MEMORANDUM

To: Lebanon Area Regional Stormwater Consortium Participants

From: Dan Cannistraci

RE: Streambank Restoration Projects

Date: May 2, 2017

Members of the Lebanon Area Regional Stormwater Consortium,

The purpose of this memorandum is to update the Consortium on matters related to potential partnerships with the Quittapahilla Watershed Association (QWA) and related to the Best Management Practices (BMPs) to be included in the Consortium's Pollutant Reduction Plan (PRP).

Attached is a list of streambank restoration and wetland construction projects that has been curtailed from a larger list included in the QWA's Restoration and Management Plan dated December 2006. These projects are all located within the Urbanized Area of one or more of the Consortium participants and are therefore eligible for inclusion in the Consortium's PRP.

Not all of the streambank restoration projects on this list will be needed in order for the Consortium to meet the pollution reduction requirements of this permit term. The primary purpose of this list is to identify areas of overlap between the goals of this Consortium and the goals of the Quittapahilla Watershed Association so that the two groups may jointly move forward in restoring the impaired waters of Lebanon County. It may be prudent to send written correspondence to the QWA in the near future stating the Consortium's support and willingness to contribute to the projects included on this list. The Consortium should also be prepared to take on a leading role in executing these projects, as we are under a 5-year timeline to achieve pollutant reductions whereas the QWA is a volunteer organization and has no such time constraints.

As stated before, streambank restoration projects will be credited highly under DEP's credit scheme for the 2018-2023 permit cycle. It is our recommendation that the Consortium's PRP consist of several of these streambank restoration projects. There is no guarantee that streambank restoration will continue to be credited highly beyond 2023, and for that reason we believe that the group should take advantage of the favorable crediting policy while it is still available. Other BMPs such as basin retrofits, vegetated swales, rain gardens, infiltration trenches, etc. may still be included in the PRP, but we anticipate that the pollutant reductions achieved by these BMPs will be small in comparison to those achieved by streambank restoration.

We are planning to begin discussing the BMPs to be included in the Consortium's PRP at the May 22, 2017 meeting to be held at 10:00 AM at Steven's Towers in Lebanon. If you have any questions before that meeting, please feel free to contact me at (717) 272-7110 x126 or at dcannistraci@steckbeck.net.

SECTION E

SELECT BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

SECTION E. SELECT BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

The Consortium has identified 60 potential projects which are located within the MS4 planning area. These projects are listed in Table E.1: Lebanon County Stormwater Consortium Proposed Projects along with applicable data including an identification number, the participating municipality where the project is located, an estimated cost, the calculated TSS load reduction to be achieved by the project, and a cost per pound of TSS reduced figure. The identification numbers are assigned by watershed, for example, the project identification number SQ1 represents the first project located within the Snitz Creek-Quittapahilla Creek watershed. Combinations of these projects or other projects that materialize within the 5-year permit term will be implemented to meet the required pollutant reductions in each of the applicable HUC-12 watersheds. The projects can generally be divided into three categories: streambank restorations, basin retrofits, and new BMPs. Each is described in more detail below, following the proposed project listing in Table II. Table II is a condensed form of the information presented in Table E.1.

Table II: Proposed Projects

ID#	Projects
SQ1	Streambank restoration on the Quittapahilla Creek mainstem upstream of the 22nd St bridge (1,700 ft)
SQ2	Stormwater wetland basin between the Quittapahilla Creek and Chestnut Street
SQ3	Streambank restoration on the Quittapahilla Creek mainstem upstream of the Chestnut St bridge (850 ft)
SQ4	Streambank restoration on the Quittapahilla Creek mainstem from Chestnut Street to Reigle Auto (1640 ft)
SQ5	Stormwater wetland basin south of the Chestnut Street bridge
SQ6	Streambank restoration on the Quittapahilla Creek mainstem from Mill Street to Dairy Road (4,510 ft)
SQ7	Streambank restoration on the Brandywine Creek mainstem at Stoever's Dam Park/Mt. Lebanon Cemetery (2,460 ft.)
SQ8	Streambank restoration on the Snitz Creek mainstem in and upstream of Creekside and Fieldcrest (3,290 ft.)
SQ9	Streambank restoration on an UNT to the Brandywine Creek between Mechanic Street and Reinhol Street (1,710 ft.)
SQ10	Streambank restoration on the Quittapahilla Creek mainstem from the Annville Township line to Clift Auto sales (860 ft)
SQ11	Streambank restoration on the Quittapahilla Creek mainstem from Clift Auto Sales to the Annville Township line (1,800 ft)
SQ12	Streambank restoration on an UNT to the Quittapahilla Creek between the RR tracks and N. 11th Ave (620 ft)
SQ13	Streambank restoration on the Quittapahilla Creek mainstem between Lincoln Avenue and 4th St (1,500 ft)
SQ14	Streambank restoration on the Snitz Creek mainstem along the Hershey property on the Snitz Creek (1,200 ft)
SQ15	Riparian Buffer Restoration at Northeast Park
SQ16	Basin retrofit at the Quentin Circle shopping plaza
SQ17	Basin retrofit at Hauck Manufacturing
SQ18	Basin retrofit at Sholley Ave/Kappa Ave
SQ19	Basin retrofit east of Tanglewood Court
SQ20	Basin retrofit between Catherine Court and Colebrook Road

SQ21	Basin retrofit at the Oak Hills northern basin
SQ22	Basin retrofit at Horseshoe Circle
SQ23	Basin retrofit in Walnut Mill-northwest basin
SQ24	Basin Retrofit at Stone Hedge Court
SQ25	Basin retrofit in Walnut Mill-southeast basin
SQ26	Basin retrofit at Hickory Blvd
SQ27	Basin retrofit at Bently Court
SQ28	Basin Retrofit at Clover Drive
SQ29	Basin retrofit east of Millbridge Drive
SQ30	Basin retrofit at Comcast
SQ31	Basin retrofit at Todd Court
SQ32	Basin retrofit in Runnymeade East
SQ33	Basin retrofit at Wal-Mart
SQ34	Basin retrofits at the Lebanon Rails Business Park (4 basins)
SQ35	Basin retrofit at ManorCare Health Services
SQ36	Basin retrofits at Eagle Graphics (2 basins)
SQ37	Basin retrofits in Creekside (4 basins)
SQ38	Stormwater wetland basin at the Quittapahilla Creek headwaters
SQ39	Continuing the current weekly street sweeping program for the next 5 years
SQ40	Stormwater wetland basin and riparian buffer south of Lancaster Street
SQ41	Bioretention basins at South Hills Park
SQ42	Stormwater wetland basin at Optimist Park
SQ43	Bioretention Basins at the Cleona Playground and the Borough Hall
SQ44	Basin Retrofit at the North Cornwall Township Building
SQ45	Increased street sweeping program
SQ46	Stormwater wetland basin downstream of Lehman Street
SQ47	Basin retrofit/expansion behind Kmart/Lowe's
SQ48	Landscape Restoration and Tree Planting at 3 City properties
RS1	Shoreline Stabilization at Lion's Lake (1,285 linear feet)
RS2	Basin retrofit at Ebenezer Elementary School
RS3	Basin retrofit at Lake Drive/Water Street
RS4	Basin retrofit at St. Stephen's Church
RS5	Riparian Buffer along an UNT to the Swatara Creek north of East Brookfield Drive
RS6	Rain Garden in open space between Ebenezer and Old Ebenezer Road
LS1	Bioswale along North Lebanon Township property at North 8th Ave/PA Route 343
LS2	Basin retrofit at Oakridge Court
T1	Basin retrofit at Union Canal Elementary school
T2	Basin retrofit east of Cider Lane
T3	Roadside swales along N Mine Road and Birch Road
T4	Storm Sewer Filter Bags in inlets along Mallard Lane and associated maintenance

Table II: Proposed Projects (ctd.)

Streambank restoration projects (SQ1, SQ3, SQ4, SQ6-SQ14, RS1) involve the removal of legacy sediment from floodplains, the stabilization of eroded stream channels using live stakes, boulders, and other native materials, the establishment of riparian plantings along the stream, or a combination of these practices. While all of the proposed streambank restoration projects involve at least one of these main practices, a variety of additional practices can be used to further streambank stabilization. These include installing livestock crossings to limit the access of grazing animals (SQ14), removing existing dams or other non-natural structures (SQ13), and installing aquatic habitat-enhancing structures such as log vanes, rock vanes, mud sills, toe benches, and/or J-hooks (SQ1, SQ3, SQ4, SQ6, SQ10, SQ11, and SQ14). In all cases, the primary goal of streambank restoration is to reduce the amount of sediment eroding from the banks of natural waterways by removing unstable stream bank walls and replacing them with stable native materials.

The Quittapahilla Watershed Association is a local watershed group which takes an active role in the restoration, protection, and maintenance of the entire Quittapahilla Creek watershed. This group received nearly one million dollars in grant funding to complete a 3,450-ft streambank restoration project located on the mainstem of the Quittapahilla Creek in Annville and South Annville Townships, a short distance downstream of many of the Consortium's proposed streambank restoration projects. This restoration work was completed in 2016 and serves as a flagship project for streambank restoration work in the Quittapahilla Creek watershed. The Consortium hopes to build on the success of this project and partner with the QWA for future restoration projects. All of the streambank restoration projects proposed in this PRP have also been identified in the QWA's 2006 Watershed Assessment, and many are being considered for inclusion in a Watershed Implementation Plan that the group is currently working on. Thus, there exists a significant amount of overlap and synergy between the goals of the Consortium and the QWA.

All proposed streambank restoration projects are highlighted in orange on the MS4 maps and have their project identification number on a blue octagonal symbol nearby. The projects can be easily referenced to Tables E.1 and E.2 for additional information and pollutant reduction calculations associated with each project. Project RS1 is a special case in that it is a shoreline stabilization project on Ebenezer Lake (also known as Lion's Lake). The pollutant reduction calculations for this project assume a linear footage along the centerline of the lake (1,285 feet) instead of the true linear shoreline footage of over 4,000 feet. This represents a conservative estimate.

Pollutant reductions for streambank restorations are relatively easy to compute. A flat credit is given per linear foot of streambank restored. Any area which drains to the streambank restoration project which has not already been included in an MS4 sewershed must be added to the baseline load calculation on Table E.2. These areas are delineated on the MS4 maps in light blue for each streambank restoration project. They are also included in the "Outside an Existing Sewershed" column in Table E.2 and are used to calculate the "Additional Required Reduction" for the proposed BMP. See Table E.2, footnote "b" for additional explanation.

Basin retrofit projects (SQ16-SQ37, SQ47, RS2-4, LS2, T1, T2) are among the most cost-effective projects because they utilize existing grading and existing drainage characteristics. The treatment capacity of existing BMPs is improved through the retrofitting process by way of amending the soils in existing basins, planting water-tolerant vegetation, replacing the outlet structure with a smaller orifice, reconfiguring the outlet structure to allow for infiltration, expanding the basin to allow for additional water quality volume storage, or a combination of the above practices. The basins targeted for retrofits are all existing dry detention basins. Infiltration tests will be conducted at these basins to determine their suitability for conversion to infiltration facilities. If the infiltration tests reveal conditions not suited to infiltration, the basin could be converted to a dry extended detention basin or a constructed wetland. Because the infiltration capacity of the receiving soils cannot be known at this time, this PRP assumes that the basins will all be converted to dry extended detention basins or constructed wetlands (both of

which have a TSS reduction capacity of 60%). This is a conservative measure. If any basins can be converted to infiltration facilities, the pollutant reductions will be higher than those listed in this PRP.

A procedure was developed to estimate the amount of pollutant reductions to be expected from each basin retrofit. This method was introduced briefly in the explanation for the streambank restoration projects but will be fully explained here.

The load reductions associated with each project are listed in Table E.1 and are supported by the calculations in Table E.2 for total BMP. Drainage areas to each basin retrofit project consist of areas that are within existing MS4 sewersheds and areas that are outside of existing MS4 sewersheds (typically the area that drains directly to the basin without draining through the publicly-owned storm sewer system). Such areas that drain to proposed BMPs but are outside of existing MS4 sewersheds are delineated in light blue on the MS4 maps and are labeled "proposed sewersheds." Baseline loads from these areas were not included in the baseline load calculations in Section D and therefore need to be considered in the calculation of the reductions achieved by proposed BMPs. Ten percent of the baseline loading from these areas needs to be added to the required TSS reduction, or alternately, removed from the proposed TSS reduction achieved by the BMP. The latter is accomplished by tabulating 10% of the added baseline load in the "Additional Required Reduction" column of Table E.2 and subtracting it from the Proposed Raw TSS Reduction figure for each BMP that has an applicable sewershed.

The BMPs proposed for retrofits are currently producing TSS reductions, albeit at a much lower percentage. These existing reductions were claimed in the calculation of the pollution reduction requirements in Section D and need to be accounted for in the consideration of proposed pollutant reductions so that they are not counted twice. To accomplish this, ten percent of the existing claimed reductions are subtracted from the proposed reductions in the "10% of Existing Reduction" column of Table E.2. The net TSS reduction is the raw TSS reduction achieved by the retrofitted BMP less the additional required reduction as a result of treating areas which were originally outside the MS4 area and less the existing reduction that the BMP was producing before the retrofit. This net TSS reduction is the reduction that is claimed by the proposed BMP project.

New BMP projects (SQ2, SQ5, SQ15, SQ38-SQ46, SQ48, RS5, RS6, LS1, T3, T4) are those that involve the construction or operation of a new structural or non-structural BMP. These BMPs are largely self-explanatory from the project title. Proposed in this PRP are stormwater wetland basins, riparian buffers, street sweeping, bioretention basins, tree planting, rain gardens, vegetated swales, and inlet filter bags. Load reduction calculations are completed in much the same way as those for basin retrofits, but new BMPs have differing pollutant removal efficiencies and do not have the existing load reduction considerations of basin retrofits.

All proposed projects are marked on the MS4 maps with their project identification number on a blue octagonal symbol. The projects can be easily referenced to Tables E.1 and E.2 for additional information and pollutant reduction calculations associated with each project using this identification number.

The total proposed TSS reductions for each watershed appear in Table III below.

Table III: Reduction Requirements and Proposed Reduction Totals

Watershed	TSS Reduction Requirement (lb/yr)	Total TSS reduction of proposed projects (lb/yr)
Snitz Creek-Quittapahilla Creek	4,999,685	1,318,330
Reeds Run-Swatara Creek	21,201	90,654
Lower Little Swatara Creek	3,539	6,894
Headwaters Tulpehocken Creek	5,485	18,849

As can be seen in Table III, the proposed TSS reductions far exceed the required TSS reductions for each watershed. Nearly all of the proposed projects are on private property and will require the cooperation of private landowners. The Consortium recognizes that difficulties in obtaining landowner permission to execute projects will likely occur, and for this reason the group wishes to have an excess of projects in planning stages so that backup options are available. The Consortium will complete a sufficient number of projects to meet the TSS reduction requirements shown in the "TSS Reduction Requirement" column of Table III.

Table E.1: Lebanon County Stormwater Consortium Proposed Projects Revised 8/1/2017

ID#	Projects: Snitz Creek-Quittapahilla Creek Watershed	Participant	Map Grid	Cost[1]	TSS Reduction	Cost/lb reduced
SQ1	Streambank restoration on the Quittapahilla Creek mainstem upstream of the 22nd St bridge (1,700 ft)	NCT	A5	$510,000.00	72,846	7.00
SQ2	Stormwater wetland basin between the Quittapahilla Creek and Chestnut Street	NCT	A5	$285,000.00	23,489	12.13
SQ3	Streambank restoration on the Quittapahilla Creek mainstem upstream of the Chestnut St bridge (850 ft)	NCT	A4	$255,000.00	35,041	7.28
SQ4	Streambank restoration on the Quittapahilla Creek mainstem from Chestnut Street to Reigle Auto (1640 ft)	NCT	A4	$492,000.00	65,077	7.56
SQ5	Stormwater wetland basin south of the Chestnut Street bridge	NCT	A4	$100,000.00	6,953	14.38
SQ6	Streambank restoration on the Quittapahilla Creek mainstem from Mill Street to Dairy Road (4,510 ft)	Cleona/NCT	B3/B3	$1,353,000.00	197,350	6.86
SQ7	Streambank restoration on the Brandywine Creek mainstem at Stoever's Dam Park/Mt. Lebanon Cemetery (2,460 ft.)	City	B4	$738,000.00	107,274	6.88
SQ8	Streambank restoration on the Snitz Creek mainstem in and upstream of Creekside and Fieldcrest (3,290 ft.)	NCT	D6	$987,000.00	141,737	6.96
SQ9	Streambank restoration on an UNT to the Brandywine Creek between Mechanic Street and Reinhol Street (1,710 ft.)	NLT/City	E7/B2	$513,000.00	73,657	6.96
SQ10	Streambank restoration on the Quittapahilla Creek mainstem from the Annville Township line to Clift Auto sales (860 ft)	Annville	-	$258,000.00	37,504	6.88
SQ11	Streambank restoration on the Quittapahilla Creek mainstem from Clift Auto Sales to the Annville Township line (1,800 ft)	Annville	-	$540,000.00	78,335	6.89
SQ12	Streambank restoration on an UNT to the Quittapahilla Creek between the RR tracks and N. 11th Ave (620 ft)	NLT	G10	$186,000.00	27,419	6.78
SQ13	Streambank restoration on the Quittapahilla Creek mainstem between Lincoln Avenue and 4th St (1,500 ft)	City	D4	$588,000.00	65,649	8.96
SQ14	Streambank restoration on the Snitz Creek mainstem along the Hershey property on the Snitz Creek (1,200 ft)	NCT	B4	$360,000.00	50,552	7.12
SQ15	Riparian Buffer Restoration at Northeast Park	City	B5	$26,200.00	2,917	8.98
SQ16	Basin retrofit at the Quentin Circle shopping plaza	NCT	E8	$22,500.00	15,010	1.50
SQ17	Basin retrofit at Hauck Manufacturing	Cleona	B1	$15,000.00	10,316	1.45
SQ18	Basin retrofit at Sholley Ave/Kappa Ave	NLT	D7	$20,000.00	12,799	1.56
SQ19	Basin retrofit east of Tanglewood Court	NCT	E2	$25,000.00	15,779	1.58
SQ20	Basin retrofit between Catherine Court and Colebrook Road	NCT	D7	$15,000.00	8,645	1.74
SQ21	Basin retrofit at the Oak Hills northern basin	NCT	B5	$15,000.00	8,526	1.76
SQ22	Basin retrofit at Horseshoe Circle	SLT	C4	$40,000.00	19,933	2.01
SQ23	Basin retrofit in Walnut Mill-northwest basin	Cleona	B2	$15,000.00	6,535	2.30
SQ24	Basin Retrofit at Stone Hedge Court	SLT	F3	$12,500.00	5,518	2.27
SQ25	Basin retrofit in Walnut Mill-southeast basin	Cleona	C2	$12,000.00	5,292	2.27
SQ26	Basin retrofit at Hickory Blvd	SLT	E4	$40,000.00	17,225	2.32
SQ27	Basin retrofit at Bently Court	NCT	D5	$17,500.00	7,127	2.46
SQ28	Basin Retrofit at Clover Drive	SLT	G5	$20,000.00	6,666	3.00
SQ29	Basin retrofit east of Millbridge Drive	NCT	C1	$20,000.00	6,510	3.07
SQ30	Basin retrofit at Comcast	NLT	F11	$15,000.00	4,385	3.42
SQ31	Basin retrofit at Todd Court	Annville	-	$17,500.00	4,950	3.54
SQ32	Basin retrofit in Runnymeade East	NCT	D4	$16,000.00	4,313	3.71
SQ33	Basin retrofit at Wal-Mart	NLT	G10	$75,000.00	13,904	5.39
SQ34	Basin retrofits at the Lebanon Rails Business Park (4 basins)	NLT	G3, G4, H3	$50,000.00	7,376	6.78

SQ35	Basin retrofit at ManorCare Health Services	NCT	E9	$35,000.00	5,464	6.41
SQ36	Basin retrofits at Eagle Graphics (2 basins)	Annville	-	$45,000.00	5,417	8.31
SQ37	Basin retrofits in Creekside (4 basins)	NCT	D6, E6	$100,000.00	21,159	4.73
SQ38	Stormwater wetland basin at the Quittapahilla Creek headwaters	SLT	C3	$360,000.00	21,566	16.69
SQ39	Continuing the current weekly street sweeping program for the next 5 years[3]	City	All	$375,000.00	21,325	17.59
SQ40	Stormwater wetland basin and riparian buffer south of Lancaster Street	Annville	-	$100,000.00	7,437	13.45
SQ41	Bioretention basins at South Hills Park	SLT	F2	$75,000.00	5,258	14.26
SQ42	Stormwater wetland basin at Optimist Park	City	F11	$80,000.00	5,020	15.94
SQ43	Bioretention Basins at the Cleona Playground and the Borough Hall	Cleona	B2, B3	$45,000.00	3,620	12.43
SQ44	Basin Retrofit at the North Cornwall Township Building	NCT	B6	$20,000.00	1,318	15.17
SQ45	Increased street sweeping program[3]	City	All	$300,000.00	17,603	17.04
SQ46	Stormwater wetland basin downstream of Lehman Street	City	D1	$175,000.00	11,787	14.85
SQ47	Basin retrofit/expansion behind Kmart/Lowe's	NCT	F8	$300,000.00	24,201	12.40
SQ48	Landscape Restoration and Tree Planting at 3 City properties	City	C2, D2, E5	$61,500.00	545	112.84
				WATERSHED TOTAL:	**1,318,330 lb/yr**	

ID#	Projects: Reeds Run-Swatara Creek Watershed	Municipality	Map Grid	Cost[1]	TSS Reduction	Cost/lb reduced
RS1	Shoreline Stabilization at Lion's Lake (1,285 linear feet)	NLT	E4	$150,000.00	55,812	2.60
RS2	Basin retrofit at Ebenezer Elementary School	NLT	C6	$40,000.00	20,810	2.10
RS3	Basin retrofit at Lake Drive/Water Street	NLT	E4	$12,000.00	3,874	3.29
RS4	Basin retrofit at St. Stephen's Church	NLT	B6	$10,000.00	2,558	4.04
RS5	Riparian Buffer along an UNT to the Swatara Creek north of East Brookfield Drive	NLT	C4	$40,000.00	6,311	6.34
RS6	Rain Garden in open space between Ebenezer and Old Ebenezer Road	NLT	F4	$20,000.00	1,289	13.88
				WATERSHED TOTAL:	90,654 lb/yr	

ID#	Projects: Lower Little Swatara Creek Watershed	Municipality	Map Grid	Cost[1]	TSS Reduction	Cost/lb reduced
LS1	Bioswale along North Lebanon Township property at North 8th Ave/PA Route 343[4]	NLT	C8	$15,000.00	4,129	7.58
LS2	Basin retrofit at Oakridge Court	NLT	C8	$12,500.00	2,765	4.74
				WATERSHED TOTAL:	6,894 lb/yr	

ID#	Projects: Headwaters Tulpehocken Creek Watershed	Municipality	Map Grid	Cost[1]	TSS Reduction	Cost/lb reduced
T1	Basin retrofit at Union Canal Elementary school	NLT	D12	$50,000.00	8,082	6.19
T2	Basin retrofit east of Cider Lane	NLT	C11	$16,000.00	3,718	4.52
T3	Roadside swales along N Mine Road and Birch Road	SLT	D7	$25,000.00	2,223	11.25
T4	Storm Sewer Filter Bags in inlets along Mallard Lane and associated maintenance[5]	NLT	E11	$40,000.00	4,826	8.29
				WATERSHED TOTAL:	18,849 lb/yr	

[1]Cost estimates were derived from data in the PA Stormwater BMP Manual, Quittapahilla Watershed Association 2006 Watershed Assessment, and SESI data on construction costs for past projects.

[2]Reduction values derived from DEP's "BMP Effectiveness Values Table"

[3]Street swaeping must be conducted 25 times/year.

[4]Assumes no retrofit at Oakridge Court

[6]Estimate only, actual reductions will be determined by the weighing of material collected per DEP guidelines

Table E.2: Proposed Project Load Reduction Calculations

Impervious cover loading rate: 1948.53 lb/yr
Pervious cover loading rate: 269.81 lb/yr

ID#	Projects:	Within An Existing Sewershed(s)		Outside An Existing Sewershed		Proposed Percent TSS Reduction[a]	Proposed Raw TSS Reduction (lb/yr)	Addtl. Required Reduction (lb/yr)[b]	10% of Existing Reduction (lb/yr)[c]	Net TSS Reduction (lb/yr)[d]
		Drainage Area (ac)	Percent Impervious	Drainage Area (ac)	Percent Impervious					
SQ1	Streambank restoration on the Quittapahilla Creek mainstem upstream of the 22nd St bridge (1,700 ft)	0.0	0.0	28.9	55.0	N/A	76,296	3,450	0	72,846
SQ2	Stormwater wetland basin between the Quittapahilla Creek and Chestnut Street	51.5	29.0	0.3	38.0	60.0	23,513	24	0	23,489
SQ3	Streambank restoration on the Quittapahilla Creek mainstem upstream of the Chestnut St bridge (850 ft)	0.0	0.0	18.3	85.0	N/A	38,148	3,107	0	35,041
SQ4	Streambank restoration on the Quittapahilla Creek mainstem from Chestnut Street to Reigle Auto (1640 ft)	0.0	0.0	76.9	50.0	N/A	73,603	8,526	0	65,077
SQ5	Stormwater wetland basin south of the Chestnut Street bridge	0.0	0.0	26.7	15.0	60.0	8,344	1,391	0	6,953
SQ6	Streambank restoration on the Quittapahilla Creek mainstem from Mill Street to Dairy Road (4,510 ft)	0.0	0.0	143.0	5.0	N/A	202,409	5,059	0	197,350
SQ7	Streambank restoration on the Brandywine Creek mainstem at Stoever's Dam Park/Mt. Lebanon Cemetery (2,460 ft.)	0.0	0.0	71.5	10.0	N/A	110,405	3,131	0	107,274
SQ8	Streambank restoration on the Snitz Creek mainstem in and upstream of Creekside and Fieldcrest (3,290 ft.)	0.0	0.0	92.6	22.0	N/A	147,655	5,918	0	141,737
SQ9	Streambank restoration on an UNT to the Brandywine Creek between Mechanic Street and Reinhol Street (1,710 ft.)	0.0	0.0	26.3	54.0	N/A	76,745	3,088	0	73,657
SQ10	Streambank restoration on the Quittapahilla Creek mainstem from the Annville Township line to Clift Auto sales (860 ft)	0.0	0.0	13.0	34.0	N/A	38,597	1,093	0	37,504
SQ11	Streambank restoration on the Quittapahilla Creek mainstem from Clift Auto Sales to the Annville Township line (1,800 ft)	0.0	0.0	29.1	34.0	N/A	80,784	2,449	0	78,335
SQ12	Streambank restoration on an UNT to the Quittapahilla Creek between the RR tracks and N. 11th Ave (620 ft)	0.0	0.0	5.9	25.0	N/A	27,826	406	0	27,419
SQ13	Streambank restoration on the Quittapahilla Creek mainstem between Lincoln Avenue and 4th St (1,500 ft)	0.0	0.0	14.2	54.0	N/A	67,320	1,672	0	65,648
SQ14	Streambank restoration on the Snitz Creek mainstem along the Hershey property on the Snitz Creek (1,200 ft)	0.0	0.0	56.4	22.0	N/A	53,856	3,607	0	50,249
SQ15	Riparian Buffer Restoration at Northeast Park	0.0	0.0	11.8	20.8	50.0	3,646	729	0	2,917
SQ16	Basin retrofit at the Quentin Circle shopping plaza	53.2	29.0	5.7	72.6	33.0	16,079	847	222	15,010
SQ17	Basin retrofit at Hauck Manufacturing	15.3	52.0	0.0	0.0	60.0	10,490	0	174	10,316
SQ18	Basin retrofit at Sholley Ave/Kappa Ave	28.1	22.9	6.1	22.0	60.0	13,354	388	167	12,799
SQ19	Basin retrofit east of Tanglewood Court	42.4	12.6	11.6	22.2	60.0	16,729	746	204	15,779
SQ20	Basin retrofit between Catherine Court and Colebrook Road	21.3	24.0	1.0	5.9	60.0	8,827	38	144	8,645
SQ21	Basin retrofit at the Oak Hills northern basin	18.1	51.4	1.7	20.0	40.8	8,769	104	139	8,526
SQ22	Basin retrofit at Horseshoe Circle	44.9	27.6	2.2	12.0	60.0	20,366	103	329	19,933
SQ23	Basin retrofit in Walnut Mill-northwest basin	14.3	29.0	0.9	4.5	60.0	6,674	30	109	6,535
SQ24	Basin Retrofit at Stone Hedge Court	10.8	27.0	1.6	50.0	60.0	5,777	180	79	5,518
SQ25	Basin retrofit in Walnut Mill-southeast basin	9.8	30.0	2.1	30.0	60.0	5,532	165	75	5,292

SQ26	Basin retrofit at Hickory Blvd	36.1	30.6	2.9	5.6	60.0	17,612	105	283	17,225
SQ27	Basin retrofit at Bently Court	18.6	21.5	1.3	3.0	60.0	7,277	41	109	7,127
SQ28	Basin Retrofit at Clover Drive	13.8	32.0	0.9	0.0	60.0	6,800	23	111	6,666
SQ29	Basin retrofit east of Millbridge Drive	14.3	26.0	2.7	8.7	60.0	6,721	110	101	6,510
SQ30	Basin retrofit at Comcast	7.0	47.0	0.0	0.0	60.0	4,460	0	75	4,385
SQ31	Basin retrofit at Todd Court	12.9	37.9	0.0	0.0	43.2	5,034	0	84	4,950
SQ32	Basin retrofit in Runnymeade East	10.0	24.6	1.5	6.7	60.0	4,438	57	68	4,313
SQ33	Basin retrofit at Wal-Mart	0.0	0.0	40.9	51.0	40.2	18,508	4,604	0	13,904
SQ34	Basin retrofits at the Lebanon Rails Business Park (4 basins)	14.5	18.0	14.2	8.0	60.0	8,411	572	463	7,376
SQ35	Basin retrofit at ManorCare Health Services	9.0	45.0	0.0	0.0	60.0	5,555	0	91	5,464
SQ36	Basin retrofits at Eagle Graphics (2 basins)	9.2	43.0	0.0	0.0	60.0	5,474	0	57	5,417
SQ37A	Basin retrofits at Little Pond Lane	7.1	31.1	0.0	0.0	60.0	3,364	0	144	3,220
SQ37B	Basin retrofit at Waterside Circle	4.0	27.4	10.3	21.9	60.0	5,697	655	102	4,940
SQ37C	Basin retrofit at Cross Creek Court	24.9	14.3	4.6	7.3	60.0	8,692	179	207	8,306
SQ37D	Basin retrofit at Hearthside Lane	13.5	19.0	0.0	0.0	60.0	4,773	0	80	4,693
SQ38	Stormwater wetland basin at the Quittapahilla Creek headwaters	0.0	0.0	61.1	26.0	60.0	25,879	4,313	0	21,566
SQ39	Continuing the current weekly street sweeping program for the next 5 years[3]	121.6	100.0	0.0	0.0	9.0	21,325	0	0	21,325
SQ40	Stormwater wetland basin and riparian buffer south of Lancaster Street	7.9	51.3	1.5	0.0	80.0	7,478	41	0	7,437
SQ41	Bioretention basins at South Hills Park	8.1	27.0	0.0	0.0	90.0	5,258	0	0	5,258
SQ42	Stormwater wetland basin at Optimist Park	21.6	7.0	0.0	0.0	60.0	5,020	0	0	5,020
SQ43	Bioretention Basins at the Cleona Playground and the Borough Hall	3.2	60.0	0.0	0.0	90.0	3,620	0	0	3,620
SQ44	Basin Retrofit at the North Cornwall Township Building	1.1	67.0	0.0	0.0	90.0	1,318	0	0	1,318
SQ45	Increased street sweeping program[3]	100.4	100.0	0.0	0.0	9.0	17,603	0	0	17,603
SQ46	Stormwater wetland basin downstream of Lehman Street	0.0	0.0	26.5	36.9	60.0	14,145	2,357	0	11,787
SQ47	Basin retrofit/expansion behind Kmart/Lowe's	0.0	0.0	32.4	73.0	60.0	29,041	4,840	0	24,201
SQ48A	Landscape Restoration at 12th and Cumberland Streets	0.1	0.0	0.0	0.0	85.0	16	0	0	16
SQ48A	Tree Planting at 12th and Cumberland Streets	0.3	0.0	0.0	0.0	20.0	14	0	0	14
SQ48B	Landscape Restoration at the Greenwaste Recycling Facility Property	0.0	0.0	1.6	0.0	85.0	367	43	0	324
SQ48B	Tree Planting at the Greenwaste Recycling Facility Property	0.0	0.0	1.1	0.0	20.0	60	30	0	30

SQ48C	Landscape Restoration at Jadell Drive	0.0	0.0	0.8	0.0	85.0	172	20	0	152
SQ48C	Tree Planting at Jadell Drive	0.0	0.0	0.4	0.0	20.0	19	9	0	9
RS1	Shoreline Stabilization at Lion's Lake (1,285 linear feet)	0.0	0.0	27.0	25.0	N/A	57,671	1,859	0	55,812
RS2	Basin retrofit at Ebenezer Elementary School	39.1	18.0	24.0	27.6	57.0	22,784	1,760	214	20,810
RS3	Basin retrofit at Lake Drive/Water Street	10.8	20.0	0.0	0.0	60.0	3,939	0	65	3,874
RS4	Basin retrofit at St. Stephen's Church	2.7	37.0	3.0	30.0	60.0	2,814	232	24	2,558
RS5	Riparian Buffer along an UNT to the Swatara Creek north of East Brookfield Drive	0.0	0.0	44.6	5.0	50.0	7,889	1,578	0	6,311
RS6	Rain Garden in open space between Ebenezer and Old Ebenezer Road	0.0	0.0	2.2	25.0	95.0	1,441	152	0	1,289
LS1	Bioswale along North Lebanon Township property at North 8th Ave/PA Route 343	7.0	26.1	2.1	15.0	70.0	4,236	107	0	4,129
LS2	Basin retrofit at Oakridge Court	5.0	29.0	2.1	15.0	60.0	2,910	107	38	2,765
T1	Basin retrofit at Union Canal Elementary school	0.0	0.0	18.5	36.0	60.0	9,698	1,616	0	8,082
T2	Basin retrofit east of Cider Lane	8.1	22.0	3.0	10.0	60.0	3,902	131	52	3,718
T3	Roadside swales along N Mine Road and Birch Road	0.0	0.0	15.0	6.0	50.0	2,779	556	0	2,223
T4	Storm Sewer Filter Bags in inlets along Mallard Lane and associated maintenance	7.8	30.0	0.0	0.0	80.0	4,826	0	0	4,826

NOTES:

[a]From DEP's "BMP Effectiveness Values" document

[b]New load reduction requirements are from treating areas outside an existing MS4 sewershed. These areas were not included in the Base Pollutant Loading Calculations and need to be included in the proposed BMP calculation.

[c]Ten percent of the baseline load reduction claimed by original, unconverted basin in the Existing Pollutant Reduction Calculations. This value was claimed to reduce the baseline load, and must be removed from the proposed reduction calculations so it is not counted twice.

[d]Net TSS Reduction = Raw TSS Reduction - Additional Required Reduction - 10% of Existing Claimed Reduction

SECTION F

IDENTIFY FUNDING MECHANISMS

Cost Sharing Schedule for the Lebanon County Stormwater Consortium
Last Revised June 28, 2017

Municipality	Total UA (acres)	Impervious area in UA (acres)	Total Population	Population in UA	Miles of Impaired Streams in UA	Percentage of Cost[1]	Total Capital Cost +10% Working Fund	Individual Cost (rounded to the nearest dollar)	Individual Cost per Year (5-Year Timeframe)
The City of Lebanon	2,668.8	998.4	25,477	25,477	7.29	34.5835955%	$ 5,000,000.00	$ 1,729,180	$ 345,836.00
North Lebanon Twp.	4,793.6	652.8	11,429	9,333	8.52	21.2801174%	$ 5,000,000.00	$ 1,064,006	$ 212,801.20
South Lebanon Twp.	4,870.4	620.8	9,463	8,542	4.22	17.4508086%	$ 5,000,000.00	$ 872,540	$ 174,508.08
North Cornwall Twp.	3,001.6	460.8	7,553	6,788	7.56	16.1660397%	$ 5,000,000.00	$ 808,302	$ 161,660.40
Cleona Borough Authority	554.90	87.30	2,080	2,080	0.383	2.7751380%	$ 5,000,000.00	$ 138,757	$ 27,751.40
Annville Twp.	979.90	248.2	4,767	4,767	1.77	7.7443007%	$ 5,000,000.00	$ 387,215	$ 77,443.00
TOTAL	16,869.2	3,068.3	60,769	56,987	29.74	100.0%		$ 5,000,000.00	$ 1,000,000.00

[1]The cost percentage for each municipality was calculated using the formula contained in York County's Regional Pollutant Reduction Plan, as follows:
Percentage of cost = 0.2 x percent of total miles of impaired streams + 0.3 x percent of total poplulation in UA + 0.5 x percent of total impervious area in UA
The cost formula may be modified as the participating municipalities see fit.

Streambank Restoration Projects Included in the Quittapahilla Watershed Association's Restoration and Management Plan, December 2006
and
Located within the Urbanized Areas of the municipalities participating in the preparation of the Lebanon Area Regional Pollutant Reduction Plan

All table information is displayed as per the QWA's Restoration and Management Plan

Table 4.31 - Beck Creek Stream Restoration Projects						RP
ID #	Location	Length (ft)	Existing Problems	Proposed Solutions	Municipality	Priority*
17	Robert Copenhaver Farm, DS of Reist Rd	1,320	Stream fenced but crossing constructed with poor configuration such that fencing is ineffective; livestock grazing impacts; unstable C4 channel – banks completely trampled; heavy sedimentation and aggradation.	Install two (2) new crossings with modified configuration to eliminate impacts.	NCT	5
18	Ed Copenhaver Farm, UPS of Bricker Rd	990	Stream fenced but livestock watering access and crossing causing erosion and sedimentation problems.	Install two (2) new crossings with modified configuration and materials to eliminate impacts.	NCT	5
	Total	2,310				

Table 4.32 - Brandywine Creek Stream Restoration Projects						RP
ID #	Location	Length (ft)	Existing Problems	Proposed Solutions	Municipality	Priority*
1	Stovers Dam to Mt Lebanon Cemetery	2,970	Unstable F4, B4, E4, B4, and C4 channels with moderate to moderately high eroding banks, active headcuts along upper section, and aggradation along middle and lower sections. Minimal to no buffer.	Restore as stable B4c, B4, E4 and C4 streams; plant a minimum 35 foot riparian buffer.	City	N/A
2	Reinoeldville Tributary East of Miller St	825	Unstable G4 and B4 channels with high eroding banks along upper section, aggradation and bank erosion along middle and lower sections. Minimal to no buffer.	Restore as stable B4 streams; plant a minimum 15 foot riparian buffer along rear of yards and 35 feet along field.	NLT	N/A
3	Reinoeldville Tributary West of Miller St	1,650	Unstable E4 with active head cut migrating upstream through B4 channel sections with moderately eroding banks throughout; minimal to no buffer along rear of yards.	Restore as stableE4 and B4 streams; plant a minimum 15 foot riparian buffer along rear of yards.	NLT	N/A
4	Main Stem Brandywine DS of 7th St	700	Unstable F4 channel with high eroding banks throughout and aggradation in lower section UPS of tunnel gate.	Construct a stormwater wetland basin at location of tunnel gate to provide peak attenuation and water quality management.	City	N/A

5	Sand Hill Tributary DS of Mechanic St	1,650	Unstable C4 and E4 channels with low to moderately high eroding banks throughout, aggradation and bank erosion along middle and lower sections. Breached dam in middle section.	Restore as stableE4 and C4 streams. Construct a stormwater wetland basin at location of old dam to provide peak attenuation and water quality management.	City/NLT	N/A
6	Sand Hill Tributary DS of Reinoehl St	600	Unstable G4 and E4 channels with an active headcut migrating upstream from pipe inlet at Municipal Waste Disposal Site.	Stabilize headcuts and restore as stable E4 and B4 streams	City	N/A
7	Main Stem Brandywine UPS of Maple St	850	Piped section under open space area.	Open piped section and construct a stormwater wetland basin in open space area to provide peak attenuation and water quality management.	City	N/A
8	Main Stem Brandywine DS of Lehman St	700	Stream in grass and gabion flume.	Construct a stormwater wetland basin along flume and adjacent floodplain to provide peak attenuation and water quality management.	City	N/A
	Total	9,945				

Table 4.35 - Snitz Creek Stream Restoration Projects						RP
ID #	Location	Length (ft)	Existing Problems	Proposed Solutions	Municipality	Priority*
17	Main Stem Snitz Royer Farm DS of Rocherty Rd	2,310	Stream fenced and recovering from livestock impacts; heavy sedimentation observed.	Reevaluate recovery process to determine if intervention necessary.	NCT	2
18	Main Stem Snitz Property at rear of Quentin Cicle Shopping Center	1,320	Unstable C4 channel with debris jams, moderate eroding banks, and heavy sedimentation; small dam on stream for diversion to off-line ponds.	Remove dam; restore as stable B2 stream with modified diversion to supply ponds.	NCT	2
19	Main Stem Snitz Spitler Farm UPS of Colebrook Rd	660	Unstable C4 channel with debris jams, moderate eroding banks, and heavy sedimentation;	Restore as stable C4 stream	NCT	2
20	Main Stem Snitz Zimmerman Property DS of Colebrook Rd	1,500	Unstable E4 and C4 channels with debris jams, moderate to moderately high eroding banks, and heavy sedimentation	Restore as stable E4 and C4 streams.	NCT	2
21	Main Stem Snitz Creekside Subdivision UPS and DS of Creekside Drive	3,000	Unstable C4 channels with high W/D ratio, moderate to moderately high eroding banks, heavy sedimentation, and aggradation throughout; no buffers.	Restore as stable C4 stream; plant a minimum 35 foot riparian buffer along both sides of stream through subdivision. Create wetlands in adjacent floodplain.	NCT	2

22	Main Stem Snitz Mill Farm DS of Creekside	600	Stream is fenced but ineffective; livestock grazing impacts; unstable C4 channels with high W/D ratio, moderate to moderately high eroding banks, and heavy sedimentation	Restore as stable C4 stream; install fencing with a modified configuration to limit access to stream. Create wetlands in adjacent floodplain.	NCT	2
23	Main Stem Snitz Property DS of Oak St	1,980	Unstable C4 channels with moderate to moderately high eroding banks, and heavy sedimentation; poorly constructed pond diversions.	Restore as stable C4 stream; modify pond diversions.	NCT	2
24	Main Stem Snitz Horse Farm UPS of Dairy Rd	1,300	Livestock grazing impacts; unstable C4 channels with high W/D ratio, moderate to moderately high eroding banks, and heavy sedimentation	Restore as stable C4 stream; install fencing a minimum of 15 feet to either side of stream and install a livestock crossing.	NCT	2
	Total	12,670				

Table 4.36 - Upper Quittapahilla Creek Stream Restoration Projects						RP
ID #	Location	Length (ft)	Existing Problems	Proposed Solutions	Municipality	Priority*
1	Harold Wise Farm UPS of Birch Rd	1,150	Livestock grazing impacts; unstable C4 channel with banks completely trampled, heavy sedimentation and aggradation throughout. No buffer.	Install fencing a minimum of 15 feet to either side of stream and install two (2) livestock crossings.	SLT	N/A
2	Quest, Inc UPS of Metro Drive	300	Minimal to no buffer.	Plant a minimum 15 riparian buffer along lawn area.	SLT	N/A
3	Lebanon Vocational Technology School Metro Drive to 8th Ave	1,450	Stable E4 channel with recently constructed wetland system on right and left floodplain areas.	Reconstruct wetland areas as a stormwater wetland basin to provide peak attenuation and water quality management.	SLT	N/A
4	Burger King and Yingst Exterminating UPS of Rte 422	300	Unstable F4 channel – moderately high eroding banks and aggradation throughout; No buffer.	Stabilize channel and establish 10 foot filter strip along top of both banks.	SLT	N/A
5	Rte 422 to 5th Avenue	1,150	Unstable C4 and F4 channel sections – moderately high to high eroding banks, heavy sedimentation and aggradation throughout; minimal to no buffer	Restore as stableC4 and B4c streams. Plant a minimum 20 foot riparian buffer.	City	N/A

6	5th Avenue to West Lincoln Avenue	2,100	Unstable G4 and F4 channels with moderately high to high eroding banks, unconsolidated bed material and slag fill along left bank, heavy sedimentation and aggradation throughout, leachate seeping from left bank in several locations; concrete wall along right bank in upper section; minimal to no buffer	Remove unconsolidated material from bed and backfill with cobble/gravel mixture; remove slag fill from left bank to a depth of 15 feet and rebuild bank with clean soil; plant a minimum 20 foot riparian buffer along left bank. Construct a stormwater wetland basin immediately upstream of W. Lincoln Ave. to provide peak attenuation and water quality management.	City	N/A
	Total	6,450				

Table 4.37 - Main Stem Quittapahilla Creek Stream Restoration Projects						RP
ID #	Location	Length (ft)	Existing Problems	Proposed Solutions	Municipality	Priority*
1	UPS of 22nd Street (Reach 1)	1,450	Unstable C4/F4 channel with moderately high to high bank erosion, debris jams, aggradation (lateral and mid-channel bars); failing storm drain outfalls.	Alt 1 – Construct a stormwater wetland basin immediately upstream of 22nd St to provide peak attenuation and water quality management. Alt 2 – Remove debris jams, stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat. Both alternatives require repair of storm drain outfalls.	NCT	1
2	22nd St – Chestnut St (Reach 2)	850	Unstable C4 channel in lower section with moderate bank erosion. Backwater created by undersized bridge opening at Chestnut St causing aggradation (lateral and mid-channel bars).	Raise road and replace bridge with larger bridge span. Stabilize banks and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	NCT	1
3	Chestnut St – Reigle Auto Upholstery (Reach 3)	1,640	Unstable C4 channel with moderate to moderately high bank erosion throughout.	Alt 1 – Construct a stormwater wetland basin to provide peak attenuation and water quality management. Alt 2 – Stabilize banks and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	NCT	1

4	Snitz Creek – Elizabeth St (Reaches 7 and 8)	1,475	Unstable C4 with incising streambed, mod high to high bank erosion in upper and lower sections, heavy sedimentation, aggradation, numerous tires along middle section	Install grade control structures at DS end of upper section and raise streambed, stabilize banks, narrow channel in middle section by constructing toe benches along channel margins, and install structures throughout (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	NCT	1
5	Elizabeth St – Bedrock Step UPS of Garfield St (Reach 9)	1,400	Unstable C4 with moderately high to high bank erosion throughout, heavy sedimentation and aggradation; minimal to no buffer along both banks in middle and lower sections.	Stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat. Plant a minimum 20 foot buffer along the right bank and 35 feet along the left bank.	Cleona/NCT	1
6	Garfield St – Bedrock Ledge (Reach 11)	1,060	Unstable C4 with moderately high to high bank erosion throughout; minimal to no buffer along right bank in upper and middle sections and left bank in lower section.	Stabilize banks and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat. Plant a minimum 25 foot buffer along the right bank and 35 feet along the left bank.	Cleona/NCT	1
7	Bedrock Ledge – UPS of Split channel at Mill St (Reach 12)	800	Localized bank erosion and minimal to no buffer along left bank in upper and middle sections.	Stabilize banks and plant a minimum 35 foot buffer along the left bank.	Cleona/NCT	1
8	UPS of Cleona Blvd – Drop at Footbridge (Reach 14)	1,500	Unstable C4 with high bank erosion throughout; heavy sedimentation, aggradation; and minimal to no buffer along both banks	Stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat. Plant a minimum 20 foot buffer along the right bank and 35 feet along the left bank.	NCT	1

9	Drop at Footbridge – Beck Creek (Reach 15)	2,150	Unstable C4 with moderate bank erosion upper and lower sections, debris jams, heavy sedimentation, aggradation; and minimal to no buffer along the right bank in the upper section both banks in the lower section.	Remove debris jams; stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat. Plant a minimum 35 buffer along both banks.	Annville/NCT	1
10	Beck Creek – Meander at Walnut St (Reaches 16 and 17)	1,950	Unstable C4 with moderate to moderately high bank erosion; debris jams, heavy sedimentation, aggradation (lateral bars) throughout.	Remove debris jams; stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	Annville	1
11	Meander at Walnut St – Meander DS of Willow St (Reach 18)	1,200	Unstable C4 in upper section with high bank and slope erosion; aggradation, cutoff channel, and failing storm drain outfalls. Minimal to no buffer along right bank in middle section.	Stabilize banks and slopes, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat; repair of storm drain outfalls; plant minimum 20 foot buffer along right bank.	Annville	1
12	End of Bedrock-Boulder Meander DS of Spruce St – Old Dam in Quittie Park (Reach 21)	1,600	Localized bank erosion.	COMPLETED - Stabilize banks and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	Annville	N/A
13	Old Dam in Quittie Park – SD Channel along Bachman Rd (Reach 22)	1,150	Unstable C4 with moderate to moderately high bank erosion in lower section; heavy sedimentation, aggradation (lateral and mid-channel bars) throughout.	COMPLETED - Stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	Annville	N/A
14	UPS of Rte 934 – Meander at King St (Reach 23 lower section and 24)	2,100	Unstable C4 moderately high to high bank erosion, heavy sedimentation, aggradation (lateral and mid-channel bars) throughout; minimal to no buffer along right bank.	PARTIALLY COMPLETED - Stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat; plant minimum 20 foot buffer along right bank.	Annville	N/A

15	Meander at King St – Split channel DS of Old Mill Dam (Reaches 25, 26 and upper 27)	3,675	Unstable C4/F4 with high to very high bank erosion, heavy sedimentation, aggradation (lateral and mid-channel bars) throughout; minimal to no buffer along right bank in upper section.	Stabilize banks, narrow channel by constructing toe benches along channel margins, and install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat; Construct single channel DS of old mill dam; plant minimum 35 foot buffer along right bank in upper section.	Annville	1
16	Rte 422 – Concrete Flume DS of WWTP (Reach 28)	2,150	Unstable C4 with low to moderate bank erosion, heavy sedimentation, aggradation (lateral and mid-channel bars) throughout.	Narrow channel by constructing toe benches along channel margins; install structures (e.g., log vanes, rock vanes, or log-boulder J-Hooks) to divert flow away from banks and create habitat.	Annville	3
	Total	21,300	(not including completed sections)			
	Grand total, all streams	52,675	feet			

*Refers to priority groups created by Rocky Powell and recommended to the Quittapahilla Watershed Association at the organization's April 11, 2017 meeting. A total of ten priority groups were created, and select projects were placed into these ten priority groups. These numbers represent only Mr. Powell's recommendations and there is no guarantee that the QWA will adopt the same prioritization in their final updated Watershed Implementation Plan. "N/A" indicates that the project was not placed into a priority group by Mr. Powell and therefore was recommended to the QWA as a low-priority project.