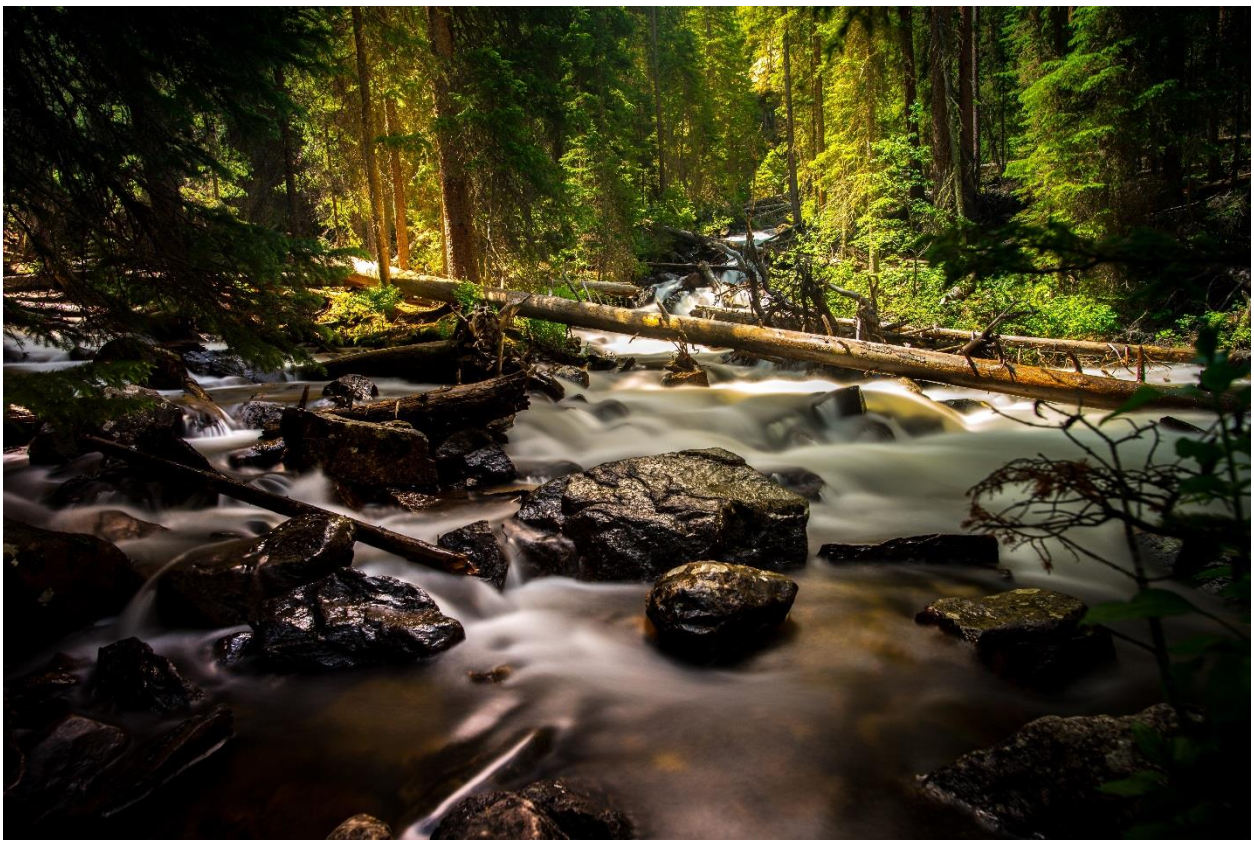
UPSTREAM SUBURBAN PHILADELPHIA CLUSTER

PHASE 2 PLAN

A Plan for Protecting and Restoring Places of Ecological Significance



CONTACT INFORMATION:

Patrick Starr
Executive Vice President
PEC Southeast Region
Email: pstarr@pecpa.org
Phone: 2155454570

CONTENTS

FIGURES

TABLES

SECTION 01

UPSTREAM SUBURBAN PHILADELPHIA CLUSTER WATERSHED STRESSORS

This strategic plan complements decades of past research and planning with the goal of halting the degradation of waterways, ecosystems, and water quality in our region of the Delaware River watershed. The Upstream Suburban Philadelphia Cluster (USPC) faces multiple localized challenges involving social, environmental, political, and economic issues. This cluster includes five hydrologically separated stream systems encompassing portions of 36 municipalities ranging from historic boroughs to first and second-class townships. Over 400,000 people reside in this cluster governed by nearly 300 local elected officials. Most of the landscape of this cluster is developed, including nearly 70% classified as urbanized and ranging from 25-50% impervious. Almost all reaches of the cluster's waterways are listed as impaired due primarily to urban stormwater runoff and secondly to excessive sediment and nutrient pollution. These issues are amplified by the high degree of urbanization, which remains the single most pressing concern for the water resources in the Upstream Suburban Philadelphia Cluster.

A multitude of stressors emerge due to urbanization as it significantly changes the physical and chemical characteristics of its watershed. Urban runoff has and is expected to further alter the hydrologic cycle, riparian corridors, stream geomorphology and assimilative capacity in our watersheds, which will affect the water quality, water quantity, habitat, and ecosystem. The stressors and direct critical threats facing this Cluster have not changed significantly since Phase 1 USPC Critical Direct Threats(Table 1). In addition, the Cluster Team continues to recommend prioritizing management of rate and volume of runoff through infiltration to address the primary determinants of ecosystem impairments. These include natural flow restoration, pollution mitigation, and habitat restoration.

Table 1: USPC Critical Direct Threats

		Critical Direct Threats						
		High Volume Stream Flows	High Velocity Stream Flows	Flooding	Low Dry-weather Baseflows	Sediment Loads	Pollutant Load	Nutrients Load
Ecosystem Stressors	Altered Hydrologic Cycle	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Altered Riparian Corridors	Yes	Yes	Yes		Yes		Yes
	Altered Stream Geomorphology		Yes	Yes		Yes	Yes	Yes
	Altered Assimilative Capacity					Yes	Yes	Yes

OUR ALIGNMENT

Our Alignment with DRWI Goals, Outcomes & Strategies

In 2013, the Upstream Suburban Philadelphia Cluster established four broad methods to facilitate watershed restoration. In consultation with the Coordinating Committee, these four methods were reduced to three in the Phase 2 planning process. Wastewater treatment plant and sewer infrastructure improvements were removed leaving these strategies:

1. Riparian Corridor Protection and Restoration: This strategy involves utilizing land use and environmental regulatory controls and land conservation tools to enhance existing protected natural lands. Restoration activities will include establishing/restoring riparian buffers, enhancing riparian habitat and developing/augmenting connectivity of riparian corridors.

2. Streambank Restoration: This consists of stabilizing stream banks, restoring stream banks, and naturalizing stream channels.

3. Stormwater Management: Includes retrofits of existing stormwater control measures (SCMs) that are antiquated or undersized, construction of new infiltration SCMs and implementation of other SCMs such as green roofs, constructed wetlands, bioretention features, capture and reuse, etc.

Each of these strategies has a high potential for delivering cross-cutting triple bottom line benefits and fostering long-term community resiliency, and is capable of wide-ranging application across sub-watersheds. These strategies also align well with the Stormwater Restoration Strategies defined in the DRWI Strategy Model. In particular, our proposed strategies align with DRWI stormwater strategies 2 through 6, which collectively address green infrastructure promotion, outreach and technical assistance to landowners and local governments, and citizen/volunteer engagement. Table 2 provides a synopsis of the relationship between our USPC strategies and our previous identified critical direct threats.

In a desire to unlock every opportunity to achieve the overall DRWI goal – a watershed that provides high-quality and sufficient water quantity for healthy ecosystems and human communities, defined as the Ability to Produce Clean and Abundant Water (APCAW) – the Upstream Suburban Philadelphia Cluster will tailor each on-the-ground strategy to the project's local context. Applied locally, DRWI's goal translates to specific catchments and reaches within an urban drainage area that provides a diminished quantity of poor quality water. For the USPC, as with similar urban areas, the ultimate goal is to slow or reverse trends in water quality degradation. It is also fundamental for our cluster to recognize that the timescale for measurable improvements in watershed health occurs over decades and as a result we are in the process of developing a set of holistic metrics to measure more immediate benefits.

To the extent possible we propose to identify both intermediate, and long-term goals with the intention of mitigating frustration due to the lack of substantial immediate (Phase 1, Years 1-3) improvements to watershed-scale water quality. The key intermediate (Phase 2, Years 4-7) outcomes in the process will vary depending on the site-specific characteristics and practices in different sub-watersheds. The following are typically the most important intermediate outcomes across the Upstream Suburban Philadelphia Cluster:

- Reduce volume and velocity of stormwater, highlighting infiltration practices
- Reduce nutrient, sediment and bacterial runoff/pollution
- Enhance understanding and engagement among community members.

The intermediate outcomes emphasized by the cluster-wide coordinators include building capacity of watershed organizations and improving inter-organizational collaboration/partnership. These collaborations are essential for the sustainability and long-term success of the cluster. USPC partners are currently involved in a variety of regional and basin-wide collaborations including the Coalition for the Delaware River Watershed, the Schuylkill Action Network, and the Municipal Technical Assistance Advisory Panel. These will continue in Phase 2.

Table 2: USPC Cluster Strategies to Address Direct Threats

		Critical Direct Threats						
		High Volume Stream Flows	High Velocity Stream Flows	Flooding	Low Dry-weather Baseflows	Sediment Loads	Pollutant Load	Nutrients Load
Strategies	Riparian Corridor Protection/Restoration	Reduce	Reduce	Reduce	Increase	Reduce	Reduce	Reduce
	Stream Bank Restoration		Reduce	Reduce		Reduce	Reduce	Reduce
	Stormwater Management	Reduce	Reduce	Reduce	Increase	Reduce	Reduce	Reduce

Through success in accomplishing our intermediate outcomes, the USP Cluster will be well positioned to achieve our longer-term performance outcomes. Outlines of these intermediate and long-term outcomes are presented in the adapted DRWI Strategy Model, Figure 1.

DRWI Planning Methodology, Technical Assistance and Modeling Resources

USPC is unique among participating clusters in the watershed protection efforts of the DRWI. As the most urbanized cluster, it was desirable that the USPC take a different approach to prioritizing, measuring and reporting on watershed initiatives.

The Philadelphia region's river and stream corridors are highly degraded and also encompass highly variable land uses with nonpoint sources that are not always well quantified. Therefore, in this environment, for valuable scientific modeling, it is important to operate at high resolution and to include proper drainage networks, which may not be apparent on topographic maps. Pilot watershed analyses firmly established that the Stream Reach Assessment Tool (SRAT) and Model My Watershed (MMW) were not acceptable as the core scientific analytic techniques to assess focus areas and potential projects primarily because:

A. SRAT generated a set of maps with errors including: incorrect point sources, unsubstantiated bank erosion rates, and unnatural recharge rates. SRAT loadings from runoff were approximately 1/3 of loadings obtained by the team using other models.

B. MMW results were inconsistent: if the same area and times were selected, different results were obtained. Further, basic outcomes were found to be incorrect: if SCMs were added (1) loads were reduced but concentrations increased and (B) runoff was reduced without any increase in subsurface flow.

C. Both models had issues with the scale and resolution required for the parcel-by-parcel approach needed in a highly urbanized setting.

Instead, the USPC developed an approach that started with the identification of land opportunities and associated site/project development prior to focus area identification. An outline of our methodology for Phase 2 planning is provided in Figure 2.

Land opportunity is the driving force in our highly urbanized cluster. To begin the process, over 250 potential projects were identified and screened using a screening tool which allowed us to rank projects based upon their environmental benefits, relevance, readiness, and viability. This screening process allowed us to develop 11 potential focus areas in the geographical ranges of highly rated projects.

To support appropriately sizing focus areas both in geographical range and in quantity of proposed projects, we used an iterative Triple Bottom Line (TBL) Analysis. The criteria for the TBL was an outgrowth of the initial screening metrics and included scientific inputs from the Spreadsheet Tool for the Estimation of Pollutant Load (STEPL), an Economic Life Cycle Cost-benefit Analysis, and a Social Life Cycle Assessment (sLCA). This approach enabled us to reduce the number of proposed focus areas from 11 to four and the number of included projects from over 250 to approximately 30.

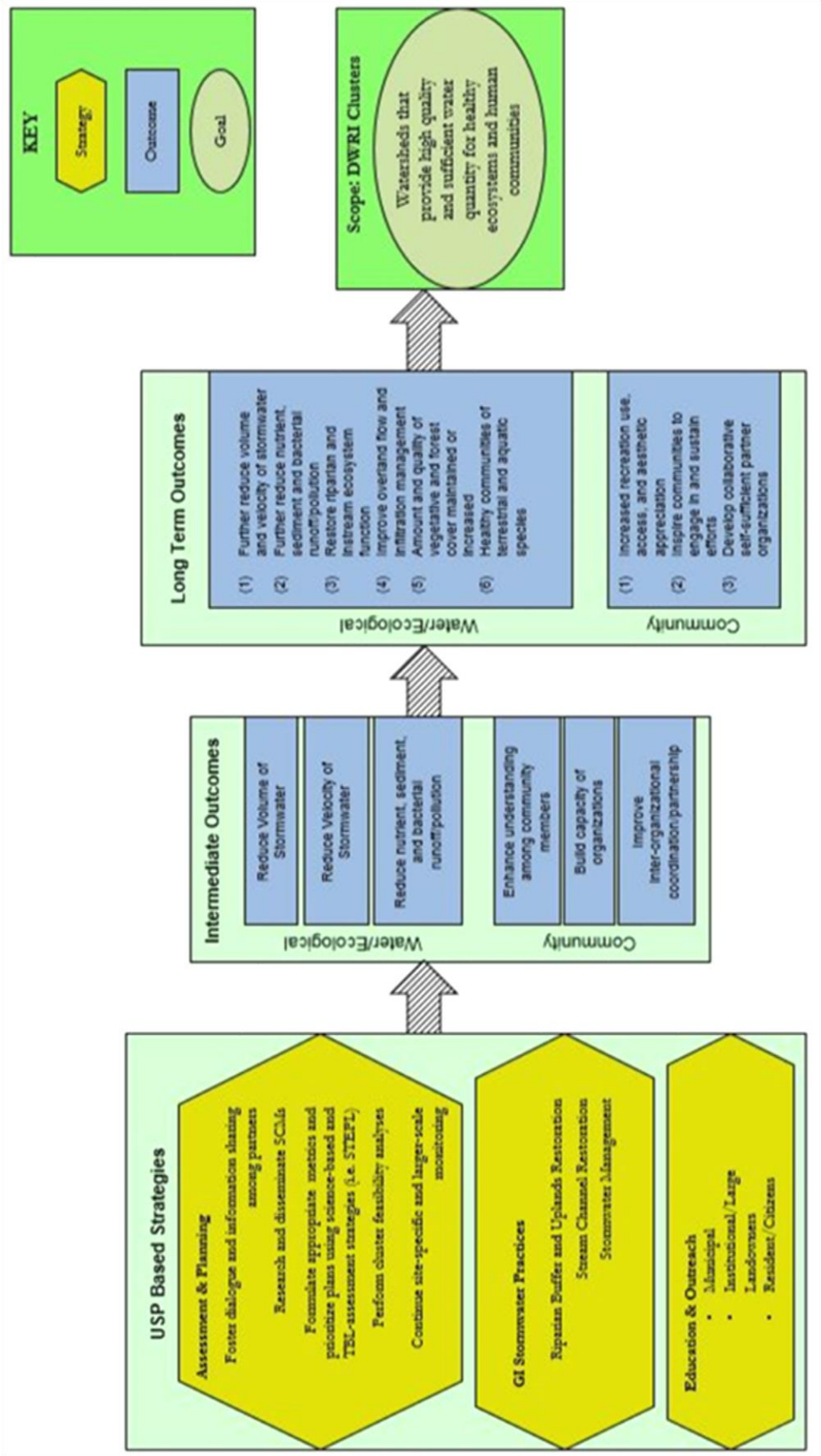


Figure 1: DRWI Strategy Model within the Context of the USPC

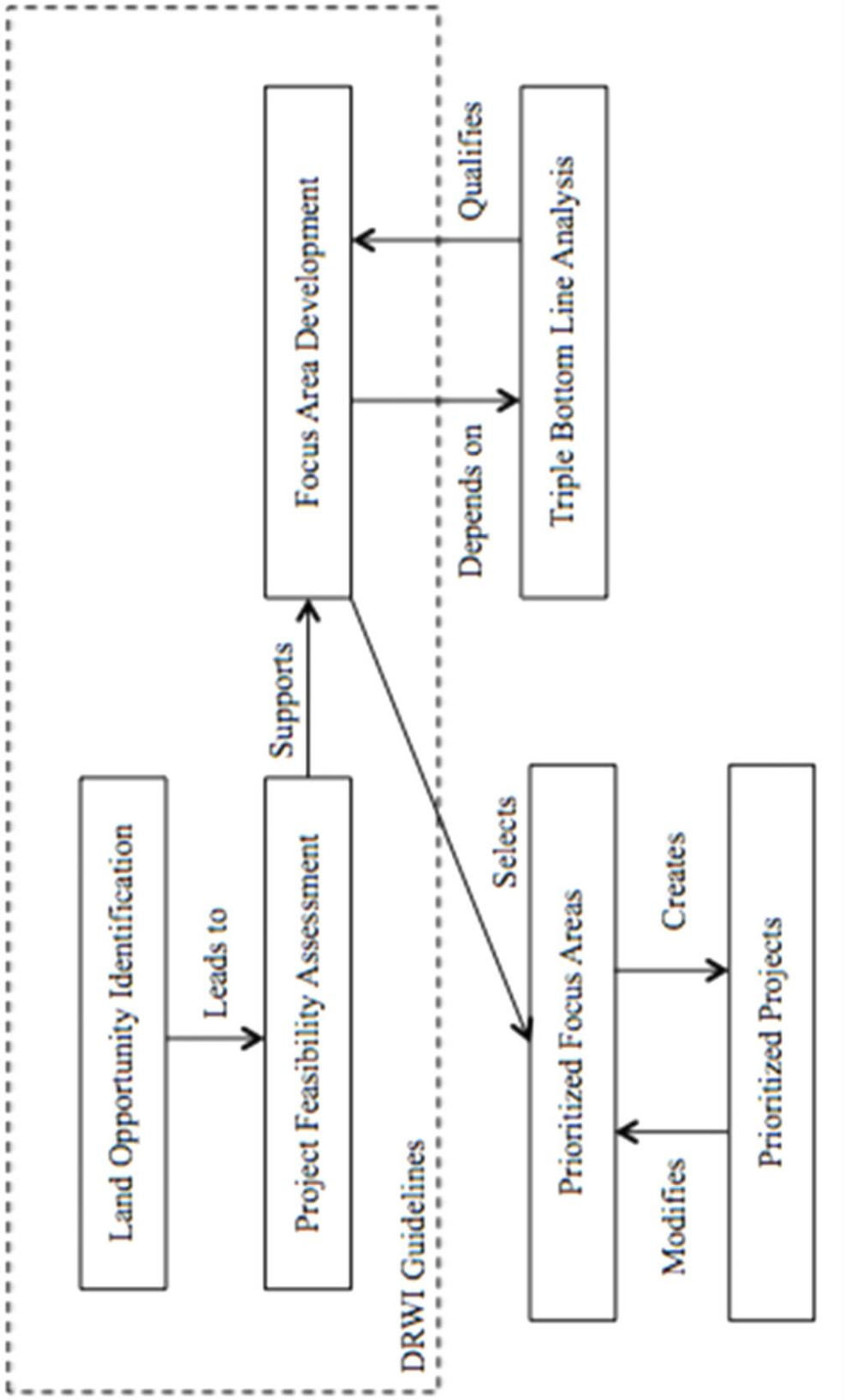


Figure 2: Conceptual Model for Focus Area Selection

SECTION 02

PROPOSED FOCUS AREAS

The USPC Planning Team worked with the local watershed partners and regional stakeholders to determine which portions of the watershed would offer the most valuable investment opportunities. Over the course of winter 2016-2017, the USPC planning team and watershed partner representatives (i.e., technical liaisons) performed an in-depth assessment (i.e., project screening and TBL) to evaluate the core needs and the geographical areas most able to benefit from DRWI engagement. Over the course of multiple iterations this multi-level assessment identified and ranked 15 potential focus areas. Analysis of those potential areas were further analyzed resulting in the prioritization of four focus areas: Sandy Run, Naylors Run, Pennypack Headwaters – Upper Moreland Un-named Tributary (UNT) and Jenkintown Creek.

The USPC arrived at this conclusion after a lengthy evaluation of the potential of the proposed projects to affect their allotted focus area. More specifically, project- and focus areas--scoring and later prioritization were determined by the indicators and associated sub-indicators shown in Table 3. We represented the TBL scores as both equally weighted and unweighted scores. The equally weighted scores value environmental, economic and social indicators equally thereby resolving unequal quantity of indicators among categories.

Table 3: Triple Bottom Line Evaluation Criteria

Category	Indicator	Sub-Indicator	Methodology
Environmental	Stormwater Management		STEPL
	Nonpoint Source Pollution Management	Nitrogen, Phosphorus and Sediment Reduction	STEPL
	Water Quantity Management		STEPL
	Biodiversity/Invasive Species Management		Stakeholder Survey; GIS Analysis
	Heat Island Effect		Stakeholder Survey; GIS Analysis
Social	Stakeholder Support	Landowner, Municipality and Neighborhood Support	Stakeholder Survey
	Community Facility/Service Provision	Youth and Landowner Education; Recreation Enhancement	Stakeholder Survey; General Area Survey
	Inequality		Environmental Justice Area GIS Analysis
	Community Engagement & Empowerment		Stakeholder Survey
	Resiliency & Longevity	-	Stakeholder Survey
Economic	Life Cycle Cost		Literature-based Economic Assessment
	Partnership & Match		Stakeholder Survey

The TBL Assessment results showed a nice diversity of high-scoring focus areas, with the four highest-scoring areas distributed among our partner watershed organizations (Figure 3). A large portion of this can be attributed to successful implementation of complementary strategies throughout Phase 1 as well as leveraging of the MS4/PRP Permitting timeline.

There is not a clear preferred focus area in the Poquessing watershed. We found that the overall TBL scores for the proposed Poquessing watershed focus areas were lowered when the potential environmental benefits associated with completed projects were weighted with potential social and economic factors. Lack of organizational capacity was the primary factor limiting the Poquessing watershed's competitiveness.

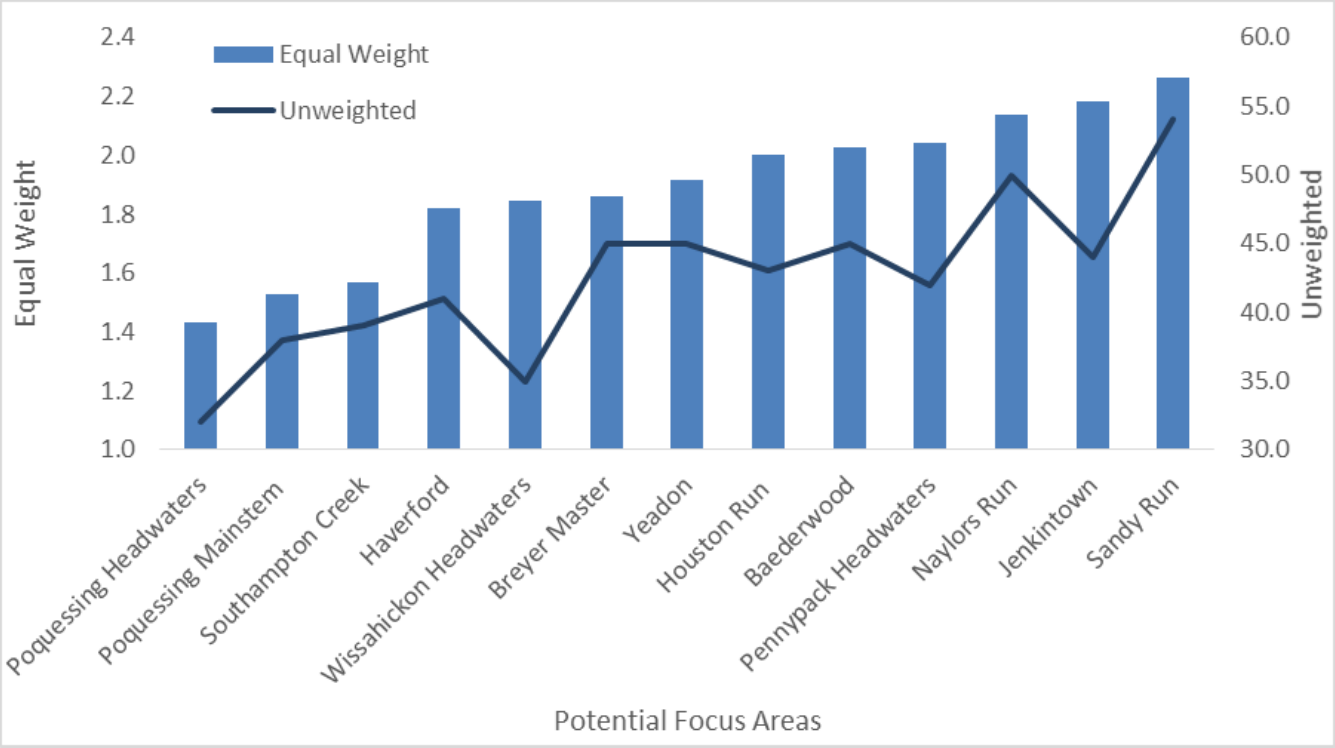


Figure 3: Potential Focus Area TBL Results

PRIORITY FOCUS AREA INTRODUCTION

The USPC Planning Team has developed the previously stated four priority focus areas for DRWI and expects, given a reasonable amount of investment during Phase 2, to begin to make progress towards meeting DRWI's overall and USPC's specific goals and performance targets within each focus area (Table 4; Figure 4).

These four focus areas exceed the remainder in terms of the quantity and quality of overall projects and project feasibility. More specifically, these focus areas will benefit from the high levels of engagement expressed by municipalities and large landowners. The projects identified range from the conceptual stage to being "shovel

ready." Further, each project is matched by the proper level of organizational capacity for successful completion of focus areas specific and USPC wide goals.

Table 4: Summary of Four Priority Focus Area

WATERSHED	FOCUS AREA	MUNCIPALITIES	AREA (ACRES)	STREAM CHANNEL LENGTH (METERS)
Cobbs	Naylors Run	Upper Darby Haverford	1900	7080
Pennypack	Pennypack Headwaters -UNT	Upper Moreland	290	1770
Tookany	Jenkintown Creek	Abington Cheltenham	1200	7890
Wissahickon	Sandy Run	Abington Upper Dublin	2025	7500

Emerging from the Coordinating Committee feedback and the first round of the TBL Assessment, the Naylors Run focus area consists of an exposed segment of the Naylors Run tributary. Sandwiched between two culverted sections of stream, the Naylors Run focus area presents a unique opportunity for innovative research based on focus area-level monitoring data. Importantly, a watershed partner organization, the Eastern Delaware County Stormwater Collaborative, has been charged with the responsibility of coordinating the watershed-wide Pollutant Reduction Plan. These synergies will allow for the maximization of match/partnership opportunities.

The Pennypack Headwaters - UNT focus area, which the cluster reduced in size in response to the TBL right-sizing process, includes the catchment area of a single unnamed Pennypack Creek tributary. This tributary was originally identified due to previous investment via a Growing Greener Grant at the Upper Moreland Middle School campus. Additionally, in Upper Moreland Township's Stormwater Management Plan prepared by Gilmore & Associates (2013) documented potential projects in the stream's watershed.

Similarly, the Sandy Run focus area was greatly reduced in size in response to the TBL right-sizing process. This focus area is home to a plethora of project opportunities identified in the Wissahickon's Act 167 plan (2013) by Temple University and NTM Engineering and throughout the Phase 2 Planning Process by Temple University and the Wissahickon Valley Watershed Association. Further, partnership/match opportunities with the municipalities of the Wissahickon watershed have been identified and strengthened as a result of the collaborative alternative TMDL process currently underway in the Wissahickon watershed. This process includes the WVWA, PEC, and Temple University, all of whom are DRWI partners.

In contrast to the other priority focus areas, the Jenkintown Creek focus area was not reduced in size since the submittal of Component 3. This focus area includes several highly successful restoration projects implemented in response to the DRWI. The focus area also has a number of strongly committed stakeholders (i.e., landowners); many of whom have indicated great satisfaction and expressed interest in future partnerships.

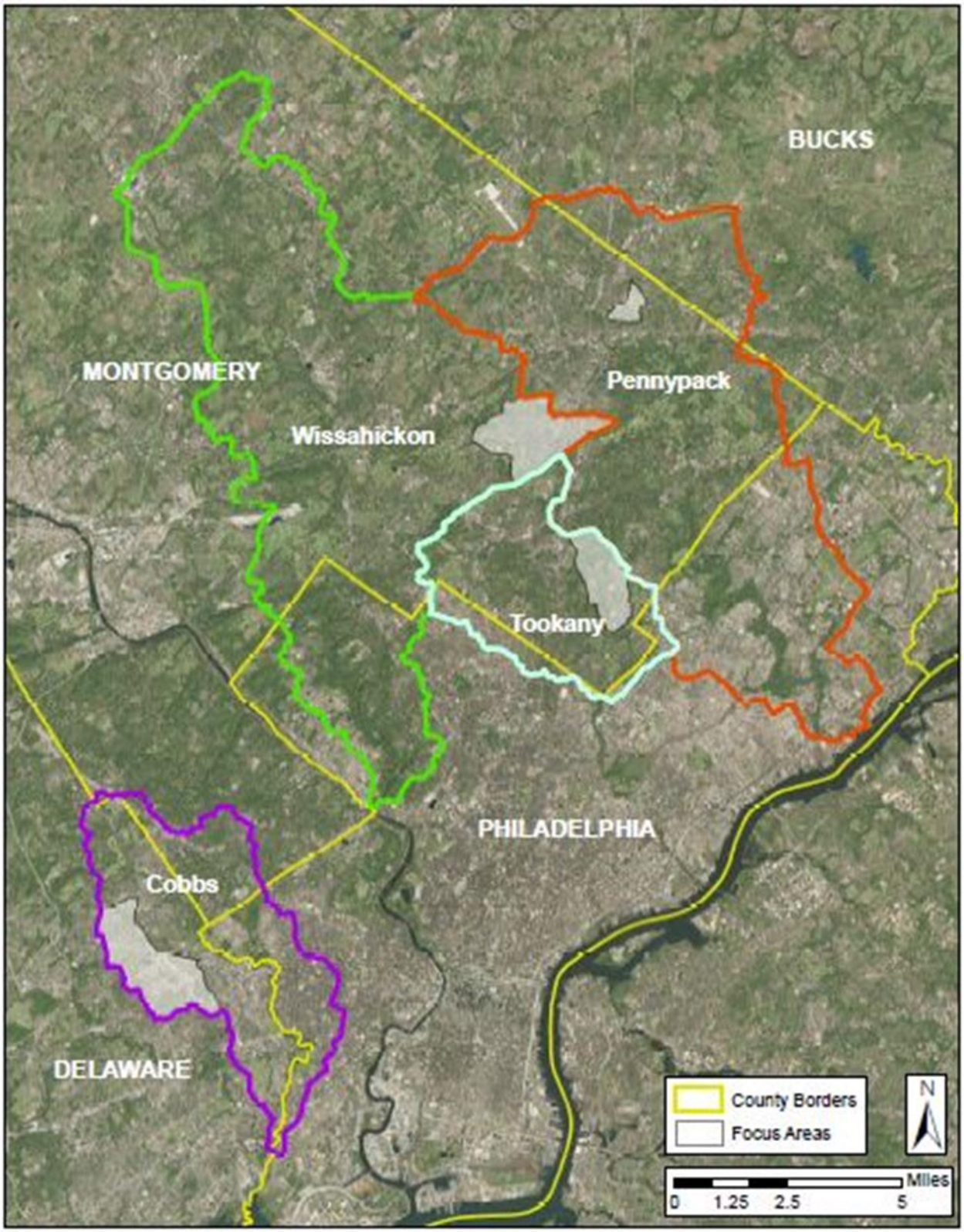


Figure 4: Four Priority Focus Area in USPC

SECTION 03

USPC OVERARCHING GOALS

The overarching goals for the USPC are:

(1) to draw on opportunities in the Philadelphia metropolitan area that further the completion of the DRWI mission; and
(2) to ensure the availability of sufficient high-quality water for healthy ecosystems and human communities in the Delaware River Watershed.

Our desired outcomes include:

- 20 – 25-year Outcome: To slow or possibly interrupt the trend in watershed and water quality degradation in the Philadelphia urban drainage area.
- 25+ year Outcome: To reverse the trend in watershed and water quality degradation in the Philadelphia urban drainage area.

Our progress in achieving USPC's overarching goal is reliant on two integral components: (A) implementing restoration projects in focus areas and (B) disseminating educational, outreach and training programs. We wish to strengthen and certify the resilience of our efforts by delivering components following an organized and inclusive process. Performance metrics are considered for the life of Phase 2 implementation, while outcome metrics are considered over the intermediate and longer term.

CAPITAL INTENSIVE STRATEGIES & METRICS

The planning process resulted in the identification and conceptualization of approximately 250 site-specific restoration projects. TBL analyses undertaken by Villanova and Temple Universities on all potential projects received as of early April 2017 yielded the projects included in Table 5 grouped by type of SCM.

Table 5: Focus Area Project Diversity by SCM (as defined by STEPL)

	SCM					
PRIORITY FOCUS AREAS	Streambank Restoration	Riparian Buffer Restoration	Bioretention (Bioswale/Rain Garden)	Wet Ponds and Wetlands	Basins (Construction/ Retrofit)	Others
Naylors Run	2	1	10	3	3	underground retention; daylighting
Pennypack Headwaters - UNT	2	1	4	1	3	
Jenkintown Creek	4		4		2	roof capture system; parking lot retrofit
Sandy Run	5	3	7	1	3	daylighting

The USPC Planning Team has received and expects to continue to receive more conceptualized projects over the coming months in these focus areas. USP partners have also identified many project opportunities outside of the four selected focus areas. As such, in addition to our focus area strategy, watershed partners will pursue the development of “Cornerstone” or “Trophy” projects where opportunities and funding sources are present. In the following section entitled “Capital Intensive Strategies Success Stories,” short descriptions of previously implemented capital projects from around the Cluster will provide some insight into the UPSC’s are expectations for future projects.

Example Constructed Project: Abington Friends

Status: Constructed, 2014 - 2016

SCM: 2 rain gardens, 1 bioretention area, 1 bioswale, and 850' of riparian buffer

USPC Partners: Tookany/Tacony-Frankford Watershed Partnership, Temple University & Villanova University

External Partners: Abington Friends School, Abington Friends Meeting, Abington Township Environmental Advisory Council

Total Cost: $215,650 secured in grants and in-kind services

Funding Source: National Fish and Wildlife Foundation, Carbon Fund, TreeVitalize, and private local contributions.

As of 2017, the Abington Friends entities have together completed four projects in the Jenkintown Creek headwaters. Beginning in fall 2014, the Abington Friends Lower School planted a 25,000 ft^2 riparian buffer. This buffer consisted of over 400 native trees, shrubs and perennials along 500' of the creek at an average width of 20' on both sides. In fall 2016, the school completed a second phase of the buffer bringing the length to 850 linear feet along the Jenkintown Creek headwaters. In fall 2015, a rain garden designed by AKRF was incorporated into a campus renovation project at the Abington Friends Lower School site. The rain garden manages the first inch of runoff from the approximately 17,000 ft^2 of adjacent asphalt parking lot and driveways.

The following year, a 1600 ft^2 rain garden was completed below the parking lot at the Abington Friends Meeting House to manage runoff from 16,282 ft^2 of parking lots, drives and lawns. A bioswale was installed to extend the flow path of drainage from the adjacent lawn area. Prior to project completion, flows were conveyed directly to the creek through 40’ of pipe. The pipe was removed and flows now pass through a vegetated swale that reduces volume and velocity prior to discharging into the creek.

Collectively the Abington Friends properties have been able to leverage $150,600 provided by the National Fish and Wildlife Foundation, $27,500 in grants from TreeVitalize and Carbon Fund, and $37,500 in in-kind services for an investment of $215,650 in green stormwater infrastructure to create 3,728 ft^3 of stormwater storage and 25,000 ft^2 of riparian buffer. Beyond these achievements of the installation of projects, projects have sparked the naming of an adjacent playground as the "Headwaters Discovery" and has provided for inclusion of hands-on watershed education and extracurricular activities that incorporate the project features at the Abington Friends School. Further, in 2017 the Jenkintown Creek Restoration project was selected by the Sustainable Business Network of Greater Philadelphia to receive the Excellence in Green Stormwater Infrastructure Award in the public projects category.

Example Constructed Project: College Settlement Site

Status: Constructed, 2014-2016

SCM: streambank restoration, stormwater wetland & rain garden

USPC Partners: Pennypack Ecological Restoration Trust, Villanova University

External Partners: College Settlement of Philadelphia, Horsham Township, Upper Moreland Township

Total Cost: $302,741 secured in grants and in-kind services

Funding Source: National Fish and Wildlife Foundation, Horsham Township, Upper Moreland Township

Completed in 2015, this site consists of: a three-cell stormwater wetland/rain garden and native plantings (Figure 5). Together these projects are able to intercept and manage stormwater flows from approximately 40 acres of up-gradient residential subdivisions and 20 acres of meadows and woodlands. To date, the constructed wetlands on site filter the largest capture area of any individual project in the Upstream Suburban Philadelphia Cluster (Figure 6). The designers scaled the project to accommodate the significant runoff generated by upstream residential development built without stormwater management features.

Figure 5: College Settlement Stormwater Wetland Design Schematic

Figure 6: Post-Construction Stormwater Wetland

As a whole, the College Settlement Site leveraged $198,820 provided by the National Fish and Wildlife Foundation and municipal contributions with $113,921 in matching contributions to create 481,000 gallons (1.5 acre-feet) of stormwater management capacity.

Example Constructed Project: Darby Cobbs Rain Garden Initiative

Status: In development, 27 Constructed Raingardens to date

SCM: Rain Gardens

USPC Partners: PRC, EDSCS and DCVA

External Partners: Upper Darby Township, Haverford Township, Yeadon Borough, Sharon Hill Borough, Norwood Borough, Morton Borough

Total Cost (to date): $162,578

Funding Source: National Fish and Wildlife Foundation (NFWF), Royal Bank of Canada, Ethel Sergeant Clark Smith Foundation, Growing Greener, In kind labor from municipal public works staff and volunteers

During Phase 1, the Pennsylvania Resources Council (PRC) in partnership with the Eastern Delaware County Stormwater Collaborative (EDCSC) and the Darby Creek Valley Association (DCVA) and the Haverford EAC received a NFWF grant ($51,290) to install high-visibility rain gardens on both public and private lands in the Darby and Cobbs watershed. This grant was matched by funds from the Royal Bank of Canada ($10,000) and the Ethel Sergeant Clark Smith Foundation ($6,000) and municipal in-kind staff time as well as volunteers ($87,431). The project is currently funded through a Growing Greener grant in the amount of $89,834.

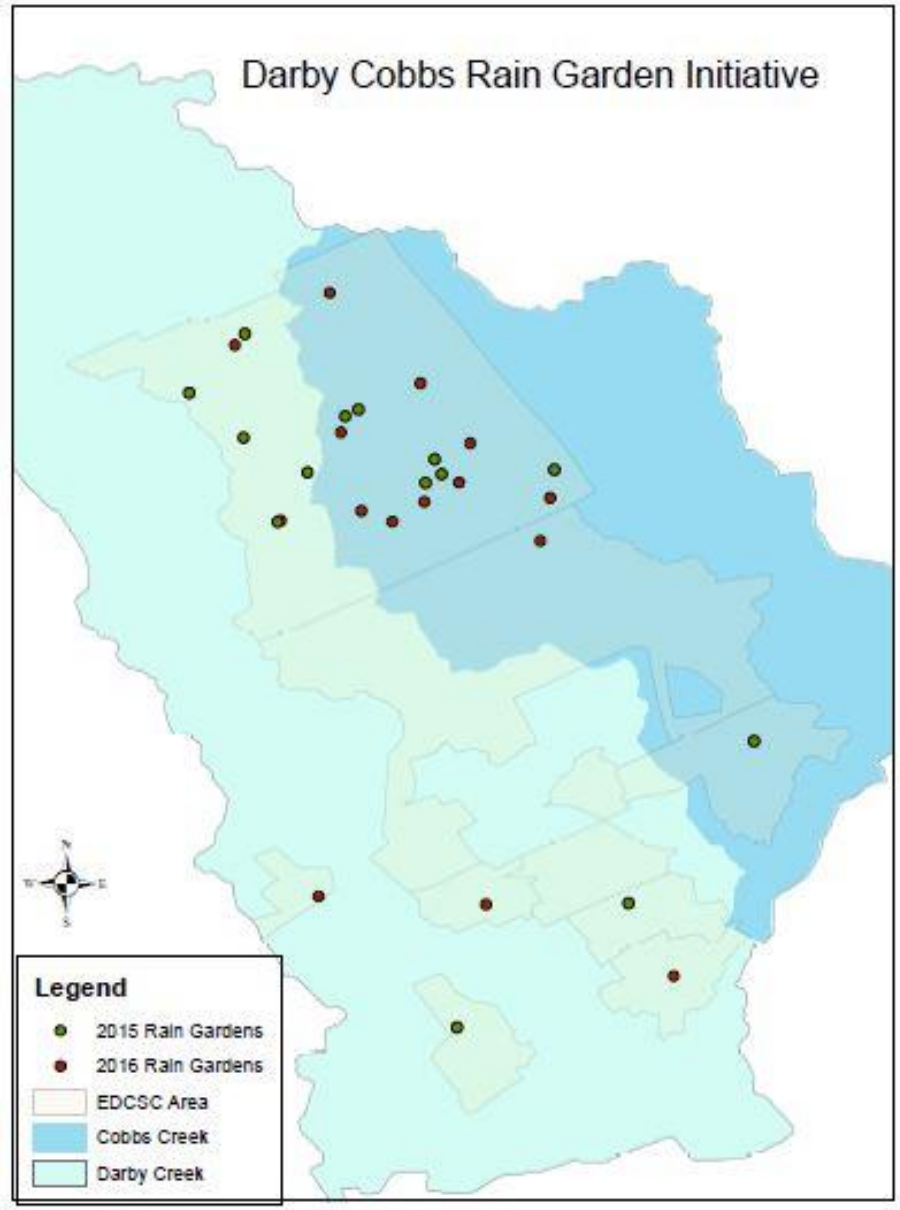
Each garden design is simplified, using the native soils, have no underdrains, and a simplified overflow (Figure 7). This design coupled with the volunteer and municipal public works in kind staff time greatly reduced the cost per garden. To date, 27 gardens have been installed, 20 on private properties and seven on public properties (Figure 8).

Figure 7: Small Rain Garden Installation

These simplified rain gardens are vital to improving the health of the Darby and Cobbs Creeks. This watershed was developed without any stormwater controls and is heavily urbanized with very few opportunities to install large scale stormwater control measure. This makes the installation of these small rain gardens key to reducing the volume of stormwater entering the waterways. The small sips of water removed, add up to a larger reduction. In this intensely urbanized area, it will take small private landowner managing some of the stormwater on their property to improve water quality. This rain garden program serves as a kick start to the Darby-Cobbs Watershed Initiative "Getting to the New Normal" using small scale projects to build relationships with public and private property owners to create stormwater improvements via:

- awareness building through installation rain gardens in parks, school properties, and municipal buildings and libraries;
- citizen capacity building through educational works which assist in all aspects of backyard-scale rain garden design; and
- coordination of volunteer to serve a construction support.

Figure 8: Rain Gardens Installed to Date by The EDCSC Rain Garden Initiative



FOCUS AREA & CAPITAL INTENSIVE PERFORMANCE & OUTCOME METRICS

The following three goals arise from implementation of restoration projects and will heartily contribute towards the Upstream Suburban Philadelphia Cluster's desired 20-25 year Outcome.

Phase 2 Goal 1: Mitigate erosion and restore hydrology.

Performance Metrics

Total # km of stream with restored hydrology

Intermediate Outcomes Metrics, 3 – 6 years

Reduction in suspended-sediment load

Outcome Metrics, 6+ years

Reduction in stream temperature

Reduction in nitrogen, phosphorus and suspended sediment downstream of projects

(Associated Strategies: stream channel restoration, riparian corridor protection and restoration)

Phase 2 Goal 2: Intercept runoff and subsurface water pollutants.

Performance Metrics

Total # (% and value) of acres of forested/vegetated buffer, floodplain restored, or treated by green stormwater infrastructure

Intermediate Outcomes Metrics, 3 – 6 years

Increase in volume of runoff captured during storm event

Increase in water quality during and after storm event

Outcomes Metrics, 6+ years

Reduction in nitrogen, phosphorus and suspended-sediment downstream of projects

(Associated Strategy: stormwater management)

Phase 2 Goal 3: Prevent downward trend in stream degradation.

Performance Metrics

Increase # of landowners and land managers who use green infrastructure throughout the cluster

Intermediate Outcome Metrics, 3 – 6 years

No decline in IBI indices and physical habitat assessment at focus area monitoring points

Outcomes Metrics, 6+ years

Stabilization in IBI indices and physical habitat assessment over the whole cluster

(Associated Strategy: See Goals 1 & 2)

The associated performance metrics (Table 6; Table 7) assume a steady progression in project implementation, but does not assume full funding for all of the proposed projects in the focus areas. We assume a level of NFWF funding in Phase 2 similar to Phase 1 (approximately $1.5 million). Estimated costs for proposed projects were used to target spending at the midpoint and end for the project and estimate needed leverage. Then the associated capture areas (in acres) and stream restoration (in ft.) for projects adding up to the target spending were used for metrics. Projects with a high likelihood of leveraging were included. For example, an estimated $900,000 of leverage projects has been tentatively committed in Sandy Run already, providing full funding for the proposed project when complement by NFWF funding. The projects are typically placed in problem areas that are anticipated to have significant impact on stream quality.

Table 6: Performance Metric Targets

Naylors Run			
Performance Metrics	Midpoint of Phase 2	End of Phase 2	Amount Leveraged
Total length of stream restoration (ft.)	1600	3900	2193
(cum # of projects)	1	2	1.6
Total area treated by gsi (acre)	32	75	60
(cum # of projects)	5	11	8.8
Pennypack - UNT			
Performance Metrics	Midpoint of Phase 2	End of Phase 2	Amount Leveraged

Total length of stream restoration (ft.)		750	444
(cum # of projects)		1	0.6
Performance Metrics	**Midpoint of Phase 2**	**End of Phase 2**	**Amount Leveraged**
Total area treated by gsi (acre)	14	38	23
(cum # of projects)	1	3	1.8
Jenkintown Creek			
Performance Metrics	**Midpoint of Phase 2**	**End of Phase 2**	**Amount Leveraged**
Total length of stream restoration (ft.)	490	1740	1010
(cum # of projects)	1	2	1.2
Total area treated by gsi (acre)	25	53	31
(cum # of projects)	3	6	3.5
Sandy Run			
Performance Metrics	**Midpoint of Phase 2**	**End of Phase 2**	**Amount Leveraged**
Total length of stream restoration (ft.)	2000	3880	2926
(cum # of projects)	2	4	2.3
Total area treated by gsi (acre)	154	308	151

The outcome metrics are described for each goal, although some of the metrics are overlapping (

Table 7). Additional metrics and ties to watershed goals are provided in the focus area profiles in the appendix. The monitoring strategies are described in more detail in Table 8. Note that Temple University and Villanova University bring an array of data loggers and monitoring equipment to the project that they will continue to use in Phase 2, along with modeling to provide additional assessment. For example, Temple has

approximately a dozen data logging stations deployed around the cluster, including three automatic stormwater sampling stations. Villanova has three high intensity project monitoring sites developed under Phase 1 funding. The university research is not described in detail here because of space limitations.

Table 7: Outcome Metrics for Tracking Progress

Relevant Phase 2 Goals			Outcome Metric	Data Collection/Monitoring Methodology
Goal 1: Mitigate erosion and restore hydrology.	Goal 2: Intercept runoff and subsurface water pollutants.	Goal 3: Prevent downward trend in stream degradation.		
✖		✖	Reduction in suspended-sediment downstream of project or focus area pour point	Bank pins, EnviroDIY loggers, photos
	✖	✖	Reduction in nitrogen and phosphorus downstream of project or stabilization on main stem	Water quality sampling, STEPL and SWMM modeling
	✖	✖	Reduction in stream temperature adjacent to project or on main stem	EnviroDIY and university loggers
✖			Increase in volume of runoff captured during storm event	EnviroDIY and university loggers, webcams and photos
	✖		Improvement in water quality (N/P/TSS) discharge during and after storm event	Stormwater sampling, STEPL and SWMM modeling

Relevant Phase 2 Goals			Outcome Metric	Data Collection/Monitoring Methodology
Goal 1: Mitigate erosion and restore hydrology.	Goal 2: Intercept runoff and subsurface water pollutants.	Goal 3: Prevent downward trend in stream degradation.		
		✖	Stabilize or improve IBI scores at focus area pour points and on main stem	Macroinvertebrate sampling, fish surveys
		✖	Stabilize or improve habitat scores at focus area pour points and on main stem	Annual habitat surveys

MONITORING PLAN

The monitoring strategy plans were developed by a committee with representatives from each of the partner watershed organizations and the universities. The committee began by reviewing ongoing monitoring efforts, evaluating available resources, and identifying future strategies for measurable outcomes. The need to improve the linkage of monitoring measurable outcomes and to increase the tier of monitoring was key to planning for Phase 2 modifications and setting goals.

Because it is challenging to monitor change in urban streams, the cluster proposes a continuation of the long-term baseline monitoring in the main stem (Table 8). Thus, baseline or main stem monitoring is one component of the monitoring program, and this strategy was elevated to a goal. These long-term monitoring sites provide key information for helping to understand focus area monitoring. Urban streams experience a variety of stresses that compound and that, together, may create tipping points which influence ecosystem functioning. The long-term baseline monitoring helps determine whether urban streams are continuing to degrade, have stabilized or have begun to improve. If other factors are causing degradation that offset the project benefits in the focus areas, the long-term monitoring sites will record this change. To ensure these data will be used to evaluate outcomes, the universities will work in partnership with watershed staff to compile and examine the long-term monitoring data. These partnerships will ensure that the data are used to inform the overall monitoring strategy.

The second component of the monitoring program involves focus areas, and for our cluster includes both project and watershed-scale monitoring. The project-scale monitoring is conducted in part by the universities and in part under future project funding, as directed by the Coordinating Committee (Table 12). The watershed-scale monitoring for focus areas will include two monitoring points for each focus area, typically above and below the projects. The projects are clustered such that a monitoring point can be clearly identified at the upstream end, close to the projects. Field scoping has not yet taken place, however. In some cases, where projects are focused on a single tributary that feeds into a main stem, it may be feasible to monitor above and below the tributary mouth on the main stem in addition to or instead of above and below projects when the university collaborators can provide equipment. Existing monitoring sites will be incorporated into the monitoring strategies where feasible. For

example, Villanova University will continue to monitor one site (College Settlement) that is no longer in a focus area. The watershed scale monitoring for focus areas will be led by the cluster partner's staff with assistance from the universities; the project scale monitoring will be led by the universities with assistance from the partner's staff. The university scientists can ensure that the monitoring encompasses a variety of projects and that the monitoring is conducted for a sufficient period to reach a conclusion about effectiveness.

Our monitoring strategies also include an active cadre of volunteers who have been cultivated over Phase 1 of the DRWI. We developed a number of monitoring strategies for Phase 2 that can involve volunteers and will provide measurable outcomes or will provide background data for monitoring site selection. Bank pins have been used to measure erosion in many streams; although not always quantitative in assessing stream quality, the data can be used as a screening tool to identify sites for follow-up monitoring using data loggers. The volunteer training is minimal for bank pin monitoring and would dovetail with what volunteers have already been doing in the watersheds. We also plan to introduce new monitoring equipment that volunteers can help maintain. We will be installing EnviroDIY loggers and web cams, both of which are expected to be included in Citizen Science monitoring. The EnviroDIY loggers will supplement university monitoring, allowing us to incorporate additional sites. The web cams can be rotated among sites to evaluate sites where drainage pathways are unclear and suggest locations for follow-up water level monitoring. The partners will encourage volunteers to take photographs to document conditions at both flow monitoring and bank pin monitoring sites.

With these new monitoring strategies for volunteers, we dropped the Phase 1 strategy of using field test kits for water quality parameters to engage volunteers in monitoring. These kits were expensive and the data were not being integrated into water quality assessment. We feel our new volunteer monitoring program dovetails with the tier 1 monitoring throughout the cluster.

After discussions with the Academy of Natural Sciences of Drexel University (ANS) and Stroud Water Research Center, the number of sites for biological monitoring has been reduced to concentrate on focus areas and existing integrative sties. We also recommend maintaining macroinvertebrate sampling for a portion of the long-term sites on the main stem because of the importance of evaluating watershed health to provide a comparison with the focus area monitoring. We can reduce the number of sites and alternate years at some sites to focus on just 10 sites per year for baseline biomonitoring. This reduction in sites from Phase 1 should provide a manageable number for sample collection and counting, but also provide metrics for trend analysis. Staff and volunteers will assist with macroinvertebrate sampling as well physical habitat assessment.

The write up for Metrics provides information on performance metrics for both an intermediate target during Phase 2, at year three following the end of Phase 2 (Table 6) and for longer term. Longer term targets are needed in the highly stressed urban setting.

Table 7 provides performance metrics for each of the recommended goals. Table 8 and Table 9 explains in detail each of the monitoring strategies, who is in charge of the monitoring and measurement, what is the goal of each monitoring strategy (as related to the outcome metrics), and the location and number of samples or monitoring points. Some of the strategies (such as stormwater sampling and modeling) will be described in more detail in the university proposals, but are mentioned briefly here to provide an overview of how strategies are linked.

All of these monitoring efforts will be coordinated between the watershed partners, the universities, ANS, and Stroud. Data management is included in the budgets for the universities. Thus, the data will be used to update monitoring strategies as well as measure outcomes and inform the public (in particular citizen science partners).

Table 8: Monitoring Strategy Plan

Strategy	Tier	Group Performing Monitoring	Metric/Parameter	Number of samples/related tasks breakdown
Focus area sampling	1	Watershed staff with university and ANS support	Improve water quality as measured by TSS and nutrients	Sample analysis for nutrients and TSS (96 samples including QA/QC) 2 sites per focus area (Upstream and downstream) 4 times per year for 3 years
				Staff time and travel for sample collection
				Sample analysis by ANS (96 samples)
				Data analysis by watershed staff and universities
Long term baseline sampling on main stem	1	Watershed staff with university and ANS support	Stabilize or improve water quality as measured by TSS and nutrients.	Sample analysis for quarterly measurements of Cl, nutrients, and TSS at long term monitoring sites (480 samples including QA/QC) 40 sites, 4 times per year, 3 years
				Staff time and travel sampling 4x per year
				Sample analysis by ANS (540 samples)
				Data analysis and database management (ANS and universities)
Data loggers at focus area pour points	1	Site selection by watershed staff with university support. Logger training provided by Stroud. Logger maintenance by Citizen Scientists.	Improve water quality as measured by TSS and temperature. Change in runoff volume as measured by water level.	Loggers at 2-3 locations upstream and downstream of the pour points of focus areas or before and after projects. Continuous monitoring for a year or more. Sites can be rotated if needs change and site locations are focus-area dependent.
		Watershed staff lead by WVWA		Citizen science coordination

Strategy	Tier	Group Performing Monitoring	Metric/Parameter	Number of samples/related tasks breakdown
Bank pins near projects and at points of interest on main stem	2	Watershed staff and volunteers, data management with help from university	Evaluate erosion mitigation, help select sites for TSS monitoring, evaluate one contribution to habitat disruption, implied improvement in IBI	Bank pin supplies (minimal cost) Number of sites depending on volunteer availability. Sites can be long term or rotated.
				Data management by universities
Webcams and photos near projects and focus area pour points	2, 3	Watershed staff and volunteers with university support	Help select higher level monitoring sites by estimating change in volume of runoff captured during storm event, identify erosion features	Webcams at selected projects and incised banks Number of sites to be determined after projects are selected. Webcams can be rotated to include more sites
		Volunteers		Photos at selected projects and incised banks
Macro-invertebrates at focus area pour points and on main stem	1	Watershed staff collects, analysis by Stroud supplemented by volunteers	Stabilize or improve IBI	Annual survey in each of focus area, supplemented by volunteer surveys (4 composited sites per focus area for 3 years or 16 per year) Additional baseline (main stem) samples by Stroud or volunteers (10 samples per year for 3 years)
				Staff time for 8 to 16 samples, composited to 4 samples for each focus area Up to 10 main stem samples per year
				Sample analysis by Stroud (12 samples at focus areas up to 30 samples on main stem)
Habitat surveys at focus area pour points and on main stem	2	Watershed staff and volunteers	Stabilize or improve habitat survey scores	Annual habitat surveys by watershed staff and volunteers
Fish, algae, and diatom surveys at integrated sites selected by ANS	1	ANS	Stabilize or improve IBI	Survey each of watershed at previously selected integrated sites. Schedule set by ANS.
Project monitoring	1	Universities, some citizen scientists depending on logger availability	Evaluate stormwater capture at project scale, change in volume of runoff during storm event.	Continue monitoring at Phase 1 sites. Instrument 1 to 3 new sites. May include, depending on the site, weather, water level, temperature, and flow.

Strategy	Tier	Group Performing Monitoring	Metric/Parameter	Number of samples/related tasks breakdown
Modeling of projects and focus areas	2	Universities	Stabilize or improve water quality as measured by TSS and nutrients. Change in volume of runoff captured during storm event.	Construct STEPL model for every project. SWMM model for each focus area.
Stormwater sampling at projects	1	Universities	Stabilize or improve water quality as measured by selected water quality parameters.	Use a combination of dataloggers, automatic samplers, and grab samples at selected sites with project monitoring.

Table 9: Monitoring by Focus Area or Watershed

Strategy	Baseline WQ * samples	Habitat Surveys	Pour point monitoring	Project monitoring	Citizen Science Monitoring
Naylors Run	6 locations[&] 2 QA/QC quarterly	1 macroinvertebrate focus area sample 2 main stem macroinvertebrate samples 1 fish, algae, and diatom survey at ANS integrated site All annually	Loggers above and below project area (Temple) 2 WQ samples above and below project area Physical habitat survey annually at pour point	Additional high-level monitoring by Villanova EnviroDIY monitoring Model assessment Additional as included in project design or university monitoring	Bank Pins (locations to be determined) EnviroDIY (2 initially) Photo app (locations on demand) Webcam (rotating locations as needed)
Jenkintown	5 locations 1 QA/QC quarterly	1 macroinvertebrate focus area sample 2 main stem macroinvertebrate samples 1 fish, algae, and diatom survey at ANS integrated site All annually	Loggers above and below project area (Temple) 2 WQ samples above and below project area Physical habitat survey annually at pour point	Existing high-level monitoring by Villanova at Abington Friend School (water quality and quantity) and Abington Friends Meeting House (water quantity). EnviroDIY monitoring Model assessment Additional as included in project design or university monitoring	Bank Pins (locations to be determined) EnviroDIY (2 initially) Photo app (locations on demand) Webcam (rotating locations as needed)

Strategy	Baseline WQ * samples	Habitat Surveys	Pour point monitoring	Project monitoring	Citizen Science Monitoring
Pennypack Unnamed Trib	5 locations 1 QA/QC quarterly	1 macroinvertebrate focus area sample 2 main stem macroinvertebrate samples 1 fish, algae, and diatom survey at ANS integrated site All annually	Loggers above and below project area (Temple) 2 WQ samples above and below project area Physical habitat survey annually at pour point	Existing high-level monitoring by Villanova at College Settlement EnviroDIY monitoring Model assessment Additional as included in project design or university monitoring	Bank Pins (locations to be determined) EnviroDIY (2 initially) Photo app (locations on demand) Webcam (rotating locations as needed)
Sandy Run Head-waters	13 locations 2 QA/QC quarterly	1 macroinvertebrate focus area sample 2 main stem macroinvertebrate samples 1 fish, algae, and diatom survey at ANS integrated site All annually	Loggers above and below project area (Temple) 2 WQ samples above and below project area Physical habitat survey annually at pour point	EnviroDIY monitoring Model assessment Additional as included in project design or university monitoring	Bank Pins (locations to be determined) EnviroDIY (2 initially) Photo app (locations on demand) Webcam (rotating locations as needed)
Poquessing	5 locations quarterly	1 main stem macroinvertebrate sample annually			Bank Pins (locations to be determined) Photo app (locations on demand)

* Water Quality (WQ) parameters are nitrate, nitrate, orthophosphate, chloride, total P, total suspended solids. Others may be added if recommended by ANS.

& Sample locations were provided to ANS during proposal review. Five sites will be omitted from the initial list.

COMPLEMENTARY STRATEGIES & METRICS

Complementary strategies enhance or leverage capital intensive strategies or in other ways support the cluster's plans to reduce the prioritized stressors. In this cluster, our complementary strategies are based on the premise that activities that support and enhance the on-the-ground work provide us with more tools to achieve improved and sustained water quality improvements in our communities (Table 10). Working with our local governments, commercial and institutional landowners, and the residential community are critical components in building knowledge, support and sustained protection of watershed resources well into the future. Our strategies are grounded in the belief that effective water quality outreach and education programs must include top-down (e.g., elected officials) education and bottom-up (e.g., citizen) empowerment strategies.

Table 10: USPC Complementary Strategies: Enhance or Leverage Capital-Intensive Projects

GOALS		
• Improve stormwater management policies and practices • Build constituency support and disseminate learning from the focus area implementation project.		
STRATEGIES TO ACHIEVE GOALS		
Working with Local Governments	→	Education & Training, Ordinance Reviews, MS4 Support, EAC Support
Working with Special Landowners	→	Targeted Training, Special Properties, Federal, State & County Agency Coordination
Working with Residents	→	Residential Stormwater Management Programs
Building Citizen Stewards	→	Stream Monitoring Programs, MWS Support, O&M Support
Publishing USP Affiliated Research, Assist partners with Data Synthesis, Provide Opportunities for Student Training	→	Scientific Research, Assessment, and Documentation
University Support for Capital Projects	→	Project & Focus Area Level Monitoring, Trend Analysis and Modeling

In Phase 1, the Upstream Suburban Philadelphia Cluster developed a detailed education and outreach plan with goals and a suite of education and outreach program objectives, with specific audiences, outcomes, and metrics. The Phase 1 outreach plan is still an important guide for the work of the cluster partners. These measures were originally referred to as, "above the ground" strategies. For Phase 2, we evaluated the effectiveness of our Phase 1 efforts and worked together to refine/update these strategies with new or enhanced approaches. We have learned that improving and sustaining water quality improvements require specific educational and engagement programs for elected officials to build support for GSI investment and improved compliance with MS4 regulations. Our continued emphasis and expansion of citizen stewardship programs recognizes the tremendous value of building knowledgeable, local advocates for water quality. These citizen stewards can join municipal boards and community watershed organizations as well as advocate to their elected officials for better enforcement of environmental regulations.

Our Phase 2 strategies build upon the many engagement programs initiated in Phase 1. We have added several components to enrich our Phase 1 activities to be even more strategic in our approach to support and achieve our goals. Each cluster partner implements various components of complementary strategies based on their internal capacity, existing programs, and status of focus area designation.

Based on the distribution of the four focus areas, the Poquessing Creek watershed is the only one of the five partner watersheds without a designated focus area. However, work will continue with the Friends of Poquessing on building their internal capacity to plan and implement water quality programs in their upstream communities. These will focus more on residential programs since much of the upstream portion of the Poquessing is in residential ownership. The Poquessing Creek citizen monitoring program will continue as an effective outreach strategy to strengthen and empower local citizens' stream knowledge and ability to interact with their elected representatives; a cornerstone of our complementary strategies as noted above.

The following section outlines our general complementary strategy framework. Six individual strategies are described, followed by expected outcomes. Please note that additional details on complementary strategies with metrics specifically targeted to individual focus areas are included in Tables 20, 25, 30 and 36 of APPENDIX 1. Several tables also include metrics related to areas that may fall outside of our four specific focus areas, but support overall water quality improvement goals of the cluster.

The Upstream Suburban Philadelphia Cluster's Complementary Strategies are described below. Following these descriptions, we have assembled Table 11 which summarizes general strategies and metrics. These include:

1. Improving *municipal* stormwater regulatory policies and practices. Increasing municipal investment in Green Stormwater Infrastructure (GSI) measures and enhancing compliance with MS4 permits. Increasing municipal financing for long-term operation and maintenance, and expanding and improving strategic relationships among cluster partners and local government officials. Promote formation of new Environmental Advisory Councils (EACs) in the 17 municipalities without these boards; and building capacity of existing EAC's especially those in focus area municipalities.

   Expected Outcomes:

   - Increased level of consistency of regulatory ordinance standards and criteria among municipalities for specific codes related to riparian buffers, wetland and floodplain protection, steep slopes, and woodland protection.
   - Decreased number of variances and waivers undercutting water quality improvement efforts.
   - Increased number of municipalities that include fast track or by-right provisions for projects that include low- impact development or GSI elements.
   - Increased involvement of municipal staff and elected officials in MS4 training.
   - Increased spending as percentage of overall budget for GSI projects.
   - Promote formation of new Environmental Advisory Councils in the 17 municipalities without these boards; support and build capacity of existing EAC's within focus area municipalities.
   - Increased support and interaction among existing EACs in Cluster
   - Increase capacity of existing EAC's to undertake programs and projects that help their municipality comply with its MS4 permit requirements and become stronger voices for water quality improvement

2. Expanding outreach and training to *specialized large landowners*, and property and facility managers. Improve coordination with related federal and state agencies whose activities/projects/regulatory requirements

overlap with cluster goals including by not limited to: US Army Corps of Engineers, PA DEP, FEMA, PA Turnpike Commission, PECO, Penn DOT, PENNVEST, and SEPTA.

Expected Outcomes:

- GSI best practices training workshops conducted for specialized properties including: golf courses, corporate parks, shopping centers, military bases, and school/institutional property managers and staff.
- Partnerships strengthened with aligned groups such as the Schuylkill Action Network, International Facility Management Association, River Network, American Rivers, Center for Watershed Protection, and Sustainable Business Network, and Philadelphia Water Department.
- Process established to maintain contact with federal, state, and regional agencies in advance of project development or mitigation needs. Coordination of project planning efforts, design, and funding proposals.

3. Adapting and implementing *residential* GSI and pollution prevention training and support programs such as Stream Smart Stormwater House Calls, backyard buffers, rain barrel and rain garden workshops.

   Expected Outcomes:

   - "Clean water" residential outreach and training programs continued and/or expanded, including evaluating program effectiveness evaluation.
   - Rain Check, Stream Smart or similar residential support and education programs adapted to and implemented in cluster watershed communities.
   - Lessons learned to inform future expansion in other cluster communities.

4. Expanding *citizen training* and empowerment opportunities. Support and promote formation of Operations and Management teams to care for USP cluster projects.

   Expected Outcomes:

   - Retooled citizen monitoring program to focus on visual assessments, bank pin and EnviroDIY logger support.
   - Increased participation in citizen monitoring work.
   - Continued support of Master Watershed Stewards program, water resource teams, StreamKeepers, and Stream Watch programs. Connect trainees to local watershed organizations and local government advisory boards and commissions.
   - Formation of GSI maintenance teams to help care for installed projects.

5. Advancing *scientific research, modeling, and data analysis* of USPC funded watershed restoration projects.

   Expected Outcomes:

   - Publishing scientific research to provide information on water quality and water quantity impacts of watershed restoration projects.
   - Providing research, baseline mapping, and data analysis that would be made available for effective focus area, sub-watershed-wide and cluster-wide education and advocacy programs.
   - Continued support of science-based monitoring programs in the USPC.

6. Expanding informed decision-making in regards to *Capital Strategies*.

   Expected Outcomes:

   - Strategic placement and appropriate/timely implementation of capital projects supported.
   - Increased high tier project monitoring and continued support of pour point monitoring of focus areas. Details in Table 12.

The complementary strategies noted above can be applied across multiple clusters with similar stressors and goals. We intend to continue to participate in cross cluster and basin wide work groups/panels such as the Municipal Technical Assistance Advisory Panel that allows us to share our program efforts, strategies and lessons learned with DRWI partners and learn from our wider DRWI partners as well. As noted above, please refer to the individual focus area profiles located in APPENDIX 1 and APPENDIX 2 for more specific complementary strategy details.

Table 11: General Complementary Strategies

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
Complementary Strategy 1- Improve Municipal Stormwater Management Regulatory Policies and Practices; Increase Municipal GSI Investment; Develop Strategic Relationships with Local Government Officials, Promote Formation of new Environmental Advisory Councils; Support and Build Capacity of Existing EAC's Within Focus Areas				
Improve Stormwater Management Policies and Practices	1.a Improved **municipal** stormwater regulatory policies and practices. Reduction in waivers and variances undercutting water quality efforts.	PEC leads cluster-wide effort to gather, review and compare SW ordinance information, providing watershed group outreach leads with data and strategic approach.	# of municipalities in focus area with inconsistent standards & criteria # of municipalities that undertake efforts to review and improve codes and ordinances to provide consistent natural resource protection # of municipalities that undertake efforts to review and revise codes and ordinances to remove barriers to GSI and pollution prevention practices, and require consideration of GSI alternatives # of requested vs. approved waivers/variances from established stormwater ordinance standards and criteria	Improved and consistent codes and ordinances supporting GSI implementation and water quality improvement. Reduction in waivers and variances reported from baseline number or year.
	1.b Increased **municipa**l buy-in and enhanced compliance with MS4 permits	PEC leads cluster-wide effort to conduct Biennial Municipal Stormwater Workshop on topic relevant to municipal officials. PEC and watershed groups continue to survey needs and evaluate current suite of training opportunities.	# of municipal staff attending training or participating in technical assistance programs. (E.g. Villanova Municipal Stormwater Workshop or PEC Good Housekeeping Training) # of policies or practices added/modified because of training workshops such as: • Increase in municipal GSI land management practices. • Implementation of GSI practices through pollutant reduction plans and TMDLs.	Increased involvement of municipal staff and elected officials in Cluster MS4 training workshops. Involvement and attendance at related technical seminars, workshops or forums. Improvement over baseline[3] knowledge of municipal staff within cluster responsible for scm practice maintenance or plan implementation. (e.g. public works staff who maintain municipal facilities or vehicles)

[1] **Please see Tables 20, 25,30, and 36 for detailed complementary strategy outcomes by Focus Area**. See Table 41 for Poquessing Creek Complementary Strategies.

[2] Assumes some baseline knowledge surveys will be conducted by Coordinating Committee. Otherwise, knowledge increases or behavior changes will be measured through individual training or workshop evaluations and/or specific desired actions.

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
Improve Stormwater Management Policies and Practices		PEC and watershed groups evaluate effectiveness of training programs.		
	1.c Increased **municipal** interest and political support for financing long term support of GSI	Watershed groups monitor budgets over time to establish baseline and report to cluster leads. PEC leads targeted effort to evaluate and promote funding mechanism including sw fees/authorities.	# of approvals for cash or in-kind support of GSI projects $ invested in new GSI projects # of sw fee/authority evaluations conducted # of sw fee ordinances developed and adopted # of new sw authorities created	Increased spending as % of overall budget for GSI work, cash invested as leverage for GSI projects, consideration of fees or authorities to establish financial mechanism for long term O & M
	1.d Cluster partners continue to develop strategic relationships with **local government** officials focused on improved SWM and GSI program implementation.	PEC provides support to watershed groups for the following activities: Inventory existing relationships established through stakeholder outreach. Identify key elected officials and municipal staff currently not engaged (starting in focus areas). Develop engagement strategy.	Effectiveness in working with elected officials training program developed/updated # of USP cluster partner's and stakeholders participating in training # of other DRWI partners participating in training # of strategic relationships expanded/created; targeted at supporting above ordinance, MS4, GSI, and SW management financing metrics.	Expanded and improved strategic relationships between cluster partners and local government officials.
	1.e **Municipal** Environmental Advisory Councils (EACs) established in cluster communities lacking these advisory boards and capacity improved in existing EACs.	PEC leads effort to evaluate status of EACs in Cluster Municipalities. PEC and watershed groups provide technical assistance to establish new or improve capacity of existing EACs.	# of **new** EACs/joint EACs established (or process to establish initiated) in cluster municipalities. # of citizen stewards and champions appointed to new or existing EACs. # of collaborations with **existing EAC**s (or: # of contact hours between EAC and watershed staff)	EACs or joint EACS established and/ or improved capacity to enhance environmental awareness and constituency oversight in municipalities.

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
Complementary Strategy 2: Expand outreach and training to specialized large landowners, and property and facility managers. Improve coordination with related federal and state agencies whose activities/projects/regulatory requirements overlap with cluster goals				
Improve Stormwater Management Policies and Practices	2.a Improved **commercial/ large landowner** stormwater management policies and practices	PEC and watershed groups continue outreach and provide training events by target users, (e.g. golf courses, corporate parks, shopping centers. Survey needs and report to cluster.	# of facility managers/employees attending GSI benefit and maintenance training # of facility managers/employees with improved understanding of runoff, water quality or pollution prevention issues. # of facility managers allowing partner access to their land for GSI projects. # of facility managers who directly incorporate new strategies or practices to prevent pollution.	Improvement over baseline[1] of knowledge of landowners/facility managers responsible for implementing land management practices to minimize pollution into surface waters.
	2.b. Increased **commercial/large landowner** sector investment in GSI	PEC and watershed groups survey and monitor commercial sector contacts/participants during and after training events.	# of facility managers recommending investment in new GSI projects. $ invested in new GSI project design and implementation.	Percent increase over baseline of facility managers/landowner who invest in design and development of GSI vs. traditional swm controls
	2.c Improved public/private **educational landowner** stormwater management policies and practices	PEC and watershed groups continue outreach and target training events aimed at educational institution facility managers. Survey knowledge and report to cluster.	# of facility managers/employees attending GSI benefit and maintenance training # of facility managers/employees with improved understanding of runoff, water quality or pollution prevention issues. # of school facility managers allowing partner access to their land for GSI projects. # of school facility managers who directly incorporate new strategies or practices to prevent pollution.	Improvement over baseline[1] of knowledge of landowners/facility managers responsible for implementing land management practices to minimize pollution into surface waters.
	2.d Increased public/private **educational landowner** investment in GSI	Watershed groups survey and monitor school facility contacts/participants during and after in training events.	# of facilities managers recommending investment in new GSI projects. $ invested in new GSI project design and implementation.	Percent increase over a baseline of facility managers who invest in the design and development of GSI practices vs. traditional swm controls.
	2. e Coordination enhanced among federal, state and regional agencies to leverage water quality improvement opportunities & funding	PEC leads cluster-wide effort to communicate regularly with Federal, state and regional agencies such as US ACOE, FEMA, PECO, PennDOT, PA Turnpike Commission, SEPTA, PHS and others to identify strategic funding /mitigation opportunities.	# of projects which can leverage funding from outside agency aligned programs $ leveraged with support of outside agencies.	Increased awareness of funding or mitigation opportunities of related agencies which can enhance capital project implementation and financing and improve public and private support.

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
Complementary Strategy 3: Adapt and Implement Residential GSI and Pollution Prevention Training and Support Programs.				
Improve Stormwater Management Policies and Practices	3.a Improved **residential** pollution-prevention practices and increased investment in GSI measures.	Watershed groups continue or expand "clean water" residential outreach and training programs, including evaluating program effectiveness evaluation.	# of residents participating in workshops/site assessments # of residents with improved understanding of runoff, water quality or pollution prevention issues # of residents installing GSI practices on their properties.	Expansion of residential GSI training workshops, increased awareness and understanding of water quality benefits, and increased use of GSI techniques.
Complementary Strategy 4: Expand Citizen Water Quality Monitoring Training and Watershed Stewardship Empowerment Opportunities; Support and Promote Formation of O&M Teams to Care for USP Cluster GSI Projects.				
Build Constituency Support and Disseminate Learning from the Focus Area Implementation Projects	4.a Citizens empowered to increase interactions with local officials related to land use decisions impacting water quality.	Watershed groups with PEC supports develop and/or expand citizen empowerment training programs.	# of citizens attending training workshops. # indicating willingness to engage and meet with elected officials (measured from baseline)	Programs/Training developed to improve citizen effectiveness in working with elected officials.
	4.b Citizens watershed champions trained and become more involved in watershed groups/local commissions.	Watershed groups continue citizen stream monitoring, stormwater resource teams, and master watershed steward training programs. PEC continues to support county-wide master watershed stewards program planning and implementation.	# of new citizen stream watchers/monitors trained in visual stream assessment protocols # of volunteer hours in training and stream monitoring activities. # of trainees who participate in local watershed organizations or are appointed to municipal boards/commissions.	Increase number of new StreamKeepers/stream watchers, stormwater resource teams, and Master Watershed Stewards trainees into established programs
	4. c Operation and Maintenance (O/M) Team formed to care for USP Cluster partner projects (e.g. modelled after Power Corps).	Watershed groups assess feasibility of creating and funding O/M team.	# Number of people recruited/trained for O/M team. # of projects managed by team. # of inspections and maintenance activities conducted.	O/M team formed, DRWI funded projects managed, and activities performed.

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
Complementary Strategy 5: Scientific research, assessment and documentation (University lead)				
Expand knowledge and disseminate results and methods to scientific and lay communities	5.a Increase engagement of new watershed professionals	Provide opportunities for student training	# of students (undergraduate and graduate) trained in modeling techniques # of students (undergraduate and graduate) trained in field methods # of student educational programs conducted by university partners	Students recruited and trained. Graduate students' complete thesis and/or dissertation.
	5.b Better informed monitoring in watershed	Science-based monitoring programs in USPC	# of projects instrumented and monitored # of stream reaches instrumented and monitored # of DIY-loggers installed in the USPC	Hydrologic and water quality performance of individual stormwater management projects is monitored Specific individual, strategic stream reaches are instrumented and water quality is monitored
	5.c Better informed modeling of watersheds	Science-based modeling of FAs	# of SWMM models built and calibrated	SWMM built and calibrated for each new FA
	5.d Increased understanding of water quality trends, leading to better informed decision making and public education.	Data analysis, baseline mapping and research to support education and outreach programs	# of programs supported # of education and outreach programs supported by university research # of research hours committed to developing material for education and outreach programs	Requests for information, data and mapping from education and outreach programs are fulfilled
	5.e Increase recognition of USPC and DRWI	Conferences and meetings to inform partners and the scientific community of USPC findings	# of meetings/consultations targeted to inform partners of USPC findings # of presentations at professional meetings and conferences	USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged
	5.f Increase scientific understanding of urban hydrology	Publications to inform scientific community and partners of USPC findings	# of peer reviewed journal articles submitted # of communications (newsletter, twitter, email, etc.) articulating USPC finding to DRWI partner organizations and other key stakeholders	USPC results are disseminated to the scientific community and the importance of findings is discussed and explained.
Complementary Strategy 6: Support for Capital Projects (University lead)				
To support implementation and performance	6.a Appropriate and timely project implementation	Assist partner with project submissions and support coordination for funded projects	# of meetings to support project development # of project submissions supported # of project submissions funded for implementation # of projects completed	Project submissions supported with site description, project narrative, cost estimates, permitting guidance, mapping, modeling and pollutant reduction estimates.

Goal	Outcome[1]	Strategy[2]	Metric	*Definition of Metric*
monitoring of projects	6.b Strategic placement of capital projects	Modeling and conceptualization of projects	# of site descriptions developed # of projects modeled with STEPL # of landowners participating in capital projects consistent with DRWI goals # of acres analyzed for potential inclusion of project in the cluster	STEPL used to model pollutant load reduction expected from individual projects Site descriptions and recommendations provided to landowners
	6.c High tier project monitoring	Continue intensive project-level monitoring in the Pennypack and TTF. Add project monitoring in Cobbs.	# of sites instrumented and maintained # of storm events monitored and analyzed # of findings related to functionality (e.g. modification suggested or finding of no changes needed)	Provide highly instrumented sites to evaluate projects and make suggestions about functionality.
	6.d Pour point monitoring of focus areas	Develop an enhanced monitoring program for pour points	# of focus areas in which water quality at the pour point is monitored	A parameter-specific water quality monitoring plan is developed for the pour point of each focus area

Table 12: High Tier Monitoring of Capital Projects Parameter, Instrumentation and Location

Category	Instrument	Purpose/Parameter	Sites
Soil Moisture Sensors	Soil moisture meter	Soil temperature and conductivity; Soil water content	Abington Friends School, Multiple depths Abington Meeting House, Multiple depths Naylors Run, To be installed 2018
Instream Monitoring[1]	Flowmeter	Creek's depth, velocity, and temperature	Abington Friends School & Meeting House, Single Meter in Jenkintown Creek Naylors Run, To be installed 2018
	Autosampler or Grab Sampling	pH, conductivity, TSS, TDS, TKN, NO_2, TKP, PO_4, CHL and NO_X	Abington Friends School & Meeting House, Multiple locations College Settlement, Multiple locations Naylors Run, To be installed 2018
Weather Station	Tipping Bucket	Precipitation	Abington Friends School College Settlement Naylors Run, To be installed 2018
	Wind/Air Sensor	Wind speed and direction; Air temperature, humidity, and barometric pressure	Abington Friends School College Settlement Naylors Run, To be installed 2018
	Pyranometer	Solar radiation	Abington Friends School College Settlement Naylors Run, To be installed 2018
SCM Monitoring[1]	Weir w/ Bubbler Tube	SCM outflow's depth, velocity, and temperature	Abington Friends School Rain Garden Abington Meeting House Rain Garden College Settlement Detention Basins Naylors Run, To be installed 2018
	Bubbler	Ponding depth and infiltration	Abington Friends School Rain Garden Abington Meeting House Rain Garden College Settlement Detention Basins Naylors Run, To be installed 2018
	Pore Water Samplers	pH, conductivity/TDS, TKN, NO_2, TKP, PO_4, CHL and NO_X	Naylors Run, To be installed 2018
Visual Inspection[2]	N/A	Infiltration; Inflow and outflow accumulation, vegetation cover, sediment accumulation, and erosion	Saint Basil

[1]12-15 storms samples a year and 4 baseflow samples a year
[2]Quarterly more than 72 hours after rainfall event

SECTION 04

FINANCIAL PLAN & BUDGET

The current projected Phase 2 expenses for the Upstream Philadelphia Cluster are summarized below. Full budget information will be uploaded to the Dropbox in a separate file titled Appendix 4.

Total Operational Funding Request for USP Action Plan	**TOTAL: $3,543,692**
NFWF Capital Funding Estimate for Action Plan	**$3,006 146**

CLUSTER TEAM & EXTERNAL PARTNERS

The creation of USPC's Strategic Phase 2 Plan was a collaborative and transparent effort. Implementing this plan will require continued commitment and collaboration at all levels. The Planning Team has developed an updated matrix of the management framework to best reflect and reduce Phase 1 challenges areas and communications gaps (

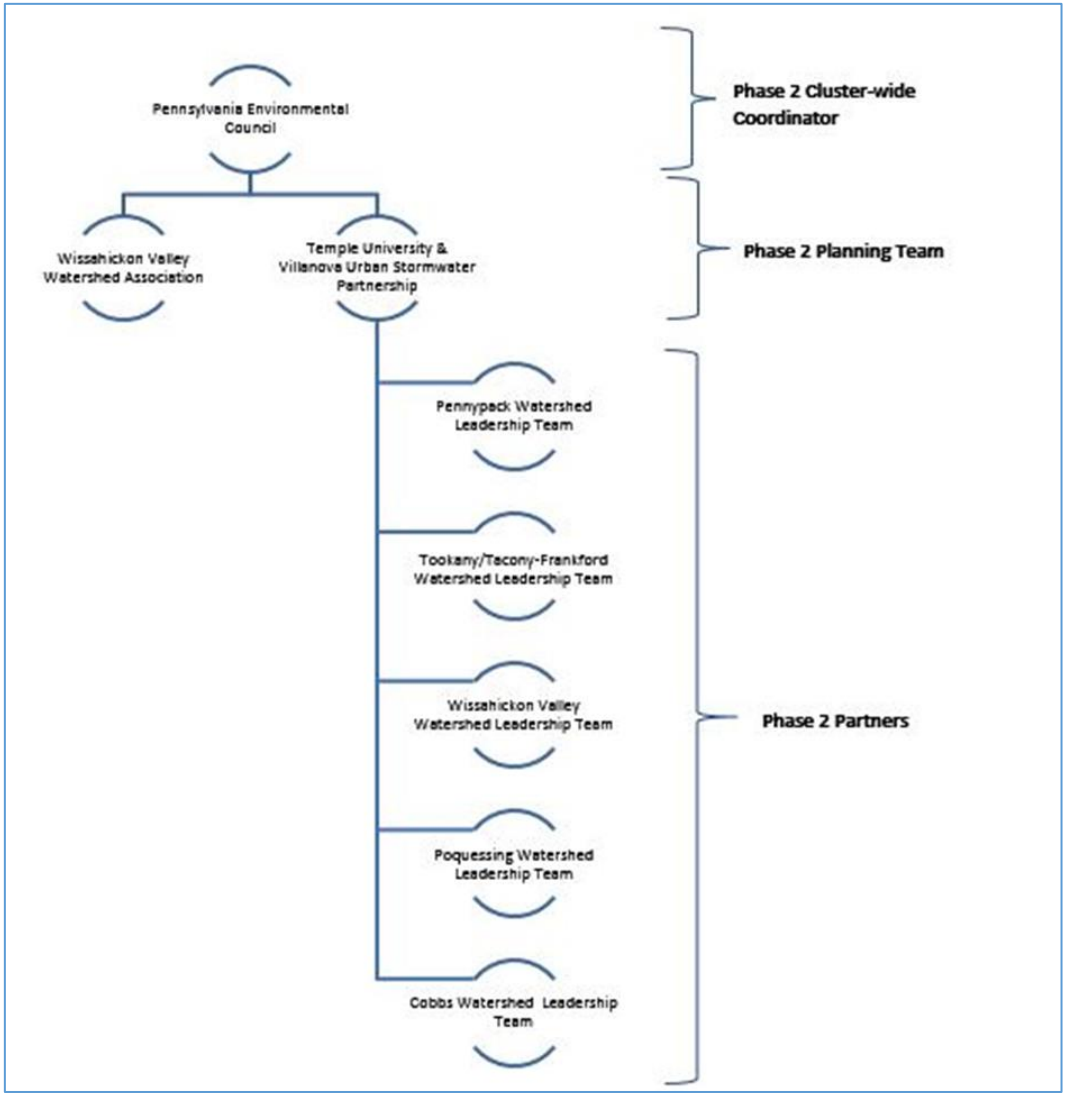


Figure 9;

Table 13)

Table 13 Additionally, the USPC Planning Team and Partner organizations have pieced together an extensive list of current and anticipated stakeholder and supporting organizations over the course of Phase 2 (Table 15).

Figure 9: USPC Phase 2 Organization Structure

Table 13: Phase 2 Cluster Team

Partner Organization	Core Team	Role/Responsibility
Pennsylvania Environmental Council	Patrick Starr Susan Myerov Paul Racette	Since 1970, PEC has been a central figure in the environmental and conservation discussion in Pennsylvania. As of 2013, PEC has managed challenges facing the Delaware River Watershed from past activities, current practices, or potential future development impacts. PEC coordinates efforts of the Upstream Suburban Philadelphia cluster in this multi-year initiative.

Partner Organization	Core Team	Role/Responsibility
Temple University	Dr. Laura Toran Dr. Robert Ryan Susan Harris Dr. Manahel Soro Richard Fromuth Various Graduate Students & Research Technicians	Temple acts as a resource for partner organizations, providing modeling and monitoring services, project management and development tools, and various information to improve decision-making relative to project implementation and maintenance.
Villanova Urban Stormwater Partnership	Dr. Andrea Welker Madeline Foley Various Graduate Students & Research Technicians	As a leader in the field of stormwater management since the early 1990s, Villanova's Urban Stormwater Partnership models and monitors installed SCMs and nearby receiving waters. The VUSP works with all of the watershed partners on educational and outreach efforts as well.
Wissahickon Valley Watershed Association	Gail Farmer Lindsay Blanton	The Wissahickon Valley Watershed Association takes a core role in Phase 2 in addition to performing the role of Wissahickon Watershed Leadership Team. WVWA coordinates and assists in the localized development of watershed-wide Complementary strategy initiatives.
Lower Merion Conservancy	Maurine McGeehan Tom Clark Chelsea Heck	Cobbs Watershed Leadership Team member
Darby Creek Valley Association	Derron LaBrake Jaclyn Rhoads	Cobbs Watershed Leadership Team member
Eastern Delaware County Stormwater Collaborative	Jamie Anderson	Cobbs Watershed Leadership Team member
Pennsylvania Resource Council	Mario Cimino	Cobbs Watershed Leadership Team member
Pennypack Ecological Restoration Trust	David Robertson Kevin Roth	Pennypack Watershed Leadership Team
Friends of the Poquessing Watershed	Donna Remick Meghan Rogalus Vlad Erkalov	Poquessing Creek Leadership Team
Tookany/Tacony Frankford Watershed Partnership	Julie Slavet	Tookany-Tacony Frankford Leadership Team

Table 14: Anticipated Partners and Stakeholder for Phase 2

Supporting Organization	Contact	Current Level of Engagement/Anticipated Role
Abington EAC	Sue Myerov, Jenn Sherwood, Andrea Soo	Support for project identification
Abington Friends School	Rosanne Mistretta	Project partner, project site, monitoring and education
Abington School District	Tom Schneider	Client/End User, project partner, potential project sites
Abington Township	Richard Manfredi, Mike Powers, Andy Oles	Client/End User, project partner
Alverthorpe Manor	Andy Oles	Client/End User, project partner, potential project sites
American Rivers	Laura Craig	Project implementation support, Technical and policy assistance
Army Corps of Engineers	Mark Eberle, Regina Kukola	Funder; Project Implementation Support
Bensalem School District	Robin Fanini	Client/End User, project partner, potential project sites
Bensalem Township	Matt Takita, Bill Comey, Tony Belfield	Client/End User, project identification and implementation partner
Breyers Masters Communities	Ben Romney	Client/End User, project partner, potential project sites
Briar Bush	Greta Brunschwyler	Project partner, potential project site, monitoring and education
Bucks County Conservation District	Meghan Rogalus	Project implementation support
Bucks County Planning Commission	Donna Byers	Regulator partner; Funder
Cerulean LLC	Susan Harris	Consultant (involvement includes: Plan & Grant Writing; Project Manager)
Center for Watershed Protection	Mike Hickman	Technical support
Cheltenham Township	Bryan Havir, Alyson Elliott	Client/End User, project partner
Coalition for the Delaware River Watershed	Madeline Urbish	Policy and regulatory advocacy
Darby Borough	Mark Possenti	Client/End User, project partner
Delaware County Conservation District	Brian Vadino	Project implementation support
Delaware County Planning Commission	Karen Holm	Planning partner; Funder

Supporting Organization	Contact	Current Level of Engagement/Anticipated Role
Delaware Valley Regional Planning Commission	Chris Linn, Alison Hastings, Christina Arlt	Non-profit partner; Support for planning and municipal outreach; Leading Municipal Technical Assistance Advisory Panel (MTAAP)
Einstein Hospital	Harry Kamnikha	Client/End User, project partner, potential project site
Folcroft Township	Marianne French	Client/End User, project partner
Glen Foerd on the Delaware	Meg Sharp Walton	Land manager; project and educational programming
Glenolden Township	Brian Razzi	Client/End User, project partner
Gratz College	Rosalie Guzofsky	Client/End User, project partner, potential project sites
Green Hill Condominium Complex	Barry Bauman	Client/End User, project partner, potential project sites
Haverford Township	Larry Gentile	Client/End User, project partner
Heritage Conservancy	Jeff Marshal	Conservation and municipal outreach
Holy Family University	Sister Maureen McGaretty	Volunteer Monitoring
Horsham Township	Bill Walker, Mark Hudson	Client/End User, project partner
Jenkintown Borough	George Locke	Client/End User, project partner
Lansdale Borough	Chris Kunkel	Client/End User, project partner
Lower Gwynedd Township	Jamie Worman	Client/End User, project partner
Lower Moreland School District	Bryan Swank, Julie Hartman; Rachel Theirolf	Client/End User, Project partner (Pine Road Elementary)
Lower Moreland Township	Loreen Montagon, Chris Hoffman	Client/End User, project partner
Lower Southampton Environmental Advisor Council	Dean Bryson, Jim Kates; Bruce Offner	Support for project identification
Lower Southampton Township	Joseph Golden	Client/End User, project partner
Manor College	John Peri	Client/End User, project partner, potential project sites

Supporting Organization	Contact	Current Level of Engagement/Anticipated Role
Montessori School	Laurie Stulb	Client/End User, project partner
Montgomery County Conservation District	Krista Shierer	Project implementation support
Montgomery County Planning Commission	Jody Holton, Jon Lesher, Drew Shaw	Planning partner; Funder; Facilitating Wissahickon Clean Water Partnership
Montgomery Township	Larry Gregan	Client/End User, project partner
MRNenvironmental, Inc.	Richard Nalbandian	Project promotion; focus on Pennypack Watershed
Natural Lands Trust	Rick Tralies, Ann Hutchinson, Ryan Walker	Various support to Upstream Partnership Conservation and municipal outreach
Neshaminy School District	Tim Trzaska	Client/End User, project partner, potential project sites
PA Department of Environmental Protection	David Burke; Jennifer Fields	Project support for Growing Greener grants and expert assistance on MS4 Compliance Programs (including Pollutant Reduction Plans)
PA Dept. of Community and Economic Development	Dennis Davin, David Smith	Funder – Watershed Restoration and Protection grants – CFA
PA Dept. of Conservation and Natural Resources	Drew Gilchrist	Project support for community conservation partnership program
Partnership for the Delaware Estuary	Jen Adkins, Virginia Vassalotti	Project implementation support
Parx Casino	Ron Davis	Client/End User, project partner, potential project sites
PECO	Sara Hall, Amanda Benner	Regional partner; Right of way green landscaping
Penn Future	Alice Baker, Zakia Elliott, Jay Andrews	Support for complementary strategies including municipal outreach and stormwater finance.
PennDOT District 6	Robert Eppley	Regional partner; Potential project support through mitigation projects
PENNVEST	Tesra Schlupp	Funder; revolving PA State water fund
Philadelphia Horticulture Society	Glen Abrams, Bob Adams	Citizen outreach support via Rain Check and Tree Vitalize
Philadelphia Water Department	Maggie Rwakazina, Chris Anderson; Jason Cruz	Watershed specialists and support staff for Wissahickon Clean Water Partnership and Upstream Partnership

Supporting Organization	Contact	Current Level of Engagement/Anticipated Role
Rockledge Borough	Grace Metzinger	Client/End User, project partner
Saint Basil Academy	Gwen Cote, Glen Angus, Soo Chang	Client/End User, project partner, potential project sites
Salus University	Donald Kates	Client/End User, project partner, potential project sites
Schuylkill River Heritage Center	Tim Fenchel	Funding program – Schuylkill River Restoration Fund
SEPTA	Becky Collins	Regional partner, green infrastructure and right of way landscaping
Sisters of Saint Basil the Great	Sister Dorothy Ann Busowski	Client/End User, project partner, potential project sites
Springfield Township	Don Berger	Client/End User, project partner
Stroud Water Research Center	John Jackson	Technical support for monitoring program
Tri-State Engineers	Larry Young, Wayne Kiefer, John Genovesi	Consulting Engineer, Lower Southampton Township; Project support
Trout Unlimited	Denis Mora, David Kenny	Volunteers, project partners
Upper Dublin Township	Paul Leonard	Client/End User, project partner
Upper Moreland School District	Bob DeMarco	Client/End User, project partner
Upper Moreland Township	David Dodies	Client/End User, project partner
Upper Southampton Township	Joseph Golden	Funder; Client/End User; project partner
Warminster Township	Gregg Schuster, Amanda Zimmerman, Eric Hinz	Client/End User, project partner
Whitemarsh Township	Rick Mellor	Client/End User, project partner
Whitpain Township	Jim Blanch	Client/End User, project partner
World Mission Society	Ivan Rodriguez	Client/End User, project partner, potential project sites

IMPLEMENTATION TIMELINE

Table 15: Phase 2 Timeline

Partner (s)	Strategies	2018				2019				2020				2021		2022		2023	
	Capital Intensive	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Winter Spring	Summer Fall	Winter Spring	Summer Fall	Winter Spring	Summer Fall
	Riparian Corridor Protection/Restoration																		
WLT[1] w/ Temple & PEC	Outreach																		
WLT w/ Temple	Funding																		
WLT w/ Temple & Villanova	Implementation																		
	Streambank Restoration																		
WLT w/ Temple & PEC	Outreach																		
WLT w/ Temple	Funding																		
WLT w/ Temple & Villanova	Implementation																		
	Stormwater Management																		
WLT w/ Temple & PEC	Outreach																		
WLT w/ Temple	Funding																		
WLT w/ Temple & Villanova	Implementation																		
	Complementary																		
	1. Improve Municipal Stormwater Management Policies and Practice; Promote Formation of new Environmental Advisory Councils; Support and Build Capacity of Existing EAC's Within Focus Areas																		
PEC w/WLT	A																		
PEC w/WLT	B																		
PEC w/WLT	C																		
PEC w/WLT	D																		
PEC/WLT	E																		
	2. Expand outreach and training to specialized large landowners, and property and facility managers. Improve coordination with related federal and state agencies whose activities/projects/regulatory requirements overlap with cluster goals																		
WLT w/ Universities & PEC	A																		
WLT w/ Universities & PEC	B																		
WLT w/ Universities & PEC	C																		

	Capital Intensive	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Winter Spring	Summer Fall	Winter Spring	Summer Fall	Winter Spring	Summer Fall
WLT w/ Universities & PEC	D																		
WLT w/ Universities & PEC	E																		
	3. Adapt and Implement Residential GSI and Pollution Prevention Training and Support Programs																		
WLT	A																		
	4. Expand Citizen Water Quality Monitoring Training and Empowerment Opportunities; Support and Promote Formation of O&M Teams to Care for USP Cluster GSI Projects																		
WLT w/ PEC	A																		
WLT w/ PEC	B																		
PEC w/ Universities & WLT	C																		
	5. Advancing scientific research, modeling, and data analysis of USPC funded watershed restoration projects.																		
Temple & Villanova	A																		
Temple & Villanova	B																		
Temple & Villanova	C																		
Temple & Villanova	D																		
Temple & Villanova	E																		
Temple & Villanova	F																		
	6. Expanding informed decision-making in regards to *Capital Strategies.*																		
Temple & Villanova	A																		
Temple & Villanova	B																		
Villanova	C																		
Temple	D																		

[1]Watershed Leadership Team

[2]Training Program

[3]Survey & Assessment

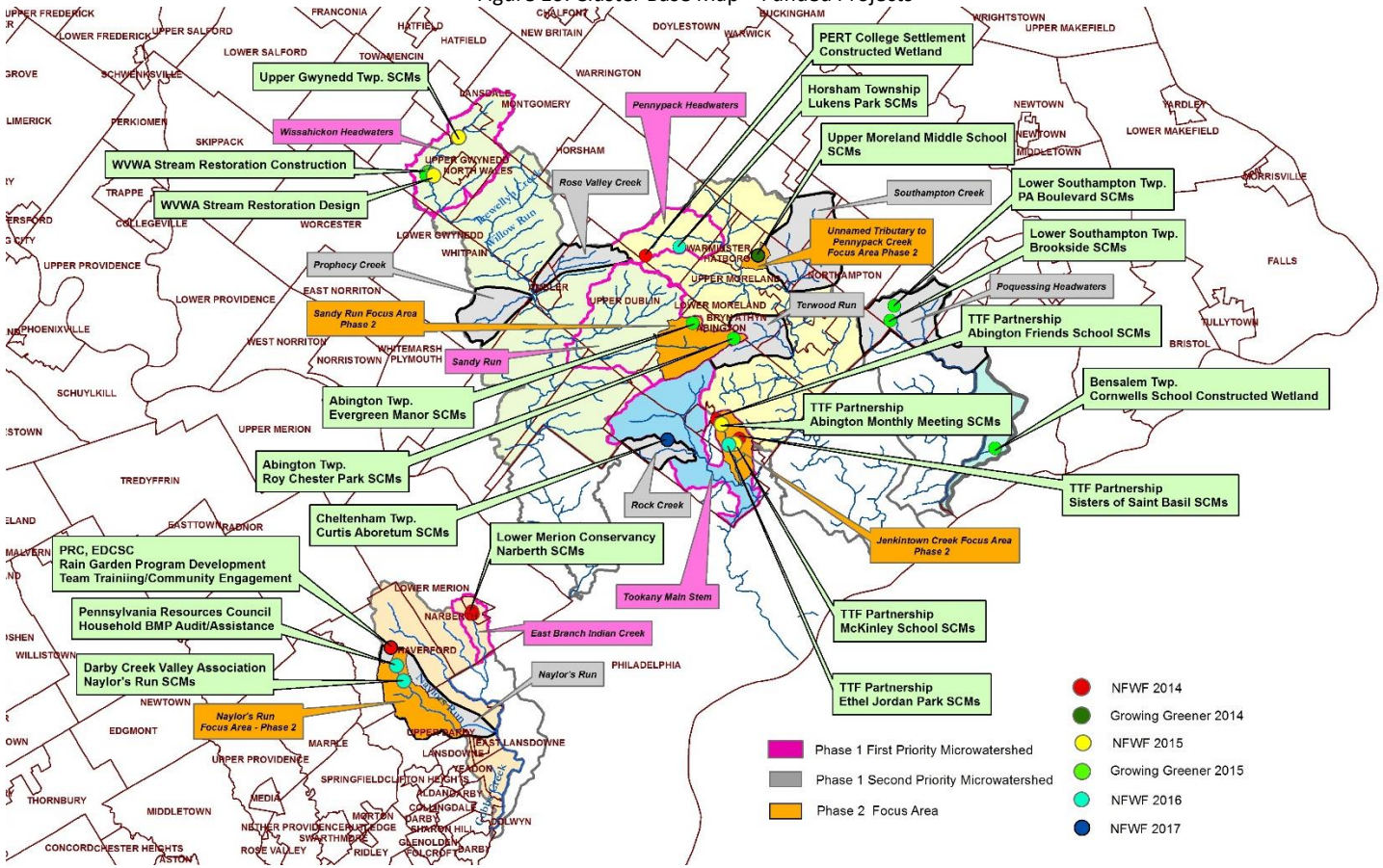
[4]Target Audience

APPENDIX

1. FOCUS AREA PROFILES

Following the guidance from the DRWI, the USPC has prioritized four focus areas which are expected, given the approximate amount of capital project investment, to slow or reverse trends in water quality degradation (Figure 10). All critical information about the focus areas are found in the following Focus Area Profiles. These Profiles dive into more detailed information for each of these focus areas and identify unfunded or partially funded projects for future consideration.

Figure 10: Cluster Base Map – Funded Projects



1A. Naylors Run

The Naylors Run focus area drains approximately 1900-acre, including portions of Upper Darby and Haverford Townships. The focus area consists of the exposed segment of the Naylors Run tributary to the Cobbs Watershed, sandwiched between East Marshall Road and North Eagle Road. Stormwater runoff and low dry-weather baseflow triggers substantial nonpoint source pollutant loads and sedimentation across the Cobbs watershed. Here, we will focus on an unusual area without extensive channelizing and relocation of the stream. Hence, we plan to strategically implement riparian corridor restoration and stormwater management projects to ultimately reduce runoff.

Watershed Description

The Naylors Run Focus area is located in Delaware County, Pennsylvania. The watershed covers 2239.37 acres over three municipalities (Figure 11). The watershed is 97.2 % urban cover, with the highest majority consisting of Residential: Single Family Detached homes at 55.29 % of the watershed cover according to 2015 DVRPC data (Refer to Figure 12 and Table 16). Figure 17 provides total annual loads for Naylors Run focus area.

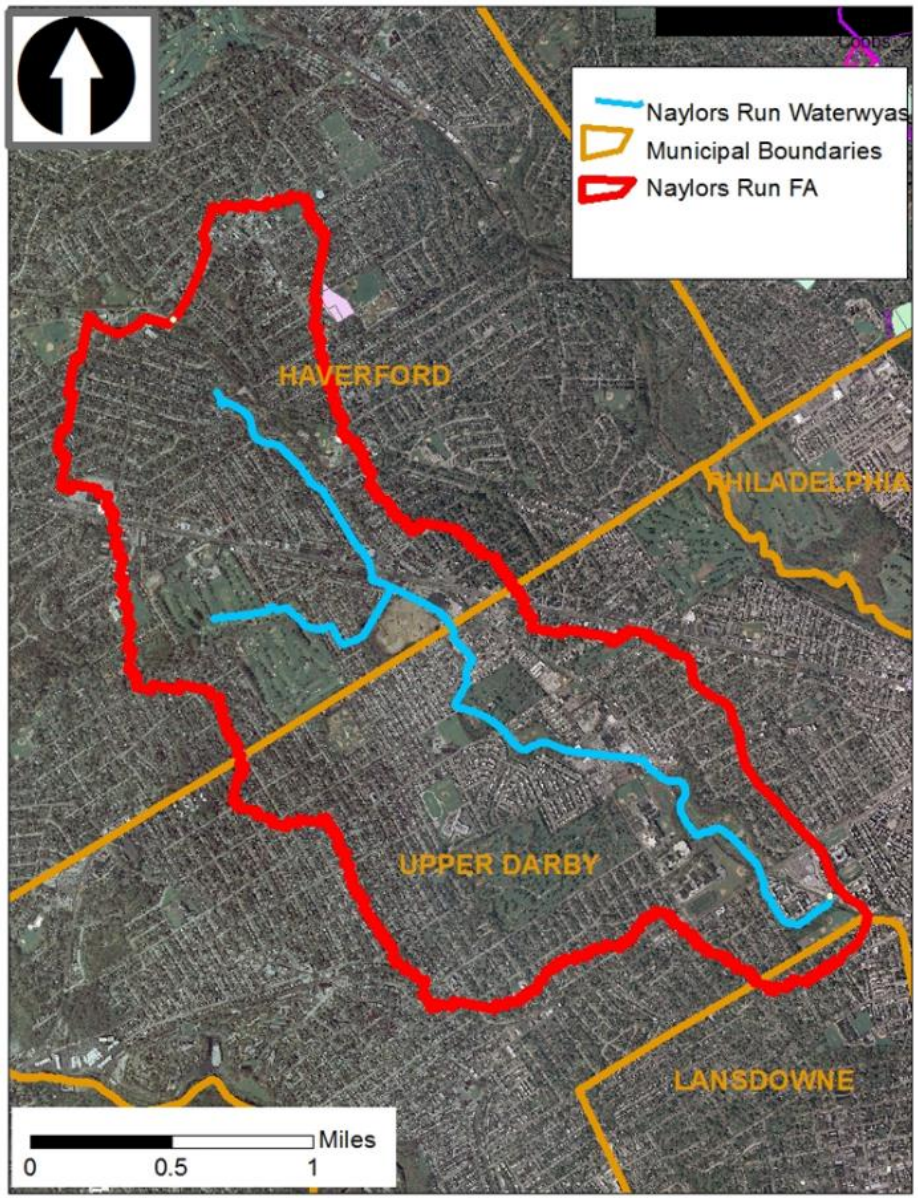


Figure 11: Naylors Run Focus Area and Municipalities

Figure 12: Naylors Run Focus Area Land Use Map

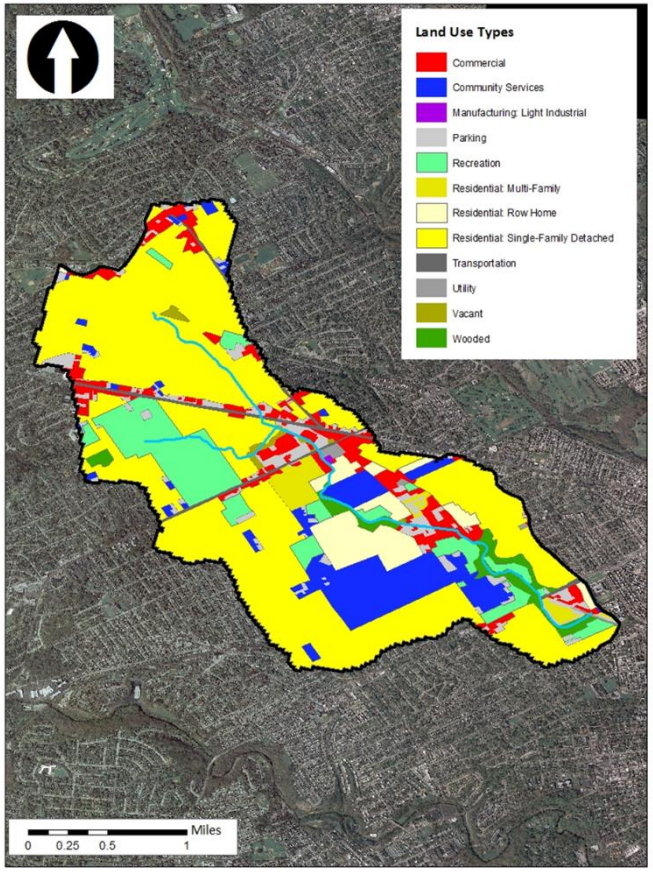


Table 16: Naylors Run Land Use Delineation

Land Use Category	Area	
	acres	%
Wooded	61.63	2.75%
Commercial	152.10	6.79%
Community Services	216.27	9.66%
Manufacturing: Light Industrial	1.09	0.05%
Parking	106.77	4.77%
Recreation	232.68	10.39%
Residential: Multi-Family	46.97	2.10%
Residential: Row Home	123.82	5.53%
Residential: Single-Family Detached	1238.11	55.29%
Transportation	37.10	1.66%
Utility	8.66	0.39%
Vacant	14.17	0.63%
Total	**2239.37**	**100%**

Table 17: Focus Area Total Loads

Sources	N Load	P Load	Sediment Load
Total Loads (lb.)	9086	1605	1002498
Loading Rates (lb./acre)	4	0.7	448

Capital Intensive Strategies

Since our watershed partners are in the mist of coordinating the watershed-wide Pollutant Reduction Plan we are able to expand on past strategies in the focus area (Table 19). In the past, due to cost and space constants, restoration efforts have focused on small-scale rain garden projects (Figure 14). Today, with municipal collaboration underway and new sources of financial match, future projects have expanded in scale (Figure 13; Table 18). That said, with a number of established relationship with landowners we have been able to conceptualize a diverse array of projects in the focus area.

This focus area holds four moderately sized education facilities - Monsignor Bonner & Archbishop Prendergast Catholic High School/Archdiocese of Philadelphia, Upper Darby High School, Drexel Hill Middle School and Hillcrest Middle School. Additionally, this area is rich in private and public parks/recreation areas, containing opportunities for us to enhance open space at the following: Naylors Run Park, Drexel Gardens Park, Dermond Recreation Area, Llanerch Country Club, Pennsy Trail, Thompson Nature Park, Williamson Field and Bailey Park. Further, the Naylors Run focus area contains two large cemeteries - Montrose Cemetery and Har Jehuda Cemetery - that could serve as project partners.

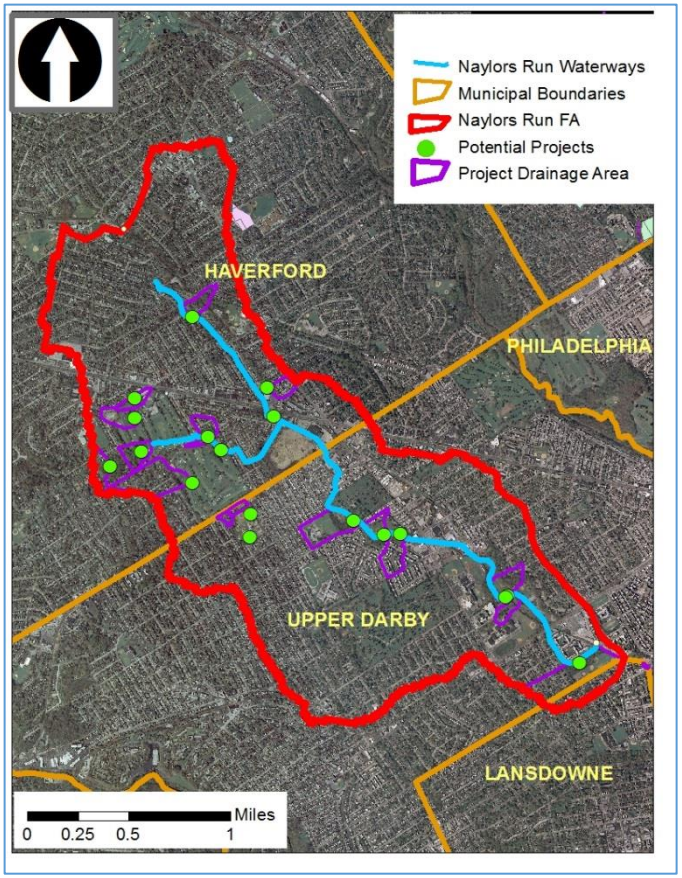


Figure 13: Naylors Run Headwaters Focus Area and Potential Drainage Area

Table 18: Potential Projects in Naylors Run Focus Area over Phase 2 Timeframe

Project Name	Status (Estimated Break Ground Date)	SCM	Project Pollutant Reduction	Potential Partners	Cost Estimates	Potential Funding Support	PRP/TMDL Plan Support
Drexel Garden's Park 1[1]	Preliminary: Construction within five years following PA DEP approval	Stream Stabilization & Riparian Buffer	Sediment reduction = 103244 lb./yr.	Upper Darby Twp.; DCVA; PRC	$855600	Upper Darby Twp.	Yes
Drexel Garden's Park 2[1]	Preliminary: Construction within five years following PA DEP approval	Bioinfiltration/Retention/Wetland	Sediment reduction = 14426 lb./yr.	Upper Darby Twp.; DCVA; PRC	$368900	Upper Darby Twp.	Yes
Drexel Garden's Park 3[1]	Preliminary: Construction within five years following PA DEP approval	Bioswale	Sediment reduction = 420 lb./yr.	Upper Darby Twp.; DCVA; PRC	$46500	Upper Darby Twp.	Yes
Pennsy Trail[2]	Conceptualized	Bioswales	884 lbs./yr. of silt; 2 lbs./yr. of Phosphorus; 19 lbs./yr. of Total Nitrogen	DCVA; PRC			-

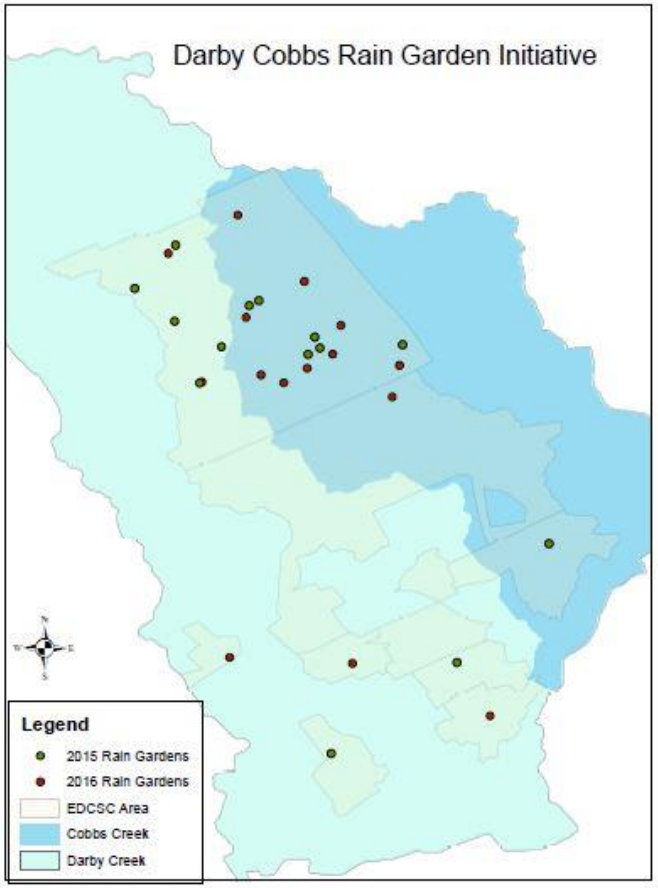
Project Name	Status (Estimated Break Ground Date)	SCM	Project Pollutant Reduction	Potential Partners	Cost Estimates	Potential Funding Support	PRP/TMDL Plan Support
Richland Park[2]	Conceptualized	Filtering Practices	61 lbs./yr. of silt; 0.1 lbs./yr. of Phosphorus; 0.7 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Dermond Rec 1[1]	Preliminary: Construction within five years following PA DEP approval	Bioswale	Sediment reduction = 269 lb./yr.	DCVA; PRC	$83700	Upper Darby Twp.	Yes
Dermond Rec 2[1]	Preliminary: Construction within five years following PA DEP approval	Rain Garden w/ Underdrain	Sediment reduction = 61 lb./yr.	DCVA; PRC	$26040	Upper Darby Twp.	Yes
Dermond Rec 3[1]	Preliminary: Construction within five years following PA DEP approval	Infiltration/Retention Underground	Sediment reduction = 164 lb./yr.	DCVA; PRC	$34875	Upper Darby Twp.	Yes
Thompson Nature Park[2]	Conceptualized	Wet Ponds & Wetlands	847 lbs./yr. of silt; 2 lbs./yr. of Phosphorus; 19 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Naylors Run Park 1[2]	Conceptualized	Basin	-	DCVA; PRC			-
Naylors Run Park 2[1]	Preliminary: Construction within five years following PA DEP approval	Rain Garden/ Bioswale	Sediment reduction = 36 lb./yr.	Upper Darby Twp.; DCVA; PRC	$54312	Upper Darby Twp.	Yes
Bailey Park[2]	Conceptualized	Wet Ponds & Wetlands	378 lbs./yr. of silt; 0.8 lbs./yr. of Phosphorus; 2 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Hillcrest Elementary School[2]	Conceptualized	Bioretention/Rain Gardens	2336 lbs./yr. of silt; 4 lbs./yr. of Phosphorus; 14 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Llanerch Country Club 1[2]	Conceptualized	Linear Bioswale	-	DCVA; PRC			-
Llanerch Country Club 2[2]	Conceptualized	Basin Retrofit	153 lbs./yr. of silt; 0.09 lbs./yr. of Phosphorus; 0.7 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Llanerch Country Club 3[2]	Conceptualized	Basin Retrofit	153 lbs./yr. of silt; 4 lbs./yr. of Phosphorus; 0.5 lbs./yr. of Total Nitrogen	DCVA; PRC			-
Llanerch Country Club 4[2]	Conceptualized	Daylighting	-	DCVA; PRC			-
Llanerch Country Club 5[2]	Conceptualized	Streambank Restoration	71770 lbs./yr. of silt; 27 lbs./yr. of Phosphorus; 61 lbs./yr. of Total Nitrogen	DCVA; PRC			-

[1]STEPL analysis performed by municipality during PRP/MS4 planning.
[2]STEPL analysis performed by Temple University during Phase 2 planning.

Table 19: Past Projects in Focus Area

Project Name	Status	SCM	Partners	Cost	Funding Support
Darby-Cobbs Stormwater Initiative	Long-term Initiative; 27 Rain Gardens Completed; $17855 Spent on Installation	Rain Gardens	PRC; EDCSC; DCVA; Numerous Homeowners	$81981 (including 20000 in-kind match)	NWFW ($51290, 2014) Ethel Sergeant Clark Smith Foundation ($60000, 2014) Volunteer Labor ($20000, 2014-2017)

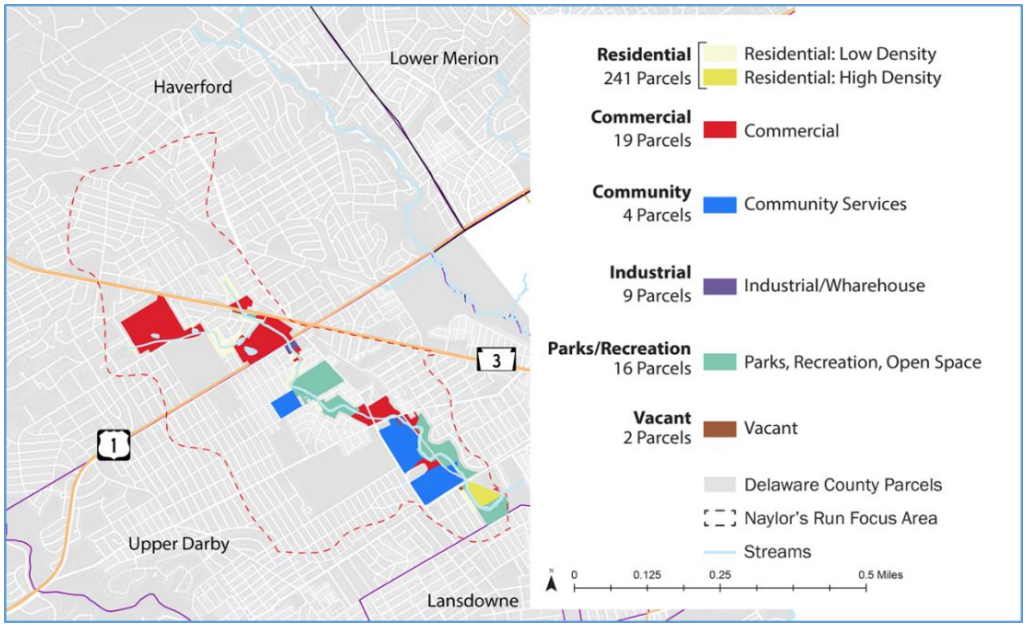
Figure 14: Darby Cobbs Rain Garden Initiative



Complementary Strategies

As described above, the Naylors Run focus area predominately includes a mix of residential (about 63%), schools (about 10 %), park and recreation areas (about 10 %), and commercial corridors (about 7%) (Figure 16; Figure 17). A small rain garden initiative has been launch in the area targeting residential and institutional properties. USP Cluster partner organizations stakeholder outreach has resulted in the identification of a suite of green infrastructure opportunities as documented in Table 18 above. These reside on the mix of

Figure 15: Focus Area –Streamside Parcels by Land Use



of large landowner properties such as schools, park and recreation centers, and a country club.

Complementary strategies will include education of park users, school students, and nearby residents to build support for the capital project investments. Education and outreach messaging will focus on the value and benefits to water quality and land values, the promotion of behavior change in the form of supporting and/or directly installing green stormwater infrastructure, and on the creation of new clean water ambassadors in the community who value and understand the multiple benefits of proper stormwater management and healthy streams.

We will promote residential adoption of water quality improvement practices that provide both an avenue for engagement and increased opportunities to reduce stormwater volume and related pollutants from entering the municipal systems and the nearby stream. This includes a continuation of the rain garden program, and the promotion of stream side planting and other re-vegetation efforts through the Stream Smart Stormwater House Calls. Similar educational efforts with large landowners such as schools and private institutions will be conducted.

Our complementary strategies will also work on the municipal level to insure enhanced land use protections are considered/enforced in this location to maintain effectiveness of capital project investment and not undermine water quality improvement efforts. Haverford Township does not have a riparian buffer ordinance, while Upper Darby does (50 feet across two zones). We will work to promote an equitable and more robust level of regulatory protection.

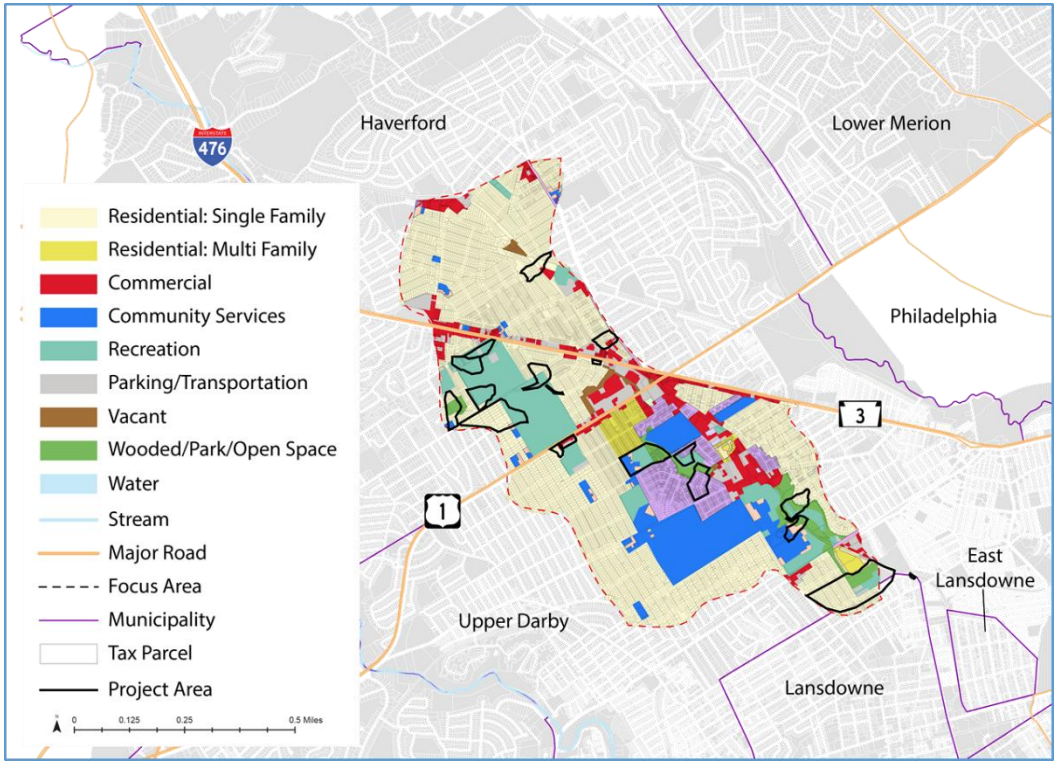


Figure 16: Focus Area – Land Use and Streamside Parcel Information

Figures 16 illustrates the distribution and land use classification of streamside properties in this focus area. We have identified 214 residential, 19 commercial, 4 community (schools), 16 park and recreation, and 9 industrial/warehouse parcels with streamside access in this focus area. Our primary audience will be streamside landowners and those located within the proposed project drainage areas, but programs would be available to all in this focus area. We are particularly interested in developing joint programming with the school districts to work with the high school, middle-school, and elementary school students in monitoring the impacts of green stormwater infrastructure installed on school properties. We are also interested in specific educational programs that reach park and recreation area users.

Both Haverford and Upper Darby Townships have Environmental Advisory Council, we will continue to work with these EACs to engage them in the DRWI Phase 2 work and improve their overall capacity to support green infrastructure and related water quality programs.

Naylors Run Focus area and overall Cobbs Watershed Complementary strategies are described in Table 20.

Table 20: Complementary Strategies Naylors Run

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
1. Improved Municipal Stormwater Regulatory Policies & Practices. Increased investment in GSI. Increased local government relationships. Improve Capacity of Existing EACs or assist in establishing new EACs in cluster municipalities.	Municipal Elected Officials, Administration, Engineers, Zoning Officer, EAC, Planning Commission, Zoning Hearing Board Members	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area	Provide training opportunities for municipal officials and staff on basic stormwater management competencies. Continue successful Demonstration GSI Program with installations of simple small-scale rain gardens/bioswales on at least 10 sites on public property to educate officials & residents. Work with EDCSC and individual municipalities to coordinate MS4 Pollutant Reduction Plan (PRP) with DRWI initiatives. Haverford: Adopt Riparian Buffer/Riparian Corridor Ordinance. Evaluate/increase level of protection offered by Upper Darby's buffer ordinance; maintain consistency between the two Township's resource protection regulations. Narberth Borough: work with Borough Council members to form an EAC. 5 EAC/SRT members become stream monitors.	Support implementation for proven GSI best practices to reduce stormwater runoff quantity velocity, reduce streambank erosion, moderate thermal impacts, leading to improved water quality. Additional steam ambassadors created to promote clean water policies and projects to focus area and target watershed stakeholders. Coordination of DRWI priorities with implementation of robust watershed-wide Pollutant Reduction Plans (PRP's) being developed by Cobbs and Darby municipalities to meet PADP MS4 requirement, including municipal funding of GSI projects, leverages additional impact of DRWI funding.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
			2 EAC member trains as a Master Watershed Stewards. EAC & Stormwater Resource Team members champion GSI projects through municipal approval process.	
2. **Expand outreach & training to specialized large landowners.** Improved Large landowners/institutional Stormwater Management Policies and Practices. Increased investment in GSI. Enhanced coordination among Federal, State and Regional Agencies.	Government Agencies, School Districts, Private Educational & Charitable Institutions, Homeowner Associations, Real Estate Developers/Investment, Country Clubs & Recreational Organizations, Cemetery Owners, and other large property owners.	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area	Establish relationships with large landowners in Naylors Run Focus Area and Cobbs Creek Watershed to facilitate overall understanding of stormwater impacts and future coordination of major GSI implantation projects on these large properties. Educational programming delivered to institutional facility managers, and operations staff, administrators and boards of directors on value and benefits of proposed GSI at these locations. Lower Merion: Create task force with LMT and stakeholders to address future development of St. Charles Borromeo. New/increased support for GSI project investment and continued maintenance. In-kind or cash contributions for project funding applications	Support implementation for proven GSI best practices to reduce stormwater runoff quantity velocity, reduce streambank erosion, moderate thermal impacts, leading to improved water quality. Facilitate relationships that will lead to near- and/or long-term large-scale implementation of GSI & stormwater management best practices.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
3. Adapt and Implement Residential GSI and Pollution Prevention Training. Improved Residential Pollution-Prevention Practices & increased investment in GSI measures.	Residential property owners in Naylors Run Focus Area and Cobbs Creek Watershed.	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area	Continue Residential Rain Garden Program in Haverford Township & expand to at least 2 other municipalities. Install at least 30 rain gardens under this program. Continue Stream Smart Stormwater House Call audit program. Complete at least 100 stormwater audits; at least 50 participating households adopt or more residential GSI practices. Continue Backyard Buffers/Rain barrel Workshops for Cobbs Creek Watershed residents. 250 rain barrels distributed for residential installation at least 5 workshops.	Support implementation for proven GSI best practices to reduce stormwater runoff quantity velocity, reduce streambank erosion, moderate thermal impacts, leading to improved water quality. Small-scale, inexpensive residential GSI, practices, when aggregated over a large number of properties, results in significant reductions in stormwater volume, velocity and pollutants entering stream. Because the Cobbs Watershed is extensively built-out with small residential properties, water quality improvements are significantly dependent on widespread adoption of residential scale GSI practices. Builds stronger support and awareness among residents.
4. Expand Citizen Water Quality Monitoring Training Opportunities. Promote Formation of O&M Teams to Care for GSI projects. Build Constituency support and Disseminate Learning from Focus Area Implementation Projects.	Existing Citizen Water Quality Monitors & new recruits among residents of Naylors Run Focus Area & Cobbs Creek Watershed. High school/college science faculty, students, & clubs. Municipal public works managers & staff.	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area	Continue & expand existing Citizen Monitoring Programs in Cobbs Watershed with specific emphasis on supporting monitoring of Naylors Run focus area projects. Expand Stormwater Resource Team (SRT) in Haverford and establish SRT in Upper Darby to support Naylors Run Focus Area GSI implementation & citizen monitoring.	Stream monitors raise knowledge of water quality issues and transfer knowledge to neighbors and community leaders. Additional on-site monitors help identify illegal/illicit discharges to streams.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
	School, institutional & private sector facility managers & staff.		Establish SRT's in at least 2 additional Cobbs Creek Watershed municipalities. Additional curriculum for high and middle school students incorporating GSI monitoring. Four adult residents from within the focus area become streamside monitors. Four high school students are trained as streamside monitors. Create and secure funding to support GSI maintenance team who can help support care of completed GSI projects. Provide training to municipal public works staff & other facility managers on GSI O&M best practices.	Building strong watershed champions/leaders for watershed groups increases local awareness and ownership. Proper maintenance of GSI systems prolongs their water quality effectiveness, minimizes failures, and helps maintain aesthetics.
5. Scientific research, assessment and documentation.	Scientific and Lay Stakeholder Communities	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area	Develop parameters for DRWI Phase II water quality monitoring plan. Quarterly monitoring of pour point & upstream sampling locations in Naylors Run focus area. Intensive monitoring, at least quarterly, of 1 selected GSI implementation project in Naylors Run focus area.	Demonstrate measurable change resulting from GSI implementation projects in Naylors Run Focus Area. Continue annual collection of baseline data on water quality on Cobbs Watershed. Share scientific data to educate and inform scientific and lay communities on water quality

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
			Continue existing annual baseline monitoring of 6 sites elsewhere within the Cobbs Creek Watershed DRWI target area. USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged. USPC results are disseminated to the scientific community and to other watershed stakeholders and the importance of findings is discussed and explained.	trends and effective measures to improve impairments.
6. Support for Capital Projects. STEPL used to model pollutant load reduction expected from individual projects. Site descriptions and recommendations provided to landowners. Evaluate projects and make suggestions about functionality.	Cluster Partner Organizations	DRWI Naylors Run Focus Area; Cobbs Creek Watershed Target Area.	Coordinate DRWI & MS4 PRP GSI implementation projects in Naylors Run Focus Area with Haverford and Upper Darby Townships. Coordinate up to 3 selected high-priority GSI implementation projects ("trophy projects") in other municipalities within DRWI Cobbs Creek Target Area. Develop conceptual planning & design for high priority GSI projects in coordination with municipal engineers & administrators. Conduct outreach to local residents & stakeholders to explain & build support for GSI projects, to assure successful approval & implementation with municipalities. Submit grant proposals for GSI implementation projects to leverage	Scientifically supported project location and development and leads to reliable and replicable water quality outcomes. Effective planning and stakeholder outreach increases likelihood of successful GSI project implementation leading to improved water quality outcomes.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
			municipal GSI investments through matching funds. Specific focus on GSI projects identified for funding in municipal PRP's and DRWI Phase II plan. Periodic review of DRWI Phase II implementation plan to assure strategic effectiveness of GSI investments in relation to opportunities and challenges that may arise with municipal partners and other stakeholders over time.	

1B. Pennypack Headwaters – Unnamed Tributary

This approximately 270-acre focus area contains the entirety of an unnamed tributary on the lower headwaters section of the Pennypack Creek. While initially excluded from the Phase 1 Focus Area plan, engagement over the past few years and the density of proposed projects to improve stormwater control have strengthened the potential for improving stormwater management in this drainage; this focus area has the potential to deliver measurable water quality improvements. Here, similar to the entire Pennypack Creek watershed, stormwater runoff and low dry-weather baseflow constitute the core stressors. The Pennypack Creek's entire main stem is impaired due to urban runoff, and almost all tributaries are on the state's 303(d) list. Hence, the goal of this focus area is to intercept runoff and subsurface water pollutants in advance of the main stem. This will be achieved through strategic implementation of basin retrofits and placement of new stormwater extended detention systems.

Watershed Description

The Pennypack Headwaters are located in the upper portion of the Pennypack Creek watershed, located in Montgomery County, Pennsylvania. The watershed covers 273 acres over two municipalities (Figure 17). The watershed is 97.6 % urbanized, with the highest proportion of cover consisting of residential, single family detached homes at 43.7 % according to 2015 DVRPC data (Refer to Figure 18 and Table 21). Table 22 provides total annual loads for Pennypack focus area.

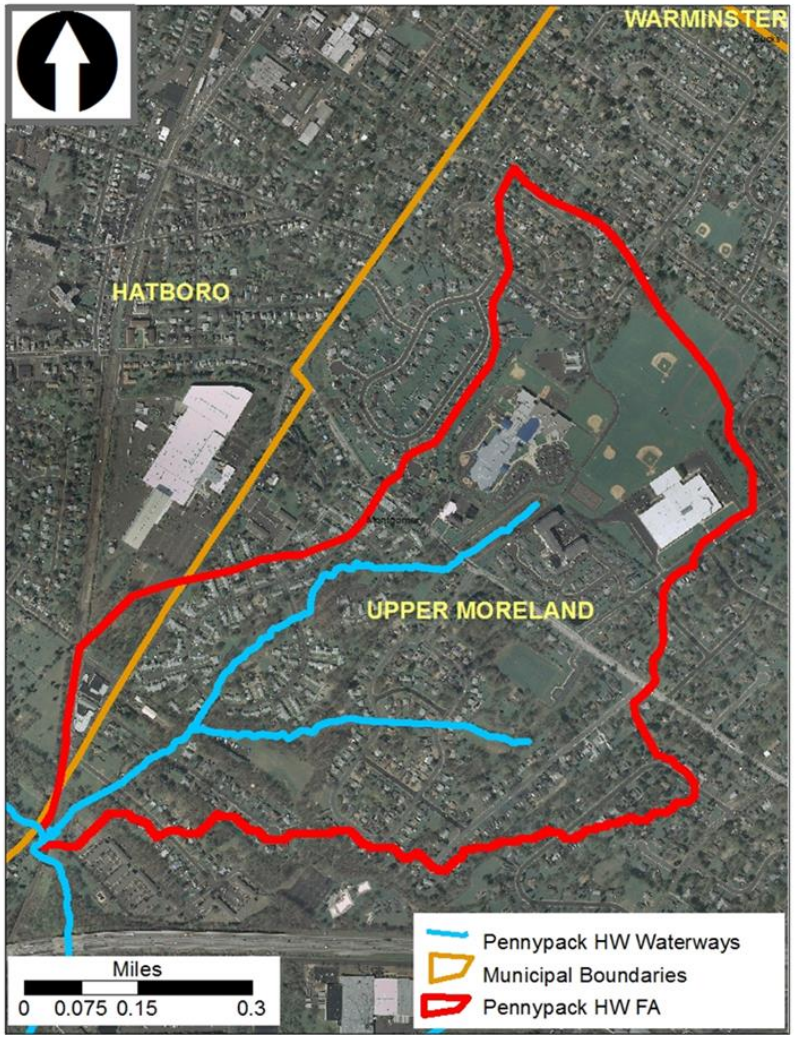


Figure 17: Pennypack Headwaters Focus Area Boundary and Municipalities

Error! Reference source not found.

Figure 18: Pennypack Headwaters Focus Area Land Use Map

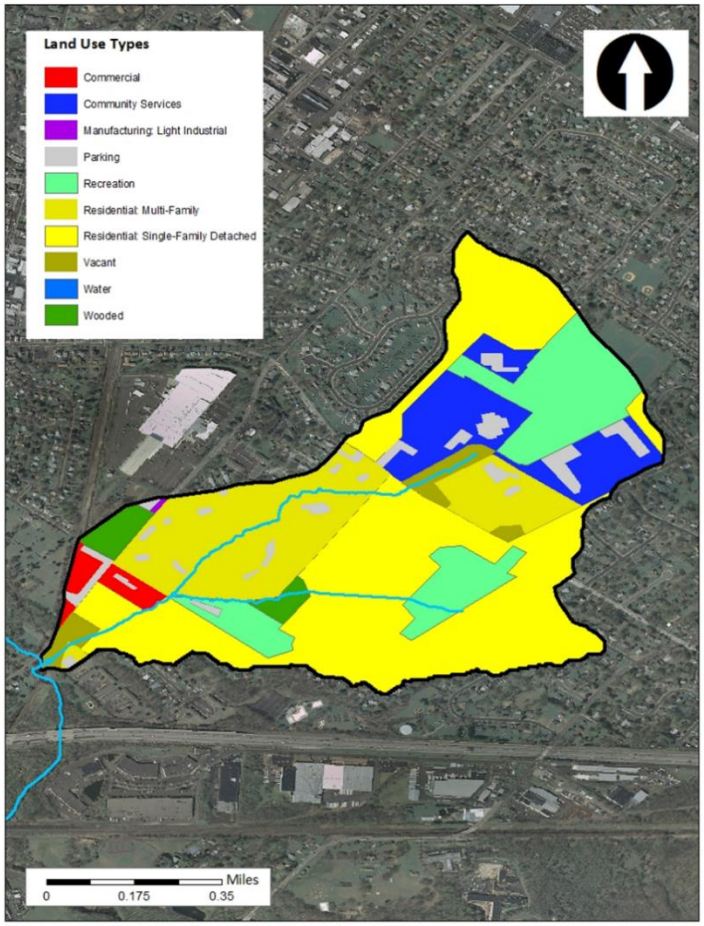


Table 21: Pennypack Headwaters Focus Area Total Loads

Land Use Category	Area	
	Acres	%
Wooded	6.47	2.4%
Water	0.06	0.0%
Commercial	4.88	1.8%
Community Services	26.56	9.7%
Manufacturing: Light Industrial	0.20	0.1%
Parking: Commercial	1.58	0.6%
Parking: Community Services	6.25	2.3%
Parking: Multi-Family	3.81	1.4%
Parking: Recreation	0.35	0.1%
Parking: Light Industrial	0.31	0.1%
Recreation	41.61	15.2%
Residential: Multi-Family	54.56	20.0%
Residential: Single-Family Detached	119.33	43.7%
Vacant	7.21	2.6%
Total	**273.18**	**100%**

Table 22: Pennypack Headwaters Focus Area Land Use Delineation

Sources	N Load	P Load	Sediment Load
Total Loads (lb)	1218	238	365084
Loading Rates (lb/acre)	4	0.8	1336

Capital Intensive Strategies

This small focus area presents a rich opportunity for aggregation of new and retrofitted basin projects (Table 23). This focus area is mostly developed with hundreds of single-family homes and a handful of residential complexes. This focus area holds three moderately sized educational facilities – Upper Moreland Primary, Intermediate and Middle School – on a single large property. The Pennypack Ecological Restoration Trust (PERT) and Cerulean have several established relationships with landowners (Table 24). Upper Moreland Township and School District will be the

principal partners and contributors within this focus area. That said, the major risk of not working in this focus area is losing the momentum of landowner engagement developed throughout the Phase 2 Planning process.

Stormwater control and flood mitigation are the principal goals for the strategy in the Pennypack – UNT Focus Area. This catchment already had a number of projects conceptualized and included as recommendations in the Upper Moreland Township Stormwater Management Plan completed by Gilmore & Associates in 2013. With the partnership of Upper Moreland Township and Upper Moreland School District, we plan to carry out the following projects (Figure 19).

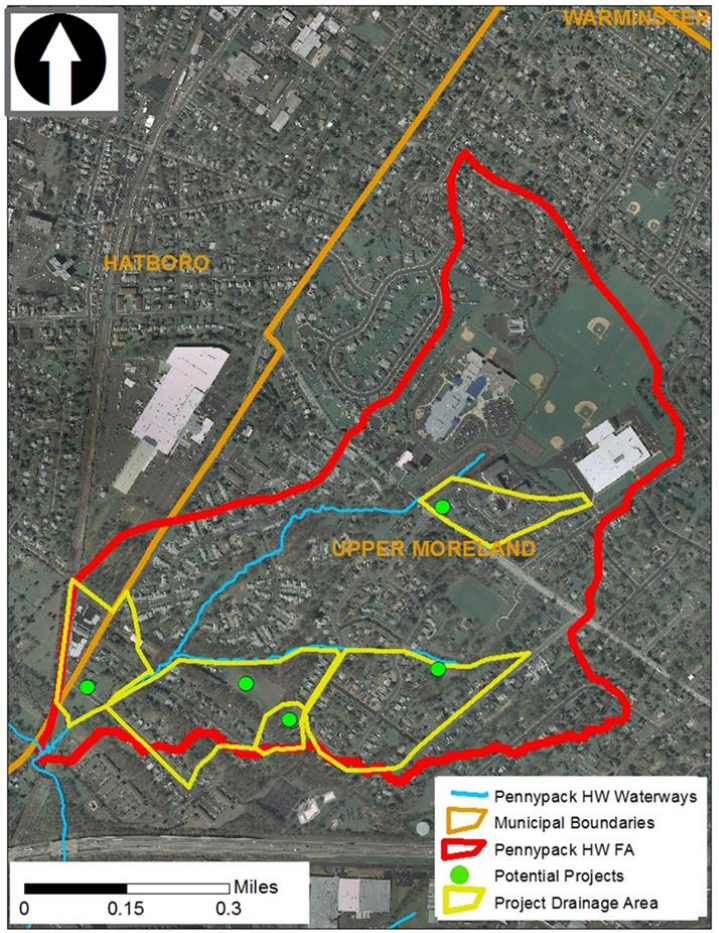


Figure 19: Pennypack Headwaters Focus Area and Potential Projects Drainage Area

Dawson Manor Park is a small 1-acre municipally owned parcel which contains a playground, basketball court and landscaping. The proposal at Dawson Manor Park includes installing a new inlet on Lukens Lane to intercept flows from the roadway and residential lawns and direct them towards the park. A 120-foot bioswale would be installed to convey the drainage from the stormwater inlet to a rain garden adjacent to the basketball court.

Boileau Park is a 10.4-acre municipally owned park with multi-purpose athletic fields, parking lots, historic structures and walking trails. The proposed projects at this park would include streambank stabilization downstream of the existing stormwater culvert outlet endwall, creation of constructed wetlands to increase storage capacity during storm events, and streambank restoration extending from the constructed wetlands to an existing culvert inlet near Round Meadow Lane. A master plan developed in 2003 for this site recommended including educational features such as a wetland boardwalk with interpretive signage and a terraced outdoor learning space.

Surrey Lane – Upper Moreland Township acquired multiple properties near Surrey and Lori Lanes along Warminster Road as FEMA flooding buyouts. The project proposed for these parcels includes installing a stormwater conveyance feature on Warminster Road to prevent high velocity

direct discharge to the creek. The conveyance feature would outfall to a new naturalized stormwater feature prior to discharging to the creek. The section of creek that flows through the site would be stabilized to mitigate erosion and sediment transport.

Betz & Byberry Basin Retrofit – Upper Moreland Township owns and manages a basin located at the corner of Betz and Byberry Roads. A proposed retrofit for the basin includes removing the concrete low flow channel, leveling the basin bottom and modifying the outlet structure to provide extended detention, and installing an energy dissipation feature below the outfall to reduce velocity of discharge to the creek.

Fulmor Heights – The 60-acre Fulmor Heights residential community is under private management with an active homeowners' association.

Figure 20: Fulmer Heights Outfalls

The creek flows for approximately 1,740 feet through the community. Currently, lawn areas are mowed to the edge of the streambanks and there is evidence of erosion along the waterway and downslope of outfalls (Figure 20).

Opportunities include intercepting outfalls that are currently directly discharging to the creek, installing stream buffers and streambank stabilization practices, and creating new stormwater control features.

Upper Moreland School District – The 69-acre campus includes the Upper Moreland Primary, Middle, and Intermediate Schools. In 2015, the School District received a Growing Greener Grant to retrofit the stormwater basin on this campus. Building onto the existing stormwater improvement project, additional opportunities have been identified for managing flows from impervious areas and providing demonstration rain gardens for water quality improvements as well as educational tools for environmental learning.

Table 23: Potential Projects in Pennypack Focus Area over Phase 2 Timeframe

Project Name	Status (Estimated Break Ground Date)	SCM	Project Pollutant Reduction*	Potential Partners	Cost Estimates	Potential Funding Support	**PRP/TMDL Plan Support**
Betz and Byberry[1]	Fall 2019	Basin Retrofit	P removal = 0.5 lbs./yr N removal = 6 lbs./yr Sediment removal = 770 lbs./yr	Upper Moreland Township, PERT, Temple	$50,000	DCED Watershed Restoration & Protection, Growing Greener, NFWF	Yes

Project Name	Status (Estimated Break Ground Date)	SCM	Project Pollutant Reduction*	Potential Partners	Cost Estimates	Potential Funding Support	PRP/TMDL Plan Support
Boileau Park[1]	Fall 2020	streambank stabilization & constructed wetland	P removal = 0.8 lbs./yr N removal = 5 lbs./yr Sediment removal = 887 lbs./yr	Upper Moreland Township, PERT, Temple	$300,000	DCED Watershed Restoration & Protection, Growing Greener, NFWF, DCNR C2P2, TreeVitalize	Yes
Fulmor Heights[1]	Riparian buffer – Fall 2019 Basin – Fall 2020	Riparian buffer, rain garden, Dry Extended Detention Basin	P removal = 1 lbs./yr N removal = 6 lbs./yr Sediment removal = 1036.6 lbs./yr	Upper Moreland Township, PERT, Temple	$340,000	TreeVitalize, NFWF, DCED Watershed Restoration and Protection, Growing Greener, Upper Moreland Township, Fulmer Heights HOA, ACOE Section 566	yes
Surrey Lane[1]	Fall 2020	Stormwater Basin and streambank stabilization	P removal = 1.6 lbs./yr N removal = 15 lbs./yr Sediment removal = 1686 lbs./yr	Upper Moreland Township, PERT, Temple	$500,000	TreeVitalize, NFWF, DCED Watershed Restoration and Protection, Growing Greener, Upper Moreland Township, Fulmer Heights HOA, ACOE Section 566	yes
Dawson Manor Park[1]	Fall 2019	Rain garden and bioswale	P removal = .09 lbs./yr N removal = 0.4 lbs./yr Sediment removal = 91 lbs./yr	Upper Moreland Township, PERT, Temple	$50,000	NFWF, Upper Moreland Township	yes
Upper Moreland School District	Fall 2020	Rain Gardens	-	Upper Moreland School District, PERT, Temple	$120,000	DEP Environmental Education, NFWF	-

[1]STEPL analysis performed by Temple University during Phase 2 planning.

Table 24: Past Projects in Pennypack Focus Area

Project Name	Status	SCM	Partners	Cost	Funding Support
Upper Moreland Middle School	In design	Basin retrofit	Upper Moreland School District	$305,308	Growing Greener ($305308, 2014)

Complementary Strategies

As noted above this focus area provides opportunities for new and aggregated retrofits of existing stormwater basins in an area with a high percentage of residential properties, including a 60-acre HOA community and a 69-acre school campus. Complementary strategies will include education of nearby residents and students to build support for the capital project investment, emphasizing the value and benefit of clean water and its effect on land values. We also seek to create new clean water ambassadors among community members who value and understand the multiple benefits of proper stormwater management and healthy streams.

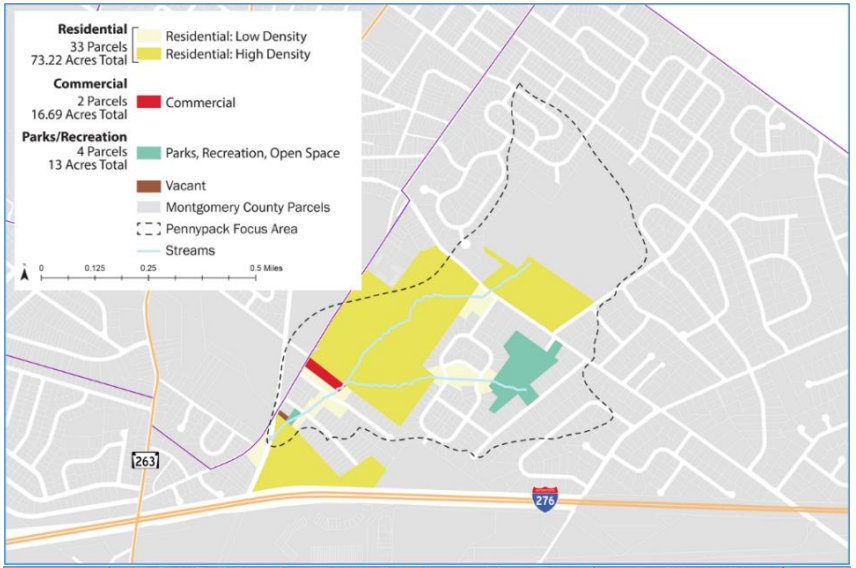


Figure 21: Parcels within Project Drainage Area

We will also promote residential adoption of water quality improvement practices that provide both an avenue for engagement and increased opportunities to reduce stormwater volume and related pollutants from entering the municipal systems and the nearby stream. Our complementary strategies will also work on the municipal level to insure enhanced land use protections are considered/enforced in this location to maintain the effectiveness of the capital project investments and not undermine water quality improvement efforts.

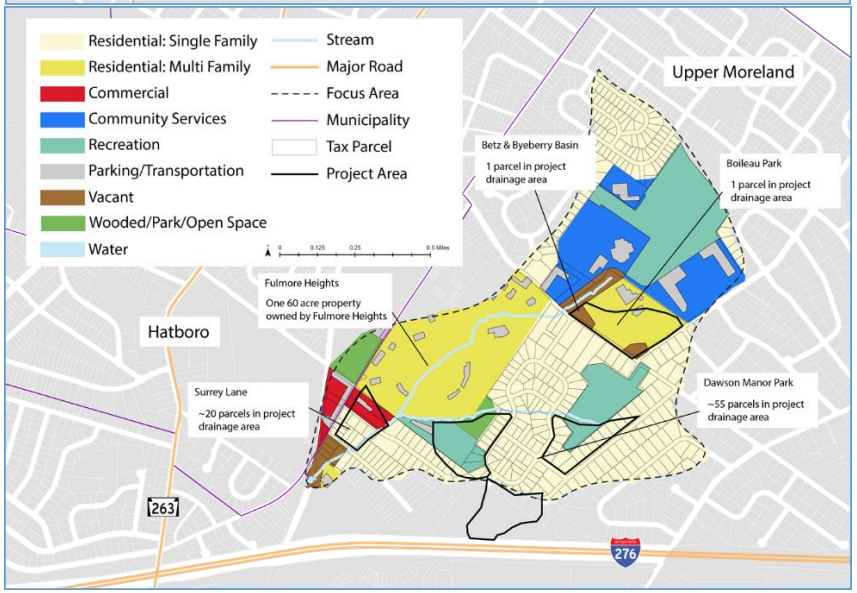


Figure 22: Focus Area Land Use and Streamside Parcel Information

Figures 21 illustrates the distribution and land use classification of streamside properties in this focus area. We have identified 34 residential, two commercial, and four publicly owned parcels with streamside access in this focus area. Figure 22 illustrates the distribution of parcels within the proposed project's drainage areas. Our primary audience will be streamside landowners and those located within the proposed project drainage areas, but programs would be available to all in this focus area. We are particularly interested in further developing joint programming with the school district to work with the elementary and middle-school students in monitoring the impacts from new/retrofitted basins. We are also interested in specific educational programs for HOA residents.

Upper Moreland does not currently have an adopted riparian buffer ordinance, but the Pennypack Creek Act 167 Plan requires buffer protection for new development along streams. The township does have an Environmental Advisory Council. These existing conditions are considered in our complementary strategies as described in Table 25.

Table 25: Complementary Strategies Pennypack Headwaters - UNT

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
1. **Improve Municipal Regulatory Policies & Practices.** Build capacity of existing EAC to champion GSI projects, become citizen stream monitors or master watershed stewards.	Upper Moreland Municipal Officials, Zoning Officer, Planning Commission, EAC members and Zoning Hearing Board Members	Pennypack Creek Headwaters Focus Area	Adoption of Riparian Buffer or Riparian Corridor Ordinance consistent with Pennypack Act 167 Riparian Buffer requirement. 2 EAC members become stream monitors. 1 EAC member trains as a Master Watershed Steward. EAC members champion GSI projects through municipal approval process.	Proven practice to reduce streambank erosion, slow runoff, moderate thermal impacts, leading to improved water quality. Additional steam ambassadors created to promote clean water policies and projects to focus area neighbors. 3 GSI proposed projects approved and municipality provides matching funds for each as part of application process.
2. **Expand outreach & training to specialized large landowners.**	Upper Moreland School District, Fulmer Heights HOA	Pennypack Creek Headwaters Focus Area	Educational programming delivered to school district facility managers and HOA Governing Board on value and benefits of proposed GSI at these locations. New/increased support from HOA Board and residents and school district facility managers for GSI project investment and continued maintenance.	Stream stabilization, pollution reduction, environmental educational opportunities.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
			In-kind or cash contributions for project funding applications Additional curriculum for elementary and middle school students incorporating GSI monitoring.	
3. **Adapt and Implement Residential GSI and Pollution Prevention Training.**	34 Streamside residents	Pennypack Headwaters Focus Area	Ten (10) single family residences purchase rain barrels. Two install rain gardens. Ten (10) improve streamside land care.	Smaller distributed GSI, when aggregated results in reductions in stormwater volume, velocity and pollutants entering stream. Builds stronger support and awareness among residents.
4. **Expand Citizen Water Quality Monitoring Training Opportunities.** Expand participation in County Master Watersheds Stewards Training. Create new Maintenance Corps.	1.Streamside residents within the focus area 2. Residents within focal area, but not with streamside properties. 3. Parents of students within schools located in focus area Existing stream monitor volunteers Municipal staff, school district facility staff, interested residents.	Pennypack Headwaters Focus Area	Four residents from within the focus area become streamside monitors. Two additional stream monitors are added from school parents. 4 Stream Monitors enroll in MWS training. Create and secure funding to support GSI maintenance team who can help support care of completed GSI projects	Stream monitors raise knowledge of water quality issues and transfer knowledge to neighbors and community leaders. Additional on-site monitors help identify illegal/illicit discharges to streams. Building strong watershed champions/leaders for watershed groups increases local awareness and ownership. Proper maintenance of GSI systems prolongs their water quality effectiveness, minimizes

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
				problems and helps maintain aesthetics.
5. **Scientific research, assessment and documentation.**	Scientific and Lay Communities	Pennypack Headwaters Focus Area	USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged USPC results are disseminated to the scientific community and the importance of findings is discussed and explained.	Sharing scientific data to educate and inform scientific and lay communities on water quality trends and effective measures to improve impairments.
6. **Support for Capital Projects.** STEPL used to model pollutant load reduction expected from individual projects. Site descriptions and recommendations provided to landowners. Evaluate projects and make suggestions about functionality.	Cluster Partner Organizations	Continue intensive project-level monitoring in the Pennypack Creek.	Appropriate and timely project implementation. Strategic placement of capital projects. High tier project monitoring. Pour point monitoring of focus areas. Develop parameter specific water quality monitoring plan.	Scientifically supported project development and placement leads to reliable and replicable water quality outcomes.

1C. Jenkintown Creek

This 1200-acre focus consists of the drainage area of the 3.6-mile Jenkintown Creek in Abington and Cheltenham Townships. Within the watershed, extensive channelization creates challenges for the exposed portions of the creek. During Phase 1, we implemented a number of streambank stabilization, green stormwater infrastructure and riparian buffer projects. The Tookany/Tacony-Frankford Watershed Partnership's (TTF) leadership and oversight, combined with the community's enthusiasm and engagement, and funding from NFWF and other sources were key factors in the successful completion of these projects. Over the next phase we will build upon this momentum by continuing to engage private and public landowners to implement projects to intercept runoff and pollutants in advance of entering the Creek. The approach in this focus area is to combine implementation of green stormwater infrastructure projects with watershed restoration strategies, and influence land management practices in order to mitigate nutrient and sediment impairments across the watershed.

Watershed Description

The Jenkintown Creek is a tributary to the main stem of the Tookany Creek – part of the Tookany-Tacony Frankford watershed – located in Montgomery County, Pennsylvania. The watershed area covers 1177 acres over four municipalities (Figure 23). The watershed is 81% urban cover, with the highest majority consisting of Residential: Single Family Detached homes at 55% of the watershed cover according to 2015 DVRPC data (Refer to Figure 24 and Table 27). Total annual loads for the Jenkintown Focus area are listed in Table 26.

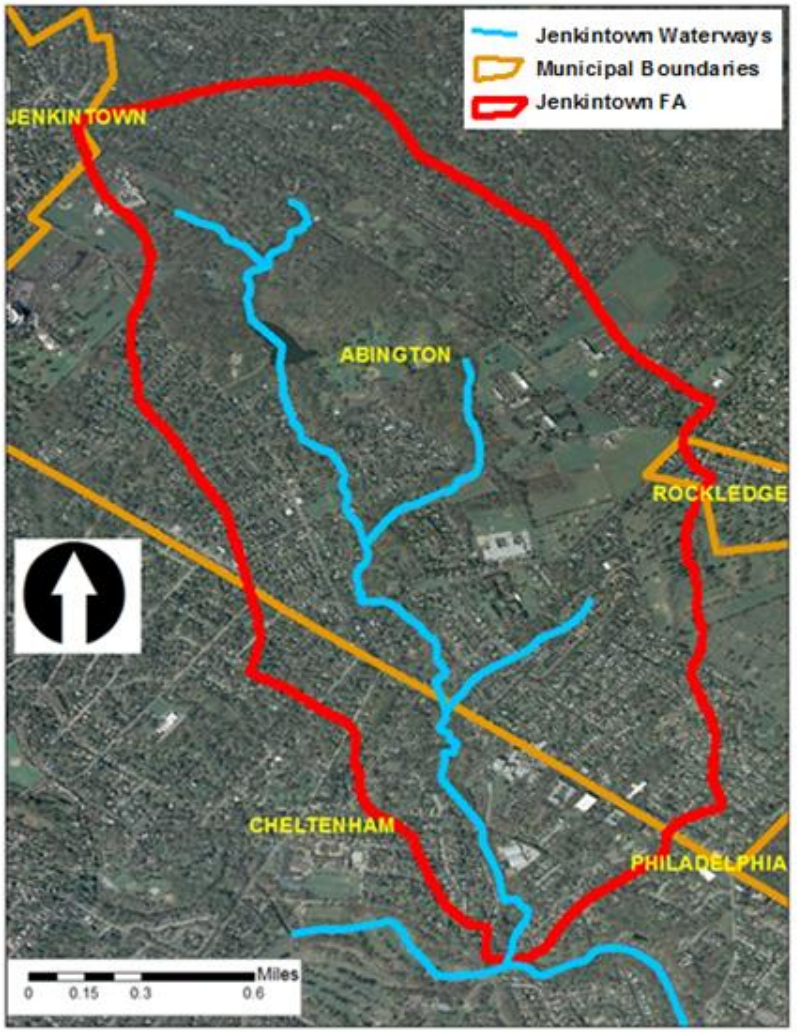


Figure 23: Jenkintown Focus Area Boundary and Municipalities

Figure 24: Jenkintown Focus Area Land Use Map

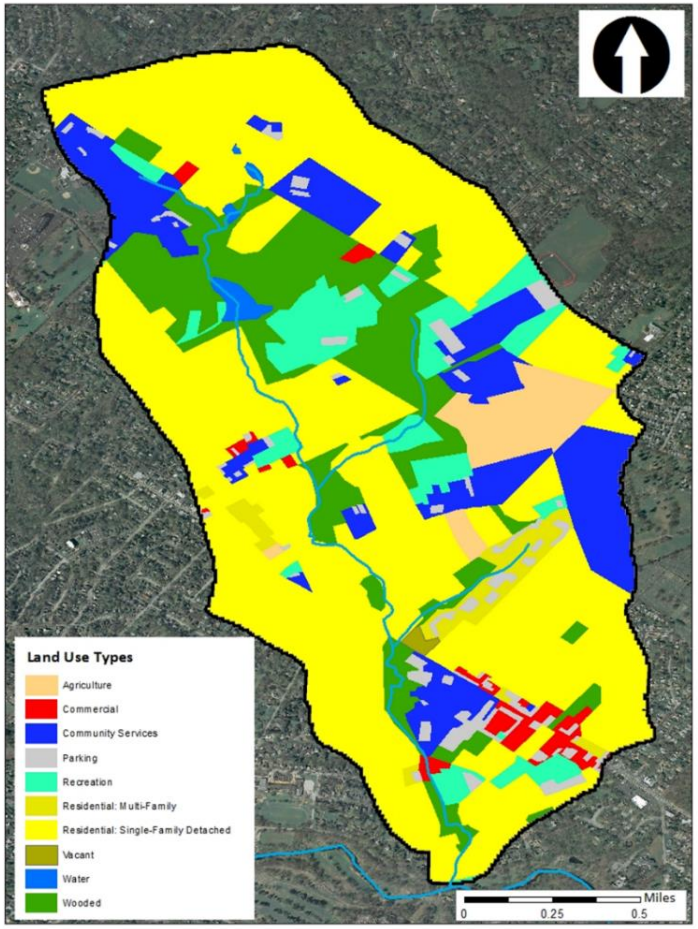


Table 26: Jenkintown Focus Area Total Loads

Sources	N Load	P Load	Sediment Load
Total Loads (lb)	4181	945	1349321
Loading Rates (lb/acre)	4	0.8	1146

Table 27: Jenkintown Focus Area Land Use Delineation

Land Use Category	Area	
	acres	%
Agriculture	42.75	3.63%
Wooded	173.32	14.72%
Water	7.37	0.63%
Commercial	19.52	1.66%
Community Services	141.83	12.05%
Parking	36.16	3.07%
Recreation	82.55	7.01%
Residential: Multi-Family	24.04	2.04%
Residential: Single-Family Detached	647.49	55.01%
Vacant	2.10	0.18%
Total	**1177.13**	**100%**

Operational Funds to support Stormwater Restoration Capital Strategies

- Pursue National Fish and Wildlife Foundation (NFWF) Delaware River Restoration Fund (DRRF) and other grants for projects to combine implementation of green stormwater infrastructure (GSI) and stream restoration strategies to manage the velocity and volume of runoff, and mitigate sediment and nutrient impairments.
- Develop and pursue opportunities to implement these same strategies in collaboration with private and non-profit landowners.

- Develop and pursue opportunities to implement additional projects with partners at completed sites.
- Coordinate and provide support and training for maintenance of completed projects.
- Provide opportunities to promote these projects and practices through a targeted communications program including the following efforts: tours, signage, and distribution of materials.

Capital Intensive Strategies

The Jenkintown Creek focus area is largely developed but consists of a few landowners with significant acreage and stream frontage, such as Einstein Medical Center, Valley Glen, Conklin Pool and Manor College (Figure 25). This focus area is home to a number of moderately sized educational and religious facilities - World Mission Society Church of God, Sisterhood St Anny, St Michael the Archangel Ukrainian Catholic Church, Elkins Park Presbyterian Church, Abington Friends School, Abington Friends Meeting, Abington Arts Center, and McKinley Elementary School. TTF has established a strong partnership with Abington Township, the landowner of the single largest green space in the drainage area – Alverthorpe Park, which is approximately 125 acres. Abington Township is committed to working with TTF on project implementation at this site and has included the project in their Pollutant Reduction Plan (PRP) (Table 28; Table 29). Similarly, Cheltenham Township is including the Phase 2 identified priority sites towards satisfying Pollutant Reduction Plan requirements.

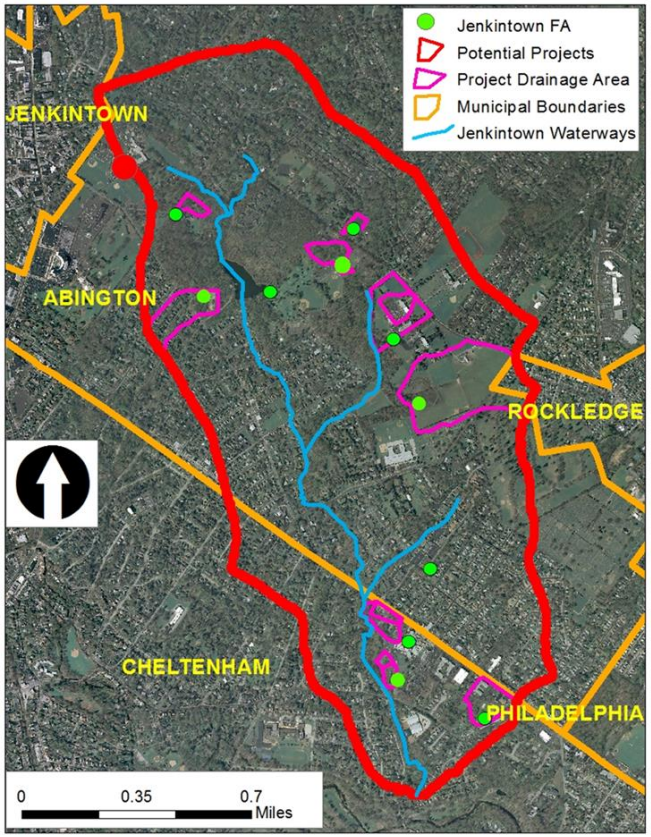


Figure 25: Jenkintown Focus Area and Potential Projects Drainage Area

Abington Arts Center is positioned between the Abington Friends and Alverthorpe Park (Figure 26). The property offers a unique opportunity of combining stormwater management techniques with art. It provides a forum for a new audience in our educational outreach. At the Arts Center, there are currently creative exhibits along the trails and in the woodland area. The previous estate owner installed a swimming pool and pool house in the floodplain. The pool is now silted in and the impervious pad of the pool house remains. The pool could be converted to a constructed wetland feature and the impervious surface associated with the pool house could be removed and planted with native vegetation. There are two outfalls which collect the roadways, parking lots, and rooftops. There is space available to intercept the outfalls and provide stormwater management for the impervious drainage areas.

Alverthorpe Park has multiple identified project opportunities including the installation of rain gardens, a 525' bioswale and bioretention features along parking lots which will collectively manage drainage from 15 acres of impervious and lawn areas. Two of the features proposed are

downstream from the lake while the larger proposed rain garden will intercept a direct discharge which conveys off site roadways and residential properties to the lake. During phase 2, we also intend to further evaluate and develop a strategy and recommendations for the lake.

Figure 26: Abington Arts Center Concept

Conklin Recreation Center project will include bioretention features which will manage offsite contributing drainage areas prior to reaching the creek. Currently, runoff generated from surrounding commercial properties flows directly to the creek without any existing stormwater management. The steeper topography is further exacerbating high velocities and erosive conditions. The creek restoration will include naturalizing the streambanks and incorporated deep rooted native vegetation to filter and reduce volume and velocity of flows.

Einstein Hospital is located in Cheltenham Township on a tributary to the Jenkintown Creek. There are a few parking lots which sit on the edge of the streambanks. There are multiple opportunities to manage flows from the parking lots as well as convert areas of existing turf to filtering practices and stream buffers. Additional project opportunities include stabilizing areas where flows are undercutting the streambank and vegetation resulting in denuded surfaces.

Figure 27: Tree Wells

Manor College project is an opportunity to capture and manage the stormwater runoff from the College's 1.75 acre parking lot. The parking lot could be retrofitted to install subsurface biofiltration systems which includes tree wells (Figure 27). The approach is to direct the stormwater to the tree wells where it passes through the underground filtration system prior to discharging towards the Creek.

Biofiltration units are recognized for their stormwater and pollutant volume reductions. The system's pollutant removal capabilities have resulted in reductions in the range of 70% Phosphorus, 93% oil and grease, and 83% total suspended solids. Incorporating trees into the parking lot will provide additional benefits of temperature reduction of the parking lot and stormwater which flows from it.

Valley Glen is located immediately upstream from Einstein Hospital. The site contains one of the few existing stormwater basins in the Jenkintown Creek watershed (basin location shown as yellow circle), along with 1700 feet of stream frontage (Figure 28). We have visited the site and identified opportunities for stream restoration and stormwater improvement projects. We intend to continue outreach to the landowner during Phase 2 to engage them in efforts to improve water quality.

Figure 28: Valley Glen Concept

Table 28: Potential Projects in Jenkintown Creek Focus Area over Phase 2 Timeframe

Project Name	Status (Estimated Break Ground Date)	SCM	Projected Pollutant Reduction	Potential Partners	Cost Estimates	Potential Funding Support	PRP, TMDL Plan Support
Alverthorpe 1[1]	Design work completion date early 2018. Construction completion date targeted for 2020	Rain Garden	P reduction = 1 lb/yr N reduction = 4 lb/yr Sediment reduction = 722 lb/yr	TTF; Abington Township	$162,350	NFWF, Abington Township, TreeVitalize, DCED watershed Protection, Growing Greener, DCNR C2P2	yes
Alverthorpe 2[1]	Design work completion date 2018. Construction completion date targeted for 2020	Parking Lot Capture Bio-Retention Area	P reduction = 1 lb/yr N reduction = 3 lb/yr Sediment reduction = 305 lb/yr	TTF; Abington Township			yes
Alverthorpe 3[1]	Design work completion date 2018. Construction completion date targeted for 2020	Rain Garden	P reduction 0.09 lbs./yr N reduction = 168 lb/yr Sediment reduction = 58 lb/yr	TTF; Abington Township			Yes
Alverthorpe 4[1]	Design work completion date late 2019. Construction completion date targeted for 2021	Stream Restoration	P reduction = 8 lb/yr N reduction = 19 lb/yr Sediment reduction = 21,979 lb/yr	TTF; Abington Township	$250,000		yes
Alverthorpe 5[1]	Design work completion date 2018. Construction completion date targeted for 2020	525' Bioswale	P reduction = 1 lb/yr N reduction = 5 lb/yr Sediment reduction = 470 lb/yr	TTF; Abington Township	$57,650		yes

Project Name	Status (Estimated Break Ground Date)	SCM	Projected Pollutant Reduction	Potential Partners	Cost Estimates	Potential Funding Support	PRP, TMDL Plan Support
Abington Arts Center[1]	Design work targeted for completion date late 2019. Construction targeted for 2021	Constructed wetland & Roof Capture System	P reduction = 2lb/yr N reduction = 4 lb/yr Sediment reduction = 1214 lb/yr	TTF; Abington Township, Abington Art Center	$165,000	Knight Foundation, NFWF, TreeVitalize, Abington Township	yes
Einstein 1[1]	Design work targeted for completion during early 2019. Construction targeted for 2021.	Bioretention parking lot capture	P reduction = 1 lb/yr N reduction = 5 lb/yr Sediment reduction = 427 lb/yr	TTF, Einstein, PHS	$115,000	Einstein, NFWF, Growing Greener, DCED, TreeVitalize	-
Einstein 2[1]	Design work completed during early 2019. Construction targeted for 2021	Streambank Restoration	P reduction = 25 lb/yr N reduction = 65 lb/yr Sediment reduction = 57,913 lb/yr	TTF, Einstein, PHS	$72,000		-
Conklin Recreation 1[1]	Design work targeted for 2017, construction 2019	Dry Extended Detention Basin	P reduction = 1 lb/yr N reduction = 13 lb/yr Sediment reduction = 1455 lb/yr	TTF, Cheltenham	$100,000	Cheltenham Township, TreeVitalize, NFWF, MCPC Comp plan 2040 grant	yes
Conklin Recreation 2[1]	Design work targeted for 2017, construction 2019	Stream Restoration	P reduction = 7 lb/yr N reduction = 13 lb/yr Sediment reduction = 19,288 lb/yr	TTF, Cheltenham	$140,000		yes
SSB/Manor 1[1]	Design work targeted for 2020, construction 2021	Parking Lot Retrofit	P reduction = 3 lb/yr N reduction = 20 lb/yr Sediment reduction = 1448 lb/yr	TTF, Manor College, Sisters of Saint Basil Saint Basil Academy	$160,000	NFWF, Growing Greener, DCED, MCPC Comp plan 2040, TreeVitalize	-
Valley Glen/Oak Shade Lane (municipal section) 2[1]	Design work to be completed late 2018. Construction targeted for 2019	Stream Restoration	P reduction = 18 lb/yr N reduction = 42 lb/yr Sediment reduction = 49,341 lb/yr	TTF, Abington Township, Valley Glen HOA	$90,000	HOA contributions, NFWF, Growing Greener, DCED Lindy, NFWF, Growing Greener, DCED	-

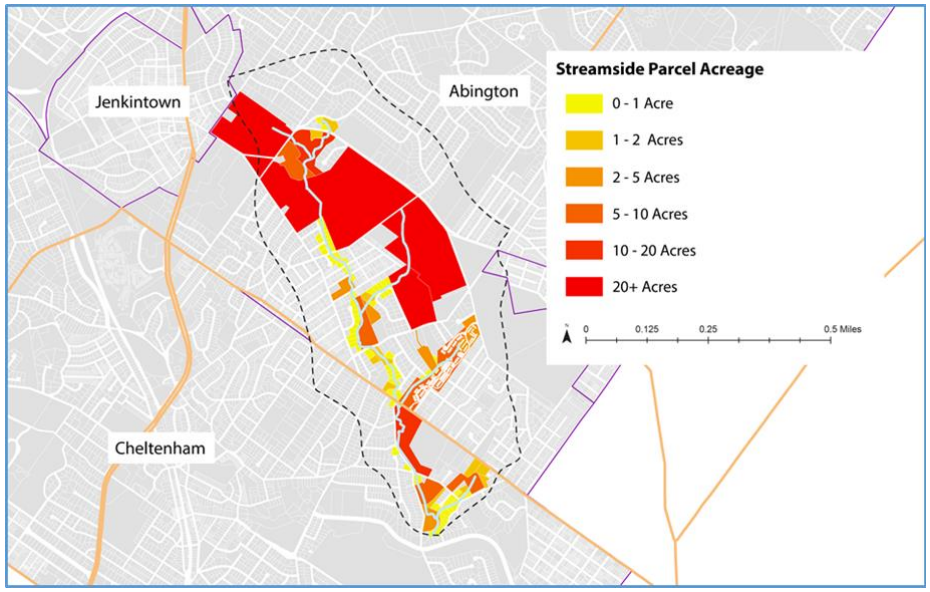
[1]STEPL analysis performed by Temple University during Phase 2 planning.

Table 29: Past Projects in Jenkintown Creek Focus Area

Project Name	Status	SCM	Partners	Total Cost	Funding Support
JCR: Abington Friends School & Sisters of St. Basil	Completed	Stream & Riparian Buffer Restoration & Parking Lot Bio-Retention Feature	TTF; Abington Friends School; Sisters of St. Basil the Great, Manor College, Saint Basil Academy	$151,500	NFWF ($135000, 2014) TreeVitalize $13,000 Carbon Fund $3500
JCR.: McKinley ES	Completed	Stream & Riparian Buffer Restoration	TTF; Abington School District	$53,250	NFWF ($46,750, 2015) TreeVitalize $6500
JCR.: Abington Meeting House	Completed	Stream & Riparian Buffer Restoration	TTF; Abington Friends Meeting	$93,100	NFWF ($83,10066, 2015) TreeVitalize $10,000
JCR: Ethel Jordan Park	Estimated completion Spring 2018	Streambank Stabilization & 2 Bio-Retention Features	TTF; Abington Township	$121,308	NFWF ($86308, 2016) Abington Township $25,000 TreeVitalize $10,000

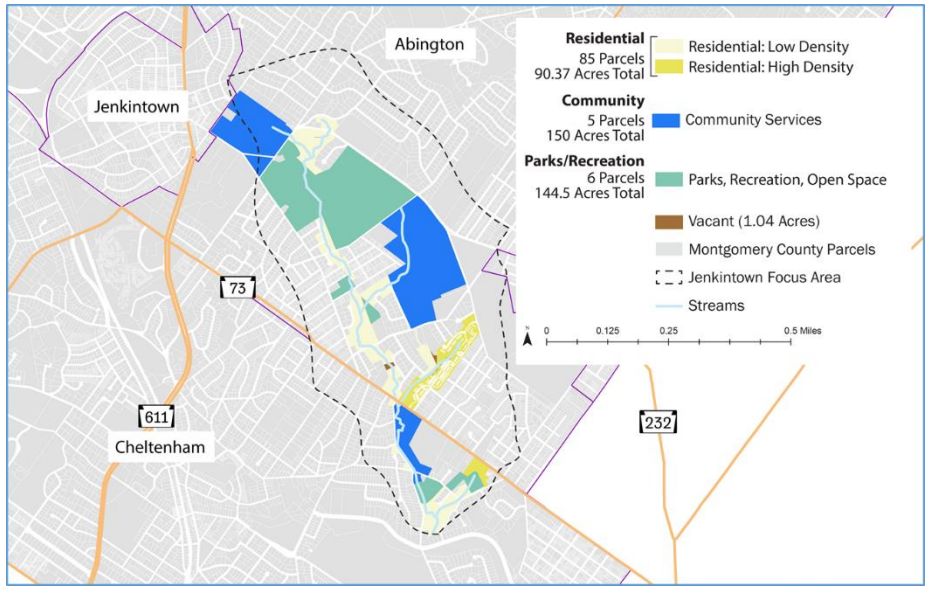
Complementary Strategies

Figure 29: Jenkintown Creek Streamside Parcels by Size



As noted above this focus area provides multiple opportunities for new SCMs at a variety of public and private locations. The Jenkintown Creek flows through an area characterized by numerous residential properties along with multiple public and private educational campuses, pubic parkland and the Valley Glen HOA community. These present exciting opportunities to build and expand activities with existing and dedicated partners such as Abington Friends and Sisters of St. Basil/Manor College. Complementary strategies will include continued education and engagement for nearby residents and students to strengthen support for the municipal capital project investment; including value and benefits to water quality and land values, and to create new clean water ambassadors among the community who value and understand the multiple benefits of proper stormwater management and healthy streams. We will also continue to promote residential adoption of water quality improvement practices that provide both an avenue for engagement and increased opportunities to reduce stormwater volume and related pollutants from entering the municipal systems and the Jenkintown tributary.

Figure 30: Jenkintown Creek Land Use and Streamside Parcel Information



Our complementary strategies will also work on the municipal level to insure enhanced land use protections are considered/enforced in this focus area to maintain effectiveness of capital project investment and not undermine water quality improvement efforts. Continued and sustained partnerships with Abington and Cheltenham Townships will help achieve goals

related to improving both environmental land use protection and consistency among various land use and stormwater controls implemented at the local level. When crossing municipal boundaries, resource protection measures vary. Both Abington and Cheltenham have strong and active municipal environmental advisory councils, who have been and will continue to be critical partners in efforts to engage residents and provide bridge to elected officials.

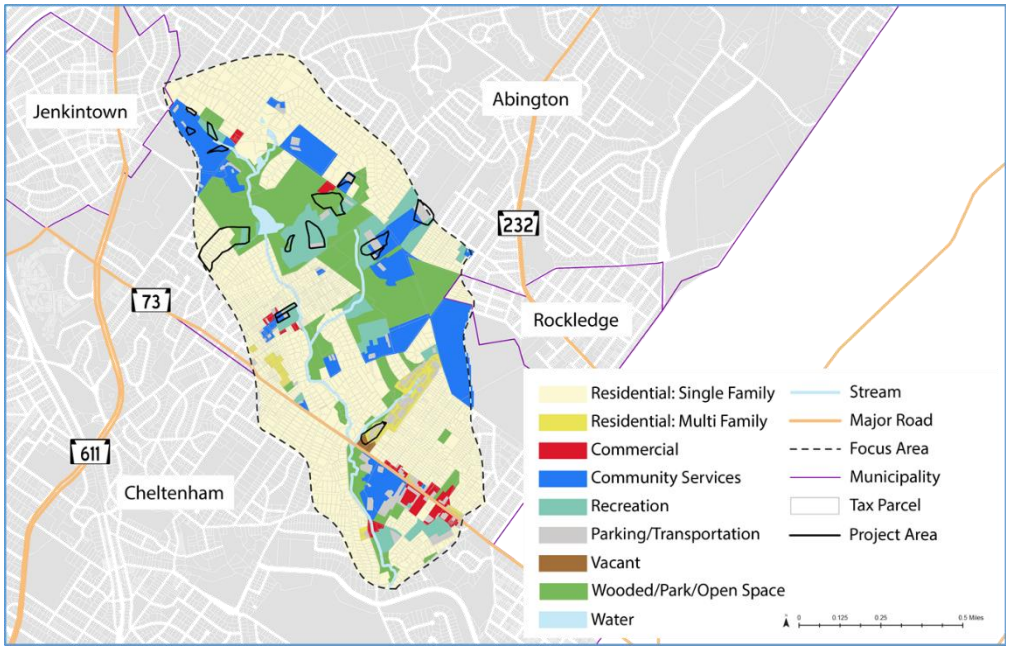


Figure 31: Jenkintown Parcels within Project Drainage Areas

Figure 29 shows the parcels adjacent to the Jenkintown Creek Focus Area by size. Figure 30 illustrates the distribution and land use classification of streamside properties. We have identified 85 residential, 5 community service (schools) and 6 publicly owned parcels with streamside access in this focus area. Figure 31 illustrates the distribution of parcels within the proposed project's drainage areas. Our primary audience will be streamside landowners and those located within the proposed project drainage areas, but outreach and engagement programs would also be available to residents and landowners within the broader focus area. Within this focus area, programming will continue with established educational partners in monitoring the impacts from new SCMs. Educational programs to engage residents of Elkins Park Terrace and Valley Glen HOA will be led by TTF Watershed Partnership.

Abington and Cheltenham Townships each have adopted Riparian Buffer Ordinances. There are also riparian buffer provisions within the Tookany Creek Act 167 Stormwater Management Plan. Some inconsistencies among the various standards and criteria exist, resulting in uneven requirements for riparian protection along the stream as it crosses multiple jurisdictions. These factors are considered in our complementary strategies as described in Table 30.

Table 30: Complementary Strategies Jenkintown Creek

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
1. Improve Municipal Regulatory Policies & Practices. Work with EACs and civic associations to champion GSI projects, become citizen stream monitors or master watershed stewards.	Abington & Cheltenham Municipal Officials, Civic Associations, Zoning Officer, Planning Commission, EAC and Zoning Hearing Board	Jenkintown Creek Focus Area	Adoption of Consistent Riparian Buffer or Riparian Corridor Ordinances across municipalities. Installations of signage at four locations along Jenkintown Creek. 2 EAC members become stream monitors. 2 Citizen monitors join EAC. 2 EAC members train as a Master Watershed Stewards. EAC members and civic leaders champion GSI projects through municipal approval process.	Consistent levels of riparian protection enhances effectiveness in reducing streambank erosion, slowing runoff, and moderating thermal impacts; practices which can lead to improved water quality. Additional stream ambassadors created to promote clean water policies and projects to focus area neighbors. 3 GSI proposed projects approved and municipality provides matching funds for each as part of application process.
2. Expand outreach & training to specialized large landowners.	Abington Friends School, Sisters of St. Basil, Manor College, Elkins Park Terrace and Valley Glen HOA Board land managers, school district and township parks & recreation and public works departments.	Jenkintown Creek Focus Area	Educational programming delivered to institutional facility managers and HOA Governing Boards on value and benefits of proposed GSI at these locations. New/increased support from HOA Board for GSI project investment and continued maintenance. In-kind or cash contributions for project funding applications. School sites participate in GSI and creek monitoring.	Stream stabilization, pollution reduction, environmental educational opportunities.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
3. Adapt and Implement Residential GSI and Pollution Prevention Training.	100 Streamside residents	Jenkintown Creek Focus Area	10 single family residences purchase rain barrels. 2 residential property owners install rain gardens or plant buffers. 25% improve streamside land care.	Smaller distributed GSI, when aggregated results in reductions in stormwater volume, velocity and pollutants entering streams. Builds stronger support and awareness among residents.
4. **Expand Citizen Water Quality Monitoring Training Opportunities.** Expand participation in County Master Watershed Stewards Training. Create new Maintenance Corps.	Streamside residents within the focus area. Residents within focus area, but not with streamside properties. Parents of students within schools located in focus area. Existing stream monitor volunteers. Citizen monitors, municipal staff and school facility staff, interested residents.	Jenkintown Creek Focus Area	4 residents from within the focus area become streamside monitors or join the Maintenance Corps. 2 schools participate in stream monitoring. 3 Stream Monitors enroll in MWS training. Create and develop system and funding to support GSI maintenance team to support care of completed GSI projects.	Stream monitors raise knowledge of water quality issues and transfer knowledge to neighbors and community leaders. Additional on-site monitors are trained to identify illegal/illicit discharges to streams. Building strong watershed champions/leaders for watershed groups increases local awareness and stewardship. Proper maintenance of GSI systems prolongs their water quality effectiveness, minimizes problems and helps maintain aesthetics.
5. Scientific research, assessment and documentation.	Scientific and Lay Communities	Jenkintown Creek Focus Area	USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged. USPC results are disseminated to the scientific community and	Sharing scientific data to educate and inform scientific and lay communities on water quality trends and effective measures to improve impairments.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goal
			the importance of findings is discussed and explained.	
6. Support for Capital Projects. STEPL used to model pollutant load reduction expected from individual projects. Site descriptions and recommendations provided to landowners**.** Evaluate projects and make suggestions about functionality	Cluster Partner Organizations	Continue intensive project-level monitoring in the Jenkintown Creek.	Appropriate and timely project implementation. Strategic placement of capital projects. High tier project monitoring. Pour point monitoring of focus areas. Develop parameter specific water quality monitoring plan.	Scientifically supported project development and placement leads to reliable and replicable water quality outcomes.

1D. Sandy Run

This approximately two thousand-acre focus area, shown in Figure 32, encompasses the headwaters of the Sandy Run Watershed in Abington Township and ends just upstream of the Abington Waste Water Treatment Plant in Upper Dublin Township. This focus area contains a large portion of Phase 1's Sandy Run focus area. The change in scale, a reduction of over 6,000-acres, is an outcome of our "right-sizing" process for Phase 2 focus area selection. This process aimed to enhance measurable environmental, social, and economic change by localizing investment opportunities. Ultimately, the Sandy Run focus area was selected because it contains a wide range of proposed projects across our three strategies: stream channel restoration; riparian corridor protection and restoration; and stormwater management (Table 33). Because the Sandy Run tributary has higher turbidity than the main-stem Wissahickon, targeting this focus area presents an opportunity to effect notable pollution reduction in this sub-watershed.

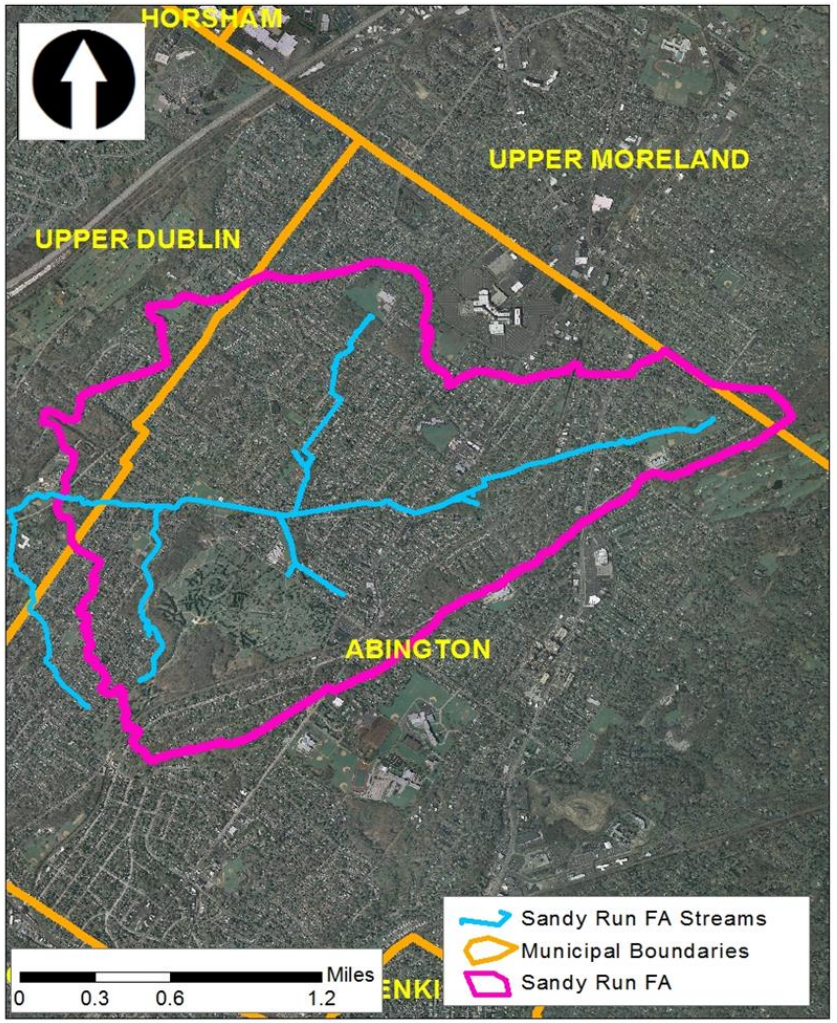


Figure 32: Sandy Run Focus Area Boundary and Municipalities

Watershed Description

Sandy Run is a mid-stream tributary to the Wissahickon Creek, located in Montgomery County, Pennsylvania. The focus area covers 2,032.13 acres over two municipalities. The watershed is 92.4% urban cover, with the majority consisting of residential, single family detached homes at 66.4% of the watershed cover according to 2015 DVRPC data (Refer to Figure 33 and Table 32). Total annual loads and annual concentration for Sandy Run focus area are listed in Table 31.

Table 31: Sandy Run Focus Area Total Loads

Sources	N Load	P Load	Sediment Load
Total Loads (lb)	5734	1111	898116
Loading Rates (lb/acre)	3	0.5	442
Annual Concentration (mg/l)	0.5	0.1	77

Figure 33: Sandy Run Focus Area Land Use Map

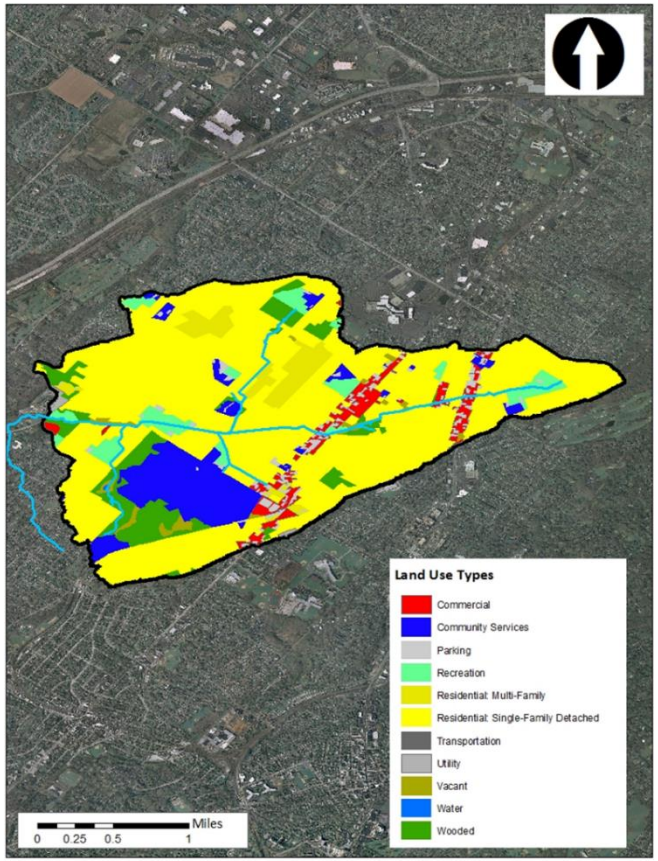


Table 32: Sandy Run Focus Area Land Use Delineation

Land Use Category	Area	
	Acres	%
Wooded	151.92	7.48%
Water	3.04	0.15%
Commercial	73.84	3.63%
Community Services	200.14	9.85%
Parking	47.17	2.32%
Recreation	95.58	4.70%
Residential: Multi-Family	84.53	4.16%
Residential: Single-Family Detached	1349.05	66.39%
Transportation	0.21	0.01%
Utility	4.85	0.24%
Vacant	21.81	1.07%
Total	**2032.13**	**100%**

Capital Intensive Strategies

WVWA, Cerulean, and Temple University have many established relationships within the Sandy Run focus area that will enable them to pursue numerous diverse projects over the course of Phase 2 (Table 33). In addition, a high-level of municipal support and collaboration is anticipated due to WVWA's involvement in the Wissahickon Clean Water Partnership (TMDL Alternative) process underway in the watershed. There are 20 potential projects identified in the 2,000 acres focus area. All of these projects have some level of municipal buy-in and many are already planned as part of Abington Township's MS4 pollution reduction plans.

Given that the Wissahickon Valley Watershed Association has limited capacities for pursuing capital projects in this large focus area (we cannot manage 20 projects across 3 years), coupled with the fact that a priority for Phase 2 is designing our work to maximize the potential for measurable improvements in stream health, we have developed a targeted strategy for our capital investment projects.

Figure 34: Sandy Run Headwaters Drainage Basin (micro watershed)

We are using a three-pronged approach to reduce stormwater runoff through capital investments in a single 110-acre drainage area (micro-watershed) at the headwaters of Sandy Run (see Figure 34). The first prong is collaboration with the Abington School District to install GSI at Overlook Elementary School (3 projects have been conceptualized; details below and in Table 33), building upon past green infrastructure investments at Overlook by the school district. The second prong involves collaborating with Abington Township Parks & Recreation to install GSI at Roychester Park (5 projects have been conceptualized; details below and in Table 33), building upon past green infrastructure investments there. The third prong is to address the significant impact of residential stormwater in a focus area where 70% of the land cover is residential (425 residences in the 110-acre micro-watershed), by working with residents to install green stormwater infrastructure on their properties.

Roychester Park

The 12.7-acre Roychester Park is the location of the headwaters for the Sandy Run, which flows for 1,130 ft. through the park (Figure 35). The Park includes athletic fields, basketball and tennis courts, and a community building. We have had several conversations with Abington Township and they are enthusiastic partners for this work. They have previously installed some stormwater controls in the Park, so this work will be building on that investment.

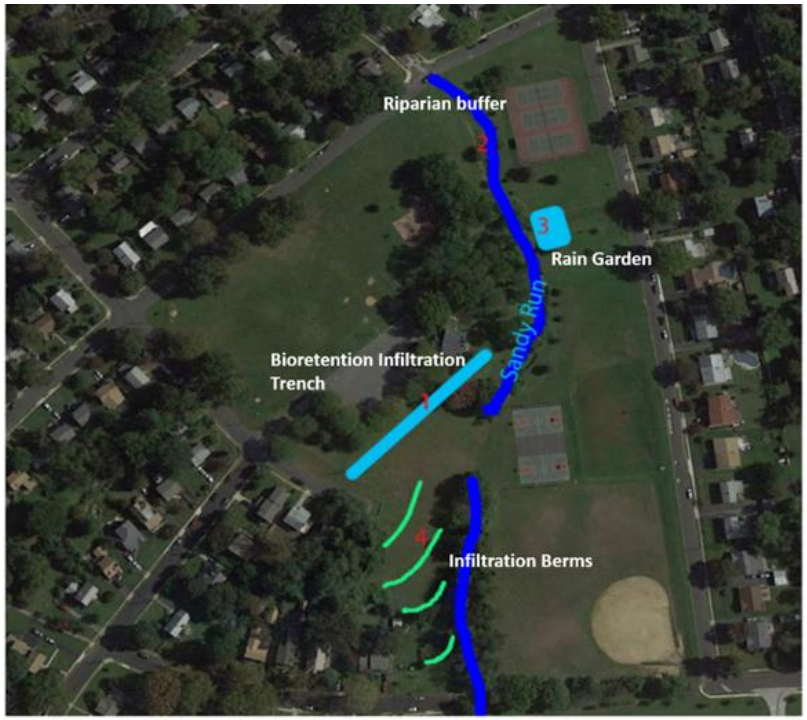


Figure 35: Aerial View of Roychester Park with Projects Identified and Numbered

1. Bioretention area and infiltration trench

A vegetated bioretention area with a subsurface of stone trench could capture runoff from the adjacent 31,000 sq. ft. parking lot, the overflow would be conveyed to the Sandy Run (Figure 36). The vegetated bioretention area would be planted with deeper rooted native vegetation, which could include options such as low maintenance grasses, flowering perennials, or shrubs selected to compliment current land use needs. This is a high visibility area near the park entrance that would make this project an excellent educational and demonstration opportunity, in addition to providing storage and filtration of the parking lot runoff.

Figure 36: Looking from Sandy Run Towards the Outfall from the Surrounding Residences

2. Riparian plantings and stream buffer

There is an existing buffer along the headwaters to the Sandy Run (Figure 37). The existing buffer could be significantly enhanced by planting additional vegetation, providing a stabilized ground cover on denuded surfaces, and converting areas of turf grass to deeper rooted native grasses prior to planting native trees and shrubs. There also appears to be opportunities to widen the buffer without interfering with current land use needs.

Figure 37: Existing Stream Buffer at Sandy Run Headwaters

3. Rain garden

There is an outfall that discharges stormwater from the surrounding residential community to Roychester Park. There is an opportunity to intercept the stormwater through the installation of a rain garden. The rain garden could be designed to capture the first 1 inch of runoff. By providing extended detention and filtration prior to discharging. Following construction of the rain garden, the area will be planted with native vegetation to further promote groundwater recharge and filter stormwater before discharging into the creek.

4. Infiltration berms

The hillside slopes towards the Sandy Run in the lower corner of the Park. There is an opportunity to slow and capture runoff in this area by constructing infiltration berms. Infiltration berms provide the ability to manage stormwater by creating a minor impoundment behind the

berms prior to discharge into the stream. This linear feature should be installed along existing contours and can be vegetated using native grasses or meadow vegetation.

5. Streambank stabilization and daylighting

A segment of the Sandy Run headwaters is piped underground and there is an opportunity to remove the pipe and expose the creek to the surface. This would involve significant stream bank restoration and stabilization work. We would plant deep rooted native vegetation as well as native trees and shrubs, providing shade and filtration.

Overlook Elementary School

Overlook is about 2,000 ft. downstream of the headwaters. The 9.6-acre property has subsurface stormwater control measures that manages runoff from the building and impervious areas (Figure 38). Opportunities exist to capture runoff from the athletic fields and lawn areas, which are excluded from the drainage area to the existing stormwater management facilities. In our initial conversations with Abington School District, they expressed that while they were not prepared to invest dollars in installing these GSI projects, they would fully support and cooperate with our efforts and are prepared to invest in the long-term maintenance and sustainability of installed GSI improvements.

Figure 38: Aerial View of Overlook Elementary School with 3 GSI Project Locations Identified

1. Stream restoration and buffer

The landscape along a 260-ft. long section of the Sandy Run that flows through the Overlook property is currently managed as turf grass and erosion is evident along the stream channel. The turf grass could be converted to deeper rooted native grasses and, once established, a buffer of native trees and shrubs could be planted along the creek. The gradual slopes through this section of the streambank also provides the opportunity to prevent in stream bank erosion through re-vegetation by use of live stakes along the stream bank. This restoration will help to filter the sheet flow of runoff from the 300 ft. of athletic field above the creek.

2. Bioretention area

There are approximately 2.5 acres of turf athletic fields which sheet flows to the Sandy Run. There is an opportunity to capture the sheet flow in a linear bioretention system which would run parallel to the athletic field. Compacted soils would be removed from the bioretention area and replaced with amended soils that have greater void space for stormwater storage. A shallow planting bed could be installed on the surface, planted with native vegetation to complement current land use.

Figure 39: Existing Stormwater Inlet Discharging in the Sandy Run

3. Rain garden

There is an existing inlet on the property (location #3 on Figure 38), which receives runoff from an estimated 20,000 Sq. feet area that is conveyed to this location through an existing swale. The inlet could be retrofitted to install a rain garden. The top of grate elevation could be raised and the surrounding area excavated to provide a level planting bed. The rain garden would be designed to manage the first inch of runoff prior to discharging to the Sandy Run.

Residential GSI installations

The details of our program to improve stormwater management on residential properties in this micro-watershed is outlined in the Complementary strategies section. However, we are including details here as well, given that one could argue that our residential component is something a capital strategy in that we go beyond educating residents about GSI and we will actually be helping them to install GSI on their properties, and this work will have direct impacts on water quality.

Within the Sandy Run headwaters micro-watershed, WVWA will pilot a program similar to Cobb's Stream Smart House Calls or the Philadelphia Water Department's Rain Check program, where we will provide educational workshops for targeted homeowners in the micro-watershed, which will qualify them for a house call where we will provide an assessment of GSI opportunities on their property to reduce stormwater runoff, and we will provide financial and technical support to residents that opt to install the proposed GSI projects on their property. We are looking for new private and public funding sources to match homeowner investment in green stormwater infrastructure.

By targeting our 3-pronged approach in the micro-watershed of the headwaters drainage basin (Figure 34), we have a greater opportunity to see measurable impacts at the pour point of that basin and we also have the opportunity to gain a better understanding of on-the-ground thresholds

for water quality improvements using a combination of residential and public green stormwater infrastructure installations across the entire headwaters drainage basin.

In addition to our targeted capital projects, we will provide support and collaboration to Abington Township in their pursuit of other identified capital projects in the rest of Sandy Run focus area (Table 33; Table 34; Table 35).

Table 33: WVWA Capital Projects in the Sandy Run Focus Area Micro-Watershed

Project Name	Status (Estimated Break Ground Date)	SCM	Projected Pollutant Reduction	Potential Partners	Total Cost Estimates	Potential Funding Support	PRP/TMDL Plan Support
Overlook[1]	Conceptualized	Bioretention area & Rain Garden	205 lbs./yr of silt; 1 lbs./yr of Phosphorus; 2 lbs./yr of Total Nitrogen	WVWA	$48000	-	-
Overlook	Conceptualized	Stream restoration and Buffer	STEPL analysis not yet performed	WVWA	172,240		
Roychester Park 1[2]	Preliminary: Construction within five years following PA DEP approval	Rain Garden	4716 lbs./yr of silt; 17 lbs./yr of Phosphorus; 90 lbs./yr of Total Nitrogen	WVWA; Abington Township	$44210	-	Yes
Roychester Park 2[2]	Preliminary: Construction within five years following PA DEP approval	Riparian Buffer Restoration	6467 lbs./yr of silt; 25 lbs./yr of Phosphorus; 71 lbs./yr of Total Nitrogen	WVWA; Abington Township	$34495	-	Yes
Roychester Park 3[2]	Preliminary: Construction within five years following PA DEP approval	Bioretention/Infiltration Trench	1729 lbs./yr of silt; 4 lbs./yr of Phosphorus; 33 lbs./yr of Total Nitrogen	WVWA; Abington Township	$24055	-	Yes
Roychester Park 4[2]	Preliminary: Construction within five years following PA DEP approval	Infiltration Berms/Ret. Grading	5433 lbs./yr of silt; 19 lbs./yr of Phosphorus; 107 lbs./yr of Total Nitrogen	WVWA; Abington Township	$46140	-	Yes
Roychester Park 5[1]	Preliminary: Construction within five years following PA DEP approval	Streambank Stabilization & Daylighting	34988 lbs./yr of silt; 13 lbs./yr of Phosphorus; 30 lbs./yr of Total Nitrogen	WVWA; Abington Township	$186,000		-

[1]STEPL analysis performed by municipality during PRP/MS4 planning.
[2]STEPL analysis performed by Temple University during Phase 2 planning.

Table 34: Other Project Opportunities in the Sandy Run Focus Area

Project Name	Status (Estimated Break Ground Date)	SCM	Projected Pollutant Reduction	Potential Partners	Total Cost Estimates	Potential Funding Support	PRP/TMDL Plan Support
4200land Avenue[1]	Conceptualized	Streambank Stabilization	62798 lbs./yr of silt; 23 lbs./yr of Phosphorus; 7 lbs./yr of Total Nitrogen		$69000	-	-
Roslyn Park 3[1]	Conceptualized	Stream Stabilization & Buffers	26914 lbs./yr of silt; 10 lbs./yr of Phosphorus; 53 lbs./yr of Total Nitrogen		$42000	-	-
Ardsley Park[1]	Conceptualized	Basin Expansion & Forebay Retrofit	11980 lbs./yr of silt; 9 lbs./yr of Phosphorus; 71 lbs./yr of Total Nitrogen		$575000	-	-
Grove[2]	Preliminary: Construction within five years following PA DEP approval	Stream Restoration	195000 lbs./yr of silt; 117 lbs./yr of Phosphorus; 254 lbs./yr of Total Nitrogen	Abington Township	$650000		Yes
Deel Park[1]	Conceptualized	Stream Restoration & Buffers	44877 lbs./yr of silt; 17 lbs./yr of Phosphorus; 38 lbs./yr of Total Nitrogen		-	-	-
Briar Bush[1]	Conceptualized	Bioretention/Rain Garden	622 lbs./yr of silt; 1 lbs./yr of Phosphorus; 5 lbs./yr of Total Nitrogen		$65000	-	-
Washington Avenue[1]	Conceptualized	Wet Ponds & Wetlands	1158 lbs./yr of silt; 2 lbs./yr of Phosphorus; 10 lbs./yr of Total Nitrogen		$44500	-	-
Willow Hill[1]	Conceptualized	Infiltration Trenches	-		$80000	-	-
Roslyn Community Center[1]	Conceptualized	Bioretention/Rain Garden	514 lbs./yr of silt; 1 lbs./yr of Phosphorus; 6 lbs./yr of Total Nitrogen		$45000	-	-
Evergreen Manor[2]	Preliminary: Construction within five years following PA DEP approval	Infiltration Basin	15829 lbs./yr of silt; 58 lbs./yr of Phosphorus; 314 lbs./yr of Total Nitrogen	Abington Township	$33600	Growing Green ($186000, 2015)	Yes

Table 35: Past Projects in Focus Area

Project Name	Status	SCM	Project Pollutant Reduction	Partners
Roslyn Park 1[1]	installed	Riparian Buffer Restoration	2683 lbs./yr of silt; 16 lbs./yr of Phosphorus; 3 lbs./yr of Total Nitrogen	Abington Township
Roslyn Park 2[1]	Installed	Rain Garden	982 lbs./yr of silt; 3 lbs./yr of Phosphorus; 16 lbs./yr of Total Nitrogen	Abington Township

[1]STEPL analysis performed by municipality during PRP/MS4 planning.

Complementary Strategies

The 2,000-acre Sandy Run focus area provides multiple opportunities for new and retrofitted stormwater control measures at a variety of public and private locations, including multiple opportunities to build off of Phase I GSI investment projects (Figure 40). The Sandy Run flows through a highly urbanized section of Abington Township that has a history of significant flooding events. In fact, several segments of the upper Sandy Run are fully channelized with concrete, a practice historically used to protect adjacent properties from flooding. Along with these challenges, the Sandy Run also flows through existing Abington Township parks, including Roychester, Grove, Ardsley, and Roslyn parks and along Roslyn, Willow Hill and Overlook Elementary Schools.

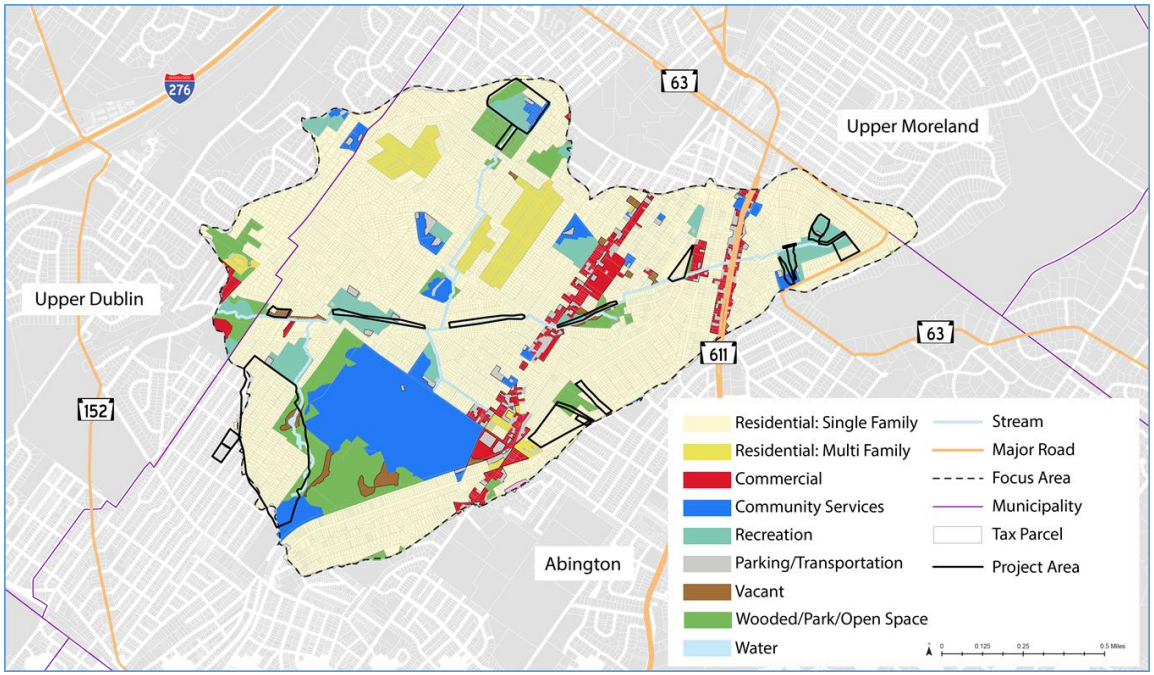


Figure 40: Sandy Run Focus Area Land Use Information

These adjacent land uses provide opportunities for GSI investments that are visible and accessible to the public and can be incorporated into educational activities at these locations (Figure 41). They provide exciting opportunities to build and expand activities with continued strong municipal partners in both Abington and Upper Dublin Townships and Abington's School District.

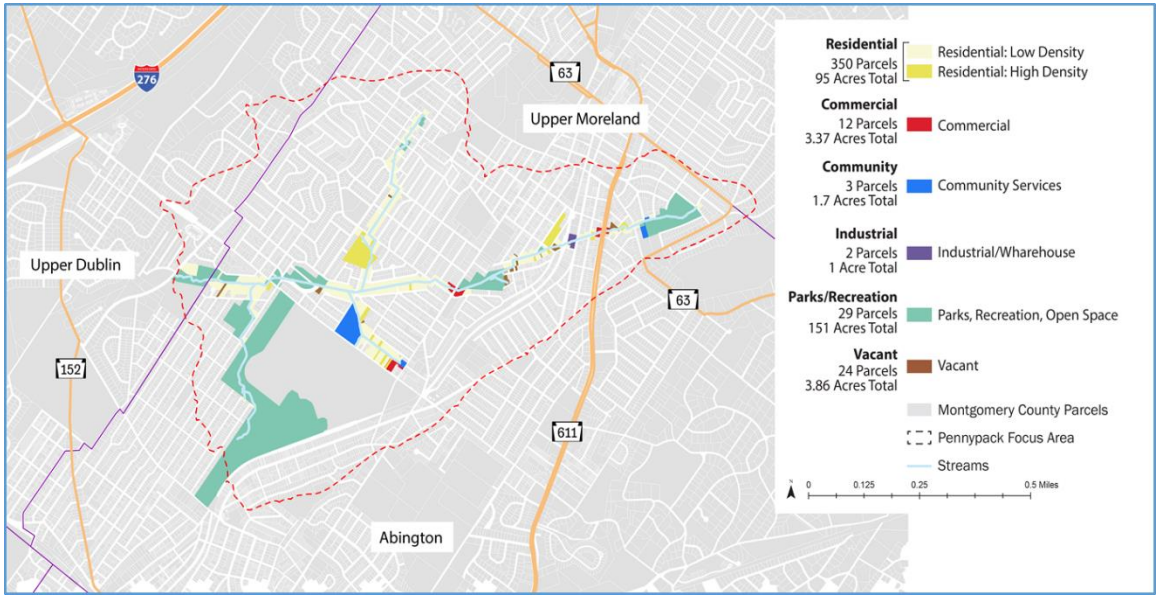


Figure 41: Sandy Run Focus Area Streamside Parcel Information

WVWA's Complementary strategies will focus on four key stakeholder groups: municipalities, residents, large-landowners, and volunteers engaged in citizen advocacy and monitoring the creek (Table 36; Table 37). Many of these Complementary strategies synergize with outreach led by WVWA for the Wissahickon Clean Water Partnership initiative (WCWP). This effort encompasses the entire Wissahickon Watershed, including 13 of its 16 municipalities, and 4 Wastewater Treatment facilities, one of which is along the Sandy Run. Our complementary strategies will support on-going and future compliance with Municipal Separate Sewer Systems (MS4) and TMDL permits, and support the larger collaborative effort to develop the Wissahickon Water Quality Improvement Plan through the WCWP initiative. Additionally, our Complementary strategies will use targeted outreach to educate the public about the on-going water quality improvement efforts to build constituency engagement and support for sustained stormwater management projects throughout the watershed and in the focus area.

Both Abington and Upper Dublin have municipal environmental advisory councils who are and will continue to be critical partners in efforts to engage residents and provide avenues to engage with elected officials. Abington EAC's highly successful "Rain Barrel the Town" initiative is one example of a local partnership activity that can help reach additional residences in the focus area.

Another key complementary strategy to be deployed in this focus area is continued and enhanced cooperation and collaboration with related agencies such as the US Army Corps of Engineers, FEMA and PA state agencies such as PA DEP and DCNR. All of these agencies support related water quality and stream restoration projects in this focus area. The US ACOE is currently designing stream stabilization and daylighting projects in both Grove and Roychester Parks with $2.3 million secured funding for Grove Park and $1.3 million anticipated for Roychester Park.

Seventy percent of the focus area land use is residential, therefore our complementary strategies engaging residents is a key priority. Our residential Complementary strategies will include continued education and engagement for focus-area residents to strengthen support for the municipal capital project investment and to create new clean water ambassadors (Creek Watchers) among the focus area communities who value and understand the multiple benefits of proper stormwater management and healthy streams. Our primary audience will be the 420 landowners located within the Sandy Run headwaters drainage area (micro watershed, Figure 34), but outreach and engagement programs would also be available to residents and landowners within the broader focus area. Within this micro-watershed, WVWA will pilot a program similar to Cobb's Stream Smart House Calls or the Philadelphia Water Department's Rain Check program, where we will provide educational workshops for targeted homeowners in the micro-watershed, which will qualify them for a house call where we will provide an assessment of GSI opportunities on their property to reduce stormwater runoff, and we will provide financial and technical support to residents that opt to install the proposed GSI projects on their property. This program will be launched in tandem with education and outreach related to demonstration GSI projects at Overlook Elementary and Roychester Park. Installing capital projects at these community centers provide us with an unequaled opportunity to further engage and educate the community.

Finally, our Complementary strategies will focus on continuing to engage and empower our citizen scientists, many of whom have been monitoring the Wissahickon Creek since the start of the Creek Watch program in 2014. We will coordinate cluster-wide trainings for our citizen scientists that provide further education and instruction on volunteer monitoring techniques. These cluster-wide trainings will also promote greater connection between all USPC volunteers working to monitor their local creeks, and provide them a network to share their experiences and become more empowered about their work.

In addition to the creek monitoring opportunities, we also plan to expand our Creek Watch engagement beyond citizen science to include community education and advocacy to their training and volunteer opportunities. This is particularly critical in the Sandy Run focus area, where we hope to galvanize community interest and understanding in the capital projects through outreach and engagement by their own neighbors whom we will have engaged as Creek Watch volunteers.

Table 36: Complementary Strategies Sandy Run

Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
1. Improved Municipal Stormwater Regulatory Policies, Practices & Increased investment in GSI; Increased local government relationships	Abington and Upper Dublin Township staff and elected officials. Zoning Officer, Planning Commission, EAC members and Zoning Hearing Board Members	Sandy Run Focus Area	Abington and Upper Dublin commit to future investment in GSI through the Wissahickon Clean Water Partnership Water Quality Improvement Plan Abington Township will invest in at least 3 GSI projects in the focus area	Consistent level of riparian protection enhances effectiveness in reducing streambank erosion, slowing runoff, and moderating thermal impacts; practices that can lead to improved water quality. Additional stream ambassadors created to promote clean water policies and projects to focus area neighbors.

Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
Continue to work with existing EACs to champion GSI projects, become citizen stream monitors or master watershed stewards	Abington and Upper Dublin EAC Members		2 EAC members become volunteer Creek Watchers 1 EAC member trains as a Master Watershed Steward EAC members champion GSI projects through municipal approval process	6-8 proposed GSI projects approved and municipality provides matching funds for each as part of application process.
2. Improved large landowners/ institutional Stormwater Management Policies and Practices & Increased investment in GSI; Enhanced coordination among Federal, State and Regional Agencies	Large landowners (educational institutions, corporations, township parks & recreation)	Sandy Run Focus Area	Educational programming to Abington School District facility managers to enhance capital strategies on school properties Collaboration with Abington School District and Abington Township to provide educational opportunities associated with capital strategies and projects Enhanced collaboration with Federal & State Agencies leading to additional funding opportunities GSI projects.	Environmental education opportunities to community organizations with large land holdings Increase stewardship and awareness among watershed stakeholders.
3. Improved Residential Pollution-Prevention Practices & increased investment in GSI measures	Residents in Sandy Run focus area	Sandy Run Focus Area	Engage 50 micro-watershed homeowners in the Stream Smart House Calls program. Install rain barrels at 35 micro-watershed residences Install rain gardens or similar SCM at 15 micro-watershed residences. 20 micro-watershed landowners improve streamside land care.	Smaller distributed GSI, when aggregated results in reductions in stormwater volume, velocity and pollutants entering stream. Builds stronger support and awareness among residents.

Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
4. Expand Citizen Water Quality Monitoring Training Opportunities **Expand participation in County Master Watersheds Stewards Training**	Existing and new citizen science volunteers	Sandy Run Focus Area	Conduct expanded cluster-wide volunteer training opportunities, connecting volunteers together across organizations and watersheds Educate citizen scientists about WCWP effort and how they can engage in the process 10 residents from within the focus area become Creek Watch volunteers, helping with stream monitoring and community education and advocacy 4 resident Creek Watch volunteers enroll in Master Watershed Stewards training.	Stream monitors raise knowledge of water quality issues & transfer knowledge to neighbors and community leaders. Monitors help identify illegal/illicit discharges to streams. Building strong watershed champions/leaders for watershed groups increases local awareness and ownership.
5. Scientific research, assessment and documentation.	Scientific and Lay Communities	Sandy Run Focus Area	USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged. USPC results are disseminated to the scientific community and the importance of findings is discussed and explained.	Sharing scientific data to educate and inform scientific and lay communities on water quality trends and effective measures to improve impairments.

Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
6. Support for Capital Projects STEPL used to model pollutant load reduction expected from individual projects. Site descriptions and recommendations provided to landowners**.** Evaluate projects and make suggestions about functionality	Cluster Partner Organizations	Continue intensive project-level monitoring in the Sandy Run.	Appropriate and timely project implementation. Strategic placement of capital projects. High tier project monitoring. Pour point monitoring of focus areas. Develop parameter specific water quality monitoring plan.	Scientifically supported project development and placement leads to reliable and replicable water quality outcomes

Table 37: Complementary Strategies Watershed-Wide`

Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
1. Improved Municipal Stormwater Regulatory Policies, Practices & Increased investment in GSI; Increased local government relationships Continue to work with existing EACs to champion GSI projects, become citizen stream monitors or master watershed stewards	Township staff and elected officials. Zoning Officer, Planning Commission, EAC members and Zoning Hearing Board Members	Watershed-wide (outside Sandy Run focus area)	Majority of watershed municipalities commit to future investment in GSI through the Wissahickon Clean Water Partnership WQIP Overall increase in municipal GSI investment and practices across watershed through the Wissahickon Clean Water Partnership WQIP	Consistent level of riparian protection enhances effectiveness in reducing streambank erosion, slowing runoff, and moderating thermal impacts; practices that can lead to improved water quality.
2. Improved large landowners/ institutional Stormwater Management Policies and Practices & Increased investment in GSI; Enhanced coordination among Federal, State and Regional Agencies	Large landowners (educational institutions, corporations, township parks & recreation)	Watershed-wide (outside Sandy Run focus area)	Increased collaboration with local, state and federal agencies	More coordinated approach to stormwater management in the watershed utilizing full partnership opportunities

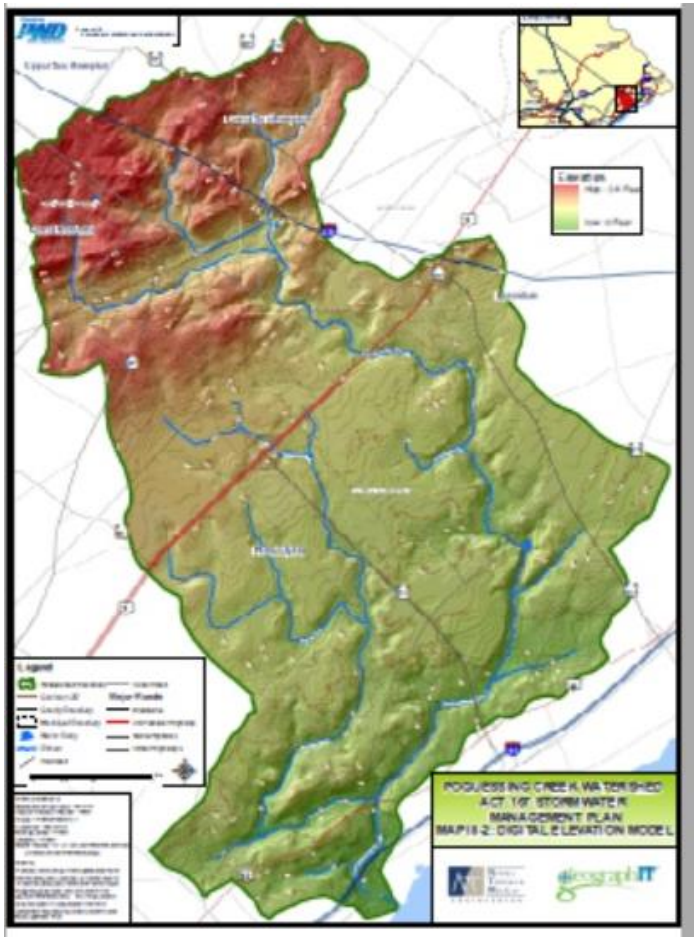
Strategy (Activity)	Target Audience	Location	Target Accomplishments (in 3 yrs.)	Connection to Outcomes & Water Goal
4. Expand Citizen Water Quality Monitoring Training Opportunities	Existing and new citizen science volunteers	Watershed-wide (outside Sandy Run focus area)	Shared cluster workshops and trainings 4 Creek Watchers take Master Watershed Steward training Broaden engagement of Creek Watch volunteers to include community education and advocacy. Educate citizen scientists about WCWP effort and how they can engage in the process	Stream monitors raise knowledge of water quality issues & transfer knowledge to neighbors and community leaders. Monitors help identify illegal/illicit discharges to streams. Building strong watershed champions/leaders for watershed groups increases local awareness and ownership.

2. NON-FOCUS AREA OPPORTUNITIES

2A. Poquessing Watershed Profile

Watershed Description [A]

Much development in the watershed took place before stormwater management plans and ordinances were adopted. More recent regulations including ordinances required by the 2012 *Poquessing Watershed Act 167 Stormwater Management Plan* have sought to address stormwater runoff issues. Because of the high degree of urbanization, the Act 167 Stormwater Management plan calls for corrective measures to existing problem areas, coupled with regulations that require "retrofits" during redevelopment that better detain and infiltrate stormwater.



Capital Intensive Strategies

The *Poquessing Watershed Act 167 Stormwater Management Plan* lists 71 problem areas identified by municipalities, including sedimentation sites, erosion sites, flooding, and water back-ups behind bridges and other obstructions (Figure 42). Ten (10) detailed problem areas were further analyzed where more severe risks to life, property, or the environment were identified. The Act 167 plan identifies watershed restoration projects (*Appendix G Improvements*) that include potential new stormwater management regional basins, retrofitting existing stormwater management basins, and stream bank planting projects (riparian buffer restoration).

Figure 42: Poquessing Watershed Elevation Map from Act 167 Plan, PWD and NTM Engineering, Inc.

The watershed restoration projects identified in the Act 167 Plan served as a starting point for Upstream Suburban Philadelphia Cluster partner efforts to develop and implement capital intensive strategies. Cluster partners including Friends of Poquessing Watershed, Pennsylvania Environmental Council, and the Bucks County Conservation District reached out to municipalities and other land managers during Phase 1 and the Phase 2 planning process. Act 167 projects proposed for problem areas, as well as a broader list of Act 167 improvement projects, were considered.

Under Phase 1 work, grant proposals were submitted to the National Fish and Wildlife Foundation's DRWI grant program, PA DEP's Growing Greener grant program, and the Pennsylvania Department of Community and Economic Development Community Financing Authority grant program. Two Growing Greener grants were awarded, including one for two basin retrofit projects in Lower Southampton Township and one for a wetland restoration project in Bensalem Township (Table 38).

Stakeholder outreach during the Phase 2 planning process resulted in the identification of two potential focus areas as noted in Section 2. The outreach continued to utilize the Act 167 Plan project recommendations. The two potential focus areas included:

- Several tributaries make up the Poquessing headwaters area in Lower Southampton Township. The PA Boulevard and Brookside basin retrofit projects are in one tributary area. The Lower Southampton Township Building and several schools are in a second tributary area. Under the Phase 2 assessment the latter tributary area was analyzed as a potential focus area. It was not a higher scoring focus area and so has not moved forward as a recommended Phase 2 USP cluster focus area.

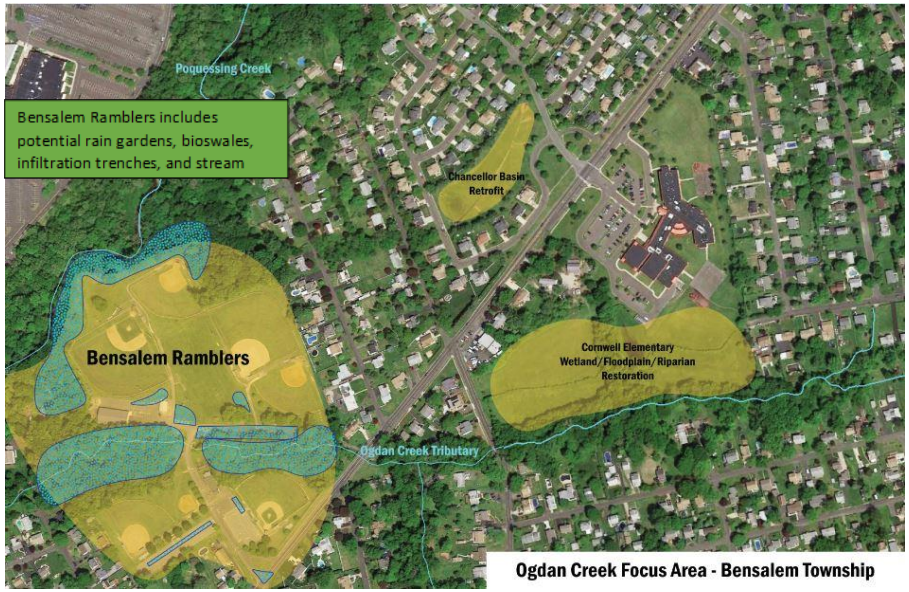


Figure 43: Ogden Tributary Concept

- Two tributaries in Bensalem Township draining into the Poquessing mainstem were considered as a focus area. Several Township owned properties with potential projects were identified. Along one tributary these include the Bensalem Ramblers sport complex (rain garden and stream restoration), the Chancellor basin retrofit, and the Cornwells wetland project (Figure 43). Along a second adjacent tributary these included rain gardens and stream restoration on the Bensalem Country Club (Figure 44). This potential focus area also did not score high enough to move forward as a recommended Phase 2 USP cluster focus area.

Figure 44: Bensalem Country Club Concept

Poquessing Watershed partners are providing education and outreach activities in support of the two Growing Greener projects, and plan additional outreach (see details in below Complementary Strategies section) (Table 41). The Poquessing partners plan to pursue Trophy/Cornerstone projects if available under NFWF-DRWI grant programs, and financing through other grants/funding sources, considering first the projects identified during Phase 1 and Phase 2 planning. Some of the potential Poquessing Watershed projects are listed on Table 39.

Table 38: Current Projects in Watershed

Project Name	SCM	Project Pollutant Reduction	Partners	Cost	Funding Support
Brookside Basin	Basin Naturalization	-	Lower Southampton Twp.	Total: $126,014	Growing Greener, Design Grant: $103,777; Township and other match: $22,237
PA Boulevard Basin	Basin Naturalization	-	Lower Southampton Twp.	Part of above cost detail.	Part of above cost: Growing Green – Design
Cornwell Elementary	Wetland Restoration (project originally included new basin, but high groundwater table pushed project more fully to wetland restoration.	-	Bensalem Twp.	Total: $570,585	Growing Greener, Design: $173,170; Township and other match for construction: $397,415

Table 39: Potential Projects in Watershed over Phase 2 Timeframe

Project Name	Status (Estimated Break Ground Date)	SCM	Projected Pollutant Reduction	Potential Partners
Bensalem Country Club 1[1]	Conceptualized	Tributary Stream Restoration/Buffer	76255.200 lbs./yr. of silt; 28.519 lbs./yr. of Phosphorus; 64.817 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Country Club 2[1]	Conceptualized	Tributary Stream Restoration/Buffer	1121140.00 lbs./yr. of silt; 41.940 lbs./yr. of Phosphorus; 95.319 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Country Club 3[1]	Conceptualized	Main Stem Stream Restoration/Buffer	112140.000 lbs./yr. of silt; 50.328 lbs./yr. of Phosphorus; 114.383 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Country Club 4[1]	Conceptualized	Bioretention/ Infiltration	247.384 lbs./yr. of silt; 0.650 lbs./yr. of Phosphorus; 3.002 lbs./yr. of Total Nitrogen	Bensalem Twp.
Chancellor Basin[1]	Bensalem Twp. has expressed interested in completing one or two of these project over the next 3-5 years	Basin Retrofit & Naturalization	63.071 lbs./yr. of silt; 0.038 lbs./yr. of Phosphorus; 0.378 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Ramblers 1[1]		Main Stem Stream Restoration/Buffer	89712.000 lbs./yr. of silt; 33.552 lbs./yr. of Phosphorus; 76.255 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Ramblers 2		Tributary Stream Restoration/Buffer	-	Bensalem Twp.
Bensalem Ramblers 3[1]		Permeable Pavement	23.319 lbs./yr. of silt; 0.028 lbs./yr. of Phosphorus; 0.042 lbs./yr. of Total Nitrogen	Bensalem Twp.
Bensalem Ramblers 4[1]		Bioretention/ Infiltration	102.327 lbs./yr. of silt; 0.223 lbs./yr. of Phosphorus; 0.785 lbs./yr. of Total Nitrogen	Bensalem Twp.
Cornwell Elementary	Revised Concept Design by Dec 2017, Construction by Dec 2018	Wetland Restoration	-	Bensalem Twp. and Bensalem School District
Poquessing Middle School projects	Conceptualized	Rain gardens, pervious parking lot infiltration, meadows	-	Lower Southampton Township
Lower Southampton Township Building	Conceptualized	Rain gardens	-	Lower Southampton Township
Pine Road Elementary	Conceptualized	Basin and stream bank restoration	-	Lower Moreland Township

[1]STEPL analysis performed on conceptualized project during Phase 2 planning or PRP/TMDL planning.

[A]Poquessing Watershed information drawn from the 2012 *Poquessing Watershed Act 167 Stormwater Management Plan*, and the 2013 *Upstream Suburban Philadelphia Cluster Implementation Plan* (Phase 1 Plan).

Complementary Strategies

The Friends of Poquessing Watershed, PEC, and other stakeholders have and will continue to pursue complementary strategies that support existing and promote future capital project strategies. Based on the predominant land use in the upstream Poquessing Watershed (residential), this effort will focus on complementary strategy 3 (Adapt and implement residential green stormwater infrastructure and pollution prevention programs). As indicated by Act 167 Land use statistics in Table 40, residential land use makes up close to 50% of the watershed. As will be done for focus area watersheds, we will promote residential adoption of water quality improvement practices that provide both an avenue for engagement and increased opportunities to reduce stormwater volume and related pollutants from entering the municipal systems and the nearby

stream. Opportunities to pursue complementary strategy 2 (Outreach and training to specialized large landowners, and property and facility managers) will also be pursued along commercial corridors, at schools, and with other larger landowners.

Education and outreach audiences associated with the current capital projects in the watershed include residential (Brookside basin retrofit), commercial/industrial (PA Boulevard basin retrofit), and residential/elementary school (Cornwells wetland). The Cornwells project is planning to include park/open space area accessible to the elementary school students and the surrounding community. Opportunities to engage students and surrounding residents with this project and broader stormwater management practices will be sought. Additional audiences include public recreational users of the Bensalem Ramblers sporting complex. Rain gardens, infiltration beds, and stream restoration projects promoted at the Ramblers facility will be complemented with signage and other outreach to these youth and family audiences. Good Housekeeping practices addressing water quality will be promoted at the PA Boulevard basin retrofit project, and expanded to other commercial/industrial property owners/managers.

Table 40: Land Use from Poquessing Creek Act 167 Plan

Land Use	Square Miles	Acres	Percent Area
Agriculture	0.26	166.1	1.20
Commercial	1.41	900	6.52
Community Services	1.21	776.5	5.63
Manufacturing: Light Industrial	1.56	999.8	7.25
Military	0.01	4.7	0.03
Mining	0.02	10.9	0.08
Parking	1.62	1,034.9	7.50
Recreation	1.5	959.7	6.96
Residential: Mobile Home	<0.01	1.9	0.01
Residential: Multi-Family	1.51	968.4	7.02
Residential: Row Home	1.59	1,019.4	7.39
Residential: Single-Family Detached	5.85	3,744	27.11
Transportation	1.04	663.1	4.81
Utility	0.09	57.4	0.42
Vacant	0.97	622.5	4.51

Water	0.1	62.6	0.45
Wooded	2.83	1,809.1	13.11
TOTAL	**21.55**	**12,801**	**100**

The Poquessing Watershed partners will also continue to promote and expand citizen monitoring programs under complementary strategy 4 (expand citizen training; support and build capacity of existing EACs). This includes further expansion of the StreamKeeper program focusing on streamside residential landowners, and adopting Phase 2 monitoring tools such as bank pins and webcams. This will also include increased support and interaction with existing EACs (Lower Southampton and Bensalem) and exploring the formation of a new EAC (Lower Moreland). The Complementary Strategies are summarized in Table 41 below.

Table 41: Poquessing Watershed Complementary Strategies

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goals
1. **Improve Municipal Regulatory Policies & Practices** Build capacity of existing EAC to champion GSI projects, become citizen stream monitors or master watershed stewards	Bensalem and Lower Southampton Townships Municipal Officials, Zoning Officer, Planning Commission, EAC members and Zoning Hearing Board Members. Bensalem and Lower Southampton Township EAC members.	Overall watershed area in each Township, with focus on current project areas and potential focus areas.	Adoption of Riparian Buffer or Riparian Corridor Ordinance consistent with Poquessing Act 167 Riparian Buffer requirement. EAC members champion GSI projects through municipal approval process	Proven practice to reduce streambank erosion, slow runoff, moderate thermal impacts, leading to improved water quality. Additional steam ambassadors created to promote clean water policies and projects to focus area neighbors. 2 additional GSI proposed projects approved and municipality provides matching funds for each as part of application process.
2. **Expand outreach & training to specialized large landowners**	Industrial Park owners/managers around PA Boulevard basin retrofit project. School teachers, administrators, and facility managers (starting with Cornwells Elementary	Overall watershed area in each Township, with focus on current project areas and	Educational programming delivered to industrial park business owners/facility managers on Good Housekeeping and the value and benefits of proposed GSI at these locations.	Stream stabilization, pollution reduction, environmental educational opportunities.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goals
	School in Bensalem, and expanding to Pine Road Elementary School in Lower Moreland and Poquessing Middle School in Lower Southampton). Students at above-noted schools.	potential focus areas.	Promote GSI projects to school district facility managers for GSI project investment and continued maintenance. Educational programming delivered to school students focusing watershed restoration and stormwater management. In-kind or cash contributions for project funding applications Additional curriculum for elementary and middle school students incorporating GSI monitoring.	
3. Adapt and Implement Residential GSI and Pollution Prevention Training.	Streamside residents starting with those adjacent to Cornwells and Brookside projects.	Overall watershed area in each Township, with focus on current project areas and potential focus areas.	Ten (10) single family residences install rain barrels. Five (5) improve streamside land care.	Smaller distributed GSI, when aggregated results in reductions in stormwater volume, velocity and pollutants entering stream. Builds stronger support and awareness among residents.
4. Expand Citizen Water Quality Monitoring Training Opportunities	1. Streamside residents starting with those in project and in potential focus areas. 2. Residents near projects and within potential focus areas, but not with streamside properties. 3. Parents of students within schools. 4. Municipal staff, school district facility staff, interested residents.	Overall watershed area in each Township, with focus on current project areas and potential focus areas.	Four residents become streamside monitors. StreamKeepers expand their knowledge and use of monitoring tools such as bank pins and webcam monitoring.	Stream monitors raise knowledge of water quality issues and transfer knowledge to neighbors and community leaders. Additional on-site monitors help identify illegal/illicit discharges to streams. Proper maintenance of GSI systems prolongs their water quality effectiveness, minimizes problems and helps maintain aesthetics.

Strategy Number (Activity)	Target Audience	Location	Target Accomplishments	Connection to Outcomes & Water Quality Goals
5 Scientific research, assessment and documentation	Scientific and Lay Communities	Poquessing Creek Trophy projects	USPC/DRWI findings are presented to the scientific community and partner organizations. Support of USPC/DRWI is credited and acknowledged USPC results are disseminated to the scientific community and the importance of findings is discussed and explained.	Sharing scientific data to educate and inform scientific and lay communities on water quality trends and effective measures to improve impairments.

2B. Potential Restoration Projects Outside of Focus Areas

Table 42: Potential Restorations Projects Outside of Focus Areas

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Cobbs Watershed						
1, 3, 5 Main[1]	39.9169, -75.24712	Riparian Buffer	Sediment reduction = 65.00 lb./yr.	Yes	EDCSC; PRC; Darby Borough	$1993
100 Block of Penn Blvd[1]	39.9117, -75.2606	Bioswale	Sediment reduction = 291.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$111,600
500 Block of Baltimore Ave[1]	39.9406, -75.26139	Infiltration Trench	Sediment reduction = 237.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$8,227
200 Block of Penn Blvd[1]	39.9469, -75.2611	Bioswale	Sediment reduction = 346.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$111,600
Argyle Circle Basin 2	39.960919, -75.290554	Basin Retrofit	Sed reduction = 1585.65 lb./yr.; N reduction = 11.69 lb./yr.; P reduction = 3.21 lb./yr.	-	DCVA	-
Chatham Glen Elementary School	39.975443, -75.299043	Infiltration/Filter Strip & Rain Garden	Sed reduction = 714.24 lb./yr.; N reduction = 9.03 lb./yr.; P reduction = 1.69 lb./yr.	-	EDCSC; PRC	-
Chatham Glen Park 1	39.973547, -75.292135	Dry Extended Detention Basin	Sed reduction = 780.71 lb./yr.; N reduction = 4.57 lb./yr.; P reduction = 0.72 lb./yr.	-	EDCSC; PRC; DCVA	-
Chatham Glen Park 2	39.974043, -75.292057	Tiered Rain Garden	Sed reduction = 77.567 lb./yr.; N reduction = 0.611 lb./yr.; P reduction = 0.18 lb./yr.	-	EDCSC; PRC; DCVA	-
E. Lansdowne School 1[1]	39.9458, -75.26415	Bioswale 1	Sediment reduction = 174.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$59520

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
E. Lansdowne School 2[1]	39.9456, -75.26139	Bioswale 2	Sediment reduction = 81.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	-
E. Lansdowne School 3[1]	39.9456, -75.26333	Rain Garden	Sediment reduction = 71.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$11102
E. Lansdowne School 4[1]	39.9459 -75.26323	Bioswale 3	Sediment reduction = 5.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$37200
Evans Elementary	39.936283, -75.252483	Filtering Practices	Sed reduction = 915.08 lb./yr.; N reduction = 12.70 lb./yr.; P reduction = 1.95 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$74400
Fairmount	39.975201, -75.280369	Off Channel Storage Area	Sed reduction = 4706.93 lb./yr.; N reduction = 23.26 lb./yr.; P reduction = 7.68 lb./yr.	-	DCVA	-
Firehouse 1[1]	39.9453, -75.26194	Infiltration Trench	Sediment reduction = 117.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$22320
Firehouse 2[1]	39.945, -75.2625	Bioswale	Sediment reduction = 27.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$111600
Foxglove Lane	39.992687, -75.262248	Off Channel Storage Area	Sed reduction = 1335.97 lb./yr.; N reduction = 7.60 lb./yr.; P reduction = 2.39 lb./yr.	-	DCVA	-
Green Hills Condo 1	39.987022, -75.258261	Bio-Retention/Rain Garden	Sed reduction = 106.43 lb./yr.; N reduction = 0.589 lb./yr.; P reduction =0.18 lb./yr.	-	LMC	-
Green Hills Condo 2	39.9871, -75.257481	Bioswale	Sed reduction = 177.93 lb./yr.; N reduction = 3.60 lb./yr.; P reduction = 0.50 lb./yr.	-	LMC	-
Green Hills Condo 3	39.9872, -75.258828	Bio-Retention/Rain Garden	Sed reduction = 47.72 lb./yr.; N reduction = 0.38 lb./yr.; P reduction = 0.14 lb./yr.	-	LMC	-
Green Hills Condo 4	39.986756, -75.258947	Permeable Pavement	Sed reduction = 103.33 lb./yr.; N reduction = 0.54 lb./yr.; P reduction = 0.11 lb./yr.	-	LMC	-
Green Hills Condo 5	39.986361, -75.261575	Bio-Retention/Rain Garden	Sed reduction = 90.87 lb./yr.; N reduction = 0.40 lb./yr.; P reduction = 0.29 lb./yr.	-	LMC	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Green Hills Condo 6	39.984714, -75.260183	Bio-Retention/Rain Garden	Sed reduction = 366.31 lb./yr.; N reduction = 4.65 lb./yr.; P reduction = 0.88 lb./yr.	-	LMC	-
Green Hills Condo 7	39.986025, -75.258853	Dry Extended Detention Basin	Sed reduction = 767.82 lb./yr.; N reduction = 0.75 lb./yr.; P reduction = 6.90 lb./yr.	-	LMC	-
Green Hills Condo 8	39.985397, -75.259086	Basin Retrofit	Sed reduction = 250.66 lb./yr.; N reduction = 1.98 lb./yr.; P reduction = 0.14 lb./yr.	-	LMC	-
Hathaway-SEPTA Bus	39.995014, -75.305055	Filter Strip	Sed reduction = 143.86 lb./yr.; N reduction = 0.90 lb./yr.; P reduction = 0.38 lb./yr.	-	EDCSC; PRC	-
Haverford College 1	40.006684, -75.301454	Streambank Stabilization & Riparian Buffer	Sed reduction = 89712.00 lb./yr.; N reduction = 76.255 lb./yr.; P reduction = 33.552 lb./yr.	-	LMC; EDCSC; PRC; DCVA	-
Haverford College 2	40.009032, -75.306724	Underground Retention	-	-	LMC; EDCSC; PRC; DCVA	-
Haverford College 3	40.01110, -75.303056	Pond	-	-	LMC; EDCSC; PRC; DCVA	-
Holy Cross Cemetery[1]	39.9622, -75.30537	Streambank Restoration	Sediment reduction = 71269.44 lb./yr.	Yes	EDCSC; PRC: Yeadon Borough	$558000
Kaiserman JCC	39.981247, -75.267243	Off Channel Storage Area	Sed reduction = 582.51 lb./yr.; N reduction = 4.20 lb./yr.; P reduction = 1.288 lb./yr.	-	DCVA; LMC	-
Kerr Field[1]	39.9391, -75.24805	Rain Garden	Sediment reduction = 51.00 lb./yr.	Yes	EDCSC; PRC; Yeadon Borough	$7401
Lankenau Hospital	39.989827, -75.258950	Wet Ponds & Wetlands	Sed reduction = 1399.35 lb./yr.; N reduction = 12.50 lb./yr.; P reduction = 2.98 lb./yr.	-	PRC; DCVA	-
Lee Circle	40.011859, -75.318452	Dry Extended Detention Basin	Sed reduction = 2316.68 lb./yr.; N reduction = 19.09 lb./yr.; P reduction = 2.175 lb./yr.	-	DCVA	-
Municipal Building 1[1]		Porous Paving		Yes		$37200

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
	39.9453, -75.26194		Sediment reduction = 108.00 lb./yr.		EDCSC; PRC; E. Lansdowne	
Municipal Building 2[1]	39.9456, -75.26194	Infiltration Trench	Sediment reduction = 71.00 lb./yr.	Yes	EDCSC; PRC; E. Lansdowne	$70699
Brief Road Municipal Lot[1]	39.962, -75.26277	Infiltration Trench	Sediment reduction = 487.00 lb./yr.	Yes	EDCSC; PRCP; Upper Darby	$1190400
McCall Golf Club 1	39.974154, -75.281432	Streambank Restoration	Sed reduction = 89712.00lb/yr.; N reduction = 76.255 lb./yr.; P reduction = 33.55 lb./yr.	-	EDCSC; PRC; DCVA	-
McCall Golf Club 2	39.973958, -75.281039	Dry Extended Detention Basin	Sed reduction = 149.54 lb./yr.; N reduction = 0.489 lb./yr.; P reduction = 0.166 lb./yr.	-	EDCSC; PRC; DCVA	-
McCall Golf Club 3	39.972924, -75.282599	Dry Extended Detention Basin	Sed reduction = 148.28 lb./yr.; N reduction = 0.485 lb./yr.; P reduction = 0.165 lb./yr.	-	EDCSC; PRC; DCVA	-
Merion Golf Club	40.000147, -75.310719	Off Chanel Storage Area	Sed reduction = 778.819 lb./yr.; N reduction = 4.383 lb./yr.; P reduction = 1.65 lb./yr.	-	EDCSC; PRC; DCVA	-
Merwood Park	39.994695, -75.302716	Streambank Stabilization	Sed reduction = 61004.16 lb./yr.; N reduction = 51.85 lb./yr.; P reduction = 22.82 lb./yr.	-	EDCSC; PRC	-
Montgomery Court	40.00939, -75.26255	Rain Garden	Sed reduction = 430.21 lb./yr.; N reduction = 2.484 lb./yr.; P reduction = 0.90 lb./yr.	-	LMC	-
Narberth Park	40.00459, -75.26516	Underground Retention	-	-	LMC	-
Penn Wynne Park	39.985106, -75.270497	Off Channel Storage Area	Sed reduction = 627.60 lb./yr.; N reduction = 2.945 lb./yr.; P reduction =1.42 lb./yr.	-	DCVA	-
Penn Wynne Elementary School	39.98796, -75.27822	Rain Garden	Sed reduction = 222.96 lb./yr.; N reduction = 2.57 lb./yr.; P reduction = 0.46 lb./yr.	-	LMC	-
Powdermill Park 1				-	EDCSC; PRC; DCVA	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
	39.983506, -75.284156	Wet Ponds & Wetlands	Sed reduction = 1497.18 lb./yr.; N reduction = 8.65 lb./yr.; P reduction = 3.10 lb./yr.			
Powdermill Park 2	39.983506, -75.284156	Daylighting	-	-	EDCSC; PRC; DCVA	-
Remington Road	39.990551, -75.271032	Basin Retrofit	-	-	DCVA; LMC	-
Route 3 Median	39.963027, -75.264842	Tree Trenches/Bioswale	Sed reduction = 1359.67 lb./yr.; N reduction = 34.42 lb./yr.; P reduction = 3.79 lb./yr.	-	EDCSC; PRC	-
Garrett Road Municipal Lot[1]	39.964, -75.26306	Infiltration Trench	Sediment reduction = 522.00 lb./yr.	Yes	EDCSC; PRC; Upper Darby	$744000
Shortridge Park 1	39.996892, -75.263764	Off Channel Storage Area	Sed reduction = 655.97 lb./yr.; N reduction = 3.51 lb./yr.; P reduction = 1.40 lb./yr.	-	DCVA; LMC	-
Shortridge Park 2	39.99674, -75.26378	Streambank Stabilization	Sed reduction = 69975.36 lb./yr.; N reduction = 59.48 lb./yr.; P reduction = 26.17 lb./yr.	-	DCVA; LMC	-
Spring Mill Lane	40.008375, -75.315106	Off Channel Storage Area	-	-	DCVA	-
St. Margaret's School	40.0085, -75.25989	Demonstration Rain Garden	Sed reduction = 302.05 lb./yr.; N reduction = 3.80 lb./yr.; P reduction = 0.86 lb./yr.	-	LMC	-
Temple Beth Hillel/Beth El	39.99439, -75.2694	Rain Garden/Bioswale	Sed reduction = 31.17 lb./yr.; N reduction = 3.40 lb./yr.; P reduction =1310.15 lb./yr.	-	LMC	-
Violet Lane	39.991033, -75.261402	Off Channel Storage Area	Sed reduction = 867.80 lb./yr.; N reduction = 4.35 lb./yr.; P reduction = 1.58 lb./yr.	-	DCVA	-
Wynnewood Basin	39.991605, -75.297038	Off Channel Storage Area	Sed reduction = 688.12 lb./yr.; N reduction = 3.58 lb./yr.; P reduction = 1.35 lb./yr.	-	DCVA	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
WW Valley Park 1	39.985850, -75.282685	Dry Extended Detention Basin	Sed reduction = 689.50 lb/yr; N reduction = 3.45 lb/yr; P reduction = 0.70 lb/yr	-	DCVA	-
WW Valley Park 2	39.987263, -75.281570	Dry Extended Detention Basin	Sed reduction = 1050.16 lb/yr; N reduction = 6.03 lb/yr; P reduction = 1.02 lb/yr	-	DCVA	-
Yeadon Community Park 1[1]	39.9354, -75.26424	Bioswale 1	Sediment reduction = 103.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$74400
Yeadon Community Park 2[1]	39.9356, -75.26195	Bioswale 2	Sediment reduction = 294.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$260400
Yeadon Community Park 3[1]	39.9356, -75.26424	Rain Garden 1	Sediment reduction = 52.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$15798
Yeadon Community Park 4[1]	39.9359, -75.26365	Bioswale 3	Sediment reduction = 450.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$148800
Yeadon Community Park 5[1]	39.9359, -75.26365	Rain Garden 2	Sediment reduction = 103.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$22084
Haverford Skating	40.008629, -75.301625	Pervious Pavement	-	-	EDCSC; PRC; DCVA; LMC	-
Longacre Blvd Circle[1]	39.9366, -75.24939	Bio-Retention/Rain Garden	Sediment reduction = 13.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$7401
Golfview Circle 1	39.996059, -75.308878	Bio-Retention/Rain Garden	Sed reduction = 219.30 lb/yr; N reduction = 3.71 lb/yr; P reduction = 0.79 lb/yr	-	EDCSC; PRC	-
Golfview Circle 2	39.996059, -75.308878	Bio-Retention/Rain Garden	Sed reduction = 90.40 lb/yr; N reduction = 0.71 lb/yr; P reduction = 0.20 lb/yr	-	EDCSC; PRC	-
Wellington Road 1[1]	39.9623, -75.25436	Infiltration Trench	Sediment reduction = 36.00 lb/yr	Yes	EDCSC; PRC; Upper Darby	$130200

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Wellington Road 2[1]	39.9617, -75.25412	Bioswale 1	Sediment reduction = 322.00 lb/yr	Yes	EDCSC; PRC; Upper Darby	$78120
Wellington Road 3[1]	39.9611, -75.25396	Bioswale 2	Sediment reduction = 380.00 lb/yr	Yes	EDCSC; PRC; Upper Darby	$68820
Wellington Road 4[1]	39.9604, -75.25379	Bioswale 3	Sediment reduction = 410.00 lb/yr	Yes	EDCSC; PRC; Upper Darby	$74400
Garrett Road and Bywood Avenue[1]	39.9545, -75.2755	Bioswale	Sediment reduction = 4138.00 lb/yr	Yes	EDCSC; PRC; Upper Darby	$1860000
Septa Western Loop Outfall C190 Reconstruction[1]	39.9634, 75.25789	Rock Swale and Stream Stabilization	Sediment reduction = 17233.92 lb/yr	Yes	EDCSC; PRC; Upper Darby	$133920
Borough Hall[129]	39.9364, -75.25348	Rain Garden	Sediment reduction = 31.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$29605
700-709 Redwood Ave[1]	39.9355, -75.25347	Rain Garden	Sediment reduction = 114.00 lb/yr	Yes	EDCSC; PRC; Yeadon Borough	$37006
Pennypack Watershed						
Witmer Road	-	Basin Retrofit	Sed reduction = 3045.66 lb/yr; N reduction = 20.74 lb/yr; P reduction = 1.81 lb/yr	-	PERT	-
Fair Oaks	-	Dry Extended Detention Basin	Sed reduction = 2941.88 lb/yr; N reduction = 21.18 lb/yr; P reduction = 2.81 lb/yr	-	PERT	-
Saw Mill 1	-	Basin Retrofit	Sed reduction = 566.02 lb/yr; N reduction = 3.81 lb/yr; P reduction = 1.43 lb/yr	-	PERT	-
Saw Mill 2	-	Stream Restoration	Sed reduction = 29515.25 lb/yr; N reduction =25.09 lb/yr; P reduction = 11.04 lb/yr	-	PERT	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Blair Mill Village 1	-	Basin Retrofit	Sed reduction = 1190.86 lb/yr; N reduction =8.45 lb/yr; P reduction = 0.77 lb/yr	-	PERT	-
Blair Mill Village 2	-	Bio-Retention	Sed reduction =1978.42 lb/yr; N reduction =27.86 lb/yr; P reduction = 4.40 lb/yr	-	PERT	-
Blair Mill Village 3	-	Parking Lot Retrofit	-	-	PERT	-
Hidden Meadow	-	Dry Extended Detention Basin	Sed reduction = 974.77 lb/yr; N reduction =4.82 lb/yr; P reduction = 0.89 lb/yr	-	PERT	-
Blair Mill ES 1	-	Linear Infiltration Trenches	-	-	PERT	-
Blair Mill ES 2	-	Stream Restoration	-	-	PERT	-
Inverness	-	Wet Ponds & Wetlands	-	-	PERT	-
Saint Basil Academy	-	Parking Lot Retrofit	-	-	PERT	-
Seeds Property	-	Floodplain Storage	-	-	PERT	-
Horsham Friends 1	-	Parking Lot Retrofit	-	-	PERT	-
Horsham Friends 2	-	Riparian Buffer	-	-	PERT	-
Mason Mill Park	40.1575, -75.0788	Dry Extended Detention Basin	Sed reduction = 4257.13 lb/yr; N reduction = 31.47 lb/yr; P reduction = 3.96 lb/yr	-	PERT	-
Upper Moreland HS 1	-	Parking Lot Retrofit	-	-	PERT	-
Upper Moreland HS 2	-	Riparian Buffer	-	-	PERT	-
Justa Park	40.158, -75.0552		Sed reduction = 800.89 lb/yr; N reduction = 5.48 lb/yr; P reduction = 1.40 lb/yr	-	PERT	-
Lower Moreland Park	-	Bio-Retention		-	PERT	$52,000
Morrissey Property	40.1618, -75.0518	Dry Extended Detention Basin	Sed reduction = 2256.41 lb/yr; N reduction = 23.12 lb/yr; P reduction = 2.09 lb/yr	-	PERT	-
William Tenant 1	40.1838, -75.0713	Bio-Retention	Sed reduction = 1686.40 lb/yr; N reduction = 40.54	-	PERT	$55,000

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
			lb/yr; P reduction = 4.43 lb/yr			
William Tenant 2	40.1838, -75.0713	Infiltration Trenches	Sed reduction = 1214.46 lb/yr; N reduction = 28.98 lb/yr; P reduction = 3.38 lb/yr	-	PERT	$65,000
William Tenant 3	40.1838, -75.0713	Basin Retrofit	Sed reduction = 628.47 lb/yr; N reduction = 2.32 lb/yr; P reduction = 0.412 lb/yr	-	PERT	$40,000
William Tenant 4	40.1838, -75.0713	Parking Lot Bio-Retention Island	-	-	PERT	$78,000
Bryn Athyn CS 1	-	Riparian Buffer	-	-	PERT	-
Bryn Athyn CS 2	-	Rain Garden	-	-	PERT	-
Lorimer Park	-	Parking Lot Retrofit	-	-	PERT	-
Mann Road	-	Wet Ponds & Wetlands	Sed reduction =108578.98 lb/yr; N reduction = 223.55 lb/yr; P reduction = 97.82 lb/yr	-	PERT	-
SH Estates 1	40.17527, -75.0553	Basin Retrofit	Sed reduction =24891.96 lb/yr; N reduction = 53.87 lb/yr; P reduction = 22.04 lb/yr	-	PERT	$230,000
Pioneer Road	40.17222, -75.08	Parking Lot Retrofit	Sed reduction =32744.88 lb/yr; N reduction = 27.83 lb/yr; P reduction = 12.25 lb/yr	-	PERT	-
Warminster Park 1	40.19472, -75.0672	Wet Ponds & Wetlands	-	-	PERT	$85,500
Warminster Park 2	40.19472, -75.0672	Basin Retrofit	Sed reduction =558.29 lb/yr; N reduction = 3.18 lb/yr; P reduction = 0.315 lb/yr	-	PERT	$62,000
McDonald ES	40.1927, -75.0714	Bio-Retention	Sed reduction = 4005.63 lb/yr; N reduction = 91.52 lb/yr; P reduction = 10.08 lb/yr	-	PERT	$135,000
Abington Outpatient	40.1966, -75.0811	Parking Lot Retrofit	-	-	PERT	$80,000
Scymaneck Park 1	40.190962, -75.0714	Bio-Retention/Rain Garden	Sed reduction = 3669.03 lb/yr; N reduction = 87.91 lb/yr; P reduction = 10.39 lb/yr	-	PERT	$110,000

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Scymaneck Park 2	40.190962, -75.0714	Stream Restoration	Sed reduction = 15558.13 lb/yr; N reduction =25.38 lb/yr; P reduction = 9.01 lb/yr	-	PERT	$48,000
Centennial Station	40.19018, -75.0717	Basin Retrofit	Sed reduction = 2107.59 lb/yr; N reduction = 17.21 lb/yr; P reduction = 2.44 lb/yr	-	PERT	$175,000
Pilleggi Park	40.17306, -75.0836	Dry Extended Detention Basin	Sed reduction = 3378.11 lb/yr; N reduction = 33.58 lb/yr; P reduction = 3.19 lb/yr	-	PERT	$425,000
Butternut Drive	40.17027, -75.0836	Dry Extended Detention Basin	Sed reduction = 77.61 lb/yr; N reduction = 4.86 lb/yr; P reduction = 0.73 lb/yr	-	PERT	$88,500
Tookany						
Abington Jr High 1	40.07638, -75.1038	Rain Garden 1	Sed reduction = 256.73 lb/yr; N reduction = 3.11 lb/yr; P reduction = 0.63 lb/yr	-	TTF	$610,000
Abington Jr High 2	40.07638, -75.1039	Rain Garden 2	Sed reduction = 461.84 lb/yr; N reduction = 5.32 lb/yr; P reduction = 0.96 lb/yr	-	TTF	-
Abington Jr High 3	-	Master Plan	-	-	TTF	$10,000
Breyer Master 1	40.08622, -75.1343	Basin Retrofit	Sed reduction = 1392.02 lb/yr; N reduction = 7.27 lb/yr; P reduction = 1.01 lb/yr	-	TTF	-
Breyer Master 2	40.08622, -75.1344	Bio-Retention/Rain Garden	Sed reduction = 128.24 lb/yr; N reduction = 1.49 lb/yr; P reduction = 0.32 lb/yr	-	TTF	-
Breyer Master 3	40.08622, -75.1345	Bioswale 1	Sed reduction = 81.94 lb/yr; N reduction = 1.83 lb/yr; P reduction = 0.23lb/yr	-	TTF	-
Breyer Master 4	40.08622, -75.1346	Bioswale 2	Sed reduction = 303.33 lb/yr; N reduction = 6.79 lb/yr; P reduction = 0.85 lb/yr	-	TTF	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Breyer Master 5	40.08622, -75.1347	Filtering Practices	Sed reduction = 186.53 lb/yr; N reduction = 2.39 lb/yr; P reduction = 0.42lb/yr	-	TTF	-
Abington School District Property	40.11222, -75.1324	Bio-Retention/Rain Garden	Sed reduction = 1233.69 lb/yr; N reduction = 15.61 lb/yr; P reduction = 2.95 lb/yr	-	TTF	$70,000
Baederwood Park	40.10921, -75.1337	Floodplain Restoration	Sed reduction = 61542.43 lb/yr; N reduction = 52.31 lb/yr; P reduction = 23.02 lb/yr	-	TTF	$80,000
Bishop McDevitt	-	Bio-Retention Feature	-	-	TTF	-
Glenside Library	-	Rain Garden Demo Project	-	Yes	TTF; Cheltenham Township	$82,000
Glenside Park	-	Rain Garden Demo Project	-	Yes	TTF; Cheltenham Township	$64,000
VFW	-	Bank Stabilization	-	-	TTF	$32,000
Wissahickon						
Hillbrook Condo	-	Bio-Retention Feature	Sed reduction = 698.08 lb/yr; N reduction = 8.58 lb/yr; P reduction = 1.72 lb/yr	-	WVWA	-
Knapp Road School	40.238211, -75.264081	Bio-Retention Feature	Sed reduction = 827.75 lb/yr; N reduction = 9.53 lb/yr; P reduction = 1.96 lb/yr	-	WVWA	$80,000
Laurel Lane	40.2301, -75.271247	Floodplain Mitigation	Sed reduction = 590.87 lb/yr; N reduction = 2.12 lb/yr; P reduction = 0.77 lb/yr	-	WVWA	$12,000
Houston Run	40.169533, -75.222708	Bio-Retention Feature	Sed reduction = 2548.83 lb/yr; N reduction = 17.57 lb/yr; P reduction = 2.36 lb/yr	-	WVWA	-
Wissahickon HS	40.171875, -75.227776	Rain Garden	Sed reduction = 5465.67 lb/yr; N reduction = 86.90 lb/yr; P reduction = 13.42 lb/yr	-	WVWA	-

Project Name	Location	Project Type	Project Pollutant Reduction	PRP/TMDL Plan Inclusion	Potential Partner or Match Contributor	Cost Estimates
Wissahickon MS	40.168111, -75.226414	Rain Garden	Sed reduction = 1080.35 lb/yr; N reduction = 10.97 lb/yr; P reduction = 2.57 lb/yr	-	WVWA	-
Dam Across Creek	40.165094, -75.22875	Floodplain Storage	Sed reduction = 19345.92 lb/yr; N reduction = 21.43 lb/yr; P reduction = 9.02 lb/yr	-	WVWA	-
Fellowship Park	-	Stream Restoration	-	-	WVWA	-
Montessori School	40.1586397, -75.1615242	Bio-Retention Feature	Sed reduction = 114.16 lb/yr; N reduction = 0.51 lb/yr; P reduction = 0.31 lb/yr	-	WVWA	$75,000
9th Street Park	40.215219, -75.269753	Bio-Retention Feature	Sed reduction = 95.31 lb/yr; N reduction = 0.60 lb/yr; P reduction = 0.23 lb/yr	-	WVWA	$68,000
Tuckerstown	-	Bas	-	-	WVWA	$55,000
Jarrettown ES 1	-	Bio-Retention Feature	-	-	WVWA	-
Jarrettown ES 2	-	Basin Retrofit	-	-	WVWA	$105,000
Bantry Drive 1	-	Basin Retrofit	-	-	WVWA	$97,000
Bantry Drive 2	-	Basin Retrofit	-	-	WVWA	$24,000
Dublin Hunt	-	Basin Retrofit	-	-	WVWA	$110,000
Heller Way & Leah Dr	-	Basin Retrofit	-	-	WVWA	$80,000
Rapp Run	-	Basin Retrofit	-	-	WVWA	$38,000
Maple Manor Swim Club	-	Infiltration Trenches	-	-	WVWA	$56,580

3. DATA ORGANIZATION STRATEGY

Table 43: Data/Metrics Collection, Storage & Dissemination

Data/Metrics Category	Type of Data	Data Collector	Compile and Store Data	Where Data Reported
Tables 5 and 6 Capital projects (number and type of projects and associated performance metrics)	Green acres, feet of stream restoration, % of projects by cost, cumulative # of projects	Watershed groups	PEC	WPF annual reports
Table 7 Outcome metrics Table 8 Monitoring Plan These also tie into Table 11 Comp strategies 5 and 6 data/metrics noted below	Bank pins, EnviroDIY loggers, web cams and photos, water quality sampling, STEPL and SWMM modeling, university loggers, stormwater sampling, macroinvertebrate sampling, fish surveys, annual habitat surveys	Bank pins, EnviroDIY, web cams and photos. (Watershed Groups and StreamKeepers with University/ANS help) Water quality sampling at focus areas and baseline (Watershed Groups with University/ANS help) STEPL and SWMM (Temple and Villanova) University loggers (Universities) Stormwater sampling at projects (Villanova) Macroinvertebrate sampling (Watershed Groups) Fish surveys and other biota (ANS) Annual habitat surveys (Watershed Groups and StreamKeepers)	Temple WVWA Universities Villanova Villanova WVWA ANS WVWA	Summary reports to Cluster Partners ANS doing sample analyses. Temple summary/project reports to cluster. Summary report (inform WPF via annual report) Summary/project reports to cluster partners Summarize in WPF annual reports Assumes analysis by ANS/Stroud; potential for citizen scientist analysis. ANS ANS
Table 11 - Comp Strategy 1 - Municipalities and agencies Including metric details in focus area profiles	Munics review and improve codes and ordinance, # of munics and others attending trainings, *knowledge gains over baseline*, GSI policy/practices added/modified, munic GSI investments, new strategic	Watershed groups report to PEC annually *Coordinating Committee responsible for measuring baseline knowledge*	PEC	WPF annual reports

Data/Metrics Category	Type of Data	Data Collector	Compile and Store Data	Where Data Reported
	relationships, new EACs/EAC members/EAC collaborations			
Table 11 - Comp Strategy 2 - Large landowners Including metric details in focus area profiles	# of facility managers attending trainings, *knowledge gains*, facilities allowing partner access for projects, facilities with new GSI practices and investments, Coordination with fed/state/local agencies (project/$ leverage)	Watershed groups report to PEC annually PEC	PEC PEC	WPF annual reports
Table 11 - Comp Strategy 3 – residents Including metric details in focus area profiles	# of residents participating in workshops/site assessments, knowledge gains, GSI installed	Watershed groups report to PEC annually	PEC	WPF annual reports
Table 11 - Comp Strategy 4 – citizen stewardships Including metric details in focus area profiles	# of citizens attending trainings, citizens engaging elected officials, New StreamKeepers, # of StreamKeepers hours, StreamKeepers joining watershed groups and munic boards/commissions, new Master Watershed Stewards, O/M teams formed and deployed.	Watershed groups report to PEC annually	PEC	WPF annual reports
Table 11 - Comp Strategy 5 – Science Including metric details in focus area profiles	# of students trained, # of student educational programs # of projects/stream reaches monitored, including DIY loggers # of SWMM models built/calibrate # of research/data analysis programs	Universities Universities/Watershed groups Universities Universities Universities and cluster partners Universities	Universities WVWA & Temple Universities Universities Universities and cluster partners Universities	WPF annual reports ANS doing water quality sample analyses. Temple summary/project reports to cluster. Summary report (inform WPF via annual report) Inform WPF via annual reports Inform WPF via annual reports Inform WPF via annual reports

Data/Metrics Category	Type of Data	Data Collector	Compile and Store Data	Where Data Reported
	# of presentations at meetings/conferences # of scientific papers/reports/presentations			
Table 11- Comp Strategy 6 – Capital projects Including metric details in focus area profiles	# of project meetings, project submissions, projects funded, projects completed # site descriptions/STEPL runs # of landowners participating # of acres analyzed # of sites high tier instrumented, storm events monitored, findings made (see Table 12 for High Tier monitoring projects) Pour point monitoring	Temple working with watershed groups Temple working with watershed groups Villanova Temple supporting Watershed groups	Temple with Susan Harris Temple with Susan Harris Villanova WVWA	Summarize in WPF annual reports Summarize in WPF annual reports Summarize in WPF annual reports ANS doing water quality sample analyses. Temple summary/project reports to cluster.

4. PHASE 2 BUDGET

Full budget information will be uploaded to the Coordinating Committee Dropbox in a separate file titled Appendix 4.