North Branch Neshaminy Creek Phase 2 Implementation Project

Final Report

September 30, 2018

Prepared By:

Bucks County Conservation District
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North Branch Neshaminy Creek Phase 2 Implementation Project

Final Report

PA DEP Document No. 4100066563

Project No. 1413

Prepared For:

Pennsylvania Department of Environmental Protection
Office of Water Resources Planning
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

United States Environmental Protection Agency
Mid-Atlantic, Region 3
1650 Arch Street, #2
Philadelphia, PA 19103

Table of Contents

1. Project Funding and Schedule

The North Branch Neshaminy Creek Phase 2 Implementation Project was funded by the Pennsylvania Department of Environmental Protection (PA DEP) through Section 319, the Nonpoint Source Management Program of the Clean Water Act administered by the United States Environmental Protection Agency (US EPA). The Bucks County Conservation District provided project management and technical assistance via design and construction oversight services for construction of the best management practices (BMPs). The contract between the District and PA DEP was executed on April 11, 2014, and the project was completed on September 30, 2018.

2. Project Location and Justification

The North Branch Neshaminy Creek (NBNC) watershed is a subbasin of the Neshaminy Creek and has a surface area of 15.8 square miles, of which approximately equal portions are divided among Plumstead and New Britain Townships, with significantly smaller portions in Hilltown and Doylestown Townships, Bucks County. Lake Galena is a 365-acre, county-owned impoundment and serves as the focal point of Peace Valley Park. The lake and surrounding parkland are open year-round and provide visitors with a variety of recreational opportunities and the environmental education center Peace Valley Nature Center, which offers a variety of environmental education programming to all ages.

In addition to providing regional flood control and recreational value, drinking water is drawn from the NBNC approximately two miles downstream of the Lake Galena outfall. Surface water is treated at the Forest Park water facility, which is jointly owned by North Penn and North Wales Water Authorities. The facility supplies water to about 55,000 households in Bucks and Montgomery Counties. Despite the importance of Lake Galena and the NBNC for flood control, recreation and drinking water, the lake exhibits signs of degraded water quality including algal blooms and high turbidity.

In 2002, a TMDL assessment was completed for the entire Neshaminy Creek watershed, including the NBNC and Lake Galena subbasin. As noted in this assessment, the Lake Galena watershed experienced a significant increase in residential development over the prior 5-10 years, which has been identified as an important source of sediment to the lake during this period. The lake was identified on Pennsylvania's 303(d) list as being impaired by nutrients and suspended solids from various sources, including on-site wastewater, agriculture, urban runoff/storm sewers, and other.

The objective of this North Branch Neshaminy Creek Phase 2 Implementation Project was to improve water quality by reducing sediment and nutrients entering surface and groundwater within the NBNC and Lake Galena Watershed via the implementation of nutrient management best management practices (BMPs) on two equine operations in the watershed (Figure 1). Both farms were identified in the 2011 Lake Galena & North Branch Neshaminy Creek Watershed Implementation Plan (WIP) as priorities for BMP implementation.

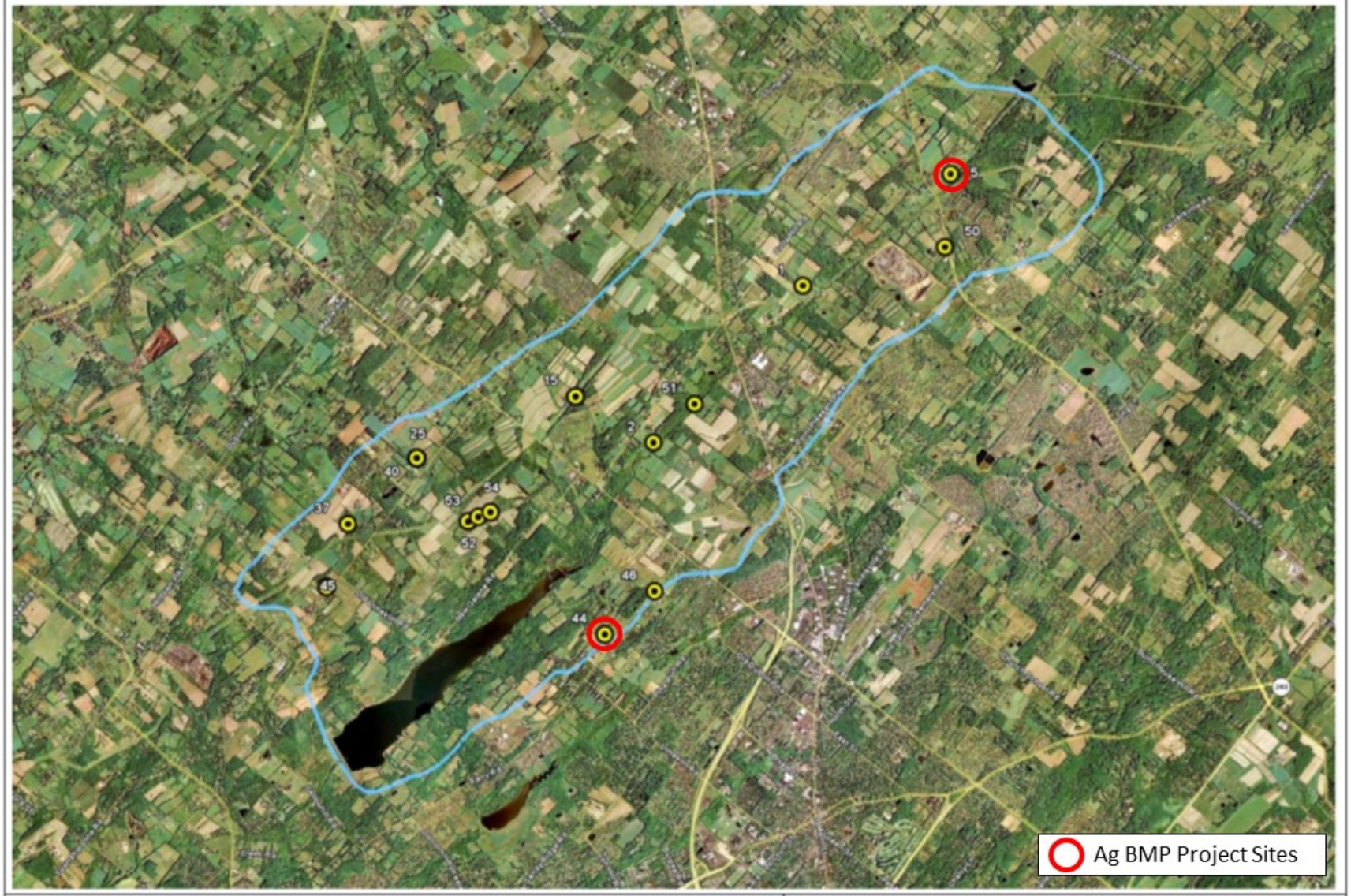


Figure 1. Locations of Implemented Agricultural BMP Projects North Branch Neshaminy Creek Phase 2

Aqua Link, Inc.
Water Resources & Watershed Management
www.aqualinkinc.com
P.O. Box 605
Doylestown, PA 18901
Ph: 215.230.9325

3. Project Overview

The primary objective of this project was to improve water quality by reducing sediment and nutrients entering surface and ground water within the North Branch Neshaminy Creek and Lake Galena watershed via implementation of agricultural best management practices (BMPs). Under this grant, agricultural BMPs were implemented on 2 equine operations in the watershed (Figure 1) that were identified in the Lake Galena & North Branch Neshaminy Creek Watershed Implementation Plan (Aqua Link and Bucks County Conservation District 2011). A final project site, Peace Valley Nature Center, was identified for design of a stormwater management BMP in summer 2018 near the grant expiration deadline.

4. Equine Facility Best Management Practice Implementation

The Bucks County Conservation District implemented agricultural BMPs on two equine operations within the NBNC and Lake Galena watershed. Best Management Practices on the equine operations were designed according to NRCS standards and specifications. The installed BMPs are discussed in the following subsections.

4.1 WIP Participant #44

WIP Participant #44 (Figure 1) is an approximately 48-acre equine facility located in New Britain Township, Bucks County. The site is an equine boarding and riding training facility and contains approximately 150 feet of an unnamed tributary to Lake Galena.

Below is a list of BMPs that were implemented to encourage proper pasture management and to prevent the mixing of surface water and groundwater with manure, thereby minimizing the transport of phosphorus and sediment into Lake Galena. The project site plan is provided in Appendix A and photos are included in Appendix B. The practices were completed between May 2014 and October 2016.

- Installed 32ft x 40ft roofed concrete stack pad with 6ft high walls to encourage proper storage of manure and prevent mixing with surface water and transport of nutrients and pathogens to groundwater
- Installed 1,480 ft of subsurface drainage and reshaped and restabilized existing grassed diversion to maintain grass cover and mitigate erosion in pastures
- Installed 4,721 ft of fencing to promote proper pasture management and exclude animal access to grassed BMPs
- Installed 30ft x 20ft infiltration bed and 30ft long rock level lip spreader at outlet of existing grassed waterway to sheetflow into wooded area along property boundary and mitigate erosion along Ferry Road
- Developed approved Forest Stewardship Plan for 23.2 acres of the property adjacent to Peace Valley County Park. The area is not used for pasture but contains an UNT to Lake Galena
- Planted 0.09 acres along UNT to Lake Galena to expand existing buffer (funded by AquaPA with TreeVitalize Watersheds funding)

- Installed 150 ft of 10' wide stabilized access lanes for equipment and livestock movement to individual paddocks (labor and materials self-funded/provided by landowner)

Sediment and nutrient load reductions resulting from BMP implementation for this project were estimated using EPA's Region 5 Model for Feedlot Pollution Reduction, Agricultural Fields and Filter Strips and Gully Stabilization. Model output is provided in Appendix C. The model predicted a total load reductions of 24.1 tons sediment per year, 109 lbs. phosphorus per year and 909.1 lbs. nitrogen per year due to the BMPs implemented at this site.

4.2 WIP Participant #5

WIP Participant #5 is an 11-acre equine facility located in Plumstead Township, Bucks County that is designated as a Concentrated Animal Operation (CAO) according to the Pennsylvania Nutrient Management Act. The property is in the headwaters of the NBNC watershed and is bisected by two unnamed tributaries to the creek.

The farm's nutrient management plan was initially developed in 2011. The practices outlined in that comprehensive plan were designed to establish animal concentration areas to encourage proper pasture management and divert stormwater around animal concentration areas to minimize transport of phosphorus and sediment into the NBNC. To address the resource concerns on site the following practices were implemented from June 2014 to September 2018. A site map is provided in Appendix A and photos are provided in Appendix B.

- Installed a 40ft x 40ft roofed concrete stack pad with 6ft high walls to prevent manure mixing with surface water and leaching/transport of nutrients and pathogens to groundwater
- Installed system of stormwater inlet, subsurface drainage, waterways and diversions to divert stormwater around animal concentration areas, walkways and roofed stack pad
    - 150ft x 8ft x 0.7ft parabolic grassed waterway (WW#1)
    - 100ft x 12ft x 1ft grassed diversion (Diversion #1)
    - 140ft x 10ft x 0.8ft waterway (WW#2); 100ft of the length is rock-lined
    - 90ft x 12ft x 1.1ft grassed diversion (Diversion #2)
    - 2ft x 2ft stormwater inlet/water control structure
    - 403ft of 15in N-12 HDPE pipe underground outlet
    - 300 ft2 rock outlet at end of pipe to dissipate water velocity entering UNT to North Branch Neshaminy Creek
    - 105ft x 12ft x 1ft grassed diversion (Diversion #3)
    - 15ft x 10ft x 0.7ft rock-lined outlet at the base of grassed diversion #3 to outlet water to UNT to North Branch Neshaminy Creek
- Installed 2,926 ft of fencing for combination of pasture management/defining animal concentration areas and exclude animal access to grassed BMPs
- Reseeded 1.5 acres of pasture

- Updated Act 38 Nutrient Management Plan to capture changes in site BMPs during design revisions
- Planted 0.05 acres along UNT to North Branch Neshaminy Creek (funded by AquaPA with TreeVitalize Watersheds funding)

Sediment and nutrient load reductions resulting from BMP implementation for this project were estimated using EPA's Region 5 Model for Feedlot Pollution Reduction. Model output is provided in Appendix C. The model predicted a total nutrient load reduction of 168 lbs. phosphorus per year and 1,163 lbs. nitrogen per year due to the BMPs implemented at this site.

5. Stormwater Management BMP Design

The Friends of Peace Valley Nature Center, Inc. had been working to fund the design and implementation of an overflow parking area at Peace Valley Nature Center within Peace Valley Park to improve the use of the nature center and its surrounding trail network during field trips and other events. The location determined best suited for this use is a grassed field that is within 150 feet of the Lake Galena shoreline (photo in Appendix D). The proposed permeable paver option provides an alternative to a traditional asphalt parking lot, a particularly desirable option as this location is near Lake Galena.

As per the PADEP Stormwater BMP Manual, we estimate that permeable paving will reduce total suspended solids (TSS) and total phosphorus (TP) loading by up to 85%. In addition, the proposed lot will serve as a demonstration project to educate park stakeholders on a parking surface alternative that can reduce pollutant loading as well as the rate and volume of runoff. The remaining funding in our grant budget contributed toward the development of the designs for the new permeable paved lot. The Region 5 Urban BMP Model was used to estimate the anticipated loading reductions when the design is implemented: 2.17 tons sediment per year, 9 lbs. phosphorus per year, 62 lbs. nitrogen per year. The model output is provided in Appendix C and site plan is included in Appendix D.

Appendix A. Equestrian Facility Site Plans

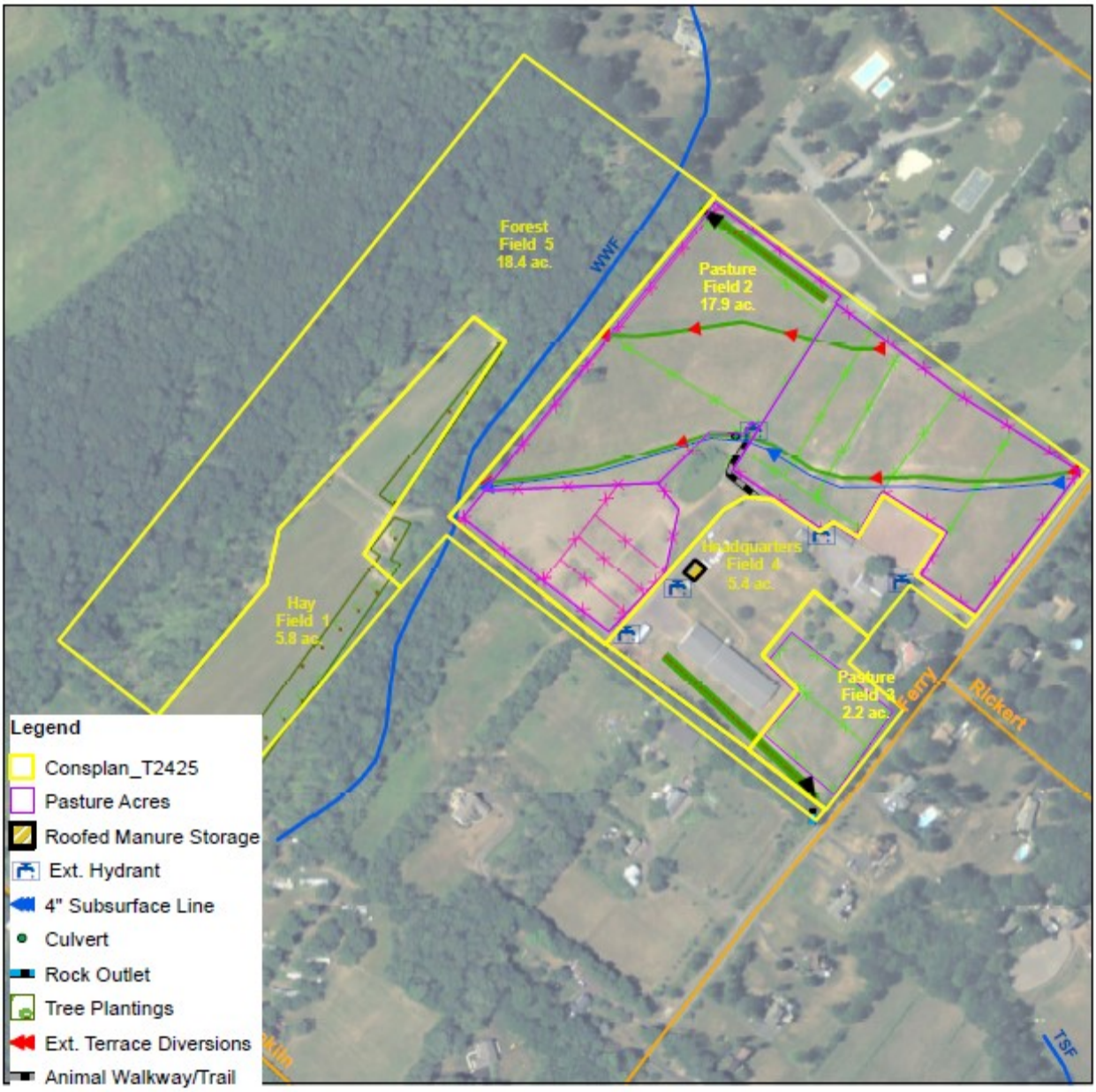
WIP Participant #44

Customer(s): [redacted]

Date: 4/2/2014

Field Office: PERKASIE SERVICE CENTER
Agency: USDA-NRCS
Assisted By: Kent Himelright
State and County: PA, BUCKS

District: BUCKS COUNTY CONSERVATION



Plan View
Participant #5

Field Office: PERKASIE SERVICE CENTER

District: BUCKS COUNTY CONSERVATION DISTRICT

Assisted By: RACHEL ONUSKA

Approximate Acres: 11.3

Legal Description: All boundaries and acreages are approximate

Legend

- Consplan Heavens Gate
- Paddock Grading
- Planned Fence
- Existing Fence
- Drop box
- Roof Runoff Structure
- Roofed Waste Storage Facility
- Underground Outlet
- U.O. Stack Pad Gutters
- Barn
- Stone-center waterway
- Grassed Waterway
- Grassed diversion
- Rock Outlet
- Pasture Planting
- Filter/Buffer Area
- Sacrifice Lot
- Wetlands
- Streams

Prepared with assistance from USDA-Natural Resources Conservation Service

USDA

150 0 150 Feet

N

Appendix B. Equestrian Facility BMP Project Photos

Photo 1. Before installation of subsurface drainage at (WIP Participant #44).

Photo 2. After subsurface drainage installation and diversion repair (WIP Participant #44)

Photo 3. Before roofed stack pad construction (WIP Participant #44).

Photo 4. Roofed stack pad shortly after construction (WIP Participant #44).

Photo 5. Erosion on Ferry Rd embankment before infiltration bed and level lip spreader install (WIP Participant #44).

Photo 6. Infiltration bed and level lip spreader shortly after construction (WIP Participant #44).

Photo 7. Before roofed stack pad construction (WIP Participant #5).

Photo 8. Roofed stack pad shortly after construction (WIP Participant #5).

Photo 9. Grassed diversion #3 and rock outlet stabilization (WIP Participant #5).

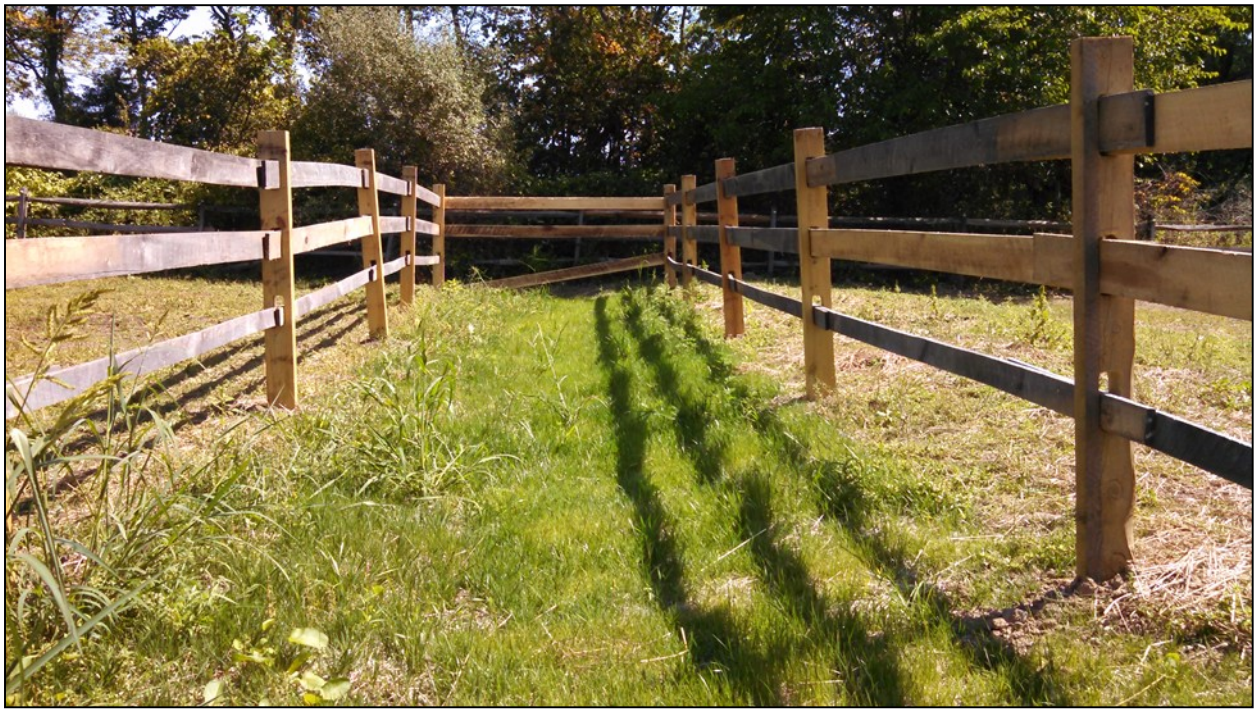


Photo 10. Fully stabilized grassed diversion #3 and exclusion fencing (WIP Participant #5).

Photo 11. Waterway #2 damage due to horse wash water (WIP Participant #5)

Photo 12. Waterway #2 after repair to rock-lined and looking up to Waterway #1 (WIP Participant #5).

Photo 13. Buffer planting approximately 10 months after planting (WIP Participant #5).

Appendix C. Region 5 Model Output

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
An animal lot refers to an open lot or combination of open lots intended for confined feeding, breeding, raising or holding animals. It is specifically designed as a confinement area in which manure accumulates or where the concentration of animals is such that vegetation cannot be maintained. The purpose of these calculations is to represent Biological Oxygen Demand (BOD), phosphorus (P), and nitrogen reductions after an animal waste system is installed. This method has two assumptions: 1) the feedlot is adjacent to a receiving hydrological system without any buffering areas; and 2) installing the animal waste system will prevent any further pollutants from the lot from reaching the hydrologic system. Feedlots that cannot show impact to the hydrologic system being protected should not be evaluated with this computation.

The fundamental methodology of this worksheet is based on "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" (Michigan DEQ, June 1999). However, the Michigan DEQ methodology was modified to calculate annual load through inclusion of climatological data. In addition, biological oxygen demand, phosphorus, and nitrogen constants used in this worksheet were derived from U.S. EPA's STEPL model, developed by Tetra Tech, Inc. in order to enhance consistency between methods.

STEP 1

1.9 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E IN

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
37	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- ( ) Diversion
- ( ) Filter Strip
- ( ) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- (•) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	**2,167**	**NA**	**NA**
Phosphorus load (lbs/yr)	**128**	**77**	**51**
Nitrogen load (lbs/yr)	**1,300**	**845**	**455**

NA indicates no BMP efficiency data available.

Gully Stabilization

These may include:

Grade Stabilization Structure
Grassed Waterway
Critical Area Planting in areas with gullies
Water and Sediment Control Basins

Please select a soil textural class:

( ) Sands, loamy sands	( ) Silty clay loam, silty clay
( ) Sandy loam	( ) Clay loam
( ) Fine sandy loam	( ) Clay
( ) Loams, sandy clay loams, sandy clay	( ) Organic
(•) Silt loam	

Please fill in the gray areas below:

Parameter	Gully	Example	
Top Width (ft)	2	**15**	
Bottom Width (ft)	2	**4**	
Depth (ft)	2	**5**	
Length (ft)	65	**20**	
Number of Years	1	**5**	
Soil Weight (tons/ft3)	0.0425	**0.05**	
Soil P Conc (lb/lb soil)* USER	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)* USER	0.001	**0.001**	*

* If not using the default values, users must provide input (in red) for Total P and Total N soil concentrations

Estimated Load Reductions

	BMP Efficiency*	Gully	Example
Sediment Load Reduction (ton/year)	1.0	11.1	**10**
Phosphorus Load Reduction (lb/year)		11.1	**8**
Nitrogen Load Reduction (lb/yr)		22.1	**16**

10/25/2018

Agricultural Fields and Filter Strips

Please check which BMPs apply:

- [x] Agricultural Field Practices
- [ ] * Filter Strips

Please select a state and a county, and default USLE parameter values will be ente

Users should use the local USLE parameter values if available!

State: Pennsylvania

County: Bucks

Please fill in the gray areas below:

USLE or RUSLE	Before Treatment	After Treatment	Example Before Treatment	Example After Treatment
Rainfall-Runoff Erosivity Factor (R)	173.00	173.00	**120**	**120**
Soil Erodibility Factor (K)	0.35	0.35	**0.35**	**0.35**
Length-Slope Factor (LS)	0.49	0.49	**0.44**	**0.44**
Cover Management Factor (C<=1.0)*	0.04	0.00	**0.7**	**0.5**
Support Practice Factor (P<=1.0)*	1.00	1.00	**0.775**	**0.11**
Predicted Avg Annual Soil Loss (ton/acre/year)	1.27	0.07	**10.03**	**1.02**

* User must use the local C and/or P values (in red) to obtain the reduction due to the field practices.

		Example
Enter contributing area (acres)	17	**14**

Please select a gross soil texture:

- ( ) Clay (clay, clay loam, and silt clay)
- (•) Silt (silt, silty clay loam, loam, and silt loam)
- ( ) Sand (sand, sandy clay, sandy clay loam, sandy loam, and loamy sand)
- ( ) Peat

Estimated Load Reductions for Agricultural Field Practices

	Treated	Example
Sediment Load Reduction (ton/year)	13	**85**
Phosphorus Load Reduction (lb/year)	21	**100**
Nitrogen Load Reduction (lb/yr)	42	**200**

Estimated Additional Load Reductions through Filter Strips

	Filter-Strip Efficiency	Filter-Strip Treated	Example
Sediment Load Reduction (ton/year)	0.65	0	**0**
Phosphorus Load Reduction (lb/year)	0.75	0	**0**
Nitrogen Load Reduction (lb/yr)	0.70	0	**0**

Total Estimated Load Reductions

	Total	Example
Sediment Load Reduction (ton/year)	13	**85**
Phosphorus Load Reduction (lb/year)	21	**100**
Nitrogen Load Reduction (lb/yr)	42	**200**

Pennsylvania State University. 1992. Nonpoint Source Database. In U.S. EPA, Guidance specifying management measures for sources of nonpoint pollution in coastal waters, page 2-15.

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
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STEP 1

2.4 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E IN

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
35	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- ( ) Diversion
- ( ) Filter Strip
- ( ) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- (•) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	2,050	NA	NA
Phosphorus load (lbs/yr)	122	73	49
Nitrogen load (lbs/yr)	1,230	799	430

NA indicates no BMP efficiency data available.

Feedlot Pollution Reduction

Please fill in the gray areas below.

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STEP 1

2.4 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E IN

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
11	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- (•) Diversion
- ( ) Filter Strip
- ( ) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- ( ) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	644	NA	NA
Phosphorus load (lbs/yr)	38	27	11
Nitrogen load (lbs/yr)	386	174	213

NA indicates no BMP efficiency data available.

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
An animal lot refers to an open lot or combination of open lots intended for confined feeding, breeding, raising or holding animals. It is specifically designed as a confinement area in which manure accumulates or where the concentration of animals is such that vegetation cannot be maintained. The purpose of these calculations is to represent Biological Oxygen Demand (BOD), phosphorus (P), and nitrogen reductions after an animal waste system is installed. This method has two assumptions: 1) the feedlot is adjacent to a receiving hydrological system without any buffering areas; and 2) installing the animal waste system will prevent any further pollutants from the lot from reaching the hydrologic system. Feedlots that cannot show impact to the hydrologic system being protected should not be evaluated with this computation.

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STEP 1

0.2 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E IN

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
4	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- ( ) Diversion
- ( ) Filter Strip
- (•) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- ( ) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	234	NA	NA
Phosphorus load (lbs/yr)	14	11	2
Nitrogen load (lbs/yr)	141	NA	NA

NA indicates no BMP efficiency data available.

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
An animal lot refers to an open lot or combination of open lots intended for confined feeding, breeding, raising or holding animals. It is specifically designed as a confinement area in which manure accumulates or where the concentration of animals is such that vegetation cannot be maintained. The purpose of these calculations is to represent Biological Oxygen Demand (BOD), phosphorus (P), and nitrogen reductions after an animal waste system is installed. This method has two assumptions: 1) the feedlot is adjacent to a receiving hydrological system without any buffering areas; and 2) installing the animal waste system will prevent any further pollutants from the lot from reaching the hydrologic system. Feedlots that cannot show impact to the hydrologic system being protected should not be evaluated with this computation.

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- ( ) 50-74%
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STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E IN

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
12	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- (•) Diversion
- ( ) Filter Strip
- ( ) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- ( ) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	703	NA	NA
Phosphorus load (lbs/yr)	42	29	12
Nitrogen load (lbs/yr)	422	190	232

NA indicates no BMP efficiency data available.

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
An animal lot refers to an open lot or combination of open lots intended for confined feeding, breeding, raising or holding animals. It is specifically designed as a confinement area in which manure accumulates or where the concentration of animals is such that vegetation cannot be maintained. The purpose of these calculations is to represent Biological Oxygen Demand (BOD), phosphorus (P), and nitrogen reductions after an animal waste system is installed. This method has two assumptions: 1) the feedlot is adjacent to a receiving hydrological system without any buffering areas; and 2) installing the animal waste system will prevent any further pollutants from the lot from reaching the hydrologic system. Feedlots that cannot show impact to the hydrologic system being protected should not be evaluated with this computation.

The fundamental methodology of this worksheet is based on "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" (Michigan DEQ, June 1999). However, the Michigan DEQ methodology was modified to calculate annual load through inclusion of climatological data. In addition, biological oxygen demand, phosphorus, and nitrogen constants used in this worksheet were derived from U.S. EPA's STEPL model, developed by Tetra Tech, Inc. in order to enhance consistency between methods.

STEP 1

0.16 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
4	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- ( ) Diversion
- ( ) Filter Strip
- (•) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- ( ) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	**234**	**NA**	**NA**
Phosphorus load (lbs/yr)	**14**	**11**	**2**
Nitrogen load (lbs/yr)	**141**	**NA**	**NA**

NA indicates no BMP efficiency data available.

Feedlot Pollution Reduction

Please fill in the gray areas below.

Notes:
An animal lot refers to an open lot or combination of open lots intended for confined feeding, breeding, raising or holding animals. It is specifically designed as a confinement area in which manure accumulates or where the concentration of animals is such that vegetation cannot be maintained. The purpose of these calculations is to represent Biological Oxygen Demand (BOD), phosphorus (P), and nitrogen reductions after an animal waste system is installed. This method has two assumptions: 1) the feedlot is adjacent to a receiving hydrological system without any buffering areas; and 2) installing the animal waste system will prevent any further pollutants from the lot from reaching the hydrologic system. Feedlots that cannot show impact to the hydrologic system being protected should not be evaluated with this computation.

The fundamental methodology of this worksheet is based on "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" (Michigan DEQ, June 1999). However, the Michigan DEQ methodology was modified to calculate annual load through inclusion of climatological data. In addition, biological oxygen demand, phosphorus, and nitrogen constants used in this worksheet were derived from U.S. EPA's STEPL model, developed by Tetra Tech, Inc. in order to enhance consistency between methods.

STEP 1

0.2 **Contributing Area (acres): the area contributing polluted water to the discharge point(s).**

STEP 2

Percent Paved: Percent of the contributing area that is paved

- (•) 0-24%
- ( ) 25-49%
- ( ) 50-74%
- ( ) 75-100%

STEP 3

Please select your State. Pennsylvania

Please select your County. Bucks

Nearest Weather Station PA ALLENTOWN A-B-E

Note: Precipitation data for Alaska and Hawaii were unavailable for this version of the workbook.

STEP 4

Animal Numbers	Animal Type	Design Weight*
0	Slaughter Steer	1,000
0	Young Beef	500
0	Dairy Cow	1,400
0	Young Dairy Stock	500
0	Swine	200
0	Feeder Pig	50
0	Sheep	100
0	Turkey	10
0	Chicken	4
0	Duck	4
6	Horse	1,000

*Design weight in pounds. Interpolation of values should be based on the maximum weight animals would be expected to reach.

STEP 5

Select a Best Management Practice

- ( ) No BMP
- ( ) Diversion
- ( ) Filter Strip
- (•) Runoff Mgmt System
- ( ) Terrace
- ( ) Waste Mgmt System
- ( ) Waste Storage Facility
- ( ) Solids Separation Basin
- ( ) Solids Separation Basin w/ Infilt Bed

END

Estimated Load and Load Reductions

Pollutants	Load before BMP	Load Reduction	Load after BMP
Biochemical Oxygen Demand load (lbs/yr)	351	NA	NA
Phosphorus load (lbs/yr)	21	17	4
Nitrogen load (lbs/yr)	211	NA	NA

NA indicates no BMP efficiency data available.

URBAN RUNOFF BMP POLLUTANT LOAD REDUCTION WORKSHEET (BASED ON LAND USE RUNOFF LOADING RATE)

Please fill in the gray areas below.

Notes:
The methodology and efficiency values used in this worksheet were developed by the Illinois Environmental Protection Agency.

Please Select a Best Management Practice:

○ Vegetated Filter Strips	○ Sand Filters	○ Sand Filter/Infiltration Basin
○ Grass Swales	○ WQ Inlets	○ WQ Inlet w/ Sand Filter
○ Infiltration Device	○ Weekly Street Sweeping	○ Oil/Grit Separator
○ Extended Wet Detention	○ Infiltration Basin	○ Wet Pond
○ Wetland Detention	○ Infiltration Trench	○ Green Roof
○ Dry Detention	● Porous Pavement	
○ Settling Basin	○ Concrete Grid Pavement	

Green Roof:
The green roof in such a way that a generated would quality of runoff g the land use of th roof is on, i.e. co institutional, resic the entire loading eliminated.

Please enter landuse of contributing/drainage area in acres:

	Sewered	Unsewered
Commercial	0	0
Industrial	0	0
Institutional	0	0
Transportation	0	0.8
Multi-Family	0	0
Residential	10	0
Agriculture	0	0
Vacant	0	0
Open Space	0	33

Note: Sewered and Unsewered refer to storm sewers.

Please enter landuse specific pollutant loading rate (lbs/ac/yr)

● Default ○ User Defined

DEFAULT AVERAGE POLLUTANT LOADS BY LAND USE (Lbs/Ac./Yr.) 1

	Commercial	Industrial	Institutional	Transportation	Multi-Family	Residential	Agriculture	Vacant	Open Space
BOD (Sewered)	85	50	52	50	52	22		2	1
BOD (Unsewered)	75	40	31	30	42	11	3	0.9	0.4
COD (Sewered)	589	260	320	881	320	140		64	46
COD (Unsewered)	520	230	190	518	260	71	28	26	15
TSS (Sewered)	1180	1240	1320	2260	1320	309		100	61
TSS (Unsewered)	1040	1080	790	1330	1050	154	153	40	20
LEAD (Sewered)	1.03	1.58	0.37	2.67	0.37	0.23		0.03	0.02
LEAD (Unsewered)	0.90	1.39	0.22	1.57	0.29	0.12	0.00	0.01	0.01
COPPER (Sewered)	0.2	0.21	0.1	0.56	0.1	0.048		0.01	0.01
COPPER (Unsewered)	0.18	0.18	0.061	0.33	0.081	0.024	0.0044	0.004	0.002
ZINC (Sewered)	1.6	1.3	0.57	3.2	0.57	0.9		0.1	0.08
ZINC (Unsewered)	1.4	1.2	0.34	1.9	0.46	0.45	0.069	0.06	0.03
TDS (Sewered)	2830	1290	623	6060	623	436		1210	724
TDS (Unsewered)	2500	1130	374	3565	498	218	89.2	483	241
TN (Sewered)	21	14	11	13	11	6		1	1
TN (Unsewered)	18	12	6.5	7.7	8.6	3.1	2.4	0.5	0.2
TKN (Sewered)	6.9	4	6.4	18	6.4	3.2		2.2	1.3
TKN (unsewered)	6.1	4	3.8	11	5.1	1.6	0.91	0.88	0.44
DP (Sewered)	0.69	0.86	0.61	0.2	0.61	0.26		0.1	0.08
DP (Unsewered)	0.61	0.75	0.36	0.1	0.48	0.13	0.08	0.05	0.03
TP (Sewered)	1.3	1.5	1.4	1.8	1.4	0.81		0.22	0.39
TP (Unsewered)	1.2	1.3	0.8	1.1	1.1	0.4	0.18	0.088	0.13
CADMIUM (sewered)	0.008	0.025	0.0037	0.021	0.0037	0.002		0.0003	0.0002
CADMIUM (Unsewered)	0.0071	0.022	0.0022	0.012	0.003	0.001	0.0002	0.0001	0.0001

1. Unit Area Pollutant Load Estimates for Lake County, Illinois Lake Michigan Watersheds." NIPC. August 1993.

Estimated Load and Load Reductions

	Load before BMP (lbs/yr)		Load after BMP (lbs/yr)		Load Reduction (lbs/yr)
BOD	257		U		U
COD	2,309		462		1,848
TSS	4,814		481		4,333
LEAD	4		0		4
COPPER	1		U		U
ZINC	12		0		12
TDS	15,165		U		U
TN	73		11		62
TKN	55		U		U
DP	4		U		U
TP	13		5		9
CADMIUM	0		U		U

U = Removal Efficiency for the particular BMP and constituent unavailable.

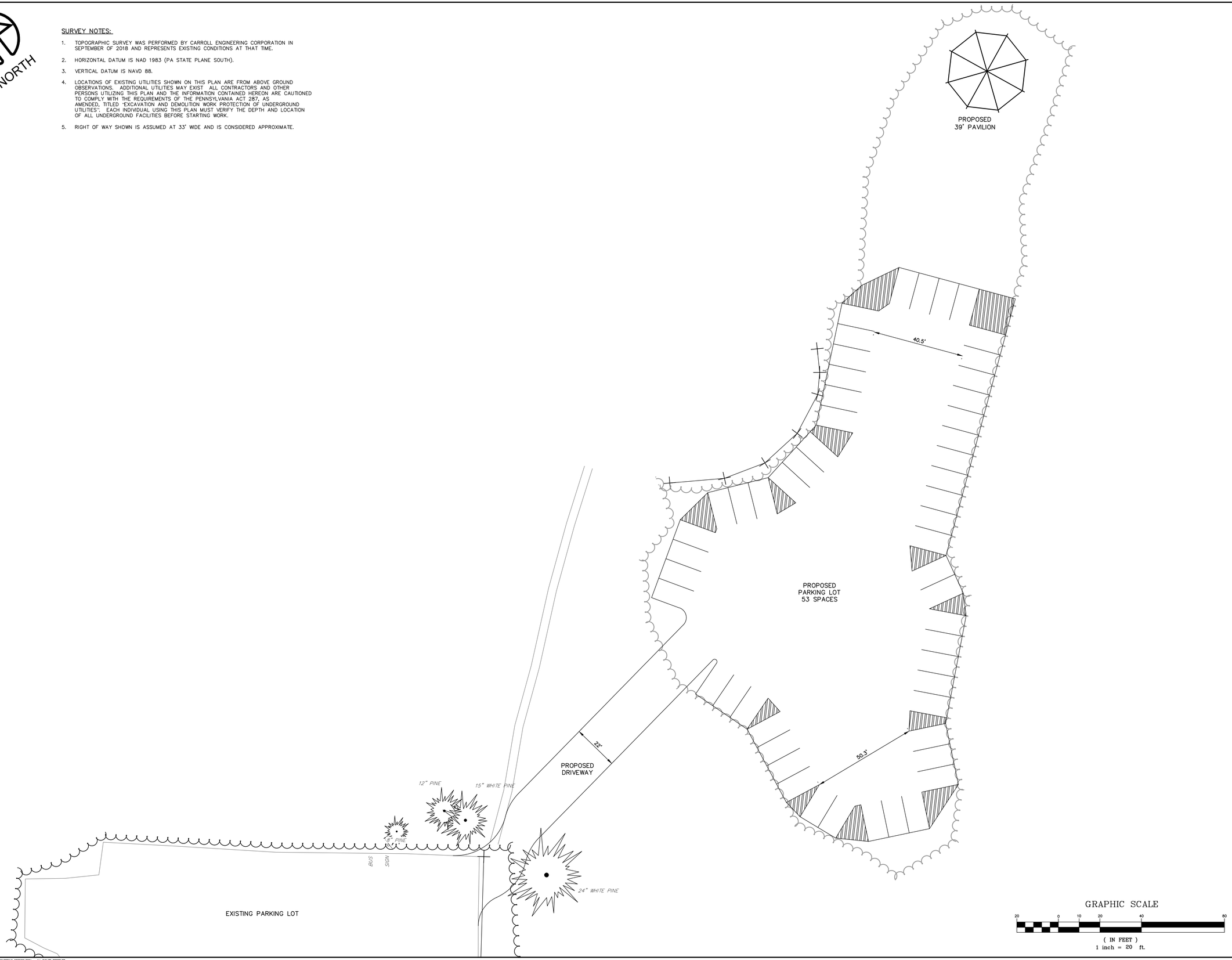
Appendix D. Peace Valley Nature Center Project Area Photos and Plan

Photo 1. Location of Peace Valley Nature Center permeable paving parking area.

NORTH

SURVEY NOTES:

1. TOPOGRAPHIC SURVEY WAS PERFORMED BY CARROLL ENGINEERING CORPORATION IN SEPTEMBER OF 2018 AND REPRESENTS EXISTING CONDITIONS AT THAT TIME.
2. HORIZONTAL DATUM IS NAD 1983 (PA STATE PLANE SOUTH).
3. VERTICAL DATUM IS NAVD 88.
4. LOCATIONS OF EXISTING UTILITIES SHOWN ON THIS PLAN ARE FROM ABOVE GROUND OBSERVATIONS. ADDITIONAL UTILITIES MAY EXIST. ALL CONTRACTORS AND OTHER PERSONS UTILIZING THIS PLAN AND THE INFORMATION CONTAINED HEREON ARE CAUTIONED TO COMPLY WITH THE REQUIREMENTS OF THE PENNSYLVANIA ACT 287, AS AMENDED, TITLED 'EXCAVATION AND DEMOLITION WORK PROTECTION OF UNDERGROUND UTILITIES'. EACH INDIVIDUAL USING THIS PLAN MUST VERIFY THE DEPTH AND LOCATION OF ALL UNDERGROUND FACILITIES BEFORE STARTING WORK.
5. RIGHT OF WAY SHOWN IS ASSUMED AT 33' WIDE AND IS CONSIDERED APPROXIMATE.



GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

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SITE IMPROVEMENT PLAN

PEACE VALLEY NATURE CENTER
GAZEBO AND PARKING LOT ADDITION

SITUATED IN
NEW BRITAIN TOWNSHIP, BUCKS COUNTY PA
PREPARED FOR

PEACE VALLEY NATURE CENTER
170 NORTH CHAPMAN ROAD
DOYLESTOWN, PA 18902

NO.	DATE	DESCRIPTION	INITIALS

DATE	9/27/2018
CADD FILE	1814180002
JOB NO	18-1418
DSG BY	JLK
DWN BY	JLK
CKD BY	
SCALE	1" = 20'
DRAWER NUMBER	–
SHEET	1 OF ___ SHEETS

DRAWING NUMBER
C-101

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