boundary, where concentrations were generally higher near the site and lower away from it.

Fish are particularly vulnerable to PCBs because the compound "biomagnifies" in their tissue. This means that PCB concentrations in fish tissue can be much higher than concentrations in the water or sediment around them. Flesh samples of trout taken from creeks in the Valley Creek Watershed showed that PCBs exceeded the U.S. Food and Drug Administration's action level of 2 ppm for human consumption of fish. As a result, in 1985, the Pennsylvania Fish and Boat Commission designated Valley Creek and its tributaries as a "Pollution Zone," and the Pennsylvania Department of Health, Pennsylvania Fish and Boat Commission, and Pennsylvania Department of Environmental Protection issued a fish consumption advisory for fish taken from Valley Creek. Shortly thereafter, the Pennsylvania Fish and Boat Commission and the National Park Service posted warning signs to anglers and reclassified the fishery in the entire Valley Creek Watershed (including Little Valley Creek and all tributaries) as "no-harvest," and imposed catch-and-release only restrictions for all fish species. Also at this time, the Pennsylvania Fish and Boat Commission stopped stocking Valley Creek with trout. The restrictions remain in place today.

These fishing restrictions caused a dramatic decline in the number of fishing trips taken by the public to Valley Creek. The Trustee Council, with assistance from Industrial Economics Incorporated (an economics and policy consulting firm), prepared a claim based on the total number of angler trips lost between 1985 and 1991. The claim showed that, in 1996 dollars, the estimated value per lost trip would have been $35.45. The 1999 Consent Decree, in addition to its other stipulations, required the three settling defendants, as a group, to pay $1,450,000 in damages, which consisted of past assessment costs of $600,000 and $850,000 in future restoration costs to the Trustee Council to settle their liability pursuant to the lost-use claim. This *Valley Creek Restoration Plan* presents the restoration actions that could be implemented with these settlement monies. The document is a programmatic environmental assessment, and should a settlement be reached with the fourth rail company, American Premier Underwriters, Inc., this *Restoration Plan* could also be used as guidance on spending those settlement monies.

PURPOSE OF AND NEED FOR THE PLAN

The purpose of, and need for, the plan is mandated by the terms of the 1999 Consent Decree and the 1999 Memorandum of Agreement (see appendix A) between the Commonwealth of Pennsylvania (acting through the Pennsylvania Fish and Boat Commission) and the Department of the Interior, and also by the regulations associated with the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) of 1980 as amended, 42 U.S.C. 9601 *et seq*. The Consent Decree states that monies from the settlement

> . . . shall only be spent for *restoration*, to reimburse past trustee assessment costs, and to fund future assessment activities associated with the Site [emphasis added]

and that these expenditures shall be made

> . . . pursuant to and in conformity with the provisions and procedures set forth in a Memorandum of Agreement to be entered into between DOI and the Commonwealth of Pennsylvania.

The Memorandum of Agreement further defines "restoration" as

> . . . any actions undertaken by the Trustees pursuant to CERCLA Section 107 . . . which serve to restore, replace, acquire the equivalent of, or provide substitutes for natural resources or natural resource services injured, destroyed or lost as a result of the release of hazardous substances from the Site.

The Trustee Council is obligated to comply with the Consent Decree and the Memorandum of Agreement and must do so in accordance with CERCLA.

The *National Environmental Policy Act* (NEPA) requires that federal agencies consider all environmental impacts of a proposed action. The Act is implemented through regulations of the Council on Environmental Quality (CEQ) 40 CFR 1500.8. The National Park Service has, in turn, adopted procedures to comply with the NEPA and CEQ regulations, as found in NPS *Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision Making* (NPS 2001) and its accompanying handbook. The *Valley Creek Restoration Plan / Environmental Assessment* was prepared in accordance with *Director's Order 12* and its handbook and was reviewed in April 2004 by the interested and affected public.

SCOPE OF THE ANALYSES

This restoration plan does not include an analysis of any off-site cleanup activities in the watershed, because this became the responsibility of American Premier Underwriters, Inc. when, in 1996, the Environmental Protection Agency issued a Unilateral Administrative Order requiring them to clean up contaminated residential areas (anything above 2 ppm of PCBs) and stream sediments (anything above 1 ppm) outside the rail yard boundary.

OBJECTIVES IN TAKING ACTION

The desired results for Valley Creek are an enhanced fishery and restored natural resources, which the Trustee Council believes would best serve to reverse the lost use of services that the Valley Creek fishery once provided. To achieve this, the Trustee Council proposes to implement several projects that would

increase use directly by improving angler access to Valley Creek

increase use indirectly by enhancing the services the Valley Creek fishery provides to anglers by increasing the population of catchable fish, thereby increasing the value of the fishery to anglers and drawing more anglers back. (Under CERCLA and the Department of the Interior's Natural Resource Damage Assessment regulations, past lost uses can be compensated for by enhancing natural resources to increase the public's use of those restored resources – 43 CFR Section 11.84.)

The projects are intended to affect Valley Creek by improving conditions in the watershed. However, to be effective, many of them – particularly the fishery enhancement projects – must be implemented throughout the entire Valley Creek Watershed. The Valley Creek Watershed is a challenge for fishery enhancement projects because urbanization of the entire watershed over the years has increased stormwater runoff (water *quantity*) and decreased water *quality* (especially regarding sediments) of Valley Creek, and the Trustee Council believes that these conditions have had negative effects on the fishery.

The goal of this R*estoration Plan* is to choose those projects for implementation that would best enhance the fishery and future use of the water resources of Valley Creek, in order to compensate for the past uses that were lost as a result of PCB contamination. As defined in this document, human uses include angling, streamside walking and jogging, views from bridges and other access points, recreation in the many parks that border the streams, and bird watching. Of equal importance is the general appreciation of good water quality that one would expect from a stream that has the highest classification in Pennsylvania (Exceptional Value) and that flows through a National Park.

ISSUES BEYOND THE SCOPE OF THIS PLAN

Valley Creek Watershed continues to be affected by issues and activities that are outside the control of this R*estoration Plan*. Many of these activities are likely to occur in the watershed in the absence of this plan. The cumulative effects of the R*estoration Plan* are expected to be impacted in positive and negative ways by such activities. Current and expected activities that will affect the future of the watershed include

development of a stormwater management plan by the Water Resources Authority of Chester County

development of a total maximum daily load program by the Pennsylvania Department of Environmental Protection

widening of Route 202 from four lanes to six lanes – Pennsylvania Department of Transportation intending to mitigate the runoff

local township ordinance changes for improved stormwater management

remediation under existing federal and state laws of contaminated sites in Valley Creek Watershed, e.g., Foote Mineral, Chemclene, Bishop Tube

changing flow volumes into Valley Creek from the development of a former quarry into a lake for the Atwater office park

implementation of the Valley Creek Coalition agreement with the Pennsylvania Department of Environmental Protection for improved stormwater management on new or redeveloped lands

purchases of land for parks, open space or preservation by townships and land conservancies

stream stabilization projects in Valley Forge National Historical Park, undertaken by the National Park Service and Pennsylvania Department of Transportation

the uncertainty of pollutant discharges from a sanitary landfill upstream of Route 29, adjacent to the stream, that once received hazardous wastes

Pennsylvania Department of Environmental Protection will regulate existing and proposed discharges within the watershed under the existing National Pollution Discharge Elimination System (NPDES) process

RELATIONSHIP TO OTHER PLANS AND PLANNING STUDIES

The ideal restoration approach would be as an addendum to other assessments that were already performed for the watershed. Those include the state of Pennsylvania's total maximum daily load plan for addressing nonpoint source pollutants, a study of stream characteristics (fluvial geomorphology study), and a water resources management program for the watershed. In the absence of those studies, the Trustee Council must do the best it can to anticipate what those plans, when eventually completed, will recommend and how this restoration plan will be complementary to those recommendations. Under the total maximum daily load program, the Pennsylvania Department of Environmental Protection classifies Valley Creek as impaired, but the development of a total maximum daily load plan for Valley Creek has a medium priority, except for PCB control. PCB control is proceeding under EPA's order (EPA 1996) requiring American Premier Underwriters, Inc. to remediate PCBs in Valley Creek. Thus, the total maximum daily load plan will not likely be ready for several years or more.

Beginning January 2004, the Chester County Water Resources Authority will be conducting a two-year study of the hydrologic flow dynamics of Valley Creek and developing a stormwater management plan for the Valley Creek Watershed. This restoration plan would have been easier to design if the county's work was already completed. In lieu of that, it is the desire of the Trustee Council that the restoration plan have the flexibility to implement restoration projects that are compatible with the results of that study and management plan.

Chapter 2
Restoration Plan

CHAPTER 2 – RESTORATION PLAN

INTRODUCTION

For developing this *Restoration Plan*, the Trustee Council focused on meeting the objectives of the 1999 Consent Decree and Memorandum of Agreement, while also addressing the purpose of and need for the plan (i.e., need for restoration of lost uses).

This chapter first presents an overview of the restoration planning process, the approach to restoration, and the process for identifying restoration methods and projects. Following are descriptions of the restoration methods and actions necessary to enhance the Valley Creek fishery in accordance with the Consent Decree and Memorandum of Agreement. Next are descriptions of the selected alternative along with information on project implementation, monitoring, mitigation, and costs. Finally, this chapter presents a discussion of projects ~~alternatives~~ considered but dismissed.

RESTORATION PLANNING PROCESS

The Memorandum of Agreement of the Trustee Council defines the restoration plan as

> . . . the plan jointly developed by the Trustees to restore those natural resources adversely affected by the releases related to the Site and/or remediation of the Site. The restoration actions selected under the Plan shall have the objectives of facilitating, accelerating and/or enhancing recovery of the affected natural resources, including the biological, ecological, and human services provided by those resources. The Restoration plan shall accomplish those objectives by identifying, evaluating and selecting restoration actions that: (1) restore injured trust resources and their habitats, and (2) replace lost biological, ecological and human services. It is the intent of the trustees that the cumulative effect of restoration actions will improve the functioning and productivity of the ecosystem as a whole.

This restoration plan does not allocate monies for remediating soil and sediment contaminated with PCBs. This task is the responsibility of American Premier Underwriters, Inc. (with oversight by the Environmental Protection Agency). This plan, therefore, concentrates on identifying projects that "replace lost biological, ecological, and human services" by improving "the functioning and productivity of the ecosystem as a whole."

The following narrative describes the approach for developing a restoration plan for the Valley Creek Watershed. , The *Restoration Plan* consists of projects that the Trustee Council believes will best restore the injured natural resources and compensate for the loss of past uses of the watershed due to PCB contamination. Specific projects and types of projects are presented for implementation in a particular order and on a particular schedule throughout the watershed.

The majority of this restoration plan is estimated to require 14 years to implement assuming sufficient funds are available for all potential projects. The currently funded portion of this plan, $850,000 plus some interest, would only cover projects for four years or up to seven years if that money were matched with money from Pennsylvania and other matching-fund programs, i.e., assuming a match of 50%, the total accessible funds would be approximately $1,700,000. However, in order to provide maximum flexibility that would accommodate a fully funded scenario, this plan covers all projects identified for restoration over the next 14 years.

RESTORATION MANAGEMENT APPROACH

The following known problems for Valley Creek were used to develop the analytic approach for this restoration plan. Those issues are

decline in trout biomass since 1990

lack of cover for fish

increases in developed land

excess runoff from impervious surfaces on developed land

stream channel changes due to the added energy impact of excess runoff

excess sedimentation caused by the stream channel changes

cumulative challenges to the trout population and indirect impacts on angling and other uses

These problems are reflected in the Chester County, Pennsylvania Water Resources Compendium (CCWRA 2001) by the Chester County Water Resources Authority, which lists the reduction of stormwater runoff as its top goal for Valley Creek Watershed. The report also states that protecting first-order streams is the top priority in the watershed. First-order streams are headwater streams that originate at the outer edges or "top" of a watershed. Headwaters are usually low flow of good quality, and flow into larger, second-order, streams in the watershed.

This plan approaches restoration from a total watershed perspective by focusing on three broad strategies to watershed-wide restoration. One strategy relies on the natural powers of streams to not only restore themselves, but to create even more uses than those which existed prior to impairment. The second broad strategy focuses entirely on projects that improve the stability and biological productivity of the streams, resulting in more fish available for anglers. The third broad strategy increases access to the streams for fishing. Even with more fish, future public use would be enhanced to a greater extent by providing more access to the streams than at present.

Further, within the broad approach of restoring the biological productivity of the streams (i.e., enhancing the fishery), there are two approaches to correcting the sedimentation and stormwater runoff problems described earlier. This restoration plan could invest all funds into retrofitting stormwater infiltration to try to make up for deficiencies in earlier building codes that did not require as much infiltration, if any, as current codes. Infiltration would reduce stormwater runoff while maintaining base flows and groundwater supplies in the watershed and improve trout habitat for users. Infiltration in built-out areas of the watershed might be limited by unavailability of suitable land, permission from owners, cost to infiltrate, and amount of infiltration needed to make a difference in runoff flow rates and reduction of peak flows. Alternatively, the increased runoff from impervious surfaces could be taken as a given and the funds could be used to stabilize stream channels to accommodate that increased runoff while reducing sediment from bank erosion. Stabilizing stream channels helps reduce sediment from eroding banks that receive the force of the increased runoff. However, streambank stabilization, without increasing infiltration, can mean shallower waters during dry weather. Wide streams and shallow water decreases the ability of streams to transport sediment and may increase temperatures, all of which are detrimental to trout habitat. The enhancement of future uses of Valley Creek as a trout fishery requires reduced stormwater runoffs, on average, during summer and early fall in order to enhance biological productivity of Valley Creek by

reducing sediment. To the extent that increased infiltration cannot be achieved to its fullest, it is desirable to perform streambank stabilization to reduce sediment loads in Valley Creek.

METHODOLOGY AND PROCESS FOR IDENTIFYING THE RESTORATION PROJECTS

The process used to identify the projects described in this restoration plan was guided foremost by the restoration objectives stated in the Memorandum of Agreement.

> The restoration actions selected under the Plan shall have the objectives of facilitating, accelerating and/or enhancing recovery of the affected natural resources, including the biological, ecological, and human services provided by those resources. The Restoration Plan shall accomplish those objectives by identifying, evaluating and selecting restoration actions that: (1) restore injured trust resources and their habitats, and (2) replace lost biological, ecological and human services.

The Memorandum of Agreement further requires that the Trustees base their determination of appropriate restoration actions on the following factors

nature and extent of injury being addressed

proximity and benefit to the affected natural resources and services

proven technology/prospects for success, cost-effectiveness

recovery period

human health and safety

public comment

consistency with applicable federal and state laws and policies

The sources used for identifying restoration methods were

suggestions from the environmental planning staff at the National Park Service

suggestions by the U.S. Geological Survey (USGS)

suggestions by state (Pennsylvania Department of Environmental Protection and Pennsylvania Fish and Boat Commission) and county agencies (Water Resources Authority, Conservation District and Planning Commission) involved with the Valley Creek Watershed

suggestions from the public, including townships, land conservancies, and fishing and environmental organizations

field surveys conducted by the restoration planner hired by the Trustee Council to develop this plan

a stream assessment performed by the Pennsylvania Fish and Boat Commission, Department of Environmental Protection, and Trout Unlimited (see “Appendix B: 2002 Stream Assessment”)

locations and descriptions of detention basins by Cahill & Associates and Drexel University

mitigation methods being studied by the Pennsylvania Department of Transportation for stormwater runoff of Section 300 of the Route 202 widening

Additional methodologies included

determining the desired approach for implementing streambank restoration projects after stormwater infiltration projects so that the former would be more effective

determining the desired approach of working from the top of the watershed, down, so downstream projects would be more effective

determining the likely number of projects that could be conducted by the Open Land Conservancy, and a feasible number of the low impact development and Public Access projects that could be implemented. The Open Land Conservancy is a non-profit conservation organization located in Valley Creek Watershed. For over 20 years Open Land Conservancy has obtained land along Valley Creek through purchases or bequests and has developed conservation easements with various landowners. This plan anticipates entering into an agreement with Open Land Conservancy to rely on their expertise in getting additional easements of land along the creeks and to help establish vegetated buffers on such properties.

conducting a subbasin-by-subbasin assessment of needs and project possibilities (table B-1 and figure B-1 in appendix B)

considering site-specific factors such as soil type, landowner cooperation, and accessibility

Appendix C shows all the proposed detention basin retrofit projects, lands suitable for infiltration projects, and candidate stream channel stabilization projects that were listed by the Trustee Council for this restoration plan. The Trustee Council from these lists will select the projects that will finally be implemented.

It should be noted that, in the future, other projects may be proposed to the Trustee Council that were not possible at the time this restoration plan was being developed. Any projects other than those listed in this restoration plan that are proposed to the Trustee Council in the future would be evaluated using the Project Application and Evaluation Criteria described in appendix D.

DESCRIPTION OF PROJECT CATEGORIES

The 1999 Memorandum of Agreement provides the following guidance

> Through the restoration planning process, the Trustees shall: (1) identify and evaluate a reasonable number of possible alternatives; (2) select one or more of the alternatives; and (3) provide its reasons for the selection(s), including an explanation of how its choice is consistent with the Trustees' legal obligations.

The Trustee Council believes that there are broad categories of projects that, if implemented, could compensate for past lost uses of Valley Creek Watershed by enhancing the fishery through improvements in habitat, water quality, and flow regime; by improving public access to attract more anglers and other users; and by restoring Brook Trout in one of the tributaries. These project categories are

Stormwater Management

Stream channel stabilization

Greenways

Increased Public Access

Fish Restoration on Crabby Creek

STORMWATER MANAGEMENT

Managing stormwater helps reduce runoff by permitting greater amounts of precipitation to enter the soil and maintain base flow to Valley Creek. Of course, the soils where the precipitation accumulates must allow for adequate infiltration. Storage and infiltration conditions can be created through the building of berms or basins into which the stormwater either naturally flows or can be directed via swales and ditches. By reducing stormwater runoff, the volume and velocity of flow in Valley Creek would diminish and result in a corresponding reduction in eroded streambanks and reduced flooding.

Methods recommended in this plan to achieve stormwater management goals include

retrofitting existing stormwater detention basins

directing runoff to lands that are suitable for infiltration

implementing low impact development

Detention Basin Retrofits

One of three stormwater infiltration strategies being considered is retrofitting (modifying) existing detention basins so that more stormwater infiltrates the soil and becomes part of the groundwater system.

At least 162 detention basins exist in the Valley Creek Watershed and have been mapped by Cahill & Associates and Drexel University. Drexel started with aerial maps provided by Cahill & Associates that showed about 150 locations having ground depressions that resembled basins. Drexel visited a little more than 100 of those sites, located them using global positioning systems, and took field notes on the dimensions and conditions of the basins.

Detention basins were usually built to control the peak discharge rate of the 100-year storm. The basins were supposed to be designed to hold back enough stormwater to limit peak discharge rates during storms to no more than the pre-development peak. Many of the basins have fallen into disrepair, have not been maintained regularly, or the outlet structures have been altered so that the majority of basins do not meet their original goal of limiting peak discharges. Although the basins help reduce the peak discharge rates of large storms, the net effect is to increase the volume of runoff to streams compared to pre-development of the land.

Most of the proposed detention basin project sites (listed in appendixes C-1 and C-2) would require geophysical testing to determine characteristics such as type and compaction condition of soil (National Resource Conservation Services classifications for soils of A and B groupings are preferred for infiltration of 0.5 foot of water per hour or greater); depth of soil (minimum 3 feet required); and

characteristics of bedrock (Cahill et al. 2001). The limestone geology of Valley Creek Watershed has resulted in a number of sinkholes as the watershed has developed. Sinkhole repairs can be very costly. Owner cooperation will depend to a great deal on the professional surveys that are performed of the geology at a site plus the perception of sinkhole risk that the owner has. The Chester County Water Resources Authority has this to say about karst geology and infiltration projects.

> *Infiltration of stormwater in areas underlain by karst geology (carbonate rock units susceptible to subsidence and/or formation of sinkholes) can provide a safe and effective approach to protect and maintain ground water resources, if properly designed for the existing site conditions. Several infiltration BMPs have been successfully installed in areas underlain by karst geology in Chester County and remain fully operational after many years. Infiltration in karst geology may be viable and practical in some locations, but not in others. Infiltration should not be rejected merely because of the existence of underlying karst geology. In such areas, a site-specific evaluation of surface and subsurface characteristics and conditions should be conducted to determine site suitability and design needs as well as to determine the volume of stormwater infiltration that can be achieved. Where such an assessment concludes that the use of infiltration BMPs anywhere on the site will pose a significant risk of formation of sinkholes or other karst features that could result in surface collapse or subsidence, infiltration should be avoided.*
>
> *The stormwater and geotechnical engineering communities have not yet developed generic design standards for infiltration BMPs in areas of karst geology, and strong emphasis is placed on site-specific evaluation and design. This Plan reflects that emphasis and recommends that a site evaluation be used as the basis for determining if infiltration is viable and practical, and if so, requires that the infiltration BMP design be based on the findings of the site evaluation.*
>
> *In areas underlain by karst geology, the viability and specific design standards of infiltration BMPs at a given site must be determined on a site-specific basis to avoid ground water contamination and formation and/or expansion of solution channels, sinkholes, and other potentially dangerous karst features. A site evaluation shall be conducted by a qualified professional geologist, geotechnical engineer, or other qualified professional, licensed by the Commonwealth of Pennsylvania, to ascertain the subsurface conditions of soil, rock and ground water relevant to formation of karst features. Such an evaluation shall include, but not be limited to:*
>
> 1. *Soil thickness, gradation, anisotropy, and permeability (from existing soil data and soil borings) to determine the capacity and rate of infiltration of the soil, and relative depth of soil necessary to protect against sinkhole formation.*
>
> 2. *Karst characteristics of geologic units underlying the site (from existing publications, maps and information of U.S. Geological Survey, PA Geological Survey, PA Department of Transportation, etc.).*
>
> 3. *Inventory of existing karst landforms, visual indications and/or surface manifestations of subsurface features or other karst features (from interviews with municipal representatives familiar with known problem areas, review of aerial photography, and site reconnaissance).*
>
> 4. *Geophysical survey of the site to identify locations and extent of existing subsurface karst features.*

5. *Effectiveness of soil mantle to remove pollutants from infiltrating water to determine whether or not the need exists for removal of pollutants from stormwater runoff prior to infiltration (for example, soil thickness and soil cation exchange capacity, etc.).*

6. *Depth to ground water and vertical location of water table relative to carbonate geologic unit (from existing information and/or borings).*

7. *Other appropriate site specific parameters affecting infiltration.*

Location of infiltration BMPs is critical and should be considered early on in the site planning process. Where karst conditions exist, infiltration BMPs should be located and designed based on the subsurface conditions identified in the site evaluation, to avoid formation of new karst features and to protect existing karst features from accelerated development. Infiltration BMPs should be located at least 100 feet away from existing karst features and sited away from buildings, roadways or other structures where subsidence could damage the structure and create an unsafe condition. Where underlying geologic units are prone to formation of karst features, but no karst features are identified on the site, infiltration BMPs should be designed to avoid formation of new karst features.

Ground water quality of the carbonate aquifer should be protected from infiltration of pollutants. At a minimum, stormwater runoff from "hotspots" (i.e., sources of significant pollutant runoff) should first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration. Where soil characteristics are insufficient to provide removal of pollutants from sources other than "hotspots," stormwater runoff should first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration (Chester County Water Resources Authority, Post-Construction Stormwater Management Ordinance, Draft October 2003).

The Commonwealth of Pennsylvania does not have the legal right to implement stormwater infiltration projects on private land without a landowner's consent. Historically, landowners have not been willing participants on infiltration projects. Under this restoration plan, the permission of all landowners would have to be obtained for detention basin retrofits or infiltrating stormwater on lands suitable for infiltration (see the discussion below). The Trustee Council cannot estimate the extent to which cooperation might occur, especially in karst-underlain areas. Thus, a reason for seeking flexibility in implementing stormwater projects is the greater likelihood that the newness of such projects, and the perceived risks, would reduce the amount of landowner cooperation under this category.

Once it is determined which basins have geologic conditions and soils adequate for increased infiltration, the design options would include a combination of some of the techniques listed below.

diverting some water away from the basin and into adjacent recharge areas

placing stone infiltration trenches inside the basin in a position to intercept flow in the basin

plugging outlets at the bottoms of basins to increase retained amount for infiltration

reducing the size of riser holes to increase retained amounts for infiltration

heightening the berms/banks of the basin to increase storage capacity for more retained amounts

reconstructing the spillway for the basin to reduce erosion

scraping the basin floor of fine silts and clays

relocating basins where soil conditions are conducive to infiltration

adding a forebay at the inlet to a basin for pollution control

When basins cannot be retrofit for infiltration, another beneficial option is to refurbish the basin for improved detention and for timing the release of the basin in coordination with releases from other basins on the same stream.

Lands Suitable for Infiltration

In addition to retrofitting existing basins, improved infiltration of stormwater can also be achieved on other lands. These projects include the costs to perform geophysical testing and to undertake infiltration measures on available tracts of land. The best lands for improved infiltration consist of group A or B soils, which are among the most permeable soils. When stormwater cannot be reduced at the source, it is necessary to slow stormwater runoff so that it can permeate the soil spaces in these soil groups. Landscape features used to slow the water or direct it to permeable soils include

swales

berms and terraces

vegetation

bio-cells (i.e., islands of vegetation, soil, gravel, and stones for infiltration)

vegetated wetlands

infiltration trenches

Infiltration trenches can be used on developed land such as parking lots. A ditch of large rocks can be placed on the downslope edge of the parking lot to catch runoff and allow it to easily permeate through the large pore spaces in the rock. Parking lot islands can also be used to infiltrate runoff. The insides of the islands can be layered with permeable soil, rocks, and sand. Runoff can then be directed to naturally flow toward the islands. Islands must have a cut in the curb to allow the water to enter the inside of the island. Runoff then percolates through the highly permeable materials inside the island.

Appendix E contains a watershed map, taken from the Pennsylvania Department of Transportation *Stormwater Mitigation Report*, showing lands suitable for infiltration by subbasin. Several of the subbasins at the headwaters and southern side of Little Valley Creek are highly developed or do not have highly permeable soils and therefore are limited with respect to infiltration. There are subbasins in the northern part of the watershed that have more lands suitable for infiltration.

Table C-5 (in appendix C) contains a list, by subbasin, of sites that have been determined to be candidates for lands suitable for infiltration (excluding the eight “low-potential” and “$0” projects) using the lands suitable for infiltration potential shown in table B-3 in appendix B. Table C-5 lists the project location and an estimated cost based on $36,000 per site including geophysical testing. The implementation of these projects will be very similar to that of retrofitted basins. An owner or organization within the watershed, or member of the Trustee Council, will present the project application to the Trustee Council.

If approved, testing will be performed and paid for by the Trustee Council. The Council will also pay for the construction and maintenance requirements for up to 10% of the construction costs. Agreements will have to be established between the initiating party and the site owner to ensure the project's effectiveness and continuation.

The Chester Valley Golf Club has filed an application with the Trustee Council for a specific infiltration project on their grounds (see letter in appendix F). Currently, significant amounts of stormwater from Route 30 flood a tributary that runs through the golf club property from south of Route 30. The project would spread this stormwater over a dispersion field that the club would prepare for the infiltration. The engineer for the golf club calculated that infiltration would be 7 to 8 acre-feet of water on an average year for storms greater than 1 inch. This is the same amount of increased runoff from the widening of Section 300 of Route 202. The amount requested by the club is $49,754.

Low Impact Development

Low Impact Development projects are low-tech methods of controlling stormwater either on-site on small lots or preventing stormwater from being generated in significant quantities that go off-site. The Trustee Council will make it known through press releases and presentations that grants are available for willing property owners to install some of the following methods on a retrofit basis.

rooftop gardens that have soil to hold rainfall

cisterns or rain barrels that collect rainfall

underground storage systems that collect water from roofs and pavements and then allow it to slowly infiltrate into the sub-surface

bio-cells (vegetative filters) that collect water on-site and allow it to percolate through layers of soil, rocks, and sand

dry wells

filter strips

spreaders that distribute stormwater over a wide area for infiltration

STREAM CHANNEL STABILIZATION

A stream channel is defined herein as the place where water flows, plus the banks of the stream up to the bank-full level, which on average is about a 1.5-year stream flow. Beyond that mark are the floodplains that could be delineated for anywhere up to a 500-year storm. Stabilization of stream channels is dealt with here, while floodplain areas are included under the "Greenways" section (discussed below).

Two types of stream channel projects are applicable in the context of Valley Creek: streambed improvements and streambank stabilization.

Streambed improvements for fish consist of creating pools to provide deeper cool spots for fish when waters warm up during summer, providing cover for fish to escape natural and human predation, narrowing stream channels to keep waters deeper and cooler, and removing sediment bars.

Streambank stabilization reduces or prevents erosion and sediment generation by redirecting or decreasing the energy impact of the stream away from the bank and back to the center of the stream. This could mean reducing the vertical angle of the bank, planting vegetation on the bank slope, placing boulders in the stream in specific patterns, hardening the bank surface with rocks, or hardening the toe of the slope and planting appropriate vegetation above the toe. The design of streambank stabilization measures must take into account the expected volume and velocity of water reaching the banks. Reduction of upstream stormwater runoff volume might allow for less costly stabilization measures. If increases in stormwater runoff upstream are not considered, stabilization measures might not last long.

Several methods that can be used to achieve stream channel stabilization are shown as figures in appendix G.

Bioengineered Banks

Banks that have been vertically eroded are sloped back to about 45 degrees. The banks are then planted with natural or native vegetation (shrubs, grasses). Boulders may also be used at the base of the slope to prevent undercutting of the bank by the stream.

Riprap on Streambanks

This refers to the placement of 6- to 12-inch diameter rocks along banks to help dissipate or lessen the force of water against the banks and to minimize bank erosion.

Vanes

Boulders are placed in the stream in specific patters designed to direct the energy of the stream flow into the center of the channel and to help create pools in which fish can congregate. A “W” vane pattern is used in wider streams; a “J” vane, hook or cross vane pattern is used in smaller streams.

Skyhooks

A skyhook uses a combination of poles, logs, rocks, and posts to deflect water away from a bank and to create cover for fish.

Cover (Boulders)

The Trustee Council has selected a two-mile reach of Valley Creek from the lower end of East Whiteland Park to Overlook Road for the addition of boulders to improve epifaunal cover, which refers to substrate suitable for colonization and fish cover, consisting of a mix of snags, submerged logs, undercut banks, cobble or other stable habitat. The methods to be considered are root wad deflectors and random placement of boulders (see appendix G). If enough root wads are available locally they will serve as both cover and bank stabilization. This will reduce costs considerably. In areas where root wads are not available, the boulders can be placed in the stream while necessary bank stabilization work is being performed. The boulders must be large enough that increased flows from storms do not move them. On the other hand, boulders cannot be placed in a way that would cause stream energy to be directed at the banks of the stream, which could cause erosion.

Regarding the above categories of stream channel stabilization and cover, there is no absolute right of the Commonwealth of Pennsylvania or the Trustee Council to perform a stream channel stabilization project on someone's land that borders a non-navigable stream such as Valley Creek. There is a long history in the Valley Creek Watershed, and in other watersheds throughout Pennsylvania, of landowners allowing the Commonwealth, local townships, or community fishing and environmental groups to do stream stabilization projects. In general, landowners enjoy the stability that restoration brings to banks; they support the habitat objectives and appreciate the aesthetic enhancement often provided. Thus, the Trustee Council expects a high degree of cooperation from landowners in the Valley Creek Watershed for allowing the stream channel stabilization projects to be implemented as planned. Every landowner will be asked for permission, and if permission were not forthcoming, that owner's site would be by-passed. These omissions could affect the design and effectiveness of stream channel stabilization in those stream reaches.

GREENWAYS

This restoration plan defines greenways as areas above the bank-full point (akin to top of lowest bank) that border the streams or are physically connected to the borders. These areas will often lie within a floodplain but, in many cases, will extend beyond the floodplain as long as there is an open-space connection.

Projects in this category might include the preservation of land that connects existing open spaces or preserves distinct habitats. Greenway projects might also consist of creating buffer strips along streams that filter out pollutants, stabilize banks, provide cover and shade for the streams, and infiltrate runoff. Buffer strips consist of high grasses, shrubs, and trees. Buffer creation occurs by allowing grass to grow higher along streams, allowing natural vegetation to take over, or by planting selected native bushes and trees.

Methods to achieve greenways include

purchased land to preserve from development

attaining conservation easements on private lands

creating stream buffers by allowing natural vegetation to grow or by planting trees and shrubs

Purchased Land to Preserve from Development

One method for protecting streams, especially in the long run, is to purchase undeveloped land and protect it from development or activities that would cause increased runoff or pollution in the stream. Much of the land in the watershed is already developed. Also, there is a considerable amount of land along reaches of Valley Creek and Little Valley Creek that is either owned by the Open Land Conservancy or have conservation easements. Appendix H is a Chester County Planning Commission map designating various forms of protected land. Appendix I is a similar map showing eased and owned lands of the Open Land Conservancy. The county's map needs to be updated by the more current Open Land Conservancy map for the Valley Creek Watershed.

Regarding purchased land, Tredyffrin Township wants to buy a 6-acre parcel that lies between the Route 202 on-ramp at Chesterbrook and Swedesford Road. The reach of Little Valley Creek at this site is characterized by the Pennsylvania Fish and Boat Commission as good trout habitat, for early life stages.

Tredyffrin Township has applied to the Trustee Council (see appendix J) for assistance in buying this land and also for improvements on the property that would benefit the stream channel and increase access for anglers to Little Valley Creek Land available for purchase can be brought to the attention of the Trustee Council by the Open Land Conservancy, which has for many years either purchased land in the Valley Creek Watershed or helped owners obtain conservation easements (appendix I). The Open Land Conservancy manages purchased land as natural preserves, which preserve water quality and quantity in Valley Creek.

Regarding planned future additions to the list of protected lands that already exist, the following activities or expectations are noted. There is no activity, and none is expected, in Valley Creek Watershed by national land trust organizations. There are no lands in the watershed that are so distinct in natural resources that an organization outside of the watershed is likely to purchase or otherwise protect land from development. All future plans for protection (apart from this restoration plan) would likely come from the local municipalities, Chester County, the Open Land Conservancy and other private land conservancies.

Portions of Valley Forge National Historical Park are located in Montgomery County; the remainder of the watershed outside the park is in Chester County. Chester County's plans recommend the continued development of the Chester Valley Trail that comes from the Strubble Trail near Downingtown and parallels Route 202 into King of Prussia. Chester County recommends, but is not able to fund, an extension of this trail to Valley Forge National Historical Park. There is discussion in Tredyffrin Township about placing a footbridge over Route 202, near Chesterbrook Boulevard, and connecting the Chester Valley Trail with the Chesterbrook Community and their trails that border Valley Creek. These trails would then be a part of an extensive trail system bordering the Schuylkill River.

East Whiteland's plans for future open space protection includes supporting the school district's needs for lands associated with school activities (such as playing fields). Seven acres of land along Route 202 and bordering Valley Creek were recently given to East Whiteland Township.

Conservation Easements on Private Lands

Future plans of the Open Land Conservancy include the acquisition of, or placing of, easements on lands contiguous to Open Land Conservancy's existing preserves or eased land. Most of the larger parcels of lands in Tredyffrin Township along Valley Creek, and parts of Little Valley Creek, are already in the Open Land Conservancy portfolio, protected by municipalities, or part of open space requirements for developments. The gaps in coverage along the main stems of the creeks (as shown in appendix I) consist of smaller lots where the cost for the landowner to obtain an easement is high relative to the economic benefit of the easement to the owner, or where landowners do not want their land reassessed for tax purposes. The Open Land Conservancy cites a total average cost of $3,900 per property to obtain an easement, a cost that could be partially funded by the Trustee Council. It must also be noted that an easement, as practiced by the Conservancy, might not include a buffer along the stream. The easement may mean no future development in the floodplain and areas beyond the floodplain. Most of the existing eased land does have adequate vegetative buffers; however, if the Trustee Council intends to help place easements on additional lots, the creation of vegetative buffers would be desired. For some landowners, that requirement would act as an impediment.

Creating Stream Buffers

This restoration method consists of establishing buffers in riparian corridors from the bank-full point to a variable range depending on type of growth. The buffer options are

35 feet of forest (i.e., trees with canopies that cover, or that will cover, 85% or more of the buffer)

55 feet of shrubs (i.e., bushes and other shrubs that cover 80% of the buffer) if trees are not feasible

75 feet of tall grass attained by not mowing lawns, if trees or shrubs are not feasible

Regarding the width of buffers on each side of the stream: the U.S. Forest Service and Water Resources Authority of Chester County prefer 100-foot buffers. In Valley Creek, landowner cooperation could be more forthcoming if less than 100 feet is required. On an acre plot of land, a 100-foot buffer might consume one-half the property or more, depending on the lot's configuration. Therefore, the Trustee Council has adopted the above three options. Two disadvantages of not mowing buffers are that the unmowed area is likely have invasive species, and grass and shrubs will not adequately hold banks in place ― root balls of trees are required.

Buffers of trees cost about $9,000 per acre (Scheuler 2000). One goal of this restoration plan is to establish buffers along 3,100 linear feet of stream with buffer widths averaging 75 feet. This is equivalent to about 8.6 acres. The costs for shrub and unmowed buffers would be considerably less. Protection of newly planted trees and shrubs from deer foraging can be included. Maintenance costs are about 25% of the initial cost. Applications to the Trustee Council for buffers can come from any organization or individual in the watershed.

PUBLIC ACCESS

This category would make it easier for anglers and other visitors to access or view the streams. Methods might include

reducing the amount of posted (no trespassing) land unavailable to anglers

creating more fishing points and increasing parking availability (without increasing runoff) for stream visitors and anglers

creating trails that would enhance access to streams

Some greenway projects may also inherently increase public access to streams.

Some property owners on Valley Creek do not want anglers or other people using their property to access the creek. These feelings may go back years because of anglers discarding trash on their property, interfering with their privacy, or causing damage. In other cases, property owners are not willing, under any circumstance, to allow the angling or other public to go near the streams on their property. It may be possible that some landowners could change their thinking if they agreed that the stabilization and protection of their streambanks and restoration of Valley Creek is a public service to be shared by the community.

A complete list of access projects has not yet been created. It should be noted that the project applied for by Tredyffrin Township proposes a trail and parking lot and easier access to Little Valley Creek.

FISH RESTORATION ON CRABBY CREEK

Wild brook trout restoration in Crabby Creek would be preceded by stream channel stabilization proposed in year 1 of the restoration plan to enhance trout habitat in Crabby Creek. Wild brook trout would be introduced (suggested in year 2 of the plan) from a stream in the Schuylkill River basin selected by the Pennsylvania Fish and Boat Commission because of its similar water quality characteristics and abundant wild brook trout population. Pennsylvania Fish and Boat Commission personnel would collect different age classes of wild trout using a backpack electrofishing unit from the source stream to be identified later and transport wild fish to Crabby Creek in an oxygenated truck-mounted tank. Fish would be distributed by Pennsylvania Fish and Boat Commission personnel and volunteers along Crabby Creek in appropriate habitat above the 3 to 4 foot waterfall that serves as a barrier to upstream migration. Isolation of the brook trout population in upper Crabby Creek from brown trout in the lower portion of the stream is a desirable feature of the restoration project. Separation of these species will reduce competition and enhance viability of the introduced brook trout. The primary goal of this restoration activity would be to reestablish a historically significant species in a unique habitat in the Valley Creek Watershed. Angling benefit would be secondary since this population probably never received significant angling pressure.

DETAILS OF THE SELECTED ALTERNATIVE

This section presents further details about those restoration projects that the Trustee Council believes will best restore the injured natural resources and compensate for the loss of past angler use of the watershed due to PCB contamination. Specific projects and types of projects are presented for implementation in a particular order and on a particular schedule throughout the watershed (see table 1). Under this plan stream sediments with elevated PCB levels will be remediated by a third party (American Premier Underwriters, Inc.). Remediation of PCB contamination is outside the scope of this *Restoration Plan.*

RESTORATION PROJECTS BY CATEGORY

STORMWATER MANAGEMENT PROJECTS

The stormwater management projects will include detention basin retrofits, Lands That Are Suitable for Infiltration, and Low Impact Development. There are 59 stormwater management projects proposed under alternative A (see table 1); of these, 23 are detention basin retrofit projects, 21 are lands suitable for infiltration projects, and 15 are low impact development projects.

The lists of detention basin projects, from which the projects proposed to be implemented would be chosen, are shown in tables C-1 and C-2 in appendix C. The subbasin numbers in tables C-1 and C-2 correspond to the numbers on figure 4. The lands suitable for infiltration projects are listed in table C-5 in appendix C. There could be up to 15 low impact development projects over the course of the projected 14-year restoration period (one per year), except for the first year when there could be two. The actual low impact development projects to be implemented have not yet been chosen. Projects will be selected based on the criteria presented earlier in this chapter, especially landowner interest and cooperation, feasibility and cost-effectiveness, and site-specific conditions such as soil type and accessibility. Projects proposed for implementation (after this plan is finalized) will be selected based on the criteria in "Appendix D: Project Application and Evaluation Criteria." All the final projects will be selected and prioritized by the Trustee Council.

STREAM CHANNEL STABILIZATION PROJECTS

The candidate stream channel stabilization projects are listed in table C-6 in appendix C. Full implementation would include approximately 189 stabilization projects implemented over the course of the 14-year restoration period.

GREENWAY PROJECTS

The greenway projects for this restoration plan will include

> offers by the Trustee Council to pay fees (not to exceed $3,000) that landowners incur to ease land as long as the owner considers building a vegetative buffer of one of the types described in this chapter, for which the Council will pay . Fifteen lots could be involved, approximately one per year.
>
> offers by the Trustee Council to pay for the easement fees, as just described, plus cover the costs of any installation of lands suitable for infiltration or low impact development stormwater infiltration measures on the property

TABLE 1: PREFERRED PROJECTS AND TYPES OF PROJECTS IN ORDER OF IMPLEMENTATION

Year	Project	Subbasin (refer to figure 4)	Type of Project	Initial Cost ($,000)	Funder and/or Implementing Group
2004	Upper Crabby Creek bank stabilization and vanes	B2	SCS[1]	35	Fund
	Disperser on downstream side of railroad bridge at Malvern Road Run	B11	SM[2]	25	Fund
	Infiltration project applied for	A3	SM	50	Fund
	Property purchase plus channel stabilization	B4a	GW[3] and SCS	65	Fund and Tredyffrin Township
	250 feet of buffered streams		GW	25	Fund
	2 LIDs[4] and 2 easements		SM and GW	12	Fund
2005	1 Basin retrofit and 2 LSI[5]	B10	SM	107	Fund
	2 Basin retrofits and 1 LSI	A1	SM	106	Fund and Approach HOA[6]
	Basin Retrofit	B12	SM	35	Fund
	Wild brook trout reintroduced into Crabby Creek		FR[7]		
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access project		PA[8]	6	Fund
2006	Rip rap on Wilson Road Run	A1	SCS	75	Fund
	Basin outlet below school district property	A17	SCS	40	Fund and Approach HOA
	2 Basin retrofits	A2	SM	70	Fund
	Basin retrofit	B11	SM	35	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	250 feet of buffered streams		GW	25	Fund
	Public Access project		PA	6	Fund
2007	Disperser on downstream side of railroad bridge on tributary	B9	SM	25	Fund
	Howelville tributary to Little Valley Creek, vanes and rip rap	B1	SCS	30	Fund and Tredyffrin Township
	1 Basin retrofit and 1 LSI	A4	SM	71	Fund
	1 Basin retrofit and 1 LSI	B6	SM	71	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2008	Little Valley Creek channel from Route 29 to Vanguard entrance	B10	SCS	123	Fund
	1 Basin retrofit and 1 LSI	A5	SM	71	Fund
	LSI	B8	SM	36	Fund
	Bank stabilization	A6	SCS	24	East Whiteland and Fund
	1 Basin retrofit and 2 LSI	A6	SM	107	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2009	Little Valley Creek channel from Vanguard entrance to Route 202	B10 and B8	SCS	122	Fund

Year	Project	Subbasin (refer to figure 4)	Type of Project	Initial Cost ($,000)	Funder and/or Implementing Group
	Basin retrofit	B6	SM	35	Fund
	3 Basin retrofits	A8	SM	105	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2010	Bank stabilization from EW Park to Church Road on Valley Creek	A8	SCS	161	Fund
	1 Basin retrofit and 1 LSI	B5	SM	71	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2011	1 Basin retrofit and 2 LSI	A9	SM	107	Fund
	1 Basin retrofits and 1 LSI	A10	SM	71	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2012	Boulders for cover from Church Road to railroad bridge	A8 and A9	SCS	79	Fund
	Bank stabilization from Church Road to dam	A9	SCS	473	Fund
	2 LSI	B7	SM	72	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2013	1 Basin retrofit and 2 LSI	B4 and B4a	SM	107	Fund
	Bank stabilization on Little Valley Creek from Route 202 to North Valley Road	B5	SCS	61	Fund
	250 feet of buffered streams		GW	25	Fund
	1 LID and 1 easement		SM and GW	6	Fund
2014	1 Basin retrofit and 2 LSI	A11 and A14	SM	107	Fund
	1 Basin retrofit and 1 LSI	B1	SM	71	Fund
	150 feet of buffered streams		GW	15	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2015	Bank stabilization on Little Valley Creek from North Valley Road to confluence	B4, B4a and B1a	SCS	134	Fund
	Bank stabilization, Valley Creek from dam to Mill Road	A12 and A13	SCS	35	Fund
	150 feet of buffered streams		GW	15	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	6	Fund
2016	1 LSI	A15 and A17	SM	36	Fund
	Bank stabilization Valley Creek from Mill Road to Bradford Road	A16	SCS	45	Fund
	2 Basin retrofits	B2	SM	70	Fund
	150 feet of buffered streams		GW	15	Fund
	1 LID and 1 easement		SM and GW	6	Fund

Year	Project	Subbasin (refer to figure 4)	Type of Project	Initial Cost ($,000)	Funder and/or Implementing Group
	Public Access		PA	6	Fund
2017	Bank stabilization Valley Creek from Bradford Road to Valley Forge National Historical Park	A17	SCS	63	Fund
	150 feet of buffered streams		GW	15	Fund
	1 LID and 1 easement		SM and GW	6	Fund
	Public Access		PA	3	Fund
			Total	**$3,695**	

1. SCS = Stream Channel Stabilization
2. SM = Stormwater Management
3. GW = Greenway
4. LID = Low Impact Development
5. LSI = Lands Suitable for Infiltration
6. HOA = Homeowners Association
7. FR = Fish Restoration
8. PA = Public Access

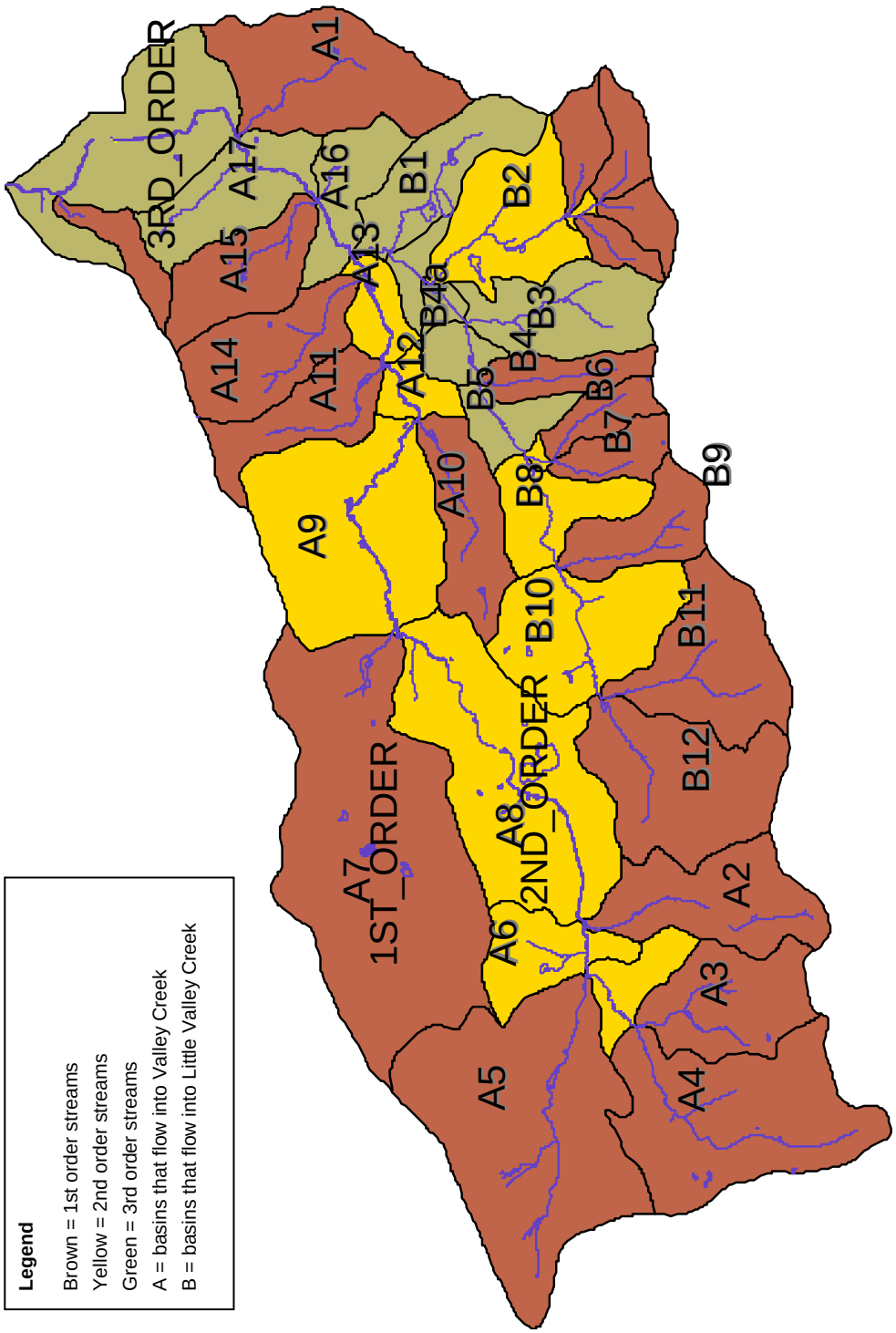

FIGURE 4: VALLEY CREEK SUBBASINS (SOURCE: CAHILL & ASSOCIATES)

proposals by the Open Land Conservancy to participate in the purchase of land parcels, especially for land improvements to restore stream channels or infiltrate stormwater

Assistance in buying the parcel of land in Tredyffrin Township at Route 202 and Swedesford Road, improving the access to the stream for anglers, and improving the stream channel to improve cover and other conditions for fish

There are approximately 30 greenway projects in alternative A (see table 1) proposed to be implemented over the course of the projected 14-year restoration period: one is a land purchase, 15 are easements with buffers, and 14 are added buffers. Projects would be selected based on the criteria presented in "Appendix D: Project Application and Evaluation Criteria." The Trustee Council will determine final project selection and prioritization.

PUBLIC ACCESS PROJECTS

A complete list of public access projects has not been identified as yet, although Tredyffrin Township did apply for a project that would include a trail and parking lot and easier access to Little Valley Creek. A percentage of the total amount of funding committed to these projects could be spent on at least one project per year (except two for the first year) during the projected 14-year restoration period. The Trustee Council will determine final project selection and prioritization.

FISH RESTORATION ON CRABBY CREEK

Fish stocks that have vanished will be considered for restoration. Specifically, the Pennsylvania Fish and Boat Commission proposes capture of wild brook trout from a similar nearby stream and release of those fish into Crabby Creek following stabilization of stream habitat. This may enhance angling, will improve the quality of outdoor experience and will restore the habitat quality possessed in earlier days.

PROJECT IMPLEMENTATION, MITIGATION AND RESOURCE PROTECTION, AND MONITORING

PROJECT IMPLEMENTATION

The Trustee Council has four application mechanisms for the projects.

Initiation by the Pennsylvania Fish and Boat Commission and Valley Forge National Historical Park (any type of project)

Application by a community organization for a project or set of projects within the watershed (any type of project)

Application by an individual for a project on his or her own property (any type of project relevant to the applicant's property)

Acceptance of requests from the Open Land Conservancy to make payment for the cost of easements on small properties and the creation of stream buffers on any size property

Implementation of any of the projects may require a more site-specific assessment, including further compliance with local, state, and federal environmental requirements.

The Trustee Council will remain flexible when implementing the restoration plan, particularly with regard to the candidate project's location and restoration method chosen. When actual sites come up on the schedule for implementation, it will be necessary for an engineer or scientist to recommend and design the project. There could be numerous reasons why a restoration method identified in the plan may eventually not be the most appropriate or suitable for a particular site. Some landowners might not want their slopes graded back to enable a bioengineering method to be used. In those cases the project designer may need to switch to a method more suitable for a vertical bank, such as rip rap, a J vane, or a skyhook. It is possible that the soil type at a particular site may not be appropriate for a proposed infiltration project. If it is determined that a change in a restoration method is required, one of the other restoration methods discussed in this plan would be chosen, rather than implementing a method for which the environmental consequences were not analyzed in the *RP/EA*. The Trustee Council will not choose a restoration method that involves building concrete channels, walls, or other similar "hard engineering" methods. The experience gained by the Trustee Council in implementing and monitoring the first projects will also influence the selection of future restoration projects and their timing. The timing, selection of method, and design will also be influenced by the Chester County Water Resources Authority's stormwater study of Valley Creek.

The method of restoration chosen for a stream channel must match location needs. Table C-5 in appendix C lists the locations of highly eroded banks in the Valley Creek Watershed. These are defined as banks that have no vegetation, show signs of recent erosion, and have a high potential for future erosion. The list organizes the locations by the subbasins in Valley Creek that were shown on figure 4.

Regarding preferred projects, the Trustee Council prefers to give high priority to clustering of projects in subbasins; in other words, to work subbasin by subbasin, from the headwaters (1^{st}-order streams) of the watershed to the bottom. Clustering may include implementing several stormwater infiltration projects, several stream channel projects, and greenways projects at the same time in a subbasin. For example, the practicalities of using front-end loaders and track hoes and getting landowner approval for using their land to perform projects, suggests that it is best to do all restoration projects over an entire stretch of a stream, such as between two roads or between a road and a railroad bridge.

The Trustee Council also prefers to match a stream channel stabilization project to the amount of force the banks receive from the volume of stream flow. For example, skyhooks and J vanes would be used on sharp bends of streams where the outer edges of banks receive the greatest energy from high flow. Vegetated banks with cutback slopes would be used to restore eroded banks in low-energy impact stream areas.

In general, the Trustee Council must maintain flexibility when determining which projects are done, when they are done, and in what sequence. Most of the retrofit stormwater infiltration projects identified will require field tests to determine the technical and economic feasibility of obtaining meaningful infiltration. Some identified detention basin retrofit projects, for example, may not pass the percolation tests, or the depth to bedrock does not meet the 3-foot requirement. In these instances, the focus may have to shift to another project.

The Open Land Conservancy has extensive knowledge and experience dealing with land purchases and easements within the watershed. Rather than the Trustee Council purchasing land or offering easements, the Council feels that restoration will be better served by relying on the experience of the Conservancy. The role of the Trustee Council would be to contribute toward the purchase price for a particularly important parcel that would further the Council's goal of improving the biological productivity of Valley Creek. The method will be for the Open Land Conservancy to apply to the Trustee Council for each project for which it seeks funds. The Conservancy will be requested to provide the terms of the easements at the time of the request to assure the Trustee Council that the project will be compatible with restoration

plan goals. The Trustee Council is more interested in funding land improvements on a site that will improve the stream channel or infiltrate stormwater than they are in actually buying property.

The voluntary cooperation and involvement by the landowners of properties in the watershed will be needed to implement greenway projects. Although restoration funds might be used to create greenway projects, the property owners will continue to own the properties and, in the long run, maintain the greenway (for example, a buffer zone along a stream).

Another need for flexibility arises from the impact of a two-year study that "Chester County, with the Chester County Water Resources Authority as the lead agency, will be conducting to develop an Integrated Stormwater Management Plan for East Valley Creek Watershed. The Integrated Stormwater Management Plan will include both the Phase I and Phase II components of a Pennsylvania Stormwater Management Study (referred to as an Act 167 Plan) and a fluvial geomorphology assessment of Valley Creek Watershed. The County will then present the combined results, conclusions, and recommendations for watershed restoration and stormwater management in a single plan. It is anticipated that the County will initiate the study in January 2004 and that the geomorphology assessment, which will evaluate the stream characteristics of the watershed, will be published in July 2004" (pers. comm. CCWRA, 2003). This restoration plan would have been easier to develop with a fluvial geomorphology assessment of the watershed completed. However, since the fluvial geomorphology assessment is not complete at this time, it is the desire of the Trustee Council that the restoration plan have the flexibility to implement restoration projects that are compatible with the results of Chester County's Integrated Stormwater Management Plan for the East Valley Creek Watershed. The Trustee Council would prepare an amended restoration plan and solicit public comment if the Council proposes to use monies from the restoration fund to implement a project that falls outside the objectives or environmental impacts of the project categories described in this restoration plan.

Table 1 above shows the Trustee Council's preferred projects and types of projects to be undertaken over the next 14 years, along with the year of implementation and subbasin location. The table also shows the initial cost for each project and how the funds would be spent on a yearly basis if the preferred sequence of projects are undertaken. Outlays for projects total approximately $3.7 million in initial capital expenses.

MITIGATION AND RESOURCE PROTECTION

The method for analyzing potential effects on archeological resources and historic structures or objects will be presented in a project-specific study plan prepared by the Trustee Council and presented to the Pennsylvania Bureau for Historic Preservation. This plan describes how the Trustee Council will conduct the resource surveys prior to implementation of each project. The Pennsylvania Bureau for Historic Preservation requirements are presented in appendix K. The Trustee Council will be responsible for paying for any required historical and archeological site surveys, unless a cost-sharing program could be established with the landowners where objects are found.

Prior to implementing any project, the Trustees will consult with the U.S. Fish and Wildlife Service, Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, and Department of Environmental Protection to avoid or mitigate adverse effects to federally listed endangered and threatened species. Field surveys will be performed as necessary. If consultation identifies potential threats to threatened or endangered species, the project will be re-designed to eliminate those threats or abandoned entirely. Site-specific impacts and an alternatives analysis associated with a phased state Waterways Obstruction and Encroachment Permit (PA Code, Title 25, Chapter 105) will be evaluated for each site in the initial phase, as well as each site in subsequent phases that require a major or minor permit

amendment. Where applicable, areas of soil disturbance greater than 5,000 square feet will have an Erosion and Sedimentation Control Plan developed under Chapter 102 of the PA Code, and if greater than 1-acre of disturbance, an NPDES permit will be required.

Should stream channel stabilization projects be implemented under this plan, it will be necessary to ensure that the remaining high concentrations of PCB contamination (in the sediments of the three tributaries and main stems) are remediated before any project is undertaken in that vicinity. The Environmental Protection Agency has provided the Trustee Council with the list of high PCB-contamination spots, which are all in the lower portion of the watershed and away from upper-watershed areas and first-order streams that would be restored first under this plan. Extraction of the contaminated spots started in 2004. Under each alternative, remediation of PCB-contaminated stream sediments is the responsibility of American Premier Underwriters, Inc. (the responsible party ordered under the CERCLA Record of Decision to conduct off-site remediation).

This restoration plan does not propose projects that would impact wetlands in this "Exceptional Value" watershed. A project-by-project analysis of wetlands will be conducted prior to implementation. All measures would be taken to ensure no diminishment in the quantity or quality of existing wetlands. All U.S. Army Corps of Engineers procedures for section 404 permits under the *Clean Water Act*, and notification would be followed. All Pennsylvania Department of Environmental Protection Chapter 105 regulations pertaining to wetlands under the Clean Streams Law on non-federal lands will be followed.

In addition, this restoration plan does not recommend any project that would create or support the creation of wetlands, except perhaps as a treatment method for retrofitted detention basins or lands suitable for infiltration.

The Trustee Council will also take other steps to prevent or minimize impacts in the manner shown in table 2.

PROJECT MONITORING

There are three important reasons why the Trustee Council will monitor the performance of every project; those reasons are to

determine if the project is performing as designed and implemented to accomplish its objectives. The project application will have to include a description of the objectives for the project.

determine the effectiveness or success of each project and an indication of the cumulative effects of upstream projects to Valley Creek. The project application will have to include an explanation of the baseline condition against which future results and the objectives can be evaluated for success.

assess the need for maintenance or re-design to keep the project working effectively. Maintenance costs would be paid for by the restoration fund in most instances.

The preferred monitoring steps, frequency, and responsible party are presented in table 3.

TABLE 2: MITIGATION MEASURES FOR RESTORATION CATEGORIES

Method	Potential Impacts*	Mitigation
Stormwater Management		
Retrofit Basins	Sinkholes	Will avoid projects on residential properties unless fenced. Soil, groundwater and bedrock tests will be done on a site-by-site basis as part of feasibility evaluation to assess the risk of sinkholes. Frequent construction, e.g., twice per year, and post-construction monitoring will occur to determine if sinkholes are developing and to take immediate remedial action, including stoppage of the project.
Lands Suitable for Infiltration	Sinkholes, mosquitoes, and risk of drowning in standing water.	Will avoid projects on residential properties unless fenced. Soil, groundwater and bedrock tests will be done on a site-by-site basis as part of feasibility evaluation to assess the risk of sinkholes. Frequent construction (e.g., twice yearly) and post-construction monitoring will occur to determine if sinkholes are developing and to take immediate remedial action, including stoppage of the project. Biological controls will be introduced if mosquitoes emerge. The amount of time for standing water will be limited to 24-hours.
Low Impact Development		No specific mitigation required.
Stream Channel Stabilization		
Bioengineered banks	Erosion and sedimentation during implementation and possibly during trout spawning season. Stream encroachments.	Will comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Will ensure that vegetation is quickly established on the bank to minimize amount of exposed surfaces before next storms.
J and W Vanes	Erosion and sedimentation during implementation, including trout spawning season. Stream encroachment and less vegetation on banks.	Vanes will be used when the preferred bioengineered methods are unsuitable for the soils and the force received by the banks that are to be stabilized. Will comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow.
Rip Rap	Erosion and sedimentation during implementation, including trout spawning season. Stream encroachment and less vegetation on banks. Increase in temperature of water.	Will comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow over time. Only to be used on tributaries which do not flow during dry weather or as part of a bioengineering project.

Method	Potential Impacts*	Mitigation
Skyhooks	Erosion and sedimentation during implementation and trout spawning season. Stream encroachment and less vegetation on banks.	Will comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow over time.
Boulders for Fish Cover	Erosion and sedimentation during placement of boulders and trout spawning season. Increased erosion on unstable adjacent banks.	Will comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation by trapping sediment. Would only place boulders where stream flow will not be directed at banks. Will not undertake boulder placement during trout spawning season.
Greenways		
Property Purchases	Invasive plants.	Maintenance needs for each property to be identified and agreement established for maintenance cost and invasives management.
Easements		No mitigation measures required.
Buffers	Stream channel stabilization likely to occur simultaneously with creation of buffer. Potential erosion and sediment generation during construction (see above mitigation). Invasive plants likely to emerge.	Would comply with Pennsylvania Department of Environmental Protection Chapter 102 regulations on erosion and sedimentation for adjacent stream channel stabilization. Agreements need to be established for each property for maintenance, invasive plant management, and cost responsibility.
Public Access		
Removing Postings	Loss of vegetation and compaction of soil for highly used areas. Minor amounts of litter left behind by anglers and other users. Erosion on banks used to access streams.	If unacceptable land usage or litter, can allow landowner to return to posting. Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Access with Parking	Land conversion from natural to recreational areas and parking. Minor amounts of litter left behind by anglers and other users. Erosion on adjacent banks.	Sites will be designed with pervious parking and infiltration of up to and including 2-year storm. Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Trails	Soil compaction and vegetation loss. Minor amounts of litter left behind by anglers and other users. Erosion on adjacent banks.	Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Crabby Creek Brook Trout Restoration		
Restoration of Brook Trout in Crabby Creek	Possible strain differences with previous species of brook trout. Pressure on fish population from stream where taken.	Potential strain differences will be avoided by selecting brook trout from nearby stream. PFBC has already identified stream in contiguous county that contains a sufficient brook trout population.

* All projects will be subject to archeological and historical surveys to determine if objects of historical significance are present. All projects will be subject to threatened and endangered species surveys and wetlands avoidance.

TABLE 3: MONITORING PROCESS FOR SELECTED PROJECTS

	Design and Implementation	Effectiveness	Maintenance Needs
Basin Retrofits	Consultant in years one, three and five after project completion	Consultant in years one, three and five after project completion	Consultant in years one, three and five after project completion
Lands Suitable for Infiltration	Consultant in years one, three and five after project completion	Consultant in years one, three and five after project completion	Consultant in years one, three and five after project completion
Low-impact Development	Contractor, one time, first or second year	Contractor, one time, first or second year	Owner's responsibility
Stream Channel Stabilizations	PFBC[1] in years one, three and five after project completion	PFBC in years one, three and five after project completion	PFBC, in consultation with the cooperating organization, in years one, three and five after project completion
Property Purchases	VFNHP[2] in years two, four and six after project completion	VFNHP in years two, four and six after project completion	VFNHP in years two, four and six after project completion
Easements w/buffers	OLC[3] in years one, three, and five after project completion	OLC in years one, three, and five after project completion	OLC in years one, three, and five after project completion
Buffers	VFNHP in years one, three and five after project completion	VFNHP in years one, three and five after project completion	VFNHP in years one, three and five after project completion
Postings Removals	PFBC in second and fourth years after removal	PFBC in second and fourth years after removal	PFBC in second and fourth years after removal
Access w/parking	PFBC in first, second and fourth years after project completion	PFBC in first, second and fourth years after project completion	PFBC in first, second and fourth years after project completion
Trails	PFBC in second and fourth years after trail established	PFBC in second and fourth years after trail established	PFBC in second and fourth years after trail established
Fish Restoring on Crabby Creek	PFBC in years one, three and five after restoration	PFBC in years one, three and five after restoration	PFBC in years one, three and five after restoration

1. PFBC = Pennsylvania Fish and Boat Commission.
2. VFNHP = Valley Forge National Historical Park.
3. OLC = Open Land Conservancy.

Funding for an outside consultant to evaluate the stormwater infiltration projects submitted by applicants will be provided from portions of the administrative cap that will exist when the restoration plan is implemented. The desired approach will be to enter into a contract with an organization on a multiple-task type contract that could span several years. The consultant would serve two purposes: review design plans and be present at the site at critical times during project construction. If deficiencies were noted in design and construction, the consultant or inspecting party would contact the responsible project manager and make recommendations for corrective action and note where the original design is not being followed. The project manager and the consultant would resolve unexpected or adverse construction conditions.

The Trustee Council will be responsible for paying the costs of project evaluation and monitoring work to accomplish the tasks specified in table 3. The applicant will file reports of effectiveness with the Trustee Council to be used in making decisions on future project alternatives. When maintenance needs are identified, the implementing party will perform the maintenance or they will ensure that another entity (such as the Fish and Boat Commission, the park, the community applicant, or the Open Land Conservancy) performs the required maintenance.

The project manager or applicant for the project will also be responsible for complying with all the laws and regulations described under the "Applicable Laws and Regulations" chapter of this plan.

PROJECT COSTS

STORMWATER MANAGEMENT PROJECTS

Detention Basin Retrofits

Initial retrofit costs are estimated at $35,000 per basin, assuming a 3-acre collection area, the use of infiltration trenches, and including a $3,000 geophysical test. These projects must be maintained on an annual basis, at the expense of the owner, regardless of whether or not they have been retrofitted. This restoration method will include an annual maintenance check and necessary repairs for a specified number of years or the remaining number of years the restoration fund has monies. The group that conducts the retrofit will be responsible for the annual check, and the fund will pay for any expenditures. Under this plan, 10% of the initial budget for the basin will be set aside for expenditures, such as, improving operations or altering the design to be more effective.

The cost of testing and implementation will be paid by the restoration fund. The initiative to retrofit a basin can be undertaken by the site owner, an environmental organization, a municipality, or the Trustee Council. The evaluation process for projects assessed and future potential projects was described earlier in this chapter and in appendix D.

Lands Suitable for Infiltration Projects

For lands suitable for infiltration projects, the costs for applying these methods vary widely, as do estimates of the increased amount of infiltration. Ideally, the information that would be required for preparing cost estimates is a list of all infiltration projects, along with their annualized cost and amount of incremental infiltration expected. With this information, the Trustee Council would be able to choose the most cost-effective projects or the projects with the most infiltration as priorities under this restoration plan. Unfortunately, at this time data does not exist systematically. Projects that can be listed are those in areas of the watershed where infiltration is most needed, which is a systematic way to determine the technical and economic feasibility of infiltration. For the purposes of this restoration plan, an assumption was made that the cost of infiltration would be $36,000 per site, including the geophysical tests.

The average $36,000 cost per lands suitable for infiltration project was derived by assuming a maximum of 3 acres per project at an average cost of $11,000 per acre (see table 4) plus $3,000 for geophysical testing of each site. In 2003, Cahill & Associates performed soils and geological surveys on several basins owned by East Whiteland and installed a rock trench in one of those basins. The total cost was $39,000.

TABLE 4: TYPICAL COST OF INFILTRATION PER ACRE OF DRAINAGE AREA

Drainage Area	Cost of Infiltration* (per acre)
Ponds and Wetlands	$1,500 to $2,500
Infiltration Trenches	$8,000 to $9,000
Surface Sand Filters	$7,000 to $8,000
Bio-retention	$10,000 to $12,000
Underground Sand Filters	$15,000 to $25,000
Proprietary Devices	$10,000 to $12,000

* The range of costs was developed by the Center for Watershed Protection.

The implementation of these projects will be very similar to that of retrofitted basins. An owner or organization within the watershed, or member of the Trustee Council, will present the project application to the Trustee Council. If approved, testing will be performed and paid for by the Trustee Council. The Council willx also pay for the construction and maintenance requirements for up to 10% of the construction costs. Agreements will have to be established between the initiating party and the site owner to ensure the project's effectiveness, continuation, and value and to ensure that the design and engineering of the project will not be altered without Trustee Council review and mutual agreement.

Low Impact Development Projects

The Trustee Council does not have specific cost estimates for low impact development project technologies. Therefore, the Trustee Council will accept applications for up to two low impact development demonstration projects on individual residential properties. Based on the results of these demonstrations, and the costs incurred, the Trustee Council would establish a funding limit for individual low impact development grants (see appendix D for the Project Application and Evaluation Criteria.

For purposes of this restoration plan, an assumption was made that the Trustee Council will provide up to $3,000 per property for up to 15 parcels. This limit was suggested in order to budget the proposed projects with a greater degree of certainty. The projects contained in this plan will require approval of the applications from property owners to retrofit their existing site (of 5 acres or less) with these technologies. The property owner will be responsible for regular maintenance without payment by the Trustee Council.

The Trustee Council does not have information about the extent to which the low impact development program might be used. No one from the watershed has requested such a program. The Trustee Council is aware of this type of individual property owner project in other communities. Many times low impact developments are designed into new developments and not as retrofits to existing residences.

STREAM CHANNEL STABILIZATION PROJECTS

Field observations and photographs determined the lengths of eroded streambanks for each candidate project. The project cost per eroded bank section was estimated on the basis of assigning one of the four stream channel stabilization methods listed in table C-6 (appendix C) and the cost per foot. Cost figures are intended to include design, permits, construction, and monitoring. Cost figures for this geographical area were set by the Trustee Council at higher levels than what others have experienced for installing such systems in more rural areas of Pennsylvania. Higher labor costs in southeastern Pennsylvania for all phases of work are the reason for the higher cost factors.

The costs for bioengineered banks, rip rap, and vanes were obtained from the Center for Watershed Protection and the Chesapeake Bay Journal (Blankenship 2002). Those costs also agreed with a case study (Worobee and Wayne 2002) on Big Bear Creek that was presented at the Third Annual Natural Stream Channel Design Summit held April 25-27, 2002, at Penn State University. The cost for skyhooks was obtained from the Valley Forge Chapter of Trout Unlimited, which installed a skyhook in 2000 on Valley Creek. The chapter kept records of all purchases and labor hours. For placing boulders, the total initial cost assumes 1 mile of stream at $15 per foot or $79,200, and annual maintenance cost is assumed to be zero. Biohabitats of Baltimore, MD cites costs of $75 to $150 per linear foot based on their experience in the Philadelphia area.

These costs include all initial installation costs such as construction, design, and permitting. These costs do not include the maintenance and upkeep required to keep the projects operating as designed. These

types of projects are known to need periodic "tweaking," and a figure of 10% of initial construction costs is allocated for such maintenance.

GREENWAY PROJECTS

Conservation Easements on Private Lands

A conservation easement, in the context of stormwater management, will preclude development from taking place in the floodplain as a minimum. The preclusion is a choice by the landowner. The landowner could also stipulate that a vegetated buffer be maintained for a certain length and width along the stream. The owner of an easement is entitled to tax benefits. For conservation easement projects under this restoration plan, up to $3,000 will be provided to a property owner who is willing to record an easement on their deed and consider having a buffer constructed in a manner specified in this chapter. The Open Land Conservancy will administer the program, obtain funds from the Trustee Council, and be paid a one-time fee to inspect these lands for conformity to the agreement. Appendix L contains a draft agreement between the Trustee Council and the Open Land Conservancy. The Trustee Council plans to complete a final agreement with the Conservancy.

Stream Buffers

Constructed or natural stream buffers are estimated to cost $9,000 per acre (Scheuler 2000). The intent of this restoration plan is to pay for buffers along 3,100 feet of streambank (considering each bank separately) for buffer widths averaging 75 feet, which is equivalent to about 8.6 acres. Maintenance costs are estimated at 25% of the initial cost. Applications to the Trustee Council for buffers can come from any organization or individual in the watershed.

PUBLIC ACCESS PROJECTS

At this point, a complete list of public access projects has not been identified. For purposes of this restoration plan, a budget of $75,000 has been targeted for access projects, plus a 10% maintenance budget. The budget for this category is based on a limited number of opportunities expected in the watershed and a relatively good amount of existing access by anglers.

FISH RESTORATION ON CRABBY CREEK

Two sets of cost will comprise this category. In year one, approximately $35,000 is estimated for stream stabilization projects prior to stocking. In year two the brook trout would be placed in Crabby Creek at a negligible cost borne by Pennsylvania Fish and Boat Commission and local conservation organizations like Trout Unlimited. Habitat assessment teams made restoration recommendations for the watershed and commented on the reaches with the poorest scores. The team felt that the upper reach of Crabby Creek (the highest scoring reach), where brook trout have been found in the past, is a good reach for vanes and bank stabilization of two major areas in order to create pools for improved habitat, especially adult fish. This recommendation agrees with a recommendation made in the past by Mike Kaufmann, a fisheries biologist with the Pennsylvania Fish and Boat Commission, southeast Pennsylvania region.

LIMITATION OF ADMINISTRATIVE EXPENSES ON PROJECT IMPLEMENTATION

The Memorandum of Agreement (appendix A) between the U.S. Department of the Interior and Pennsylvania Fish and Boat Commission contains a clause that limits the amount of administrative expenses to no more than 10% of the $850,000 in the restoration fund (or $85,000). The Trustee Council strongly favors spending as much of the fund as possible on actual physical projects. One-half of the administrative expenses were spent in development of this restoration plan. This leaves approximately 5% to spend on administrative expenses for implementing projects. This limitation on administrative expenses will act as a constraint on the kind of projects selected and the method by which projects are administered. There are three broad options for administering projects.

Use of existing staff to review periodic applications from community organizations. This system places the least burden on Valley Forge National Historical Park and Pennsylvania Fish and Boat Commission staff time to implement projects by relying on the initiative and interest of watershed organizations to apply for and receive grants for installing projects. Staff from the Commission and the National Park would prepare bid packages, solicit proposals from the community, review applications, award grants, and oversee installation. Applying organizations would be encouraged to use restoration fund monies as a match against funds available from programs, such as, Pennsylvania's Growing Greener program, the Delaware Estuary Program, and various foundations that fund projects in Pennsylvania.

Part-time hired staff to prepare bid packages for designated projects, review proposals, and oversee implementation. This system could be implemented with part-time staff but would entail more administrative costs against the cap than the above system. The part-time staff could also make applications to the Growing Greener program.

Full-time hired staff to do the above work, plus devote outreach efforts to urge community organizations to implement projects. In addition to the work under the second option above, this option recognizes that community outreach, by a hired staff person, may be required to inform some organizations of the benefits of implementing projects discussed in this restoration plan on their own property. Outreach would be conducted with such entities as townships, corporations, property managers, land conservancies, and homeowners associations. This option is limited in application because of the administrative expense cap.

The Trustee Council prefers to rely on the efforts of local governments, homeowners associations, environmental organizations, conservancies, corporate landowners, and others to undertake projects that will be funded by this restoration plan. The scenario preferred by the Trustee Council is that each organization use monies from the restoration fund as match monies for Pennsylvania's Growing Greener program grants and other funding programs for as long as they are available. Similarly, Chester County has an open space grant program where restoration plan monies could be used to match such grants. Applicants for restoration fund monies will be asked to explore all possible funding matches.

CUMULATIVE COSTS OF RESTORATION CATEGORIES AND PROPOSED PROJECTS UNDER ALTERNATIVE A

Table 5 below shows how the monies would be spent on a yearly basis if the preferred sequence of projects were undertaken. This table includes both the initial costs that were presented in table 1 above, as well as the associated annual maintenance costs. The $850,000 that came to the Valley Creek Restoration fund from the three rail companies (that entered a settlement agreement) is clearly not sufficient to meet the restoration needs of the watershed or to compensate for lost past uses. It is the goal of the Trustee

Council to use the funds, whenever possible, as a match against other funds available in Pennsylvania. For example, over the past five years, there has been a "Growing Greener" program in the Commonwealth of Pennsylvania that has partially funded projects similar to the types included in this restoration plan. If each project could be funded in equal parts by the restoration fund and the Growing Greener program, the leveraging can effectively increase the coverage of restoration projects to approximately $1.7 million out of the estimated $3.7 million in initial capital costs. Although the calculations are not shown in table 1, the $850,000 would last approximately four years and the $1.7 million amount, if available (assumes the ability to get matching funds for the $850,000) would be spent at the end of 2009.

Table 6 lists the project categories and subcategories and table 7 reports the total initial and cumulative maintenance costs for the projects proposed under alternative A.

The cumulative capital expenditures through the year 2017 are estimated at $3,670,000.

TABLE 5: CUMULATIVE INITIAL AND ANNUAL COSTS FOR PROJECTS

Year	Initial Capital Costs ($,000)	Sum Including 10% maintenance costs on average
2004	212	232
2005	285	314
2006	257	283
2007[1]	234	257
2008	398	438
2009[2]	299	329
2010	269	296
2011	215	227
2012	661	727
2013	199	219
2014	205	226
2015	196	216
2016	178	196
2017	87	96
Total	$3,670	$4,066

1. Year in which present fund of $850,000 would be spent.

2. Year in which a 100% leveraged fund of $1.7 million would be spent.

TABLE 6: RESTORATION PLAN PROJECT CATEGORIES AND TOTAL COST ESTIMATES

		Initial	Maintenance	Total
Stormwater Management				
Retrofitted Detention Basin[1]	23 x $35K each	$805,000	$80,500	$885,500
Lands Suitable for Infiltration[1]	21 sites x $36K each	756,000	75,600	831,600
Low Impact Development	15 lots x $3K each	45,000	0	45,000
Stream Channel Stabilization		1,505,000	150,500	1,655,500
Vegetated Banks				
Rip rapped Banks				
Vanes				
Skyhooks				
Cover Enhancement (Boulders)		79,200	0	79,200
Greenways				
Purchased Land	Angler Park	50,000	0	50,000
Conservation Easements[2]	15 lots x $3K	45,000	4,500	49,500
Stream Buffers[3]	3,100 feet x $100/feet	310,000	77,500	387,500
Public Access		75,000	7,500	82,500
Fish Restoration on Crabby Creek		0	0	0
		3,670,200	396,100	4,066,300
		Estimated Initial Plus Total Annual Costs = 4,093,800		

1. Maintenance cost budget of 10%.
2. Maintenance cost budget of 25%.
3. Payments to OLC of $250 per easement plus $1,600.

TABLE 7: TOTAL INITIAL AND CUMULATIVE MAINTENANCE COSTS

Category	Cost ($,000)	Distribution (%)
Stormwater Management	1,762,100	43.3
Stream Channel Stabilization	1,734,700	42.7
Greenways	487,000	12.0
Public Access	82,500	2.0
Fish Restoration on Crabby Creek		
Total	4,066,300	100.0

CATEGORIES OF PROJECTSCONSIDERED BUT ELIMINATED FROM FURTHER EVALUATION

Four potential categories of projects were considered in addition to those described in Methodology and Processes for Identifying the Restoration Process. They were limited fish stocking, dredging upstream of dams, establishing of a trust fund, and dredging of PCBs.

FISH STOCKING IN VALLEY CREEK

Fish stocking would, at first, appear to compensate for past lost usage of the fishery because increasing the fish population might attract more anglers. It is the policy of the Pennsylvania Fish and Boat Commission to not stock trout as long as the stream meets the class A standard for biomass. The Pennsylvania Fish and Boat Commission policy does allow for replacement of decimated species, such as brook trout in Crabby Creek. No other areas of Valley Creek are being considered for stocking. Stocking hatchery-reared trout in waters other than Class A can occur if publicly accessible stream segments at least two miles long are found to have acceptable water quality. No sections meeting these criteria were found.

DAM DREDGING/BREACHING

Two dams exist on the main stem of Valley Creek outside Valley Forge National Historical Park. Both dams are silted-in and probably increase the temperature of the impounded waters during summer months. The dams also preclude fish migration. One of these dams is historic since it provides water to a historic non-functioning gristmill. The Trustee Council feels that dredging those dams is the responsibility of the private owners of those dams. Without breaching, the dams would silt-in within a few years and require re-dredging.

ESTABLISHING A TRUST FUND

The idea of saving the principal and only using interest generated by the trust fund for restoration activities was also considered. Based on legal advice from the Department of the Interior, the Trustee Council decided that this concept does not fit within the intent of a restoration fund because the idea would postpone compensation for lost past uses of the watershed. Because this is a multi-year restoration effort, monies would be programmed and projects sequenced to gain the maximum benefits to the watershed.

DREDGING PCB-CONTAMINATED SEDIMENTS

The Trustee Council also considered the benefit that would come from dredging PCBs either prior to action by the responsible party, or in addition to the activities conducted by American Premier Underwriters, Inc. The Trustee Council has, however, noted progress by the Environmental Protection Agency and American Premier Underwriters to remediate PCB concentrations in sediment, and it believes that the actions ultimately approved for implementation, as set forth in the Record of Decision associated with the cleanup of the Paoli Rail Yard site, are protective of human health and the environment, and that further attempts to remove PCBs would not add additional cost-effective benefits.

Chapter 3
Affected Environment

CHAPTER 3 – AFFECTED ENVIRONMENT

INTRODUCTION

This chapter provides a general description of the environment and resources of the Valley Creek Watershed.

PHYSICAL ENVIRONMENT

WATERSHED

Figure 5 below shows the 23.4 square-mile Valley Creek Watershed. East Whiteland and Tredyffrin Townships occupy about 90% of the watershed. The watershed also includes small parts of Upper Merion Township in Montgomery County; Schuylkill, Charlestown, and Willistown Townships in Chester County; and the Borough of Malvern. The Valley Forge National Historical Park occupies the downstream, or northeastern, portion of the watershed, comprising about 10% of the watershed.

Valley Creek flows from southwest to northeast, joining its main tributary, Little Valley Creek, 3.1 miles above where Valley Creek enters the Schuylkill River. The figure also shows the more than 30 mostly unnamed tributaries that flow into Valley and Little Valley Creeks. The subbasins of Little Valley Creek and their tributaries represent about one-third of the acreage of the watershed. About one-half of the tributaries of Valley and Little Valley Creeks flow perennially; the remainder flow intermittently.

The Paoli Rail Yard (the source of PCB contamination) covers 28 acres and is shown in red at the southern watershed border on the map. PCB concentrations were found in three tributaries that flow northward from the Paoli Rail Yard and in Little Valley Creek and Valley Creek.

Valley Creek has the designation of “Exceptional Value,” which is the Pennsylvania Department of Environmental Protection’s highest category for stream quality. Valley Creek also has the Pennsylvania Fish and Boat Commission’s highest designation of class A wild trout fishery. In addition to the Paoli Rail Yard there are several other contaminated sites that present water quality and water quantity challenges for the natural resources of Valley Creek. As noted in chapter 1, there are many other activities occurring in the watershed that will affect water quality and quantity including

a stormwater management study by the Water Resources Authority of Chester County

development of a total maximum daily load program by Pennsylvania Department of Environmental Protection

ongoing studies by Drexel University, funded by a National Science Foundation grant, of stream biology, pollutants, groundwater, temperatures, and social factors

widening of Route 202 from four lanes to six lanes – Pennsylvania Department of Transportation intending to mitigate the runoff

local township ordinance changes for improved stormwater management

continuing work to remedy several hazardous waste sites in the watershed

changing flow into Valley Creek from the development of a former quarry into a lake for the Atwater office park

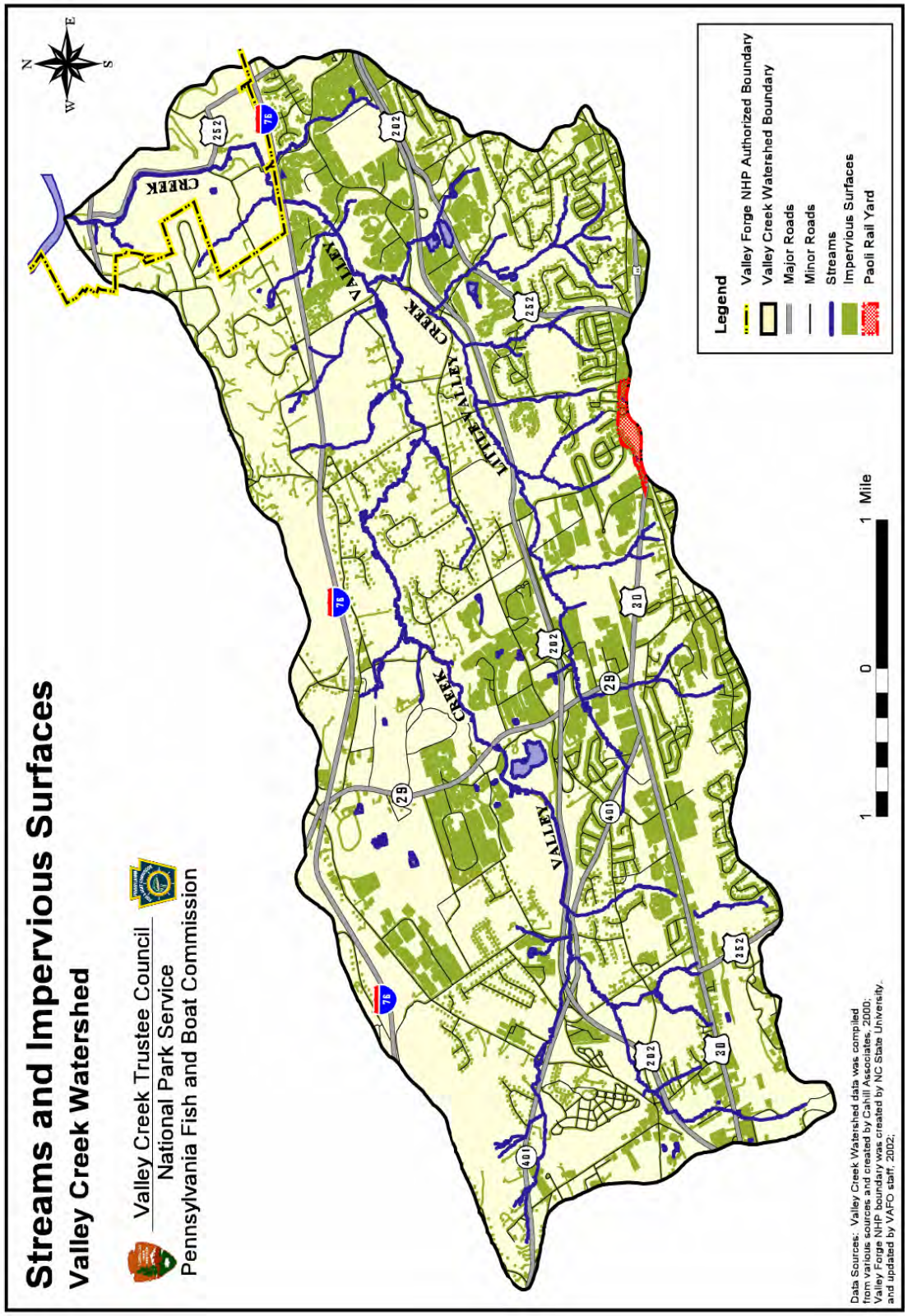

FIGURE 5: STREAMS, IMPERVIOUS SURFACES, AND OTHER FEATURES OF THE VALLEY CREEK WATERSHED

implementation of the Valley Creek Coalition agreement with Pennsylvania Department of Environmental Protection for improved stormwater management on new or redeveloped lands

purchases of land for parks, open space or preservation by townships and land conservancies

stream stabilization projects in Valley Forge National Historical Park, undertaken by the National Park Service and Pennsylvania Department of Transportation

LAND USE

The stream corridor for the lower 2.2 square miles of Valley Creek is within Valley Forge National Historical Park. Upstream, on Valley Creek, the land uses abutting the stream consist of township parks, private homes, a landfill, quarries, major corporate centers, and Route 202. There are three dams on the main stream of Valley Creek, one of which is on the National Register of Historic Places because it supplied water to a historic mill, which is still standing. A third dam is in Valley Forge National Historical Park. Both impoundments outside Valley Forge National Historical Park are heavily laden with silt upstream of the dam. Water held by the dams warms in the summer and prevents the migration of fish, and does not allow the natural sediment-carrying properties of the stream to work properly. Little Valley Creek land uses above the confluence are dominated by a major residential development, private homes, a major corporate development, the Paoli Rail Yard, and Routes 202 and 30. As a result of the amount of impervious surface and runoff volumes, the stream channels of both Valley Creek and Little Valley Creek are highly eroded and fewer trout are found upstream of Route 202.

The population for the watershed is approximately 22,257 for 1998 and is projected at 24,653 for 2020. It is estimated that an increase of approximately 10% in population growth by 2020 will contribute to reductions in land uses associated with permeable surfaces, such as agricultural and wooded lands, and an increase in land uses associated with impervious (non-permeable) surfaces, such as residences (CCWRA 2002). Table 9 contains estimated land use distribution data for Valley Creek Watershed for 1998 and 2020.

The last column in table 9 shows that wooded land is estimated to have the largest drop of 524 acres from a total in the watershed of 14,981. Agriculture (-135 acres) and vacant land (-75 acres) also show losses. The largest land use increases are for residential single/family (+434 acres), commercial services (+105 acres), and transportation/utility (+75 acres).

The amount of impervious cover and stormwater runoff in the watershed has increased in direct proportion to the growth in the watershed. Figure 5 shows impervious surfaces in the watershed. The Great Valley, through which Valley Creek flows, has been the location of extensive growth of residential, commercial, and transportation/utility development. Impervious surface coverage has grown from 9% in 1987 to approximately 18% in 1995, according to the Geographic Information System work performed by Cahill & Associates. The Chester County Water Resources Authority's *Watersheds Compendium* report (CCWRA 2002) states that impervious surfaces comprise 24.3% of the watershed. The county's estimates for 2020 show that impervious surfaces are projected to increase to 26.1%. (The calculations of Cahill & Associates that showed 18% cover excluded counting sidewalks and driveways and was based on 1995 aerial photos.)

It cannot be said that all rainfall falling on impervious surfaces goes to the streams in the watershed. A large, but uncalculated amount of the impervious cover is not curbed and therefore some runoff goes into greenways and infiltrates. Also, much of the water that goes into storm sewers and streams would have been lost to evapotranspiration prior to the building of impervious surfaces.

TABLE 9: LAND USE PERCENTAGES FOR VALLEY CREEK WATERSHED

Land Use	Estimated Percentages for 1998	Estimated Percentages for 2020	Number of Acres Change*
Permeable Surfaces			
Agriculture	7.3	6.4	-135
Mining	3.1	3.1	0
Recreation	3.9	3.9	0
Vacant	5.2	4.7	-75
Water	0.4	0.4	0
Wooded	32.4	28.9	-524
Percent Permeable	52.3	47.4	
Non-permeable Surfaces			
Commercial Services	6.6	7.3	+105
Community Service	1.9	2.1	+30
Industrial	2.0	2.0	0
Parking	3.9	4.3	+60
Residential-High Density	0.7	0.8	+15
Residential-Multi-family	1.9	2.2	+45
Residential-Single Family	26.1	29.0	+434
Transportation/Utility	4.6	5.1	+75
Percent Non-permeable	47.7	52.8	
Total	**100.0 %**	**100.0 %**	

Source: Compendium, Chester County Water Resources Authority, p. 9-35.

* Plus and minus figures in column four do not sum to zero because of the rounding process.

The amount of impervious cover changes significantly from subbasin to subbasin in the Valley Creek Watershed. In 1999 GTS Technologies (Delaware Valley Regional Planning Commission 1999) calculated impervious covers and runoff numbers by subbasin for those subbasins that are near section 300 of Route 202. Table 10 shows a range of 9% to 41.9% impervious cover for the subbasins studied by GTS. The subbasins with higher than the total watershed impervious figure of 24.3% (CCWRA 2002) are all in the headwaters of Little Valley Creek, adjacent to Routes 202 and 30 and Paoli and Malvern. The term “curve number” represents a relative stormwater runoff value. A higher curve number means more runoff. Curve numbers are influenced most by soil type, land cover, and slope of the land.

Only recently have the stormwater management ordinances of East Whiteland and Tredyffrin Townships required, where technically feasible, infiltration of up to 2-year rain events. Also, the September 2001 agreement between the Pennsylvania Department of Environmental Protection and the Valley Creek Coalition (VCC 2001) recognizes that stormwater runoff from continued development has cumulative consequences for Valley Creek. Under that agreement all new development must accommodate infiltration that is equal to or greater than pre-construction infiltration of precipitation, assuming that baseline land conditions are meadows. This is required for up to and including a two-year, 24-hour rain event. While these ordinances and agreement will play strong roles in preventing excess runoff in the future, the stormwater flow situation in Valley Creek, and its tributaries, is likely to get worse before it gets better. This is because there is much approved development yet to be built as a result of permits issued under the former system that will not be subject to the Valley Creek Coalition agreement.

TABLE 10: IMPERVIOUS COVER AND RUNOFF NUMBERS FOR SELECTED VALLEY CREEK BASINS

Subbasin Code[1] (refer to figure 4)	Impervious (percent)	Curve Number[2]
A4	22.2	73
A5	9.0	69
A2	18.9	71
A6	14.7	76
A3	16.5	71
B11 and B12	33.1	76
B9	26.3	71
B10	41.9	76
B7 and B8	27.5	72
B6	20.4	74
B3	20.4	73
B2	20.8	73

1. These are the same subbasin code numbers that appear in figure 4 in chapter 2.

2. For curve number, the higher the number the greater the amount of stormwater.

Appendix H contains a map showing protected open space in the Valley Creek Watershed and appendix I depicts the Open Land Conservancy nature preserves and conservation easements in the watershed.

HYDROLOGY

Valley Creek and its tributaries extend from the western edge of the watershed to Valley Forge National Historical Park and its confluence with the Schuylkill River (figure 5). Little Valley Creek begins in the southcentral portion of the watershed and joins Valley Creek about 1 mile west of the park. Figure 4 (in chapter 2) shows all the subbasins for Valley Creek and Little Valley Creek and indicates whether they are 1st, 2nd, or 3rd order streams. First-order streams contain the originating stream, second-order streams are fed by first-order streams, etc. Fifty-six percent of stream miles in Valley Creek are 1st order streams. The legend shows that the brown-colored subbasins are 1st order; the yellow-colored subbasins are 2nd order; and the green-colored subbasins are 3rd order streams. Figure 4 also applies a code to the subbasins to facilitate basin-by-basin presentations of tabular data shown in table 10. The "A" sequence of codes is for basins that flow into Valley Creek, while the "B" codes are for basins that flow into Little Valley Creek.

There are numerous water quality and water quantity challenges for the natural resources of Valley Creek, including an increasing amount of impervious surfaces and increased stormwater runoff, which is the most significant water quantity problem in Valley Creek. However, one typical watershed problem that does *not* plague Valley Creek Watershed is excessive stream withdrawals (CCWRA 2002).

A U.S. Geological Survey gauge on Valley Creek is located just outside Valley Forge National Historical Park boundary at Route 76, and it is 2.2 miles from the confluence with the Schuylkill River. The gauge, installed in 1981, reflects a 20.8 square-mile drainage area of the watershed's total 23.4 square miles. The available quantitative flow data for Valley Creek Watershed comes from this gauge.

The width of Valley Creek, from its confluence with the Little Valley Creek to its confluence with the Schuylkill River, ranges from about 20 feet to 50 feet at bank full levels. The width of Little Valley Creek ranges from about 7 feet to 16 feet. Valley Creek, above the confluence with Little Valley Creek, ranges in width from 13 feet to 26 feet. The tributaries of both streams are 3 feet to 10 feet wide.

Table 11 below shows the average median flows in cubic feet per second (cfs) for Valley Creek for each month since the USGS gauge was installed in 1981.

Table 12 illustrates the frequency of certain flows in Valley Creek for approximately the last 20 years. The data seem to show that low to median flows were higher in the first 10 years (1982 to 1992) than the following nine-year period. It is unclear if an actual decline in flow has occurred because there were more years of drought in the latter period. Other factors also influence flows, for example the amount of discharge from the former Warner Quarry (see below).

Baseflow is the amount of stream flow coming from groundwater. Significant groundwater recharge supports a cold water aquatic community for brown trout. A 1990 USGS study of Valley Creek (Sloto 1990) showed that baseflow from 1983 to 1987 averaged 17 inches, which represented a discharge of 26.15 cfs.

The official lowest 7-day flow during the past 10-year period was an average of 10.7 cfs, or less than half of the 1983-87 average baseflow. As shown in table 12, the lowest average flow for one-day was 7.4 cfs. There were also 10 days in 1999 when mean daily flow flows were below 9.6 cfs (pers. comm. Kirk White, USGS 2003). The highest instantaneous flow in the past 20 years was 6,280 cfs in September 1999 during Hurricane Floyd. The figure of 2,020 in table 12 represents a mean daily average.

There are two schools of thought regarding the effect of increased runoff on groundwater and stream base flows. One school holds that there has not been a decrease in Valley Creek Watershed's groundwater (Schraffler, WRIR 97-4113, 1997) (except during droughts) and that the volume of increased runoff is water that would have been part of evapotransporation, which is typically about 22 inches out of the 45 inches of total annual rainfall in Valley Creek Watershed (15 inches per year infiltrate and the remaining 8 inches per year is runoff). Thus, the lost evapotranspiration is what causes the increases in peak stream flows and the accelerated erosion of downstream streambanks. The second school holds that groundwater has been affected by increased runoff as evidenced by the fact that several once perennially flowing tributaries are, according to long-time residents, now only intermittent tributaries. Recent droughts have also made it difficult to determine if low or nonexistent flow is due to those droughts or reduced infiltration.

TABLE 11: MONTHLY AVERAGE MEDIAN FLOWS IN CUBIC FEET PER SECOND FOR VALLEY CREEK FOR THE YEARS 1981 TO 2002

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
34.7	33.2	44.7	44.8	37.5	28.4	27.6	23.6	29.6	23.5	28.1	32.1

TABLE 12: FREQUENCY OF VARIOUS FLOWS* IN VALLEY CREEK FOR TWO DIFFERENT PERIODS OF RECORD

Time Flow Equaled or Exceeded (percent)	Flow Oct 1, 1982 – Sept 30, 1992 (cubic feet per second)	Flow Oct 1, 1992 – Sept 30, 2001 (cubic feet per second)	
100	9.8	7.4	Lowest flow
90	16	14	
50	24	23	
20	36	39	
10	51.8	52	
0	684	2,020	Highest flow

* From USGS gauge – Valley Creek at Turnpike.

Regardless of its effect on groundwater, it is undisputed that increased runoff does occur from more impervious surfaces, whether it is rain that would have infiltrated or rain that runs off instead of evaporating. The increased runoff volume, as well as peak volume from storms may cause substantial erosion of streambanks (pers. comm. T. Cahill, T. Graupensperger, K. White 2001) and may deposit or remove sediment in or from the channels.

An important hydrologic factor for Valley Creek is the flow of pumped water from the Warner Quarry, a defunct limestone quarry being redeveloped into a corporate center. Since the early 1980s, pumping from the quarry kept the quarry floor dry for excavation. The quarry discharge point is about 5 miles above the USGS gauge. Average daily flows from the quarry were approximately 6.7 cfs, or about 4.5 million gallons per day (mgd) until 2001. When redevelopment began, pumping was reduced, and the rate is currently at 4 cfs, or 2.7 mgd. Meanwhile, the quarry has been allowed to fill according to the redevelopment design. When the quarry has filled some of the raised groundwater table will flow into Valley Creek; how much is undetermined. In the past, when low flows at the USGS gauge approached historical lows of 10 cfs, the Warner Quarry discharge of between 4 cfs and 6.7 cfs contributed a large percentage of the flow of Valley Creek.

WATER QUALITY

The water quality of Valley Creek Watershed is generally good. Valley Creek Watershed has the highest stream classification categories of both the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission. The Pennsylvania Department of Environmental Protection classification is “Exceptional Value,” while the good water quality has contributed to a Pennsylvania Fish and Boat Commission Class A trout population which contains more than 40 kilograms of brown trout biomass per hectare of stream surface, or about 36 pounds per acre of surface water. Additionally, “Exceptional Value” means that any new point source discharges must meet existing stream water quality; in other words, dilution is not allowed in order to improve water quality.

The Valley Creek Watershed is not affected to a significant degree by several problems that can typically occur in a watershed, such as, industrial point source discharges. Sewage discharge plants are also not a problem in this watershed since they were removed in the 1970s, however, increases in fecal coliform, an indicator of sewage, were found in stretches of Valley Creek near the location of where the most septic systems are still in use. Chemical contamination, such as ammonia in Valley Creek near Route 29, is a localized problem. Chemical contaminants are usually from waste sites, all of which are being, or are about to be, controlled under Superfund or Pennsylvania Department of Environmental Protection programs.

The water quality and water quantity challenges that do exist for the natural resources of Valley Creek include PCB contamination, suspended sediments, lithium, boron, bromates, high turbidity from unknown sources, and a “barrier” to fish passage upstream of Route 29 from groundwater springs that are low in oxygen and high in ammonia and nitrites.

Contaminated waste sites (including discharges of organic compounds and metals), PCBs, sewage from septic systems, and sediments threaten the water quality of Valley Creek. In addition to the Paoli Rail Yard Superfund site, other Superfund and hazardous waste sites covered by federal and state laws include Foote Mineral (lithium, boron, and bromate discharges), Chemclene Corp. (organic compounds), Bishop Tube (organic compounds), Unisys (chlorinated compounds and chromium), and Worthington Steel (cyanide and organic compounds). Knickerbocker Landfill is a closed landfill that accepted hazardous wastes at a sanitary facility. Fecal coliform levels from septic systems were found by Drexel University’s study team at levels that do not violate water quality standards, but are significantly higher than

background concentrations. For the most part, those pollution situations that exist or threaten Valley Creek are either being managed by the Environmental Protection Agency or Pennsylvania Department of Environmental Protection through recent or planned actions.

The Trustee Council concludes that sediment is the most significant pollutant in Valley Creek that needs to be managed in order to increase future uses of the watershed. Excess sedimentation is occurring in the watershed and there is no effective management program in place to correct this problem for past development. The Valley Creek Coalition Agreement described above should help to control some of the future development. Sedimentation is an impairment to the habitat and biological productivity of Valley Creek, and must be reduced for improved use of Valley Creek and enhanced ecological resources. Sediment problems in Valley Creek are driven by high stream volumes during storm events. The sources of sediments are the eroding streambanks of the streams (pers. comm. T. Cahill, T. Graupensperger, K. White 2001) and, to a lesser extent, traditional out-of-stream nonpoint sources in the watershed, such as construction of various kinds or agriculture.

Under the Commonwealth of Pennsylvania's total maximum daily load program, Valley Creek and Little Valley Creek are listed as being impaired for the pollutants or activities listed in table 13. Although nutrients are listed in this table, the Trustee Council does not consider them to be a significant problem that should be addressed in this restoration plan, since most grazing and crop growing in the watershed no longer occur, and agricultural land has been replaced by residential and business land uses. Water- quality data at the USGS sampling stations do not show high nutrient levels.

TABLE 13: SECTION 303(D)[1] LIST FOR LITTLE VALLEY CREEK AND VALLEY CREEK

Source of Pollutant or Activity	Pollutant or Activity Causing Impairment	Priority[2]
Little Valley Creek		
Bank Modifications	Flow Alterations	Low
Bank Modifications	Turbidity	Medium
Removal of Vegetation	Flow Alterations	Low
Removal of Vegetation	Turbidity	Medium
Road Runoff	Turbidity	Medium
Urban Runoff / Storm Sewers	Nutrients	Medium
Urban Runoff / Storm Sewers	Siltation	Medium
Urban Runoff / Storm Sewers	Turbidity	Medium
Industrial Point Source	PCBs	High
Valley Creek		
Channelization	Siltation	Medium
Channelization	Turbidity	Medium
Grazing Related Agriculture	Nutrients	Medium
Removal of Vegetation	Siltation	Medium
Road Runoff	Turbidity	Medium

1. Commonwealth of Pennsylvania, Section 303(d) (under the *Clean Water Act*) list, Pennsylvania Department of Environmental Protection, January 24, 2000).

2. The priority determines the ranking for that watershed in the development of actual total maximum daily load loading allocations and implementation plans for Pennsylvania.

Several factors have contributed to diminished levels of PCBs in stream sediments and in fish; those include the occurrence of floods in Valley Creek, the normal movement of sediments into the Schuylkill River, and preventative measures to prohibit PCBs from entering the Valley Creek Watershed. After Hurricane Floyd in 1999, EPA spot tests of sediments in the creek bed and floodplains of Valley Creek in the National Park area showed PCB levels of less than 1 ppm (part per million). This is below the 1 ppm level that the Environmental Protection Agency specifies as the standard for removal of PCB-contaminated sediments. Thus, the risk to humans from PCBs in the National Park appears to have been lowered. American Premier Underwriters, Inc. has recently tested the sediments in stream channels and in floodplains of the three tributaries to Little Valley Creek, Little Valley Creek itself, and the lower portion of Valley Creek; these tests indicate there is a need for further excavation of PCB-contaminated sediments (Kelley Chase, EPA, 2002). The status of PCB remediation was described in chapter 1.

GEOLOGY AND CHANNEL MORPHOLOGY

The Valley Creek Watershed is bounded on the north and south by hills of resistant crystalline rock. The floor of the watershed is a carbonate (or karst) valley that presents challenges for some of the restoration techniques that are evaluated in this plan. Sixty-eight percent of the basin is underlain by Cambrian and Ordovician limestone and dolomite (Sloto 1990). The stream channel has changed considerably over the decades.

Certain types of limestone (karst) geology can be susceptible to sinkholes. “Dissolution is the primary weathering process of carbonate rock. Dissolution generally is the most active above and within the zone of water-table where water movement is relatively rapid and recharge water is acidic. Below the zone of water-table fluctuation, water movement is comparatively slower, and acidic recharge water becomes neutralized. Near the land surface, dissolution of carbonate rock results in the filling of voids by clay, the collapse of solution openings, and the progressive lowering of the land surface.” (Sloto 1990) The concentration of stormwater, which in eastern Pennsylvania is highly acidic, in un-lined or non-clay basins over those susceptible situations can lead to sinkholes.

Valley Creek Watershed is characterized by rapidly growing areas of impervious surfaces. Impervious surfaces, such as asphalt parking lots and roads, cement surfaces, and rooftops, do not allow water to infiltrate or evapotranspirate. The concern is that the increasing amount of impervious surfaces will result in increasing stormwater runoff into streams. As more stormwater flows down stream at a faster rate, energy from the flow erodes banks in Valley Creek and its tributaries at almost every bend and turn. Sediment from eroded banks deposits in piles, or bars, is carried downstream, and eventually flows into the Schuylkill River. Piles of woody debris are also present in the streams of Valley Creek Watershed in numerous places. The presence of woody debris is not necessarily bad. Debris establishes cover for trout and other macroinvertebrates. However, water flowing around some of these blockages has also eroded the adjacent banks.

A May 2002 stream assessment (appendix B) performed by the Pennsylvania Fish and Boat Commission and Department of Environmental Protection examined twenty-six 328-foot reaches on Valley Creek, Little Valley Creek, Crabby Creek, and two unnamed tributaries. Two of the top four worst-ranking factors were bank stability and sedimentation. The principal cause of erosion was high volumes of upstream stormwater runoff impacting streambanks. Stream corridors were in poor to fair condition in many areas due, in large part, to failing banks.

The streambanks of Valley Creek Watershed, including the tributaries, show a wide variety of erosion from stream flow that cuts into beds and lowers channels and from widening of stream channels. Stream meandering and re-channeling is a natural process, however, the pace of natural changes in the meanders

of Valley Creek has been accelerated by the increased runoff in the watershed. Although no systematic studies have been performed, the general conclusion is that the increased runoff over decades has widened or deepened many channels and has carried damaging sediments down the streams. It appears that eroded clays are carried out of the watershed and that sands, silts, and gravels are deposited onto stream beds where they cause harm to spawning and macroinvertebrates. This impact is still likely to continue in Valley Creek even if development were to stop at this point. In the steeper tributaries, the banks are cut deep until bedrock is hit and then the cuts widen. Failing banks indicate that the stream needs to create wider channels to carry increased flow or that cutting of stream beds has occurred that also causes eroded banks. In the flatter tributaries and main stems, there are extensive amounts of nearly perpendicular 4- to 9-foot slopes that have no vegetation. In flatter tributaries, where upstream development is not significant, there are still gradual banks.

The headwaters of Little Valley Creek had lower stream assessment scores (see appendix B) than the lower half of the creek. Although, the upper half of Little Valley Creek has good riparian vegetation, there is high channel sedimentation, bank instability, and low epifaunal cover. This suggests that high runoff occurs upstream of this area and causes the banks to erode even though the riparian area is well vegetated. The curve runoff numbers for these tributaries, presented earlier, are among the highest in the watershed.

The valley floor slope ranges from 2% to 4%, and the stream meanders with many riffles and pools. The stream also carries a large sediment load from the erosion of streambanks, as well as from activities such as construction. The stream has numerous sand and gravel bars along the bottoms. Table 14 shows the average composition of Valley and Little Valley Creek substrates based on these 26 reaches.

The presence of gravel, cobble, and boulders is considered good for aquatic insect life and trout development. These substrates comprised 58 % of the stream beds. As shown in table 14 and taken from Appendix B, sand (25 %) is present in large quantities in the watershed and is a substandard material for aquatic life. Silt and clay comprise 14 % of the substrate in the watershed. Large amounts of gravel, sand, silt, and clay are transported in the Valley Creek Watershed during storms. Silt and clay, which can smother aquatic life, are transported to the Schuylkill River and still areas of Little Valley and Valley Creeks. Sand and gravel are deposited many places in the stream channel. Shifting stream bed material does not provide a stable environment for development of aquatic life. Considerable silt and clays were present in Valley Creek below the confluence with Little Valley Creek and in the tributaries in the headwaters of Valley Creek. The sediment composition in the lower half of Little Valley Creek consists of larger gravel, cobble, and boulders. Silt and clays were lowest in Crabby Creek.

TABLE 14: AVERAGE COMPOSITION OF VALLEY AND LITTLE VALLEY CREEK SUBSTRATES

Substrate	Percentage of Substrate (%)
Bedrock	3
Boulder	7
Cobble	20
Gravel	31
Sand	25
Silt	8
Clay	6
	100

Source: 2002 Stream Assessment (see appendix B).

The substrate composition data shows that gravel is the most prevalent (31 %), followed by sand (25 %). In general, substrate sizes smaller than gravel (sand, silt, and clay) equal 40 % of substrate composition compared to 29.0% for the larger sizes of cobble, boulder, and bedrock. The biological implication is that larger particles provide more cover under which invertebrates can reside. For trout, gravel is the optimal size particle for egg deposition, water movement, and oxygenation.

Sediment loads in the water can also increase the abrasive impact on streambanks. The substrate compositions determined during stream assessments (see appendix B), showed that most reaches had a high level of gravel, which is good for fish spawning and survival. However, there were many reaches where sand, silt, and clays were the predominant substrates after gravel. The literature (USFWS 1986) clearly shows that silt and clay can smother eggs, and sand has a more uncertain role in helping or hindering spawning and embryo survival. Sedimentation can also have an adverse effect on insect diversity.

FLOODPLAINS

Flooding of Valley Creek now occurs regularly in Valley Forge National Historical Park and elsewhere in the watershed. During Hurricane Floyd in 1999, floodwaters reached the walkway immediately in front of Washington's Headquarters. Flooding also threatened the park's historic covered bridge that is located about 1.25 miles upstream from Washington's Headquarters. Downstream from the covered bridge, within the park, a footbridge over Valley Creek was destroyed by the floodwaters of Hurricane Floyd. High waters also caused the collapse of a portion of Route 252 that runs along the east side of Valley Creek between the covered bridge and Route 23, near Washington's Headquarters. The Chester County Water Resources Authority's Compendium also lists other places in the watershed where flooding is a chronic problem during smaller storms than hurricanes.

A few structures still stand in the floodplains of the watershed. East Whiteland and Tredyffrin Townships, which control 90% of the watershed land usage, have long had zoning laws prohibiting building in the floodplains. The Commonwealth of Pennsylvania requires permits for construction within the 100-year floodplain (pers. comm. B. Lambert, VFNHP 2003). In addition, the Open Land Conservancy has purchased or has conservation easements on several miles of stream corridor. Conservancy ownership and easements prohibit building in the floodplains.

Although studies are lacking, the prevailing opinion of local professionals is that the banks of the main stems of Valley Creek and its floodplains are not acting in a natural way to dissipate the energy of runoff waters and promote infiltration where possible. This condition is not unexpected given the extensive development that has occurred in the watershed, including considerable earthmoving in the floodplains and the location of some structures.

There are numerous locations where streambanks receive excessive energy from flood flows as evidenced by highly eroded banks and deeply indented pockets. Also, deeply cut stream channels do not allow high flow levels to reach their floodplains, and the adjacent streambanks become eroded from the force of more and faster water. In addition, available floodplains are not well utilized to store and infiltrate stormwater. Stream channel stabilization is required that would reconnect the floodplains and the streams to achieve flood management and reduce eroded banks.

Stream channel stabilization projects that reconnect the streams with their floodplains will have a high priority in the Restoration Plan.

GROUNDWATER

USGS groundwater data (Sloto WRIR-4169, 1990) shows the following for the Valley Creek basin. Groundwater flows to the northeast toward the Schuylkill River. The basin receives an estimated 0.75 million gallons per day (mgd) from the adjacent West Valley Creek basin and 0.85 mgd from the southeastern side of the basin. Valley Creek basin loses 1.76 mgd on the east side of the basin, for a net hydrologic loss in basin groundwater of 0.16 mgd.

The basin is subject to a modest amount of water withdrawals. A regional water company has public drinking water wells, and there are withdrawals for quarrying and residential wells. During the highest groundwater periods, up to 1 mgd can infiltrate public sewer lines (VFSA 2001). A study conducted by the U.S. Geological Survey, which evaluated Valley Creek Watershed, from 1983 to 1987, determined groundwater withdrawals were 10% of recharge (Sloto 1990). The Chester County Water Resources Authority's *Compendium* report (CCWRA 2002) also shows that groundwater withdrawals or exports at these modest levels are not a significant impact to Valley Creek Watershed.

Groundwater comprises a large percentage of the flow to Valley Creek. During the 1983 to 1987 period of record, groundwater was found to comprise 76% of the flow of Valley Creek. Sixty-eight percent of the Valley Creek basin is underlain by Cambrian and Ordovician limestone and dolomite. Groundwater flows through a network of interconnected secondary openings since primary porosity is virtually nonexistent (Cowardin et al. 1979). Some of these openings have been enlarged by the collapse of dissolution openings that causes subsequent subsidence. Fifty percent of water-bearing zones are present within 100 feet of the land surface, and 81% are within 200 feet (Sloto 1990).

WETLANDS

Figure 6 contains a wetlands map of the Valley Creek Watershed. It was developed by the U.S. Fish and Wildlife Service using records from the National Wetlands Inventory (NWI)) and is based on USGS 7.5-minute quadrangle maps. NWI wetlands are identified according to the Cowardin classification system (see table 15). Drexel University has located 173 springs that are often the water source for wetlands in the watershed. Drexel plans to map those springs (pers. comm. C. Welty, 2003). The wetlands are generally located in isolated areas adjacent to open waters, such as quarries or ponds. A small amount of wetlands are adjacent to the main stems of Valley Creek and Little Valley Creek.

Some consider the information in the map in figure 6 incomplete and recommend ground-truthing before the information is used. One reason for this is that NWI maps typically do not identify wetlands smaller than three acres. Also, the NWI maps only map the riverine systems of Valley Creek and a couple of tributaries inside the boundaries of the national park.

BIOLOGICAL RESOURCES

FISH

The Pennsylvania Fish and Boat Commission and Department of Environmental Protection take measurements of trout abundance in the Valley Creek Watershed. Figures 7 and 8 contain graphs (by sampling reach) showing measurement results for several time periods. The fish species present in Valley and Little Valley Creeks are similar and include those listed in tables 16 and 17. Crabby Creek, in the southeast portion of the watershed, contained a native brook trout population above migratory barriers to brown trout. This native brook trout population was not present in 2002 and was likely

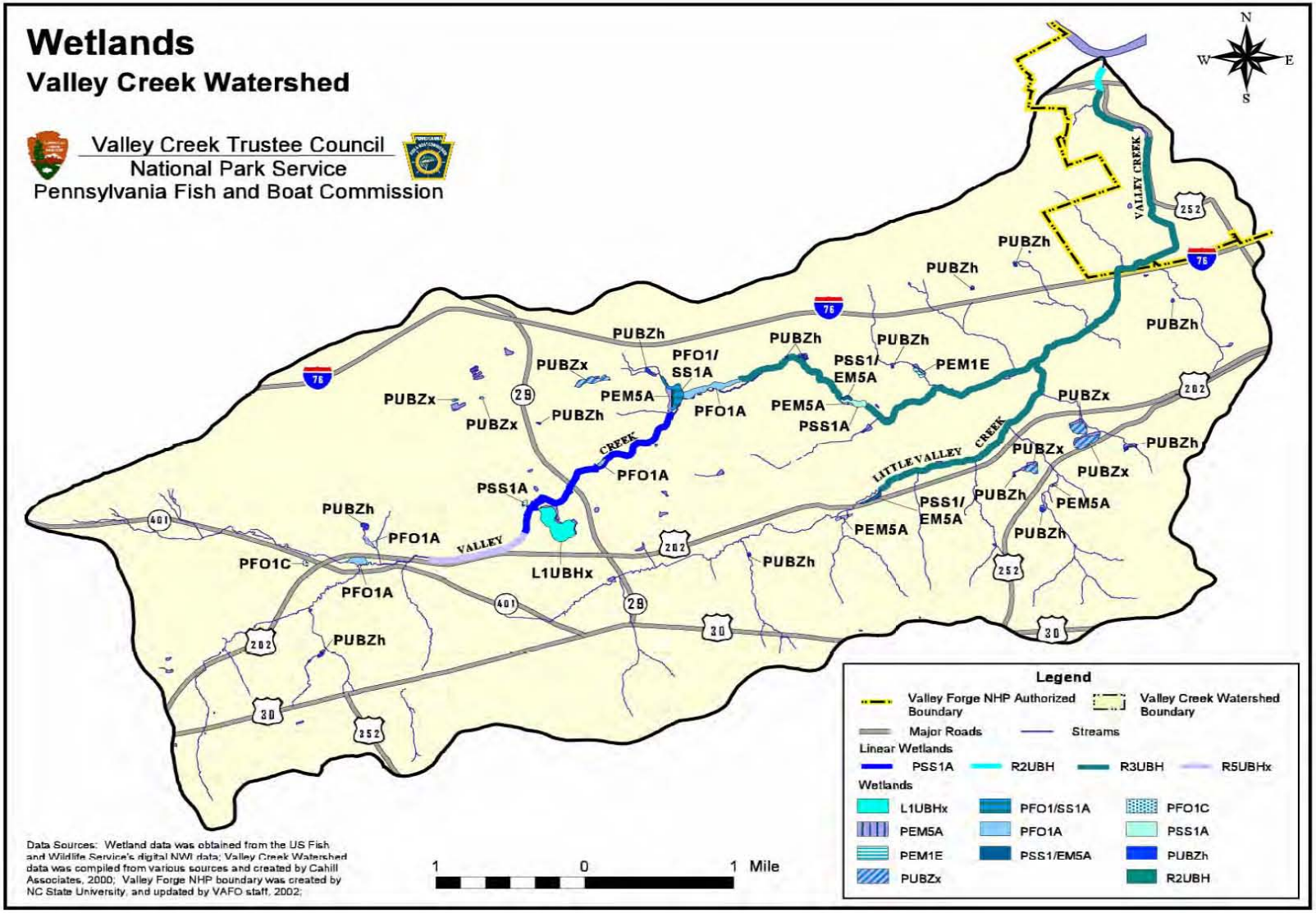

FIGURE 6: WETLANDS IN VALLEY CREEK WATERSHED 2002

TABLE 15: NATIONAL WETLANDS INVENTORY (NWI) CODES

L1UBHx	[L] Lacustrine, [1] Limnetic, [UB] Unconsolidated Bottom, [H] Permanently Flooded, [x] Excavated
PEM5A	[P] Palustrine, [EM] Emergent, [5] ?, [A] ?
PEM1E	[P] Palustrine, [EM] Emergent, [1] Persistent, [E] Seasonally Flooded/Saturated
PUBZx	[P] Palustrine, [UB] Unconsolidated Bottom, [Z] Intermittently Exposed/Permanent, [x] Excavated
PFO1A	[P] Palustrine, [FO] Forested, [1] Broad-Leaved Deciduous, [A] Temporarily Flooded
PFO1A/SS1A	[P] Palustrine, [FO] Forested, [1] Broad-Leaved Deciduous, [A] Temporarily Flooded /[P] Palustrine, [SS] Scrub-Shrub, [1] Broad-Leaved Deciduous, [A] Temporarily Flooded
PSS1A	[P] Palustrine, [SS] Scrub-Shrub, [1] Broad-Leaved Deciduous, [A] Temporarily Flooded
PSS1	[P] Palustrine, [SS] Scrub-Shrub, [1] Broad-Leaved Deciduous
PSS1/EM5A	[P] Palustrine, [SS] Scrub-Shrub, [1] Broad-Leaved Deciduous / [P] Palustrine, [EM] Emergent, [5] ?, [A] ?
PFO1C	[P] Palustrine, [FO] Forested, [1] Broad-Leaved Deciduous, [C] Seasonally Flooded
PUBZh	[P] Palustrine, [UB] Unconsolidated Bottom, [Z] Intermittently Exposed/Permanent, [h] Diked/Impounded
R2UBH	[R] Riverine, [2] Lower Perennial, [UB] Unconsolidated Bottom, [H] Permanently Flooded
R3UBH	[R] Riverine, [3] Upper Perennial, [UB] Unconsolidated Bottom, [H] Permanently Flooded
R5UBHx	[R] Riverine, [5] Unknown Perennial, [UB] Unconsolidated Bottom, [H] Permanently Flooded, [x] Excavated

TABLE 16: FISH SPECIES PRESENT IN VALLEY CREEK, 2002 PENNSYLVANIA FISH AND BOAT COMMISSION

Fish Species	Church Road (rm[1] 6.42)	Mill Lane (rm 8.51)
Brown trout	x[2]	x
White sucker	x	x
Blacknose dace	x	x
Pearl dace		x
Creek chub	x	x
Pumpkinseed		x
Bluegill	x	x
Green sunfish	x	

1. rm = River mile beginning from the confluence with Schuylkill River.

TABLE 17: FISH SPECIES OBSERVED IN LITTLE VALLEY CREEK, 2002 PENNSYLVANIA FISH AND BOAT COMMISSION

Fish Species	Farm Lane (rm[1] 0.78)	N Valley Rd (rm 1.36)	Crabby Creek
Brown trout	x[2]		
White sucker	x	x	
Blacknose dace	x		X
Pearl dace			
Creek chub	x	x	
Pumpkinseed	x		
Bluegill			
Green sunfish	x	x	
Cutlips minnow	x		
Brook trout			
Longnose dace		x	

1. rm = River mile from the confluence of Valley Creek and the Schuylkill River.

eliminated by flushing from Hurricane Floyd (pers. comm., Kaufmann, PFBC 2002). Crabby Creek has a higher slope than other tributaries in the watershed and this may have added to the elimination of the brook trout. Additional species found in Valley Creek in 1982 include; rainbow trout, tessellated darter, and brown bullhead.

Wild brown trout biomass in Valley Creek improved from 1984 to 1990. Brown trout responded positively to protection associated with a no-harvest regulation established in 1985 to address fish tissue contamination. Other improvements in the watershed during this time may have contributed to increased biomass.

From 1990 to the present, wild brown trout biomass has generally declined in Little Valley and Valley Creeks (see tables 18 and 19 and figures 7 and 8). The one exception to this trend is the higher biomass in upper Valley Creek near Mill Lane. Changes in land use, droughts, and Hurricane Floyd are all factors that could have caused biomass decreases at the other monitoring stations.

The primary fish species of interest in the Valley Creek Watershed is brown trout. The Pennsylvania Fish and Boat Commission had stocked Valley Creek until 1985 when PCBs were discovered in the creek. The stocking program was discontinued that year, and the Pennsylvania Fish and Boat Commission and Chester County Health Department issued a health advisory regarding consumption of fish from the creek. To this day, Valley Creek is a catch-and-release stream because of PCB-contaminated fish. The Pennsylvania Fish and Boat Commission has no plans to reintroduce the stocking program because natural reproduction of the trout continues to sustain the population. Based on its 1990 survey results, the Pennsylvania Fish and Boat Commission listed Valley and Little Valley Creek in their top category: class A for wild trout reproduction.

TABLE 18: WILD BROWN TROUT BIOMASS FOR VALLEY CREEK

Site	1984	1990	2002
VFNHP[1] – rm[2] 0.72	24	120.21	57.31
LeBoutillier Road - rm 3.61	25.9	78.04	46.73
Church Road - rm 6.42	51.1	66.86	42.48
Mill Lane – rm 8.51		1.28	12.07

1. VFNHP = Valley Forge National Historical Park.

2. rm = River mile beginning from the confluence with Schuylkill River.

3. Biomass is expressed as kilograms (kg) per hectare (ha). (Conversion Factor: 1 kg/ha = 0.89 pounds/acre.)

TABLE 19: WILD BROWN TROUT BIOMASS FOR LITTLE VALLEY CREEK

Site	1983	1990	1996	2002
Near Mouth - rm[1] 0.04	115.71			75.07
Farm Lane - rm 0.78		79.48	34.22	29.43
North Valley Road - rm 1.36			65.06	40.83
Church Road - rm 2.52			0.5	1.37

1. rm = River mile from the confluence of Valley Creek and the Schuylkill River.

2. Biomass is expressed as kilograms (kg) per hectare (ha). (Conversion Factor: 1 kg/ha = 0.89 pounds/acre.)

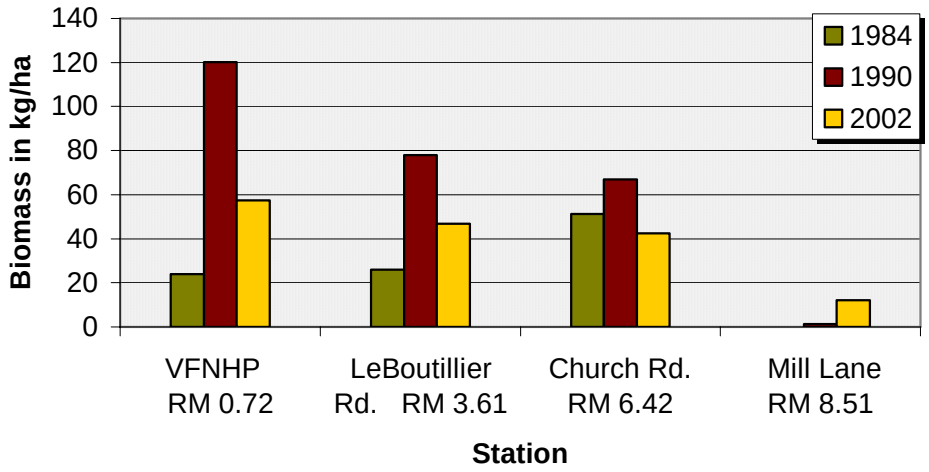

FIGURE 7: WILD BROWN TROUT BIOMASS FOR VALLEY CREEK, 1984–2002

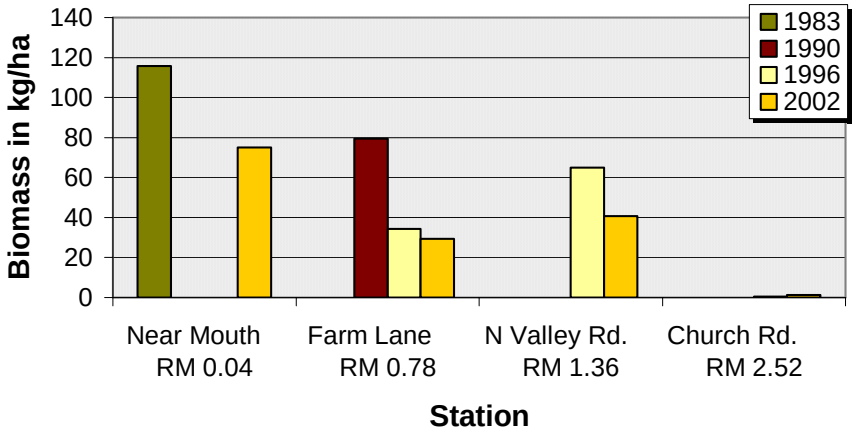

FIGURE 8: WILD BROWN TROUT BIOMASS FOR LITTLE VALLEY CREEK, 1984–2002

SPAWNING HABITAT

Sediment is the most significant pollutant in Valley Creek with regard to the fishery. The stream assessment data (see appendix B) for all 26 reaches assessed show that sediment is one of the top four lowest-ranked factors. Numerous areas of Valley Creek's stream channels show sediment deposition that suffocate trout eggs and affect the biological diversity and habitats of other living creatures and plant life. This interferes with trout reproduction and the supply of insects as a food source for fish. Observations of the streambeds of Valley Creek, Little Valley Creek, and some of the tributaries show that the channels are embedded (coated) with fine sediment, which inhibits flow through gravel and limits biological activity. The Pennsylvania Department of Environmental Protection suggests that the upper half of Little Valley Creek is not a viable fishery (pers. comm. M. Boyer, PADEP 2001). The sediment composition in the lower half of Little Valley Creek consists of larger gravel, cobble, and boulders.

FISH COVER

Fish cover throughout Valley Creek Watershed is limited according to the stream assessment (see appendix B). Of the 10 parameters in the assessment, cover in the stream channel was ranked as the second worst. Fish do not have enough stable cobble, gravel, and boulders in the stream to hide from anglers or other predators. There is also limited vegetation in and along the streams and insufficient streambank overhang for fish to hide.

Accumulated woody debris is present in the streams of Valley Creek Watershed in numerous places. The presence of woody debris is not necessarily bad, because debris establishes cover for trout and other macroinvertebrates. Throughout Little Valley and Valley Creeks there are piles of debris in the stream. About half of these piles represent good cover for fish, while the other half causes bank erosion by diverting water from the center of the stream to the banks.

AQUATIC MACROINVERTEBRATES

The baseline quality of the biological environment of Valley Creek Watershed is first categorized using aquatic invertebrate trends expressed by the Brillouin's diversity index for Valley Creek and Little Valley Creek (see appendix M). The U.S. Geological Survey has measured the Brillouin diversity index and other parameters at Little Valley Creek and Valley Creek (just above the confluence) for about 25 years, and the data show a positive trend in diversity over time that had leveled as of 1996 (USGS 1999).

The upward trend of the index for both streams started in 1974 and is generally associated with the installation of a regional sewer system that replaced septic systems with sewers, closed small inadequate sewage treatment plants in Valley Creek and Little Valley Creek and transported the sewage outside the watershed to the Valley Forge Sewer Authority.

The Pennsylvania Department of Environmental Resources considered Valley Creek similar to many limestone valley streams with regard to aquatic biota in its 1990 *Special Protection Evaluation Report* (PADER [now PADEP]1990). Relatively low numbers of invertebrate types (12 to 28) were represented by large numbers of individuals, as is characteristic of a productive limestone valley stream system. The community was believed to be under slight stress, and the abundance of filter feeding insects, which capture small organic particles, indicated runoff and siltation as the most probable stress causes. Similar analyses by U.S. Geological Survey in the 1990s support this conclusion.

Limestone-influenced streams often support a "signature" invertebrate assemblage; they contain large numbers of Amphipods (scuds), Isopods (aquatic sowbugs) and Ephemerellid mayflies. The latter were present in great numbers in Valley Creek at the Pennsylvania Department of Environmental Protection water quality station just inside Valley Forge National Historical Park until the early to mid 1990s, but have recently declined, presumably because they are sensitive to siltation. Amphipods and Isopods are still present in large numbers (pers. Comm., Mike Boyer, PADEP 2003).

RIPARIAN VEGETATION

The stream assessment data (see appendix B) show that one of the four poorest parameters for all the reaches investigated is riparian vegetation.

In 2002, the Pennsylvania Fish and Boat Commission and Department of Environmental Protection performed a habitat assessment, contained in appendix B, at 26 locations along Valley Creek and Little Valley Creek. Three of the 10 parameters measured involved banks and riparian corridors. Overall,

stream channels and floodplains were in poor to fair condition in many areas due to failing banks, limited vegetated zone width, and cropped or disturbed vegetation. Sometimes eroded banks can occur in well-vegetated buffered areas because of the volume of stormwater flowing from upstream of the area. The watershed has a large population of deer that present a challenge to establishing riparian vegetation. The deer eat young shoots of bushes and trees. The staff at Valley Forge National Historical Park enclose newly planted bushes and trees in the riparian buffers with fencing to keep the deer out until the vegetation is well established.

The Heritage Conservancy, in a flyover of Valley Creek in April 2000, performed a riparian buffer assessment (Heritage Conservancy 2002) along 38 miles of the creek. The assessment found

> 3.4 miles lacking forested buffers on one side ("lacking" means less than 50-foot-wide forest and less than 50% canopy closure)
>
> 6.8 miles lacking buffers on both sides
>
> a total of 10.2 miles, or 27% of the total miles assessed, lack riparian buffers

Figure 9 illustrates this assessment. The red shows both sides of the stream lacking buffers. The yellow shows one side lacking.

THREATENED AND ENDANGERED SPECIES

The Trustee Council is required to undertake consultation with appropriate state and federal agencies initially on a broad basis and then on a project-by-project basis in many cases so that threatened and endangered species and their habitats are preserved. To determine the threatened and endangered species present in Valley Creek Watershed an inquiry was made of Pennsylvania's Department of Environmental Protection's Pennsylvania Natural Diversity Index which serves as a one-stop data source for organizations contemplating activities in various geographical areas. The list of species tracked by the Pennsylvania Natural Diversity Index for Valley Creek Watershed was obtained from Pennsylvania's Natural Diversity Index program and is contained in table 20. More specific consultation was also sought from the Pennsylvania Fish and Boat Commission (appendix P), the Pennsylvania Game Commission (appendix O), and the U.S. Fish and Wildlife Service (appendix N). Since there are several hundred potential projects that could be undertaken over many years under alternative A, the consultation to-date has consisted of describing the restoration plan process in letters to the agencies and requesting their comments and information on the presence and location of threatened and endangered species and on procedures to be used by the Trustee Council when undertaking projects.

The U.S. Fish and Wildlife Service (FWS) lists Valley Creek Watershed as being "within the known range of the bog turtle and possibly the red-bellied turtle, a species that is federally listed as threatened. A few bog turtles have been reported over many years but no survey has been performed. The FWS will require field surveys and further information on impacts and mitigation of threatened and endangered species by specific projects. Consultation will not be complete until this information is submitted and they receive a letter of concurrence, i.e., a finding of "not likely to affect." The Pennsylvania Game Commission has not identified any state-listed threatened or endangered bird or mammal species for the potential project areas within Valley Creek Watershed. Consultation was also initiated with the Pennsylvania Fish and Boat Commission, which identified reptiles of concern and "requests further information on a case-by-case basis. The consultation is not complete but acceptable (to the Pennsylvania Fish and Boat Commission) at this point as long as this EA clearly commits to continuing consultation with the Pennsylvania Fish and Boat Commission on each project, as it's being designed, and

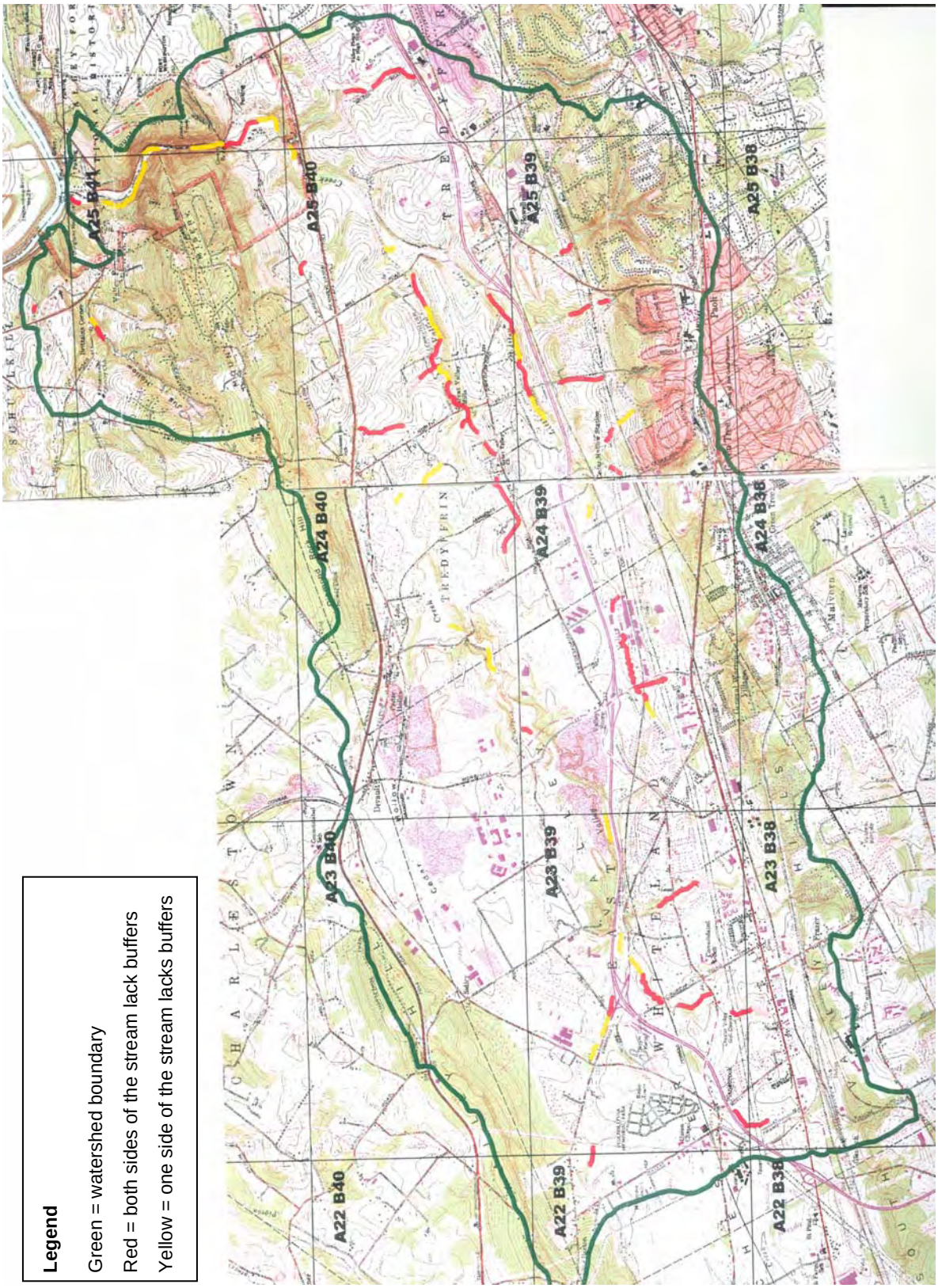

FIGURE 9: STREAM BUFFERS

incorporates Pennsylvania Fish and Boat Commission avoidance and mitigation recommendations." Pennsylvania endangered red-bellied turtles are known to occur in the nearby Schuylkill River, but restoration projects would avoid the still-water habitat the red-bellied turtles prefer and grassy wetlands with hummocks that bog turtles prefer.

The Commonwealth of Pennsylvania tracks the federal and state species of concern in each watershed and maintains the list of these species (see table 20). The status of some of the plants listed in table 20 are under review or tentatively undetermined. Despite some of the plants in table 20 not being definitively listed as rare, threatened, or endangered, the Trustee Council will, since they are listed in the Pennsylvania Natural Diversity Index, treat them as if they are threatened and endangered species.

OTHER WILDLIFE

The streams of Valley Creek have these common species: Canada geese, mallards, great blue herons, and kingfishers in addition to the types of fish shown above in tables 16 and 17. Ospreys have occasionally been observed in the watershed. The Audubon Society and other wildlife organizations consider Valley Forge National Historical Park a highly regarded birding area where more than 200 species have been identified. Several of those species of birds are threatened or endangered. The watershed is home to a large population of deer, squirrels, mink, raccoons, possums, and skunks.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

There are archeological sites scattered throughout the watershed. Valley Creek Watershed was home to Native Americans and populations of settlers from pre-revolutionary days. Prior to the 1777–1778 encampment of the Continental Army at Valley Forge, there was much agricultural and timbering activity. Several mills were operating in the watershed, especially along Valley Creek in the area now contained by the National Park. The Commonwealth of Pennsylvania records archeological site findings registered by individuals and institutions. Many of these sites are in the floodplains; however, the state will not release records in order to protect site contents and locations.

TABLE 20: THREATENED AND ENDANGERED SPECIES POTENTIALLY PRESENT IN VALLEY CREEK WATERSHED

Scientific Name	Common Name	Species Status
Amelanchier canadensis	Serviceberry	Status under review for future listing
Clemmy's muhlenbergii	Bog Turtle	Pennsylvania endangered
Cystopteris tennesseenis	Bladder Fern	Tentatively undetermined
Hypericum stragulum	St Andrew's Cross	Tentatively undetermined
Isotria medeoloides	Small-whorled Pogonia	Pennsylvania endangered
Juncus torreyi	Torrey's Rush	Pennsylvania endangered
Lupinus perennis	Lupine	Pennsylvania rare
Lyonia mariana	Stagger-Bush	Pennsylvania endangered
Panicum lucidum	Shining Panic-Grass	Pennsylvania endangered
Phaseolus polystachios	Wild Kidney Bean	Critically Imperiled and Imperiled, Tentatively Undetermined
Quercus falcate	Southern Red Oak	Pennsylvania endangered
Viburnum nudum	Possum-aw	Pennsylvania endangered
Woodwardia areolata	Netted Chainfern	Pennsylvania threatened
Pseudemys rubriventris	Red-bellied Turtle	Pennsylvania threatened

Sources: Pennsylvania Natural Diversity Index, Pennsylvania Fish and Boat Commission (appendix P), Pennsylvania Game Commission (appendix O), and U.S. Fish and Wildlife Service (appendix N).

HISTORIC STRUCTURES

Over 100 historical sites in Valley Creek Watershed are registered with the Commonwealth of Pennsylvania's Bureau for Historic Preservation. The records for these sites are available, but the Bureau has not mapped the sites for the watershed. Also, there are three dams on Valley Creek, one of which is on the National Register of Historic Places because it supplied water to a historic mill (still standing). Another is in Valley Forge National Historical Park. A Trustee Council representative has met with a representative from Pennsylvania Bureau for Historic Preservation and was given guidance as to developing a general plan for submittal to the Pennsylvania Bureau for Historic Preservation. Archaeological surveys do not have to be performed where the land has been previously disturbed, for example, where streams have meandered significantly and where land was farmed. Appendix K contains the Trustee Council's plan that will be submitted to the Pennsylvania Bureau for Historic Preservation for meeting historical and archeological resource requirements prior to implementing potential restoration projects. Historical and archaeological surveys will have to be performed on specific projects undertaken under this *Restoration Plan*..

CULTURAL LANDSCAPE

Just upstream from the confluence of Valley Creek and the Schuylkill River are important historical buildings in Valley Forge National Historical Park, including Washington's Headquarters. Floodwaters from Hurricane Floyd in 1999 reached the base of the foundation for Washington's Headquarters and contributed to the exposure of pre-encampment building foundations in the nearby streambanks. Those floodwaters also damaged a road adjacent to Valley Creek in Valley Forge National Historical Park, wiped out a foot bridge over the creek, and flooded a historic covered bridge in the park. Valley Forge National Historical Park buildings upstream of that bridge are set further back from the stream and were not damaged. Only a few buildings or other cultural features are located in the floodplains of Valley Creek upstream of Valley Forge National Historical Park. One notable building is a historic gristmill that used Valley Creek to power its mill. Township parks are located along Valley Creek and a landfill is located on both sides of Valley Creek.

A well-used trail borders Valley Creek in Valley Forge National Historical Park where many anglers and other users enjoy Valley Creek. The banks along the trail are subject to erosion from users trying to get direct access to the creek. There are both formal and informal walkways along Valley Creek for about three miles above Valley Forge National Historical Park. The Chester County Planning Commission would like to connect Valley Forge National Historical Park to a cross-county paved trail that is about one mile away from Valley Creek at one possible connecting route. There are no funds available for connecting those trails. If connected, increased use of the trails along Valley Creek would likely occur.

Several historic trees exist in Valley Forge National Historical Park and in areas just upstream of the park. One of these is only a few feet from Valley Creek.

SOCIOECONOMIC ISSUES AND RESOURCES

RECREATION AND VISITOR USE

The human uses of the water resources of Valley Creek Watershed consist of angling, walking, viewing, jogging, biking, horseback riding, and bird watching. The number of people who engage in those activities is highest in Valley Forge National Historical Park. There are four township parks that border Valley Creek outside the National Park, and several formal trails exist along the stream corridor. The

National Park estimates that 1.2 million people visit the park each year, and 100,000 use the trails and roads that border Valley Creek in Valley Forge National Historical Park.

Angler Use

The number of anglers fishing the watershed is lower than in the past due to the contamination advisory and prohibition on fish harvest.

Table 21 shows the number of angler trips to Valley Creek in Valley Forge National Historical Park dating back to 1978. These trip numbers have typically not returned to the levels that existed prior to the discovery of PCB contamination in the creek, the discontinuance of stocking, and the subsequent health advisory that imposed the catch-and-release restriction. For the majority of years prior to the PCB detection, the number was above 10,000 per year. Since 1984 the annual numbers range from 3,424 to 8,457. Prior to 1985, the number of anglers fishing Valley Creek outside Valley Forge National Historical Park was estimated by the Pennsylvania Fish and Boat Commission to be 3,287 per year (PFBC 1986).

Despite significant natural reproduction of trout in Valley Creek, the number of anglers remains low. Assuming that the health advisory is lifted at some time, the Pennsylvania Fish and Boat Commission will not restart stocking because of the amount of natural reproduction of wild trout that has occurred. There is insufficient data available to determine the extent of increase in number of anglers should the health advisory be lifted without adding more trout through stocking and without improving the biological productivity of the system. The Trustee Council believes that angler trips will recover if the biological health of the watershed is improved and leads to an increase in the trout population. This will help mitigate the angler trips for stocked trout that were lost due to contamination.

TABLE 21: HISTORIC DATA ON ANGLER TRIPS TO VALLEY CREEK IN VALLEY FORGE NATIONAL HISTORICAL PARK

Year	Number of Trips[1]	Year	Number of Trips[1]
1978	10,165	1990	6,895
1979	7,101	1991	6,179
1980	10,670	1992	6,664
1981	9,092	1993	NA[2]
1982	12,641	1994	NA
1983	12,800	1995	4,986
1984[3]	12,374	1996	5,490
1985[4]	4,604	1997	5,464
1986	3,682	1998	3,424
1987	4,973	1999	7,029
1988	3,717	2000	8,457
1989	3,973	2001	6,247

1. Data on the number of fishing trips to the National Park are from park records.

2. NA – Not available.

3. The Pennsylvania Fish and Boat Commission (Commission) and Department of Environmental Protection issue “limited” fish consumption advisory.

4. The Commission imposes no-harvest restriction (catch and release only) on fishery and ends the trout stocking program.

PUBLIC ACCESS TO CREEKS

In 1976 the Pennsylvania Fish and Boat Commission documented that 84% of lands adjacent to Valley Creek were privately owned and 16% were publicly owned. The entire creek was accessible to fishing, and 23 parking spaces per mile were available. In 1983, 99% of Little Valley Creek was privately owned and 1% was publicly owned. All of Little Valley Creek was accessible to fishing and 31 car parking spaces per mile were available. Since those surveys, a significant number of properties in private and corporate hands along both streams have been closed to public access. About 25% of the 6-mile length of Little Valley Creek is now posted (i.e., access is prohibited), and about 20% of the 10-mile length of Valley Creek is now posted. Data is not available for the 15 flowing tributaries, but for the most part, there are no fish in most of those tributaries. Also, access is through private property that may not be posted, and generally, some small lots appear very private, which can deter access. So, current ease of access often can be difficult due to lack of parking spaces, difficulty moving through the wooded buffers, some posted private lands, and the uncertainty that some lands are private but not posted.

Despite the large amount of private land, considerable access through that land is still possible at both creeks because of landowner cooperation. Avid anglers are less inhibited in finding ways to access the streams, but novice anglers will probably do their fishing in public parks and well-marked trails. The best access to Valley Creek exists in Valley Forge National Historical Park where access points are numerous on both sides of the creek. The Valley Forge National Historical Park / Chesterbrook / Mill Park complex has particularly good access; these three contiguous tracts provide 100% public access along approximately 4 miles of creek.

There are no parking areas adjacent to the creek inside Valley Forge National Historical Park, but there are three lots nearby that anglers and other visitors use. The Knox lot is near the covered bridge and holds about 50 cars. The parking lot for Washington's Headquarters has about 75 spaces. The closest and most popular is a small lot on Yellow Springs Road that contains roughly 10 spaces (pers. comm., B. Lambert, VFNHP 2003).

The Valley Creek Trail, from the covered bridge downstream to Route 23, is approximately 1 mile long. An unnamed trail, which stretches from the Chesterbrook / National Park boundary to the covered bridge, is also about 1 mile long. Both are heavily used.

Outside the park, access is good from paved and dirt foot paths along the main stems of Valley and Little Valley Creeks for the next 1.5 miles to the Tredyffrin Township's Mill Park, which borders both Valley and Little Valley Creeks. Access to Little Valley Creek within that park is available all along the stream. It is private property above the township park on Little Valley Creek until more paved trails are available in the corporate center upstream of Route 202 and adjacent to another Tredyffrin Township park.

Above the confluence of Valley and Little Valley Creeks, access to Valley Creek is good because of the property holdings and eased property of the Open Land Conservancy. Access is also good further upstream at two East Whiteland parks. Access is not available along the landfill.

LOCAL ECONOMY

Valley Forge National Historical Park is very important to the local economy, and Valley Creek is an integral part of the park. As an "Exceptional Value" stream (Pennsylvania Department of Environmental Protection classification) and class A fishery (Pennsylvania Fish and Boat Commission classification) within the Philadelphia metropolitan area, Valley Creek has enormous recreational value. The creeks attract people who live and work in the watershed, as well as people from the surrounding areas. An

angler day has been evaluated economically and, in 1996 dollars, was worth $35.45 (Hay et al. 1996). Similar evaluations have not been performed for the other human uses of Valley Creek.

Chapter 4
Applicable Laws and Regulations

CHAPTER 4 – APPLICABLE LAWS AND REGULATIONS

There are numerous federal environmental statutes that projects identified for potential implementation will have to address. Those primary laws are

National Environmental Policy Act (NEPA)
National Parks Omnibus Management Act of 1998
National Park Service Organic Act of 1916
National Park Service Resource Protection Act
Clean Water Act (CWA)
Comprehensive Environmental Response, Compensation, and Liability Act
National Historic Preservation Act (NHPA)
Endangered Species Act (ESA)
Executive Order (EO) 11990 on Wetlands
Executive Order 11988 on Floodplains
Executive Order 12580 Superfund
Executive Order 12898 on Environmental Justice

The major state environmental statutes and programs that will have to be addressed are the Commonwealth of Pennsylvania's *Clean Streams Law* (administered by the Pennsylvania Department of Environmental Protection); Pennsylvania Natural Diversity Index; Pennsylvania Fish and Boat Commission's stream restoration authorities under the Pennsylvania Fish and Boat Code, and identification of any endangered or threatened species; and the Pennsylvania Game Commission's identification of wildlife or wildlife habitats.

Prior to implementation (during the planning process), projects will also be subject to review by the Pennsylvania Bureau for Historic Preservation for both federal and state archeological sites and historic structures.

Permits (such as for grading) will also be required from the township for many projects.

Table 29 lists the environmental requirements that must be addressed for each restoration method. Following the table is a description of each law or requirement.

FEDERAL STATUTES

Three overarching environmental protection laws and policies guide the National Park Service: the *National Environmental Policy Act (NEPA) of 1969* and its implementing regulations, the *National Parks Omnibus Management Act of 1998*, and the *National Park Service Organic Act of 1916*.

The *National Environmental Policy Act* is implemented through regulations of the Council on Environmental Quality (CEQ) (40 CFR 1500–8). The National Park Service has in turn adopted procedures to comply with NEPA and the CEQ regulations, as found in *Director's Order 12*: *Conservation Planning, Environmental Impact Analysis, and Decision Making* (NPS 2000a) and its accompanying handbook.

TABLE 29: PROJECT ALTERNATIVES AND REGULATORY REQUIREMENTS[1,2]

Restoration Method	Clean Water Act	Endangered Species Act	Pennsylvania Fish and Boat Commission	Executive Order 11990 Wetlands	Executive Order 11988 Floodplains	Section 106[3]
Basin retrofits	X	X			X	
Lands suitable for infiltration	X	X		X	X	X
Low impact developments		X				X
Bioengineering	X	X	X	X	X	X
Rip Rap	X	X	X	X	X	X
Vanes	X	X	X	X	X	X
Skyhooks	X	X	X	X	X	X
Boulders	X	X	X	X	X	X
Purchased land[4]	X	X		X	X	X
Easements[4]	X	X		X	X	X
Buffers	X[5]	X		X	X	X
Postings		X				X
Access with parking	X	X		X	X	X
Trails		X		X	X	X

1. NEPA and Executive Order 12898, Environmental Justice, required for the restoration plan but not for individual project implementation unless project deviates substantially from the restoration plan. Executive Order 12580 pertains to the formation of response teams for responses to pollution of natural resources, but not to the actual restoration plan.

2. Pennsylvania Game Commission has no species listed for the project areas of under this restoration plan (appendix L).

3. Section 106 of the *National Historic Preservation Act*.

4. The columns with an X are for instances where the purchased or eased land needs to be surveyed for subsequent land management projects.

5. It is possible that streambank work would be performed at the same time that buffers are installed.

The *National Parks Omnibus Management Act* underscores the *National Environmental Policy Act*, and both acts are fundamental to NPS park management decisions. Both acts provide direction for articulating and connecting the ultimate resource management decision to the analysis of impacts, using appropriate technical and scientific information. Both also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

The *Omnibus Act* directs the National Park Service to obtain scientific and technical information for analysis. The NPS handbook for *Director's Order 12* states that if "such information cannot be obtained due to excessive cost or technical impossibility, the proposed alternative for decision will be modified to eliminate the action causing the unknown or uncertain impact or other alternatives will be selected" (Section 4.4).

Section 4.5 of *Director's Order 12* adds to this guidance by stating "when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the regulations of the Council on Environmental Quality (40 CFR 1502.22)." In summary, the National Park Service must state in an environmental assessment or impact statement whether such information is incomplete or unavailable, the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment, a summary of existing credible scientific studies showing adverse impacts that are relevant to evaluating the reasonably

foreseeable significant adverse impacts, and an evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.

The NPS *Organic Act* commits the National Park Service to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

NATIONAL ENVIRONMENTAL POLICY ACT, AS AMENDED, 42 U.S.C. 4321, ET SEQ., 40 CFR PARTS 1500-1508

The *National Environmental Policy Act* (NEPA) requires an assessment of any federal action that may significantly impact the human environment. NEPA applies to restoration actions undertaken by federal trustees, except where a categorical exclusion or other exception to NEPA applies. Congress enacted NEPA in 1969 to establish a national policy for the environment. NEPA established the Council on Environmental Quality (CEQ) to advise the President and to carry out certain other responsibilities relating to implementation of NEPA by federal agencies. Pursuant to Executive Order, federal agencies are obligated to comply with the NEPA regulations adopted by the CEQ. These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing environmental documents to comply with NEPA. NEPA requires that an environmental assessment (EA) be prepared in order to determine whether the proposed restoration actions would have a significant effect on the quality of the human environment.

Generally, when it is uncertain whether an action would have a significant effect, federal agencies begin the NEPA planning process by preparing an environmental assessment, and undergoing a public review and comment period. Federal agencies may then review the comments and make a determination. Depending on whether an impact is considered significant, an environmental impact statement (EIS) may be prepared or a "Finding of No Significant Impact" (FONSI) is issued. Regarding this restoration plan, an environmental assessment (RP/EA) was prepared in accordance with NPS *Director's Order 12* and Handbook.

The Trustee Council integrated this RP/EA with the NEPA process and NPS processes to comply, in part, with those requirements. This integrated process allowed the Trustee Council to meet the National Park Service, NEPA, and CEQ public involvement requirements concurrently. The RP/EA complied with NEPA and CEQ by (1) summarizing the current environmental setting, (2) describing the purpose of and need for restoration action, (3) identifying alternative actions and their impacts, and (4) incorporating public participation in the decision process. If, in the future, projects are proposed that do not meet the criteria outlined in this *Restoration Plan*, a separate NEPA analysis and document may be required for those individual projects. Public involvement would also be undertaken.

CLEAN WATER ACT (FEDERAL WATER POLLUTION CONTROL ACT), 33 U.S.C. SECTION 1251, ET SEQ.

The objective of the *Clean Water Act* is to restore and maintain the chemical, physical, and biological integrity of the nation's water. The *Clean Water Act* is the principle statute governing pollution control and water quality of the nation's waterways. The Pennsylvania *Clean Streams Law* (discussed below) represents the state's implementation of the *Clean Water Act* that governs the activities of this restoration plan.

Section 404 of the *Clean Water Act* provides direct wetlands protection by authorizing the U.S. Army Corps of Engineers (COE) to prohibit or regulate, through a permit process, discharge of dredged or fill material into the waters of the United States which includes navigable waterways, perennial and intermittent streams, open waters such as lakes and ponds, and both tidal and nontidal wetlands. The entire watershed is subject to the potential need for COE 404 permits. There are three levels of COE oversight relevant to restoration/stabilization projects and the size of wetlands involved in Valley Creek: a nationwide permit, a notification procedure on small sites, and de minimis sites (less than 0.1 acre) where nothing is required. The Trustee Council, or its grantee, will file the necessary applications with the Corps of Engineers. See the discussion under Pennsylvania *Clean Streams Law* below for state water-related requirements.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, LIABILITY AND COMPENSATION ACT, 42 U.S.C. 9601

This statute governs the immediate responses by agencies at hazardous waste sites to reduce short-term risk and also determines permanent solutions to the cleanup of hazardous waste sites. The Natural Resources Damage Assessment portion of the *Comprehensive Environmental Response, Liability and Compensation Act* (CERCLA) governs the compensation for damage of natural resources. The settlement agreement entered into by the three railroad companies for the PCB damage of the Valley Creek Watershed was based on the Natural Resources Damage Assessment, and the Trustee Council's authority arises from the assessment. The cleanup of PCBs in the watershed is governed by the *Comprehensive Environmental Response, Liability and Compensation Act,* which the Trustee Council would violate if the Council undertook projects that would increase the risk posed by PCBs. Therefore, the Trustee Council will not undertake projects in areas of the watershed that are targeted by the U.S. Environmental Protection Agency for PCB extraction.

NATIONAL HISTORIC PRESERVATION ACT, SECTION 106 REVIEW

The National Historic Preservation Act (NHPA, amended 1996, 36 CFR Part 800) established a comprehensive program to preserve the historical and cultural foundations of the Nation. Section 106 of NHPA requires agencies to consider and evaluate the effects of their actions on historic places, prior to implementation. The review performed under Section 106 encourages federal agencies to preserve historic places, but does not mandate it. Since this restoration plan is a federal action, it is covered by Section 106. Likewise, the presence of many historic archeological sites and historical properties within Valley Creek Watershed gives rise to the potential for impact to occur under the restoration plan. Under Section 106, a project has an adverse effect if it may alter the characteristics that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property. Integrity is the ability of the property to convey its significance, based on its location, design, setting, materials, workmanship, feeling and association. Adverse effects can be direct or indirect and include reasonably foreseeable impacts that may occur later in time, be farther removed in distance, or be cumulative. If harm is likely and unavoidable, a legally binding agreement is established showing how the agency will address the adverse effects. The implementation of a Section 106 review is performed between the federal agency and the State Historic Preservation Officer (SHPO). In Pennsylvania the SHPO is part of the Pennsylvania Bureau for Historic Preservation. The Pennsylvania program is described in the next section under state statutes.

ENDANGERED SPECIES ACT, 16 U.S.C. 1531, ET SEQ., 50 CFR PARTS 17, 222,224

The federal *Endangered Species Act* (ESA) directs all federal agencies to conserve federally and state listed endangered and threatened species and their habitats and encourages such agencies to utilize their authorities to further these purposes. Under the Act, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service publish lists of endangered and threatened species. Section 7 of the Act requires that federal agencies consult with those two agencies to minimize the effects of federal actions on endangered and threatened species. Prior to implementation of each project in this restoration plan, the Trustee Council would conduct Section 7 consultations in conjunction with Essential Fish Habitat consultation.

EXECUTIVE ORDER (EO) 11988 – CONSTRUCTION IN FLOOD PLAINS

This Executive Order directs federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of development in floodplains wherever there is a practicable alternative. Each agency is responsible for evaluating the potential effects of any action it may take in a floodplain. Before taking any action, the federal agency should determine whether the proposed action would occur in a floodplain. For any federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's NEPA compliance document(s). The agency should consider alternatives to avoid adverse effects and incompatible development in floodplains. If the only practicable alternative requires siting in a flood plain, the agency should (1) design or modify the action to minimize potential harm, and (2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain. This restoration plan contains restoration measures that could be located in floodplains. These include walking trails and the installation of access points to the stream, some of which could include limited parking areas. The trails could be planned with some modest clearing of brush. It is expected that the length of trails would not exceed 1,000 feet and would not be paved. Access areas could also involve some clearing, the building of a bridge, some planking, and development of parking spaces made of porous blocks or other porous materials. The restoration plan does contain stream corridor projects that could affect floodplains; namely, stream channel stabilization projects and creation of buffer zones. Whenever a project is implemented in a floodplain area, all measures will be taken to design projects that do not expand floodplains, damage any existing property, and that conform to natural stream fluvial dynamics.

EXECUTIVE ORDER (EO) 11990 – PROTECTION OF WETLANDS

This 1977 Executive Order directs federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. EPA's definition of wetlands states, "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (EPA regulations listed at 40 CFR 230.3(t)).

The National Park Service has issued *Directive Order's 77-1* that presents NPS policies regarding the implementation of EO 11990. Under this order, the National Park Service has a goal of no net loss of wetlands and will strive to achieve a longer-term of net gain of wetlands. The NPS definition of wetlands is more inclusive than that of the Environmental Protection Agency; it includes submerged vegetation in stream channels. There are a few areas in the watershed where that occurs.

EXECUTIVE ORDER (EO) 12580 – SUPERFUND IMPLEMENTATION

On January 23, 1987, President Reagan signed EO 12580 to cover procedures for implementing certain aspects of the superfund program. The order sets forth the roles, under the National Contingency Plan, of National and Regional Response Teams for national planning and coordination of preparedness and response actions. The order lists the federal agencies that shall provide representatives to the National and Regional Response Teams. The order also designates the chair and vice-chair of these teams as EPA and the United States Coast Guard, respectively. The Coast Guard chairs teams where the coastal zone is involved. The order also indicates that state and local governments and Indian Tribal governments can be represented on the teams. The Environmental Protection Agency is to also take responsibility for revisions to the National Contingency Plan. In accordance with the *Federal Water Pollution Control Act*, the agencies designated as Federal trustees for natural resources (for example, Valley Creek) includes, among others, the Secretary of the Interior.

EXECUTIVE ORDER (EO) 12898 – ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This Executive Order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The Environmental Protection Agency and Council on Environmental Quality have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under the *National Environmental Policy Act* and developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations. The Trustee Council has concluded that no low-income or ethnic minority populations would be adversely affected by the proposed restoration activities.

PENNSYLVANIA STATE STATUTES AND PROGRAMS

PENNSYLVANIA CLEAN STREAMS LAW OF 1937 AS AMENDED (35 P.S. 691.1)

This law grants statutory authority to the Pennsylvania Department of Environmental Protection to conserve and protect waters of the Commonwealth. Chapter 102 of Pennsylvania Code Title 25, Erosion Control, created a planning and permit system to control soil erosion and sediment pollution caused by activity that disturbs soil. Under these requirements, areas of soil disturbance of 5,000 square feet do not have to develop an erosion and sedimentation control plan or apply for a discharge permit. Areas of disturbance greater than 5,000 square feet, but less than one acre, must develop a plan and maintain it on site. For areas greater than one acre, a plan must be developed and an NPDES permit applied for. Chapter 105, Dams and Waterways, establishes a permit system to control construction activities for any obstruction, excavation, or encroachment in waters of the Commonwealth (including on floodplains). The Trustee Council will have to file for Chapter 105 permits for stream channel stabilization projects, buffers, and some infiltration projects. Some of those projects might be eligible for GP-3 (bank rehabilitation, bank protection, and gravel bar removal), GP-7 (minor road crossings) or GP-1 (fish habitat enhancement structures) general permits. The Trustee Council will hold pre-construction meetings with the Pennsylvania Department of Environmental Protection to determine the permits required and to determine phased approaches to multiyear work on various tributaries.

PENNSYLVANIA NATURAL DIVERSITY INVENTORY

This program is administered by the Pennsylvania Department of Environmental Protection and provides species inventory information as a consultation to construction activities. The program is also administered in conjunction with the Pennsylvania Fish and Boat Commission and the Pennsylvania Game Commission. The list of threatened and endangered species provided by Pennsylvania Natural Diversity Inventory was presented in the "Affected Environment" chapter of this restoration plan.

Each project performed under this restoration plan will, prior to the work, require separate consultation with the above agencies to identify the precise location of the project and a response from the agencies listing specific species potentially affected by the species. The Trustee Council will use that information to develop a project plan that ensures no impact on that species.

PENNSYLVANIA ADVISORY COUNCIL ON HISTORIC PRESERVATION

As described above under national programs, Section 106 of the *National Historic Preservation Act* requires federal agencies to consider the effects of their actions on historic properties. The Pennsylvania Bureau for Historic Preservation has been delegated the authority by the federal government to administer their own program to comply with the federal act. The Pennsylvania Bureau for Historic Preservation requires that they be given opportunity to comment on federal projects prior to implementation. Federal agencies must determine if Section 106 applies to a given project and, if so, initiate the review with the Pennsylvania Bureau for Historic Preservation; gather information to decide which properties in the project area are listed on or eligible for the National Register of Historic Places; determine how historic properties might be affected; explore alternatives to reduce harm, and reach agreement with the State Historic Preservation Officer and tribal government on measures to deal with adverse effects.

This restoration plan is considered a federal action. Therefore, archeological and historical surveys must occur for every project undertaken with restoration fund monies. The "Alternatives" chapter and appendix K describe how a plan will be submitted to Pennsylvania Bureau for Historic Preservation to indicate when such surveys are required.

PENNSYLVANIAFISH AND BOAT CODE (30 Pa C.S.)

The Pennsylvania Fish and Boat Commission is acting pursuant to its responsibilities under this statute. The responsibilities include, among others, "the encouragement, promotion, and development of the fishery interests," and "the protection, propagation and distribution of fish." The Pennsylvania Fish and Boat Commission may promulgate rules and regulations concerning fishing to aid in the better protection, preservation, and management of fish.

Chapter 5
Consultation and Coordination

CHAPTER 5 – CONSULTATION AND COORDINATION

PERSONS AND AGENCIES CONSULTED

This chapter lists those people and agencies that provided input to the Trustee Council during preparation of the Restoration Plan..

VALLEY FORGE NATIONAL HISTORICAL PARK

Arthur Stewart
Bob Krumenaker
Barbara Pollarine
Scott Kalbach
Brian Lambert
Dierdre Gibson
Meghan Carfioli
Liza Rupp
Barbara Rosoff

U.S. NATIONAL PARK SERVICE

Sarah Bransom
Rick Dawson
Mark Flora
Bill Jackson
Jacki Katzmire
Kevin Noon
David Reynolds
Tammy Whittington
Mark VanMouwerik

U.S. DEPARTMENT OF THE INTERIOR

Marcia Gittes

PENNSYLVANIA FISH AND BOAT COMMISSION

John Arway
Dennis Guise
Laurie Shepler
Leroy Young
Mark Hartle
Richard Snyder
Karl Lutz
Mike Kaufmann
Ron Tibbott

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Mike Boyer
Jim Newbold
Mike Menghini

U.S. ENVIRONMENTAL PROTECTION AGENCY

Jon Capacasa
Kelley Chase
Kevin Magerr

U.S. GEOLOGICAL SURVEY

Kirk White
Ron Sloto
Bob Ross
Ron Thompson

U.S. FISH AND WILDLIFE SERVICE

Cindy Tibbott
Mark Roberts

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

Len Taoso
Bob Eppley
John Otten
Susan LaPenta

STATE REPRESENTATIVE

Carole Rubley

CHESTER COUNTY WATER RESOURCES AUTHORITY

Jan Bowers

Craig Thomas

CHESTER COUNTY CONSERVATION DISTRICT

Dan Grieg
Chotty Sprenkle
Gay Lynne Criswell

CHESTER COUNTY PLANNING COMMISSION

Jake Michael

TREDYFFRIN TOWNSHIP

Joe Janasik
Bill Bryant
Tom Rodriguez

EAST WHITELAND TOWNSHIP

Terri Woodman
Surender Kohli
William Steele

TREDYFFRIN/EASTTOWN SCHOOL DISTRICT

Michael Cunningham

DREXEL UNIVERSITY

Claire Welty
Sue Kilham
Luanne Steffy
Rob Ryan
Clay Emerson

CENTER FOR WATERSHED PROTECTION

Tom Schueler
Ted Adams

PENNSYLVANIA ENVIRONMENTAL COUNCIL

Ellen Bryson
Amy Thut

CRUM CREEK PARTNERSHIP

Mary McLaughlin

OPEN LAND CONSERVANCY

Mitsi Toland
Mac Wilson
Liz Feinberg

VALLEY FORGE CHAPTER OF TROUT UNLIMITED

Joe Armstrong
Owen Owens
Carl Dusinbarre
Karl Heine
Jim Leonard
Chris Mulvey
Rod Horton
Pete Goodman
Andy Schaum
John Wilmer

GREEN VALLEYS ASSOCIATION

Catherine Swan
Johnh Hoekstra
Anne Murphy
Ralph Heister

ENVIRONMENTAL FUND FOR PENNSYLVANIA

Gabrielle Gidings

WEST CHESTER FISH, GAME, BOAT, AND WILDLIFE ASSOCIATION

John Johnson

HERITAGE CONSERVANCY

Russ Johnson

DELAWARE RIVERKEEPER

Chari Towne
Faith Zerbe
Melissa Keeley
Dan Salas

VALLEY FORGE SEWER AUTHORITY

Joe Bateman

PHILADELPHIA SUBURBAN WATER

Preston Lutweiler

FOX REALTY MANAGEMENT

Rick Furches

CAHILL & ASSOCIATES

Tom Cahill
Wes Horner
Michelle Adams
Susan McDaniels

GTS CONSULTING

Tom Graupensperger

LANDSTUDIES

Mark Gottshall

RAYMOND PROFITT FOUNDATION

Mark Hersh

TRAMMELL CROW

Jeff Holcomb
David Buzzell

GLASGOW CORPORATION

Brian Chabak

CHESTER VALLEY GOLF CLUB

Pat Imperato

LIST OF PREPARERS

Chuck Marshall, Restoration Planner. Primary author.

Mark VanMouwerik, National Park Service. Secondary author.

Jacki Katzmire, National Park Service. Advisor.

Sarah Bransom, National Park Service. Advisor.

Brian Lambert, Valley Forge National Historical Park. Provided major planning, advisory, oversight, and editorial input.

Mark Hartle, Pennsylvania Fish and Boat Commission. Provided major planning, advisory, oversight, and editorial input.

Tamara Whittington, National Park Service. Reviewer.

Rick Dawson, National Park Service. Reviewer.

Marcia Gittes, Department of the Interior. Reviewer.

Anne Murphy, Volunteer. Developed the list of detention basins shown in the “Alternatives” chapter. Also responsible for producing the map of protected lands in appendix H. Established the working meetings with Tredyffrin and East Whiteland Townships.

Chapter 6
Implementation of the Valley Creek Restoration Plan

CHAPTER 6 – IMPLEMENTATION OF THE VALLEY CREEK RESTORATION PLAN

This chapter describes the procedures that the Trustee Council will use in implementing this *Restoration Plan* over future years. It describes the procedures that individuals and organizations may use to apply for project funds, the procedures of the Trustee Council for approving project expenditures, and the system for maintaining, monitoring and evaluating projects.

As explained in chapter 2, applications for project funding can be made by the following procedures;

- The Trustee Council can issue a Request for Proposal for a particular project that the council wants to undertake
- National Park Service personnel can submit an application to the Trustee Council.
- Pennsylvania Fish & Boat Commission personnel can submit an application to the Trustee Council.
- Any individual, private or public entity contemplating a project in Valley Creek Watershed of the type contained in this *Restoration Plan* can apply to the Trustee Council.
- The Open Land Conservancy can also submit applications for projects covered by their agreement with the Trustee Council.

Only projects that fit into the categories of projects described in chapter 2 can qualify.

Applications can be submitted to the Trustee Council anytime during a year.

Application forms can be obtained by mailing or visiting the following two locations:

Superintendent	Chief
Valley Forge National Historical Park	Environmental Services Division
PO Box 953	PA Fish & Boat Commission
Valley Forge, PA 19482	450 Robinson Lane
	Bellefonte, PA 16823-9620

Applications can also be downloaded from www.fish.state.pa.us and clicking on Forms.

Application decisions will be made within 45 days of an application being considered complete. An applicant will receive notification of when that 45-day period begins. The Trustee Council may request a visit to the sight or a meeting with the project engineer, if applicable.

Appendix D of this *Restoration Plan* contains a scoring system that the Trustee Council will use in evaluating projects. This scoring system may be changed from time-to-time to reflect the realities of experience in implementing this plan. When an application package is sent to an interested party it will include the form, the scoring system, and a set of instructions for completing and submitting the application.

The Trustee Council can pay for the upfront portion of total costs for a project that an individual or entity may need to buy equipment, materials, or supplies. The application instructions will describe how an applicant can show these expenditures. The Trustee Council can withhold up to 10% of the total approved amount of funding until all reports are submitted, an on-site inspection has been made or whatever customized requirement the Trustee Council has placed into the approval document.

As indicated in chapter 2 the Trustee Council may also pay for ongoing maintenance expenditures over a number of years to be specified in the approval document. Maintenance costs are not to exceed 10 percent of the construction costs unless specified in the project agreement.

All applicants will be responsible for providing a significant amount of matching funds for the project. Matching amounts could consist of grants from other institutions, cash, or in-kind labor, equipment, materials, and supplies. The addition of matching funds will affect the proposed project's score in evaluation of the project's merit.

The Trustee Council will pay for salary costs containing benefits but will not pay for general overhead allocations. This pertains to contractors and subcontractors, design firms, construction firms and entities involved with design and construction.

Applicants will be required to obtain all necessary environmental and building permits. The Trustee Council considers these as qualifying expenses. The applicant must also conduct the necessary archeological and historical surveys and all surveys for wetlands and endangered and threatened species. These expenses also qualify as expenses.

Appendixes

APPENDIX A: MEMORANDUM OF AGREEMENT

MEMORANDUM OF AGREEMENT
BETWEEN
THE COMMONWEALTH OF PENNSYLVANIA
acting by and through the Pennsylvania Fish & Boat Commission
AND
THE UNITED STATES DEPARTMENT OF THE INTERIOR

REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT,
RESTORATION, REPLACEMENT AND/OR ACQUISITION
OF EQUIVALENT NATURAL RESOURCES INJURED,
DESTROYED OR LOST BY RELEASES FROM
THE PAOLI RAIL YARD SUPERFUND SITE

I.
INTRODUCTION

This Memorandum of Agreement ("Agreement" or "MOA") by and between the Commonwealth of Pennsylvania acting by and through the Pennsylvania Fish and Boat Commission ("State") and the United States Department of the Interior ("DOI") (hereinafter referred to collectively as "Parties" or Trustees"), is entered into in recognition of their common interest in the restoration, replacement and/or acquisition of equivalent natural resources which have been injured, destroyed or lost by the releases of hazardous substances from and/or at the Paoli Rail Yard Superfund Site ("Site") and to ensure the coordination and cooperation of the Parties in their application of natural resource funds including natural resource damages ("NRD") recovered for the Site. The Site is located in Chester County, Pennsylvania and includes the 28-acre rail yard as well as the surrounding Valley Creek watershed.

The United States and the Commonwealth of Pennsylvania have filed complaints in Federal Court to recover, among other things, damages for injury to, destruction of, or loss of natural resources resulting from the releases of hazardous substances into the environment in and around the Paoli Rail Yard Superfund Site. Pursuant to the Consent Decree entered in the above-referenced case, the Parties have jointly recovered $850,000.00 from three of the potentially responsible parties (Conrail, the Southeastern Pennsylvania Transportation Authority (SEPTA) and Amtrak) for damages to natural resources, oversight costs, and past assessment costs.

II.
AUTHORITY

A. The Parties enter into this Agreement in accordance with the natural resource trustee authorities provided for each party by Section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), as amended, 42 U.S.C. 9607(f), Section 2506 of the Fish and Boat Code of 1980 (30 Pa. C.S. 2506) and other applicable Federal and State laws and regulations including Executive Order No. 12580 (January 23, 1987); 43 C.F.R. Part 11, as amended.

B. In accord with Subpart G of the NCP, 40 CFR 300.600 through 300.615, 55 Federal Register 47450 - 47452 (September 15, 1994), the following officials or their designees shall act on behalf of the public as Federal and State Trustees for natural resources under this Agreement:

1. The Executive Director of the Pennsylvania Fish and Boat Commission as subdesignee for the Secretary of Environmental Protection, designee of the Governor of the Commonwealth of Pennsylvania

2. The Secretary of the Interior

III.
DEFINITIONS

For purposes of this Agreement the following definitions shall apply:

A. **"Damage Assessment Costs"** means costs including all related administrative, legal and enforcement costs associated with the planning, design, implementation and oversight of the Trustees' damage assessment process, which addresses the fact, extent and quantification of the injury to, destruction of or loss of natural resources and the services provided by those resources resulting from releases related to the Paoli Rail Yard Superfund Site, and with the planning, implementation, and monitoring of restoration of such natural resources and the services provided by those resources, and any other costs necessary to carry out the Trustees' responsibilities with respect to natural resources injured by the Paoli Rail Yard Superfund Site, provided, however, that such other costs shall be limited to costs incurred and described in the Trustees' damage claims consistent with the Consent Decree.

B. **"Federal Trustee"** means the Secretary of the Interior or his authorized designee.

C. **"Joint use"** means use of natural resource damage recoveries by the State or Federal Trustee, whether individually or collectively, in such a manner as is agreed upon by the Trustees in accordance with the terms of this Agreement.

D. **"Monitoring"** means Trustee actions appropriate to measure, evaluate and document the success of the selected restoration actions.

E. **"Natural resources"** shall have the same meaning as set forth in Section 101(16) of CERCLA, as amended, 42 U.S.C. '9601(16).

F. **"Natural resource damage(s) recovery(ies)"** means any award, judgment, settlement or other payment to the Federal Trustees or the State Trustee which is received or controlled by either of the Trustees, individually or jointly, for or as a result of claims for natural resource damages against any potentially responsible parties at the Site, except any such award which is judgment, settlement, or payment in reimbursement of natural resource damage assessment costs incurred independently by either Trustee.

G. **"Oversight expenses"** means any costs associated with individual trustee participation in the restoration planning process, Trustee Council administrative proceedings, costs associated with the retention of consultants, coordinators, or any other technical or administrative services associated with the development of the restoration plan, or any other costs reasonably related to the implementation of this Agreement other than the physical implementation of the final restoration plan approved by the Trustee Council. For the purposes of this MOA, the trustees agree to cap these expenses in accordance with the Statement of Principles set forth at Paragraph X.C. of this MOA.

H. **"Restore", "Restoration", "Replace", "Acquire the Equivalent of"** means any actions undertaken by the Trustees pursuant to CERCLA Section 107(f)(1), as amended, 42 U.S.C. '9601(f)(1), and other applicable laws or regulations, including planning, implementation, administration and oversight, which serve to restore, replace, acquire the equivalent of, or provide substitutes for natural resources or natural resource services injured, destroyed or lost as a result of the release of hazardous substances from the Site.

I. **"Restoration Coordinator"** means a person who may be appointed/hired by the Trustee Council to conduct activities as described at Section VIII, Paragraph F.

J. **"Restoration Plan"** means the plan jointly developed by the Trustees to restore those natural resources adversely affected by the releases related to the Site and/or remediation of the Site. The restoration actions selected under the Plan shall have the objectives of facilitating, accelerating and/or enhancing recovery of the affected natural resources, including the biological, ecological and human services provided by those resources. The Restoration Plan shall accomplish these objectives by identifying, evaluating and selecting restoration actions that: (1) restore injured trust resources and their habitats, and (2) replace lost biological, ecological and human services. It is the intent of the trustees that the cumulative effect of restoration actions will improve the functioning and productivity of the ecosystem as a whole.

K. **"Site"** or **"Site vicinity"** means the Paoli Rail Yard Superfund Site ("Site"), encompassing the Rail Yard itself, approximately twenty-eight (28) acres as well as its surrounding watershed. The Site is located Chester County, Pennsylvania and includes all areas beyond those acres where releases of hazardous substances, particularly polychlorinated biphenyls (PCBs), at or from the Site are now or come to be located, and all natural resources and areas which may have been or may be affected by hazardous substances released at or from the Site, located in or near Chester County.

L. **"State Trustee"** means the Governor of the Commonwealth of Pennsylvania or his designee. In this case, the Executive Director of the Pennsylvania Fish and Boat Commission, acting pursuant to its responsibilities under Section 2506 of the Fish and Boat Code of 1980 (30 Pa.C.S. 2506), serves as a subdesignee.

M. **"Trustees"** means the Federal and State Trustees.

N. **"Trustee Representatives"** means the two (2) authorized designees one of whom is appointed by appointed by PFBC and the other of whom is appointed by DOI to the Trustee Council.

O. **"Trustee Council"** means the two Trustee Representatives appointed by the State and DOI to oversee coordination of the natural resource damage assessment and restoration as described herein at Section VIII.

IV.
SCOPE

This Agreement is intended to cover natural resources as defined under Section 101(16) of CERCLA, as amended, 42 U.S.C. 9601(16), and Section 2506 of the Pennsylvania Fish and Boat Code of 1980 (30 Pa. C.S. 2506), belonging to or managed by, controlled by, or

appertaining to the Trustees under CERCLA and the NCP in the vicinity of the Site located in or near Chester County, Pennsylvania.

V.

PURPOSE

The purpose of this MOA is to provide a framework for intergovernmental coordination among the Parties for restoration of natural resources affected by hazardous substances released from the site. It is understood and agreed that restoration within the Valley Creek watershed is the principal objective of this MOA. The Restoration Plan will include measures to restore, replace or acquire the equivalent of natural resources affected by hazardous substances released from the Site. It is understood and acknowledged that additional agreements may be executed among the Trustees with regard to natural resource restoration, replacement, and/or acquisition of equivalent natural resources in the vicinity of the Site which have been injured, destroyed or lost by the release of hazardous substances from the Site.

The Trustees shall base their determination of appropriate restoration actions on the following factors: nature and extent of injury being addressed; proximity and benefit to the affected natural resources and services; proven technology/prospects for success, cost-effectiveness; recovery period; human health and safety; public comment; and consistency with applicable Federal and State laws and policies. Through the restoration planning process, the Trustees shall: (1) identify and evaluate a reasonable number of possible alternatives; (2) select one or more of the alternatives; and (3) provide its reasons for the selections(s), including an explanation of how its choice is consistent with the Trustee's legal obligations. It is understood that the Trustees may identify an action or category of actions which cannot be fully implemented because of the limitations of available settlement funds; however they may determine that it is appropriate and prudent to initiate certain actions with the understanding that if additional funding becomes available, other phases of the restoration activities related to this category will be pursued. The Trustees may adjust the sequence of individual actions provided that such adjustments are consistent with the goals of the final Restoration Plan as approved.

VI.

OBJECTIVES

The Parties shall coordinate, using a Restoration Coordinator as they deem appropriate, their activities pursuant to this Agreement to meet their respective natural resource trustee responsibilities under CERCLA, the Pennsylvania Fish and Boat Code and other applicable laws and regulations and to achieve the following objectives:

A. Coordinate and conduct all Trustee activities required to restore natural resources injured at or by the Site;

B. Prepare a comprehensive Restoration Plan to address natural resource injuries resulting from hazardous substance releases from the Site;

C. Develop the Restoration Plan for restoration efforts in compliance with the federal National Environmental Policy Act, 42 U.S.C. 4321 et seq.;

D. Identify and evaluate a range of potential restoration alternatives in the Site vicinity and select appropriate alternatives for restoration, replacement and/or acquisition of equivalent natural resources;

E. Determine the costs and expenses likely to be incurred for the restoration, replacement and/or acquisition of equivalent natural resources;

F. Implement the Restoration Plan to restore, replace, and/or acquire the equivalent natural resources injured, destroyed, or lost;

G. Fairly allocate the costs and expenses of carrying out the objectives of this Agreement among the Trustees;

H. Where appropriate, coordinate the activities under this Agreement with the ongoing remedial actions being undertaken at the Site; and

I. Foster public participation in development and implementation of the Restoration Plan.

VII.
USE OF NATURAL RESOURCE DAMAGE RECOVERIES

A. State and Federal Trusteeships. The Parties recognize that each of them has trusteeship, through their respective natural resource Trustees, under CERCLA over natural resources at the Site and that the scopes of their some of their respective trusteeships overlap.

B. Use of Natural Resource Damage Recoveries. The Trustees agree that any natural resource damage recoveries, as defined in Section III of this Agreement, obtained or received by the Parties, individually or collectively, and any interest earned thereon, shall be jointly

used to restore natural resources which have been injured, destroyed or lost as a result of the release of hazardous substances from the Site.

VIII.
ORGANIZATION

A. Natural Resource Trustee Council

To implement this Agreement, a Natural Resource Trustee Council (Trustee Council) is hereby created. Each Trustee will designate one representative to the Trustee Council. If the primary representative is unavailable, the Trustees may identify an alternate representative to serve on an ad hoc basis. Each party to this agreement will have one vote that will be cast by the party's primary representative, or in the absence of the primary representative, by the alternate representative. In addition, the U.S. Department of Justice, the Attorney General's Office of the Commonwealth of Pennsylvania, and the U.S. Department of Interior's Office of the Solicitor and the Chief Counsel for the Pennsylvania Fish and Boat Commission may each provide assistance to representatives in a legal or consultative role. The Trustee Council may seek advisory participation of other federal or state agencies or any other entity as deemed appropriate by the Trustee Council.

Within twenty (20) working days after the final execution of this Agreement, each Trustee shall notify the other Trustees of the names, addresses, telephone numbers, and facsimile numbers of that Trustee's primary representatives to the Trustee Council. Communications regarding the Trustee Council business shall be addressed to the primary representative.

B. Powers, Duties and Responsibilities

On behalf of the Parties to this Agreement, the Trustee Council shall coordinate and authorize all Trustee activities required to restore the injured natural resources at the vicinity of the Site. Any Trustee on the Trustee Council may convene a meeting of the full Trustee Council. The Trustee Council may conduct business via conference calls.

To the extent authorized by applicable laws and policies, the Trustee Council may take the following actions, among others, to address the Trustees' natural resource responsibilities:

1. Conduct and/or oversee scientific and technical studies, sampling and the restoration remedies for injured natural resources;

2. Seek compensation from the responsible party(ies) for damages assessed to address the injured natural resources and for assessment costs as defined in Section III;

3. Arrange, through one or both of the Trustees, contracts with a professional consultant(s) or contractor(s), technical or otherwise, that the Trustee Council determines are necessary to provide services to the Trustee Council so that it can fulfill its responsibilities under this MOA;

4. Participate in negotiations with responsible parties when appropriate;

5. Conduct and/or oversee the development and implementation of a plan for the restoration of the injured natural resources;

6. Create trustee advisory committees or workgroups comprised of individual or organizational representatives to advise the Council on specific aspects of restoration activities;

7. Select a Restoration Coordinator

8. Delegate specific duties to individual Trustees;

9. Appoint individual Trustees to be Lead Trustees for specific restoration projects; and

10. Make or oversee all necessary decisions for the management and administration of monies received in settlement of natural resource liability related to the Paoli Rail Yard Site.

11. Authorize expenditures from the Damages Trust Account described in Article X.

C. Decision Making

The Trustees agree that decisions implementing this MOA shall require the unanimous approval of the Trustee Council members. In the event that unanimous agreement cannot be reached among the members of the Trustee Council, the matter in dispute will be elevated within the Trustee agencies for resolution. If necessary, the Trustees may establish further mechanisms to resolve disputes. The Trustees agree that decision-making deliberations will focus on the Trustees' mutual purposes of restoring injured natural resources.

D. Lead Trustee for Restoration Projects

The responsibilities of the lead trustee for a specific restoration project include, but are not limited to:

1. Provide for the Trustee Council's approval a detailed statement of the proposed project, a project schedule, and estimated budget for the life of the project;

2. Obtain the Trustee Council's authorization to commence the project;

3. Select and retain qualified contractor(s) to implement the project;

4. Disburse funds from the established account to pay for costs;

5. Oversee, coordinate and monitor the progress of the project;

6. Submit quarterly reports to the Trustee Council which shall include a progress report and a estimate of funds spent;

7. Establish and maintain records and relevant documents related to the project;
8. Inform other Trustees of all pertinent developments regarding the project on a timely basis; and

9. Carry out such other duties as directed by the Trustee Council.

E. Restoration Coordinator.

The Trustee Council may designate a Restoration Coordinator whose work shall be directed exclusively by the Trustee Council. The responsibilities of the Restoration Coordinator may include:

1. Preparation of a Restoration Plan;

2. Coordination, management, reporting and monitoring of the natural resource restoration process;

3. Scheduling of meetings of the Trustee Council and preparation of agendas for those meetings and the recording of all actions taken at such meetings;

4. Preparing and issuing, from time to time, public reports on the work of the Trustee Council;

5. Conducting public outreach and fostering public participation in the development and implementation of the Restoration Plan;

6. To the extent permitted by applicable law, identify and secure, wherever possible, other financial resources such as, but not limited to, grants that may be available to the Trustee Council or individual Trustees for use according to the terms of this Agreement.

7. Such other duties as are agreed upon by the Trustee Council.

IX.
TECHNICAL SERVICES

A. The Trustee Council may determine that it needs technical advisors, consultants or other service providers to assist it in carrying out its responsibilities under this Agreement. The Trustee Council, through its individual members or collectively, may expend natural resource damage recoveries for service providers to perform the following services:

1. Provide project design and technology review, site analysis, restoration planning or services, testing, sampling, and other services related to the development or implementation of a restoration plan for the Site;

2. Provide the Trustee Council with logistical support and coordination;

3. Organize and prepare for Trustee Council meetings;

4. Provide technical advice to the Trustee Council during Trustee Council meetings;

5. Provide technical or other advice to the Trustee Council as required to carry out the purposes of this Agreement;

6. Provide such other services, consistent with applicable law, as requested by the Trustee Council.

X.

DAMAGES TRUST ACCOUNT

A. Structure of Account

To the extent permitted by applicable law, the Trustees agree that the settlement funds received and all future settlement funds received by the Trustees, either as a result of judgment or settlement of future natural resource damage actions brought against additional responsible parties, shall be deposited in an interest bearing trust account to be disbursed only for the purposes described in this MOA.

The Trustee Council shall establish standards and procedures governing the joint use of all natural resource damages received by the Trustees for the purposes of restoring the natural resources injured as a result of the Paoli Rail Yard Site.

B. Uses of Account

The Trustees may recover such costs and expenses from the account including, but not limited to: 1) past costs and expenditures for damage assessment and restoration actions undertaken for the Paoli Rail Yard Site; 2) costs and expenditures for on-going or future restoration actions; 3) costs incurred for compliance with federal, state and local laws including permitting requirements that may be applicable to the Trustee's activities; 4) costs for monitoring restoration projects; and 5) any other actions that the Trustees deem necessary or appropriate to carry out their responsibilities with regard to this MOA. The cost of establishing, maintaining and administering the account will be paid from the interest accrued in that account.

C. Statement of Principles.

The Trustees agree that expenditures from the Account should be managed in such a way as to maximize expenditures for restoration projects and efforts and minimize expenditures for oversight expenses, including restoration planning and administrative costs. The Trustees agree that they will limit expenditures for oversight expenses to no more than 10% of the $850,000 initial deposit in the Account, exclusive of interest. By way of further explanation, it is understood that approved expenditures from the account should be limited to no more than 7½% for restoration planning and no more than 2½% for other oversight expenses including administrative costs. In the event that the Trustee Council determines that exigent circumstances require expenditures for oversight expenditures in excess of 10% of the amount deposited in the Account, such expenditures are subject to approval at an elevated level within the

Trustee agencies. The Trustees agree that if, in the future, the Account grows to amounts in excess of the $850,000 deposited initially into it, it should be possible to expend lower percentages of the Account for oversight expenses, including restoration planning and administrative costs. Future assessment expenses beyond these recovered amounts will be sought from other sources.

XI.
AMENDMENT

A. This Agreement may be amended by agreement of the Parties if it is determined that an amendment is necessary to accomplish the objectives of this Agreement, or is necessary to modify the objectives of this Agreement consistent with the requirements of CERCLA, any amendments thereto, or other applicable Federal or State law.

B. Any amendment of this Agreement shall be effective only if it is in writing and executed by all parties to this Agreement.

XII.
CONFIDENTIALITY

The Trustees agree that it is generally in the public interest that scientific data arising out of the assessment of natural resource injuries related to the Paoli Rail Yard Site be made public. Therefore, such data shall be made public as soon as its publication will not prejudice the accomplishment of the purposes of this MOA. Public sharing of scientific data, whenever possible, will be the general policy of the Trustees. However, all parties to this MOA recognize that litigation related to the Paoli Rail Yard Site may occur. The Trustees and their legal counsel may determine that certain written or oral communications related to the assessment and recovery of damages for injury to natural resources are being undertaken in anticipation of litigation. Accordingly, all oral and written communications and work product not shared affirmatively with the responsible party(ies) will be treated as privileged attorney-client communications, attorney work product or protected by other applicable privilege (or a combination thereof), as appropriate, and will be protected from disclosure to the maximum extent possible under applicable Federal or State law. The parties further agree that whenever a request for production of such a record is received pursuant to any applicable Federal or State law, the request will be forwarded for response to the Trustee or Trustees to which the privilege applies or whose representatives originally generated or contributed to the record requested. Nothing contained herein shall

be construed as prohibiting or restraining the Trustees or the Trustee Council from agreeing to release any record.

XIV.
RESERVATION OF RIGHTS

Each Trustee reserves the right to take whatever action is necessary to pursue or preserve any legal remedies available to that Trustee in connection with the Paoli Rail Yard Site. Nothing in the MOA is intended to waive or foreclose any such right or to cede any responsibility or authority inherent in a Trustee's control or trusteeship over natural resources.

XV.
LIMITATION

Nothing in this MOA shall be construed as obligating the United States, the Commonwealth of Pennsylvania or any other public agency, their officers, agents or employees, to expend any funds in excess of appropriations authorized by law.

XVI.
THIRD-PARTY CHALLENGES OR APPEALS

Nothing in this MOA may be the basis of any third-party challenges or appeals. This MOA creates no rights or causes of action in persons not parties to this agreement.

XVII.
MODIFICATION OF AGREEMENT

Modification of this MOA must be in writing and approved by all Trustees currently parties to the MOA.

XVIII.
TERMINATION

This MOA shall be in effect from the date of execution until termination by agreement of the Trustees. At any time the Trustees determine that the purposes underlying this MOA have been addressed, the MOA will terminate. In the event any Trustee withdraws from the MOA, such withdrawal must be in writing and provided to the rest of

the Trustees at least thirty days in advance of the withdrawal. In the event of such withdrawal, this MOA remains in full force and effect for the remaining parties.

In the event of the withdrawal of any Trustee, or at the termination of this MOA, there shall be a full and complete accounting to the Trustee Council and their legal representatives of all funds received, deposited, held, disbursed, managed, expended from any joint or separate account(s) established in accordance with Section VI of this MOA.

XIX
EXECUTION: EFFECTIVE DATE

This MOA may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the original MOA and shall be retained by the Trustee Coordinator. The date of execution shall be the date of the signature of the last Trustee to sign the MOA.

SIGNATURES:

The Commonwealth of Pennsylvania

By: Peter A Colangelo
Name:
Title: Executive Director PFBC

Date: March 9, 2000

Approved as to legality and form (Commonwealth of Pennsylvania):

Authorized Agency Attorney

(Deputy) Attorney General

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Date: 2/09/00

APPENDIX B: 2002 STREAM ASSESSMENT

To assist in the restoration plan development, the quality of the aquatic habitat in Valley Creek watershed was measured during an assessment performed May 15–16, 2002. Two teams of representatives from the Pennsylvania Fish and Boat Commission, Pennsylvania Department of Environmental Protection (DEP), and Trout Unlimited assessed 26 reaches of 100 meters (328 feet) each. The assessments were performed on Valley Creek, Little Valley Creek, Crabby Creek (a tributary to Little Valley Creek), and two unnamed tributaries to Valley Creek. Several reaches were chosen to correspond with the areas chosen by the Pennsylvania Fish and Boat Commission for fish surveys. An EPA Stream Assessment Protocol (Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish. Environmental Protection Agency, EPA 841-B-99-002, July 1999. Second Edition) was used to perform the evaluation. This protocol has 10 parameters that are scored from 0–20 and then summed for an overall total. Ratings for the overall scores, including the number of reaches in each category in parentheses, are as follows

0–59 Poor	(0)
60–109 Marginal	(4)
110–159 Sub-optimal	(21)
160–200 Optimal	(1)

The average score for all 26 reaches was 132.2, slightly below the mid-point of the sub-optimal category. Table B-1 shows raw scores and summary data for all 26 reaches. Table B-2 then evaluates the poor and marginal reaches as well as those in the sub-optimal range with scores less than 120. See figure B-1 for watershed locations of scores including the reaches listed in table B-1.

The four highest rated parameters are channel alterations (lack thereof), channel flows, frequency of riffles, and the velocity depth regime. The higher channel flow scores were influenced by rainfall in the two days prior to the assessment. These rankings seem to indicate that Valley Creek's fundamental flow characteristics are good, but that sedimentation from banks and riparian areas are degrading in-stream characteristics and, by inference, habitat.

With respect to stream sections, the average scores for the five sections are as follows

Valley Creek below confluence with Little Valley Creek	129
Valley Creek above confluence with Little Valley Creek	122
Valley Creek tributaries at upper end	112
Little Valley Creek	137
Crabby Creek	152

The above data shows that Little Valley Creek scored higher than Valley Creek, and that Crabby Creek scored the highest of all sections. Although Little Valley Creek scored higher than Valley Creek, two of the three most upstream reaches assessed showed very low scores. Unnamed tributaries of Valley Creek in the upper end of the watershed had the lowest average score (reaches L, P, and HH). These subbasins in upper Little Valley Creek were also shown in figure B-1 and table B-3 to have the highest runoff curve numbers. The reach with the lowest score of all was in Valley Forge National Historical Park (reach B), located in the area where Hurricane Floyd caused split channels and sediment deposition at the upstream end of a mill dam pool that includes very highly eroded banks. The highest score was for the upper-most reach of Crabby Creek, which is not limestone-influenced and has a much higher gradient than the other reaches assessed.

TABLE B-1: STREAM ASSESSMENT SCORES BY REACH

Reach	Assessment Results: Substrate Character		Stream Channel					Bank/Rip Corridor				
Code	**Epifaunal**	**Embedded**	**Vel/Dep**	**Sediment**	**Chanl Flow**	**Chan Altr**	**Freq Riffs**	**Bank Stab**	**Veg Prote**	**Rip Veg Zone**	**Total**	
A	17	14	18	11	12	14	17	3	6	3	**115**	VBC
B	3	13	13	7	18	7	2	6	7	6	**82**	VBC
C	17	15	16	17	17	18	16	14	18		**157**	VBC
D	13	10	16	14	15	20	18	11	13	14	**144**	VBC
E	11	10	17	14	16	19	17	13	13	17	**147**	VBC
F	13	16	15	17	19	18	11	10	15	7	**141**	VAC
G	9	13	12	13	19	12	16	12	8	2	**116**	VAC
H	9	11	17	6	11	19	17	6	8	18	**122**	VAC
H2	9	15	15	12	17	19	10	16	18	20	**151**	VAC
I	12	14	17	12	10	12	17	11	13	12	**130**	VAC
J	8	5	16	11	10	20	17	7	12	20	**126**	VAC
L	10	9	7	10	14	7	2	16	18	13	**106**	VAC
M	11	11	15	10	15	17	9	12	14	9	**123**	VAC
N	12	8	14	11	12	18	17	12	15	14	**133**	VT
P	8	10	13	12	15	12	16	2	2	0	**90**	VT
Valley Creek	10.8	11.6	14.7	11.8	14.7	15.5	13.5	10.1	12.0	10.9	125.5	
AA	18	18	18	15	16	17	18	7	14	17	**158**	LVC
BB	16	16	16	16	18	14	18	16	16	6	**152**	LVC
CC	13	14	16	17	19	17	17	14	13	3	**143**	LVC
DD	14	16	17	13	18	16	17	13	14	5	**143**	LVC
EE	10	10	15	8	16	12	15	9	13	6	**114**	LVC
FF	12	17	12	14	16	14	17	13	16	17	**148**	LVC
GG	13	12	14	12	14	18	14	12	10	18	**137**	LVC
HH	6	14	12	8	8	18	10	2	8	18	**104**	LVC
Little Valley Creek	12.8	14.6	15.0	12.9	15.6	15.8	15.8	10.8	13.0	11.3	137.4	
1CC	12	16	16	14	15	12	18	16	18	18	**155**	LVCT
2CC	10	16	8	6	13	16	17	18	18	18	**140**	LVCT
3CC	15	18	10	17	14	18	18	14	18	18	**160**	LVCT
Crabby Creek	12.3	16.7	11.3	12.3	14.0	15.3	17.7	16.0	18.0	18.0	151.7	
	12.5	**14.8**	**16.0**	**13.6**	**16.6**	**17.3**	**16.5**	**12.4**	**14.7**	**13.4**	**132.2**	
Code	**Epifaunal**	**Embedded**	**Vel/Dep**	**Sediment**	**Chanl Flow**	**Chan Altr**	**Freq Riffs**	**Bank Stab**	**Veg Prote**	**Rip Veg Zone**	**Total**	
Rank of Score	**9**	**5**	**4**	**7**	**2**	**1**	**3**	**10**	**6**	**8**		

VBC is Valley Creek (VC) Below Confluence; VAC is VC above confluence; VT is VC tributary. LVC is Little Valley Creek (LVC); LVCT is tributary of LVC. Shadowed cells indicate worst scores.

TABLE B-2: CHARACTERIZATION OF LOWEST SCORING REACHES OF VALLEY CREEK WATERSHED

Reach ID	Score	Location	Low Scoring Parameters	Comments by Assessors
B	82	Valley Creek, 200 to 300 meters* upstream from old dam	1. Frequency of riffles 2. Epifaunal substrate/available cover 3. Bank stabilization 4. Riparian vegetation 5. Sedimentation and vegetation protection on banks	Deep slow flow, much depositing, very bad bug population, poor area for fish
P	90	Chester Valley Golf Club tributary to Valley Creek, 100 meters downstream from parking lot on back 9	1. Riparian vegetation 2. Bank stabilization 3. Vegetation protection on banks 4. Sedimentation	No buffers; need bank stabilization
HH	104	Little Valley Creek, downstream Worthington Steel to 25 meters above old Church Road	1. Bank stabilization 2. Epifaunal substrate/available cover 3. Sedimentation 4. Vegetation protection on banks	Riffles infrequent and poor; prevalence of clay makes for poor habitat with limited potential for improvement; banks high and eroded
L	106	Valley Creek, 200 meters downstream of Route 202 bridge, along Knickerbocker Landfill	1. Frequency of riffles 2. Channel alterations 3. Velocity/depth regime 4. Embeddedness	Highway runoff concern, highway channelization, Route 202 being widened, need to examine what the Pennsylvania Department of Transportation will do
EE	114	Little Valley Creek, 75 meters upstream of North Valley Road	1. Riparian vegetation 2. Sedimentation 3. Bank stabilization 4. Epifaunal substrate/available cover and embeddedness	Blown out rock dam causing major bank problems; pool quality poor; more embedded substrate; strongly changing site
A	115	Mouth of Valley Creek, between Route 23 and Rail Bridge	1. Riparian vegetation 2. Bank stabilization 3. Vegetative protection 4. Sedimentation	Horribly eroding high banks; riparian area poor; instream habitat not bad
G	116	Valley Creek to dam upstream North Valley Road	1. Riparian Vegetation 2. Vegetative protection 3. Epifaunal substrate/available cover	Dam removal should create buffer

*1 meter = 3.28 feet

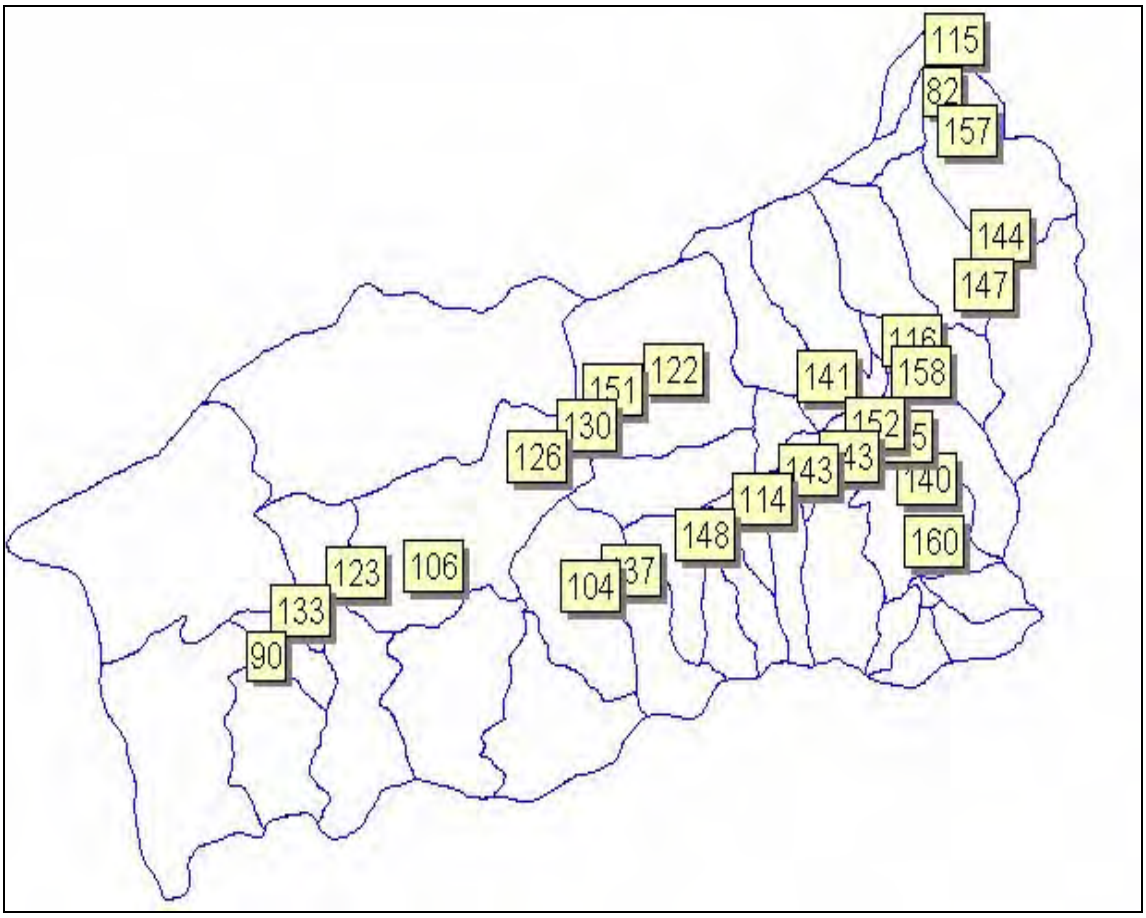


Figure B-1: Graphic Display of Watershed Assessment Scores

TABLE B-3: ASSESSMENTS BY SUBBASIN, JUNE 2002

Code	Name	Observations	Reach-Stream Score	Total/ Candidate Basins for Retrofits	Lands Suitable for Infiltration (LSI)	SCR Priority	LSI Priority	Basin Retrofit Priority
A1	Wilson Run	Intermittent stream; highly eroded channels below Chesterbrook Boulevard to Valley Creek; moderately eroded channels between Wilson Tract and Chesterbrook Boulevard	NA	3/2	Minimal; built-out area	High	Low	Moderate
A2	Mill Road	Flowing stream; tributary observed at crossing of Swedesford Road; erosion up and down covering 150 yards was minimal; also observed minimal erosion on tributary at Route 401	NA	9/5	Low LSI	Low	Low	High
A3	Immaculate and Golf Course	Flowing stream; low stream assessment score on golf course; extensive bank erosion from golf course downstream to confluence with Valley Creek	P – 90	1/0	Golf course lands suitable for infiltration; township land to be infiltrated as new building designed	High on Chester Valley Golf Club property; moderate elsewhere	Moderate	Low
A4	Ravine	Intermittent stream; low erosion when crosses Route 30; extensive stream bank erosion from Planebrook and Swedesford down to golf course; Pennsylvania Department of Transportation to upgrade streambank where crosses Route 202	NA	6/1	High	High; need to prevent sediment from going downstream	High	Low
A5	Route 401	Intermittent flow starts at GVHS; Pennsylvania Department of Transportation plans to upgrade streambanks and perform infiltration mitigation from Mill Lane back to Moores Road	NA	5/2	Low-moderate	Low	Low	Moderate
A6	Mill Lane	No flow during October 2001; small flow after storm of November 25 and 26, 2001; extensive development of watershed upstream; basins being installed; tributary moderately eroded; after May 2002 rain event, considerable erosion entering Valley Creek- suspect from construction sites	M – 123 N – 133	6/6	Moderate	Moderate	Moderate	High
A7	Catenach	Stream flows into Glasgow quarry and into sink hole; Warner Quarry collects stormwater in its new lake	NA	16/0	Cones of depression to quarries	Low	Low	Low
A8	Corporate Center	Main stem of Valley Creek; East Whiteland Park parking lot will be upgraded for infiltration by East Whiteland Township; moderate to high bank erosion between EW Park and Church Road	I – 130 J – 126 L – 106	8/2	Slope, soils, and quantity of undeveloped land suggests LSI	High	High	Moderate

Code	Name	Observations	Reach-Stream Score	Total/ Candidate Basins for Retrofits	Lands Suitable for Infiltration (LSI)	SCR Priority	LSI Priority	Basin Retrofit Priority
A9	No. Cedar Hollow	Quarry discharge; above Church Road TU has developed two stabilization projects; extensive bank erosion from Church Road to dam at North Valley Road	G – 165 H – 122 H2 – 151	7/2	Investigate preserves owned by the Open Land Conservancy (OLC); moderate – high LSI	Low for Cedar Hollow Run, but high for main stem	Moderate	Moderate
A10	Western Middle Valley	Flowing stream; channel is mildly-eroded and often without buffers	NA	7/6	Investigate eased land of OLC; moderate LSI	Low	Moderate	High
A11	Octagonal School	Lower part at LeBoutellier Road and looks adequate	NA	3/0	Moderate	Low	Moderate	Low
A12	Central Middle Valley	Main stem; scored in the suboptimal range of assessment	F – 141	0	Moderate; examine George Lorimer Preserve	Low	Moderate	Low
A13	Eastern Middle Valley	Main stem; moderate bank erosion from where LeBoutellier Road crosses Valley Creek to dam 100 yards upstream of Mill Road; large sediment load behind dam; Hudson property on south bank a good flood plain area; many highly eroded banks between bridge at Mill Road and confluence with Little Valley Creek	NA	2/2	Investigate land on south bank of Valley Creek	Moderate	Moderate	Moderate
A14	Yellow Springs	Intermittent stream; eroded tributary below LeBoutellier Road	NA	1/0	High	Moderate	High	Low
A15	Bradford Road	Intermittent stream; large storm sewer discharges onto large meadows floodplain	NA	2/0	Low	Low	Low	Low
A16	Chesterbrook	Main stem; very limited infiltration by several basins on south side of Valley Creek; basin discharges lead to heavy channel cutting in places between Bradford Road and Mill Road	NA	7/0	Heavily built-out area	High for basin outlet stabilization	Low	Low
A17	Lower Chesterbrook and West Valley Forge Park	Main stem plus intermittent tributary; gentle swale through wooded area enters stream from north side; looks okay; hundreds of feet of streambank are heavily-eroded; stream assessment value was in suboptimal range; one basin below school property has 15-foot-deep ravine	E – 147	3/0	Investigate school property; otherwise area is built-out	High for bank restoration and high for basin outlet stabilization	Low	Low

Code	Name	Observations	Reach-Stream Score	Total/ Candidate Basins for Retrofits	Lands Suitable for Infiltration (LSI)	SCR Priority	LSI Priority	Basin Retrofit Priority
B1	Howelville	Flowing stream; stream from Route 202 to Valley Creek is highly-eroded; upstream from Route 202 to Route 252 is okay; new pond/basin along Route 252 needs to be evaluated for amount of runoff captured and stored before discharge to tributary; new Pennsylvania Department of Transportation basin needs to be evaluated also	AA – 158	9/2	Built-out area	High	Low	Moderate
B2	Crabby	Confluence near Route 252 and Swedesford Road looks okay; through Trammel Crow site is okay; moderate streambank erosion where Crabby enters Little Valley Creek (TU says needs restoration); upper reach could be improved to create pools for adult fish	1CC –155 2CC – 140 3CC – 160	9/2	Built-out area	Upper Crabby needs bank stabilization, vanes, and stream narrowing	Low	Moderate
B3	Bear Hill Road	Flowing stream; mild erosion on channel from Route 202 to confluence with Little Valley Creek; some signs of past impact from tributary flow onto opposite bank of Little Valley Creek	NA	3/0	Built-out area	Low	Low	Low
B4	North Valley Road	Intermittent stream; gets stormwater from Route 202 (will Pennsylvania Department of Transportation upgrade stream where it crosses 202?); moderate channel erosion of tributary from Route 202 to Little Valley Creek (about 150 yards); much erosion in top most channel on steeper slopes	CC – 143 DD – 143	2/1	Built-out area	Moderate - high	Low	Low
B4a	Eastern Little Valley	Little Valley Creek stem; stabile from Swedesford west for 300 yards; potential for buffer on north side; moderate erosion downstream from North Valley Road to confluence with Route 252 tributary	BB – 152	2/1	Low	Moderate	Low	Low
B5	Middle Little Valley	Little Valley Creek stem; moderate to heavy streambank erosion from North Valley Road west to farm house; moderate to heavy erosion of banks from farmhouse to where Little Valley Creek comes under Route 202	EE – 114	3/3	Low	Moderate – High	Low	High
B6	Hollow Road	Intermittent stream; moderately eroded streambank above Hawthorne Road; need to observe stream as it goes through the Open Land Conservancy's Airdrie Forest Preserve; after joins with Cedar Hollow Road Run; stream flows through Vanguard; joint stream flows below Vanguard East Campus onto floodplain; moderate erosion from road to rail tunnel	NA	2/1	Culvert restrictor at rr bridge? Otherwise low LSI	Moderate	Low	Low

Code	Name	Observations	Reach-Stream Score	Total/ Candidate Basins for Retrofits	Lands Suitable for Infiltration (LSI)	SCR Priority	LSI Priority	Basin Retrofit Priority
B7	South Cedar Hollow	Stream flows from half-way up road that comes down from Paoli; highly eroded channel coming down hill from Paoli; last 75 yards of stream highly eroded before meeting Little Valley Creek (see above description for joint stream flow through Vanguard)	NA	0	Culvert restrictor at rr bridge? Vanguard has areas suitable for infiltration	Moderate	Moderate	Low
B8	Vanguard East and North of Route 202 near Unisys	Main stem; Little Valley Creek; moderately eroded through this stretch running from Cedar Hollow Rd. to where Little Valley Creek crosses under Route 202; need to observe where runoff goes from parking lots on north side of Route 202	FF – 148 GG – 137	5/2	Low	High	Low	Moderate
B9	Nursing Home	Flowing stream; moderate channel erosion from Route 30 north to rail track culvert; stream looks okay coming north through Vanguard site to just above confluence with Little Valley Creek; moderate erosion in last 150 feet of stream	NA	3/0	Basin next to Vanguard boulevard; opportunity for recharge; culvert restrictor at railroad bridge?	Moderate	Moderate	Low
B10	Matthews Road	Deep channelization on Little Valley Creek opposite Worthington Steel at small utility area off Matthews Road; also severe erosion on Little Valley Creek from Worthington down to where next tributary comes in; streambanks look moderately-eroded opposite new Vanguard properties; short tributary at eastern edge of Worthington property not a problem.	HH – 104	6/3	Large volumes of stormwater come from north side of Route 202; moderate LSI	High	Moderate	High
B11	Malvern Road Run	Heavy channelization south from Malvern downhill to General Warren Inn; not sure if enough space before rail bed to put in a flow restrictor before culvert; north of tracks to confluence with B12 moderate channelization, significant deterioration of abandoned rail bed; Vanguard has two basins next to stream with little detention; limited space for additional basins	NA	2/1	Investigate the installation of an inlet restrictor on the upstream side of the culvert for the raised railroad berm	High, much erosion in tributary plus downstream in Little Valley Creek	Low	Low
B12	Diner and People's Light	Okay where Little Valley Creek crosses Route 401; Drexel reports no flow at People's Light & Theater Company site in Fall 2001; observed small flow after the storm of November 25 and 26, 2001; large catchment area, but relatively flat; okay to where it joins with tributary B11	NA	4/2	High LSI.	Low	High	Moderate

The following are water quality and quantity descriptions pertaining to each subbasin of Valley or Little Valley Creek, as studied by the Trustee Council, and also an identification of restoration priorities within each of those 30 subbasins. Table 2-1 and figure 2-1 in the "Restoration Plan" (chapter 2), show the subbasin map and codes for each subbasin. Some subbasins are also identified by a name in the text that follows that is either generally used throughout the watershed or was assigned by this project where no other name was known to exist. Table B-3 describes the problems and opportunities and the restoration priorities for each sub-basin.

Team comments on the lowest scoring reaches plus other related data are as follows

Valley Creek

- Reach A (6th lowest score) is targeted by Valley Forge National Historical Park (VFNHP) for bank stabilization.

- Reach B (lowest score), and all areas of Valley Forge National Historical Park in need of stream stabilization work, are targeted for restoration with VFNHP funds and are not planned to require monies from the Restoration Fund.

- Reach G (7th lowest score) is downstream of the dam near No. Valley Road. According to the Open Land Conservancy, the owner wants to keep the dam but dredge behind it. Area below dam is under easement with Open Land Conservancy. Reach is unbuffered on both sides of the stream. Dam breaching and/or dredging is a project category to be discussed in section 3.

- Reach L (4th lowest score) is adjacent to Route 202, which is going to be widened by the Pennsylvania Department of Transportation over the next 2–3 years, and it is likely that the department would be doing some streambank stabilization in that area.

- Reach P (2nd lowest score) is on the Chester Valley Golf Course. The Chester Valley Golf Club has recently approved a project costing almost $400,000, which includes a stream bank restoration and stabilization and pond reduction project through their property. (The club has requested $49K of funding support from the Plan (appendix C). Their plan and its effect on the stream appear to qualify as a potential restoration project. The Trustee Council will consider their application after this restoration plan is final.)

Little Valley Creek

- The upper half of Little Valley Creek, including reaches HH and EE (3rd and 5th lowest scores), had scores less favorable than the lower half of Little Valley Creek (126 vs. 149). Good riparian vegetation, but high channel sedimentation, bank instability, and low epifaunal substrate/available cover (see table B-4) characterized the upper half of Little Valley Creek. This suggest that high runoff occurs upstream of this area and is a cause for eroding banks even though the riparian area is well vegetated. This raises the question of what is happening to the sand and silt sediments that have eroded from those banks. Does the sand and silt sediment stay where it is generated or is it transported through the lower half of Little Valley Creek, into Valley Creek and the Schuylkill River where it settles? Mike Boyer, a biologist with the Pennsylvania Department of Environmental Protection, feels that the upper half of Little Valley Creek is not a viable fishery, but that streambanks there should be stabilized to reduce sediment loads downstream.

TABLE B-4: PERCENT SUBSTRATE COMPOSITION OF REACHES OF VALLEY CREEK

Substrate Components																											
	A	B	C	D	E	F	G	H	H2	I	J	L	M	N	P	AA	BB	CC	DD	EE	FF	GG	HH	1CC	2CC	3CC	Avg%
Bedrock	0	0	15	5	0	0	5	0	0	0	5	0	0	0	0	0	15	15	5	5	0	0	0	0	0	0	2.7
Boulder	25	0	20	10	5	5	5	0	0	5	5	5	5	0	5	10	10	5	10	5	5	0	0	10	5	15	6.5
Cobble	20	5	30	35	30	10	30	5	15	25	20	10	15	10	15	25	35	30	10	15	40	10	10	20	10	35	19.8
Gravel	40	5	20	25	30	35	30	40	25	40	30	30	10	45	30	35	25	30	60	25	30	35	25	25	45	40	31.2
Sand	10	30	10	15	30	40	25	45	50	15	20	40	30	30	25	25	10	15	10	30	25	40	20	30	30	10	25.4
Silt	5	50	5	5	5	5	5	5	10	5	5	15	25	10	10	0	5	5	0	10	0	10	5	10	5	0	8.3
Clay	0	10	0	5	0	5	0	5	0	10	15	0	15	5	15	5	0	0	5	10	0	5	40	5	5	0	6.1
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	VBC	VAC	VT	LVC	LVCT
Bedrock	4	1.25	0	5	0
Boulder	12	3.75	2.5	5.6	10
Cobble	24	16.3	13	22	21.7
Gravel	24	30	38	33	36.7
Sand	19	33.1	28	22	23.3
Silt	14	9.38	10	4.4	5
Clay	3	6.25	10	8.1	3.33
	100	100	100	100	100
%belGrav	36	49	48	34	32

VBC = Valley Below Confluence
VAC = Valley Above Confluence
VT = Valley Tributary
LVC = Little Valley Creek
LVCT = Little Valley Creek Tributary

APPENDIX C: DETENTION BASIN RETROFIT, LANDS SUITABLE FOR INFILTRATION, AND STREAM CORRIDOR RESTORATION PROJECT INFORMATION

Tables C-1 and C-2 list the detention basins for East Whiteland and Tredyffrin Townships, respectively. The list shows the location and ownership of each basin. The first column contains a Y (yes) or N (no) to indicate whether or not the site is a candidate for retrofit. Each candidate basin retrofit site will require geophysical testing at the time that a retrofit is being considered. Basins considered as candidates for further evaluation for retrofitting were selected based on the townships' engineers and Tom Cahill's personal knowledge of the basins. Reasons why the other basins are not good candidates are given for each basin as a code with a description at the bottom. All basins considered retrofit candidates could be chosen by the Trustee Council to be funded and implemented.

Locations of detention basins by the same number in tables C-1 and C-2 are shown on figure C-1.

In order to prioritize basins that are candidates, it would be ideal to have the cost and increased infiltration rate for each basin. The basins then could be ranked by either the greatest to the least cost-effective basins, or from the most to the least infiltration. Cost and infiltration data is only available to the following extent. Retrofit costs were estimated at approximately $130,000 per acre of basin that included 3 acres of drainage area and are the equivalent of $0.40 per cubic foot of water infiltrated. The cost of basin testing is approximately $3,000 (Cahill & Associates 2002). Tom Graupensperger of GTS Technologies estimated costs for infiltrating water on lands suitable for infiltration at $1/cubic foot of infiltrated water (pers. comm., Graupensperger 2003). These costs excluded land acquisition, design, and permitting. The Center for Watershed Protection estimated costs per acre of drainage at an average (for four different methods) of about $9,000 that converts to $11,000 per acre in 2003. An estimated cost of $35,000 per retrofitted basin, including testing costs, was adopted for this plan.

The subbasin numbers in tables C-1 and C-2 correspond to the subbasin locations identified on figure C-2. Figure C-3 is a watershed map of the locations of those existing detention basins (Cahill & Associates 2002). Figure C-4 is another map of the watershed showing the codes used for the subbasins.

Table C-5 contains a listing of subbasins for Valley Creek Watershed and the number of land sites that are considered suitable for infiltration. The development of this list was based on an analysis contained in table B-3, under the columns entitled lands suitable for infiltration and lands suitable for infiltration priority. The subbasin numbers in table C-5 corresponds to the subbasin locations identified on figure C-4.

Table C-6 lists candidate projects for stream channel stabilization on most streams of the watershed. Costs for stabilization are estimated based on a range of $75 to $150 per linear foot depending on the height of the bank and the type of stabilization method that is estimated to be required. Rock vane and bioengineering projects are at the lower range and skyhooks are at the upper range. For the Valley Creek Watershed, table C-6 lists the locations of highly eroded banks. These are defined as banks that are usually denuded of vegetation and show signs of recent erosion and that have a high potential for future erosion. The list organizes the locations by the subbasin codes for Valley Creek that were shown on figure C-4. All of these locations can be considered as project sites under this category designated by the Trustee Council. The lengths of eroded streambanks for each project candidate were determined by field observations and photographs. The project cost per eroded bank section was estimated on the basis of assigning one of the four restoration methods first listed in chapter 2 and the cost per foot.

Table C-7 contains cost data for the four stabilization methods used in this plan as proxies for all methods.

TABLE C-1: SITE INFORMATION FOR DETENTION BASIN RETROFIT PROJECTS IN EAST WHITELAND

Potential Retrofit Site?	Reason	Twp Owns Basin?	Subbasin	Property Owner[1] Potential Growing Greener Site	Owner[2]	Crossroads	Acres	Site on Cahill Map?	Tax Map	Parcel ID
Yes			A5	North side of Wyckfield*	Unlined Basin	Phoenixville Pike & Moores		Yes	3	42-3-
Yes			A5	South side of Wyckfield*	Unlined Basin	Phoenixville Pike & 401		Yes	3	42-3-
Yes		Yes	A5	Bryn Erin Development*	Unlined Basin	Markel & Church	20	No	3	42-3-116
Yes		Yes	A4	Bryn Erin Development*	Unlined Basin	Markel & Church		No		
Yes		Yes	A7	Pickford Run*	Unlined Basin	Sidley & Thayer		Yes	4	42-4-
Yes			A8	Fieldstone Partners LP			67.3	Yes	4	42-4-2.3
Yes			A8	National Liberty Insurance	c/o McElroy	Sidley & Moores	1	Yes	4	42-4-2
Yes			B10	Penn State GV*			53	Yes	4	42-4-260
Yes			B11	Liberty Property Ltd Trust	Valley Brook South	Rt 29 & Rt 202	incl	Yes	4M	42-4-254
Yes			B10	Woodview Associates LP	Woodview Circle			Yes	5	42-5-13
Yes			B10	Bell Atlantic Properties			incl	Yes	4	42-4-260.4
Yes		Yes	A4	SF: Glenloch		Ravine Road	1	No	6	42-6G-16
Yes		Yes	A4	SF:Glenloch: Whitewood	Commonwealth Constrctn	adj Penn Central yards	1	No	6	42-6G-244
Yes			A6	East Whiteland Twp	2 small basins	Rt 401	8.6	Yes	4	42-4-58.1
Yes			B12	Lincoln Investors LP	Shopping Mall on Rt 30		20.5	Yes	4	42-4-97.1
Yes			B12	Lincoln Investors LP	Shopping Mall on Rt 30			Yes		
Yes			A2	Norcini Development Corp		Swedesford& Westgate	13.9	No	4	42-4-85
Yes			A2			Swedesford& Westgate	13.9	No	4	42-4-85
Yes			A2			Swedesford& Westgate	13.9	No	4	42-4-85
Yes			B12	Thomas Morelli Revocable Trust	Industrial Park nr Rt 30	Rt 30	2.1	No	4L	42-4-140
Yes			A6	Fieldstone Partners LP			6.5	No	4	42-4-5.2
Yes			A8			Oak Drive		Yes		42-4-20
Yes			A8	GV Industrial Park: Liberty Property				Yes	4	42-4-15-

Potential Retrofit Site?	Reason	Twp Owns Basin?	Subbasin	Property Owner[1] Potential Growing Greener Site	Owner[2]	Crossroads	Acres	Site on Cahill Map?	Tax Map	Parcel ID
Yes			B10	Liberty Property Ltd Trust			incl	Yes	4	42-4-53
Yes			B12	Liberty Property Ltd Trust	Valley Brook South	Rt 29 & Rt 202	24.5	Yes	4M	42-4-254
				Total Potential Retrofits=25						
				Other Basins						
No	SML[3]		A4	1 Bacton Hill Partnership		Swedesford/ Phoenixville	54	No	3	42-3-81
No	SML		A4	Cherry Pie Farm	Robert & Marilyn Dietz	Bacton Hill Road	2.9	No	3	42-3-84.1
No	QD[4]	Yes	A7	Pickford Run		Almy		Yes	4	42-4-
No	Pond[5]		A6	Corporate Center		Sidley & Church		Yes		
No	PI[6]		A5	Trammel Crow Office Park	c/o McElroy	North side of Rt 401 & Church	25.1	No	3	42-3-45.6A
No	QD		A7	Glasgow Properties	quarry	Rt 29	186	Yes	2	42-2-3
No	Pond		A8	GV Industrial Park: Liberty Property				Yes	4	42-4-
No	Pond		A8	GV Industrial Park: Liberty Property			17.4	Yes	4	42-4-25
No	Pond		B10	Liberty Property Ltd Trust		Swedesford&Valley Stream	incl	No	4	42-4-53
No	PI		A4	Daniel Tabas/Home Depot		Rt 30	14	Yes	6	42-6-14
No	PI		A4	Home Depot				Yes		42-6-21
No	PI		A4	Home Depot				Yes		42-6-21
No	OS[7]		A3	Frazer Realty Holdings		South side of Rt 30 & Church	1.7	No	4	42-4-303
No	OS		A3	Edwin Bauer, Lionville		South side of Rt 30	3.1	No	4	42-4-306
No	NL[8]		B11	Whiteland Woods Assn		Rt 30	16	No	4R	42-4-339
No	NL		B11	Whiteland Woods Assn		Rt 30	3	No	4R	42-4-339
No	NL		B11	Sunrise Paoli Assisted Living		Rt 30	0.5	No	5	42-5-20
No	OS, SML		B11	Residence Hotel		West Rt 29& 30	10	No	4M	42-4-132
No	OS		B11	Across from Hotel		East Rt 29 &30		Yes		
No	SHO[9]		A2	Piroeff Family LP	adj Westgate Pumping Station	Rt 30	5.2	No	4	42-4-87.1
No	SHO		A2	Piroeff Family LP	adj Westgate Pumping Station	Rt 30	5.2	No	4	42-4-87.1

Potential Retrofit Site?	Reason	Twp Owns Basin?	Subbasin	Property Owner[1] Potential Growing Greener Site	Owner[2]	Crossroads	Acres	Site on Cahill Map?	Tax Map	Parcel ID
No	OS		A4	c/o Somserset Tire, Inc., NJ	near Ch Valley GC	Davis & Rt 30	0.5	No	3R	42-3r-10
No	OS		A4	c/o Somserset Tire, Inc., NJ	near Ch Valley GC	Davis & Rt 30	0.5	No	3R	42-3R-10
No	PI		B10	Wyeth Trinity Corporate Cntr Assoc	1st Evergreen Mangt	Wyeth		No	5	42-5-1
No	OS		A4	None listed		Rt 30	2.2	Yes	6	42-6-9
No	Pond		B10	Liberty Property Ltd Trust			106	Yes	4	42-4-53
No	PI		A8	Siemens			111	Yes	4	42-4-53.3
No	SHO, NL		A2	SF: Patricia Moris	End of SF cul de sac	Frazer near Rt 352		Yes	7A	42-7A-34
No	SHO, NL		A2	Ma Haiching	Lot bordering RR	Frazer Av near Penn Central	6.5	Yes	7A	42-7A-25
No	SHO, NL		A2					Yes		
No	NL, OS		B12	Sugartown Ridge Associates			16.8	No	4Q	42-4-281
No	NL, PI		A3	Immaculata College			150	Yes	6	42-6-34
No	NL, PI		A3	Immaculata College			incl	No	6	42-6-34
No	NL, PI		A3	Immaculata College			incl	No	6	42-6-34
No	SHO		A6	Michael Antecki		Mill @ Reading Railroad	1	Yes	4	42-4-65
No	SHO		A6	SF Development		Off 401		Yes		
No	SHO		A2	Ralph Malin Trust			9.5	Yes	4	42-4-88
No	SHO		A2	Barker Pipe Fittings		Maple Linden Ln	7.6	Yes	4P	42-4P-100
No	SHO		A4	Albert Augustine	SF-near Ch Valley GC	Planebrook & Golfview	0.5	No	3Q	42-3Q-22
No	SHO		A4	Anthony & Js. Celia	Near Pump Station	Rt 30 & Frame	1	Yes	3Q	42-3-148
No	QD		A7	GV Ind Prk: Liberty Property	open space	Wilburdale & Flat	12	Yes	4	42-4-15.9A
No	QD		A7	American Sweetners Inc.	Lee Ave Industrial Park	Lee Ave	6.7	Yes	2	42-2-10.1
No	QD		A7	Lee Ave Industrial Park				Yes		
No	QD		A7	Lee Ave Industrial Park				Yes		
No	QD		A7	Lee Ave Industrial Park				Yes		
No	QD		A7	Lee Ave Industrial Park				Yes		
No	QD		A7	GV Ind Prk: Liberty Property	7 Great Valley Parkway	ES Rt 29		Yes	2	42-2-12

Potential Retrofit Site?	Reason	Twp Owns Basin?	Subbasin	Property Owner[1] Potential Growing Greener Site	Owner[2]	Crossroads	Acres	Site on Cahill Map?	Tax Map	Parcel ID
No	QD		A7	GV Ind Prk: Liberty Property		Flat Rd & Rt 29		Yes	2	42-2-12
No	QD		A7	GV Ind Prk: Liberty Property			4.2	No	2	42-2-52.5
No	QD		A7	GV Ind Prk: Liberty Property			14.2	No	2	42-2-52
No	Pond		A8	GV Ind Prk: Liberty Property	nr Lapp Rd PS	Lapp Rd & Rt 29		Yes	4	42-4-
No	OS		A4	Wawa Inc.	near Ch Valley GC	Planebrook	3	No	3R	42-3-179
No	OS		A4	Issa Azat		Rt 30	1	No	3Q	42-3-181
No	OS		A4			Rt 30 near Planebrook				
No	Q, Pond		A8	Desmond Hotel Pond		Rt 29				42-4-53-
No	Not Valley Creek		A5	Transcontinental Pipeline		West border of township	157	Yes		42-3-64
				Total Other Basins=56						
				Total Basins in EW= 81						

1. Property Owners – This means the entity that is recorded as holding title to the property.
2. Owners – This means the tenant's name or some additional information as to location on the property.
3. SML = Site too small or inadequate land.
4. QD = Site drains to a quarry pond.
5. Pond = Basin also functioning as a decorative pond.
6. PI = Previous Infiltration or basin plantings.
7. OS = Older site (often with concrete structures).
8. NL = Not in limestone (lower priority).
9. PNI = Party not interested.
10. SHO = Single unaffiliated homeowner (cost prohibitive).

TABLE C-2: SITE INFORMATION FOR DETENTION BASIN RETROFIT PROJECTS IN TREDYFFRIN

Possible Retrofit Site?	Reason	Subbasin	Property Owner[1]	Crossroads	Acres	Parcel ID	On Cahill Map?
			Chesterbrook Sites				
No	PI[2]	**B1**	Tredyffrin Township building	Duportail		43-9-161.1	Yes
No	PNI[3]	**B1**	Fox Realty	across from Township building	6.7	43-5-26.12	Yes
No	PNI	**A16**	Fox Realty	Lee Blvd & Chesterbrook	9	43-5-26.3	No
No	PNI	**A16**	Fox Realty	Chesterbrook Shop. Center		43-5-26.31	No
Yes		**A1**	Green Hills Homeowners Association	Adams & Chesterbrook			Yes
Yes		**A1**	Green Hills Homeowners Association	south West side of Adams			Yes
No	Sml[4]	**A1**		south West side of Wilson			Yes
No	PNI	**A1**	Fox Realty	south West side of Jefferson		43-5-26.27	No
No	PNI	**A16**	Fox Realty	Bradford & Chesterbrook	10	43-5-26.28	Yes
No	PNI	**A16**	Fox Realty	Chesterbrook-near Duportail			Yes
No	PNI	**A16**	Homeowners Association	Behind Bradford Pool			Yes
No	sml	**B1**	Tredyffrin Township	across from Mill Road Park			No
No	sml	**B1**	Tredyffrin Township	south South side of Duportail & Swedesfd	11.9	43-9-161.1	No
No	PNI	**A16**	Fox Realty	south East side of Morris near Duportail	5.1	43-5-26.4	No
No	PNI	**A16**	Fox Realty	Back of Office Park near Creek		43-5-26.36	No
No	PNI	**A1**	Homeowners Association	End of Chase Rd			Yes
			Total basins this group=18 (4 possible retrofits)				
			Non-Chesterbrook Sites				
			North of Turnpike				
No	NPS[5]	**A17**	Valley Forge National Historical Park	Rt 252, & Lafayettes Headquarters			
No	SHO[6]	**A15**		south Southside of General Alex. Near Rt 202			
			Total basins this group= 4				
			Between Turnpike & Rt. 202				
No	PNI	**A15**	Homeowners Association	Chesterbrook			
No	sml	**B4a**	basin not there or small	Le Boutillier & Swedesford			Yes
Yes		**B4a, A13**	Open Space Homeowners Association	Eaves Spring	11.4	43-4-	Yes

Possible Retrofit Site?	Reason	Subbasin	Property Owner[1]	Crossroads	Acres	Parcel ID	On Cahill Map?
						151.34	
Yes		**A14**	Summerhill Homeowners Association	size of soccer field		43-4-150	Yes
Yes		**A14**	Summerhill Homeowners Association	not found			Yes
Yes		**A14**	Summerhill Homeowners Association	size of football field		43-4-150	Yes
No	SHO	**A9**	John & Mary Ring	Minden Ln Off N Valley		43-4-142.1H	Yes
No	SHO	**A9**	Nick & Regina Recchi	Minden Ln Off N Valley		43-4-142.1A	Yes
No	PI	**A9**	Planted detention basins	Minden Ln Off N Valley			
No	sml	**A9**	Near Vanguard School	North Valley & Page Place	4.1	43-4-145	Yes
Yes		**A9**	Homeowners Association	Overlook Place			
Yes		**A9**	Wisteria Homeowners Association	North side of Wisteria			Yes
Yes		**A10**	Wisteria Homeowners Association	size of soccer field		43-9-39.24	Yes
Yes		**A10**	Maple Hill Homeowners Association	size of football field			
Yes		**B5**					Yes
Yes		**B8**					Yes
No	QD[7]	**A9**	Warner Quarry				Yes
Yes		**B8**	Liberty Property LP	Matthews Rd		43-9-20	Yes
Yes		**A10**	Liberty Property LP	Church & Swedesfd		43-9-20	Yes
Yes		**B8**		Matthews Rd & Cedar Hollow	10.1	43-9-35.1	No
Yes		**A10**		Industrial Park & Cedar Hollow			
No	Pond[8]	**A10**	Liberty Property LP	North Church	10.7	43-9-1.3	Yes
			Total Basins this group= 26 (18 possible retrofits)				
			South of Rt. 202-Paoli				
No	NL[9], OS[10]	**B9**	Bundy Corp, Paoli Industrial Park				
No	NL, OS	**B8**	Bundy Corp, Paoli Industrial Park				Yes
No	NL,SHO	**B3**	nr Airdie Forest Preserve	Maude Lane			Yes
Yes		**B5**	Glen Craig Homeowners Association				Yes
Yes		**B6, B6, B4**	Lexton Woods	Hawthorne Blvd			Yes
No	NL	**B3**	Paoli Point Assisted Living	Central Ave & Rt 252			Yes
No	NL, OS	**B2**	Russel Rd Office Development Group	Russell Road & Woodmere Crt	1.3	43-10J-75	Yes
No	NL, OS	**B2**	Paoli Village Office Development Group	Russell Road & Woodmere Crt	3.2	43-10J-76	Yes
No	SHO	**B2**	Bang & Keong Jeon	Sheldrake & Russel	1	43-10J-	No

Possible Retrofit Site?	Reason	Subbasin	Property Owner[1]	Crossroads	Acres	Parcel ID	On Cahill Map?
						17.9	
			Total Basins= 15 (5 possible retrofits)				
			South of Route 202-Berwyn				
No	SHO	**B3**		Heatherstone Drive			Yes
No	QD	**B2**	H/W ROW	Westlake Dr & Swedesfd	5	43-9-74	Yes
No	QD	**B1**	Rt. 252 across from quarry				Yes
No	pond	**B1**	Office Park	Along Howelville Road			Yes
No	pond	**B1**	Pond along Swedesford				Yes
No	pond	**B2**	Pond along Rt 252				Yes
No		**B2**	PECO ROW	Field of Dreams			Yes
No		**B2**	PECO	Howellville Rd			Yes
No	OS	**B2**	Office Park	Off Howelville Rd			Yes
No	OS	**B1**	Hillside School	Between Howelville & Cloverly			Yes
No	OS, sml	**A1**	Shopping Center	Off Swedesford Road			Yes
No	PNI	**A1**	Vertex				Yes
No	NL, PI	**B1**	CHS				Yes
No	NL, SHO	**B2**	Individual Homeowner	South of CHS			Yes
			Total Basins=21 (2 possible retrofits)				
			Total Basins in Tredyffrin= 84 (29 possible retrofits)				

1. Property Owner = This means the entity that is recorded as holding title to the property.

2. PI = Previous Infiltration or basin plantings

3. PNI = Party not interested

4. SML = Site too small or inadequate land

5. NPS = National Park Service maintains

6. SHO = Single unaffiliated homeowner (cost prohibitive)

7. QD = Site drains to a quarry pond

8. Pond = Basin also functioning as a decorative pond

9. NL = Not in limestone (lower priority)

10. OS = Older site (often with concrete structures)

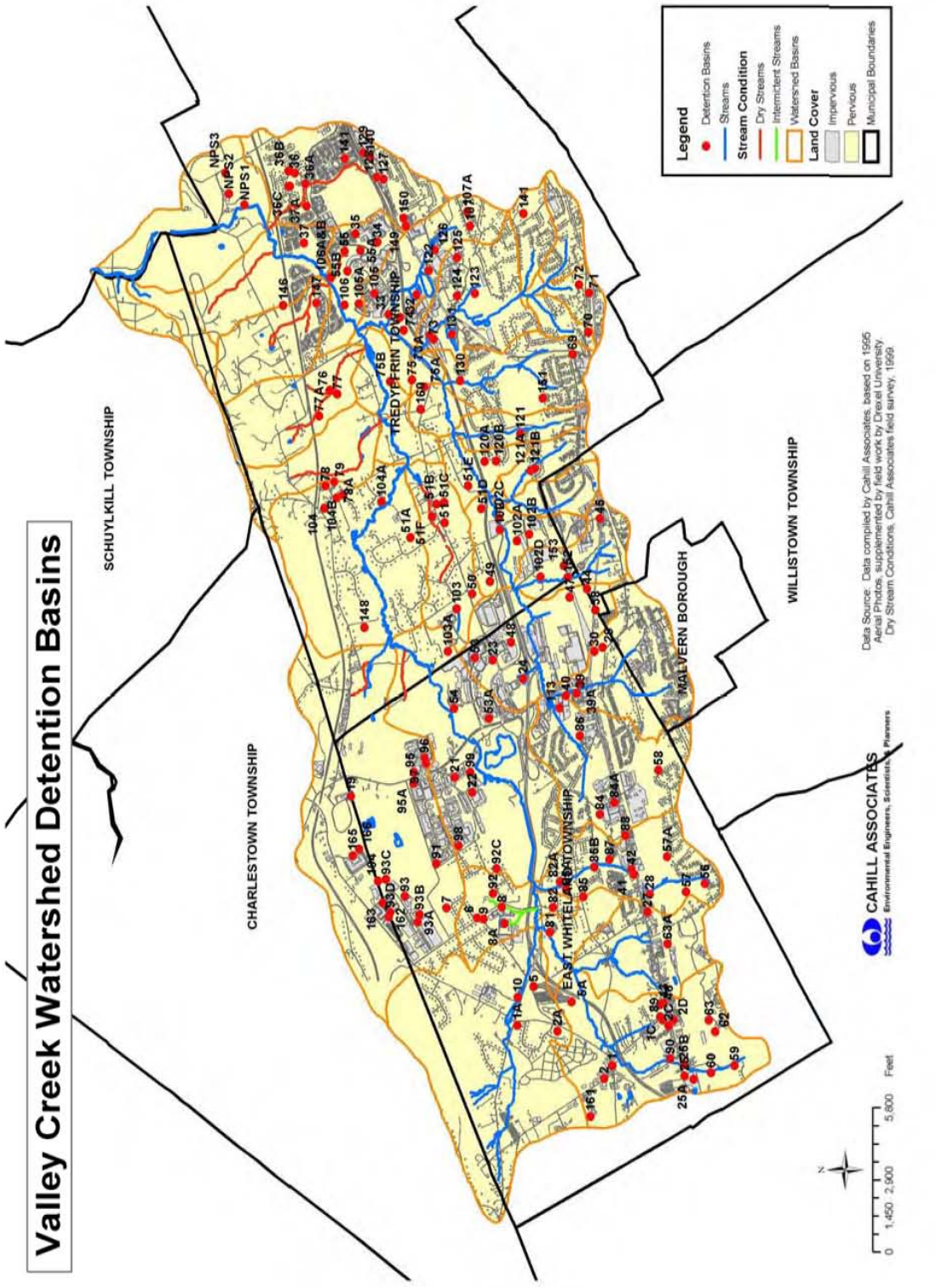


FIGURE C-3: VALLEY CREEK WATERSHED DETENTION BASINS (REFER TO INFORMATION IN TABLES C-1 AND C-2

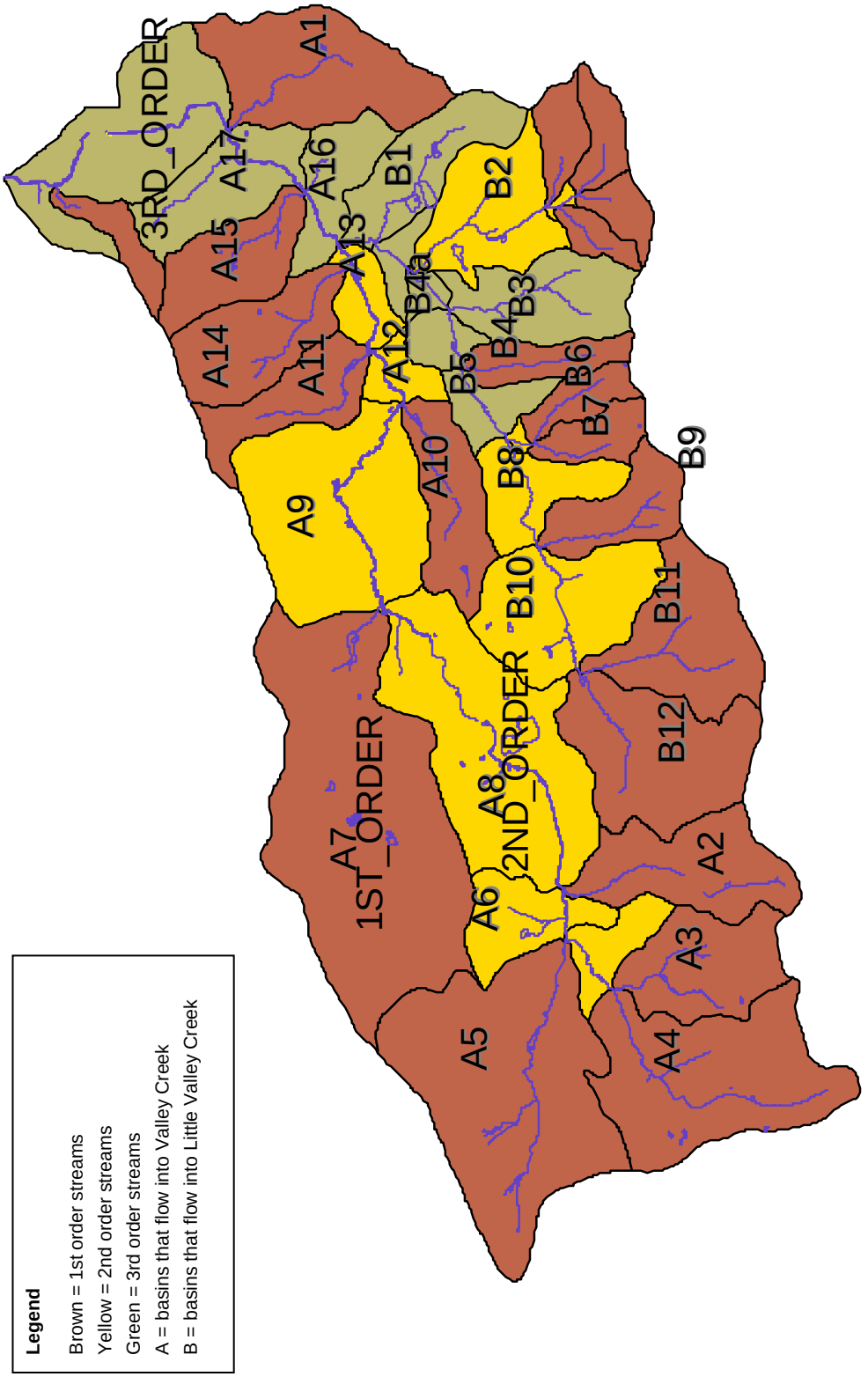


FIGURE C-4: VALLEY CREEK SUBBASINS (SOURCE: CAHILL & ASSOCIATES)

TABLE C-5: STORMWATER INFILTRATION PROJECT CANDIDATES FOR LANDS SUITABLE FOR INFILTRATION

Subbasin	Project Location	Restoration	Cost ($000)
A1	West side of closed Wilson Rd	Raise and reduce outlet size	36
A2	Low potential		0
A3	Golf Course	Dispersion area	50
A4	1 LSI* site likely		36
A5	1 LSI site likely		36
A6	2 LSI likely		72
A7	Drains to groundwater		0
A8	Lapp Rd Basin #27 of Drexel & Others	Plug lowest outlet	108
A9	LSI - Cool Valley or Valley Creek Preserve		36
A10	1 LSI site likely		36
A11	2 LSI sites likely		72
A12	Low potential		0
A13	Low potential		0
A14	1 LSI site likely		36
A15	1 LSI site likely		36
A16	Low potential		0
A17	1 LSI site likely		36
B1	1 LSI site likely		36
B2	Low potential		0
B3	Low potential		0
B4 & B4a	2 LSI sites likely		72
B5	1 LSI site likely		36
B6	1 LSI site likely		36
B7	2 LSI sites likely		72
B8	1 LSI site likely		36
B9	1 rail bridge culvert restriction likely		25
B10	Worthington Steel parking lot runoff*		0
	2 LSI sites likely		72
B11	Reduce inlet size of south side of railroad berm		25
B12	Broad Leaf Way off Oak Hill Circle #58 of Drexel		36
*	Private cost, not out of Restoration Fund		
			$966

* LSI = Lands suitable for infiltration.

TABLE C-6: COST ESTIMATE FOR STREAM CHANNEL STABILIZATION PROJECTS

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
A1	Wilson Run from Chestrbrook Blvd. to stream	500 feet x 5 feet x 2 sides	Rip Rap	75,000	75	Yes
A2	Mildly eroded - low priority			0		
A3	Most flow is through private golf course – see infiltration			0		
A4	50 yds dam (100 yds down stream of Swedesford, south side)	60 feet x 4.5 feet	Bioeng	4,500	75	Yes
	Demolish dam, remove hips			12,000		Yes
	10 yds below 2nd bridge, south side	30 feet x 4 feet	Bioeng	2,250	75	No
	40 yds below above, south side	60 x 7 feet	Bioeng	4,500	75	Yes
	Below above site, south side	50 feet x 4 feet	Bioeng	3,750	75	Yes
	10 yds below above south side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	10 yds below above, north side	60 x 3.5 feet	Bioeng	4,500	75	
	50 yds below above, south side	100 feet x 5 feet	Bioeng	7,500	75	No
	40 yds below above, south side	100 feet x 5 feet	Bioeng	7,500	75	No
	Before Route 202 tunnel, south side	50 feet x 5 feet		3,750	75	Yes
A5	Pennsylvania Department of Transportation and others to restore at Route 401 Route 202			0		
A6	Golf and Ravine Tributaries, just west of 401 south side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Just west of above, north side	80 feet x 5 feet	Bioeng	6,000	75	Yes
	Sand bar and gouge, up from above site, north side	50 inches x 4 feet	Bioeng	3,750	75	Yes
	50 yds below Church Road, south side, GC and Rav	80 feet x 4 feet	Bioeng	6,000	75	Yes
	100 yds below Church Road north side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	GC & Ravine tributaries just before confluence, with Valley Creek south side	50 feet x 5 feet	Bioeng	3,750	75	Yes
	VC N side, just above confluence of GC and Ravine	100 feet x 4 feet	Bioeng	7,500	75	Yes
	VC south side, 20 yds below confluence of GC & Ravine	100 feet x 6 feet	Vane	12,500	100	Yes
	Approximately 12 unphotographed sites, both sides tributaries	60 feet x 4 feet	Bioeng	54,000	75	No
A7	St. Peter's tributary, east of Church Road	100 feet x 6 feet	Bioeng	10,000	100	Yes
	St. Peter's tributary, 60 yds up from Church Rd	80 feet x 3.5 feet	Bioeng	6,000	75	Yes
	St. Peter's tributary, 80 yds up from Church Road	70 feet x 4 feet	Bioeng	5,250	75	Yes
A8	Eroded bank, 80 yds up from KSL culvert, south side	100 feet x 6 feet	Bioeng	10,000	100	Yes
	Eroded bank, 80 yds up from above, south side	40 feet x 4 feet	Bioeng	3,000	75	Yes
	Eroded bank, 80 yds up from above, north side	60 feet x 4 feet	Bioeng	4,500	75	Yes
	Eroded bank, down from Route 202, north side	60 feet x 4 feet	Bioeng	4,500	75	Yes

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
	Eroded bank, 40 yds down from KSL culvert	50 feet x 10 feet	Vanes	7,500	150	Yes
	Eroded hill, 50 yds down from above	100 feet x 40 feet	Vanes	20,000	200	Yes
	Eroded bank, 100 yds down from above south side	60 feet x 5 feet	Bioeng	4,500	75	Yes
	Eroded bank, north side, 15 yards down from small dam	30 feet x 4 feet	Bioeng	2,250	75	Yes
	Eroded bank, north side, 75 yards from above	100 feet x4.5	Bioeng	7,500	75	Yes
	Eroded bank, north side, 30 yards below above	70 feet X4	Bioeng	5,250	75	No
	Blockage, below Warner waste lime mountain			2,000		Yes
	Eroded banks north and south sides of blockage	40 feet x 4 x2	Bioeng	6,000	75	Yes
	Eroded banks, north side, just below blockage	100 feet x3 feet	Bioeng	7,500	75	No
	Eroded bank, 75 yds below blockage	60 feet x 5 feet	Bioeng	4,500	75	Yes
	Eroded bank, 50 yds down from above	120 feet x 4 feet	Bioeng	9,000	75	Yes
	Eroded tributary at 2nd dam below EW Park	120 feet x 4 feet x 2	Bioeng	18,000	75	Yes
	Eroded gouge, 75 yds down from above, north side	20 feet x 4 feet	Skyhook	3,000	150	No
	Eroded bank, 30 yds down from above, south side	35 feet x 5 feet	Bioeng	2,625	75	Yes
	Eroded bank, 50 yds down from above, south side	100 feet x 5 feet	Bioeng	7,500	75	No
	Eroded bank, 50 yds above Church Rd, south side	60 feet x 5 feet	Skyhook	9,000	150	No
	Eroded bank, 40 yds up from above south side	80 feet x 6 feet	Bioeng	8,000	100	No
	Eroded bank, 40 yds up from above, south side	160 feet x 7 feet	Bioeng	16,000	100	No
	Eroded bank, 100 yds down from Church Rd	80 x 5	Bioeng	6,000	75	Yes
	Eroded bank, 40 yds down from above	80 x 5	Bioeng	6,000	75	Yes
	Eroded bank, 100 yds down from above	80 x 5	Bioeng	6,000	75	Yes
	Blockage and backwaters below			15,000		No
	Eroded bank, 40 yds down from above, south side	80 feet x 4 feet	Bioeng	6,000	75	No
	Eroded bank, 100 yds down from above, north side	120 feet x 4 feet	Bioeng	9,000	75	No
	Blockage, 100 yds down from above			2,000		No
A9	Stream blockage, just past Warner discharge			2,000		No
	Eroded bank, 10 yds below above north side	100 feet x 4 feet	Bioeng	7,500	75	No
	Eroded bank, 50 yds below above, south side	80 feet x 4 feet	Bioeng	6,000	75	No

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
	Eroded bank, 80 yds below above, south side	80 feet x 5 feet	Bioeng	6,000	75	No
	Eroded bank, 50 yds below above, north side	20 feet x 3 feet	Bioeng	1,500	75	No
	Eroded bank, 70 yds below above, north side	40 feet x 3 feet	Bioeng	3,000	75	No
	Eroded bank, 70 yds below above, north side	60 feet x 4 feet	Bioeng	4,500	75	No
	Eroded bank, 30 yds below above, south side	50 feet x 4 feet	Bioeng	3,750	75	No
	Eroded bank, 50 yds below above, south side	30 feet x 4 feet	Bioeng	2,250	75	No
	Eroded bank, 50 yds below above, north side	180 feet x 4 feet	Bioeng	13,500	75	No
	Eroded bank, 50 yds below above, south side	100 feet x 4 feet	Bioeng	7,500	75	No
	Eroded bank, at Andrews property, north side	60 feet x 5 feet	Bioeng	4,500	75	No
	Eroded bank, Andrews property, north side	100 feet x 5 feet	Bioeng	7,500	75	Yes
	Eroded bank, 40 yds below Andrews bridge, south side	130 feet x 5 feet	Bioeng	9,750	75	Yes
	Eroded bank, 20 yds below above, north side	30 feet x 5 feet	Bioeng	2,250	75	No
	Eroded bank, 30 yds below above, south side	60 feet x 5 feet	Bioeng	4,500	75	Yes
	Eroded bank, 10 yds below above, north side	100 feet x 5 feet	Bioeng	7,500	75	Yes
	Stream splits erosion on each side north side	220 feet x 5 feet	Bioeng	22,000	100	No
	Stream splits erosion on each side south side	130 feet x 4 feet	Bioeng	13,000	100	No
	Eroded bank, 50 yds below above south side	100 feet x 5 feet	Bioeng	7,500	75	No
	Eroded bank, 75 yds below above, north side	80 feet x 5 feet	Bioeng	6,000	75	No
	Eroded bank, 30 yds below above, north side	80 feet x 6 feet	Vane	6,000	100	Yes
	Eroded bank, 20 yds below above, south side	80 feet x 5 feet	Bioeng	6,000	75	No
	Eroded bank, 10 yds below above, north side	100 feet x 6 feet	Vane	10,000	100	Yes
	Eroded bank, 10 yds below above, south side	150 feet x 6 feet	Vane	15,000	100	Yes
	Eroded bank, 10 yds below above, south side	100 feet x 5 feet	Bioeng	7,500	75	Yes
	Eroded bank, 40 yds above railroad bridge,	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded banks unobserved, extrapolated	1600 x Var	Bioeng	120,000	75	No
	Eroded bank, 45 yds above below, south side	100 feet x 5 feet	Bioeng	7,500	75	Yes
	Eroded bank, opposite pretty house, north side	120 feet x 5 feet	Bioeng	9,000	75	Yes

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
	Eroded bank, south side, above Overlook Road	200 feet x 5 feet	Bioeng	15,000	75	Yes
	Bridge washout at Overlook Road driveway			5,000		Yes
	Eroded bank, 15 yds below above, north side	10 feet x 4 feet	Bioeng	750	75	Yes
	Eroded bank, 50 yds below above, south side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Eroded bank, 20 yds below above, south side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded bank, 60 yds below above, north side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded bank, 20 yds below above, south side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded bank, 5 yds below above, south side	120 feet x 4 feet	Bioeng	9,000	75	Yes
	Eroded bank, 20 yds below above, north side	60 feet x 3 feet	Vane	6,000	100	No
	Eroded bank, 40 yds below above, south side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Eroded bank, 50 yds below above, south side	100 feet x 3.5 feet	Bioeng	7,500	75	Yes
	Eroded bank, below dam south side	100 feet x 5 feet	Bioeng	7,500	75	No
A10	Mildly eroded - low priority			0		
A11	Mildly eroded - low priority			0		
A12	Eroded bank, 140 yds above Mill Road, south side	60 feet x 5.5 feet + 100 feet x 5 feet	Vanes	12,000	75	Yes
	Eroded bank, 170 yds above Mill Road, north side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded bank, 250 yds above Mill Road, south side	80 feet x 3.5 feet	Bioeng	6,000	75	Yes
	Eroded bank, 320 yds above Mill Road, north side	130 feet x 4 feet	Bioeng	9,750	75	Yes
A13	50 yds below Mill Road bridge, south side	80 feet x 6 feet	Vanes	6,000	75	Yes
	80 yds down from Mill Road bridge, north side	60 feet x 5 feet	Bioeng	4,500	75	Yes
	75 degree eroded bank downstream of Reynolds' house	120 feet x 4 feet	Skyhooks	18,000	150	Yes
	Below bridge off Lebout Road, south side	60 feet x 3.5 feet	Bioeng	6,000	75	Yes
A14	Just west of Mill & Boutillier, culvert outlet E&W	50 feet x 3.5 feet*2	Bioeng	6,500	65	Yes
	50 yds down from above, west side	100 feet x 4 feet	Bioeng	6,500	65	Yes
A15	Mildly eroded - low priority			0		
A16	Basin outlet erosion -south side near Bradford	30 feet x 2 sides x 4 feet	Bioeng and Rip Rap	4,500	75	Yes
	Basin Outlet stabilization-100 yds west of above	60 feet (both sides)	Bioeng and Rip Rap	9,000	75	Yes
	Eroded banks 150 yds down from confluence north side, photo C32	100 feet x 5 feet	Skyhooks	15,000	150	Yes
	Eroded banks 65 yds down from above south side, photo C33	60 feet x 6 feet	Vane	6,000	100	Yes

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
A17	NP south site -eroded bank north side	80 feet x 6 feet	Skyhooks	12,000	150	Yes
	Outlet from basin near school property	200 feet x 2 sides x 10 feet (both sides)	Bioeng and Rip Rap	40,000	100	Yes
	Eroded bank -main stem, south side, photo C6	80 feet x 4.5 feet	Bioeng	6,000	75	Yes
	Eroded bank - main stem, south side, photo C7	100 feet x 4.5 feet	Bioeng	7,500	75	Yes
	Eroded bank - main stem, south side, photo C10	100 feet x 6 feet	Vanes	10,000	100	Yes
	Eroded bank - main stem, south side, photo C12	100 feet x 5 feet	Bioeng	7,500	75	Yes
	Eroded bank - 125 yds below Bradford, south side, photo C13	50 feet x 6 feet	Skyhook	7,500	150	Yes
	Eroded bank - 100 yds below Bradford, north side, photo C14	60 feet x 6 feet	Skyhooks	9,000	150	Yes
	Eroded banks 200 yds north side from Bradford, photo C34	30 feet x 3 feet	Bioeng	2,250	75	Yes
B1	Erosion Little Valley Creek 100 yds above confluence, south side, photo C23	50 feet x 5 feet	Skyhook	7,500	150	Yes
	Erosion Little Valley Creek 50 yds above confluence, N side, photo C24	50 inches x 6 feet	Skyhook	7,500	150	Yes
	Stream blockage, 40 yds above confl, photo C25			2,000		Yes
	Eroded banks 250 feet down north side from Mill Rd - LVC photo C26	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Eroded banks 200 yds from Mill on south side Little Valley Creek, photo C27	400 feet x 4 feet	Bioeng	30,000	75	Yes
	Eroded banks at confluence, photo C 31	100 x 4 feet	Bioeng	3,000	75	Yes
	Howel Tributary, from path down, photo C28, rip rap+vanes	100 feet x 4 feet (both sides)	Bioeng	20,000	100	Yes
	Howel Tributary, 30 yds below above, east side, photo C29	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Howel Tributary, above path, east side, photo C30	45 feet x 4 feet	Bioeng	3,375	75	Yes
B1a	Little Valley Creek 75 yds below Swedesford Road, north side	200 x 6 feet	Bioeng	20,000	100	New
	Little Valley Creek at confluence of Crabby Creek, south side	100 feet x 4 feet	Bioeng	7,500	75	New
	Little Valley Creek, 80 yds below above, south side	40 feet x 3.5 feet	Bioeng	3,000	75	New
	Little Valley Creek, 40 yds above Mill Rd, south side	120 feet x 3.5 feet	Bioeng	9,000	75	No
B2	Above railroad bridge, eroded banks	150 feet x 6 feet	Bioeng	15,000	100	No
	Above railroad bridge	300 feet	Vanes	22,500	75	
B3	Looks OK where meets with Little Valley Creek, photos C4,5,6			0		Yes
B4	Eroded banks, NV Road to Little Valley Creek, both sides	160 feet x 4 feet x 2	Bioeng	24,000	75	No
B4a	Eroded banks 300 yds above Swedesford north side, photo D5	50 feet x 4 feet	Bioeng	3,750	75	Yes

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
	Eroded banks 350 yds above Swedesford south Side, photo D6	100 feet x 4 feet	Bioeng	7,500	75	Yes
B5	Eroded banks, 40 yds below NV Rd south side, photo D7	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded banks, 60 yds below NV Road north side	100 feet x 4 feet	Bioeng	7,500	75	Yes
	Eroded banks, 100 yds west of NV Road, north side	30 feet x 4 feet	Bioeng	2,250	75	Yes
	Eroded banks, 140 yds west of NV Road, north side	120 feet x 4 feet	Bioeng	9,000	75	Yes
	Eroded banks, 260 yds west of NV Road	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Eroded banks, 300 yds west of NV Road, south side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Eroded bank 340 yds west NV Road, south side at bend, photo D15	100 feet x 3 feet	Skyhooks	15,000	150	Yes
	Eroded bank 420 yds west of NV Road,	100 x 4.5 feet	Bioeng	7,500	75	Yes
	Eroded banks, 450 yds west of NV Road, north side	60 feet x 5 feet	Bioeng	4,500	75	Yes
	530 yds west of NV Road, blockage			2,000		Yes
	Eroded banks, 80 yds downstream from Rt. 202	50 feet x 4 feet	Bioeng	3,750	75	Yes
	Eroded banks at Rt. 202	50 x 3 feet	Bioeng	5,000	100	Yes
B6	Moderate erosion at Hawthrone Road, southeast sides		Bopemg	7,500	75	Yes
B7	East Vanguard, 50 yds above rd SE side	70 feet x 4 feet	Bioeng	5,250	75	No
	50 yds below East Vanguard Road, west side	70 feet x 4 feet	Bioeng	5,250	75	Yes
	5 yds below above, east side	30 feet x 4 feet	Bioeng	2,250	75	No
	30 yds down from above, west side	70 feet x 4 feet	Bioeng	5,250	75	No
	Before RR tunnel, east side	50 feet x 5 feet	Bioeng	3,750	75	No
	Cedar Hollow trib, 50 yds from confluence up, bioveg+vanes	100 feet (both sides)	Vanes	15,000	150	No
	Cedar Hollow Trib 70 yds above confluence, east side 100 feet x 6.5 feet		Vanes	15,000	150	Yes
	Cedar Holl Rd culvert at railroad bridge			3,000		Yes
	Cedar Hollow Tributary above culvert	100 feet x 3.5 feet	Bioeng	7,500	75	Yes
B8	Vanguard West Bridge East Side, north bank erosion	150 feet x 4 feet	Bioeng	12,000	75	Yes
	Vanguard West Bridge West Side, south bank erosion	80 feet x 4 feet	Bioeng	6,000	75	Yes
	Barred road culvert draining Matthews Road	60 inches x4 feet (both sides)	Bioeng	9,000	75	Yes
	370 yds above Cedar Hollow, south side	60 feet x 4 feet	Bioeng	4,500	75	No
	330 yds above Cedar Hollow, south side	60 feet x 4 feet + 80 feet x 7 feet	Skyhooks	21,000	150	Yes
	250 Yds above Cedar Hollow, north side	35 feet x 4 feet	Bioeng	2,625	75	Yes

Subbasin	Project	Dimensions	Stabilization Method	Cost ($)	Rate ($/ft)	Photo
	130 Yds above Cedar Holl, south side, block+eros	100 feet x 4 feet	Bioeng	15,000	150	Yes
	100 yds below Cedar Hollow, south side	60 inches x 8 feet	Skyhooks	9,000	150	Yes
	125 yds below Cedar Hollow, south side	100 feet x 7 feet	Skyhooks	15,000	150	No
	175 yds below Cedar Hollow, south side	60 feet x 6 feet	Skyhooks	9,000	150	Yes
	215 yds below Cedar Hollow, north side	30 feet x 5 feet	Bioeng	2,250	75	Yes
	Below Cedar Hollow, before railroad tunnel, south side	30 feet x 3 feet	Bioeng	2,250	75	Yes
	80 yds below railroad bridge, south side	50 feet x 4 feet	Bioeng	3,750	75	Yes
	130 yds below railroad tunnel, north side	80 feet x 4 feet	Bioeng	6,000	75	Yes
	At Rt. 202 bridge, east side gouged and soil collapse			5,000		Yes
B9	Last 150 yds of tributary before confluence, both sides	150 feet x 3 feet x2	Bioeng	22,500	75	Yes
B10	Eroded banks from Rt. 29 to Vanguard Middle Campus Bridge	300 feet x4- 5 feet	Bioeng	22,500	75	No
	Upstream of No Trespass Park, south side	150 feet x 4.5	Bioeng	12,000	75	Yes
	Upstream of No Trespass Park, south side	100 feet x 5.5 feet	Skyhooks	15,000	150	Yes
	Upstream of No Trespass Park, N side	160 feet x 5 feet	Bioeng	12,000	75	Yes
	Upstream of No Trespass Park, south side	80 feet x 6 feet	Skyhooks	10,000	150	Yes
	50 yds from west side West Steel, north side	40 feet x 5 feet	Bioeng	3,000	75	Yes
	Opposite side of above	160 feet x 4 feet	Bioeng	12,000	75	No
	Below West Steel tributary, south side	100 feet x 4 feet	Bioeng	7,500	75	No
	Opposite side of above	40 feet x 4 feet	Bioeng	3,000	75	No
	Immediately below above, south side	120 feet x 5 feet	Bioeng	9,000	75	Yes
	Just below above, north side	100 feet x 6 feet	Skyhooks	15,000	150	Yes
	Down from above, blockage			2,000		No
B11	Highly eroded, but good slope for restrictor or disperser at railroad bridge			25,000		
B12	Mildly eroded - low priority					
	Total Cost			$1,736,375		

TABLE C-7: STREAM CORRIDOR RESTORATION METHODS
(DIAGRAMS OF THESE FOUR STRUCTURES APPEAR IN APPENDIX G)

Method	Description	Cost Factors	Comments
Bioengineered Banks	Vertical eroded banks are sloped back to about 45 degrees. Banks planted with natural and native materials including shrubs.	$75 per foot linear installation less than 6 feet high; $100 per foot greater than 6 feet. $5 per foot per every 2nd year for modifications	Used on relatively straight banks with minimal flow force. As force increases boulders and larger stones can be placed at the toe or base of the bank.
Rip Rap	The placement of 6 inches to 12 inches rock on banks to dissipate energy away from the banks	$75 per linear foot and $5 per foot per every 2nd year for modifications	Used on banks of smaller tributaries that are intermittent streams or which do not support fish communities. Also used on some main stem banks that receive high energy impacts that biovegetation could not sustain.
Vanes	Placement of boulders in the stream to direct the energy of stream flow into the center of the channel and to help create pools in which fish can congregate. "W" vanes used in small width streams, J vanes used in larger streams.	$ 75-$100 per linear foot of channel covered by the most upstream point to the lowest stream point with $5 annual cost per every 2nd year for modifications.	Could be used alone or in conjunction with rip rap or biovegetated banks.
Skyhooks	Combinations of poles, logs, rocks and posts to deflect water against the banks and to create cover for fish	$150 per linear foot plus $10 per foot per every 2nd year for modifications	Used at sharp bends in streams that receive much energy from stream flow.

APPENDIX D:
PROJECT APPLICATION AND EVALUATION CRITERIA

The Trustee Council has four implementation mechanisms for the various projects.

- Initiation by the Pennsylvania Fish and Boat Commission and Valley Forge National Historical Park (any project)
- Application by a community organization for a project or set of projects within the watershed (any project)
- Application by an individual for a project on their own property (any project relevant to the applicant's property)
- Acceptance of requests from the Open Land Conservancy to make payment for the cost of easements on small properties and the creation of buffered streams on any size property

The Trustee Council and its staff will use the list of projects to initiate projects in Valley Creek. The Trustee Council will also receive applications from community organizations and individuals anytime during a given year. The applications should be sent to either;

Fisheries Biologist PA Fish & Boat Commission 450 Robinson Lane Bellefonte, PA 16823-9620 814-359-5116	or	Natural Resources Specialist Valley Forge National Historical Park PO Box 953 Valley Forge, PA 19482 610-296-2583

Applications for projects will be accepted anytime and subjected to the evaluation and scoring system described below. Decisions on applications will be made in 90 days or less from receipt. Applicants for stream corridor restoration projects are encouraged to join with their neighbors in certain reaches of the stream for projects that tackle the entire reach. The Trustee Council wants to avoid multiple accesses or crossings of properties to perform work in certain areas.

In an effort to leverage the monies available in the Restoration Fund, the Trustee Council will give greater scores to those applications that can use the fund monies as a qualifying match for other environmental restoration funding programs. In the project scoring described below, the total funds for a project (including those from the Restoration Fund and those from another funding source) will be divided by the benefits. The more funds that can be obtained, the higher the project score.

The Trustee Council defines the selection of LID projects as "passive" in that the Council will not go door-to-door to promote them, but will make the option known through this document, a pamphlet that is distributed through local municipalities and watershed groups, a news release, and through public meetings by the Council. The Council will accept applications anytime in the format of the applicant's choice. The application needs to contain the following information

- the property owner
- the applicant
- property location

- existing stormwater management practices
- proposed low impact development (LID) technology
- estimated cost
- soils group on site
- estimated infiltration

EVALUATION PROCESS

EVALUATION SYSTEM FOR RESTORATION PROJECTS

The following system will be employed by the Trustee Council to evaluate specific projects for adoption into the Plan. Projects can be proposed anytime by; agencies, any community organization or individual person, local governments and Trustee Council staff.

Projects will first be screened by the Trustee Council to determine whether they qualify for further evaluation or should be denied or returned for more work to the person or organization who wrote the project description. Next, the project has to satisfy four threshold criteria. Projects that do not satisfy any one of the four criteria listed below will be returned to the applicant for further development. Projects not screened out and that satisfy the threshold criteria will be scored and ranked.

Screening (yes or no):

- Is the information available for the project complete enough to decide?
- Is there enough incentive for this project to be done without the Restoration Fund?
- Is the project an activity that is the responsibility of a regulatory agency or the regulated community? e.g., a party that is under legal obligation to reduce pollution.

Threshold Criteria (yes or no):

- Technical feasibility. Is the project technically sound taking into account the level of uncertainty or risk and experience in implementing the project?
- Is the project consistent with restoring lost uses of Valley Creek's resources?
- Does the proposed project comply with all applicable laws?
- Does the proposed project pose a threat to the health and safety of the public?

Scoring (Points):

- (Where variable points can be given, higher numbers mean higher value)
- Does the project fall into one of the pre-designated categories, i.e., greenways, stream corridor improvements, stormwater management, Crabby Creek stocking, and public access? (Yes, add 2 points)
- What is the likelihood of success for the project? (3, 2, or 1 points)

- Will successful completion of this project encourage other landowners to follow suit? (4, 3, 2, or 1 points)
- Ease of monitoring project results (2, 1, or 0 points)
- Ease of maintenance required over time (4, 2, or 0 points)
- Positive educational benefit to the community (2, 1, or 0 points)
- How does this project rate for restoring, replacing, and/or acquiring natural resources of Valley Creek watershed? (see scoring system below)

1. Quantity of permanent increased recreational use, e.g., fishing, hiking, recreation, including existing user increases in satisfaction (see a and c below)

2. Quantity of permanent ecological improvement of the watershed (see b)

   - Reduced stormwater runoff
   - Increased infiltration
   - Riparian enhancement for aquatic life (e.g., wetlands, forested buffers)
   - Streambank stabilization

3. Quantity of permanent instream habitat improvement (see b)

   - Improved spawning areas
   - Improved cover
   - Reduced sediment
   - Improved insect population

     a. Number of increased user days per year anywhere in the watershed (5, 4, 3, 2, or 1 points)

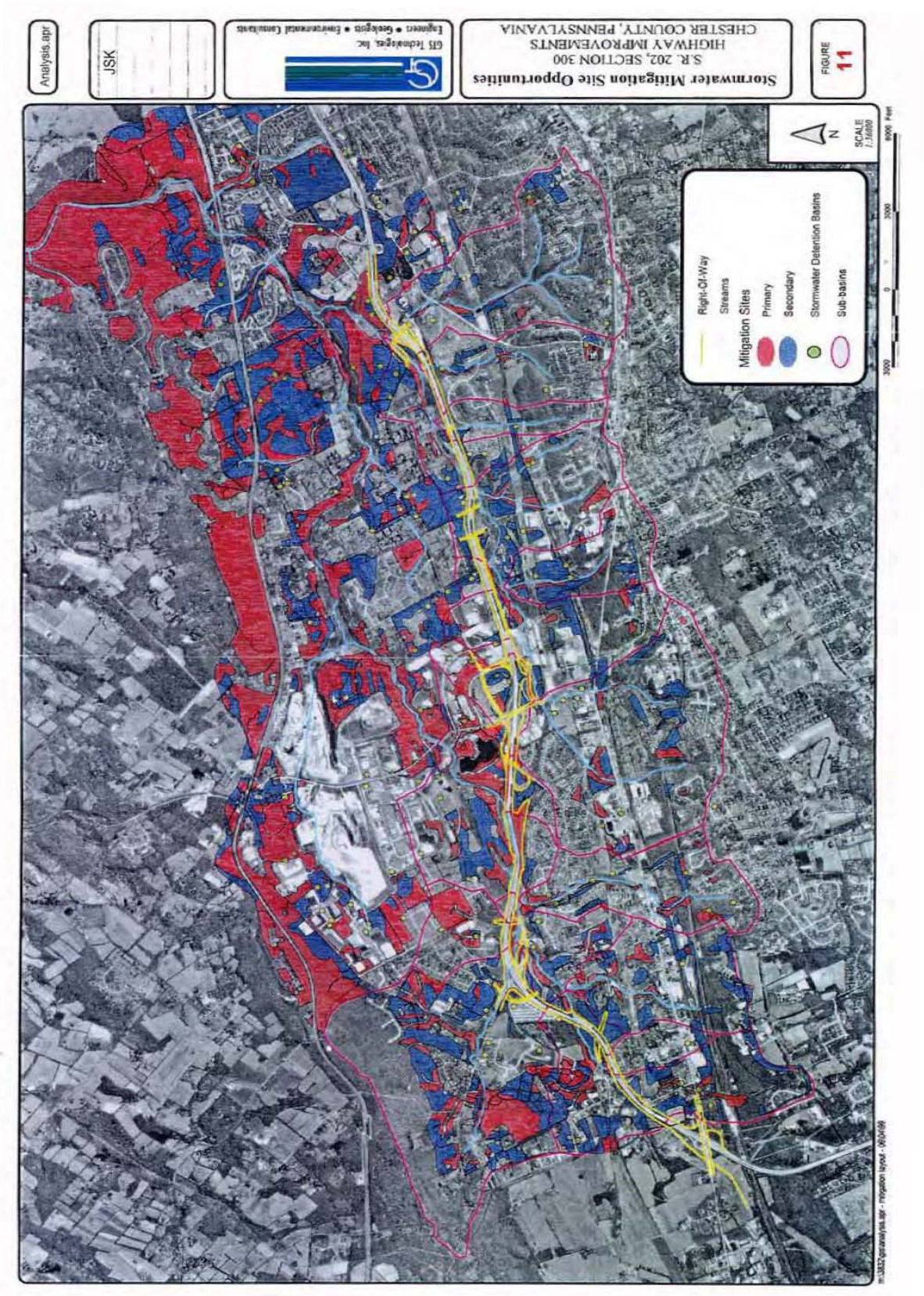
     b. Physical and biological improvement (5, 4, 3, 2, or 1 points)

     c. Value of experience enhancement (3, 2, or 1 points)

Add all points per project and divide into the net Fund dollars required for the project plus matching money available. Equivalent projects that are eligible for outside/matching funds will rank higher than those that do not.

At the end of the process, the rankings will be divided into three categories of preference; high, moderate, low. This reflects the overall uncertainties in the process and the imprecision of the above quantitative system.

APPENDIX E:
STORMWATER MITIGATION SITE OPPORTUNITIES



APPENDIX F: LETTER FROM CHESTER VALLEY GOLF CLUB

Patricia Imperato
213 Lenape Dr.
Berwyn, PA 19312
5-31-02

Charles Marshall
Trustee Council
Valley Creek Watershed
Valley Forge National Historical Park
P.O. Box 953
Valley Forge, PA 19482-0953

Dear Mr. Marshall;

The Valley Forge Chapter of Trout Unlimited applied for a PADEP Growing Greener Grant in year 2001 in the amount of $126,754 to manage urban Runoff in an Un-named Tributary to Little Valley Creek in East Whiteland Township, Chester County. The goals of the grant application were to do stream bank restoration and stabilization and recharge of storm water (Phase I) as a supplement to a larger project (Phase II) to be undertaken by the Chester Valley Golf Club (costing almost $400,00) which includes a stream bank restoration and stabilization and pond reduction project through their property.

The DEP awarded Trout Unlimited part of the application (Grant Project # SE10547 - $77,000) to do the stream bank restoration and stabilization project in an upper watershed area that was upstream of the Golf Club property. The part of the project for $49,754 to recharge storm water from an urban commercial area along Route 30 in Frazer (grandfathered from responsibility for storm water management) was not funded.

I am requesting your assistance in securing $49,754 to do the storm water recharge part of the Phase I project

The Golf Club membership has voted to fund Phase II of the project. The Golf Club has retained Matt Houtman, P.E.of Houtman & Sons Engineering in Media to execute the project. Classic Golf of Glenmore will be the construction contractor. Construction on the funded part of Phase I will begin in the summer of 2002.

Phase II, to be funded by the Golf Club, will implemented over 3 years. When completed, the effect will be reduced sediment and cooler water flowing into Valley Creek. The Golf Club currently uses best management practices for managing turf and is part of the Audubon bird sanctuary program. In addition, the Golf Club will be presenting a case study on the stream bank restoration project for the public and for other golf course managers in the area as part of the

Growing Greener Grant. They would be delighted to incorporate any work done on ground water recharge if this grant application is successful.

The engineer Matt Houtman estimates the recharge project will affect 7-8 acre-feet of area annually.

Attached are

A. The original Growing Greener Project Application (includes description of Phase II work to be done by Chester Valley Golf Club)
B. Letter from DEP granting $77,000
C. Original project budget worksheet for Phase I and revised worksheet to reflect partial funding of project; a materials and time bid from Classic Golf.
D. Pennsylvania Natural Diversity Inventory (PNDI) clearance by PA Fish and Boat, US Fish and Wildlife, and PADEP clearance on impact for plant and natural communities

I suggest funding be passed through the Valley Forge Chapter of Trout Unlimited (a 501 c3 organization) since they were the sponsors of the Phase I Growing Greener grant application to DEP.

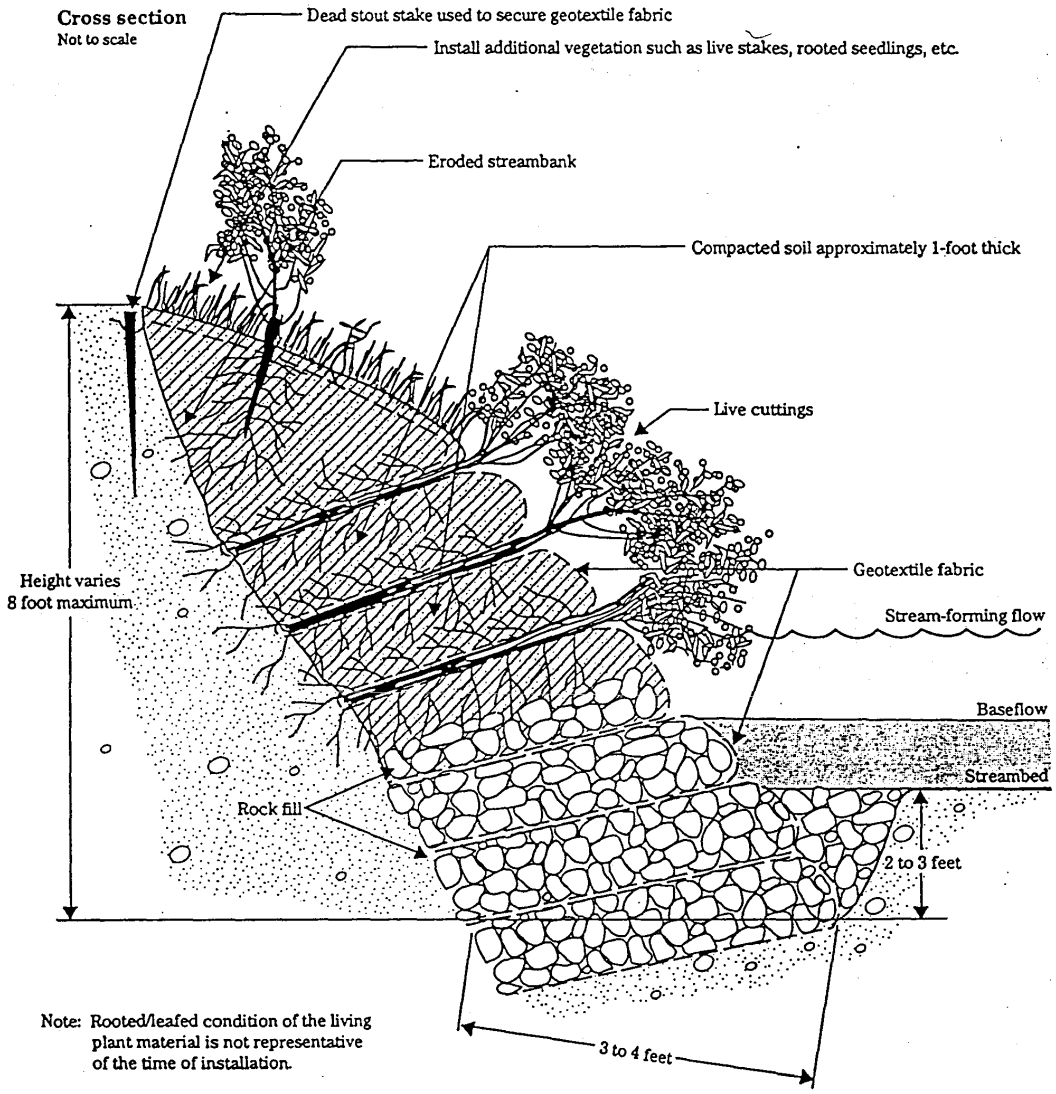
If you have any questions, please direct them to me at my office at 610-353-1555 x 221. My role in the project has been as a pro bono facilitator to get better storm water management accomplished in the Valley Creek Watershed.

Thank you for your consideration.

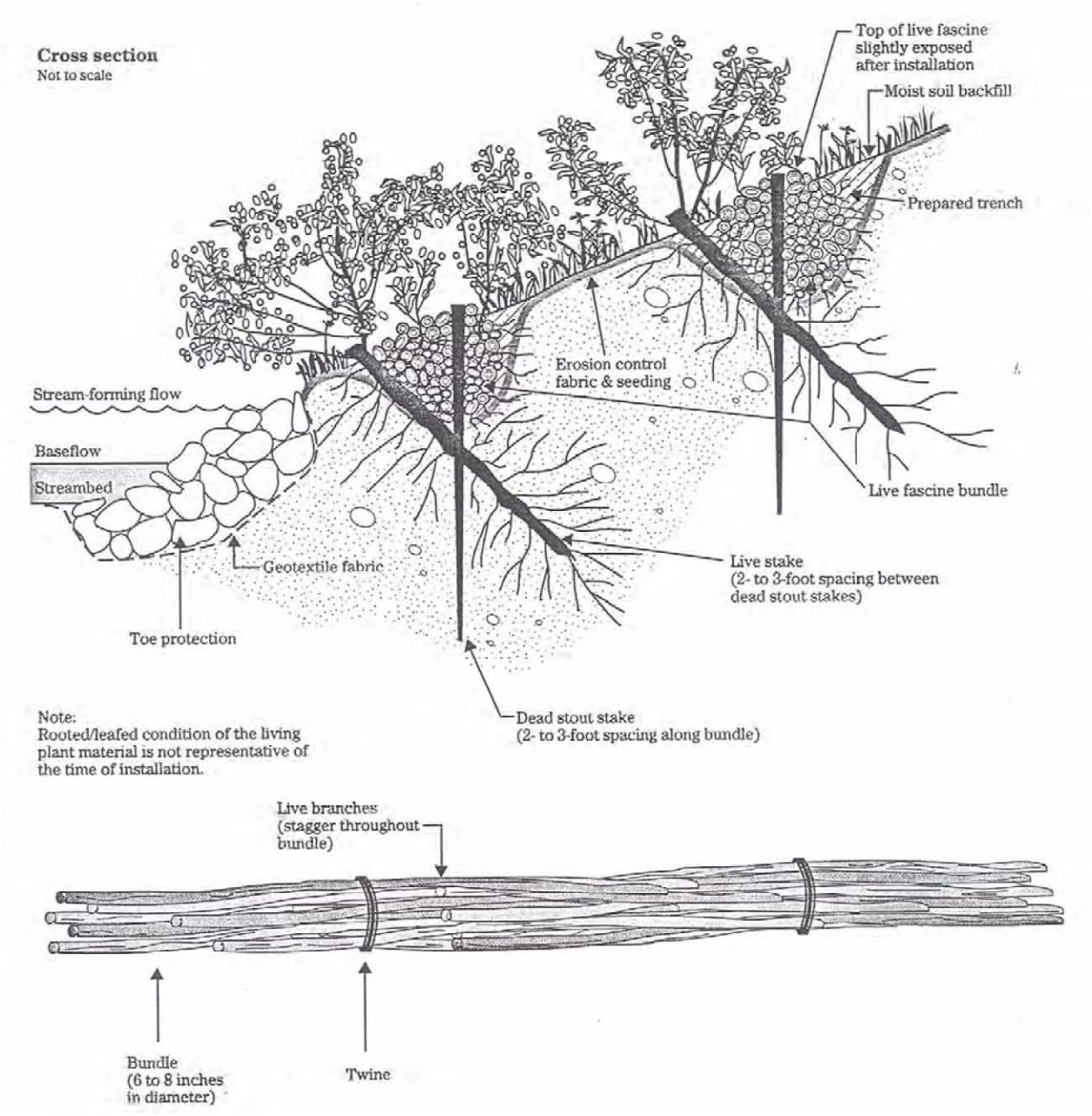
Patricia S. Imperato

cc. Mr. Carl Dusinberre, Trout Unlimited
Mr. Mike Civitello, President of Chester Valley Golf Course
Mr. Scott Ussia, General Manager of Chester Valley Golf Course

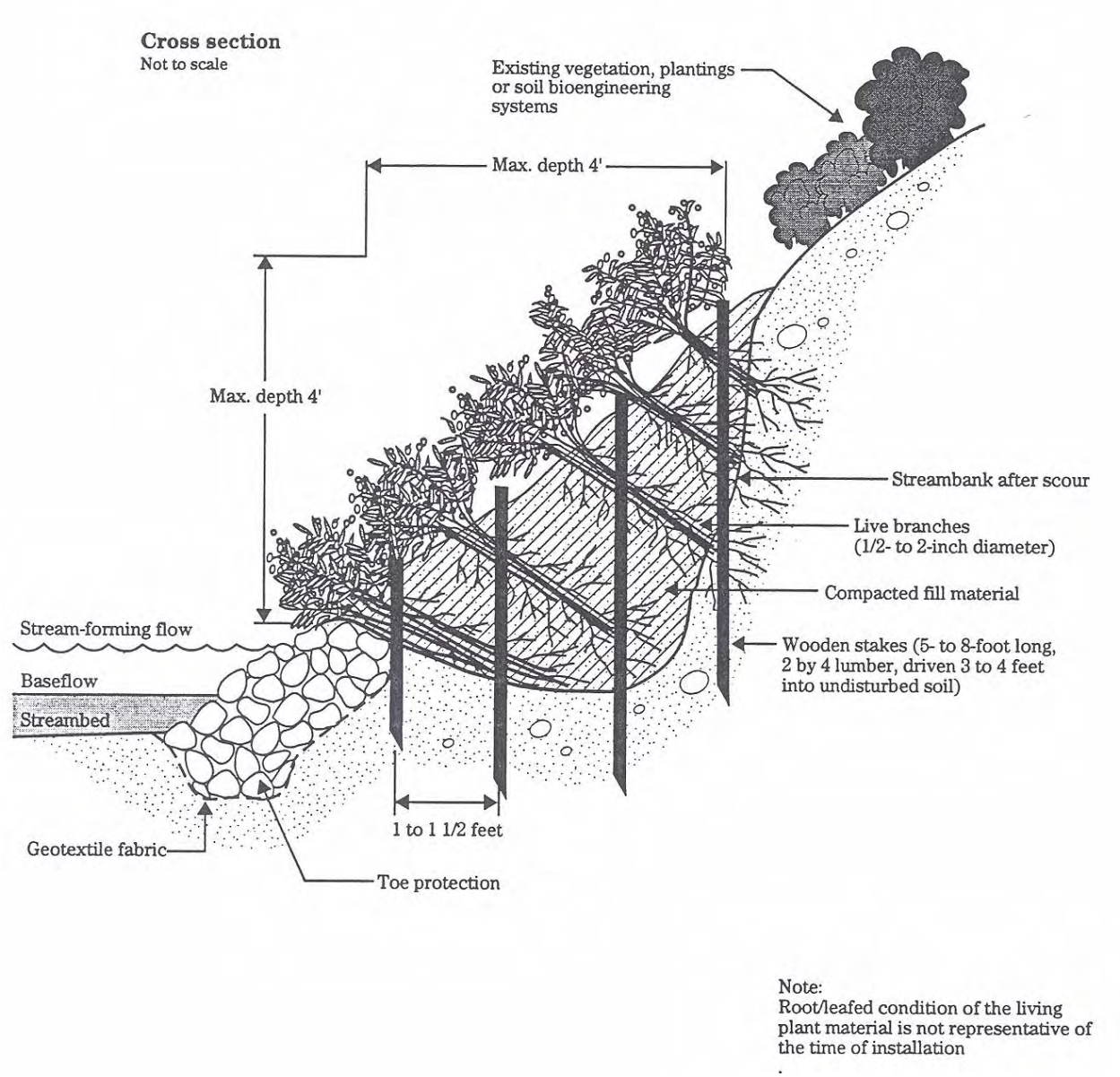
APPENDIX G: DIAGRAMS OF STREAM CHANNEL STABILIZATION METHODS



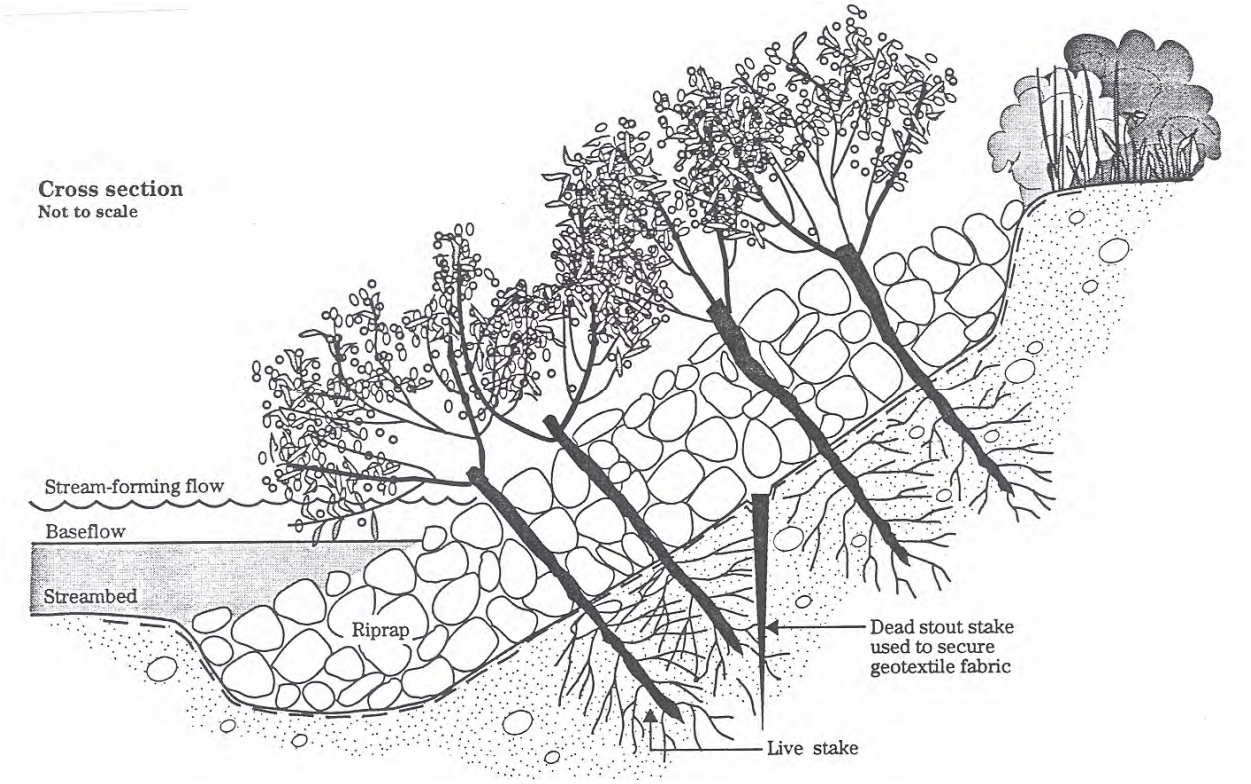
Vegetated Reinforced Soil Slope



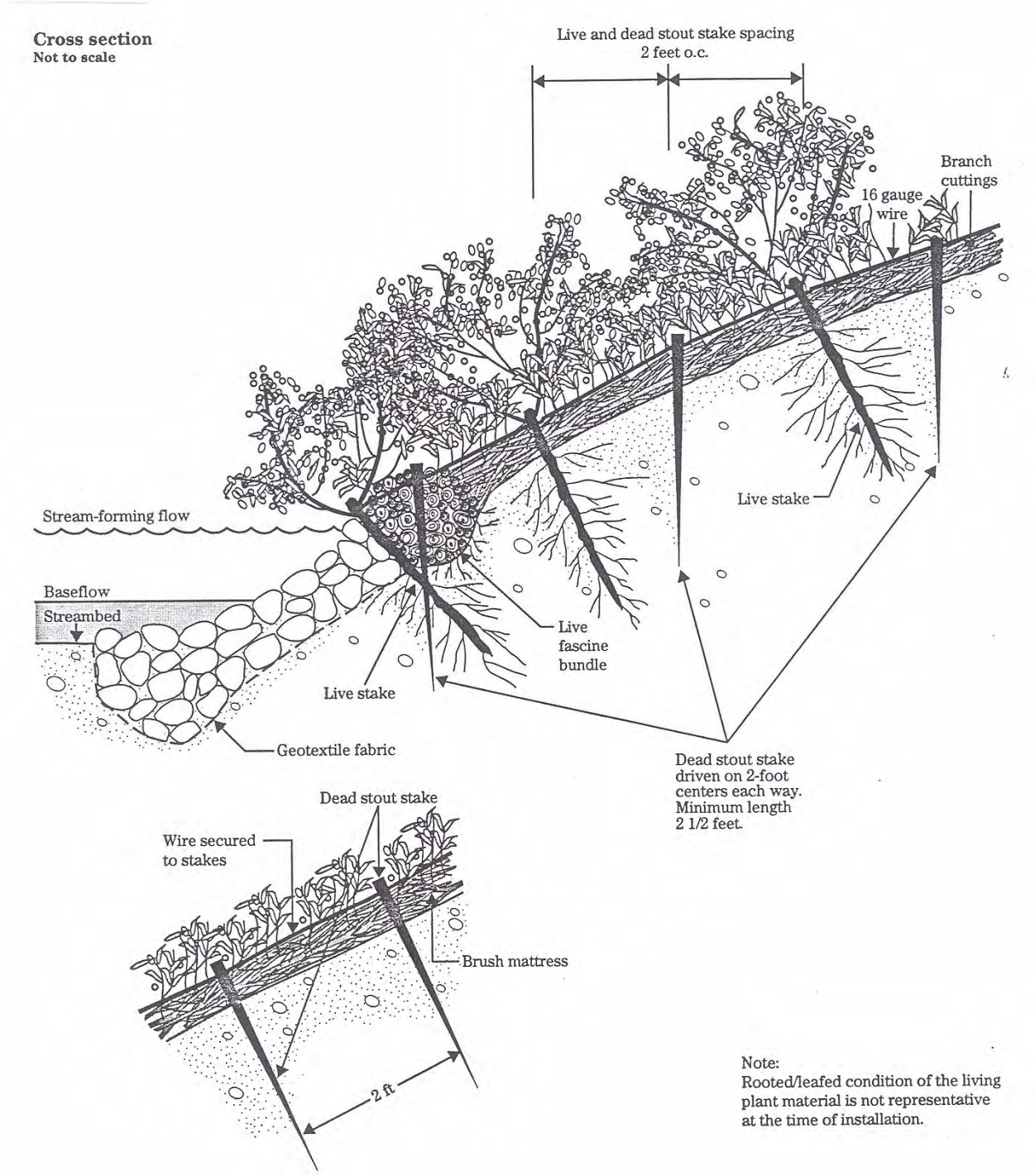
Live Fascine Details



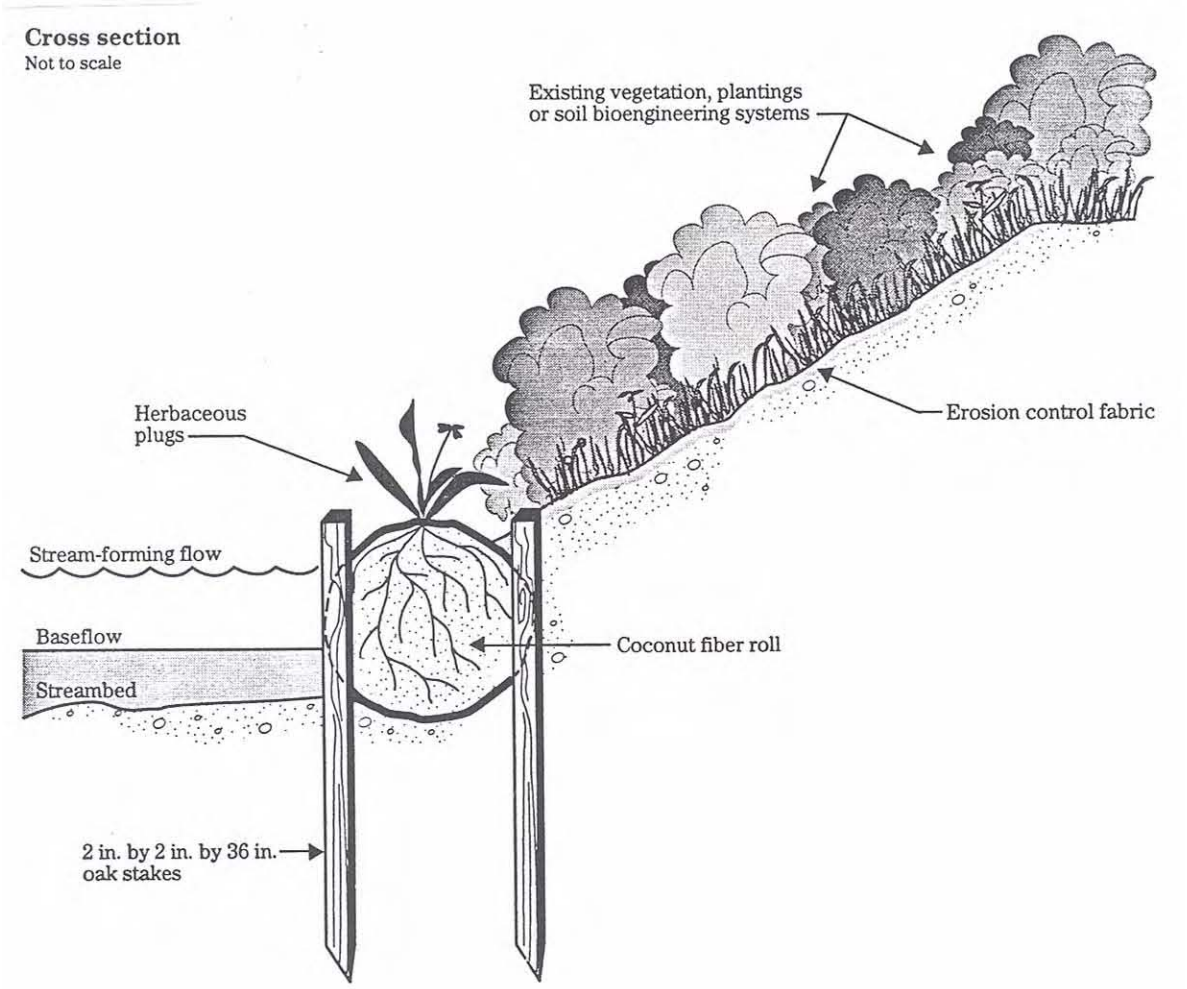
Branchpacking Details



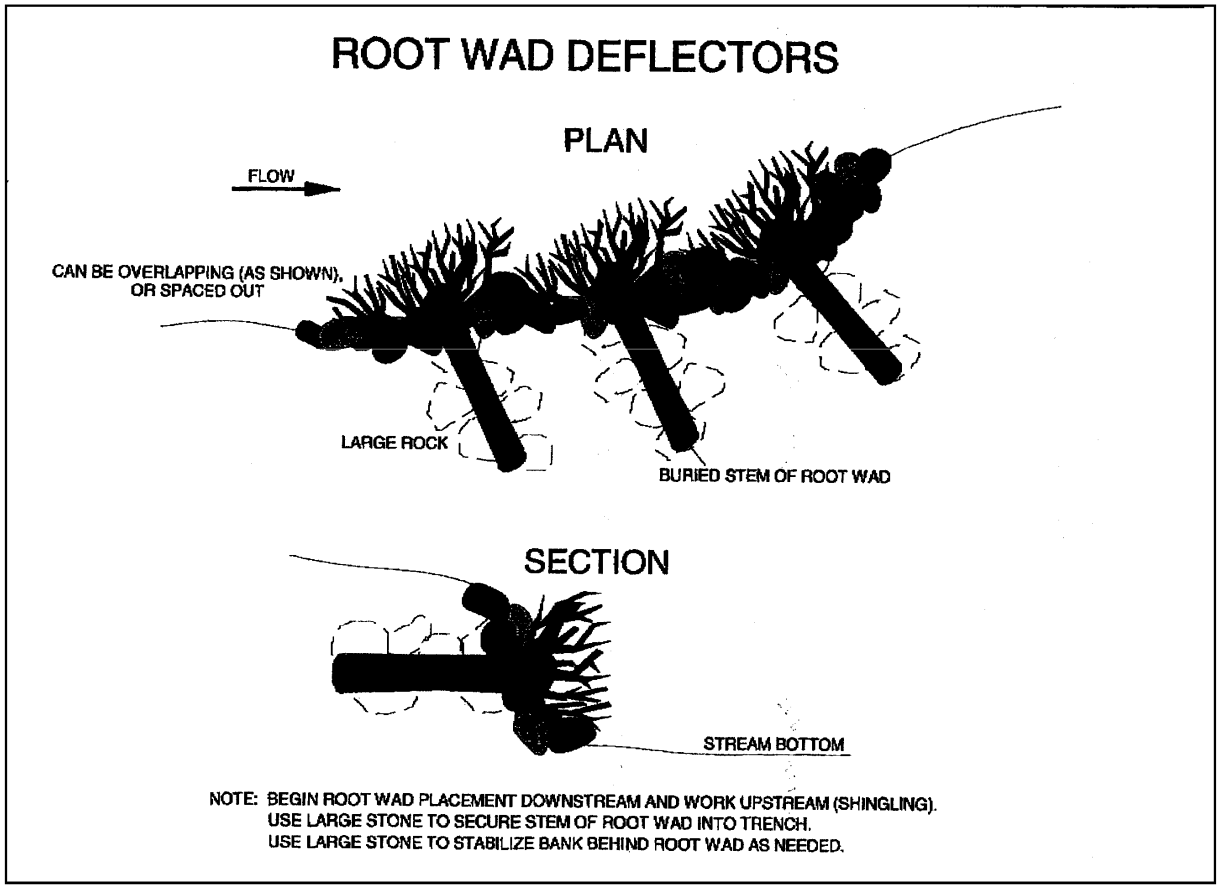
Joint Planting Details

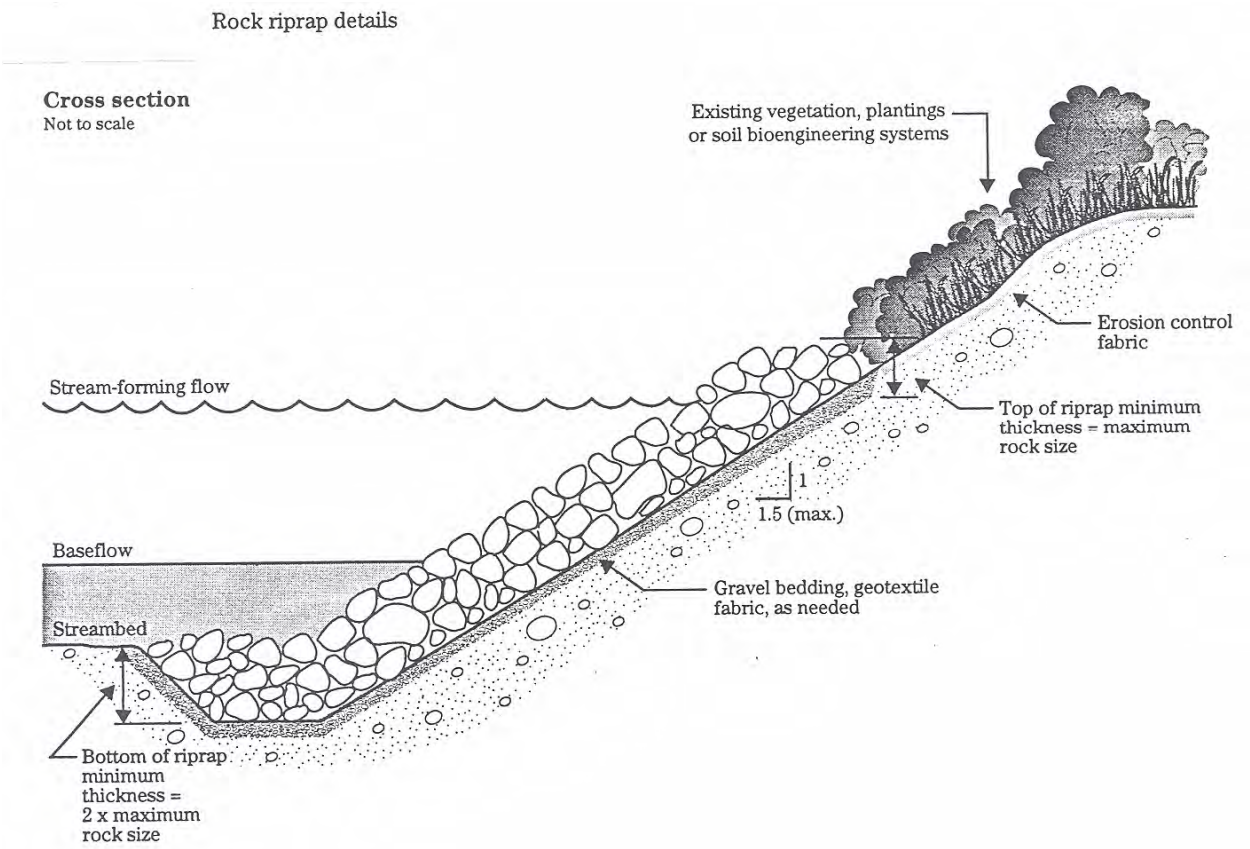


Brushmattress Details

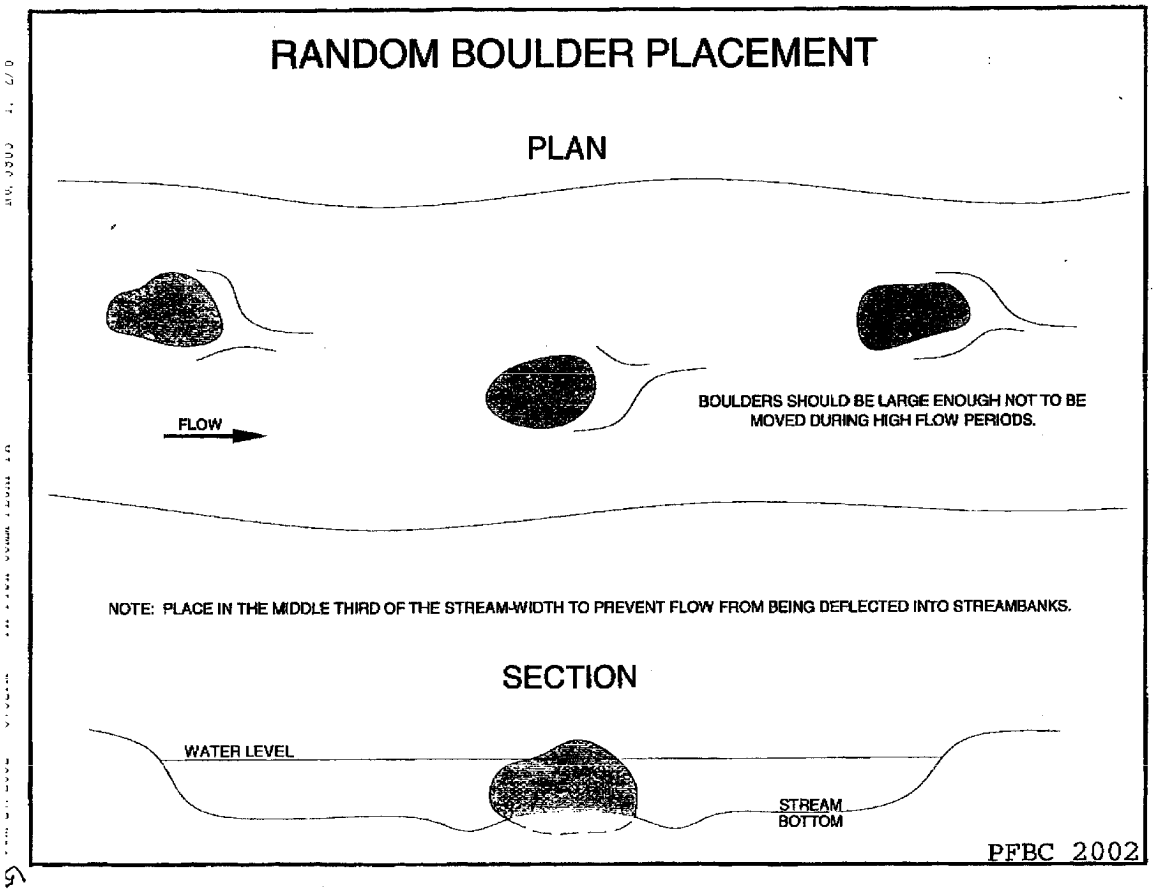


Coconut Fiber Roll Details

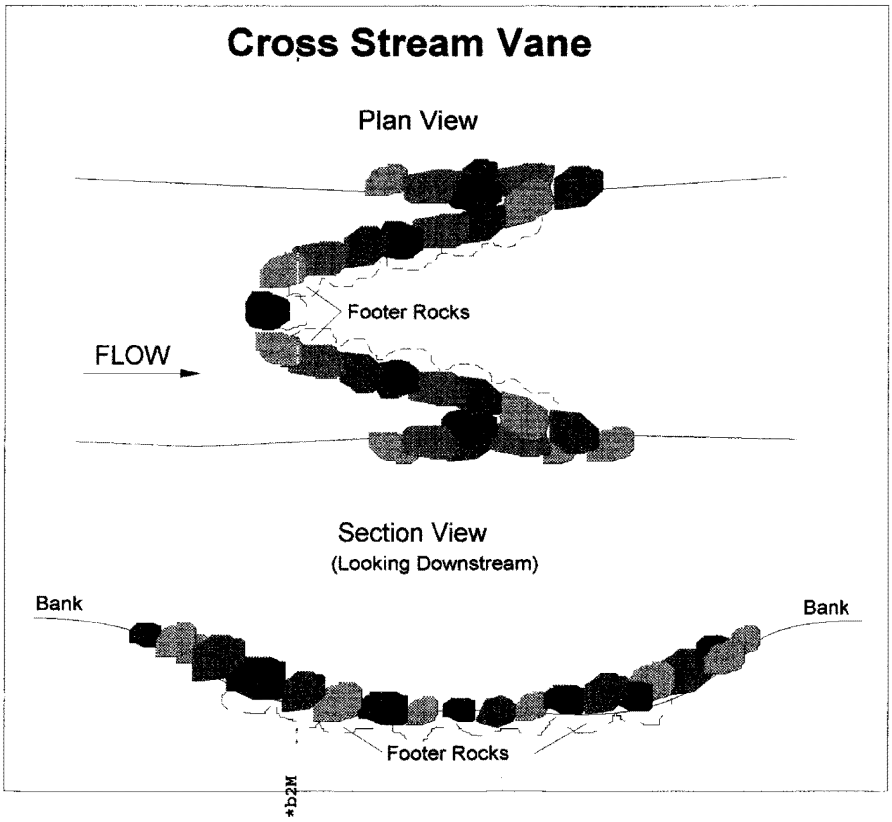

ROOT WAD DEFLECTORS
PLAN
FLOW
CAN BE OVERLAPPING (AS SHOWN),
OR SPACED OUT
LARGE ROCK
BURIED STEM OF ROOT WAD
SECTION
STREAM BOTTOM
NOTE: BEGIN ROOT WAD PLACEMENT DOWNSTREAM AND WORK UPSTREAM (SHINGLING).
USE LARGE STONE TO SECURE STEM OF ROOT WAD INTO TRENCH.
USE LARGE STONE TO STABILIZE BANK BEHIND ROOT WAD AS NEEDED.



Rock Riprap Details

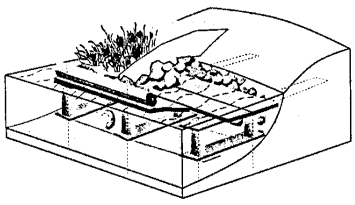

RANDOM BOULDER PLACEMENT
PLAN
FLOW
BOULDERS SHOULD BE LARGE ENOUGH NOT TO BE MOVED DURING HIGH FLOW PERIODS.
NOTE: PLACE IN THE MIDDLE THIRD OF THE STREAM-WIDTH TO PREVENT FLOW FROM BEING DEFLECTED INTO STREAMBANKS.
SECTION
WATER LEVEL
STREAM BOTTOM
PFBC 2002

-



Skyhook/

Lunker Structures



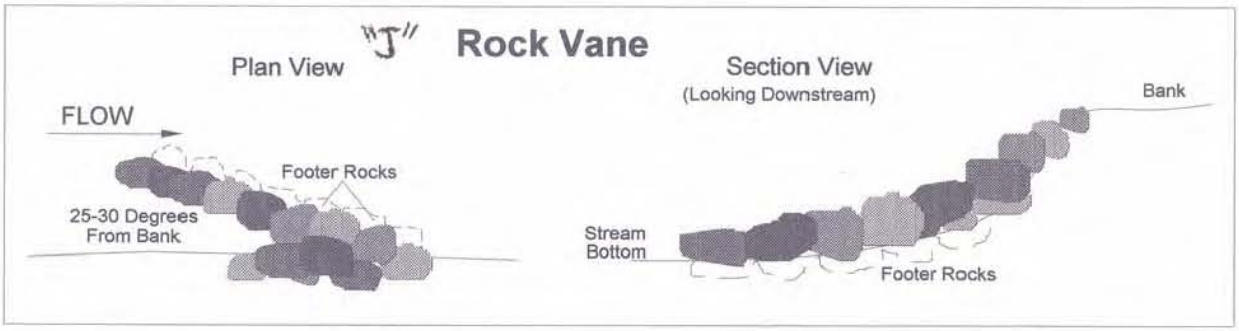
Cells constructed of heavy wooden planks and blocks which are imbedded into the toe of streambanks at channel bed level to provide covered compartments for fish shelter, habitat, and prevention of streambank erosion.

Applications and Effectiveness

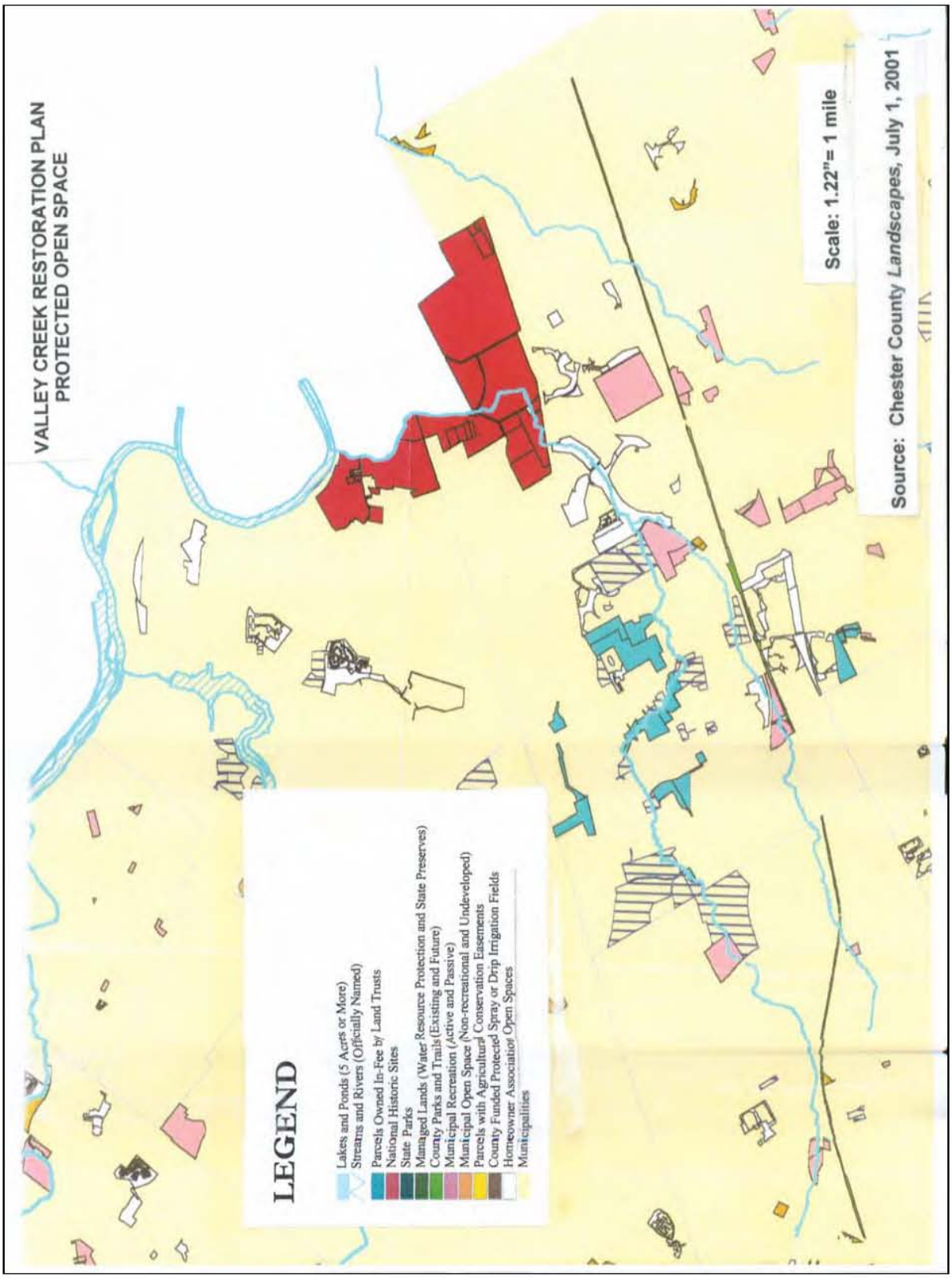
- Appropriate along outside bends of streams where water depths can be maintained at or above the top of the structure.
- Suited to streams where fish habitat deficiencies exist.
- Should, where appropriate, be used with soil bioengineering systems and vegetative plantings to stabilize the upper bank and ensure a regenerative source of streambank vegetation.
- Are often used in conjunction with wing deflectors and weirs to direct and manipulate flows.
- Are not recommended for streams with heavy bed material loads.
- Most commonly used in streams with gravel-cobble beds.
- Heavy equipment may be necessary for excavating and installing the materials.
- Can be expensive.

For More Information

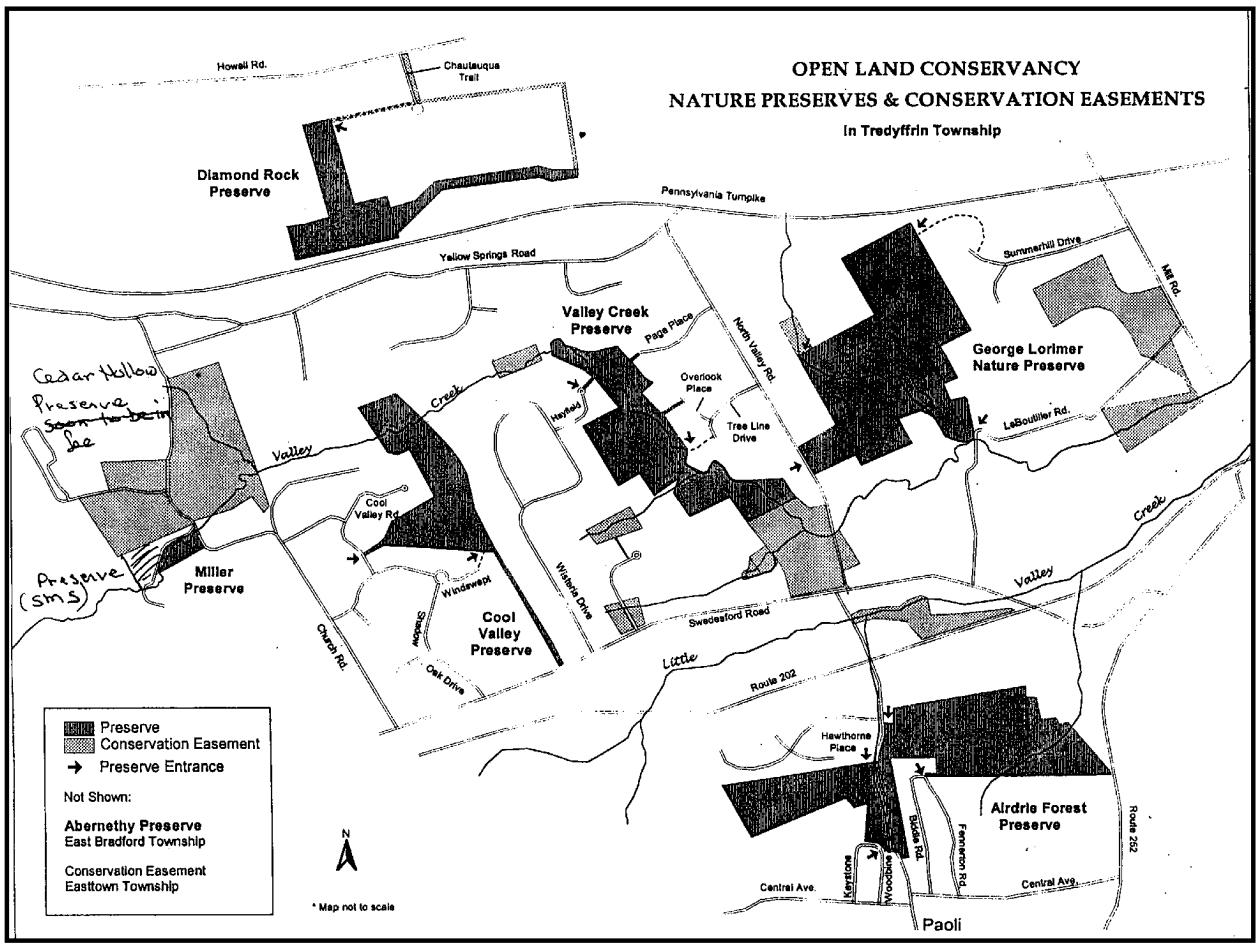
- Consult the following references: Nos. 10, 60, 65, 85.


"J" Rock Vane
Plan View
FLOW
Footer Rocks
25-30 Degrees
From Bank
Section View
(Looking Downstream)
Bank
Stream
Bottom
Footer Rocks

APPENDIX H: PROTECTED OPEN SPACE



APPENDIX I: OPEN LAND CONSERVANCY'S NATURE PRESERVES AND CONSERVATION EASEMENTS



APPENDIX J: TREDYFFRIN TOWNSHIP LETTER

BOARD OF SUPERVISORS
TREDYFFRIN TOWNSHIP

Supervisors:
John G. Bravacos, *Chairman*
Robert W. Lamina, *Vice Chairman*
Bill DeHaven
Judy L. DiFilippo
E. Brooks Keffer
Trish G. Kreek
Paul W. Olson

CHESTER COUNTY
1100 DuPortail Road
Berwyn, PA 19312-1079

(610) 644-1400 FAX (610) 993-9186
Email: tredyffrin@tredyffrin.org
Website: www.tredyffrin.org

Joseph A. Janasik
Township Manager

William H. Lamb
Solicitor

July 26, 2002

Trustee Council, Valley Creek Restoration
c/o Brian Lambert
Valley Forge National Historical Park
P.O. Box 953
Valley Forge, PA 19482

RE: Acquisition of West Swedesford Road Tract ("Angler Park")

Dear Mr. Lambert,

Enclosed is Tredyffrin Township's proposal requesting support from the Valley Creek Restoration Fund Trustee Council for its acquisition and development project at 1374 West Swedesford Road.

I would like to sincerely thank you for consideration of this project in your Restoration Plan and I hope as you review this proposal that you are as excited about it as I am. This property is in imminent danger of development; twelve single-family homes are slated for construction if the Township cannot purchase it. The Township has applied for an acquisition grant from Chester County and will seek out partnerships with the Department of Conservation and Natural Resources, PennDOT and other entities to ensure that the valuable resources on this property are protected and preserved. We hope we can add you to the partnership that will ensure another segment of the Valley Creek watershed is permanently protected from development.

We are currently working on a site plan for the property that will include a path and parking for fishing access and an analysis of the property's ability to infiltrate run-off from Route 202, thereby preventing it from draining into Valley Creek. As soon as the site plan and analysis are complete, we will forward it to you.

Thank you again for your consideration of this project in the Valley Creek Restoration Plan. If you have any questions, or would like to arrange a site visit of the property, please give me a call.

Sincerely,

Joseph A. Janasik

APPENDIX K: REQUIREMENTS OF THE PENNSYLVANIA BUREAU FOR HISTORIC PRESERVATION

Prior to implementing any project the Trustee Council will submit an overall plan to the Pennsylvania Bureau for Historic Preservation (PBHP) outlining a program for complying with federal and state regulations for assuring that historic objects are considered before land disturbance occurs on any project. The chance of encountering historic objects in Valley Creek watershed is high. Over 100 historic structures have been registered with the PBHP and archeological sites are also present.

The plan to be submitted to PBHP will first state that a project on a registered archaeological or historic site will have a Phase I survey performed to assess the presence of qualifying objects. A survey would consist of spade diggings of 20 inches deep at every 5 meters in a grid fashion. For non-registered sites the Phase I survey would also consist of a grid application of spade diggings but at up to 15 meters apart.

Should Phase I results indicate the presence of objects, Phase II would consist of complete delineation of the area by extending the grid to points where no more objects are being found. Phase III would consist of another plan that preserves or mitigates damage to the objects. The mere presence of a single object may not require Phases II or III. The PBHP would have to make a ruling that the objects found are likely to contribute to understanding of history.

Because the Council's activities are federal, the requirements of the PBHP cover all projects. However, a generic plan can be agreed to by the PBHP that separates areas of high and low probability of finding objects. Low probability areas would consist of new banks on streams where old maps showed that changes in meanders created those banks, existing basins that are going to be retrofitted, and fields that have been heavily disturbed in the past by farming or other activities. All other types of activities would be placed in the high probability category and a Phase I survey would have to be completed.

The Trustee Council could address historic sites, new or already registered, by (1) avoiding the site, (2) completing Phases II and III, or (3) re-designing the project. For example, a stream corridor stabilization project that called for banks to be cutback could be modified to another restoration method. As another example, an LSI project could be moved to another tract where a Phase I survey would still be required but might not find objects.

The Trustee Council would need to be mindful that new objects found are the property of the landowner. Prior to undertaking a historical or archaeological survey the Council and the landowner would have to agree as to whether or not ownership stays with the landowner or is gifted to Pennsylvania.

Finally, all historic survey costs would be the responsibility of the Restoration Fund unless a cost-sharing program could be established with landowners where objects are found and the owners decide to keep the objects.

APPENDIX L: DRAFT AGREEMENT RESTORATION PLAN INCENTIVE OFFER TO OPEN LAND CONSERVANCY

Background: The Trustee Council consists of the Superintendent of Valley Forge National Historical Park and the Chief, Environmental Services Division, of the PA Fish & Boat Commission. Under the terms of a settlement with three of the rail companies that discharged PCBs to Valley Creek and paid $850,000 into a Valley Creek Restoration Fund, a plan must be developed to present to the public how the Council intends to restore the damaged resources. The purpose of restoration efforts, as decided by the Council, is to restore stream corridors of Valley Creek watershed, infiltrate stormwater, and implement land use measures to prevent sediment and stormwater from entering Valley Creek.

The Incentive for Open Land Conservancy (OLC): As part of its land use objectives, the Trustee Council wishes to increase the use of buffers along the streams of Valley Creek. To help achieve long-term existence of those buffers, the Council would like to encourage landowners along Valley Creek and major tributaries to enter into easements for this and other non-development purposes. The incentive being offered herein is to pay up to $3,000 for the easement transaction costs to owners of lots. In return, the owners must agree to maintain a permanent buffer along Valley Creek or one of its major tributaries. The buffer must start at the edge of the streambank and be 50 feet wide and can consist of trees and shrubs mixed with tall grasses.

To Apply: The OLC will administer the easement process and the coverage of the expenses up to $3,000. The OLC will bill the Trustee Council for its expenditures under this program, including easement costs paid, and a one-time inspection fee of $250 per site. OLC would develop the easements with property owners using the OLC's regular procedures. In subsequent years OLC can request monies for inspections and for legal costs necessary to handle enforcement problems related to the buffer zone. These monies would be made available by the Trustee Council as long as there are monies in the Restoration Fund. A landscape plan for installing the buffer, including species type and number, a maintenance plan, and, if needed, a method for protecting plants from deer would be submitted to the Trustee Council for approval.

Cost of the Buffer: The cost of plantings of trees and shrubs, including deer protection, to form the buffer would also be paid for by the Trustee Council. The OLC would administer the approval of the buffer plan and submit the cost estimate for the work. The Trustee Council would cut a check payable to the OLC. Costs to replace trees or shrubs and eliminate invasive plants would be paid for by the Trustee Council for the first four years after the buffer is installed.

Cost of Launching the Program: The Trustee Council will also pay $600 to the OLC to hold 2 meetings with landowners in the watershed. These meetings will enable the OLC and a Trustee Council representative to explain the program to landowners and to answer questions. The Council's payment will help the OLC develop a flyer, invite landowners, develop handouts and presentation material and to serve refreshments.

APPENDIX M: BRILLOUIN'S DIVERSITY INDEX

Brillouin's Index for Little Valley Creek

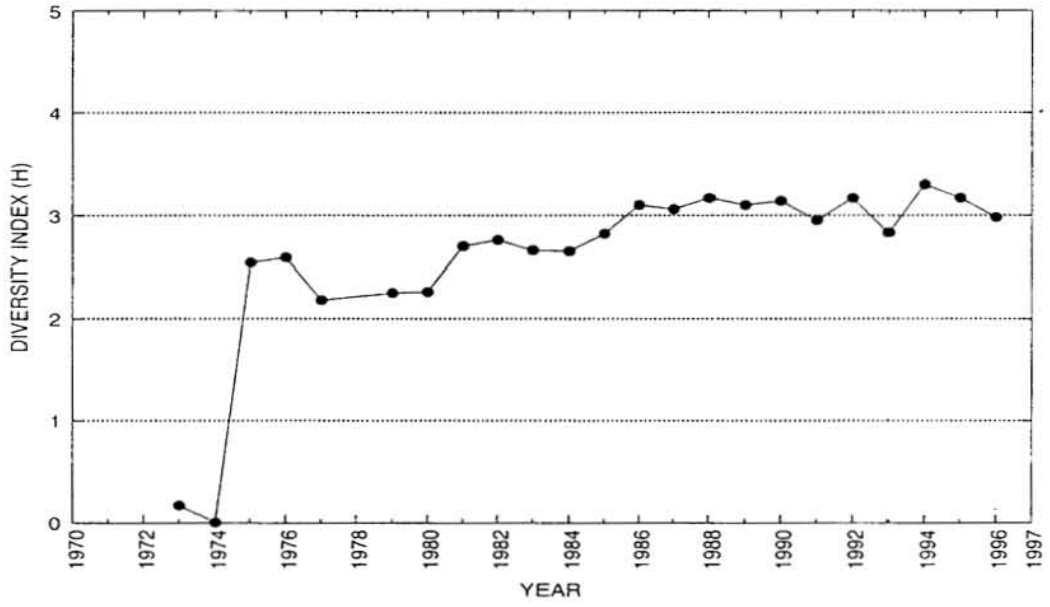
Source: USGS (Disregard Table Number in upper left corner)

Table 6. Brillouin's diversity index, maximum diversity, minimum diversity, and relative evenness by site—Continued

[—, no data]

01473167 (Site 49) - Little Valley Creek at Howellville, Pa.

Year	Total organisms	Total taxa	Brillouin's diversity index (H)	Maximum diversity (H_{max})	Minimum diversity (H_{min})	Evenness (E)
1995	395	22	3.17	4.51	0.46	0.67
1996	113	16	2.98	3.68	.89	.75
1997	—	—	—	—	—	—



Brillouin's Index for Valley Creek

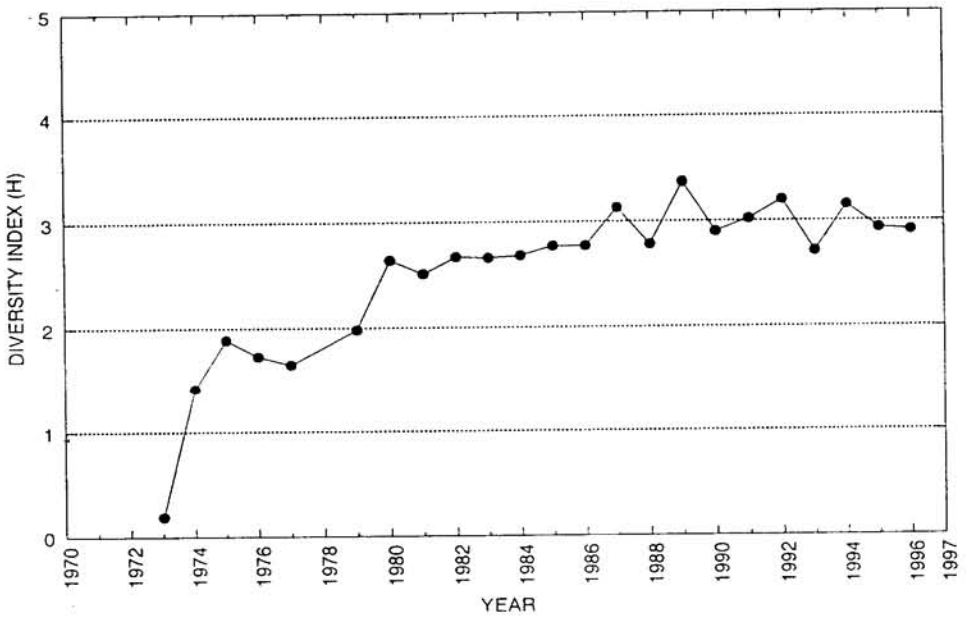
Source: USGS (Disregard Table Number in upper left corner)

Table 6. *Brillouin's diversity index, maximum diversity, minimum diversity, and relative evenness by site—Continued*

[—, no data]

01473168 (Site 50) - Valley Creek near Valley Forge, Pa.

Year	Total organisms	Total taxa	Brillouin's diversity index (H)	Maximum diversity (H_{max})	Minimum diversity (H_{min})	Evenness (E)
1995	1,032	18	2.93	4.14	0.16	0.70
1996	870	23	2.91	4.54	.25	.62
1997	—	—	—	—	—	—



APPENDIX N: U.S. FISH AND WILDLIFE LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

July 26, 2002

Chuck Marshall
Commonwealth of Pennsylvania
Pennsylvania Fish & Boat Commission
Valley Forge NHP
P.O. Box 953
Valley Forge, PA 19482

Dear Mr. Marshall:

This responds to your letter of July 10, 2002, requesting information about federally listed and proposed endangered and threatened species within the area affected by the proposed watershed restoration project (Valley Creek) located in Tredyffrin, East Whiteland, Schuylkill, Charlestown, Willistown, and Upper Merion Townships, and the Borough of Malvern, Chester and Montgomery Counties, Pennsylvania. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

The proposed project is within the known range of the bog turtle (*Clemmys muhlenbergii*), a species that is federally listed as threatened. The northern population of the bog turtle occurs in the States of Connecticut, New York, Pennsylvania, Maryland, New Jersey, Delaware and Massachusetts. Bog turtles inhabit shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures characterized by soft, muddy bottoms; clear, cool, slow-flowing water, often forming a network of rivulets; high humidity; and an open canopy. Bog turtles usually occur in small, discrete populations occupying suitable wetland habitat dispersed along a watershed. The occupied "intermediate successional stage" wetland habitat is usually a mosaic of micro-habitats ranging from dry pockets, to areas that are saturated with water, to areas that are periodically flooded. Some wetlands occupied by bog turtles are located in agricultural areas and are subject to grazing by livestock.

If any wetlands occur within or near the project area, their potential suitability as bog turtle habitat should be assessed, as described under "*Bog Turtle Habitat Survey*" (Phase 1 survey) of the enclosed *Guidelines for Bog Turtle Surveys*. This habitat survey could easily be conducted by a wetland biologist concurrent with a routine wetland identification and delineation. If any wetlands are identified as potential bog turtle habitat, efforts should be made to avoid any direct or indirect impacts to those wetlands. If adverse effects to these wetlands cannot be avoided, a more detailed and thorough survey will be necessary, as described under "*Bog Turtle Survey*" (Phase 2 survey) of the *Guidelines for Bog Turtle Surveys*. The Phase 2 survey should be conducted by a qualified biologist with bog turtle field survey experience (see enclosed list of

qualified surveyors). Survey results should be submitted to the Fish and Wildlife Service for review and concurrence. If project activities might adversely affect bog turtles, additional consultation with the Service will be required, pursuant to the Endangered Species Act.

This response relates only to endangered and threatened species under our jurisdiction based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Consequently, this letter is not to be construed as addressing potential Service concerns under the Fish and Wildlife Coordination Act or other authorities. A compilation of certain federal status species in Pennsylvania is enclosed for your information.

Please contact Michael Schmaus of my staff at 814-234-4090 if you have any questions or require further assistance regarding this matter.

Sincerely,

David Densmore
Supervisor

Enclosures

APPENDIX O: PENNSYLVANIA GAME COMMISSION LETTER

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA GAME COMMISSION
2001 ELMERTON AVENUE, HARRISBURG, PA 17110-9797

August 8, 2002

Mr. Chuck Marshall
Pennsylvania Fish and Boat Commission
Valley Forge NHP
PO Box 953
Valley Forge, PA 19482

In re: Valley Creek Watershed Restoration Project
Five Townships and Malvern Borough
In Chester County and Upper Merion Township
Montgomery County, PA

Dear Mr. Marshall:

This is in response to your letter of July 10, 2002, requesting information concerning endangered and threatened species of birds and mammals and impacts to State Game Lands as related to the proposed project.

Our office review has determined that no state listed endangered or threatened species of birds or mammals are known to occur within the proposed project area. Except for occasional transient individuals, this project should not impact any endangered or threatened species of birds or mammals recognized by the Pennsylvania Game Commission. Also, no State Game Lands are located close enough that any impacts to them are anticipated by the proposed project. However, should project plans change or if additional information on endangered or threatened species or State Game Lands becomes available, this determination may be reconsidered.

The proposed project may impact wetlands which this agency considers as critical and unique habitat. You should be aware that any impacts to wetlands or other bodies of water will require permits from the Department of Environmental Protection under Chapter 105 and the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act.

ADMINISTRATIVE BUREAUS:
PERSONNEL: 717-787-7836 ADMINISTRATION: 717-787-5670 AUTOMOTIVE AND PROCUREMENT DIVISION: 717-787-6594
LICENSE DIVISION: 717-787-2084 WILDLIFE MANAGEMENT: 717-787-5529 INFORMATION & EDUCATION: 717-787-6286 LAW ENFORCEMENT: 717-787-5740
LAND MANAGEMENT: 717-787-6818 REAL ESTATE DIVISION: 717-787-6568 AUTOMATED TECHNOLOGY SYSTEMS: 717-787-4076 FAX: 717-772-2411
WWW.PGC.STATE.PA.US
AN EQUAL OPPORTUNITY EMPLOYER

Mr. Chuck Marshall -2- August 8, 2002

If you have any questions, please contact me at (717) 783-5957.

Very truly yours,

James R. Leigey
Wildlife Impact Review Coordinator
Section Oil/Gas and Mineral Development
Bureau of Land Management

JRL/pfb

Cc: Leigey
File

Appendix Q: Finding of No Significant Impact

FINDING OF NO SIGNIFICANT IMPACT / DECISION NOTICE
Restoration Plan and Environmental Assessment for Valley Creek
Valley Forge National Historic Park
Valley Forge, Pennsylvania

The Valley Creek watershed, which contains portions of Valley Forge National Historical Park, has been contaminated by polychlorinated biphenyl compounds (PCBs) since the 1950s. Valley Creek and its tributaries are a Class A trout stream, as classified by the Pennsylvania Fish & Boat Commission (PFBC), and an Exceptional Value stream, under the Pennsylvania Department of Environmental Protection (PA DEP) classification system. The contamination emanated from the Paoli Train Yard in the south central portion of the watershed and spread to Little Valley Creek, Valley Creek, and three tributaries. The PFBC stopped stocking Valley Creek in 1985 as a result of the contamination and also classified Valley Creek as a catch-and-release only stream. The amount of angling in Valley Creek decreased substantially as a result of the contamination and ensuing actions described above.

A Trustee Council was established to address the restoration of the natural resource damages. The members of the Trustee Council are the Valley Forge National Historical Park (VFNHP), serving on behalf of the Department of Interior, and the PFBC serving on behalf of the Commonwealth of Pennsylvania. Under terms of a Consent Decree among EPA, the Trustees and three of the railroad companies that were responsible for the PCB contamination, the three companies are responsible for the cleanup of PCBs in the rail yard. To address natural resources damage, the three settling railroad companies paid $850,000 into a Restoration Fund to compensate for the lost uses of these resources.[1] As part of the process for obligating funds and implementing projects, the Trustee Council was required to develop a Restoration Plan (RP). The goal of the RP is to present projects and, ultimately, choose those projects for implementation that would best enhance the fishery and future use of the water resources of Valley Creek, in order to compensate for the past uses that were lost as a result of PCB contamination. The process used to identify the projects described in the RP was guided by the restoration objectives stated in the Memorandum of Agreement established between VFNHP and PFBC.

> The restoration actions selected under the Plan shall have the objectives of facilitating, accelerating and/or enhancing recovery of the affected natural resources, including the biological, ecological, and human services provided by those resources. The Restoration Plan shall accomplish those objectives by identifying, evaluating and selecting restoration actions that: (1) restore injured trust resources and their habitats, and (2) replace lost biological, ecological and human services.

1. Under a Unilateral Order issued by EPA, the fourth responsible rail company was ordered to remediate PCB damage outside the rail yard. The fourth responsible rail company has not entered into a settlement agreement relative to the Paoli Rail site.

In accordance with the National Environmental Policy Act (NEPA) and Director's Order and Handbook 12: *Conservation Planning, Environmental Impact Analysis, and Decision Making*, an Environmental Assessment was prepared in order to evaluate the environmental consequences of the alternatives considered for the Restoration Plan.

The Restoration Plan and Environmental Assessment (RP/EA) were issued in late March 2004 and included a preferred alternative and a no action alternative. Two public meetings were held on April 15, 2004 to present the alternatives and to receive questions and comments. A 30-day comment period was also provided that ended April 30, 2004. The Trustee Council has concluded, after an evaluation of the public comments, that the preferred alternative of the RP/EA will not result in significant impacts to the human environment and that this finding of no significant impact (FONSI) can be issued. The implementation of the Restoration Plan can begin once the public is notified of the availability of this FONSI.

SELECTED ALTERNATIVE

The alternative selected for implementation is the preferred alternative as described and evaluated in the Environmental Assessment. The preferred alternative consists of several categories of projects that would be implemented over a 14-year period. The $850,000 initial fund amount will last approximately four years under this plan and, if matched in an equal amount, will last approximately seven years. The Trustee Council believes that there are broad categories of projects that, if implemented, could compensate for past lost uses of Valley Creek Watershed by enhancing the fishery through improvements in habitat, water quality, and flow regime; by improving public access to attract more anglers and other users; and by restoring brook trout in one of the tributaries. These will be achieved by implementing five categories of projects; stormwater management, stream channel stabilization, greenways, increased public access, and brook trout restoration in Crabby Creek.

Managing stormwater to reduce runoff would permit greater amounts of precipitation to infiltrate the soil and maintain base flow to Valley Creek. Infiltration methods include retrofits of detention basins, infiltration on lands suitable for infiltration, and the use of low impact development measures.

Two types of stream channel projects are applicable in the context of Valley Creek: streambed improvements and streambank stabilization. Streambed improvements for fish consist of creating pools to provide deeper cool spots for fish when waters warm up during summer, and providing cover for fish to escape natural and human predation. Streambank stabilization reduces or prevents erosion and sediment generation by redirecting or decreasing the energy impact of the stream away from the bank and back to the center of the stream and reconnecting floodplains to stream channel

Methods to achieve greenways include purchasing land to preserve it from development, attaining conservation easements on private lands, and creating stream buffers by allowing natural vegetation to grow or by planting trees and shrubs.

Access projects would make it easier for anglers and other visitors to use or view the streams. Methods might include reducing the amount of posted (no trespassing) land unavailable to anglers, creating more fishing access points and increasing parking availability (without increasing runoff) for stream visitors and anglers, and creating trails that would enhance access along streams.

The primary goal of the fish restoration activity will be to reestablish a historically significant species, brook trout, in the unique habitat of Crabby Creek, a tributary in the Valley Creek Watershed.

The selected alternative includes a set of mitigation measures that will assure that the implemented projects will not result in a significant impact. The measures for each category and sub-category of projects are contained in Appendix A to this document.

No public comments were received that indicated that the preferred alternative should not be undertaken.

ALTERNATIVE CONSIDERED

The other alternative considered for the Restoration Plan was no action. No action would rely on natural and baseline events that would otherwise occur without initiation through the Restoration Plan, to accomplish the same objectives of increasing future use of Valley Creek. There are activities occurring in the watershed that do have beneficial effects on the resource that was injured. These activities include efforts in the townships to control flooding, actions by groups, such as, Trout Unlimited to erect buffers along streambanks, and efforts by organizations, such as, the Open Land Conservancy to preserve and ease floodplains so they are not developed. These efforts are effective, but randomly performed, too few in number and uncoordinated in implementation. Meanwhile, the resource would continue to face problems from a growing amount of development, excess runoff, and excessive sedimentation.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is defined by the Council on Environmental Quality (CEQ) as “the alternative that will promote the national environmental policy as expressed in the *National Environmental Policy Act* [Section 101(b)]. Section 101(b) states that the environmentally preferred alternative should

> fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
>
> ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings

attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences

preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice

achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities

enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources

As a result of the environmental analyses performed for this Restoration Plan, the Trustee Council has selected the environmentally preferred alternative of the RP/EA. As described in that alternative, the watershed-wide coordination and sequencing of project implementation is integral to the selection of projects. For example, it is generally better to infiltrate stormwater at the headwaters of a stream before stream stabilization is performed downstream. Infiltration will decrease the volume of runoff, which should reduce the cost of down-streambank stabilization projects and increase the chances that a project will survive high-volume and peak-rate storms.

The Trustee Council has determined that the no-action alternative is unlikely to meet the goals of the Restoration Plan. The Trustee Council believes that the biological productivity of the Valley Creek Watershed already shows degradation and will be harmed further if existing conditions are allowed to continue. Although a stream will always have some biological productivity, the Trustee Council believes that the naturally reproducing brown trout population of the Valley Creek system would be threatened and would decrease significantly if no intervention occurs. It will take decades before a new meander-and-flow equilibrium is achieved due to increased runoff from past practices and the increased runoff from grandfathered development not covered by the Valley Creek Coalition agreement of September 2001. The biological damage done during these decades of natural adjustments to high runoff levels may be irreversible.

For the reasons listed above, the environmentally preferred alternative is the selected alternative because it more fully meets the section 101(b) criteria of the *National Environmental Policy Act* than the no action alternative. Implementing all of the projects in the specific order listed in the selected alternative will also help meet the criteria specified for the environmentally preferred alternative.

WHY THE SELECTED ALTERNATIVE WILL NOT HAVE A SIGNIFICANT EFFECT ON THE HUMAN ENVIRONMENT

As defined in 40 CFR §1508.27, significance is determined by examining the following criteria:

Impacts that may be both beneficial and adverse

Streambank stabilization projects will have minor short-term adverse effects on sediment in the streams during the construction phase. In the long-run streambank stabilization projects will be beneficial by preventing more sedimentation than they create. Infiltration of runoff will help to reduce stream volumes and excess sedimentation. At the same time, some infiltration could lead to sinkhole development. To mitigate such impacts, extensive soils and bedrock sampling will be performed, infiltration will only be conducted when certain specifications are met, and frequent monitoring of construction and operation will occur. Access projects will help to attract more novice anglers and allow anglers to spread out in the watershed. On the other hand, such projects will require litter control, control of eroded streambanks where anglers climb down to the stream and climb back up. Small parking areas (with pervious surfaces) would accommodate more anglers, and have minor impacts on soil compaction and litter generation. Boulders placed in the stream will have the beneficial effect of providing cover to protect fish from predators; however, boulders improperly placed could force stream flow against banks and cause erosion. Streambank stabilization approaches involving large boulders rip rap and other hard materials will beneficially reduce erosion on banks that receive high energy flow from the stream. However, hardened materials will have a minor adverse effect on the biological interaction between streambank and stream. Hardened materials also heat up and can cause a negligible increase in stream temperature. Re-contouring land to achieve more infiltration of runoff will have a beneficial effect on stream flows and sedimentation, but could have minor adverse impacts on appearance by the alteration of vegetation and land use. The beneficial effects of extensive increased angling could put pressure on the fish population of Valley Creek and require fishing management provisions. All of the potential impacts described above are minor to moderate and are not considered significant.

Degree of effect on public health or safety

Potential health and safety effects analyzed were sinkhole development and increases of mosquitoes if more standing water occurs from stormwater management projects. As described earlier, engineering precautions, ample testing of soils and bedrock, and project monitoring should minimize or avoid sinkhole formations. Recent research suggests that West Nile virus does not occur in mosquitoes of vegetated wetlands or where mosquito-eating bugs can be introduced. Also, if infiltration without vegetation is the design choice, rapid infiltration methods, such as, rock trenches, will be used. These impacts were determined to be minor and are not significant.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas

Each project undertaken will be subjected to analyses for: archaeological artifacts and historic structures, threatened and endangered species, effects on wetlands, proximity to high PCB concentrations, and proximity to trout spawning areas during the fall. Areas that contain high quality or sensitive resources will be avoided. No critical lands or farmlands will be impacted. Potential impacts were determined to be negligible to minor and are not considered significant.

Degree to which effects on the quality of the human environment are likely to be highly controversial

The vast majority of effects from the selected alternative are minor or negligible. Where there could potentially be greater adverse effects, the net effects will be kept to minor levels by mitigation measures and by careful engineering, testing, and monitoring. There is no scientific controversy involved in the restoration techniques included in the selected alternative and there is no unresolved conflict over alternative uses of the resource. Therefore, there is no controversy regarding the effects of the selected alternative on the human environment.

Degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks

As previously described, risks involved in the preferred alternative's emphasis on infiltrating water relate to public safety. As described above and in the Restoration Plan, mitigating measures employed will reduce the effects on public safety. Sinkholes, for example, are a potential danger in a karst environment like Valley Creek and represent a controversy. The approach of the Trustee Council will be to minimize new impoundments of water, to disperse runoff over porous soils, to sample soil depths and bedrock surfaces for high-risk factors before designing or locating infiltration projects, and to frequently monitor infiltration projects. Mosquito breeding areas are another concern. Effects will also be kept to minor levels through avoiding standing water, employing rapid infiltration techniques, installing vegetated BMPs, and vector control. Therefore, there were no highly uncertain, unique, or unknown risks identified.

Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration

The types of projects included in the selected alternative are based on well-established and commonly used stream restoration techniques. Therefore, implementation of the selected alternative does not establish a precedent or represent a decision in principle about a future consideration.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts

The Trustee Council examined several potential cumulative beneficial and adverse impact topics, including; hardening of stream banks, litter effects from increased usage of the watershed, trout and other fish populations, and stream encroachments. The use of streambank stabilization techniques that involve small and large rocks, referred to as hardening techniques, individually have negligible adverse effects of reducing biological interaction between banks and streams and elevation of stream temperatures (as mentioned by a commenter). However, a very large usage of hardened materials could have moderate adverse effects. To minimize such potential impacts, the Trustee Council's first preference is to use bioengineering stabilization techniques that either have no rock or some boulders at the toe of the bank for protecting the bank from being undercut. The Trustee Council will use hardening methods when the stream's high water flow would otherwise increase the erosion of the bank because of highly erodable soils or high amounts of destructive force in the high water flow. To reduce the

cumulative effects of litter from increased use, litter control management will be factored into the planning of each project funded. A beneficial cumulative effect of the projects is to reduce sedimentation in the stream that adversely affects fish spawning and macroinvertebrates populations. Many projects might have a small impact in reducing sediments but the cumulative effect should be significantly beneficial. Some streambank stabilization projects encroach into the stream and cause flow energy to be directed to the opposite banks with potential adverse effects. The Trustee Council will avoid this potential problem by requiring that natural stream channel design techniques be used in planning projects so that both banks will be considered together. The potential impacts were determined to be minor to moderate and are not considered significant.

Degree to which the action may adversely affect sites, highways, structures, or objects listed on National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources, or which the action may adversely affect an endangered or threatened species or its critical habitat

No such resources are known to exist in potential project areas identified to date. Furthermore, every project will be preceded by a survey for archaeological artifacts and historic structures as well as to identify any wetlands, and threatened or endangered species. If these resources are identified, the site will be avoided or appropriate mitigation measures will be implemented in accordance with the applicable regulations and consultation with the appropriate federal, state or local agencies.

Whether the action threatens a violation of Federal, state, or local environmental protection law

This action does not violate any federal, state, or local environmental protection laws.

Impairment of Valley Forge National Historical Park resources

In addition to reviewing the list of significance criteria, the National Park Service has determined that implementation of the Restoration Plan will not constitute an impairment to Valley Forge National Historical Park's resources and values. This conclusion is based on a thorough analysis of the environmental impacts described in the Restoration Plan and Environmental Assessment, the public comments received, relevant scientific studies, and the professional judgment of the decision-maker guided by the direction in NPS *Management Policies* (December 27, 2000). Although the plan/project has minor adverse effects, in all cases these adverse effects are the result of actions taken to preserve and restore watershed and park resources and values. Overall, the plan results in benefits to park resources and values, opportunities for their enjoyment, and it does not result in their impairment.

PUBLIC INVOLVEMENT

A public scoping meeting was held in October 2001 to describe the process that was to be used to develop the Restoration Plan and Environmental Assessment, and to seek input from the public. Approximately 30 people attended that meeting. Numerous meetings were held during the past three years with individuals and groups involved with the watershed.

The EA was released on March 30, 2004 and made available for public review and comment during a 30-day period ending April 30, 2004. A total of eight written comments were received and approximately 50 comments or questions were raised in the two public meetings held on April 15, 2004 at Valley Forge National Historical Park and attended by approximately 24 people. The substantive questions from the eight written comments and the approximately 50 public questions or comments were able to be grouped into nine topics.

Substantive comments to the EA, not already covered above, centered on the following topics: (1) PCB remediation schedules, methods, and limits; (2)amounts of money that should be spent on access projects, outreach, and easements for the Restoration Plan; (3) the biological community for Crabby Creek and the prevention of scour in Crabby Creek; (4) incentives for landowners to infiltrate on a retrofit basis and additional options when infiltration is not possible in a detention basin and cost-effectiveness of infiltration projects vs. streambank stabilization projects in reducing sedimentation; (5) chemical contamination in Valley Creek; (6) use of declaration of restrictions in lieu of conservation easements; (7) the advantages of projects that restore the natural hydrologic balance by evaporating water; (8) requirements to install buffers on land eased with monies from the Fund; and (9) encouragement for small projects. These concerns resulted in no changes to the text of the environmental assessment but are addressed in an attachment to this FONSI.

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CONCLUSION

The selected alternative does not constitute an action that requires preparation of an environmental impact statement (EIS). The selected alternative will not have a significant effect on the human environment. Negative environmental impacts that could occur are minor or negligible in intensity. There are no significant impacts on public health, public safety, threatened or endangered species, sites or districts listed in or eligible for listing in the National Register of Historic Places, or other unique characteristics of the region. No highly uncertain or controversial impacts, unique or unknown risks, significant cumulative effects, or elements of precedence were identified. Implementation of the action will not violate any federal, state, or local environmental protection law.

Based on the foregoing, it has been determined that an EIS is not required for this project and thus will not be prepared.

This FONSI is concurred with and recommended for approval by:

Paul Van Amerongen, acting for: — 8/2/04

Tamara Whittington — Date
Restoration Program Manager
National Park Service

Marcia F. Gittes — 8/3/04

Marcia F. Gittes — Date
Attorney Advisor
Office of the Northeast Regional Solicitor
U.S. Department of the Interior

Arthur L. Stewart — 8/5/04

Arthur L. Stewart — Date
Superintendent
Valley Forge National Historical Park
National Park Service

This FONSI is approved by

Marie Rust — 8/10/04

Marie Rust — Date
Regional Director
Northeast Region
National Park Service

Attachment A
Public Comments Received and Agency Responses
Valley Creek Restoration Plan and Environmental Assessment

Substantive comments to the Valley Creek Restoration Plan and Environmental Assessment centered on nine topics: The topics, which are addressed below, resulted in no changes to the text of the environmental assessment.

PCB Remediation and Limits

Comment: PCBs should be treated in-situ by natural dechlorination and the PCB limits in fish are set too low.

Response: The issue of PCB cleanup locations, remediation methods, and the limits set for PCB concentrations in fish are all outside the responsibilities of this Restoration Plan. Also, none of the monies from the Restoration Fund will be used to perform PCB remediation.

Allocations of Restoration Funds

Comment: The Restoration Plan has an estimated budget of expenditures for project categories. Comments received suggested more money be spent on easements and outreach, less money spent on public access, and a preference for infiltration versus stabilization projects.

Response: The Trustee Council treats the budget as uncertain estimates of expenditures. There are many variables that will, over such a long period of implementation, determine the actual levels of expenditures in each category. The Trustee Council does favor easements over access projects and believes that the outreach to be performed by the Council will probably exceed the amount suggested by the commenter. The present budget on Table 6, Chapter 2, does narrowly prefer infiltration over stabilization projects.

Efficacy, Cost-effectiveness, and Incentives for Stormwater Infiltration Projects

Comment: Various comments expressed concern about what would induce landowners to allow retrofits to their detention basins, whether or not streambank stabilizations would reduce more sedimentation than basin retrofits, the effects on stream flow from retrofitting basins, and alternatives for managing basins.

Response: The Trustee Council cannot force landowners to improve their existing detention basins. The Council believes that covering the cost of retrofit does remove a barrier from an owner's willingness to retrofit. The Trustee Council would also like to see the two townships require/induce basin owners to ensure that basins are well-maintained with regard to both condition and design performance. The Council's approach to evaluating basin retrofits will consider dispersion prior to collection, biovegetation BMPs, and outlet retrofits to attain the original peak flow restrictions. The Trustee Council does not have quantitative models that can accurately predict if streambank stabilizations or stormwater infiltration are more cost-effective for removing sediments. The Council favors infiltration projects because of their capability to reduce sedimentation and to reduce flooding, especially in the lower portions of the watershed.

Crabby Creek Brook Trout Restoration

Comment: Two comments expressed concern about the adequacy of the biological community in Crabby Creek, where brook trout would be restored, and how future scour could be avoided in the prevention of sedimentation.

Response: The PA Fish & Boat Commission, co-trustee, will be managing the restoration, including ensuring that there is an adequate macroinvertebrate population in Crabby Creek. Fluvial geomorphology studies of Crabby Creek are also underway to determine how stormwaters can be better managed.

Infiltration vs. Evapotranspiration Projects

Comment: The appropriate… environmental requirement is: evapotranspiration…"

Response: The Trustee Council recognizes the validity of the comments that state that Restoration Fund projects to increase evapotranspiration would restore the hydrologic cycle while reducing stream erosion. Evapotranspiration consists of emitting water to the atmosphere by evaporation or by the respiration process of trees and other vegetation. The Council is concerned that projects that only achieve evaporation must allow water to slow down and have large surface areas for evaporation to occur. This generally requires such methods as overland flow of water, temporary pools of water, ponds, wetlands creation, and open tanks of water. Some of those methods result in a mixture of evaporation and infiltration, e.g., overland flow. Some of those projects, such as, ponding of water without biovegetation might present mosquito vector risks. East Whiteland Township has a code that requires dewatering of basins within 24 hours after a storm. The Trustee Council's final concern is cost and how runoff reduction by evaporation compares to runoff reduction by infiltration. Infiltration can be less expensive because it is done naturally by gravity when water flows over porous soils. Evaporation requires proper climatic conditions, residence time and large surface area for the water. Despite these concerns, limitations and cost uncertainties, the Trustee Council is very interested in receiving applications for evapotranspiration projects that reduce runoff in a cost-effective manner. Demonstration projects with evaluation of the results are appropriate and are compatible with the Plan's stormwater management goals as described in Chapter 2. Wetlands creation in detention basins and other suitable lands as well as vegetated buffer projects are already anticipated by the Trustee Council.

Chemical Contamination in Valley Creek

Comment: The comment concerns whether or not the Plan should address chemical contamination in the watershed.

Response: Chemical contamination does exist in Valley Creek at low concentrations. Sources of those chemicals have been identified as hazardous waste sites and runoff from roads. The hazardous waste sites are under management plans developed by the responsible parties, the U.S. EPA or PADEP. Road chemical runoff has not been identified in any studies as exceeding water quality standards. Thus, chemical

contamination in the watershed is beyond the scope of the restoration plan and environmental assessment.

Declaration of Restrictions on Deeds vs. Conservation Easements

Comment: Declarations of restrictions on land use can be effective in limiting development in the same manner as conservation easements. Has the Trustee Council considered their use?

Response: The Trustee Council will consider the use of declarations of restrictions on deeds in lieu of conservation easements when they are equally protective in preventing land from being developed, are more cost-effective than the incentive for conservation easements, and cannot be unilaterally rescinded by the landowner.

Requirements to install buffers on land eased with monies from the Fund

Comment: When fund monies are used to obtain conservation easements, the creation of forested riparian buffers should be required and the Trustee Council should reserve the right to perform stream stabilization or restoration on those properties.

Response: The Trustee Council does want eased land to have riparian buffers and will cover their costs. The Council also recognizes that even streambanks in riparian forested areas may need stabilization and the Council would cover those costs. (Chapter 2) The critical need for conservation easements in key areas will be weighed against the potential fate of the property if the landowner indicates he/she will not participate if a specific buffer or streambank stabilization is required.

Encouragement for Small Projects

Comment: Try not to make the Plan hinge on just a few large projects, but make use of multiple small projects to achieve the same net result.

Response: As evidenced by the list of projects in Appendix C of the RP/EA, the Trustee Council expects to conduct an array of infiltration projects by size and by method to improve the Council's understanding of what does and does not work. The Trustee Council will also accept applications from landowners for low-impact development kinds of projects. The Council does not have any preconceived ideas or data about the cost per gallon of water infiltrated and whether or not that data suggests economies of scale favoring large projects. The Trustee Council will carefully consider the cost/benefit of projects proposed.

APPENDIX A: MITIGATION MEASURES FOR RESTORATION CATEGORIES

Method	Potential Impacts[1]	Mitigation
Stormwater Management		
Retrofit Basins	Sinkholes	Will avoid projects on residential properties unless fenced. Soil, groundwater and bedrock tests will be done on a site-by-site basis as part of feasibility evaluation to assess the risk of sinkholes. Frequent construction, e.g., twice per year, and post-construction monitoring will occur to determine if sinkholes are developing and to take immediate remedial action, including stoppage of the project.
Lands Suitable for Infiltration	Sinkholes, mosquitoes, and risk of drowning in standing water.	Will avoid projects on residential properties unless fenced. Soil, groundwater and bedrock tests will be done on a site-by-site basis as part of feasibility evaluation to assess the risk of sinkholes. Frequent construction (e.g., twice yearly) and post-construction monitoring will occur to determine if sinkholes are developing and to take immediate remedial action, including stoppage of the project. Biological controls will be introduced if mosquitoes emerge. The amount of time for standing water will be limited to 24-hours.
Low Impact Development		No specific mitigation required.
Stream Channel Stabilization		
Bioengineered banks	Erosion and sedimentation during implementation and possibly during trout spawning season. Stream encroachments.	Will comply with PADEP[2] Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Will ensure that vegetation is quickly established on the bank to minimize amount of exposed surfaces before next storms.
J and W Vanes	Erosion and sedimentation during implementation, including trout spawning season. Stream encroachment and less vegetation on banks.	Vanes will be used when the preferred bioengineered methods are unsuitable for the soils and the force received by the banks that are to be stabilized. Will comply with PADEP[2] Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow.
Rip Rap	Erosion and sedimentation during implementation, including trout spawning season. Stream encroachment and less vegetation on banks. Increase in temperature of water.	Will comply with PADEP[2] Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow over time. Only to be used on tributaries which do not flow during dry weather or as part of a bioengineering project.
Skyhooks	Erosion and sedimentation during implementation and trout spawning season. Stream encroachment and less vegetation on banks.	Will comply with PADEP[2] Chapter 102 regulations on erosion and sedimentation by trapping sediment. To comply with Chapter 105, natural stream design principles of design of project will mitigate encroachment effects. Will not undertake such projects during trout spawning season. Some vegetation will re-grow over time.
Boulders for Fish Cover	Erosion and sedimentation during	Will comply with PADEP Chapter 102

Method	Potential Impacts[1]	Mitigation
	placement of boulders and trout spawning season. Increased erosion on unstable adjacent banks.	regulations on erosion and sedimentation by trapping sediment. Would only place boulders where stream flow will not be directed at banks. Will not undertake boulder placement during trout spawning season.
Greenways		
Property Purchases	Invasive plants.	Maintenance needs for each property to be identified and agreement established for maintenance cost and invasive management.
Easements		No mitigation measures required.
Buffers	Stream channel stabilization likely to occur simultaneously with creation of buffer. Potential erosion and sediment generation during construction (see above mitigation). Invasive plants likely to emerge.	Would comply with PADEP Chapter 102 regulations on erosion and sedimentation for adjacent stream channel stabilization. Agreements need to be established for each property for maintenance, invasive plant management, and cost responsibility.
Public Access		
Removing Postings	Loss of vegetation and compaction of soil for highly used areas. Minor amounts of litter left behind by anglers and other users. Erosion on banks used to access streams.	If unacceptable land usage or litter, can allow landowner to return to posting. Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Access with Parking	Land conversion from natural to recreational areas and parking. Minor amounts of litter left behind by anglers and other users. Erosion on adjacent banks.	Sites will be designed with pervious parking and infiltration of up to and including 2-year storm. Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Trails	Soil compaction and vegetation loss. Minor amounts of litter left behind by anglers and other users. Erosion on adjacent banks.	Will establish agreement with local service group to pickup litter periodically. Will monitor banks and take actions to prevent use or remediate problem.
Crabby Creek Brook Trout Restoration		
Restoration of Brook Trout in Crabby Creek	Possible strain differences with previous species of brook trout. Pressure on fish population from stream where taken.	Potential strain differences will be avoided by selecting brook trout from nearby stream. Pennsylvania Fish and Boat Commission has already identified stream in contiguous county that contains a sufficient brook trout population.

1. All projects will be subject to archeological and historical surveys to determine if objects of historical significance are present. All projects will be subject to threatened and endangered species surveys and wetlands avoidance.

2. PADEP = Pennsylvania Department of Environmental Protection.

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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-60 (January 2004)