Lake Luxembourg Wetland Development (Phase 1)

Final Report

September 30, 2019

Prepared By:

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Lake Luxembourg Wetland Development (Phase 1) Project

Final Report

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Project No. 1511

Prepared For:

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1. Project Funding and Schedule

The Lake Luxembourg Wetland Development (Phase 1) 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 Princeton Hydro provided professional services for engineered design, permit submission and water quality monitoring. The contract between the District and PA DEP was executed in March 2016 and completed on September 30, 2019.

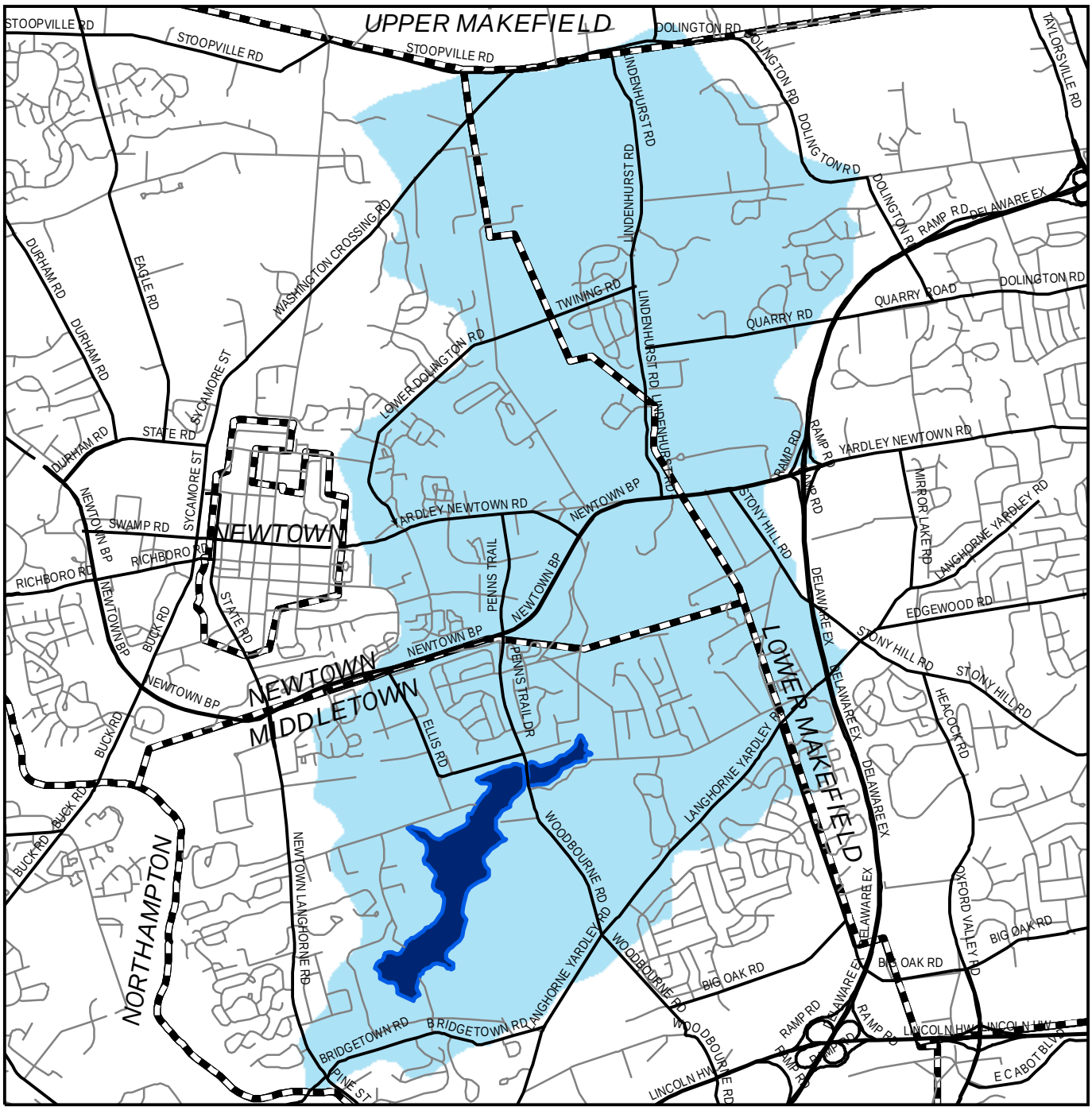
2. Project Location and Justification

Core Creek is located in Bucks County, Pennsylvania and enters Neshaminy Creek approximately 13.5 miles upstream of the Neshaminy Creek's confluence with the Delaware River. Under Public Law 566 funding, a dam was constructed across Core Creek (PA Dam 620) to provide local communities with a multi-purpose reservoir. The dam was completed in June 1976 and the reservoir, which was officially named Lake Luxembourg, was filled in the summer of 1977.

The Core Creek watershed has a surface area of 6,033 acres; almost 99% of the watershed directly drains into Lake Luxembourg (Figure 1), which has a surface area of 179 acres and is in HUC 02040201 (Crosswicks – Neshaminy, New Jersey, Pennsylvania). The lake is located entirely within Middletown Township; while the Core Creek watershed is located, with approximately equal portions, in Middletown, Lower Makefield and Newtown Townships, Bucks County. Core Creek is the main inlet and outlet of Lake Luxembourg.

Both Lake Luxembourg and Core Creek are listed on Sublist 4a of Pennsylvania draft "2018 Integrated Water Quality Monitoring and Assessment Report," indicating that both waterbodies have approved Total Maximum Daily Loads (TMDLs). Lake Luxembourg has a TMDL for nutrients, specifically total phosphorus (TP) and total suspended solids (TSS). Core Creek has a TMDL for TSS. Additionally, the Core Creek / Lake Luxembourg watershed drains to the Neshaminy Creek, which also has a TMDL for TSS.

The objective of this project was to initiate the design, engineering and permitting phase of a large, regional wetland Best Management Practice (BMP) for the Conservation Pool, located immediately upgradient of the main body of Lake Luxembourg, which has the potential to substantially reduce the TP and TSS loads targeted for reduction under the TMDLs. The restoration of the Conservation Pool has consistently been listed as a high priority for BMP implementation in multiple versions of the Core Creek/Lake Luxembourg Watershed Implementation Plan (WIP).



Princeton Hydro

FIGURE 1: SITE LOCATION MAP

BUCKS COUNTY CONSERVATION DISTRICT
WATERSHED ASSESSMENT
CORE CREEK
BUCKS CO., PENNSYLVANIA

- Lake Luxembourg
- Watershed
- Roads
- Municipal Boundaries
- State Roads

1 inch equals 4,000 feet

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
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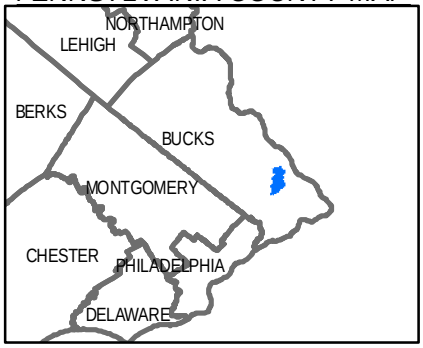
RINGOES, NJ 08551

SOURCES:
1. USGS 7.5 Minute Quadrangle of Langhorne, PA
2. Project areas outlined by Princeton Hydro, LLC

PENNSYLVANIA COUNTY MAP



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3. Project Overview

The objective of this project was to initiate the design, engineering and permitting phase of a large, regional wetland Best Management Practice (BMP) for the Conservation Pool, located immediately upgradient of the main body of Lake Luxembourg, east of Woodbourne Road. The project was divided into three main tasks which are outlined below.

3.1 Engineering Design and Technical Specifications

Shortly following the execution of the grant contract, BCCD issued a Request for Proposals for a licensed survey company to complete a topographic survey of the 50-acre area surrounding the Lake Luxembourg Conservation Pool. A contract was executed with BANC3, Inc. in April 2016, and a kickoff meeting was held on-site on May 27, 2016. The topographic survey was finalized on June 30, 2016. The survey data were used to develop a base map of the site at 0.5-foot contour intervals and included channel cross sections at 100-foot intervals, among other specifications requested by Princeton Hydro to serve as the base map for the engineered project plans.

Following the completion of the topographic survey, Princeton Hydro developed conceptual plans and initiated the hydrologic and hydraulic (H&H) analyses for the project. Several rounds of review were conducted by Bucks County Conservation District and Bucks County Department of Parks and Recreation on the project conceptual plans prior to initiating pre-application meetings with regulatory agencies starting in September 2017. After addressing regulatory agency comments and timing and activity restrictions to accommodate threatened and endangered species (more below), project plans and the H&H report were finalized in late May 2019 and updated in mid-July 2019 (Appendix A).

The plans included as Appendix A show the proposed project will include the excavation of nearly 15,000 cubic yards of accumulated sediment within the Conservation Pool and restore the upper pool to its original dimensions, which would facilitate sedimentation of suspended solids transported by the two feeder streams, Core Creek and an unnamed tributary to Lake Luxembourg. Tree vanes and turtle habitat features are included to provide habitat for wildlife. The tree vanes will be entrenched within the sediment of the existing Conservation Pool to provide structure for aquatic wildlife and to slow stormflow and facilitate sedimentation. Turtle habitat features were developed in collaboration with the Pennsylvania Fish and Boat Commission (PFBC) and are designed to encourage turtle basking within the enhancement area. Finally, a comprehensive planting regimen consisting of a suite of diverse native hydrophytes is proposed to establish a palustrine emergent wetland plant community. The wetland plants will stabilize the sediment within the Conservation Pool, provide habitat for wildlife and promote nutrient cycling. In conjunction, the proposed enhancement measures will increase the ecological value of the Conservation Pool while reducing TP and TSS loading to Lake Luxembourg.

Following the development of the engineered project plans, Princeton Hydro and Bucks County Conservation District developed the Draft Bid document and Technical Specifications which were reviewed by Clemons, Richter & Reiss, legal counsel of BCCD. A draft of these specifications is included in this report as Appendix B but will be updated upon approval of permits and BCCD obtaining full funding for the implementation stage of the project.

3.2 Estimated Load Reductions

Based on past stormwater sampling and relatively simple hydrologic estimates of the annual stormwater load flowing through the pool, Princeton Hydro estimates that the Lake Luxembourg Conservation Pool regional wetland BMP will remove approximately 602 lbs of TP and 398,547 lbs of TSS per year. Estimated removal rates were based on 75% for TP and 85% for TSS, which were derived from the PA Stormwater BMP Manual for Constructed Wetland BMPs. Total phosphorus reduction used a slightly more conservative estimate of TP removal (75% as opposed to 85% in PA Stormwater BMP Manual) since the design's directly interconnecting pools may not be as efficient at capturing dissolved phosphorus.

As per the 2017 WIP Update and BMPs implemented to date, loading reductions of 502 lbs of TP and 694,658 lbs of TSS are required to meet the TMDL goals. Implementation of the Conservation Pool wetland BMP will exceed the remaining reductions required for TP by 100lbs annually and would result in delisting Lake Luxembourg for TP. In addition, dramatic progress would be obtained toward the TSS TMDL goal, increasing from 19% of the targeted reduction in 2018 to 66% of the targeted sediment reductions as established in the TMDL.

3.3 Wetland Delineation & Permit Filing

Prior to the topographic survey, Princeton Hydro staff completed a wetland delineation of the proposed project area. The flags from the wetland survey were located during the topographic survey and included the base map for the engineered plans. Findings of the wetland delineation were included with the application for a Joint Permit (i.e., a United States Army Corps of Engineers Section 404 Permit and Pennsylvania Water Obstruction and Encroachment Permit) and are included in Appendix C of this report.

The Pennsylvania Natural Diversity Index (PNDI) review was submitted early in the plan development as Princeton Hydro and BCCD were aware of a bald eagle nest in the vicinity of the proposed project. The PNDI review also noted a potential impact to the eastern redbelly turtle (*Pseudemys rubriventris*), a state threatened species. A site visit was completed in July 2017 with Kathy Gipe, a PFBC biologist who confirmed the presence of eastern red belly turtle on site and potential use of the agricultural field proposed for beneficial reuse of dredge spoils as a turtle nesting area. Ms. Gipe provided guidance on appropriate avoidance measures. Princeton Hydro and BCCD also coordinated with United States Fish and Wildlife Service to accommodate the nesting bald eagle within the immediate project vicinity. Avoidance measures for the nesting bald eagle conflicted with timing and activity restrictions for the redbelly turtle. Unfortunately, delays in the coordination process to resolve these timing conflicts contributed to the delays in obtaining an easement from the County of Bucks for BCCD to serve as applicant for the Joint Permit, per the County's request.

Following a series of pre-application meetings (September 2017, November 2018, February 2019, April 2019) to determine the appropriate permitting pathway for this complex restoration project, the following application materials were submitted for regulatory review: Joint Permit application (Appendix C), Dredging Request (Appendix D) and NPDES for Construction Activities/Erosion and Sediment Control Plan (Appendix E). The Joint Permit and NPDES applications were submitted on June 3, 2019 and an amendment was filed in mid-July 2019 to reflect minor adjustments to the project plans. A Dredging Request was submitted to PADEP on August 8, 2019.

3.3 Water Quality Monitoring

Water quality data were collected from the lake, the Conservation Pool and the lake inlet and outlet along Core Creek six times over the course of Summer 2016 to Spring 2018. Building on the long-term database of in-lake data is vital in assessing the long-term status of Lake Luxembourg relative to the TMDL. The water quality monitoring report is included within this report as Appendix F.

Appendix A. Lake Luxembourg Conservation Pool Enhancement Plans and H&H Report

PRINCETON HYDRO

SCIENCE ENGINEERING DESIGN

Hydrologic and Hydraulic Modeling Report

Lake Luxembourg Conservation Pool Habitat Enhancement

Township of Middletown, Bucks County, Pennsylvania

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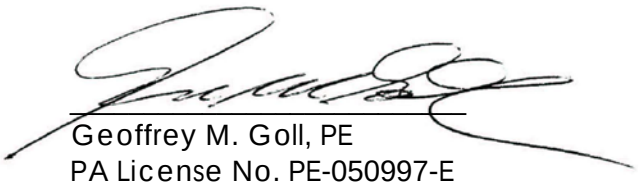

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May 2019; Revised June 2019

Project No. 0121.016

Contents

1.0 Introduction

1.1 Project Background

The Bucks County Conservation District contracted Princeton Hydro, LLC to prepare design and permitting documentation for the Lake Luxembourg (Lake) Conservation Pool Habitat Enhancement Project. This project involves the development and enhancement of wetlands in the Conservation Pool. Along with the development and enhancement of wetlands, accumulated material shall be removed from the existing Conservation Pool is proposed to reestablish a forebay for the Lake and restore the intended habitat of the conservation pool by increasing the water depth. The following report details the engineering design elements of the project which pertain to hydrologic and hydraulic analysis as well as regulatory compliance, dewatering and placement.

1.2 Site Background

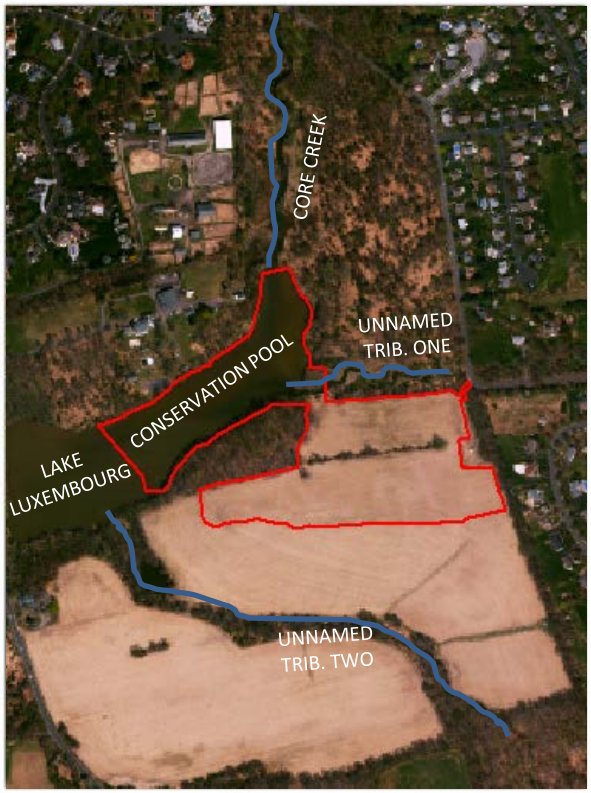


Figure One – Overview map

Lake Luxembourg, located in Bucks County, PA, serves as the focal point of Core Creek County Park. Under Public Law 566 funding, PA Dam 620 (D09-172 and NID#PA00802) was constructed across Core Creek to create a multi-purpose (e.g. flood control, recreation) reservoir. The Dam was completed in June 1976; and the reservoir, named Lake Luxembourg, was filled in the summer of 1977. Core Creek is the primary inlet and sole outlet of Lake Luxembourg. Core Creek is a subwatershed within HUC 02040201 (Crosswicks – Neshaminy) in Bucks County, Pennsylvania, and is designated as a Trout Stocking Fishery and Migratory Fishes water body. Core Creek enters the Neshaminy Creek approximately 13.5 miles upstream of the confluence of the Neshaminy Creek with the Delaware River. As a multi-use reservoir, Lake Luxembourg is important in the community for recreation and serves a vital ecological role as well.

Lake Luxembourg and Core Creek are both listed on Sublist 4a of Pennsylvania's '2016 Integrated Water Quality Monitoring and Assessment Report,' indicating that these waterbodies have approved Total Maximum Daily Loads (TMDLs). The sources of impairment targeted by the TMDLs are total phosphorus (TP) and total suspended solids (TSS). As mentioned above, the Core Creek / Lake Luxembourg watershed drains to the Neshaminy Creek, which it should also be noted, also has a TMDL for TSS.

When Lake Luxembourg was created, a 17-acre 'Conservation Pool' settling basin was established immediately upgradient of the main body of lake, east of Woodbourne Road. The Conservation Pool was intended to store 100 years of sediment while maintaining the full flood storage capacity of the main reservoir, and is currently designated as a Trout Stocking Fishery and Migratory Fishes water body. Unfortunately, due to rapid land use changes in the Core Creek watershed beginning in the early 1980s, the Conservation Pool reached its sediment storage capacity by 1986. Since then, although land use changes in the watershed have stabilized, sediment in the pool is resuspended and transported to the main body of the lake with each storm. Consequently, the Conservation Pool is currently contributing to the sediment load in Lake Luxembourg.

1.3 Review of Existing Information

Documentation

Documentation on the design and construction of the Dam and Conservation Pool were reviewed in order to develop an understanding of the original design intent and collect pertinent information for modeling hydrologic and hydraulic conditions. A file review at the Pennsylvania DEP Division of Dam Safety produced copies of the following documents, which were used to gather information on the design of the Dam and Conservation Pool.

- Final Design Report Dam PA-620 Neshaminy Creek Watershed, March 1971 (Incomplete copy)
- Neshaminy Creek Water Resources Development Plan Multiple-Purpose Dam No. PA-620 Core Creek As-Built Plans, 1971
- SCS Sedimentation Design Summary, December 1964
- PA-620 Reservoir Sediment Data Summary, August 1988
- Real Estate Evaluation Report PA 620 Core Creek Dam, WM G Major Associates, 1979

The current condition of the Conservation Pool was assessed through review of the following recent studies and survey prepared for the Lake and Conservation Pool.

- Lake Luxembourg Dredging Feasibility Report, Princeton Hydro, June 2013
- Topographic Survey of the Conservation Pool, BANC3, 2016

Information expressed in the documents listed above, along with publicly available information (e.g. regional elevation datasets, land use and land cover, etc.) are the basis of the analyses discussed in this report.

Summary of Pertinent Data

As the forebay for Lake Luxembourg the Conservation Pool accepts flow and sediment from Core Creek and two smaller tributaries.

All elevation data prior illustrated in reports prior to 1988 have been converted to NAVD88 via the following conversion:

$$Elevation\ (NAVD88) = Elevation\ (NGVD29) - 1.024\ FT$$

This elevation conversion was determined through the use of the VERTCON software maintained by NOAA.

Conservation Pool

Normal Pool Elevation:	101.48 Feet
Storage at Normal Pool (2013):	22.1 Acre Feet
Sediment Storage (2013):	77,000 Cubic Yards

PA Dam 620

Primary Spillway: Vertical concrete conduit with interior dimensions of 12-ft by 5-ft

Primary Spillway Inlet Invert Elevations:

Inlet Structure	Elevation
2 – 12-ft Ungated Weirs	101.48
36"x42" Sluice Gate	89.98
36"x48" Sluice Gate	86.98
60"x60" Sluice Gate	69.98

Primary Spillway Conduit through Dam:	60-in RCP
Inlet Invert Elevation:	69.98 Feet
Outlet Invert Elevation:	68.98 Feet
Slope:	0.00445 ft/ft
Emergency Spillway:	Trapezoidal Earth/Rock Channel with Riprap Control Section
Riprap Control Width:	550 Feet
Riprap Control Breadth:	600 Feet

Inlet Invert Elevation: 110.88 Feet

1.4 Design Goals and Objectives

This project has the following goals:

- Enhance the Conservation Pool so it functions as a regional constructed wetland Best Management Practice (BMP)
- Reduce amount of sediment being transported to Lake Luxembourg
- Maintain stability of the Conservation Pool
- Make future maintenance and sediment removal easier to implement
- Uplift the habitat quality of the Conservation Pool

These goals will be achieved through completing the following objectives:

- Selective removal of accumulated sediment from the Conservation Pool
- Restore Conservation Pool vegetation

As the Conservation Pool no longer serves its function due to being filled with sediment and lack of maintenance, the project goals serve to create a more functional space that is easier to maintain and reduces sediment load to Lake Luxembourg. To meet the project goals, Princeton Hydro proposes to remove accumulated sediment from the Conservation Pool to restore the available sediment storage, create settling pools to create smaller pockets of sediment storage that will allow for easier maintenance and stabilize the pool, and restoring the Conservation Pool. A Post Construction Stormwater Management (PCSM) Plan is not applicable because this is a restoration project, and no structural stormwater management best management practices (BMPs) are proposed. An antidegradation analysis is also not applicable because this restoration project is not proposed in a High Quality or Exceptional Value watershed.

2.0 Existing Conditions

Lake Luxembourg and its surrounding area is currently in use as a county park (Core Creek Park) in Bucks County, Pennsylvania. To the north and the east of the project location are residential areas, to the south are farm fields, and to the east is Woodbourne Road and the Conservation Pool. The land use has not changed significantly over the past 15 years, with the exception of a few additional residential areas to the northeast. As discussed earlier, Core Creek was dammed and filled to become Lake Luxembourg by 1977 which greatly altered the hydrology of the area. Aerial photographs from 1971 show that the area was primarily farmland and no lake was present at that time. The lake was created as a means for water supply, recreation, and flood control.

The Lake Luxembourg Conservation Pool discharges via a culvert under Woodbourne Road, into Lake Luxembourg, and has an area of approximately 836,000 square feet. The Conservation Pool was designed to store accumulating sediments before entering Lake Luxembourg, though as stated previously it reached its storage capacity by 1986. A bathymetry study performed by Princeton Hydro in May 2013 shows a sediment depth of up to 7 feet in the Conservation Pool.

2.1 Drainage Area

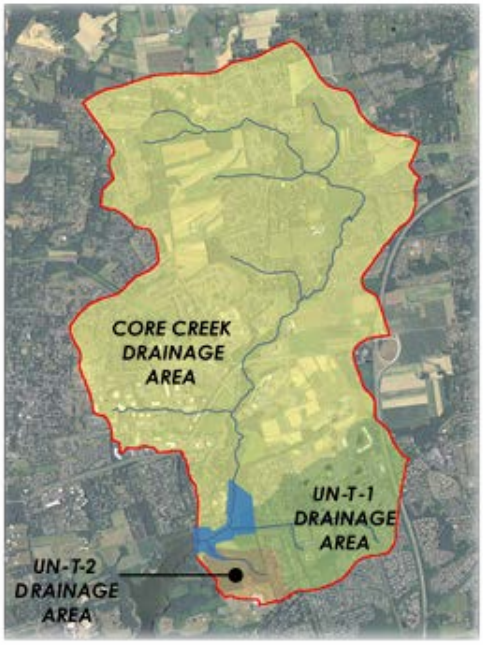


Figure Two – Drainage Overview map

In order to analyze the effects of proposed conditions, watersheds draining to the Conservation Pool were delineated. Watersheds were delineated for Core Creek, Unnamed Tributary 1, and Unnamed Tributary 2 to where they discharge at the Conservation Pool. As stated previously, the outlet of the Conservation Pool is the Woodbourne Road Culvert where it then discharges to the main body of Lake Luxembourg. The areas of the delineated watersheds are listed below.

Table 1 – *Watershed Area Review Table*

Watershed Name	Area (sq. miles)
Core Creek	6.12
Unnamed Tributary One (UN-T-1)	0.96
Unnamed Tributary Two (UN-T-2)	0.21
Total	7.29

2.2 Soils

The National Resource Conservation Service (NRCS) Web Soil Survey indicates that native onsite soils are:

- Bowmansville-Knaurs silt loams (Bo), Hydrologic Soil Group (HSG) C/D,
- Chalfont silt loam, 3 to 8 percent slopes (CbB), HSG D,
- Lansdale loam, 3 to 8 percent slopes (LgB), HSG B,
- Lawrenceville silt loam, 3 to 8 percent slopes (LkB), HSG C,
- Steinsburg gravelly loam, 3 to 8 percent slopes (StB), HSG B, and
- Steinsburg gravelly loam, 8 to 15 percent slopes (StC), HSG B.

Included in Appendix B is the NRCS soil report for the project site. The NRCS provides the following description and limitations for the soil series found on site:

Bowmansville Series

The Bowmansville series consists of very deep, poorly and somewhat poorly drained soils. They formed in recent alluvial deposits derived from upland soil materials weathered from dolerite or basalt. They are on floodplains with smooth slopes of 0 to 3 percent. Saturated hydraulic conductivity is moderately high above stratified sand and gravel and high in stratified sand and gravel.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Knauers Series

The Knauers series consists of very deep, poorly drained soils formed in recent alluvial deposits derived from sandstones and shales. They are on the backwater areas of floodplains with slightly depressed slopes of 0 to 3 percent. Saturated Hydraulic conductivity is moderately high and high in the A and B horizons, and high to very high in the C horizon.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Chalfont Series

The Chalfont series consists of deep and very deep, somewhat poorly drained soils formed in a loess mantle and the underlying residuum of shale and sandstone. Slopes range from 0 to 25 percent.

Very limited for dwellings and small commercial buildings. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Lansdale Series

The Lansdale series consists of deep and very deep, well drained soils on uplands. They formed in residuum weathered from sandstone and/or conglomerate. Slopes are 0 to 25 percent. Saturated hydraulic conductivity is moderately high to high.

Not limited for dwellings without basements, somewhat limited for dwellings with basements and small commercial buildings. Somewhat limited for roads and streets, shallow excavations, and lawns and landscaping. All areas are prime farmland.

Lawrenceville Series

The Lawrenceville series consists of deep and very deep, moderately well drained soils formed in silty transported materials. Slopes range from 0 to 15 percent. Permeability is moderately slow.

Somewhat limited for dwellings without basements and small commercial buildings, very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Steinsburg Series

Soils of the Steinsburg series are moderately deep and well drained with moderately rapid permeability. They formed in residuum mostly from weakly cemented acid sandstone, arkosic sandstone, and conglomerate. They are on upland slopes of 0 to 70 percent.

Somewhat limited for dwellings without basements, somewhat to very limited for small commercial buildings, and very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Also included in Appendix B are the NRCS soil reports for the drainage areas into the conservation pool.

3.0 Proposed Conditions

Proposed conditions include the removal accumulated material from the Conservation Pool, creation of settling pools using tree vane structures, and restoring vegetation within the conservation pool. No new channels are proposed. These proposed conditions will restore the capacity of the conservation pool and allow for ease of maintenance, while also enhancing the existing habitat. The amount of sediment entering Lake Luxembourg should decrease and the conservation pool should become more stabilized in proposed conditions.

The material to be removed is high in organic content and can be beneficial for reuse. It is proposed to place the material in the adjacent farm field for further dewatering and to be incorporated into the existing soils as an amendment.

All proposed sediment placement and soil erosion & sediment control features are located at elevations above the top of the dam, which has an elevation of 116.98 feet NAVD 88. This elevation was obtained by converting the NGVD 29 elevation of 118 feet provided on Sheet 10 of 43 of the Neshaminy Creek Water Resources Development Plan As-Builts, dated March 1971. The dam elevation conversion is included in Appendix D. The sediment placement will result in no flood storage loss, as the sediment will not be placed within the floodplain.

4.0 Soil Erosion and Sediment Control Compliance

An Erosion and Sediment Control Plan has been prepared for this project and is shown on sheets 12 and 13 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design plans, prepared by Princeton Hydro and dated October 31, 2018. This E&S plan meets the following goals:

- Minimizes extent and duration of earth disturbance.
- Maximizes protection of existing drainage features and vegetation.
- Minimizes soil compaction.

- Utilizes other measures or controls that prevent or minimize generation of increased stormwater runoff.

For this project, two soil erosion and sediment control plans have been prepared to protect the site during interim conditions and proposed conditions. The interim plan is for the sediment removal and dewatering components of the project and associated dewatering activities. The proposed plan covers the site restoration.

4.1 Methods

Soil erosion and sediment control measures are proposed in accordance with the design and performance standards contained in the Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual dated March 2012.

The following permanent soil erosion control measures will be utilized:

1. Permanent seeding will be applied to permanently stabilize the soil, assure conservation of soil and water, and enhance the environment. A permanent seeding mixture will be applied as specified on the planting plans. All seed mixtures will be specific to the region and site conditions.

The following temporary soil erosion control measures will be utilized during construction:

1. Silt fence will be placed at the toe of slopes where the existing ground slopes away from the embankment.
2. Dust generated during the course of construction activities will be controlled in areas subject to dust blowing and movement where on-site and off-site damage is likely to occur without treatment. These control measures will prevent the blowing and movement of dust from exposed soil surfaces thus reducing on-site and off-site damage and health hazards, and improving traffic safety.
3. Temporary vegetative or stabilization cover will be established on soils where earthwork is delayed or stopped for a period a four (4) days which are not being graded, not under active construction or not scheduled for permanent seeding within sixty (60) days. This temporary vegetative cover will be consistent with the permanent seeding specifications as described on the plans and will temporarily stabilize the soil and reduce damage from wind and water erosion until construction is resumed at the site. During non-germinating seasons mulching shall be used for temporary stabilization.

The interim plan includes several erosion and sediment controls, such as a stabilized construction entrance, filter socks, super silt fence, and turbidity barriers. The interim plan covers Phase 1, Phase 2A, and Phase 2B of the project. The major difference between the interim and proposed plan are the fields to be used to dewater the soil removed from the Conservation Pool. In interim conditions, the fields will have a series of 21 berms that will be used to dewater sediment. Compost filter sock and super silt fence are proposed

throughout the fields at the toes of the berms to prevent sediment from leaving the area. The berms will be stabilized with seeding & mulching and erosion control blankets will be installed on slopes steeper than 3:1. Plywood or other similar matting will be used in the field area for construction access to reduce compaction when transporting sediment to the field for dewatering.

The proposed plan covers Phase 3 of the project, which covers restoration of the project site. During this phase, the fields used for dewatering will be restored by incorporating the dewatered sediment into them existing soil. Several of the erosion and sediment controls in the field area will be removed for this to occur, though the super silt fence at the toe of the slope will remain during the incorporation of the dewatered sediment to prevent sediment from leaving the area. Upon completion of the incorporation of the soils, the area will be restored with seeding and plantings as detailed in the Plans. Once stabilized with vegetative cover all soil erosion controls shall be removed.

Overall, these plans utilize various erosion and sediment controls, use the minimum area required for the proposed work, and are proposed for the minimum extent and duration possible while also meeting timing constraints.

4.2 Temporary Crossing

A temporary stream crossing is proposed to cross one of the tributaries to the conservation pool in order to maximize distance from the bald eagle nest, minimize wetland and vegetation disturbance, and to most effectively access the portions of the conservation pool to be restored. This crossing shall span bank to bank and have the capacity for all proposed trucks and equipment to cross in a stable manner. If a large storm event is forecasted during the construction time period, the temporary crossing shall be removed so there is no restriction to flow. The crossing would then be reinstalled post the event for the duration of the work effort.

5.0 Stormwater Management

As there is no permanent change in land use proposed as part of this project, there is no net change in volume and rate of stormwater requirements. This is confirmed in Worksheet 4 of the Pennsylvania Stormwater BMP Manual and Summary Table 3 of the Application, with relevant calculations included in Appendix D. The site Limit of Disturbance was used for these calculations to show no net change in the site runoff. Summary Table 4 is not applicable as no SWM facilities are proposed for this restoration plan.

6.0 Lake Lowering and Dewatering

Lake Luxembourg will first be dewatered using the low-level outlet to 3.25 feet below normal pool elevation (Elevation ~97), at a rate no greater than 1 foot per day. In addition, a series of dewatering sumps will be used to further dewater the sediment removal area and they will discharge to a sediment trap prior to entering the

downstream waterway as deemed necessary. A stream bypass will also be constructed to divert incoming flows away from the work.

6.1 Stream Bypass

Stream bypasses were sized for both the Core Creek inflow and the Unnamed Tributary 1 inflow. The 2-year 24-hour peak flow from the StreamStats output was used to size the bypass channels, and a geotextile liner was assumed as that is what is required at minimum for a temporary swale per the PADEP Erosion and Sediment Pollution Control Program Manual.

Table 5 - Bypass Channel Summary

Description	Drainage Area (Sq. Mi.)	2-Yr Flow (cfs)	Side Slope XH:1V (ft)	Bottom Width (ft)	Channel Depth (ft)	Cross Sectional Area (sf)	Channel Slope (%)
Core Creek	6.12	646	5	20	2	60	0.02
UN-T-1	0.21	58	5	10	1	15	0.02

6.2 Dewatering

As mentioned above, the water surface elevation will be lowered to elevation 97 which is approximately 1 foot below the bottom of the proposed material to be removed. This will result in the material to be removed to partially dewater in place. Typical mechanical material removal contractors will start at the farthest point from access and high pile material closer to the truck access area for loading and transport to disposal location. This high piling will allow for water to flow from the sediment while remaining in the lake bed. No high piles will be left in the lake bed if a storm event is forecasted. The material will then be trucked to the adjacent field for further dewatering and disposal.

7.0 Conclusion

In conclusion, the proposed conditions will meet the project objectives, while reducing and avoiding negative impacts to the project area and downstream waterbodies. This project proposes to remove accumulated sediment from the existing Conservation Pool, create settling pools, and restoration of vegetation in order to achieve the goals of enhancing the Conservation Pool, reducing sediment transport to Lake Luxembourg, maintain stability of the Pool, making future maintenance easier, and uplifting the habitat of the Pool. No pollution or thermal impacts are anticipated in proposed conditions.

APPENDICES

APPENDIX A:

LOCATION AND VICINITY MAPS

File: P:\0121\Projects\0121016\GIS\MXD\Conservation_Pool_Habitat_Enhancement\Aerial.mxd, 3/7/2019, Drawn by thopper. Copyright Princeton Hydro, LLC.

NOTES:
1. Project area is approximate
2. 2015 Orthoimagery data obtained from the Pennsylvania Spatial Data Access (PASDA) website: http://www.pasda.psu.edu/

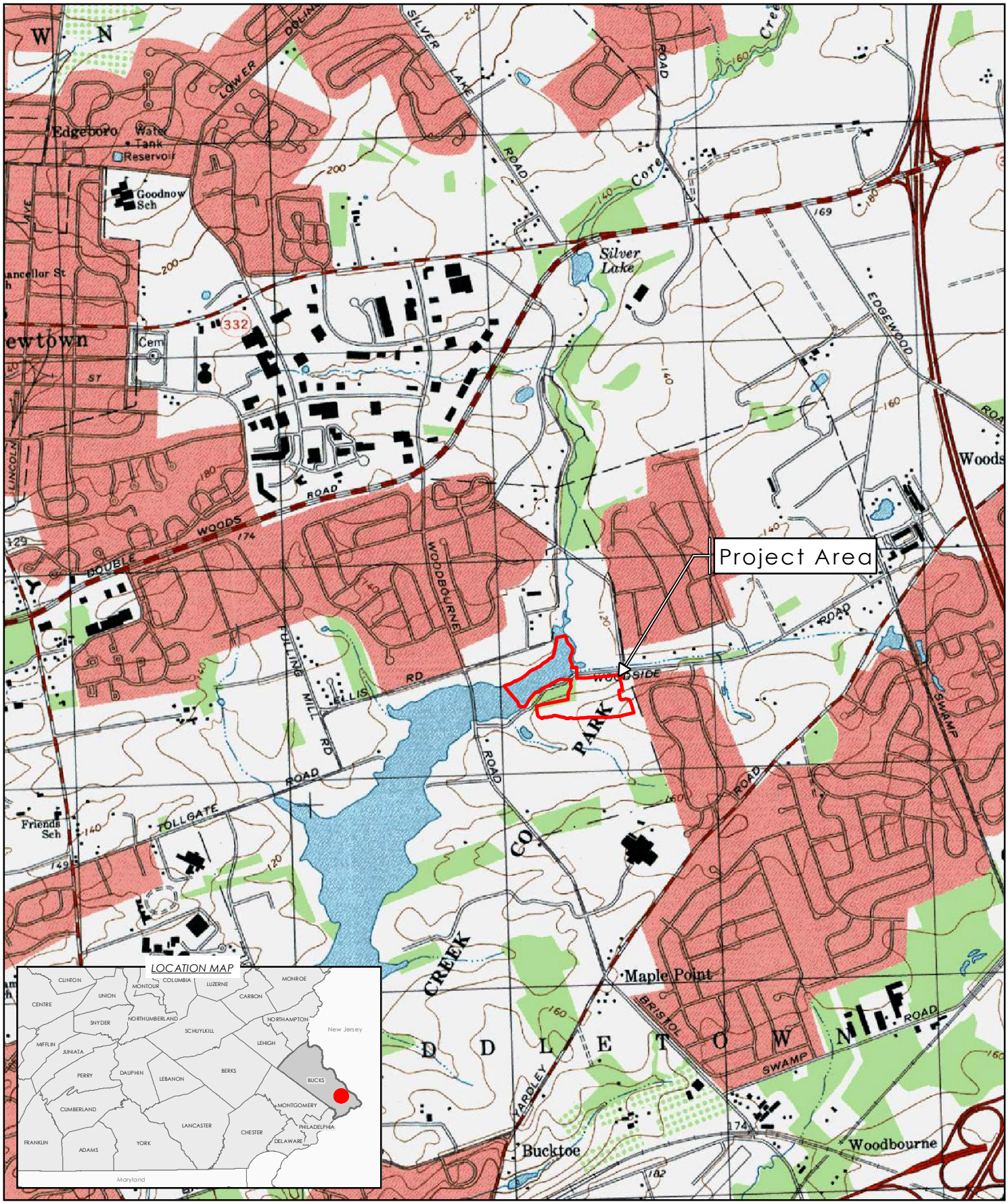
0 300 600 Feet

Map Projection: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

AERIAL OVERVIEW MAP

CONSERVATION POOL HABITAT ENHANCEMENT
LAKE LUXEMBOURG
TOWNSHIP OF MIDDLETOWN
BUCKS COUNTY, PENNSYLVANIA

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com



NOTES:
1. Project area is approximate
2. USGS topographic digital raster graphic obtained from Terrain Navigator Pro, Langhorne, PA quadrangle.

USGS SITE LOCATION MAP

CONSERVATION POOL HABITAT ENHANCEMENT
LAKE LUXEMBOURG
TOWNSHIP OF MIDDLETOWN
BUCKS COUNTY, PENNSYLVANIA

0 1,000 2,000 Feet

Map Projection: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

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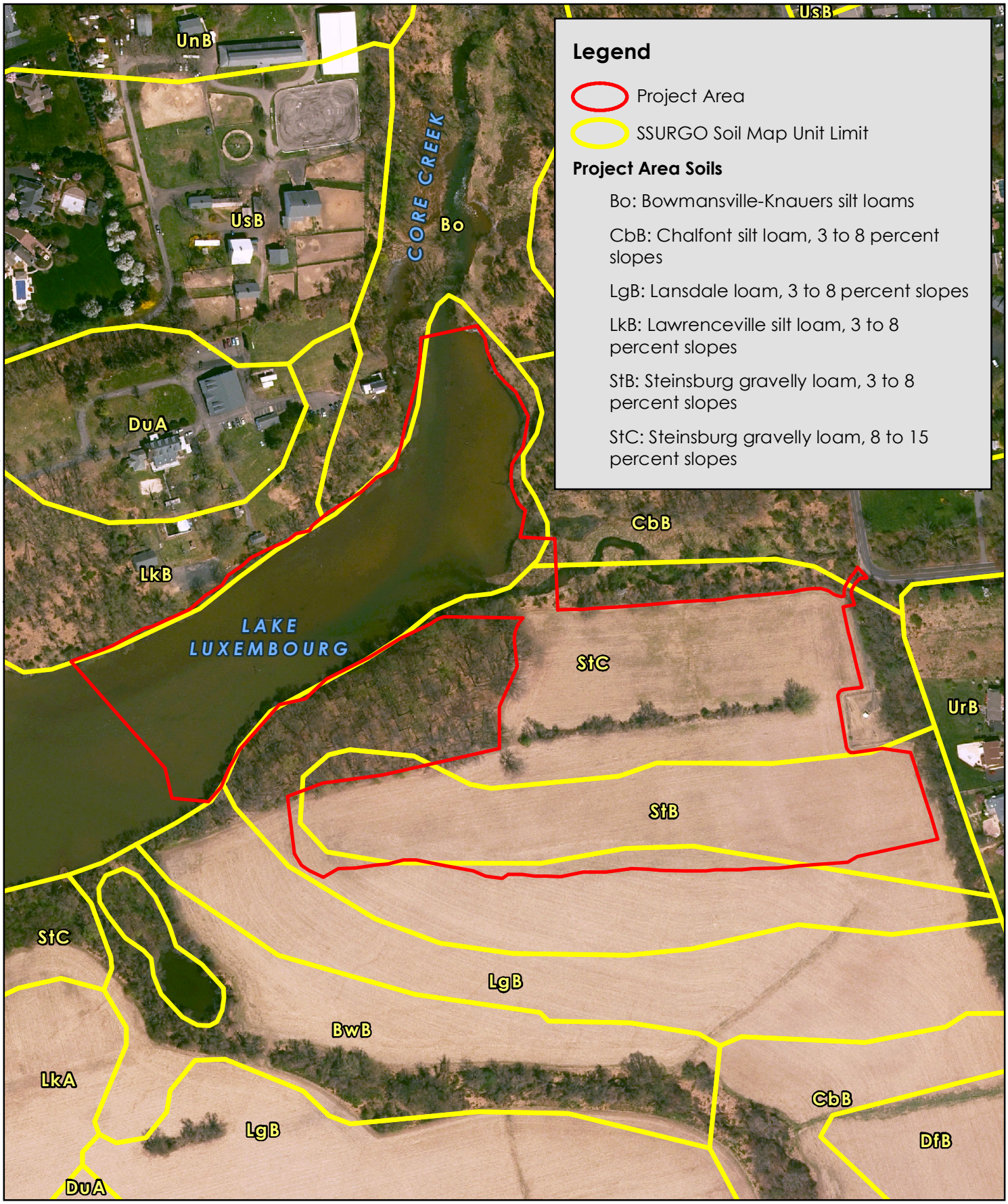


NOTES:
1. Project area is approximate
2. SSURGO Soils obtained from NRCS, USDA, Soil Survey Geographic (SSURGO) Database for Bucks County, PA.
3. 2015 Orthoimagery data obtained from the Pennsylvania Spatial Data Access (PASDA) website: http://www.pasda.psu.edu/

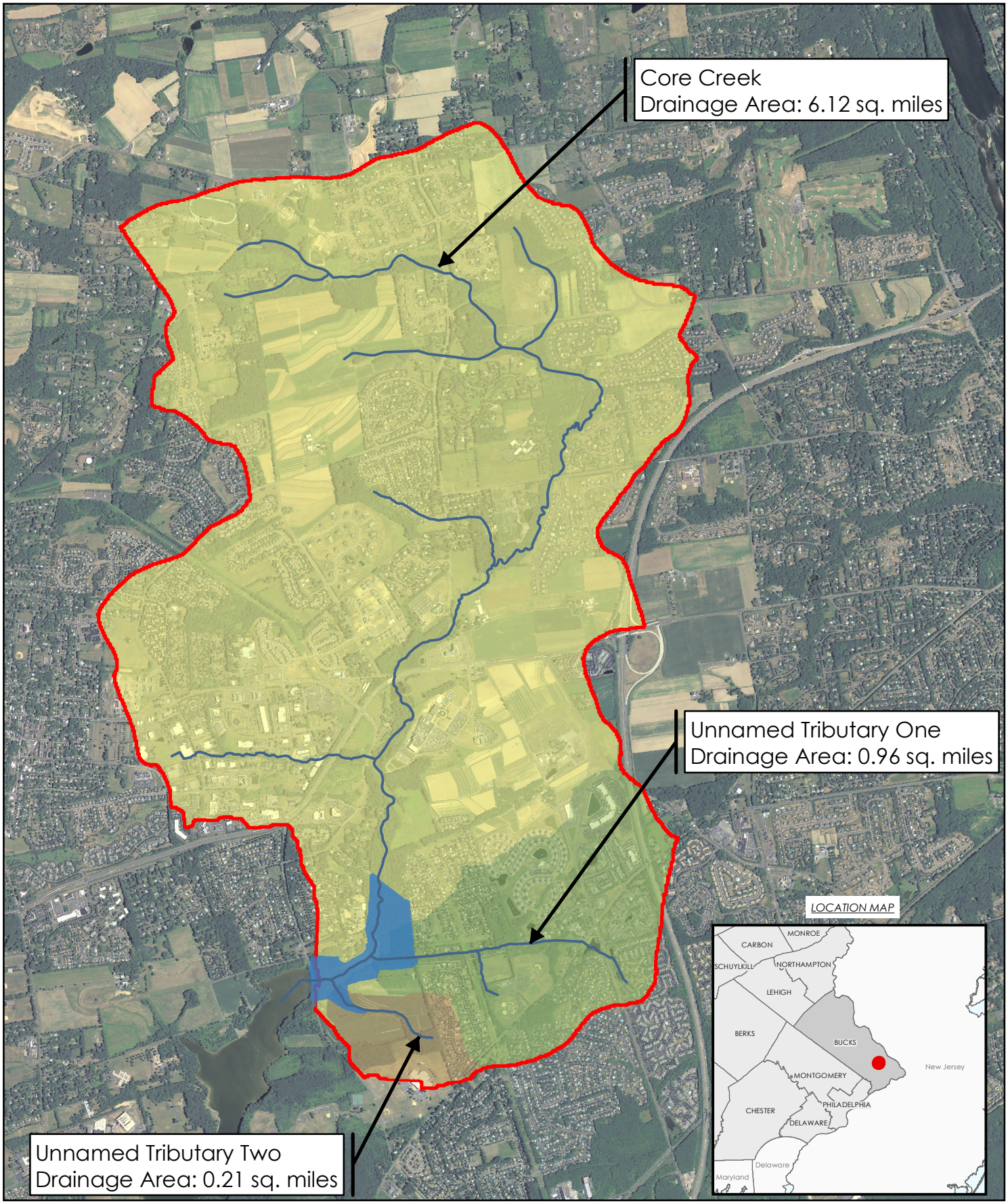
0 150 300 Feet

Map Projection: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

SSURGO SOILS MAP

CONSERVATION POOL HABITAT ENHANCEMENT
LAKE LUXEMBOURG
TOWNSHIP OF MIDDLETOWN
BUCKS COUNTY, PENNSYLVANIA

PRINCETON HYDRO
SCIENCE DESIGN ENGINEERING
www.PrincetonHydro.com



2010 AERIAL DRAINAGE AREA MAP

LAKE LUXEMBOURG
CORE CREEK WATERSHED
TOWNSHIP OF MIDDLETOWN
BUCKS COUNTY, PENNSYLVANIA

PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
*with offices in NJ, PA and CT

NOTES:
1. Project area is approximate.
2. Aerial imagery sourced from the USDA National Agriculture Imagery Program.

0 1,500 3,000 4,500 Feet

Map Projection: NAD 1983 StatePlane New Jersey FIPS 2900 Feet

File: P:\0121\Projects\012016\GIS\MXD\DRAINAGE_AREA.mxd, 10/5/2018, Drawn by eddley, Copyright Princeton Hydro, LLC.

APPENDIX B:

SOIL REPORTS

United States Department of Agriculture

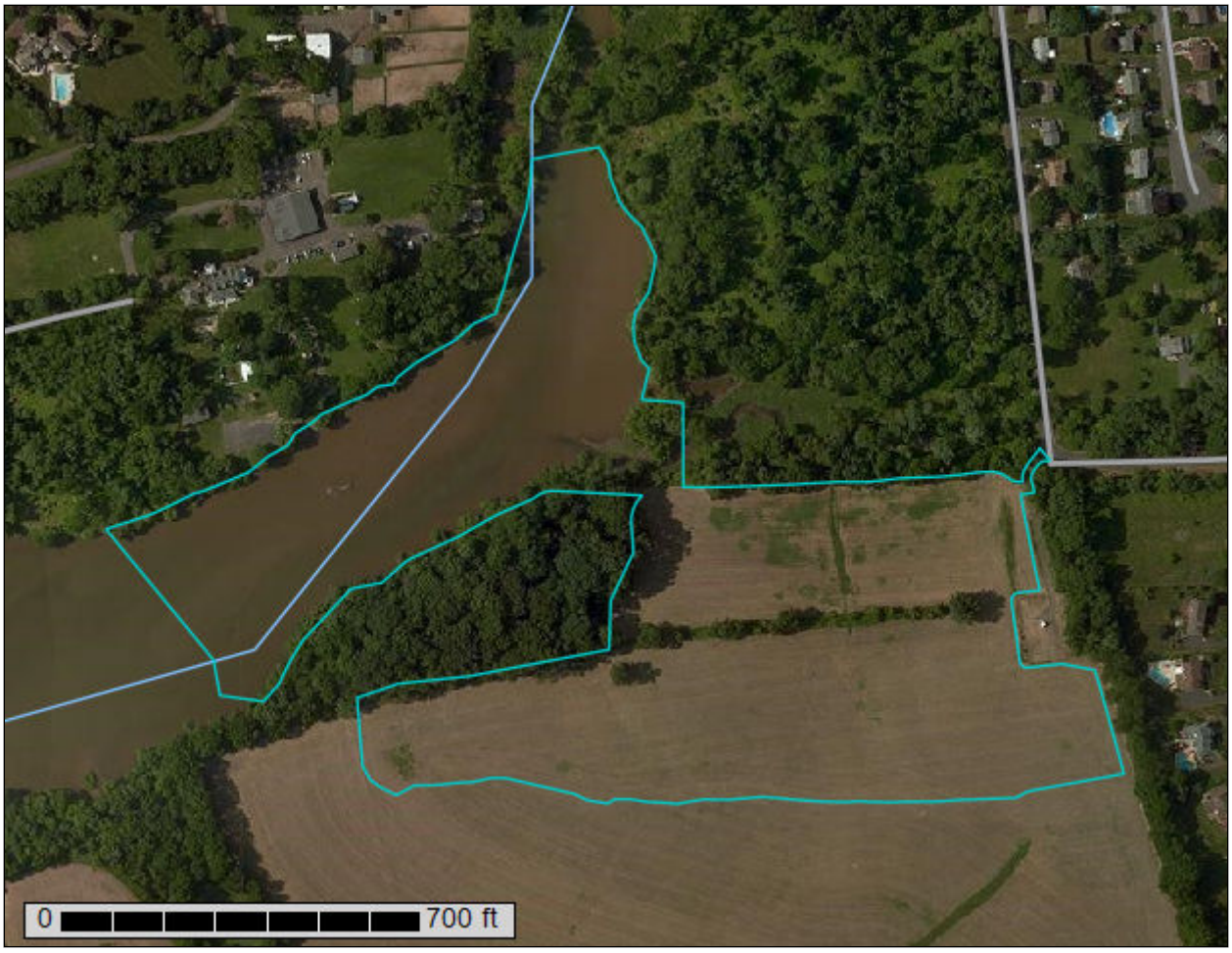
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Bucks County, Pennsylvania

Lake Luxembourg Project Area



May 10, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

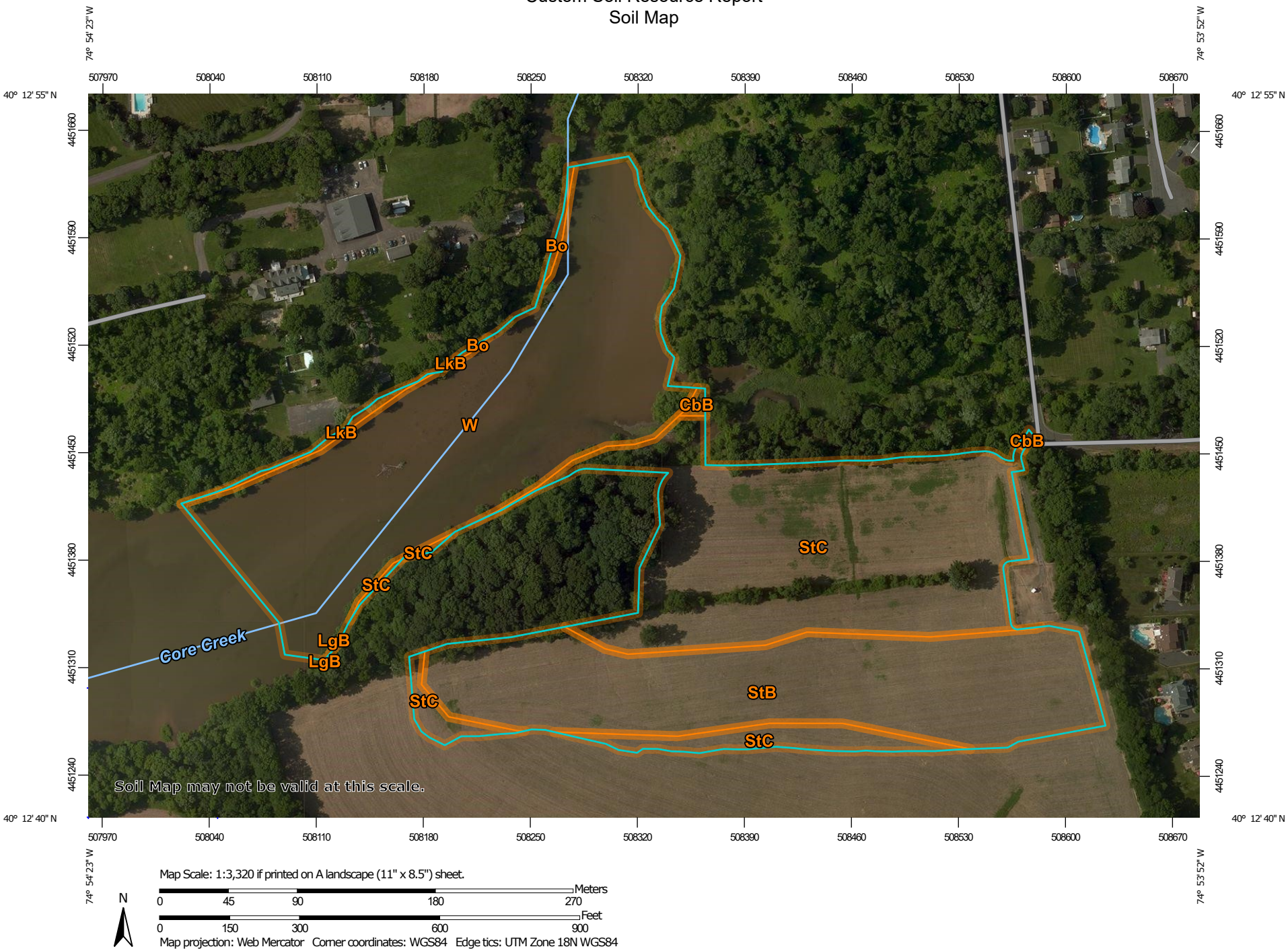
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bucks County, Pennsylvania
Survey Area Data: Version 15, Sep 18, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2014—Jul 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bo	Bowmansville-Knauers silt loams	0.1	0.3%
CbB	Chalfont silt loam, 3 to 8 percent slopes	0.1	0.3%
LgB	Lansdale loam, 3 to 8 percent slopes	0.0	0.0%
LkB	Lawrenceville silt loam, 3 to 8 percent slopes	0.1	0.5%
StB	Steinsburg gravelly loam, 3 to 8 percent slopes	6.5	26.4%
StC	Steinsburg gravelly loam, 8 to 15 percent slopes	8.7	34.9%
W	Water	9.4	37.7%
Totals for Area of Interest		**24.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Bucks County, Pennsylvania

Bo—Bowmansville-Knauers silt loams

Map Unit Setting

National map unit symbol: l7nk
Elevation: 150 to 900 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 150 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Bowmansville and similar soils: 40 percent
Knauers and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bowmansville

Setting

Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Recent alluvial deposits weathered from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: silt loam
Bg - 7 to 26 inches: silty clay loam
Cg - 26 to 43 inches: fine sandy loam
2Cg - 43 to 65 inches: stratified gravel to sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 72 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Hydric soil rating: No

Description of Knauers

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Recent alluvium derived from sandstone and shale

Typical profile

A - 0 to 8 inches: silt loam
Bg1 - 8 to 17 inches: silt loam
Bg2 - 17 to 24 inches: gravelly sandy loam
2Cg - 24 to 60 inches: stratified sand to gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 72 to 99 inches to lithic bedrock
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Occasional
Frequency of ponding: Frequent
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Rowland

Percent of map unit: 20 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

CbB—Chalfont silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7nx
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Lawrenceville

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope

Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

LgB—Lansdale loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7qd
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Reaville
Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

LkB—Lawrenceville silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: l7qm
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Lawrenceville and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile
Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Btx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Lansdale

Percent of map unit: 12 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

StB—Steinsburg gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sb
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Abbottstown

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Hydric soil rating: No

StC—Steinsburg gravelly loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7sc
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from conglomerate and/or residuum weathered from sandstone

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Abbottstown
Percent of map unit: 10 percent
Hydric soil rating: No

W—Water

Map Unit Setting
National map unit symbol: l7th
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting
Parent material: Rivers streams ponds

Properties and qualities
Runoff class: Negligible
Frequency of ponding: Frequent

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United States Department of Agriculture

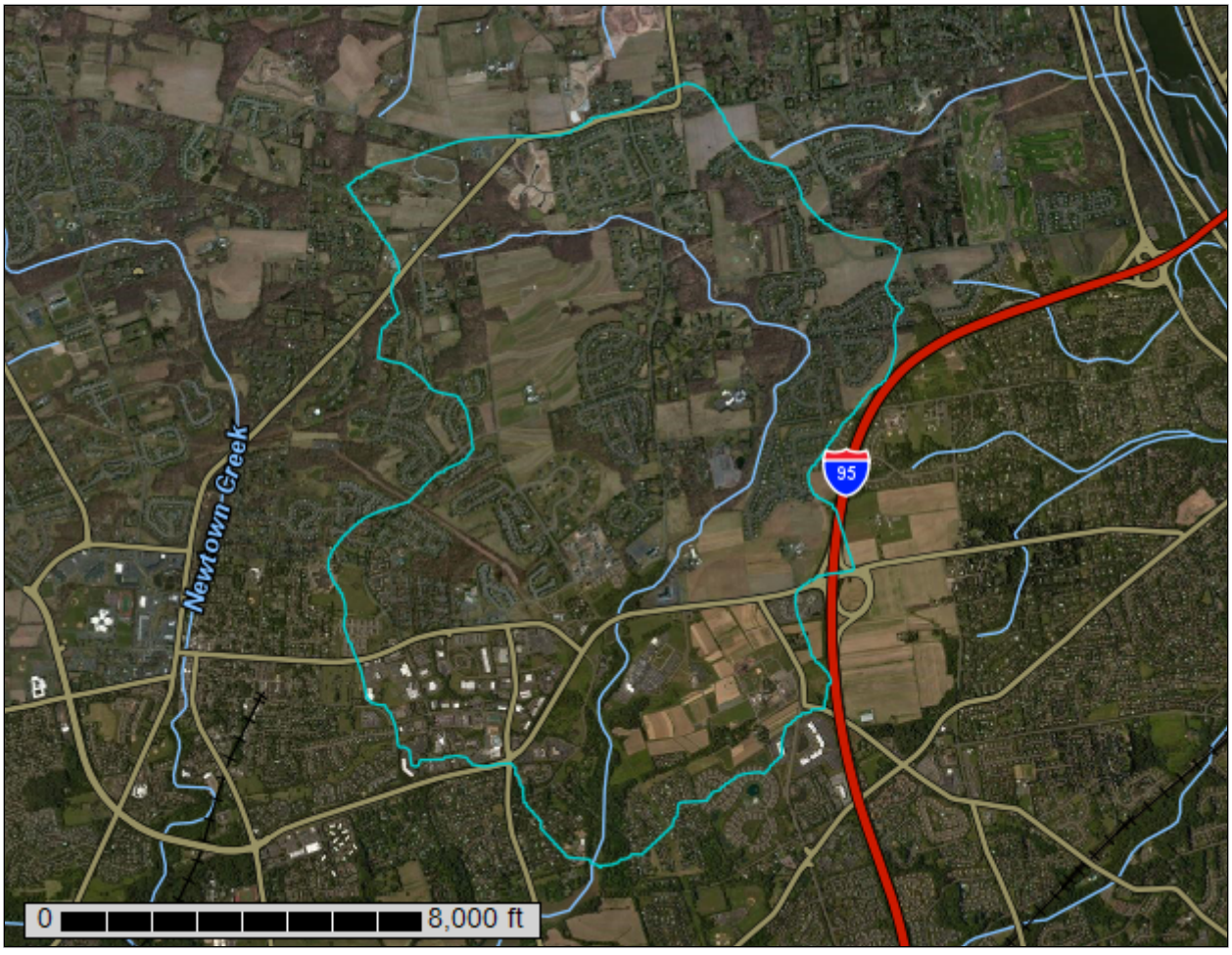
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Bucks County, Pennsylvania

Core Creek Drainage Area



July 14, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

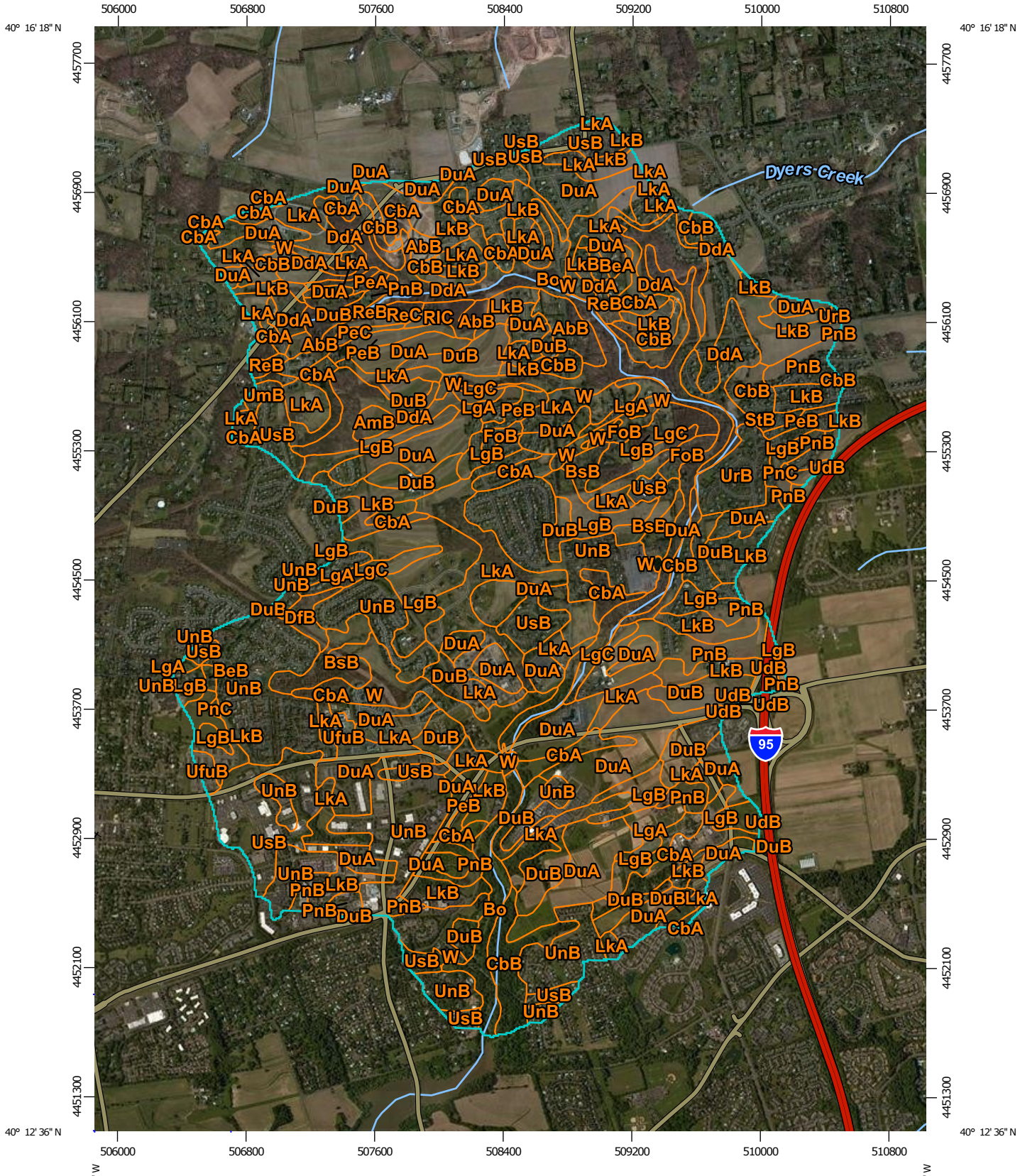
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:33,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 450 900 1800 2700

Feet
0 1500 3000 6000 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bucks County, Pennsylvania
Survey Area Data: Version 11, Nov 16, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 19, 2011—Jul 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Bucks County, Pennsylvania (PA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AbB	Abbottstown silt loam, 3 to 8 percent slopes	44.1	1.1%
AmB	Amwell silt loam, 3 to 8 percent slopes	9.5	0.2%
BeA	Bedington channery silt loam, 0 to 3 percent slopes	4.4	0.1%
BeB	Bedington channery silt loam, 3 to 8 percent slopes	2.8	0.1%
Bo	Bowmansville-Knauers silt loams	248.8	6.4%
BsB	Brownsburg silt loam, 3 to 8 percent slopes	63.0	1.6%
CbA	Chalfont silt loam, 0 to 3 percent slopes	305.9	7.8%
CbB	Chalfont silt loam, 3 to 8 percent slopes	118.4	3.0%
DdA	Doylestown silt loam, 0 to 3 percent slopes	180.9	4.6%
DfB	Duffield silt loam, 3 to 8 percent slopes	13.0	0.3%
DuA	Duncannon silt loam, 0 to 3 percent slopes	599.5	15.3%
DuB	Duncannon silt loam, 3 to 8 percent slopes	245.2	6.3%
FoB	Fountainville silt loam, 3 to 8 percent slopes	33.1	0.8%
KlB	Klinesville very channery silt loam, 3 to 8 percent slopes	7.4	0.2%
LgA	Lansdale loam, 0 to 3 percent slopes	49.4	1.3%
LgB	Lansdale loam, 3 to 8 percent slopes	254.0	6.5%
LgC	Lansdale loam, 8 to 15 percent slopes	36.5	0.9%
LkA	Lawrenceville silt loam, 0 to 3 percent slopes	438.8	11.2%
LkB	Lawrenceville silt loam, 3 to 8 percent slopes	256.9	6.6%
PeA	Penn channery silt loam, 0 to 3 percent slopes	3.5	0.1%
PeB	Penn channery silt loam, 3 to 8 percent slopes	38.1	1.0%
PeC	Penn channery silt loam, 8 to 15 percent slopes	5.5	0.1%

Bucks County, Pennsylvania (PA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
PnB	Penn-Lansdale complex, 3 to 8 percent slopes	139.5	3.6%
PnC	Penn-Lansdale complex, 8 to 15 percent slopes	6.7	0.2%
ReB	Readington silt loam, 3 to 8 percent slopes	21.1	0.5%
ReC	Readington silt loam, 8 to 15 percent slopes	4.9	0.1%
RlB	Reaville channery silt loam, 3 to 8 percent slopes	8.5	0.2%
RlC	Reaville channery silt loam, 8 to 15 percent slopes	14.2	0.4%
StB	Steinsburg gravelly loam, 3 to 8 percent slopes	6.0	0.2%
UdB	Udorthents, shale and sandstone	11.7	0.3%
UfuB	Urban land, 0 to 8 percent slopes	10.4	0.3%
UmB	Urban land-Doylestown complex, 0 to 8 percent slopes	6.6	0.2%
UnB	Urban land-Duffield complex, 0 to 8 percent slopes	483.8	12.4%
UrB	Urban land-Lansdale complex, 0 to 8 percent slopes	44.6	1.1%
UsB	Urban land-Lawrenceville complex, 0 to 8 percent slopes	182.0	4.6%
W	Water	16.2	0.4%
Totals for Area of Interest		**3,914.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called

noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Bucks County, Pennsylvania

AbB—Abbottstown silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7n4
Elevation: 200 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 130 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Abbottstown and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Abbottstown

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Acid reddish brown residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 20 inches: silt loam
Bx - 20 to 39 inches: channery loam
BCg - 39 to 48 inches: channery silt loam
R - 48 to 49 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 40 to 60 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Penn

Percent of map unit: 5 percent

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Croton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Klinesville

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Convex

AmB—Amwell silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7n9
Elevation: 100 to 1,000 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Amwell and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amwell

Setting

Landform: Hillslopes
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Fine-loamy colluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silty clay loam

Btx - 21 to 57 inches: channery silt loam
C - 57 to 75 inches: very channery loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 30 inches to fragipan; 40 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Croton

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Lawrenceville

Percent of map unit: 3 percent

Reaville

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

BeA—Bedington channery silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7ng
Elevation: 300 to 1,500 feet
Mean annual precipitation: 35 to 65 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 214 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Bedington, channery silt loam, and similar soils: 90 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bedington, Channery Silt Loam

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Fine-loamy residuum weathered from shale and siltstone sedimentary rock

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt - 10 to 43 inches: very channery silt loam
C - 43 to 63 inches: extremely channery silt loam
R - 63 to 73 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Culleoka
Percent of map unit: 1 percent

Berks
Percent of map unit: 1 percent
Landform: Ridges, valleys
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Readington
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Abbottstown
Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

Fountainville
Percent of map unit: 1 percent

BeB—Bedington channery silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: l7nh
Elevation: 300 to 1,600 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 214 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Bedington and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bedington

Setting
Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear

Across-slope shape: Concave
Parent material: Acid residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 9 inches: channery silt loam
H2 - 9 to 29 inches: channery silty clay loam
H3 - 29 to 72 inches: very channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 60 to 80 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Comly

Percent of map unit: 7 percent

Berks

Percent of map unit: 5 percent
Landform: Ridges, valleys
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Weikert

Percent of map unit: 3 percent

Bo—Bowmansville-Knauers silt loams

Map Unit Setting

National map unit symbol: l7nk
Elevation: 150 to 900 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 150 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Bowmansville and similar soils: 40 percent
Knauers and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Knauers

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Recent alluvium derived from sandstone and shale

Typical profile

A - 0 to 8 inches: silt loam
Bg1 - 8 to 17 inches: silt loam
Bg2 - 17 to 24 inches: gravelly sandy loam
2Cg - 24 to 60 inches: stratified sand to gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 72 to 99 inches to lithic bedrock
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Occasional
Frequency of ponding: Frequent
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D

Description of Bowmansville

Setting

Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Recent alluvial deposits weathered from sandstone and siltstone

Typical profile

Ap - 0 to 7 inches: silt loam
Bg - 7 to 26 inches: silty clay loam
Cg - 26 to 43 inches: fine sandy loam
2Cg - 43 to 65 inches: stratified gravel to sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: 72 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D

Minor Components

Rowland

Percent of map unit: 20 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

BsB—Brownsburg silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7ns
Elevation: 300 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 130 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Brownsburg and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brownsburg

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Parent material: Fine-silty loess over residuum weathered from red shale and siltstone

Typical profile

A - 0 to 10 inches: silt loam
B - 10 to 30 inches: silt loam
B - 30 to 44 inches: very channery loam
C - 44 to 56 inches: extremely channery silt loam
R - 56 to 66 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Klinesville

Percent of map unit: 3 percent

Chalfont

Percent of map unit: 3 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

CbA—Chalfont silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7nw
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Doylestown

Percent of map unit: 7 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Lawrenceville

Percent of map unit: 3 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

CbB—Chalfont silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7nx
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Lawrenceville

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DdA—Doylestown silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7pb
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 140 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Doylestown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Doylestown

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Eolian deposits over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 6 inches: silt loam
Btg - 6 to 28 inches: silt loam
Btx - 28 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 60 to 72 inches to lithic bedrock
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D

Minor Components

Lawrenceville

Percent of map unit: 10 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Bowmansville

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DfB—Duffield silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7pd
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duffield and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 53 inches: silty clay loam
C - 53 to 72 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 48 to 120 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Clarksburg

Percent of map unit: 5 percent
Landform: Valley flats
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Ryder

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Thorndale

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DuA—Duncannon silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7pg
Elevation: 400 to 700 feet
Mean annual precipitation: 35 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duncannon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duncannon

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 45 inches: silt loam
2C - 45 to 68 inches: channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Lawrenceville

Percent of map unit: 9 percent

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Fountainville

Percent of map unit: 1 percent

DuB—Duncannon silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7ph
Elevation: 400 to 700 feet

Mean annual precipitation: 35 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duncannon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duncannon

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 45 inches: silt loam
2C - 45 to 68 inches: channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Lawrenceville

Percent of map unit: 8 percent

Chalfont

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Fountainville

Percent of map unit: 1 percent

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

FoB—Fountainville silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7pr
Elevation: 250 to 1,000 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Fountainville and similar soils: 90 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fountainville

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 22 inches: silt loam
2Btx - 22 to 46 inches: channery silt loam
R - 46 to 56 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to fragipan; 40 to 60 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Abbottstown

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

KlB—Klinesville very channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7q6
Elevation: 200 to 1,300 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 130 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Klinesville and similar soils: 85 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Klinesville

Setting

Landform: Hillsides
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Red, residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bw - 8 to 14 inches: very channery silt loam
C - 14 to 18 inches: extremely channery silt loam
R - 18 to 28 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Minor Components

Penn

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Reaville

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Nestoria

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope

Bowmansville

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Klinesville

Percent of map unit: 1 percent

LgA—Lansdale loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7qc
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: loam
Bt - 10 to 38 inches: loam
C - 38 to 60 inches: loamy sand
R - 60 to 61 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 42 to 72 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Abbottstown

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

LgB—Lansdale loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7qd
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

LgC—Lansdale loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7qf
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

LkA—Lawrenceville silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7ql
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches

Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lawrenceville and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Bx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C

Minor Components

Lansdale

Percent of map unit: 13 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Doylestown

Percent of map unit: 4 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope

Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont
Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

LkB—Lawrenceville silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: l7qm
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Lawrenceville and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile
Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Btx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Lansdale

Percent of map unit: 12 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

PeA—Penn channery silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7rl
Elevation: 200 to 950 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Penn and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penn

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bt - 8 to 21 inches: channery silt loam
C - 21 to 34 inches: very channery silt loam
R - 34 to 44 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B

Minor Components

Readington

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Croton

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

PeB—Penn channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7rm
Elevation: 200 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 130 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Penn and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penn

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bt - 8 to 21 inches: channery silt loam
C - 21 to 34 inches: very channery silt loam
R - 34 to 44 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Readington

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Klinesville

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Convex

Croton

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

PeC—Penn channery silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7rn
Elevation: 200 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 130 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Penn and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penn

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bt - 8 to 21 inches: channery silt loam
C - 21 to 34 inches: very channery silt loam
R - 34 to 44 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Readington

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Klinesville

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Convex

Croton

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

PnB—Penn-Lansdale complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7rv
Elevation: 250 to 950 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Penn and similar soils: 69 percent
Lansdale and similar soils: 25 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penn

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt - 10 to 22 inches: channery silt loam
C - 22 to 28 inches: very channery silt loam
R - 28 to 48 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: channery loam
Bt - 10 to 30 inches: sandy loam
C - 30 to 47 inches: channery loamy sand
R - 47 to 57 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Readington

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

PnC—Penn-Lansdale complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7rw
Elevation: 250 to 1,300 feet

Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 130 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Penn and similar soils: 50 percent
Lansdale and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Penn

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt - 10 to 22 inches: channery silt loam
C - 22 to 28 inches: very channery silt loam
R - 28 to 48 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: channery loam

Bt - 10 to 30 inches: sandy loam
C - 30 to 47 inches: channery loamy sand
R - 47 to 57 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Klinesville

Percent of map unit: 6 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Convex

Reaville

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

ReB—Readington silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7s4
Elevation: 200 to 1,000 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Readington and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Readington

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 8 inches: silt loam
Bt - 8 to 29 inches: silt loam
Btx - 29 to 58 inches: channery silt loam
R - 58 to 68 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 36 inches to fragipan; 40 to 70 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Reaville

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Penn

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Croton

Percent of map unit: 6 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

ReC—Readington silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7s5
Elevation: 200 to 1,000 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Readington and similar soils: 86 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Readington

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 11 inches: silt loam
Bt - 11 to 29 inches: silt loam
Btx - 29 to 58 inches: channery silt loam
R - 58 to 68 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 36 inches to fragipan; 40 to 70 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Minor Components

Penn

Percent of map unit: 7 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Reaville

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Croton

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

RIB—Reaville channery silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7s7
Elevation: 150 to 1,300 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 130 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Reaville and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reaville

Setting

Landform: Drainageways, hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Red triassic residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bt - 8 to 19 inches: channery silty clay loam
C - 19 to 32 inches: very channery silt loam
R - 32 to 42 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Penn

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Klinesville

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope
Down-slope shape: Convex
Across-slope shape: Convex

Bowmansville

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

Joanna

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Abbottstown

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Knauers

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

RIC—Reaville channery silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7s8
Elevation: 150 to 1,400 feet
Mean annual precipitation: 38 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 160 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Reaville and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Reaville

Setting

Landform: Drainageways, hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Red triassic residuum weathered from sandstone and shale

Typical profile

Ap - 0 to 8 inches: channery silt loam
Bt - 8 to 19 inches: channery silty clay loam
C - 19 to 32 inches: very channery silt loam
R - 32 to 42 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Minor Components

Penn

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Steinsburg

Percent of map unit: 1 percent
Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Convex

Abbottstown

Percent of map unit: 1 percent

Knauers

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Bowmansville

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

StB—Steinsburg gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sb
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam

R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Abbottstown

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

UdB—Udorthents, shale and sandstone

Map Unit Setting

National map unit symbol: l7sm
Elevation: 200 to 1,500 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 160 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, shale and sandstone, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Shale And Sandstone

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of shale and siltstone; graded areas of sandstone and shale

Typical profile

Ap - 0 to 6 inches: silt loam
C - 6 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Abbottstown

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Readington

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Reaville

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Bowmansville

Percent of map unit: 2 percent

Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Berks

Percent of map unit: 1 percent
Landform: Ridges, valleys
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

UfuB—Urban land, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sq
Elevation: 800 to 1,500 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Pavement, buildings and other artifically covered areas human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Minor Components

Udorthents, unstable fill

Percent of map unit: 10 percent

Down-slope shape: Linear
Across-slope shape: Linear

UmB—Urban land-Doylestown complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sy
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 161 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Doylestown and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Doylestown

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Eolian deposits over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 45 inches: silt loam
Btx - 45 to 48 inches: silt loam
R - 48 to 58 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 15 to 45 inches to fragipan; 42 to 72 inches to paralithic bedrock
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D

UnB—Urban land-Duffield complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sz
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 44 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Duffield and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 100 inches to lithic bedrock
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Duffield

Setting

Landform: Valleys
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 53 inches: silty clay loam
C - 53 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 48 to 120 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Penlaw

Percent of map unit: 4 percent
Landform: Swales
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Clarksburg

Percent of map unit: 4 percent
Landform: Valley flats
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Thorndale

Percent of map unit: 2 percent
Landform: Depressions

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave

UrB—Urban land-Lansdale complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t1
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lansdale and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: loam
B - 10 to 38 inches: loam
C - 38 to 55 inches: loamy sand
R - 55 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 42 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

UsB—Urban land-Lawrenceville complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t3
Elevation: 200 to 1,000 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 140 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lawrenceville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 9 inches: silt loam
Bt - 9 to 25 inches: silt loam
Bx - 25 to 44 inches: silt loam
C - 44 to 74 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Chalfont

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

W—Water

Map Unit Setting

National map unit symbol: l7th
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Parent material: Rivers streams ponds

Properties and qualities

Runoff class: Negligible
Frequency of ponding: Frequent

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United States Department of Agriculture

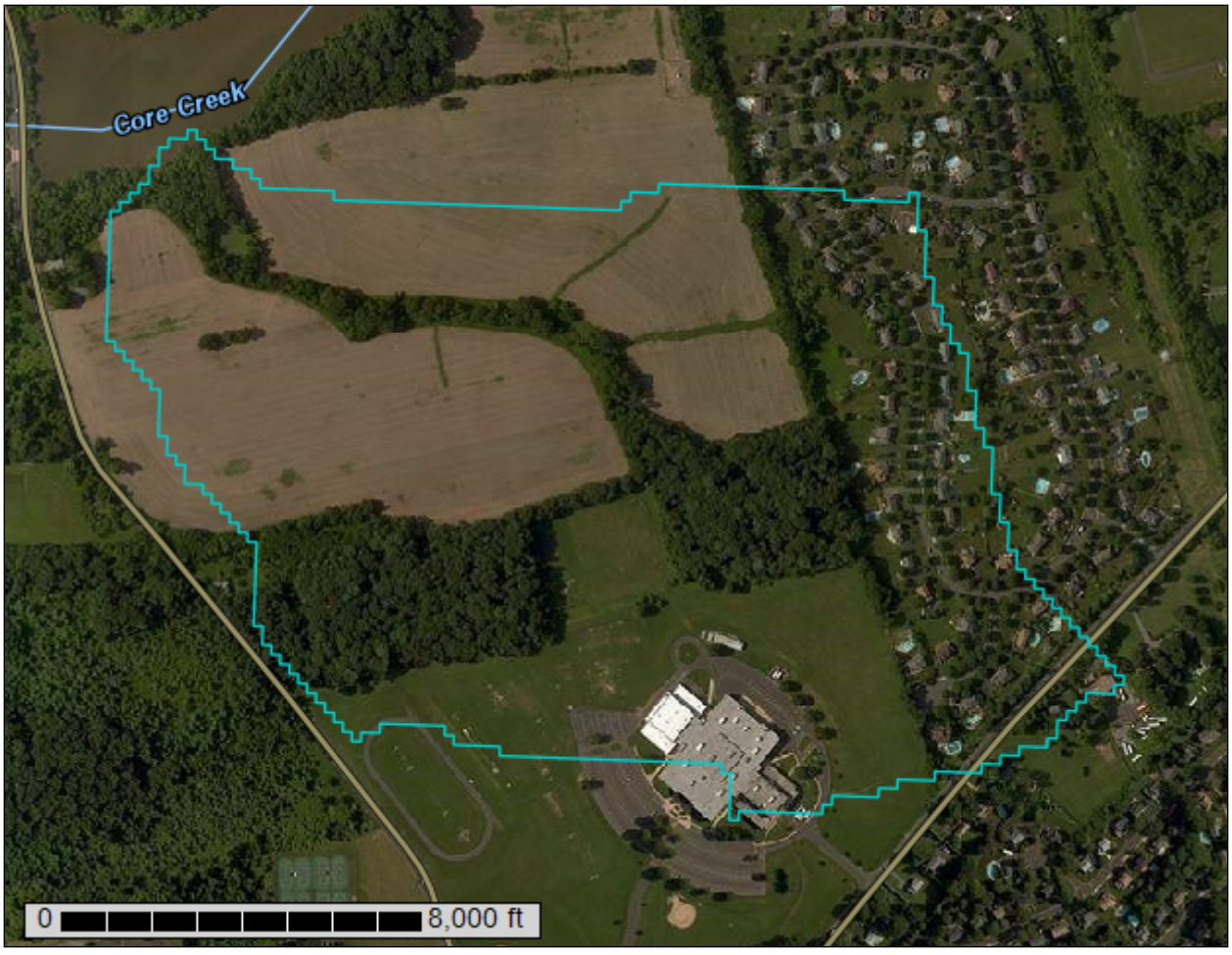
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Bucks County, Pennsylvania

Drainage Feature One Drainage Area



July 14, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bucks County, Pennsylvania
Survey Area Data: Version 11, Nov 16, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2014—Jul 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Bucks County, Pennsylvania (PA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BsB	Brownsburg silt loam, 3 to 8 percent slopes	2.6	1.9%
BwB	Buckingham silt loam, 3 to 8 percent slopes	9.4	7.2%
CbB	Chalfont silt loam, 3 to 8 percent slopes	15.6	11.8%
DfB	Duffield silt loam, 3 to 8 percent slopes	3.7	2.8%
DuA	Duncannon silt loam, 0 to 3 percent slopes	3.6	2.8%
FoB	Fountainville silt loam, 3 to 8 percent slopes	4.6	3.5%
LgB	Lansdale loam, 3 to 8 percent slopes	25.2	19.2%
LkA	Lawrenceville silt loam, 0 to 3 percent slopes	2.4	1.8%
StB	Steinsburg gravelly loam, 3 to 8 percent slopes	9.8	7.5%
StC	Steinsburg gravelly loam, 8 to 15 percent slopes	20.5	15.6%
UfuB	Urban land, 0 to 8 percent slopes	7.9	6.0%
UrB	Urban land-Lansdale complex, 0 to 8 percent slopes	23.0	17.5%
UsB	Urban land-Lawrenceville complex, 0 to 8 percent slopes	2.1	1.6%
W	Water	1.1	0.8%
Totals for Area of Interest		**131.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic

classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar

interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Bucks County, Pennsylvania

BsB—Brownsburg silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7ns
Elevation: 300 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 130 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Brownsburg and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brownsburg

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Fine-silty loess over residuum weathered from red shale and siltstone

Typical profile

A - 0 to 10 inches: silt loam
B - 10 to 30 inches: silt loam
B - 30 to 44 inches: very channery loam
C - 44 to 56 inches: extremely channery silt loam
R - 56 to 66 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Klinesville

Percent of map unit: 3 percent

Chalfont

Percent of map unit: 3 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

BwB—Buckingham silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7nv
Elevation: 150 to 900 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 150 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Buckingham and similar soils: 88 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Buckingham

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Fine-loamy colluvium and old alluvium derived from shale and siltstone

Typical profile

A - 0 to 7 inches: silt loam
Bt - 7 to 30 inches: silt loam
Btx1 - 30 to 44 inches: silty clay loam
Btx2 - 44 to 70 inches: gravelly silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to fragipan; 80 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D

Minor Components

Bowmansville

Percent of map unit: 8 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Knauers

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Croton

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

CbB—Chalfont silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7nx
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Lawrenceville

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DfB—Duffield silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7pd
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duffield and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 53 inches: silty clay loam
C - 53 to 72 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 48 to 120 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Clarksburg

Percent of map unit: 5 percent
Landform: Valley flats
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Ryder

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Thorndale

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DuA—Duncannon silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7pg
Elevation: 400 to 700 feet
Mean annual precipitation: 35 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duncannon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duncannon

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 45 inches: silt loam
2C - 45 to 68 inches: channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Lawrenceville

Percent of map unit: 9 percent

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Fountainville
Percent of map unit: 1 percent

FoB—Fountainville silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: l7pr
Elevation: 250 to 1,000 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Fountainville and similar soils: 90 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fountainville

Setting
Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile
Ap - 0 to 8 inches: silt loam
Bt - 8 to 22 inches: silt loam
2Btx - 22 to 46 inches: channery silt loam
R - 46 to 56 inches: bedrock

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to fragipan; 40 to 60 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Abbottstown

Percent of map unit: 1 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

LgB—Lansdale loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7qd
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

LkA—Lawrenceville silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7ql
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lawrenceville and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Bx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C

Minor Components

Lansdale

Percent of map unit: 13 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Doylestown

Percent of map unit: 4 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope

Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

StB—Steinsburg gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sb
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Abbottstown

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

StC—Steinsburg gravelly loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7sc
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from conglomerate and/or residuum weathered from sandstone

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Abbottstown

Percent of map unit: 10 percent

UfuB—Urban land, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sq
Elevation: 800 to 1,500 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Pavement, buildings and other artifically covered areas human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Minor Components

Udorthents, unstable fill

Percent of map unit: 10 percent
Down-slope shape: Linear
Across-slope shape: Linear

UrB—Urban land-Lansdale complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t1
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lansdale and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: loam
B - 10 to 38 inches: loam
C - 38 to 55 inches: loamy sand
R - 55 to 60 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 42 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

UsB—Urban land-Lawrenceville complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t3
Elevation: 200 to 1,000 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 140 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lawrenceville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 9 inches: silt loam
Bt - 9 to 25 inches: silt loam
Bx - 25 to 44 inches: silt loam
C - 44 to 74 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Chalfont

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

W—Water

Map Unit Setting

National map unit symbol: l7th
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Parent material: Rivers streams ponds

Properties and qualities

Runoff class: Negligible
Frequency of ponding: Frequent

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United States Department of Agriculture

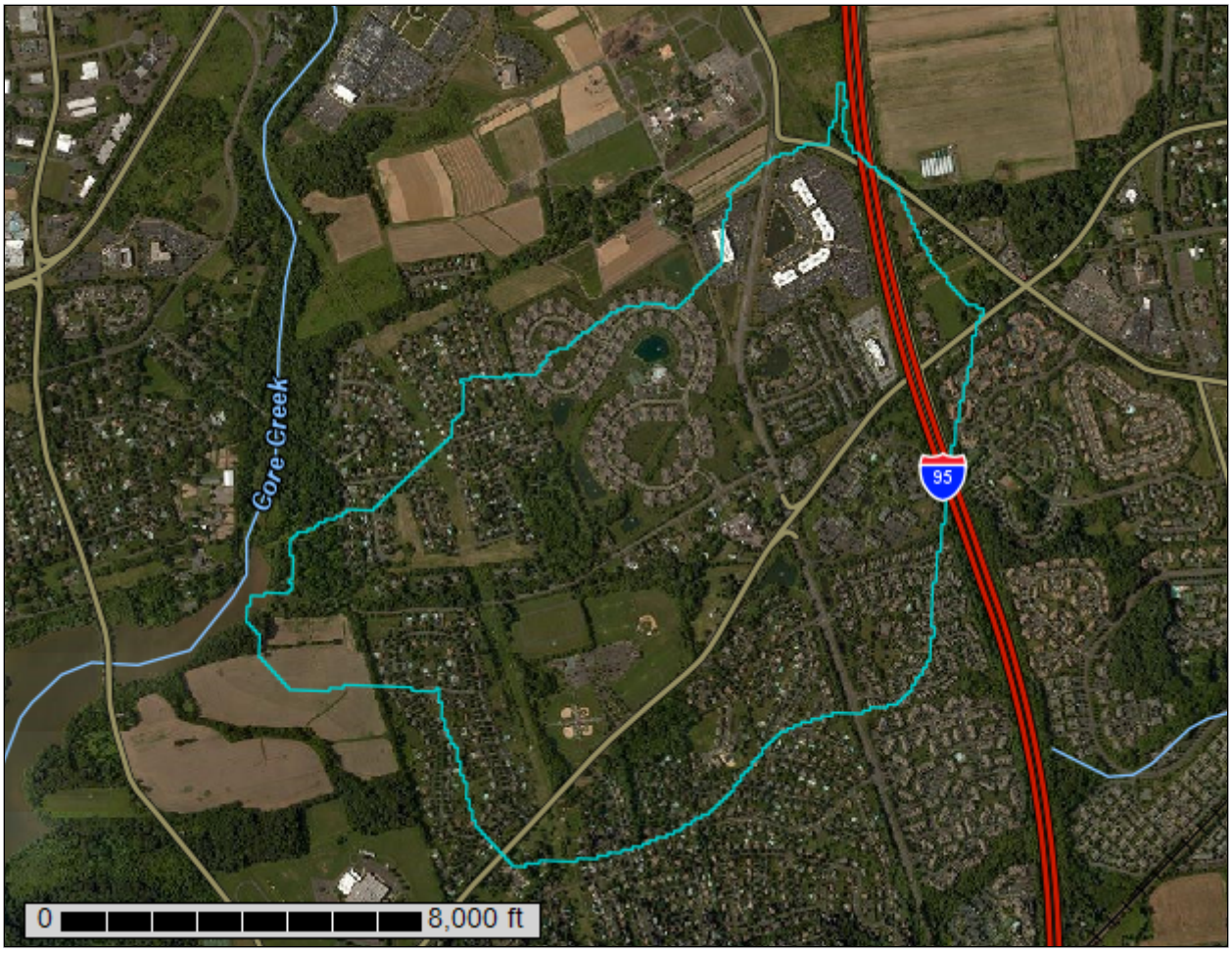
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Bucks County, Pennsylvania

Drainage Feature Two Drainage Area



July 14, 2016

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:16,700 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bucks County, Pennsylvania
Survey Area Data: Version 11, Nov 16, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 20, 2014—Jul 5, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Bucks County, Pennsylvania (PA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BsB	Brownsburg silt loam, 3 to 8 percent slopes	4.7	0.8%
CbA	Chalfont silt loam, 0 to 3 percent slopes	47.4	7.7%
CbB	Chalfont silt loam, 3 to 8 percent slopes	72.3	11.7%
DdA	Doylestown silt loam, 0 to 3 percent slopes	5.1	0.8%
DfB	Duffield silt loam, 3 to 8 percent slopes	21.2	3.4%
DuA	Duncannon silt loam, 0 to 3 percent slopes	58.7	9.5%
DuB	Duncannon silt loam, 3 to 8 percent slopes	12.8	2.1%
LgA	Lansdale loam, 0 to 3 percent slopes	19.8	3.2%
LgB	Lansdale loam, 3 to 8 percent slopes	4.4	0.7%
LkA	Lawrenceville silt loam, 0 to 3 percent slopes	11.3	1.8%
LkB	Lawrenceville silt loam, 3 to 8 percent slopes	61.6	10.0%
StB	Steinsburg gravelly loam, 3 to 8 percent slopes	31.5	5.1%
StC	Steinsburg gravelly loam, 8 to 15 percent slopes	12.3	2.0%
UdB	Udorthents, shale and sandstone	15.4	2.5%
UmB	Urban land-Doylestown complex, 0 to 8 percent slopes	18.1	2.9%
UnB	Urban land-Duffield complex, 0 to 8 percent slopes	53.5	8.7%
UrB	Urban land-Lansdale complex, 0 to 8 percent slopes	93.7	15.2%
UrC	Urban land-Lansdale complex, 8 to 15 percent slopes	10.8	1.7%
UsB	Urban land-Lawrenceville complex, 0 to 8 percent slopes	58.9	9.5%
W	Water	3.9	0.6%
Totals for Area of Interest		**617.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly

indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Bucks County, Pennsylvania

BsB—Brownsburg silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7ns
Elevation: 300 to 1,300 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 130 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Brownsburg and similar soils: 90 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brownsburg

Setting

Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Fine-silty loess over residuum weathered from red shale and siltstone

Typical profile

A - 0 to 10 inches: silt loam
B - 10 to 30 inches: silt loam
B - 30 to 44 inches: very channery loam
C - 44 to 56 inches: extremely channery silt loam
R - 56 to 66 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Klinesville

Percent of map unit: 3 percent

Chalfont

Percent of map unit: 3 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

CbA—Chalfont silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7nw
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Doylestown

Percent of map unit: 7 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Lawrenceville

Percent of map unit: 3 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

CbB—Chalfont silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7nx
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Chalfont and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chalfont

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 21 inches: silt loam
Bx - 21 to 57 inches: channery silt loam
2C - 57 to 70 inches: very channery silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 42 to 99 inches to lithic bedrock
Natural drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D

Minor Components

Lawrenceville

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

DdA—Doylestown silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7pb
Elevation: 200 to 1,500 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 140 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Doylestown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Doylestown

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Eolian deposits over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 6 inches: silt loam
Btg - 6 to 28 inches: silt loam
Btx - 28 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 30 inches to fragipan; 60 to 72 inches to lithic bedrock
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D

Minor Components

Lawrenceville

Percent of map unit: 10 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

Bowmansville

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DfB—Duffield silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7pd
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duffield and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 53 inches: silty clay loam
C - 53 to 72 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 48 to 120 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Clarksburg

Percent of map unit: 5 percent
Landform: Valley flats
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Ryder

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Thorndale

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

DuA—Duncannon silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7pg
Elevation: 400 to 700 feet
Mean annual precipitation: 35 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Duncannon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duncannon

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 45 inches: silt loam
2C - 45 to 68 inches: channery silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Lawrenceville

Percent of map unit: 9 percent

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Fountainville
Percent of map unit: 1 percent

DuB—Duncannon silt loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: l7ph
Elevation: 400 to 700 feet
Mean annual precipitation: 35 to 48 inches
Mean annual air temperature: 45 to 63 degrees F
Frost-free period: 150 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Duncannon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duncannon

Setting
Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Typical profile
Ap - 0 to 10 inches: silt loam
Bt - 10 to 45 inches: silt loam
2C - 45 to 68 inches: channery silt loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Lawrenceville
Percent of map unit: 8 percent

Chalfont
Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Fountainville
Percent of map unit: 1 percent

Doylestown
Percent of map unit: 1 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

LgA—Lansdale loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: l7qc
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Lansdale and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 10 inches: loam
Bt - 10 to 38 inches: loam
C - 38 to 60 inches: loamy sand
R - 60 to 61 inches: bedrock

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 42 to 72 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Abbottstown

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

LgB—Lansdale loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7qd
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope, interfluve
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave

LkA—Lawrenceville silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l7ql
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lawrenceville and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Bx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C

Minor Components

Lansdale

Percent of map unit: 13 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Doylestown

Percent of map unit: 4 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

LkB—Lawrenceville silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7qm
Elevation: 200 to 1,600 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Lawrenceville and similar soils: 83 percent
Minor components: 17 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lawrenceville

Setting

Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 12 inches: silt loam
Bt - 12 to 26 inches: silt loam
Btx - 26 to 47 inches: silt loam
C - 47 to 75 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Lansdale

Percent of map unit: 12 percent
Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Doylestown

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Chalfont

Percent of map unit: 2 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

StB—Steinsburg gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sb
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Abbottstown

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope

StC—Steinsburg gravelly loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l7sc
Elevation: 300 to 1,400 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 170 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steinsburg and similar soils: 85 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steinsburg

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from conglomerate and/or residuum weathered from sandstone

Typical profile

Ap - 0 to 8 inches: gravelly loam
Bw - 8 to 15 inches: sandy loam
C - 15 to 30 inches: very gravelly sandy loam
R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

Minor Components

Abbottstown

Percent of map unit: 10 percent

UdB—Udorthents, shale and sandstone

Map Unit Setting

National map unit symbol: l7sm
Elevation: 200 to 1,500 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 160 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, shale and sandstone, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Shale And Sandstone

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of shale and siltstone; graded areas of sandstone and shale

Typical profile

Ap - 0 to 6 inches: silt loam
C - 6 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear

Abbottstown

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Readington

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Reaville

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Bowmansville

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Berks

Percent of map unit: 1 percent
Landform: Ridges, valleys
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

UmB—Urban land-Doylestown complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sy
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 161 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Doylestown and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Doylestown

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Eolian deposits over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 45 inches: silt loam
Btx - 45 to 48 inches: silt loam
R - 48 to 58 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 15 to 45 inches to fragipan; 42 to 72 inches to paralithic bedrock
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D

UnB—Urban land-Duffield complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7sz
Elevation: 200 to 1,500 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 44 to 57 degrees F
Frost-free period: 120 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Duffield and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 100 inches to lithic bedrock
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Duffield

Setting

Landform: Valleys
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone

Typical profile

Ap - 0 to 10 inches: silt loam
Bt - 10 to 53 inches: silty clay loam
C - 53 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 48 to 120 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Minor Components

Penlaw

Percent of map unit: 4 percent
Landform: Swales
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Clarksburg

Percent of map unit: 4 percent
Landform: Valley flats
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

Thorndale

Percent of map unit: 2 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear, concave

UrB—Urban land-Lansdale complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t1
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lansdale and similar soils: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile
Ap - 0 to 10 inches: loam
B - 10 to 38 inches: loam
C - 38 to 55 inches: loamy sand
R - 55 to 60 inches: bedrock

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: 42 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

UrC—Urban land-Lansdale complex, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: l7t2
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 160 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 50 percent
Lansdale and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile
H1 - 0 to 6 inches: variable

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 7 inches: loam
B - 7 to 29 inches: loam
C - 29 to 60 inches: loamy sand
R - 60 to 70 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 42 to 99 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B

UsB—Urban land-Lawrenceville complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: l7t3
Elevation: 200 to 1,000 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F

Frost-free period: 140 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Lawrenceville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Runoff class: Very high
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Description of Lawrenceville

Setting

Landform: Upland slopes, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Loess over residuum weathered from shale and siltstone

Typical profile

Ap - 0 to 9 inches: silt loam
Bt - 9 to 25 inches: silt loam
Bx - 25 to 44 inches: silt loam
C - 44 to 74 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 24 to 38 inches to fragipan; 48 to 99 inches to lithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Minor Components

Chalfont

Percent of map unit: 5 percent
Landform: Upland slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

Doylestown

Percent of map unit: 5 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope, footslope, backslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave

W—Water

Map Unit Setting

National map unit symbol: l7th
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 46 to 59 degrees F
Frost-free period: 120 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Parent material: Rivers streams ponds

Properties and qualities

Runoff class: Negligible
Frequency of ponding: Frequent

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APPENDIX C:

DAM ELEVATION CONVERSION

Questions concerning the VERTCON process may be mailed to _NGS

Latitude: 40 11 48.070

Longitude: 074 55 08.710

NGVD 29 height: 118.00 FT

Datum shift(NAVD 88 minus NGVD 29): -1.020 feet

Converted to NAVD 88 height: 116.980 feet

APPENDIX D:

STORMWATER CALCULATIONS

Worksheet 4. Change in Runoff Volume for 2-YR Storm Event

PROJECT: Lake Luxembourg Conservation Pool Habitat Enhancement Design
Drainage Area: 4,588 Arces - Full Drainage Area
2-Year Rainfall: 3.34 in

Total Site Area: 24.51 acres
Protected Site Area: 0 acres
Managed Area: 24.51 acres

Existing Conditions: SAME AS DEVELOPED

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland								
Meadow								
Impervious								
TOTAL:								

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Water	N/A	420,800	9,660	100	0	0	3.34	117,123
Brush	B	19,605	0.450	48	10.833	2.167	0.115	188
Brush	D	2,895	0.066	73	3.699	0.740	1.073	259
Fields (Fallow, Crop Residue)	B	624,390	14.334	83	2.048	0.410	1.725	89,756
TOTAL:		1,067,690	24.51				6.253	207,326

2-Year Volume Increase (ft3): 0

2-Year Volume Increase = Developed Conditions Runoff Volume – Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

3. Summary Table for Supporting Calculation and Measurement Data

☒ Not Applicable in accordance with 102.8(g)(2)(iv)- provide supporting calculations and documentation in the Narrative. **If checked, proceed to Peak Rate Analysis** (provide supporting details to include a summary, calculations, and a statement and demonstration of attainment in the Narrative- Reference the *Instructions for a General (PAG-02) OR Individual NPDES Permit for stormwater discharges associated with construction activities* Section D)

☐ Not Applicable PCSM Plan satisfies an Act 167 Plan approved on or after January 2005, in its entirety- provide supporting calculations and documentation in the Narrative. **If checked proceed to Section D.4** (provide supporting details to include a summary, calculations and a statement and demonstration of attainment in the Narrative- Reference the *Instructions for a General (PAG-02) OR Individual NPDES Permit for stormwater discharges associated with construction activities* Section D)

Please reference the stormwater methodology used (Numbers generated in the table below should be consistent with Worksheets 3,4, and 5 and be accompanied by supporting calculations in the Narrative)
HydroCAD 10.00-22; SCS TR-20 Runoff Method

	Pre-construction	**Post Construction**	**Net Change**
Design storm frequency _____ Rainfall amount _____ inches			
Impervious area (acres)	1	2	3
Volume of stormwater runoff ☐ acre-feet or ☐ cubic feet (check appropriate box)	4	5	6
Volume of stormwater runoff ☐ acre-feet or ☐ cubic feet (check appropriate box)		7	8
Peak Rate Analysis: Complete Boxes 9-20 (Numbers generated in table should be accompanied by supporting calculations in the narrative) ☐ Exempt in accordance 102.8(g)(3)(ii), Complete Boxes 9-20 ☐ Not Applicable in accordance with 102.8(g)(3)(iii) {If any of the above is checked, provide supporting calculations and documentation in the Narrative}			
Stormwater peak discharge rate for the 2-year/24-hour storm (cubic feet per second (cfs))	9 85.01	10 85.01	11 0
Stormwater peak discharge rate for 10-year/24-hour storm (cfs)	12 140.42	13 140.42	14 0
Stormwater peak discharge rate for 50-year/24-hour storm (cfs)	15 208.80	16 208.80	17 0
Stormwater peak discharge rate for the 100-year/24-hour storm	18 243.04	19 243.04	20 0

Box 1. **Pre-construction impervious area**: The total acres of impervious area on the project site before construction activities begin, based on land use for five years preceding the planned project.

Box 2. **Post construction impervious area**: The total acres of impervious area on the project site after construction activities have been completed.

Box 3. **Net change of impervious area**: The change in the impervious area (acres) listed in Box 1 and Box 2. Zero or negative values are acceptable. (Box 2- Box 1)

Box 4. **Pre-construction stormwater runoff volume**: The amount of stormwater runoff volume from the project site that would result from the design storm occurrence before construction activities begin based on land use for five years preceding the project.

Box 5. **Post construction stormwater runoff volume**: The amount of stormwater runoff volume from the project site that would result from the design storm occurrence after construction activities have finished assuming that no non-structural/structural BMP(s) have been installed.

Box 6. **Net change in stormwater volume**: The change in stormwater runoff volumes listed in Box 4 and Box 5. (Box 5 - Box 4)

Box 7. **Post construction stormwater runoff volume reduction**: The amount of stormwater runoff volume reduction that would result from the planned non-structural/structural BMP(s) installation. (Total non-structural volume credit (*from worksheet 3*) + Total Structural volume (*from worksheet 5)*))

Box 8. **Net change in stormwater runoff volume with planned BMPs**: The change in stormwater runoff volume and volume reduction listed in Box 6 and Box 7. (Box 6 – Box 7)

Figures contained in the "*Summary table for supporting calculation and measurement data"* should be consistent with those on Worksheets 3, 4, and 5, when applicants have utilized the Stormwater Best Management Practices (BMP) Manual to meet design standards. Below is a depiction of which worksheet(s) corresponds (i.e. WKST 4) to each Box and where on the worksheet to find the information (i.e. 2-Year Volume Increase).

Numbers generated in the sumamry table should be consistent with Worksheets (WKST) 3, 4 and 5			
	Pre-construction	**Post Construction**	**Net Change**
Design storm frequency 2-year/24-hour storm Rainfall amount WKST 4 "2-Year Rainfall" inches			
Impervious area (acres)	1 WKST 4 Existing Condition: Impervious cover type	2 WKST 4 Developed Condition: Impervious cover type	3 Box 2 - Box 1
Volume of stormwater runoff ☒ acre-feet or ☐ cubic feet (check appropriate box)	4 WKST 4 Existing Condition: Total Runoff Volume	5 WKST 4 Developed Condition: Total Runoff Volume	6 WKST 4 2-Year Volume Increase
Volume of stormwater runoff ☒ acre-feet or ☐ cubic feet (check appropriate box)		7 WKST 3 Total non-structural volume credit + WKST 5 Total structural volume	8 WKST 5 Difference

Box 9. **Pre-construction stormwater discharge rate**: The stormwater runoff discharge rate for the 2-year/24-hour storm as determined by the land use for the past five years.

Box 10. **Post construction stormwater discharge rate**: The stormwater runoff discharge rate for the 2-year/24-hour storm after all planned stormwater BMPs are installed.

Box 11. **Net change stormwater discharge rate**: The change in stormwater runoff discharge rates listed in Box 9 and Box 10. (Box 10 – Box 9)

Box 12. **Pre-construction stormwater discharge rate**: The stormwater runoff discharge rate for the 10-year/24-hour storm as determined by the land use for the past five years.

Box 13. **Post construction stormwater discharge rate**: The stormwater runoff discharge rate for the 10-year/24-hour storm after all planned stormwater BMPs are installed.

Box 14. **Net change stormwater discharge rate**: The change in stormwater runoff discharge rates listed in Box 12 and Box 13. (Box 13 – Box 12)

Box 15. **Pre-construction stormwater discharge rate**: The stormwater runoff discharge rate for the 50-year/24-hour storm as determined by the land use for the past five years.

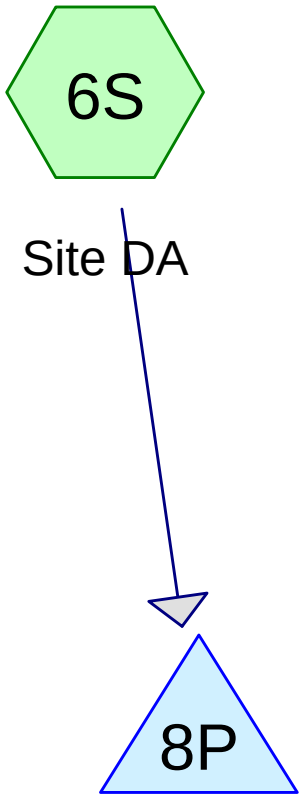
Box 16. **Post construction stormwater discharge rate**: The stormwater runoff discharge rate for the 50-year/24-hour storm after all planned stormwater BMPs are installed.

Box 17. **Net change stormwater discharge rate**: The change in stormwater runoff discharge rates listed in Box 15 and Box 16. (Box 16 – Box 15)

Box 18. **Pre-construction stormwater discharge rate:** The stormwater runoff discharge rate for the 100-year/24-hour storm as determined by the land use for the past five years.

Box 19. **Post construction stormwater discharge rate:** The stormwater runoff discharge rate for the 100-year/24-hour storm after all planned stormwater BMPs are installed.

Box 20. **Net change stormwater discharge rate:** The change in stormwater runoff discharge rates listed in Box 18 and Box 19. (Box 19 – Box 18)



Site DA

Subcat Reach Pond Link

Routing Diagram for SW_Analysis
Prepared by Microsoft, Printed 6/28/2019

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.450	48	Brush, Good, HSG B (6S)
0.066	73	Brush, Good, HSG D (6S)
14.334	83	Fallow, crop residue, Good, HSG B (6S)
9.660	100	Water (6S)
24.510	**89**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
14.784	HSG B	6S
0.000	HSG C	
0.066	HSG D	6S
9.660	Other	6S
24.510		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.450	0.000	0.066	0.000	0.516	Brush, Good	6S
0.000	14.334	0.000	0.000	0.000	14.334	Fallow, crop residue, Good	6S
0.000	0.000	0.000	0.000	9.660	9.660	Water	6S
0.000	**14.784**	**0.000**	**0.066**	**9.660**	**24.510**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Site DA Runoff Area=24.510 ac 39.41% Impervious Runoff Depth>2.06"
Flow Length=1,200' Slope=0.1000 '/' Tc=8.5 min CN=89 Runoff=85.01 cfs 4.205 af

Pond 8P: Lake Luxembourg Inflow=85.01 cfs 4.205 af
Primary=85.01 cfs 4.205 af

Total Runoff Area = 24.510 ac Runoff Volume = 4.205 af Average Runoff Depth = 2.06"
60.59% Pervious = 14.850 ac 39.41% Impervious = 9.660 ac

Summary for Subcatchment 6S: Site DA

Runoff = 85.01 cfs @ 12.00 hrs, Volume= 4.205 af, Depth> 2.06"

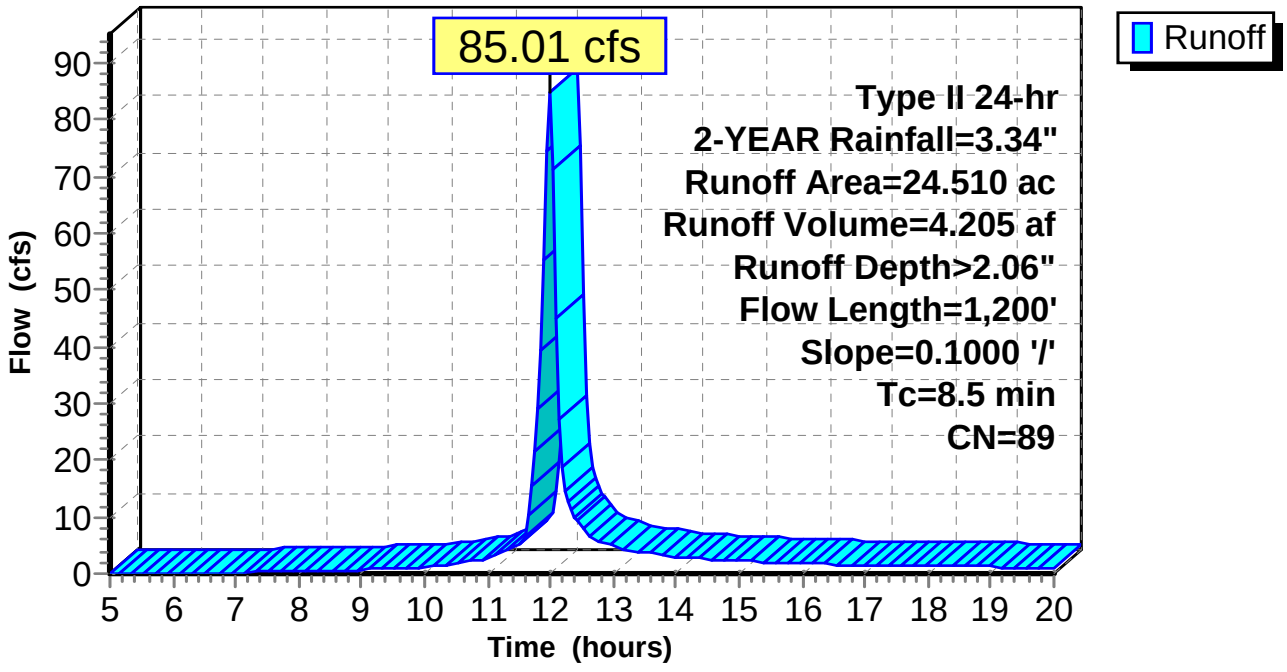
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-YEAR Rainfall=3.34"

	Area (ac)	CN	Description
*	9.660	100	Water
	0.066	73	Brush, Good, HSG D
	0.450	48	Brush, Good, HSG B
	14.334	83	Fallow, crop residue, Good, HSG B
	24.510	89	Weighted Average
	14.850		60.59% Pervious Area
	9.660		39.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	1,200	0.1000	2.35		**Lag/CN Method, Site Tc**

Subcatchment 6S: Site DA

Hydrograph

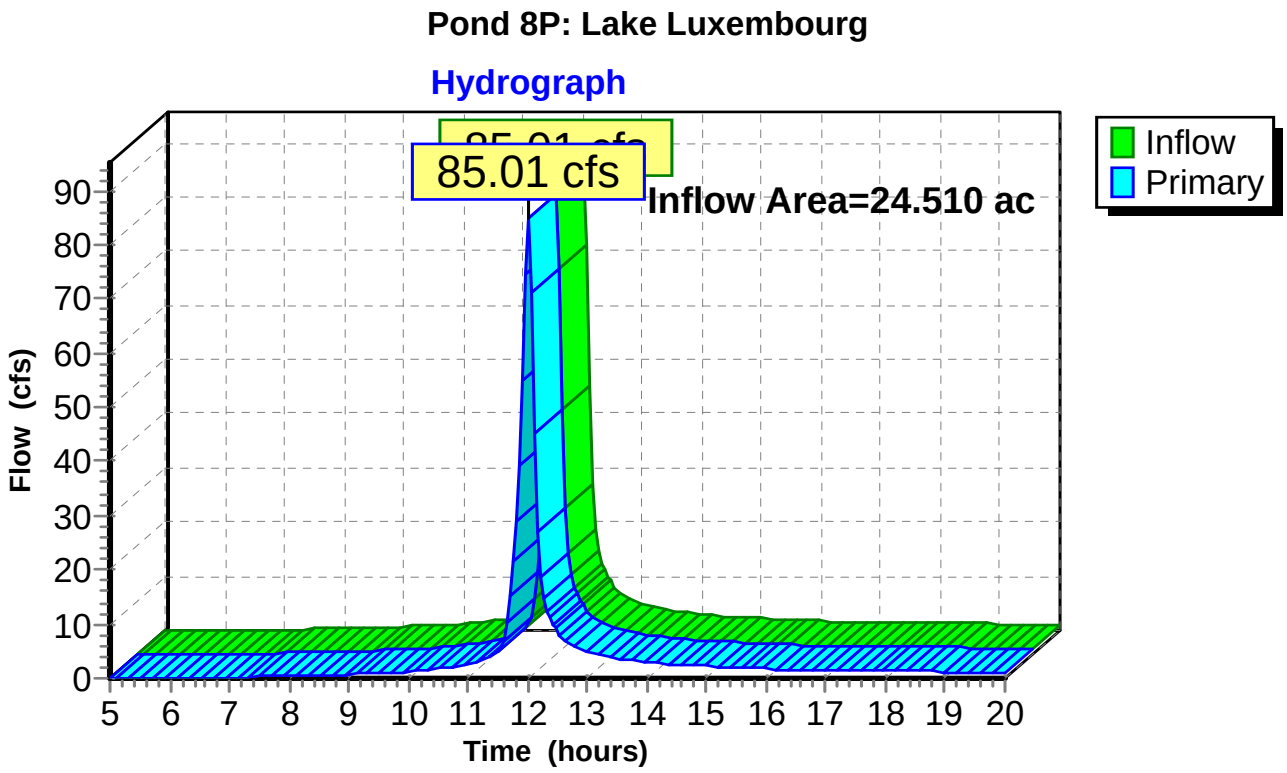


Summary for Pond 8P: Lake Luxembourg

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 24.510 ac, 39.41% Impervious, Inflow Depth > 2.06" for 2-YEAR event
Inflow = 85.01 cfs @ 12.00 hrs, Volume= 4.205 af
Primary = 85.01 cfs @ 12.00 hrs, Volume= 4.205 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Site DA Runoff Area=24.510 ac 39.41% Impervious Runoff Depth>3.52"
Flow Length=1,200' Slope=0.1000 '/' Tc=8.5 min CN=89 Runoff=140.42 cfs 7.180 af

Pond 8P: Lake Luxembourg Inflow=140.42 cfs 7.180 af
Primary=140.42 cfs 7.180 af

Total Runoff Area = 24.510 ac Runoff Volume = 7.180 af Average Runoff Depth = 3.52"
60.59% Pervious = 14.850 ac 39.41% Impervious = 9.660 ac

Summary for Subcatchment 6S: Site DA

Runoff = 140.42 cfs @ 11.99 hrs, Volume= 7.180 af, Depth> 3.52"

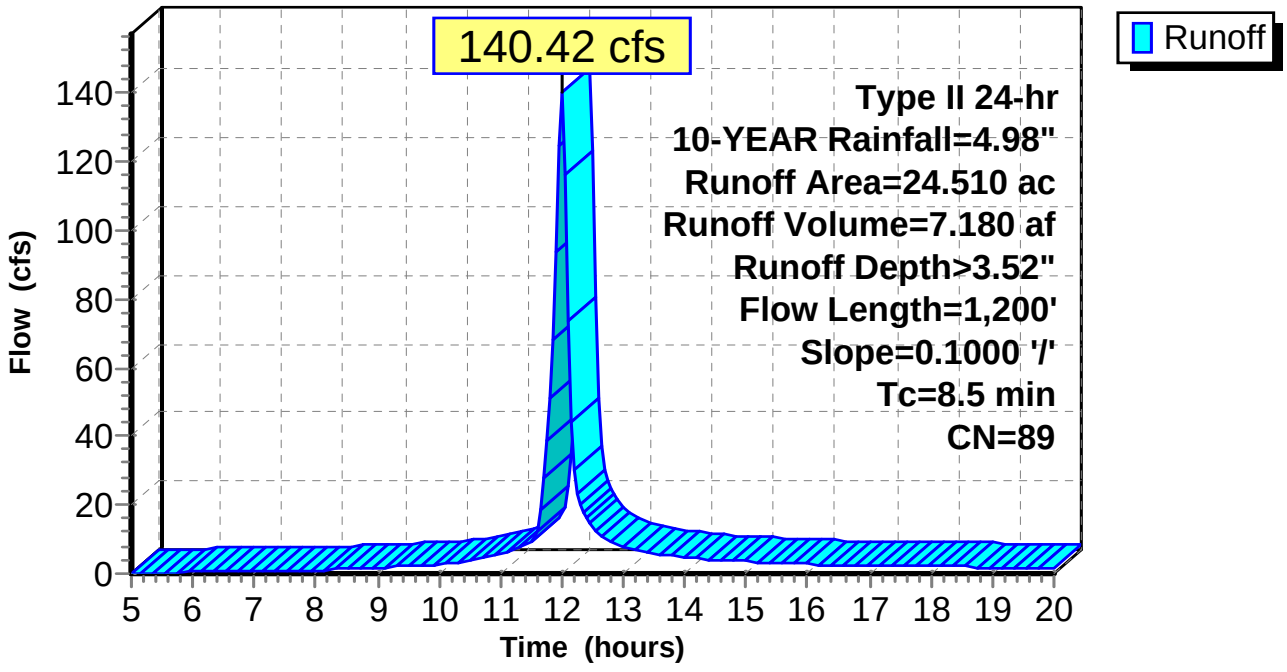
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-YEAR Rainfall=4.98"

	Area (ac)	CN	Description
*	9.660	100	Water
	0.066	73	Brush, Good, HSG D
	0.450	48	Brush, Good, HSG B
	14.334	83	Fallow, crop residue, Good, HSG B
	24.510	89	Weighted Average
	14.850		60.59% Pervious Area
	9.660		39.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	1,200	0.1000	2.35		**Lag/CN Method, Site Tc**

Subcatchment 6S: Site DA

Hydrograph

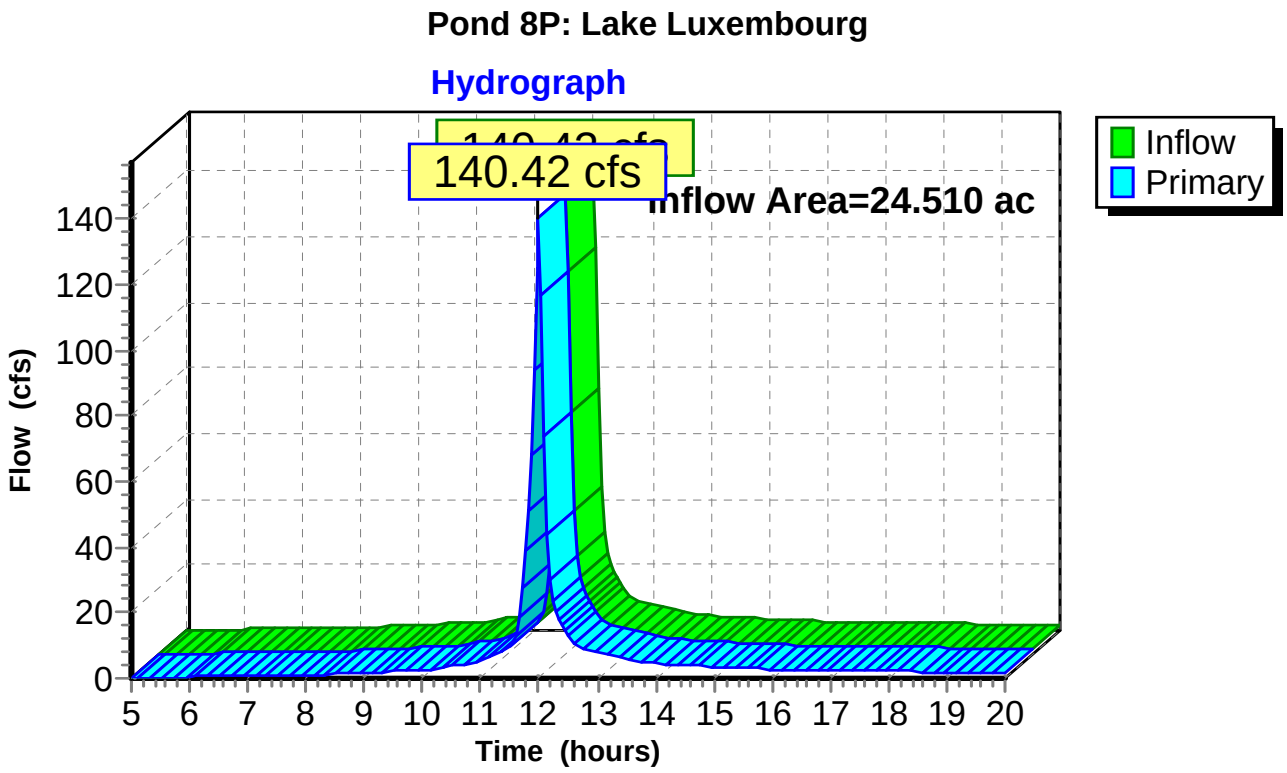


Summary for Pond 8P: Lake Luxembourg

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 24.510 ac, 39.41% Impervious, Inflow Depth > 3.52" for 10-YEAR event
Inflow = 140.42 cfs @ 11.99 hrs, Volume= 7.180 af
Primary = 140.42 cfs @ 11.99 hrs, Volume= 7.180 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Site DA Runoff Area=24.510 ac 39.41% Impervious Runoff Depth>5.37"
Flow Length=1,200' Slope=0.1000 '/' Tc=8.5 min CN=89 Runoff=208.80 cfs 10.962 af

Pond 8P: Lake Luxembourg Inflow=208.80 cfs 10.962 af
Primary=208.80 cfs 10.962 af

Total Runoff Area = 24.510 ac Runoff Volume = 10.962 af Average Runoff Depth = 5.37"
60.59% Pervious = 14.850 ac 39.41% Impervious = 9.660 ac

Summary for Subcatchment 6S: Site DA

Runoff = 208.80 cfs @ 11.99 hrs, Volume= 10.962 af, Depth> 5.37"

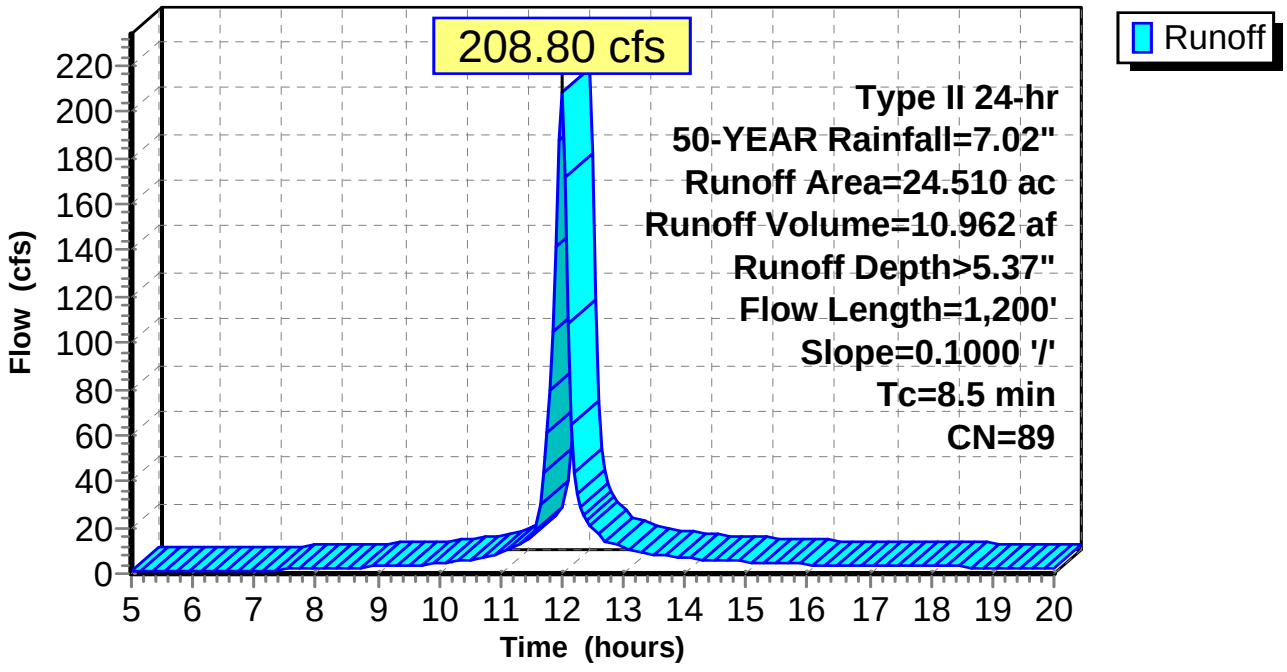
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-YEAR Rainfall=7.02"

	Area (ac)	CN	Description
*	9.660	100	Water
	0.066	73	Brush, Good, HSG D
	0.450	48	Brush, Good, HSG B
	14.334	83	Fallow, crop residue, Good, HSG B
	24.510	89	Weighted Average
	14.850		60.59% Pervious Area
	9.660		39.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	1,200	0.1000	2.35		**Lag/CN Method, Site Tc**

Subcatchment 6S: Site DA

Hydrograph

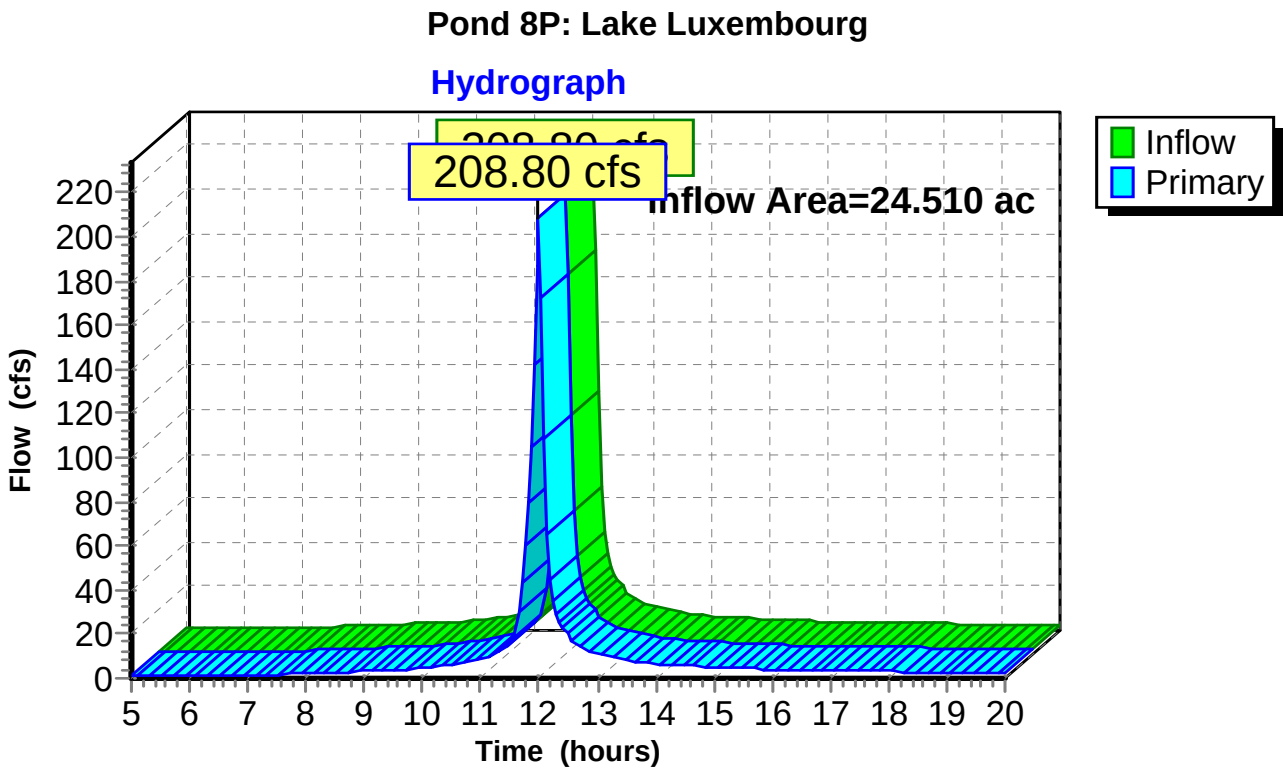


Summary for Pond 8P: Lake Luxembourg

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 24.510 ac, 39.41% Impervious, Inflow Depth > 5.37" for 50-YEAR event
Inflow = 208.80 cfs @ 11.99 hrs, Volume= 10.962 af
Primary = 208.80 cfs @ 11.99 hrs, Volume= 10.962 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 6S: Site DA Runoff Area=24.510 ac 39.41% Impervious Runoff Depth>6.31"
Flow Length=1,200' Slope=0.1000 '/' Tc=8.5 min CN=89 Runoff=243.04 cfs 12.882 af

Pond 8P: Lake Luxembourg Inflow=243.04 cfs 12.882 af
Primary=243.04 cfs 12.882 af

Total Runoff Area = 24.510 ac Runoff Volume = 12.882 af Average Runoff Depth = 6.31"
60.59% Pervious = 14.850 ac 39.41% Impervious = 9.660 ac

Summary for Subcatchment 6S: Site DA

Runoff = 243.04 cfs @ 11.99 hrs, Volume= 12.882 af, Depth> 6.31"

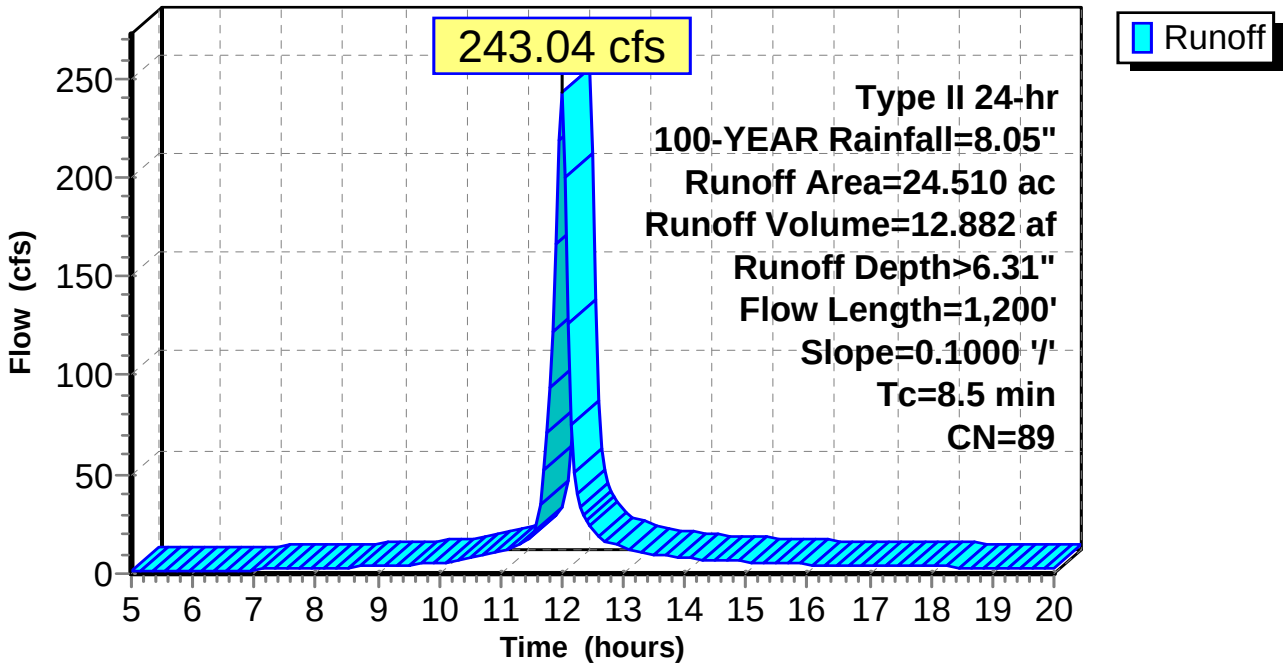
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-YEAR Rainfall=8.05"

	Area (ac)	CN	Description
*	9.660	100	Water
	0.066	73	Brush, Good, HSG D
	0.450	48	Brush, Good, HSG B
	14.334	83	Fallow, crop residue, Good, HSG B
	24.510	89	Weighted Average
	14.850		60.59% Pervious Area
	9.660		39.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.5	1,200	0.1000	2.35		**Lag/CN Method, Site Tc**

Subcatchment 6S: Site DA

Hydrograph

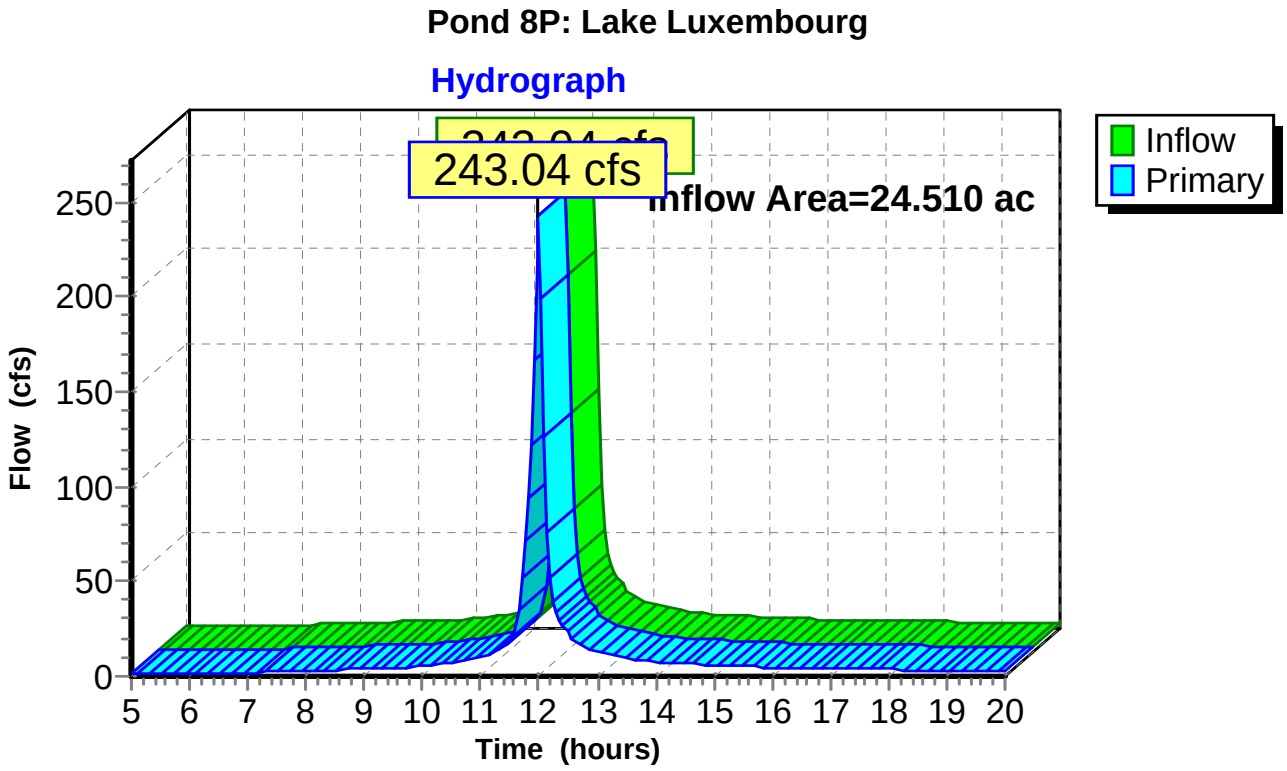


Summary for Pond 8P: Lake Luxembourg

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 24.510 ac, 39.41% Impervious, Inflow Depth > 6.31" for 100-YEAR event
Inflow = 243.04 cfs @ 11.99 hrs, Volume= 12.882 af
Primary = 243.04 cfs @ 11.99 hrs, Volume= 12.882 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



REQUEST FOR BIDS - PUBLIC NOTICE:

The Bucks County Conservation District is accepting sealed bids online via the PennBid Program for the Lake Luxembourg Conservation Pool Habitat Enhancement Project until September 5, 2019 at 11am. The project is located in Middletown Township, Bucks County.

The Mandatory Pre-Bid Meeting shall be held on August 7th, 2019 at Pavilion 10 at Core Creek Park, off of North Woodbourne Road, Middletown Township, PA 19047.

Latitude: 40° 12’ 13.53” N
Longitude: 74° 54’ 19.86” W

Questions shall be submitted via PennBid or in writing (email or facsimile) to Meghan Rogalus at mrogalus@bucksccd.org by August 14th, 2019 at 5 pm.

The project has a specific proposed timeline due to threatened and endangered species within the work area and park. The anticipated start is on or before December 1, 2019. The following is a more detailed breakdown of the construction sequencing:

- Turtle exclusion fence shall be installed prior to December 31, 2019,
- Lake Lowering may start in mid-July 2020 in accordance with Permits,
- Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and
- Restoration shall occur between April 2021 and September 2021. Only restoration within the agricultural fields may commence prior to July 31, any restoration activities within open water or access areas shall be completed post the Bald Eagle timing restriction (January 1-July 31).

All Bidding Documents and details are available online at no cost at www.PennBid.net.

The District reserves the right, at its option, to waive any informalities, defects, errors or omissions in any or all bids, and to reject any or all bids.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
BID INSTRUCTIONS

INFORMATION AVAILABLE TO ALL INTERESTED PARTIES AT www.PennBid.net

A. General Instructions for Bidders

B. Proposed Scope of Work

C. Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan Set

D. Bid Sheet

E. Rate Schedule Sheet
    1. Prevailing Wage Rate Determination

F. Non-Collusion Affidavit

G. Contractor Responsibility Certification Form

H. Public Works Employment Verification Form

I. Contractor Qualifications and Experience

J. Sample Contract
    1. Commonwealth Nondiscrimination/Sexual Harassment Clause

K. Technical Specifications for Lake Luxembourg Conservation Pool Habitat Enhancement Project at Core Creek County Park.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
A - GENERAL INSTRUCTIONS FOR BIDDERS

1. The Contractor shall provide a bid to build project as described in Scope of Work and Plans.
   (a) The Contractor shall provide a detailed project budget and timeline for tasks listed in the Scope of Work and as per the Contract Documents.
   (b) The Contractor shall provide all equipment, labor, and supplies necessary to complete the work. Coordination of equipment, materials, and supplies is the responsibility of the Contractor.
   (c) The Contractor shall be responsible for locating and protecting all utilities in a manner consistent with PA Act 287 "The Underground Utility Line Protection Law."

2. A Mandatory Pre-Bid Meeting shall be held on August 7th, 2019 at Pavilion 10 at the Core Creek Park, off of North Woodbourne Road, Middletown Township, PA 19047.
   (a) Latitude: 40° 12' 13.53" N
   (b) Longitude: 74° 54' 19.86" W

3. The Bucks County Conservation District (BCCD) is not obligated to accept the lowest bid. BCCD shall consider the cost estimate and qualifications and experience of the Contractor when making its final decision in selecting a successful proposal. Contractor is to submit details (i.e., bid items, dollar value of work, and company information) for any work proposed to be subcontracted as part of the project for BCCD review.

4. Award of a contract shall be made within sixty (60) days of the bid closing date. In the event no satisfactory bids are received, all submitters will be so notified within the same time period.

5. The Contractor to whom award is made shall provide the following information to BCCD with the signed contract
   (a) Standard Accord Certificate(s) of Insurance (Contractual Liability Type)
      i. Worker's Compensation Insurance
      ii. Public Liability and Property Damage Insurance
      iii. Automobile Bodily Injury and Property Damage Insurance
   (b) Performance Bond (100% of the contract amount)
   (c) Material and Labor Bond (100% of the contract amount)
   (d) Failure to provide the bonds or irrevocable letter of credit within twenty-one (21) days of notification of award may result in cancellation of contract award.
   (e) The Contractor will execute and return all copies of the Agreement, within seven (7) days after the notice of award of contract. The Contractor further agrees to execute the work with speed and diligence so as to ensure completion of the contract by as defined in the technical specification but no later than September 30th, 2021.

6. The contracted work described as part of this proposal shall be completed no later than September 30th, 2021. It is anticipated that the project may be started as soon as the weather permits and agreed to by BCCD and the Contractor, provided all contracts are finalized.
   (a) Portions of the project have specific completion timing restrictions based on Threatened and Endangered species within or close proximity to the project area. The district nor its project partner do not have any authority to be flexible with these restrictions.

7. Upon acceptance of the work at the Final Inspection of each site, the contractor shall submit a final invoice for the amount due. Payment shall be made by BCCD not later than thirty (30) days after receipt of the invoice.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
B - PROPOSED SCOPE OF WORK

Bucks County Conservation District has partnered with Bucks County Department of Parks and Recreation to remove accumulated sediment and enhance the habitat of the Lake Luxembourg Conservation Pool. The goal of the proposed projects is to improve water quality in the Core Creek watershed.

The proposed Lake Luxembourg Conservation Pool Habitat Enhancement Project includes the removal of 15,000 cubic yards of sediment from the Conservation Pool and dewatering the sediment in an adjacent field, which will then be incorporated into the field and seeded. In addition, turtle habitat features, and tree vanes will be installed within the Conservation Pool, and native shrubs will be planted throughout the Conservation Pool area and protected with wildlife exclusion fencing. The areas used for access will also be restored, including a small portion of forest and wetland that will be temporarily impacted.

The project has a specific proposed timeline due to threatened and endangered species within the work area and park. The anticipated start is on or before December 1, 2019. The following is a more detailed breakdown of the construction sequencing:

- Turtle exclusion fence shall be installed prior to December 31, 2019,
- Lake Lowering may start in mid-July 2020 in accordance with Permits,
- Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and
- Restoration shall occur between April 2021 and September 2021. Only restoration within the agricultural fields may commence prior to July 31, any restoration activities within open water or access areas shall be completed post the Bald Eagle timing restriction (January 1-July 31).

The project is located on public land and is funded by a grant through the U.S. EPA and Pennsylvania DEP NonPoint Source Program (Clean Water Act Section 319). Therefore, the selected contractor must provide a Non-Collusion Affidavit and adhere to the provisions of Pennsylvania Prevailing Wage Rates, Contractor Integrity, and Nondiscrimination & Sexual Harassment Policy.

The selected contractor will be responsible for implementing all components listed below:

- Installation and maintenance of all Erosion and Sediment Controls
- Site excavation and stabilization
- Grading of berms and dewatering of excavated material
- Spreading of excavated material on the adjacent field
- Installation of native plant materials and animal exclusion fencing
- Installation of turtle habitat features and tree vanes

- Site Restoration
- Final site stabilization

Please refer to attached Plans and Design Specifications for more details.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
D - BID SHEET

PROJECT LOCATION – Core Creek County Park
MUNICIPALITY – Middletown Township
COUNTY – Bucks
BID OPENING: July 15, 2019; 8:00 a.m.
BID CLOSING: September 5, 2019; 11:00 a.m.

Item No.	Specification Section	Item	Unit	Quantity	Unit Price	Total Amount
Construction						
1	017113	Mobilization/Demobilization (includes photographic documentation, temporary facilities and controls, traffic control, and environmental protection)	L.S	1		
2	312500	Temporary Stream Crossing	EA.	1		
3	312500	Temporary Rock Ramp	EA.	1		
4	311000	Selective Clearing	LS.	1		
5	015639	High Visibility Fence	L.F.	2,350		
6	017113	As-built Survey	L.S.	1		
Earthwork						
7	312316	Sediment Removal	C.Y.	15,000		
8	312316	Interim Grading - Berms	L.F.	7,220		
9	312316	Interim Grading - Dewatering Sediment	L.S.	1		
10	312316	Grading of Sediment Materials	S.F.	550,000		
Erosion and Sediment Control						
11	312500	Construction Entrance	EA.	1		
12	312500	Filter Sock	L.F.	1,740		
13	312500	Super Silt Fence	L.F.	1,610		
14	312500	Turtle Exclusion Fence (Super Silt Fence)	L.F.	2,010		
15	312500	Turbidity Barrier	L.F.	500		
16	312319	Lake Lowering	L.S.	1		
17	312319	Stream Bypass and Control of Water	L.S.	1		

Planting & Enhancement						
18	354900	Turtle Habitat Features	EA.	13		
19	354900	Tree Vane	L.F.	800		
20	329200	Wetland Mitigation Seed Mix	S.Y.	1,300		
21	329200	Farm Field Erosion Seed Mix	S.Y.	68,120		
22	329300	*Carex stricta* (Tussock Sedge)	EA.	4,300		
23	329300	*Carex vulpinoidea* (Fox Sedge)	EA.	2,200		
24	329300	*Iris versicolor* (Blueflag Iris)	EA.	4,300		
25	329300	*Leersia oryzoides* (Rice Cutgrass)	EA.	3,250		
26	329300	*Peltandra virginica* (Green Arrow Arum)	EA.	3,250		
27	329300	*Pontederia cordata* (Pickerelweed)	EA.	4,300		
28	329300	*Sagittaria latifolia* (Broad-Leaved Arrowhead)	EA.	3,550		
29	329300	*Schoenoplectus tabernaemontani* (Softstem Bulrush)	EA.	5,350		
30	329300	*Scirpus atrovirens* (Green Bulrush)	EA.	5,350		
31	329300	*Platanus occidentalis* (Sycamore) including tree cages	EA.	6		
32	329300	*Quercus bicolor* (Swamp White Oak) including tree cages	EA.	6		
33	329300	Quercus palustris *(Pin Oak) including tree cages*	EA.	8		
34	015639	Goose fencing	L.F.	8,275		

In compliance with the Bid Instructions, General Instructions for Bidders, Drawings and Specifications, the undersigned proposes to complete the entire project at the Contract Amount of $ _____based on the unit pricing provided above.

The undersigned agrees to complete all work identified no later than September 30, 2021 and to provide a Standard Certificate of Insurance, Performance Bond and Materials & Labor Bond as stipulated in the General Instructions for Bidders.

Bidding Firm Name and Address**: _____

_____

_____

_____ _____ _____
Signature Title Date

Contractor Federal Identification No.:_____

Contractor Social Security No.:_____

Witnessed by:

_____ _____ _____
Signature Title Date

** *For individuals, the Proposal must be signed by the Owner and the signature witnessed. For Partnerships, the Proposal must be signed by a Partner and the signature witnessed. For Corporations, the Proposal must be signed by the President, Vice President or Secretary or other Representative of the Corporation authorized to sign and the signature witnessed.*

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
E - RATE SCHEDULE SHEET

_____(CONTRACTOR) RATE SCHEDULE

(Complete as applicable to project appropriateness)

1.	PROJECT MANAGEMENT	$_____/HR
2.	LABOR	$_____/HR[1]
3.	EXCAVATOR	$_____/HR
4.	WHEEL LOADER	$_____/HR
5.	TRACK LOADER	$_____/HR
6.	DOZER	$_____/HR
7.	DUMP TRUCK	$_____/HR
8.	BACKHOE	$_____/HR
9.	MOBILIZATION	$_____/HR
10.	OTHER_____	$_____/HR
11.	OTHER_____	$_____/HR
12.	OTHER_____	$_____/HR

_____ _____

Witness Signature

_____ _____

Date Printed Name & Title

_____

Date

Note: 1. Prevailing wage applies per Commonwealth law.

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Lake Luxembourg Conservation Pool Habitat Enhancement Design
Awarding Agency:	Bucks County Conservation District
Contract Award Date:	9/11/2019
Serial Number:	19-05132
Project Classification:	Heavy
Determination Date:	6/25/2019
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Bucks County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	5/29/2017		$47.30	$34.85	$82.15
Asbestos & Insulation Workers	5/1/2018		$49.30	$35.85	$85.15
Asbestos & Insulation Workers	5/1/2019		$51.20	$36.95	$88.15
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2017		$28.52	$18.22	$46.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2018		$29.52	$18.22	$47.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	1/1/2019		$29.26	$18.48	$47.74
Boilermakers	1/1/2017		$44.26	$33.36	$77.62
Boilermakers	1/1/2018		$46.26	$33.36	$79.62
Boilermakers	3/1/2018		$45.89	$33.73	$79.62
Boilermakers	1/1/2019		$45.51	$34.11	$79.62
Bricklayer	5/1/2017		$40.98	$26.78	$67.76
Bricklayer	5/1/2018		$43.73	$26.78	$70.51
Bricklayer	5/1/2019		$46.48	$26.78	$73.26
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		$45.25	$27.59	$72.84
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	$45.83	$27.59	$73.42
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019	4/30/2020	$46.54	$27.59	$74.13
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020		$47.73	$27.59	$75.32
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		$39.35	$27.59	$66.94
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	$39.85	$27.59	$67.44
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019	4/30/2020	$40.47	$27.59	$68.06
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020		$41.50	$27.59	$69.09
Carpenter - Rodman (Surveying & Layout)	5/1/2017		$19.68	$19.64	$39.32
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	$19.93	$19.49	$39.42
Carpenter - Rodman (Surveying & Layout)	5/1/2019	4/30/2020	$20.24	$19.69	$39.93
Carpenter - Rodman (Surveying & Layout)	5/1/2020		$20.75	$19.49	$40.24
Carpenters	5/1/2017		$39.35	$27.59	$66.94
Carpenters	5/1/2018	4/30/2019	$39.85	$27.59	$67.44
Carpenters	5/1/2019	4/30/2020	$40.87	$27.59	$68.46
Carpenters	5/1/2020		$41.90	$27.59	$69.49
Cement Masons	5/1/2017		$36.45	$31.76	$68.21
Cement Masons	5/1/2018		$37.50	$32.26	$69.76
Cement Masons	5/1/2019		$38.50	$32.81	$71.31
DockBuilder/Pile Drivers (Building, Heavy & Highway)	5/1/2018		$43.45	$34.47	$77.92
Dockbuilder/Piledriver (Building, Heavy, Highway)	11/1/2017		$43.45	$33.22	$76.67
Dockbuilder/Piledriver (Building, Heavy, Highway)	5/1/2018		$44.70	$33.22	$77.92
Drapery Installers	5/1/2009		$31.09	$21.34	$52.43
Drywall Finisher	5/1/2017		$37.11	$26.75	$63.86
Drywall Finisher	5/1/2018		$39.27	$27.49	$66.76
Electricians	12/1/2018		$41.06	$19.38	$60.44
Electricians	6/1/2019	5/31/2020	$42.86	$19.38	$62.24
Electricians	6/1/2020		$44.72	$19.38	$64.10
Elevator Constructor	1/1/2016		$52.79	$30.29	$83.08

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Elevator Constructor	1/1/2018		$55.76	$33.05	$88.81
Floor Coverer	5/1/2019		$44.37	$28.44	$72.81
Floor Coverer	5/1/2020		$46.01	$28.44	$74.45
Floor Layer	5/1/2017		$42.51	$27.91	$70.42
Floor Layer	5/1/2018		$43.11	$28.09	$71.20
Glazier	5/1/2017		$41.30	$30.80	$72.10
Glazier	5/1/2018		$43.32	$32.33	$75.65
Glazier	5/1/2019		$43.87	$33.38	$77.25
Iron Workers - Reinforcing Steel Mesh - Rebar	7/1/2017		$42.56	$29.30	$71.86
Iron Workers - Reinforcing Steel Mesh - Rebar	7/1/2018		$51.46	$30.60	$82.06
Iron Workers (Riggers)	7/1/2017		$39.83	$27.92	$67.75
Iron Workers	1/1/2017		$46.20	$31.26	$77.46
Iron Workers	7/1/2017		$47.30	$32.91	$80.21
Iron Workers	7/1/2018		$42.88	$30.60	$73.48
Iron Workers	7/1/2019		$32.76	$29.88	$62.64
Laborers (Class 01 - See notes)	5/1/2017		$28.65	$24.95	$53.60
Laborers (Class 02 - See notes)	5/1/2017		$30.85	$25.65	$56.50
Laborers (Class 03 - See notes)	5/1/2017		$28.92	$25.18	$54.10
Laborers (Class 04 - See notes)	5/1/2017		$28.95	$24.95	$53.90
Laborers (Class 05 - See notes)	5/1/2017		$28.65	$24.95	$53.60
Landscape Laborer	5/1/2017		$22.71	$23.08	$45.79
Marble Finisher	5/1/2017		$35.55	$24.17	$59.72
Marble Finisher	5/1/2018		$37.55	$24.17	$61.72
Marble Finisher	5/1/2019		$39.75	$24.17	$63.92
Marble Mason	5/1/2017		$40.36	$26.99	$67.35
Marble Mason	5/1/2018		$43.11	$26.99	$70.10
Marble Mason	5/1/2019		$45.86	$26.99	$72.85
Millwright	7/1/2017		$41.35	$32.24	$73.59
Millwright	5/1/2018		$43.33	$32.96	$76.29
Millwright	5/1/2019		$45.50	$33.29	$78.79
Operators (Building, Class 01 - See Notes)	5/1/2017		$44.87	$28.14	$73.01
Operators (Building, Class 01 - See Notes)	5/1/2017		$44.87	$28.14	$73.01
Operators (Building, Class 01 - See Notes)	5/1/2018		$46.41	$28.60	$75.01
Operators (Building, Class 01 - See Notes)	5/1/2019		$47.95	$29.06	$77.01
Operators (Building, Class 01 - See Notes)	5/1/2020		$49.50	$29.51	$79.01
Operators (Building, Class 01 - See Notes)	5/1/2021		$51.04	$29.97	$81.01
Operators (Building, Class 01A - See Notes)	5/1/2017		$47.86	$29.03	$76.89
Operators (Building, Class 01A - See Notes)	5/1/2018		$49.41	$29.49	$78.90
Operators (Building, Class 01A - See Notes)	5/1/2019		$50.96	$29.94	$80.90
Operators (Building, Class 01A - See Notes)	5/1/2020		$52.50	$30.40	$82.90
Operators (Building, Class 01A - See Notes)	5/1/2021		$54.05	$30.85	$84.90
Operators (Building, Class 02 - See Notes)	5/1/2017		$44.62	$28.07	$72.69
Operators (Building, Class 02 - See Notes)	5/1/2018		$46.16	$28.53	$74.69
Operators (Building, Class 02 - See Notes)	5/1/2019		$47.70	$28.99	$76.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 02 - See Notes)	5/1/2020		$49.25	$29.44	$78.69
Operators (Building, Class 02 - See Notes)	5/1/2021		$50.80	$29.89	$80.69
Operators (Building, Class 02A - See Notes)	5/1/2017		$47.61	$28.97	$76.58
Operators (Building, Class 02A - See Notes)	5/1/2018		$49.16	$29.42	$78.58
Operators (Building, Class 02A - See Notes)	5/1/2019		$50.71	$29.87	$80.58
Operators (Building, Class 02A - See Notes)	5/1/2020		$52.26	$30.31	$82.57
Operators (Building, Class 02A - See Notes)	5/1/2021		$53.81	$30.77	$84.58
Operators (Building, Class 03 - See Notes)	5/1/2017		$40.53	$26.87	$67.40
Operators (Building, Class 03 - See Notes)	5/1/2018		$42.07	$27.33	$69.40
Operators (Building, Class 03 - See Notes)	5/1/2019		$43.62	$27.78	$71.40
Operators (Building, Class 03 - See Notes)	5/1/2020		$45.17	$28.24	$73.41
Operators (Building, Class 03 - See Notes)	5/1/2021		$46.71	$28.69	$75.40
Operators (Building, Class 04 - See Notes)	5/1/2017		$40.24	$26.78	$67.02
Operators (Building, Class 04 - See Notes)	5/1/2018		$41.78	$27.22	$69.00
Operators (Building, Class 04 - See Notes)	5/1/2019		$43.32	$27.69	$71.01
Operators (Building, Class 04 - See Notes)	5/1/2020		$44.86	$28.14	$73.00
Operators (Building, Class 04 - See Notes)	5/1/2021		$46.41	$28.60	$75.01
Operators (Building, Class 05 - See Notes)	5/1/2017		$38.51	$26.27	$64.78
Operators (Building, Class 05 - See Notes)	5/1/2018		$40.05	$26.73	$66.78
Operators (Building, Class 05 - See Notes)	5/1/2019		$41.60	$27.18	$68.78
Operators (Building, Class 05 - See Notes)	5/1/2020		$43.14	$27.64	$70.78
Operators (Building, Class 05 - See Notes)	5/1/2021		$44.69	$28.10	$72.79
Operators (Building, Class 06 - See Notes)	5/1/2017		$37.52	$25.98	$63.50
Operators (Building, Class 06 - See Notes)	5/1/2018		$39.07	$26.43	$65.50
Operators (Building, Class 06 - See Notes)	5/1/2019		$40.61	$26.89	$67.50
Operators (Building, Class 06 - See Notes)	5/1/2020		$42.16	$27.35	$69.51
Operators (Building, Class 06 - See Notes)	5/1/2021		$43.70	$27.80	$71.50
Operators (Building, Class 07A- See Notes)	5/1/2017		$54.14	$32.47	$86.61
Operators (Building, Class 07A- See Notes)	5/1/2018		$55.99	$33.02	$89.01
Operators (Building, Class 07A- See Notes)	5/1/2019		$57.84	$33.57	$91.41
Operators (Building, Class 07A- See Notes)	5/1/2020		$59.70	$34.10	$93.80
Operators (Building, Class 07A- See Notes)	5/1/2021		$61.55	$34.65	$96.20
Operators (Building, Class 07B- See Notes)	5/1/2017		$53.84	$32.40	$86.24
Operators (Building, Class 07B- See Notes)	5/1/2018		$55.70	$32.92	$88.62
Operators (Building, Class 07B- See Notes)	5/1/2019		$56.00	$35.03	$91.03
Operators (Building, Class 07B- See Notes)	5/1/2020		$59.40	$34.03	$93.43
Operators (Building, Class 07B- See Notes)	5/1/2021		$61.26	$34.58	$95.84
Painter	5/1/2018		$38.64	$27.64	$66.28
Painter	5/1/2019		$39.04	$28.99	$68.03
Painters Class 1 (see notes)	5/1/2017		$37.82	$26.46	$64.28
Painters Class 1 (see notes)	2/1/2018		$43.18	$27.23	$70.41
Painters Class 1 (see notes)	2/1/2019		$44.56	$28.35	$72.91
Painters (Bridges, Stacks, Towers)	2/1/2018		$54.15	$27.52	$81.67
Painters (Bridges, Stacks, Towers)	2/1/2019		$55.52	$28.39	$83.91

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Painters (Brush and Roller)(Industrial)	2/1/2018		$43.18	$27.23	$70.41
Painters (Brush and Roller)(Industrial)	2/1/2019		$44.56	$28.35	$72.91
Painters Class 2 (see notes)	5/1/2017		$53.67	$26.09	$79.76
Painters Class 2 (see notes)	2/1/2018		$54.14	$27.27	$81.41
Painters Class 2 (see notes)	2/1/2019		$55.52	$28.39	$83.91
Painters Class 3 (see notes)	5/1/2017		$38.20	$26.46	$64.66
Plasterers	5/1/2017		$37.42	$28.83	$66.25
Plasterers	5/1/2018		$37.42	$30.04	$67.46
Plasterers	5/1/2019		$37.72	$30.74	$68.46
plumber	5/1/2018		$53.45	$33.54	$86.99
plumber	5/1/2019		$55.45	$34.54	$89.99
Plumbers	5/1/2017		$51.42	$32.57	$83.99
Pointers, Caulkers, Cleaners	5/1/2017		$42.26	$25.69	$67.95
Pointers, Caulkers, Cleaners	5/1/2018		$45.01	$25.69	$70.70
Pointers, Caulkers, Cleaners	5/1/2019		$47.76	$25.69	$73.45
Roofers (Composition)	5/1/2017		$36.15	$30.22	$66.37
Roofers (Composition)	5/1/2018		$37.15	$31.27	$68.42
Roofers (Shingle)	5/1/2016		$25.70	$19.17	$44.87
Roofers (Shingle, Slate, Tile)	5/1/2018		$27.50	$20.37	$47.87
Roofers (Slate & Tile)	5/1/2016		$28.70	$19.17	$47.87
Roofers (Slate & Tile)	5/1/2018		$30.50	$20.37	$50.87
Sheet Metal Workers	5/1/2017		$46.42	$39.51	$85.93
Sheet Metal Workers	5/1/2018		$47.58	$41.60	$89.18
Sheet Metal Workers	5/1/2019		$49.79	$42.89	$92.68
Sprinklerfitters	4/1/2017		$37.40	$21.74	$59.14
Sprinklerfitters	4/1/2018		$38.80	$22.74	$61.54
Sprinklerfitters	5/1/2019		$57.20	$28.32	$85.52
Steamfitters	5/1/2017		$54.64	$32.53	$87.17
Steamfitters	5/1/2018		$56.37	$34.39	$90.76
Steamfitters	5/1/2019		$58.17	$35.99	$94.16
Stone Masons	5/1/2017		$40.36	$26.99	$67.35
Stone Masons	5/1/2018		$43.11	$26.99	$70.10
Stone Masons	5/1/2019		$45.86	$26.99	$72.85
Terrazzo Finisher	5/1/2017		$39.06	$22.73	$61.79
Terrazzo Finisher	5/1/2018		$41.31	$22.73	$64.04
Terrazzo Finisher	5/1/2019		$43.61	$22.73	$66.34
Terrazzo Grinder	5/1/2017		$39.33	$22.73	$62.06
Terrazzo Grinder	5/1/2018		$41.58	$22.73	$64.31
Terrazzo Grinder	5/1/2019		$43.98	$22.73	$66.71
Terrazzo Mechanics	5/1/2017		$43.71	$24.81	$68.52
Terrazzo Mechanics	5/1/2018		$46.46	$24.81	$71.27
Terrazzo Mechanics	5/1/2019		$49.21	$24.81	$74.02
Tile Finisher	5/1/2017		$35.55	$24.17	$59.72
Tile Finisher	5/1/2018		$37.55	$24.17	$61.72

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Tile Finisher	5/1/2019		$39.75	$24.17	$63.92
Tile Setter	5/1/2017		$43.71	$24.81	$68.52
Tile Setter	5/1/2018		$46.46	$24.81	$71.27
Tile Setter	5/1/2019		$49.21	$24.81	$74.02
Truckdriver class 1(see notes)	5/1/2017		$30.46	$17.96	$48.42
Truckdriver class 1(see notes)	5/1/2018		$31.93	$17.96	$49.89
Truckdriver class 1(see notes)	5/1/2019		$32.21	$19.19	$51.40
Truckdriver class 1(see notes)	5/1/2020		$34.93	$17.96	$52.89
Truckdriver class 1(see notes)	5/1/2021		$36.48	$17.96	$54.44
Truckdriver class 2 (see notes)	5/1/2017		$30.56	$17.96	$48.52
Truckdriver class 2 (see notes)	5/1/2018		$32.03	$17.96	$49.99
Truckdriver class 2 (see notes)	5/1/2019		$32.31	$19.19	$51.50
Truckdriver class 2 (see notes)	5/1/2020		$35.03	$17.96	$52.99
Truckdriver class 2 (see notes)	5/1/2021		$36.58	$17.96	$54.54
Truckdriver class 3 (see notes)	5/1/2017		$30.81	$17.96	$48.77
Truckdriver class 3 (see notes)	5/1/2018		$32.28	$17.96	$50.24
Truckdriver class 3 (see notes)	5/1/2019		$32.56	$19.19	$51.75
Truckdriver class 3 (see notes)	5/1/2020		$35.28	$17.96	$53.24
Truckdriver class 3 (see notes)	5/1/2021		$36.83	$17.96	$54.79

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		$51.42	$27.39	$78.81
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	$53.20	$27.69	$80.89
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019	4/30/2020	$55.38	$27.69	$83.07
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020	4/30/2021	$57.63	$27.69	$85.32
Carpenter - Chief of Party (Surveying & Layout)	5/1/2021		$59.93	$27.69	$87.62
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		$44.71	$27.39	$72.10
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	$46.26	$27.69	$73.95
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019	4/30/2020	$48.16	$27.69	$75.85
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020	4/30/2021	$50.11	$27.69	$77.80
Carpenter - Instrument Person (Surveying & Layout)	5/1/2021		$52.11	$27.69	$79.80
Carpenter - Rodman (Surveying & Layout)	5/1/2017		$35.77	$21.19	$56.96
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	$37.01	$21.34	$58.35
Carpenter - Rodman (Surveying & Layout)	5/1/2019	4/30/2020	$38.53	$21.34	$59.87
Carpenter - Rodman (Surveying & Layout)	5/1/2020	4/30/2021	$40.09	$21.34	$61.43
Carpenter - Rodman (Surveying & Layout)	5/1/2021		$41.69	$21.34	$63.03
Carpenter	5/1/2018	4/30/2019	$46.26	$27.69	$73.95
Carpenter	5/1/2019	4/30/2020	$47.81	$28.04	$75.85
Carpenter	5/1/2020	4/30/2021	$49.76	$28.04	$77.80
Carpenter	5/1/2021		$51.76	$28.04	$79.80
Carpenters	5/1/2017		$44.71	$27.39	$72.10
Carpenters	5/1/2018		$46.56	$27.39	$73.95
Carpenters	5/1/2019		$48.46	$27.39	$75.85
Carpenters	5/1/2020		$50.41	$27.39	$77.80
Carpenters	5/1/2021		$52.41	$27.39	$79.80
Cement Masons	5/1/2017		$34.45	$31.51	$65.96
Cement Masons	5/1/2018		$35.65	$32.01	$67.66
Cement Masons	5/1/2019		$37.90	$31.51	$69.41
Cement Masons	5/1/2020		$39.70	$31.51	$71.21
Cement Masons	5/1/2021		$41.55	$31.51	$73.06
Electric Lineman	5/29/2017		$52.60	$26.37	$78.97
Electric Lineman	5/28/2018		$53.64	$27.45	$81.09
Electric Lineman	5/27/2019		$54.66	$28.56	$83.22
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2016		$46.20	$31.26	$77.46
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	1/1/2017		$46.20	$31.26	$77.46
Iron Workers	7/1/2017		$47.30	$32.91	$80.21
Laborers (Class 01 - See notes)	5/1/2017		$29.75	$25.65	$55.40
Laborers (Class 01 - See notes)	5/1/2018		$31.25	$25.65	$56.90
Laborers (Class 01 - See notes)	5/1/2019		$32.80	$25.65	$58.45
Laborers (Class 01 - See notes)	5/1/2020		$34.45	$25.65	$60.10
Laborers (Class 01 - See notes)	5/1/2021		$36.20	$25.65	$61.85
Laborers (Class 02 - See notes)	5/1/2017		$29.95	$25.65	$55.60
Laborers (Class 02 - See notes)	5/1/2018		$31.45	$25.65	$57.10
Laborers (Class 02 - See notes)	5/1/2019		$33.00	$25.65	$58.65

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 02 - See notes)	5/1/2020		$34.65	$25.65	$60.30
Laborers (Class 02 - See notes)	5/1/2021		$36.40	$25.65	$62.05
Laborers (Class 03 - See notes)	5/1/2017		$29.95	$25.65	$55.60
Laborers (Class 03 - See notes)	5/1/2018		$31.45	$25.65	$57.10
Laborers (Class 03 - See notes)	5/1/2019		$33.00	$25.65	$58.65
Laborers (Class 03 - See notes)	5/1/2020		$34.65	$25.65	$60.30
Laborers (Class 03 - See notes)	5/1/2021		$36.40	$25.65	$62.05
Laborers (Class 04 - See notes)	5/1/2017		$24.55	$25.65	$50.20
Laborers (Class 04 - See notes)	5/1/2018		$26.05	$25.65	$51.70
Laborers (Class 04 - See notes)	5/1/2019		$27.60	$25.65	$53.25
Laborers (Class 04 - See notes)	5/1/2020		$29.25	$25.65	$54.90
Laborers (Class 04 - See notes)	5/1/2021		$31.00	$25.65	$56.65
Laborers (Class 05 - See notes)	5/1/2017		$30.60	$25.65	$56.25
Laborers (Class 05 - See notes)	5/1/2018		$32.10	$25.65	$57.75
Laborers (Class 05 - See notes)	5/1/2019		$33.65	$25.65	$59.30
Laborers (Class 05 - See notes)	5/1/2020		$35.30	$25.65	$60.95
Laborers (Class 05 - See notes)	5/1/2021		$37.05	$25.65	$62.70
Laborers (Class 06 - See notes)	5/1/2017		$30.65	$25.65	$56.30
Laborers (Class 06 - See notes)	5/1/2018		$32.15	$25.65	$57.80
Laborers (Class 06 - See notes)	5/1/2019		$33.70	$25.65	$59.35
Laborers (Class 06 - See notes)	5/1/2020		$35.35	$25.65	$61.00
Laborers (Class 06 - See notes)	5/1/2021		$37.10	$25.65	$62.75
Laborers (Class 07 - See notes)	5/1/2017		$30.50	$25.65	$56.15
Laborers (Class 07 - See notes)	5/1/2018		$32.00	$25.65	$57.65
Laborers (Class 07 - See notes)	5/1/2019		$33.55	$25.65	$59.20
Laborers (Class 07 - See notes)	5/1/2020		$35.20	$25.65	$60.85
Laborers (Class 07 - See notes)	5/1/2021		$36.95	$25.65	$62.60
Laborers (Class 08 - See notes)	5/1/2017		$30.25	$25.65	$55.90
Laborers (Class 08 - See notes)	5/1/2018		$31.75	$25.65	$57.40
Laborers (Class 08 - See notes)	5/1/2019		$33.30	$25.65	$58.95
Laborers (Class 08 - See notes)	5/1/2020		$34.95	$25.65	$60.60
Laborers (Class 08 - See notes)	5/1/2021		$36.70	$25.65	$62.35
Laborers (Class 09 - See notes)	5/1/2017		$30.10	$25.65	$55.75
Laborers (Class 09 - See notes)	5/1/2018		$31.60	$25.65	$57.25
Laborers (Class 09 - See notes)	5/1/2019		$33.15	$25.65	$58.80
Laborers (Class 09 - See notes)	5/1/2020		$34.80	$25.65	$60.45
Laborers (Class 09 - See notes)	5/1/2021		$36.55	$25.65	$62.20
Laborers (Class 10- See notes)	5/1/2017		$30.25	$25.65	$55.90
Laborers (Class 10- See notes)	5/1/2018		$33.30	$25.65	$58.95
Laborers (Class 10- See notes)	5/1/2018		$31.75	$25.65	$57.40
Laborers (Class 10- See notes)	5/1/2020		$34.95	$25.65	$60.60
Laborers (Class 10- See notes)	5/1/2021		$36.70	$25.65	$62.35
Laborers (Class 11 -See Notes)	5/1/2017		$30.15	$25.65	$55.80
Laborers (Class 11 -See Notes)	5/1/2018		$31.55	$25.65	$57.20

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 11 -See Notes)	5/1/2019		$33.10	$25.65	$58.75
Laborers (Class 11 -See Notes)	5/1/2020		$34.75	$25.65	$60.40
Laborers (Class 11 -See Notes)	5/1/2021		$36.50	$25.65	$62.15
Laborers (Class 12 -See Notes)	5/1/2017		$31.85	$25.65	$57.50
Laborers (Class 12 -See Notes)	5/1/2018		$32.45	$25.65	$58.10
Laborers (Class 12 -See Notes)	5/1/2019		$34.00	$25.65	$59.65
Laborers (Class 12 -See Notes)	5/1/2020		$35.65	$25.65	$61.30
Laborers (Class 12 -See Notes)	5/1/2021		$37.40	$25.65	$63.05
Laborers (Class 13 -See Notes)	5/1/2017		$33.88	$25.65	$59.53
Laborers (Class 13 -See Notes)	5/1/2018		$35.38	$25.65	$61.03
Laborers (Class 13 -See Notes)	5/1/2019		$36.93	$25.65	$62.58
Laborers (Class 13 -See Notes)	5/1/2020		$38.58	$25.65	$64.23
Laborers (Class 13 -See Notes)	5/1/2021		$40.33	$25.65	$65.98
Laborers (Class 14 -See Notes)	5/1/2017		$30.00	$25.65	$55.65
Laborers (Class 14 -See Notes)	5/1/2018		$31.50	$25.65	$57.15
Laborers (Class 14 -See Notes)	5/1/2019		$33.05	$25.65	$58.70
Laborers (Class 14 -See Notes)	5/1/2020		$34.70	$25.65	$60.35
Laborers (Class 14 -See Notes)	5/1/2021		$36.45	$25.65	$62.10
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2017		$23.52	$17.58	$41.10
Laborers Utility (PGW ONLY)	5/1/2017		$30.55	$17.58	$48.13
Landscape Laborer	5/1/2016		$21.19	$22.65	$43.84
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2017		$44.87	$28.14	$73.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2018		$46.41	$28.60	$75.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2019		$47.95	$29.06	$77.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2020		$49.50	$29.51	$79.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2021		$51.04	$29.97	$81.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2017		$47.86	$29.03	$76.89
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2018		$49.41	$29.49	$78.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2019		$50.96	$29.94	$80.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2020		$52.50	$30.40	$82.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2021		$54.05	$30.85	$84.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2017		$44.62	$28.07	$72.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2018		$46.16	$28.53	$74.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2019		$47.70	$28.99	$76.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2020		$49.25	$29.44	$78.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2021		$50.80	$29.89	$80.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2017		$47.61	$28.97	$76.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2018		$49.16	$29.42	$78.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2020		$52.26	$30.31	$82.57
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2021		$53.81	$30.77	$84.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2017		$40.53	$26.87	$67.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2018		$42.07	$27.33	$69.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2019		$43.62	$27.78	$71.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2020		$45.17	$28.24	$73.41
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2021		$46.71	$28.69	$75.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2017		$40.24	$26.78	$67.02
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2018		$41.78	$27.22	$69.00
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2019		$43.32	$27.69	$71.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2020		$44.86	$28.14	$73.00
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2021		$46.41	$28.60	$75.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2017		$38.51	$26.27	$64.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2018		$40.05	$26.73	$66.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2019		$41.60	$27.18	$68.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2020		$43.14	$27.64	$70.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2021		$44.69	$28.10	$72.79
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2017		$37.52	$25.98	$63.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2018		$39.07	$26.43	$65.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2019		$40.61	$26.89	$67.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2020		$42.16	$27.35	$69.51
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2021		$43.70	$27.80	$71.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2017		$54.14	$32.47	$86.61
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2018		$55.99	$33.02	$89.01

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2019		$57.84	$33.57	$91.41
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2020		$59.70	$34.10	$93.80
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2021		$61.55	$34.65	$96.20
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2017		$53.84	$32.40	$86.24
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2018		$55.70	$32.92	$88.62
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2019		$56.00	$35.03	$91.03
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2020		$59.40	$34.03	$93.43
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2021		$61.28	$34.58	$95.86
Painters (Bridges, Stacks, Towers)	2/1/2017		$53.67	$26.09	$79.76
Painters (Bridges, Stacks, Towers)	2/1/2018		$54.14	$27.27	$81.41
Painters (Bridges, Stacks, Towers)	2/1/2019		$55.52	$28.39	$83.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2017		$51.91	$32.53	$84.44
Steamfitters	5/1/2018		$56.37	$34.39	$90.76
Truckdriver class 1(see notes)	5/1/2017		$30.31	$17.96	$48.27
Truckdriver class 1(see notes)	5/1/2018		$31.78	$17.96	$49.74
Truckdriver class 1(see notes)	5/1/2019		$32.06	$19.19	$51.25
Truckdriver class 1(see notes)	5/1/2020		$34.78	$17.96	$52.74
Truckdriver class 1(see notes)	5/1/2021		$36.33	$17.96	$54.29
Truckdriver class 2 (see notes)	5/1/2017		$30.41	$17.96	$48.37
Truckdriver class 2 (see notes)	5/1/2018		$31.88	$17.96	$49.84
Truckdriver class 2 (see notes)	5/1/2019		$32.16	$19.19	$51.35
Truckdriver class 2 (see notes)	5/1/2020		$34.88	$17.96	$52.84
Truckdriver class 2 (see notes)	5/1/2021		$36.43	$17.96	$54.39
Truckdriver class 3 (see notes)	5/1/2017		$30.66	$17.96	$48.62
Truckdriver class 3 (see notes)	5/1/2018		$32.13	$17.96	$50.09
Truckdriver class 3 (see notes)	5/1/2019		$32.41	$19.19	$51.60
Truckdriver class 3 (see notes)	5/1/2020		$35.13	$17.96	$53.09
Truckdriver class 3 (see notes)	5/1/2021		$36.68	$17.96	$54.64

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
F - INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

1. This Non-Collusion Affidavit is material to any contract awarded pursuant to this proposal.

2. This Non-Collusion Affidavit must be executed by the member, officer, or employee of the Proposer who makes the final decision on prices and the amount quoted in the proposal.

3. Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of proposals are unlawful and may be subject to criminal prosecution. The person who signs the affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the Proposer and responsibilities for the preparation, approval or submission of the proposal.

4. In the case of a proposal submitted by a joint venture, each party to the venture must be identified in the proposal documents and an affidavit must be submitted separately on behalf of each party to the joint venture.

5. The term “complementary proposal” as used in the affidavit has the meaning commonly associated with that term in the proposal process, and includes the knowing submission of proposals higher than the proposal of another firm, any intentionally high or noncompetitive proposal, and any other form of proposal submitted for the purpose of giving a false appearance of competition.

6. Failure to submit an affidavit with the Proposal in compliance with these instructions may result in disqualification of the proposal.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
NON-COLLUSION AFFIDAVIT

State of _____:

County of _____:

I state that I am the _____(Title) of _____(Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer or potential proposer.
2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.
3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.
4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.
5. _____(Name of Firm), its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last four (4) years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to proposing and/or bidding on any public contract, except as follows:

_____

I state that _____(Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied upon by the Bucks County Conservation District in awarding the contract for which this proposal is submitted. I understand, and my firm understands, that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the Bucks County Conservation District of the true facts relating to the submission of this proposal.

_____
(Signature)

_____
(Signatory's Printed Name)

_____
(Signatory's Title)

SWORN TO AND SUBSCRIBED
BEFORE ME THIS _____ DAY OF
_____, 20___.

_____
Notary Public

My Commission Expires_____

G - Contractor Responsibility Certification
For
Middletown Township, Bucks County, PA

Firm Name: _____
Firm Address: _____
Contact Name: _____
Telephone No.: _____ Fax No.: _____
Email Address: _____

The submitting firm is required to certify compliance with the contractor responsibility standards set forth below by checking appropriate boxes. Specifically, submitting firms must legitimately answer "Yes" to Questions 1, 2 and 9, 10, 11, 12, 13 and 14 and answer "No" to Questions 3 through 8, in order to be considered for the award of the contract for this project.

☐ Yes ☐ No (1) Does the firm have all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, including, but not limited to, licenses, registrations or certificates required to : (a) do business in the designated locale; and (b) perform the contract work it seeks to perform, including but not be limited to, licenses, registrations or certificates for any type of trade work or specialty work which the firm proposes to self-perform?

☐ Yes ☐ No (2) Does the firm meet bonding requirements for the contract, as required by applicable law or contract specifications and any insurance requirements, as required by applicable law or contract specifications, including general liability insurance, workers compensation insurance and unemployment insurance requirements?

☐ Yes ☐ No (3) Has the firm been debarred by any federal, state or local government agency or authority in the past three (3) years?

☐ Yes ☐ No (4) Has the firm defaulted on any project in the past three (3) years?

☐ Yes ☐ No (5) Has the firm had any type of business, contracting or trade license, registration, or other certification suspended or revoked in the past three (3) years?

☐ Yes ☐ No (6) Has the firm committed a willful violation of federal or state safety laws as determined by a final decision of a court or government agency in the past three (3) years?

☐ Yes ☐ No (7) Has the firm or its owners been convicted of any crime relating to the contracting business by a final decision of a court or government agency in the past ten (10) years?

☐ Yes ☐ No (8) Has the firm within the past three (3) years, been found by a final decision of a court or government agency in violation of any law applicable to its contracting business, but not limited to, licensing laws, tax laws, prompt payment laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the imposition of a fine, back pay damages or any other type of penalty in the amount of $1,000.00 or more?

☐ Yes ☐ No (9) Does the firm agree to pay all craft employees that it employs on the project the current wage rates and benefits as required under the Pennsylvania Prevailing Wage Act for the duration of the referenced project?

☐ Yes ☐ No (10) Does the firm have all other technical qualifications and resources, including equipment, personnel and financial resources, to perform the referenced contract or agree to obtain same through the use of qualified, responsible subcontractors?

☐ Yes ☐ No (11) Does the firm agree to notify the Owner of any material changes to any matters attested to in this certification within the seven (7) days?

☐ Yes ☐ No (12) Does the firm understand and agree that, if it receives a Notice of Intent to Award Contract, it shall provide the Owner within seven (7) days a Subcontractor List that identifies any subcontractors it will use in connection with the project and furnish Contractor Responsibility Certifications for all identified subcontractors with all required supporting documentation.

☐ Yes ☐ No (13) Does the firm understand and agree that this certification must be executed by an authorized representative of the firm who has sufficient knowledge to address all matter addressed herein, and attests, under penalty of perjury, that all information submitted is true, complete and accurate?

In executing this Responsibility Certification, the submitting firm understands and agrees that if Middletown Township determines that this certification contains false or misleading material information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm shall be prohibited from performing work for Middletown Township for a period of three (3) years. Such circumstances shall also subject the firm to any other penalties and sanctions, including contract termination, available to the Township under law. A contract terminated under these circumstances shall further entitle Middletown Township to withhold payment of any monies due to the firm as damages.

I certify that the foregoing representations regarding the past performance and present qualifications of the undersigned firm are true and correct.

_____
Print and Sign Name

_____
Title

_____
Name of Firm

_____
Date

Subscribed and sworn to
before me this_____day
of_____, 20____

_____
Notary Public
My Commission Expires: _____

COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer)_____

Address _____

City _____ State_____ Zip Code _____

☐ Contractor ☐ Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

_____

Authorized Representative Signature

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
I - CONTRACTOR QUALIFICATIONS AND EXPERIENCE

I. EVALUATION CRITERIA

All Bids will be evaluated on the following:

A. Technical qualifications.
B. Past experience with this kind of project: list previous projects including total project cost.
C. Recommendations of previous clients.
D. Capability to meet time schedules and project budget requirements.

II. QUALIFICATIONS AND EXPERIENCE

The following items shall be covered and included in your bid package submittal:

A. Key contractor project personnel:
   1. Professional/technical training record
   2. Project history of personnel, and
   3. Other applicable information

B. Three past project references and contact information
   1. The contractor shall provide a minimum of three (3) projects of similar scope.
   2. The contractor and subcontractor(s) shall provide three (3) references for work which was completed by the contractor within the last 5 years.

C. Failure to submit technical qualifications, experience and references for similar past projects may result in disqualification of this proposal.

III. SUBCONTRACTORS

A. The prime contractor shall provide a list and qualification for each subcontractor intended to be used on this project.
B. The prime contractor shall submit a list of responsibilities for each subcontractor and submit with the proposal.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
J - SAMPLE CONTRACT

This Contract is entered into the _____ day of _____, 2019 by and between the Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA 18901, hereinafter referred to as **"District",** and _____**,** hereinafter **"Contractor".**

WHEREAS, the District has determined a need for habitat enhancement of the Lake Luxembourg Conservation Pool at Core Creek County Park, Middletown Township, Pennsylvania, to address pollution and water quality issues in the area; and

WHEREAS, the District has accepted the Contractor's bid to remove sediment and enhance the habitat of the Lake Luxembourg Conservation Pool.

NOW, THEREFORE, in consideration of the mutual promises and undertakings of the parties, they hereby agree as follows:

1. **"Contract Documents."** Attached hereto and incorporated as if fully set forth herein are the following documents:
    A. General Instructions for Bidders
    B. Proposed Scope of Work
    C. Design Drawings, Titled "Lake Luxembourg Conservation Pool Habitat Enhancement Design", Dated October 31, 2018.
    D. Bid Sheet
    E. Rate Schedule
    F. Non-Collusion Affidavit
    G. Contractor Responsibility Certification
    H. Public Works Employment Verification
    I. Contractor Qualifications and Experience
    J. Sample Contract
        1. Commonwealth Nondiscrimination/Sexual Harassment Clause
    K. Technical Specifications for Lake Luxembourg Conservation Pool Habitat Enhancement Project at Core Creek County Park, Dated July 2019.

2. **"Work."** The term Work means the construction and services required by the Contract documents and includes all other labor, equipment and services provided or to be provided by the **Contractor** to fulfill the **Contractor's** obligations.

3. **Contractor** agrees to perform all Work set forth in the Contract Documents. In consideration of the work performed, the District agrees to pay Contractor a Fixed Amount of $[AWARD AMOUNT].

4. **District's Responsibility**. **District** will assure access and provide all assessment and other information that it has about the site including, but not limited to, surveys, maps, elevations, flow rates and hazards as may be necessary for **Contractor** to complete the Work.

5. **Contractor's Responsibility**. The Contractor is responsible for the equipment, materials, labor, site preparation, stakeout, earthmoving, construction management, restoration, stabilization, site closeout, and any and all work not specifically mentioned in the contract documents but typical of that required in order to provide a fully complete and functional project delivery as described within the project documents.

6. **Acts of God -** If the Project is delayed due to adverse weather conditions, by an Act of God, strikes, war, riot, terrorism or other acts resulting directly or indirectly from other conditions beyond the control of District or the Contractor, then the contract completion date will be adjusted to reflect the new completion date without additional cost to either party. The Project Inspector for the District reserves the right to determine when weather or other unforeseen circumstances warrant a delay or suspension in work. The contractor will not be held responsible for any damage to portions of the project that have already been completed and approved by the Project Inspector.

7. **District's right to stop the Work**. If the Contractor fails to complete the Work within the Contract time or correct Work which is not in accordance with the requirements of

the Contract documents, the District, by written order, may order the Contractor to stop the Work.

8. **District's right to carry out the Work**. If the Contractor fails or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven (7) day period after receipt of a written notice from District to commence and continue correction of such default or neglect with diligence and promptness, District may after such seven (7) day period, without prejudice to other remedies, correct such deficiencies. In such case, the appropriate Change Order shall be issued, deducting from the payments then or thereafter due the Contractor, the cost of correcting such deficiencies.

9. **Time of the Essence**. Time is of the essence in this Contract and, in particular, the completion of the Work on or before September 30, 2021. A final project inspection shall be completed by the District Project Inspector by September 30, 2021. Turtle exclusion fence shall be installed prior to December 31, 2019, Lake Lowering may start in mid-July 2020 in accordance with Permits, Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and Restoration shall occur between April 2021 and July 2021.

10. **Payment Terms**. District shall, within thirty (30) days of the date of invoice receipt, inspect the Work, and remit payment to Contractor, upon approval of the Work.

11. **Dispute Resolution**. All claims, disputes and other matters in question arising out of, or relating to, this Agreement shall be referred to statutory arbitration under the Pennsylvania Uniform Arbitration Act, 42 Pa.C.S. Sections 7301 et seq. (the "Uniform Arbitration Act"). Such arbitration shall be by a panel of three arbitrators, with District and Contractor each to choose an arbitrator, and together the first two arbitrators shall choose a third arbitrator. Costs for the arbitration shall be shared equally by the parties. The arbitration shall take place in Bucks County, Pennsylvania. Arbitration shall occur within sixty (60) days from the date the written request for appointment of arbitrators is made by either party unless an extension is mutually agreed upon by the parties. This

Agreement to arbitrate shall be specifically enforceable under the prevailing Arbitration Law. The award rendered by the arbitrators shall have the effect provided in the Uniform Arbitration Act. The prevailing party shall be entitled to recover all reasonable attorney's fees.

12. Indemnification. Contractor shall be responsible for and agrees to indemnify, defend and hold harmless District from and against damages to property or injuries (including death) to any persons and other losses, damages, expenses (including all attorney's fees and expert costs), claims, demands, suits, and actions by any party against District in connection with the work performed by Contractor. Said indemnity shall be insured without interruption by an acceptable insurance carrier with limits as follows:

(a) Workers' Compensation Employers' Liability Insurance as required by Pennsylvania law with an aggregate limit of One Million Dollars ($1,000,000);

(b) General Liability Insurance on an occurrence basis in the amount of One Million Dollars ($1,000,000) combined single limit for bodily injuries and/or property damage liability; and

(c) Automotive Liability Insurance with limits of One Million ($1,000,000) Dollars per occurrence and One Million Dollars ($1,000,000) combined single limit.

Contractor shall deliver to District Certificates of Insurance evidencing coverage in the above-stated amounts and naming "Bucks County Conservation District" as an additional insured.

13. Performance Bond Contractor is required to furnish a performance bond in the amount of $[AWARD AMOUNT]. Such bond must be furnished upon notification by the District, and prior to contract award. The performance bond shall be furnished by a company licensed to do business in the Commonwealth of Pennsylvania. The performance bond shall be for the entire contract period. Failure to provide the bond

within twenty-one (21) days of notification of award may result in cancellation of contract award.

14. **Labor and Material Payment Bond** Contractor is required to furnish a labor and material payment bond in the amount of $[AWARD AMOUNT]. Such bond must be furnished upon notification by the District, and prior to contract award. The labor and material payment bond shall be furnished by a company licensed to do business in the Commonwealth of Pennsylvania. The labor and material payment bond shall be for the entire contract period. Failure to provide the bond within twenty-one (21) days of notification of award may result in cancellation of contract award.

15. **Delays and Extensions of Time**. If the Contractor is delayed at any time in progress of the Work by an act or neglect of District or by changes ordered in the Work or by labor disputes, fire, unusual delays in deliveries, unavoidable casualties or other causes beyond the Contractor's control which the Project Inspector determines may justify delay, then the time for completion shall be extended by a Change Order.

16. **Notices.** All notices required or permitted to be given under this Agreement shall be in writing and shall be deemed given when delivered personally, by facsimile, or when sent by registered or certified mail, return receipt requested, addressed to the address set forth below. If notice is sent by registered or certified mail, postage will be prepaid. Notices may also be transmitted electronically between the parties provided that proper arrangements are made in advance to facilitate such communications and provide for their security and verification.

[Contractor Mailing Address]

Bucks County Conservation District
1456 Ferry Road, Ste. 704
Doylestown, PA 18901

17. Governing Laws. This Contract shall be governed in accordance with the laws of the Commonwealth of Pennsylvania. Venue and jurisdiction for any claims arising out of this Agreement shall be exclusively in Bucks County, Pennsylvania.

18. Permits. This Contract shall abide by all relevant permits pertaining to this Project. This includes the Joint Permit for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit, General (PAG-02) NPDES Permit, and Erosion and Sediment Control Certification from Bucks County Conservation District.

18. Severability. In the event any provision of this Agreement is found to be invalid, illegal, or unenforceable by a court of competent jurisdiction, the remaining provisions of this Agreement shall nevertheless be binding upon the parties with the same effect as though the void or unenforceable part had been severed and deleted.

19. Entire Agreement. This Agreement constitutes the entire agreement between the parties with respect to this Agreement, and all prior agreements relating to the Work hereunder, express or implied, written or oral, are nullified and superseded hereby.

20. Amendments. This Agreement may not be modified, amended, assigned, supplemented, or rescinded, nor any provision hereof waived, except by an instrument in writing executed by both parties.

21. Binding Agreement. This Agreement shall be binding upon the parties and their respective successors and assigns.

22. **Counterparts**. This Agreement, and any amendment or supplement hereto, may be executed in several counterparts, each of which shall be deemed an original, and all of which taken together shall constitute one and the same instrument.

23. Authority. Each Party to the Contract states and affirms that it has full power and authority to execute, deliver and perform this Agreement and that each has obtained any and all approvals or consents required for the actions contemplated herein. Each Party to the Agreement states and affirms that its signatory has full authority to sign for the Party, and that his/her signature binds the Party to the Agreement.

IN WITNESS WHEREOF, and intending to be legally bound, the parties have executed this Agreement the day and year first above written.

Bucks County Conservation District

_____

_____ _____

Witness Name and Title (Please Print)

Contractor

_____

_____ _____

Witness Name & Title (Please Print)

ATTACHMENT B
Rev. 7/99

NONDISCRIMINATION/SEXUAL HARASSMENT CLAUSE

During the term of the Contract, the Contractor agrees as follows:

a. In the hiring of any employees for the manufacture of supplies, performance of work, or any other activity required under the Contract or any subcontract, the Contractor, subcontractor or any person acting on behalf of the Contractor or subcontractor shall not by reason of gender, race, creed, or color discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

b. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of work or any other activity required under the Contract on account of gender, race, creed, or color.

c. The Contractor and any subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

d. The Contractor shall not discriminate by reason of gender, race, creed, or color against any subcontractor or supplier who is qualified to perform the work to which the Contract relates.

e. The Contractor and each subcontractor shall furnish all necessary employment documents and records to and permit access to its books, records, and accounts by the contracting officer and the Department of General Services' Bureau of Contract Administration and Business Development for purposes of investigation to ascertain compliance with the provisions of this Nondiscrimination/Sexual Harassment Clause. If the Contractor or any subcontractor does not possess documents or records reflecting the necessary information requested, it shall furnish such information on reporting forms supplied by the contracting officer or the Bureau of Contract Administration and Business Development.

f. The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that such provisions will be binding upon each subcontractor.

g. The Commonwealth may cancel or terminate the Contract, and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the agency may proceed with debarment or suspension and may place the Contractor in the Contractor Responsibility File.

TECHNICAL SPECIFICATIONS

FOR

Lake Luxembourg Conservation Pool Habitat Enhancement Project

AT

CORE CREEK COUNTY PARK
1900 N WOODBOURNE ROAD
MIDDLETOWN TOWNSHIP, PA 19047

FOR

BUCKS COUNTY CONSERVATION DISTRICT
1456 FERRY ROAD, SUITE 704
DOYLESTOWN, PA 18901

PREPARED BY:

PRINCETON HYDRO, LLC
1108 OLD YORK ROAD, SUITE 1
P.O. BOX 720
RINGOES, NEW JERSEY 08551

JULY 2019

Geoffrey M. Goll, P.E.
Pennsylvania Professional Engineer
License No. PE-050997-E

TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

Attachments:

Attachment 1: Permits
- **Joint Permit – PADEP and USACE**
- **General NPDES Permit**
- **Erosion and Sediment Control Certification**

Attachment 2: Design Plans
Attachment 3: Bald Eagle Monitoring Guidelines
Attachment 4: Hydrologic and Hydraulic Modeling Report

SECTION K – TECHNICAL SPECIFICATIONS

SECTION 011000 - SUMMARY

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Work restrictions.
   5. Specification and drawing conventions.

B. Related Section:
   1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: **Lake Luxembourg Conservation Pool Habitat Enhancement Design Project**

All references to “Project Location,” “Property Owner,” “Project Sponsor,” “Project Engineer,” and “Project Representative “in this document shall be as defined below:

1. Project Location: Property is located in Core Creek Park west of North Woodbourne Road, Langhorne, Pennsylvania.

2. Project Sponsor: Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA 18901.

3. Property Owner: Bucks County Parks and Recreation, 901 East Bridgetown Pike, Langhorne, PA 19047.

4. Project Engineer: Princeton Hydro, 1108 Old York Road, Suite 1 P.O. Box 720, Ringoes, NJ 08551

5. Project Biologist: Ecological Associates, LLC, P.O. Box 181 Oley, PA 19547

6. Project Representatives:

   a. Project Sponsor: Ms. Gretchen Schatschneider, Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA, 18901.

b. Property Owner: Mr. Bill Mitchell, Bucks County Parks and Recreation

c. Project Engineer: Mr. Geoffrey M. Goll, P.E., Princeton Hydro, LLC, 1108 Old York Road, Ringoes, NJ 08551.

d. Project Contacts

1) Project Sponsor Representative: Ms. Meghan Rogalus, Bucks County Conservation District; 1456 Ferry Road, Suite 704, Doylestown, PA, 18901.

2) Project Engineer Representative: Ms. Amy McNamara, E.I.T., Princeton Hydro, LLC, 1108 Old York Road, Ringoes, NJ 08551.

3) Project Biologist: Mr. Marlin Corn, Ecological Associates, LLC, 315 Swamp Road, Newtown, PA 18940.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. The project involves removal of sediment from the Lake Luxembourg Conservation Pool in Langhorne, Bucks County, Pennsylvania.
2. The project involves habitat enhancement of the Conservation Pool area via, vegetation establishment, tree stump habitat features, and tree vanes.
3. The project involves dewatering of sediment removed from the Conservation Pool in an adjacent agricultural field, and integrating sediment into the field once dewatering has been completed.
4. The project involves the restoration of disturbed forest and wetlands.
5. The project consists of compliance with the design plans and all jurisdictional approvals obtained for this project.

B. Specific details on the construction can be found in the plans titled “Lake Luxembourg Conservation Pool Habitat Enhancement Design”, dated October 31, 2018, last revised May 10, 2019 as signed by Geoffrey M. Goll.

C. All unit pricing and submitted bids shall reflect a Fall/Winter 2019 through Spring/Summer 2021 construction schedule.

D. The project is broken into three (3) main parts:

1. Endangered Species Protection and Lake Lowering/Preparation for Construction,
   a. Super Silt fence around the perimeter of the project site to restrict turtles from nesting in the work zone to be installed prior to January 1, 2020 timing restriction for the Bald Eagle.
   b. Vehicular inspection of the fence in mid-April to insure it is in intact. Repairs shall be made as necessary however, direct site from the eagle nest shall be minimized and the sound muffled.

c. May, June and July vehicular inspections for damaged fence and turtles trapped within the fence. The fence shall be repaired as above and trapped turtles shall be relocated outside the work area.
d. The lake can start to be lowered at a rate of 1 foot per day in mid-July in accordance with the permits obtained for this project.
e. A separate contract between Buck's County Conservation District and Ecological Associates, LLC has been entered into. They are responsible for the inspections in April, May, June, and July. They will NOT be performing any repairs to the fence installed under this contract. They are responsible for communicating any necessary repairs to the selected contractor via the owner.

2. Sediment Removal and Dewatering, and
   a. The removal of the accumulated material, creation of the dewatering berms, and placement of the accumulated material in the farm field shall be completed August 1 and December 31st, 2020.
   b. This installation of the habitat features shall be completed between August 1 and December 31st, 2020.
3. Restoration.
   a. Work in the agricultural field can occur from April 1 through the end of July. The contractor shall respread the topsoil over the dewatered material and till them together.
   b. The installation of the vegetation within the Conservation Pool shall be installed as per the design plans post July 31, 2021.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas identified within the Limit of Disturbance indicated on the attached construction plans. Do not disturb portions of Project site beyond areas in which the Work is indicated.

C. Limits: Confine construction operations to areas within the Limit of Disturbance as shown on the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

D. Access to the work area during the bald eagle timing restriction (January 1 through July 31) shall be via closed vehicles, i.e. no ATVs or by foot to the greatest extent practical. This is especially necessary for the inspections of the turtle exclusion fence. Refer to Attachment 3 Bald Eagle Monitoring Guidelines for signs of distress to the bald eagle.

1.5 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

B. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

C. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, except as otherwise approved by the Property Owner or Authorized Project Representative.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Noise outside of standard daily traffic on Woodbourne Road and agricultural practices within the fields adjacent to the forebay shall be avoided between January 1 and July 31 of each year.

2. Notify Bucks County Conservation District and Bucks County Parks and Recreation not less than two (2) days in advance of proposed disruptive operations.

3. Obtain the Bucks County Conservation District and Bucks County Parks and Recreation's written permission before proceeding with disruptive operations.

F. Inspections during bald eagle timing restrictions shall follow this protocol as provided by U.S. Fish and Wildlife Services' Northeast Region Eagle Coordinator:

1. Monitors must be made aware of the nest's precise location;

2. Monitors must be familiar with bald eagle behavior and able to recognize signs of agitation and stress (See Section C of the Bald Eagle Monitoring Guidelines for reference included in attachment 3 of the specification);

3. Monitors must perform inspections from closed-cab vehicles to the maximum extent practicable;

4. When monitors must exit the vehicle, they must attempt to obscure their visibility to the nest using the vehicle or natural features as screens;

5. Monitors must never approach the nest directly on foot or walk within 100 feet of the nest;

6. Monitors must travel outside the 330-foot buffer to relocate collected turtles;

7. While traveling within the 330-foot buffer, monitors must not make unnecessary loud noises, such as honking horns or shouting;

8. Monitors must limit inspections to daylight hours; and

9. If monitors witness signs of stress or agitation from the eagles, they must immediately exit the 660-foot buffer. The project representative must then contact U.S. Fish & Wildlife Service and Pennsylvania Game Commission for further guidance.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)
PART 4 – MEASUREMENTS AND PAYMENTS (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.2 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

B. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

1. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
2. Coordination information, including a list of changes or modifications needed to other parts of the Work, which will be necessary to accommodate proposed substitution.
3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
5. Samples, where applicable or requested.
6. Certificates and qualification data, where applicable or requested.
7. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
8. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
9. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

10. Cost information, including a proposal of change, if any, in the Contract Sum.
11. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
12. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

C. Engineer's Action: If necessary, Project Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Project Engineer will notify Contractor of acceptance or rejection of proposed substitution within seven (7) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

1. Forms of Acceptance: Change Order, Construction Change Directive, or Project Engineer's Supplemental Instructions for minor changes in the Work.
2. Use product specified if Project Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.3 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

B. Approval: All substitution must be approved by the Project Engineer, Property Owner, and Project Sponsor.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than seven (7) days prior to time required for preparation and review of related submittals.

B. Conditions: Project Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Project Engineer will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution is consistent with the Contract Documents and will produce indicated results.

2. Substitution request is fully documented and properly submitted.
3. Requested substitution will not adversely affect Contractor's construction schedule.
4. Requested substitution has received necessary approvals of authorities having jurisdiction.
5. Requested substitution is compatible with other portions of the Work.
6. Requested substitution has been coordinated with other portions of the Work.
7. Requested substitution provides specified warranty.
8. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience: Shall follow the same procedure and protocol as described above.

PART 3 - EXECUTION (Not Used)
PART 4 – MEASUREMENTS AND PAYMENTS (Not Used)

END OF SECTION 012500

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Pre-construction photographs.
2. Final completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site with notation of vantage points marked for location and direction of each photograph. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three (3) days of taking photographs.

C. Digital Camera: Minimum sensor resolution of eight (8) megapixels.

D. Format: Minimum 1600 by 1200 pixels, 400 dpi minimum, in unaltered original files, with same aspect ratio as the sensor, uncropped, date- and time- stamped, in folder named by date of photograph, accompanied by key plan file.

E. Identification: Provide the following information with each image description in file metadata tag:

1. Name of Project.
2. Name of Contractor.
3. Date photograph was taken.
4. Description of vantage point, indicating location, direction (by compass point).
5. Unique sequential identifier keyed to accompanying key plan.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of eight (8) megapixels, and at an image resolution of not less than 1600 by 1200 pixels and 400 dpi.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

B. Flag construction limits before taking construction photographs.

C. Take at least 10 photographs to show existing conditions before starting the Work.

D. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Final Completion Construction Photographs: Take at least 10 color photographs after date of Substantial Completion for submission as project record documents.

PART 4 – MEASUREMENTS AND PAYMENTS

Completions of efforts described above shall be included in the mobilization/demobilization bid item.

END OF SECTION 013233

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

A. Site Access: Accessing site as outlined on Sheets 3 of 16 entitled Overview, Access, and Turtle Barrier Plan of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
C. Temporary facilities should be installed per the Plans to provide adequate access and protection for the Work.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until construction is nearly complete and removal is approved by Applicant's Representative and Civil Engineer.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

a. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

b. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape

development, remove soil and aggregate fill that do not comply with requirements as specified in that subsection of this document. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

c. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified by the Property Owner.

PART 4 – MEASUREMENTS AND PAYMENTS

Payment for Temporary Facilities and Controls efforts shall be incorporated in the bid item for Mobilization/Demobilization.

END OF SECTION 015000

SECTION 015526 - TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All means necessary to warn and protect the public's ingress and egress from the construction site as well as access for emergency vehicle access. All construction access shall be from the intersection of Silver Lake Road and Village Road located to the eastern side of the site.
2. It is not anticipated that there will be regular construction traffic exiting the site as the material will disposed of onsite.

1.2 GENERAL

A. The Contractor shall maintain traffic and provide safety for motorist, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipments.

B. The contractor shall route road users through the Temporary Traffic Control zones using roadside signs.

C. The contractor shall provide adequate warning, delineation, and channelization to assist guiding road users in advance of and through the Temporary Traffic Control zones and detours.

D. The Contractor shall provide positive guidance to road users traversing the Temporary Traffic Control zone.

E. Contractor should routinely inspect and monitor the temporary traffic devices.

F. The Temporary Traffic Control zones shall be divided into four areas: advance warning area, transition area, activity area, and termination area.

G. All traffic control shall meet the requirements of the "Manual on Uniform Traffic Control Devices."

H. The contractor shall provide flaggers as necessary for equipment ingress and egress to ensure safety of the public, workers, equipment, and adjacent property.

I. The contractor shall plan delivery routes which minimize the use of local and neighborhood roads to the greatest extent possible.

J. At a minimum the contractor shall install warning signs for the construction entrance along Silver Lake Road and Village Road.

PART 2 - PROCEDURES

2.1 MATERIALS

A. The Contractor shall erect and maintain in good condition temporary traffic control devices in accordance to the codes and requirements of “Manual on Uniform Traffic Control Devices” (MUTCD).

B. The colors for the warning signs shall follow the Standards in Table 2A-5 and Chapter 5G of the MUTCD manual.

C. All signs and traffic control devices shall conform to the MUTCD standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. All signs shall be erected and maintained in a substantial manner acceptable to the Project Engineer or Owner and shall be maintained so as to provide maximum visibility and legibility at all times.

B. Any damage to newly constructed or existing pavements caused by the Contractor’s operations shall be repaired by the Contractor where and as directed by the Project Engineer or Owner, at the Contractor’s expense, or the repairs will be made by others and the cost of such repairs will be charged against the Contractor.

C. The Contractor shall provide for prompt removal from existing roadways and sidewalks of all dirt and other materials that have been spilled, washed, tracked or otherwise deposited thereon by this hauling and other operations whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements or create a traffic hazard.

D. The Contractor shall provide means of access for pedestrian and vehicular traffic at all private driveways and occupied buildings affected by the work of this contract. During construction in the vicinity of a driveway, the access at the driveway entrance shall be plainly marked as meet with the acceptance of the Owner.

PART 4 - MEASUREMENTS AND PAYMENTS

Payment for Traffic Control efforts shall be incorporated in the bid item for Mobilization/Demobilization.

END OF SECTION 015526

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary High Visibility Fence for tree protection and project security fence shall be installed around the perimeter of the work area as depicted on Sheet 5 of 16 “Interim Grading Plan Viewport 2”.

2. Goose Fencing shall be installed to protect plantings within the conservation pool. The goose fence installation shall be completed immediately following the installation of plant material and outside the bald eagle timing restriction.

3. Tree Cages shall be installed around all trees and shrubs to protect for herbivore browsing.

PART 2 - PRODUCTS

A. Materials for High Visibility Fence shall comply with the following:

1. The fencing shall be installed in the locations identified on Sheet 5 of 16 “Interim Grading Plan Viewport 2”.
2. Detail D and E provided on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
3. The fence shall be a minimum of four (4) feet high with stakes installed at eight (8) foot on center.
4. The fence shall be constructed of UV stabilized high visibility orange polyethylene safety fence for use as tree protection and/or security identifying the project limit.

B. Materials for Goose Fencing shall comply with the following:

1. The fence shall be installed where plantings are proposed in the Conservation Pool as shown on Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
2. Detail F provided on Sheet 11 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Materials for Tree Cages shall comply with the following:

1. Tree cages shall be installed around each tree or shrub installed as part of this project.

2. The contractor shall cage the vegetation promptly after installation to avoid any damage from deer in the area.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fencing and cages for defects and problems that might affect performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install High Visibility Fence in accordance with Detail E on Sheet 14 of 16 and around active work area as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

B. Install Goose Fencing so as to protect the Conservation Pool plantings proposed on Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Install temporary fencing outside the drip line of trees to be saved to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion, as described in Section 312500 “Erosion and Sediment Control”. Install in accordance with Detail E on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

3.3 REPAIRS

A. Repair fencing as necessary throughout construction period and as requested by Engineer.

PART 4 – MEASUREMENTS AND PAYMENTS

HIGH VISIBILITY FENCE	LINEAR FEET
GOOSE FENCING	LINEAR FEET

Payment for tree cages shall be included in the unit price for the trees and shrubs in Section 329300 “Plants”.

END OF SECTION 015639

SECTION 015719 - ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.1 SCOPE

A. This section covers the furnishing of all labor, materials and equipment to perform all work required for the protection of the environment during construction operations except for those measures set forth in other Section of these specifications.

1.2 GENERAL

A. For the purpose of this specification, environment protection is defined as the retention of the environment in its natural state to the greatest possible extent during project construction and to enhance the natural appearance after project completion. Environment protection requires consideration of air, water, and land, and involves noise, solid waste-management and management of radiant energy and radioactive materials, as well as other pollutants. In order to prevent, and to provide for abatement and control of, any environmental pollution arising from the construction activities in the performance of this contract, the Contractor and his subcontractors shall comply with all applicable Federal, State and local laws and regulation concerning environmental pollution control and abatement. The contractor and his subcontractors shall also comply with any existing environmental permits.

1.3 SUBCONTRACTORS

A. Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

1.4 IMPLEMENTATION

A. At the pre-construction conference, the Contractor will meet with the Project Applicant/Property Owner to develop mutual understandings relative to compliance with this provision and administration of the environmental program.

1.5 PROTECTION OF LAND RESOURCES

A. The land resources with the project boundaries shall be preserved in their present condition or be restored to a condition after completion of construction which will appear to be natural and not distract from the appearance of the project. The Contractor shall confine the construction activities to limits of disturbance defined by the plans.

1.6 PROTECTION OF WATER RESOURCES

A. The Contractor shall not pollute waterways with any harmful materials. The Contractor shall comply with all applicable Federal, State, County and Municipal laws concerning pollution of waterways.

1.7 DISPOSAL OF WASTE MATERIALS

A. Contractor shall provide for proper disposal or recycling of all materials generated by the site demolition. Disposal shall be at a Pennsylvania Department of Environmental Protection (PADEP) licensed and approved hazardous waste, recycling or other appropriate facility. Owner shall receive any proceeds from sale or recycling of recycled materials. Prior to payment for any waste disposal, the contractor shall provide certifications as required by the PADEP indicating the receiving facility for the material and the method of disposal. In the event that there is no relevant PADEP regulation governing disposal and/or recycling of the material, Contractor shall supply at a minimum documentation indicating the location of the facility where disposal occurred, name of the hauling company and date that the material was delivered. If the material was considered "hazardous material', a copy of the hazardous material bill of lading shall be provided.

1.8 DUST CONTROL

A. The Contractor shall be required to maintain all work areas within the project boundaries free from dust which would cause a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and the cost thereof shall be considered incidental to, and included in the contract. The Contractor will bear all costs associated with any damages resulting from any dust nuisance and agrees to hold the Bucks County Conservation District harmless in any related action.

PART 2 – MATERIALS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

There are no specific line items for this section and any effort to protect the environment as per this subsection shall be incorporated into the project via Mobilization/Demobilization.

END OF SECTION - 015719

SECTION 017113 - MOBILIZATION/DEMOBILIZATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the Contract. It shall include transportation of personnel, equipment, and operating supplies to the site; establishment of necessary facilities at the site; and other preparatory work at the site.

B. It shall include the construction staging and stockpiling areas for equipment and materials.

C. It shall include all equipment and material transport.

D. It shall include construction layout by the contractor for verification of construction quantities.

E. It shall include completion of a survey as-built of the completed sediment removal and habitat enhancement work to verify construction was completed as designed.

F. It shall include transportation and demobilization of personnel, and equipment off the site at the conclusion of the project.

G. It shall include the items described in the specification sections for Environmental Protection, Traffic Control, Temporary Facilities & Controls, and Photographic Documentation.

H. It shall include all work not specifically mentioned in the contract documents but typical of that required in order to provide a fully complete and functional project delivery as described within the project documents.

1.2 DEFINITIONS

A. High Pile: A stockpile of material within a lake or pond intended for dewatering of material prior to transport and disposal.

1.3 SUBMITTALS

A. Health and Safety Plan prepared for work on the site. Items should include but not limited to the following:

1. Compliance with all affected federal, state, and local environmental, safety and health requirements applicable to the scope of work.

2. Compliance with all current OSHA regulations, requirements, and training.

3. Designated a safety representative and/or alternate personal to be onsite during construction to oversee all safety matters.

4. Summary of the responsibilities of the contractor and subcontractors hired by the contractor.

5. All personnel should be trained in construction safety policies, regulations, and procedures for the project prior to start of work.

6. The employees and subcontractors are being informed of all known hazardous materials.

7. Individual contractors or subcontractor competent in performing construction work

8. Detailed direction to the nearest hospitals and/or emergency facilities.

9. First Aid Kit shall be maintained onsite at all times.

10. Fire extinguisher should be provided and properly maintained near the job site.

11. Implementation of the project-specific plan.

B. Survey verification performed by the contractor or an approved subcontractor

C. Shop drawings and/or material specifications as required or identified in later sections of this Specification.

PART 2 – MATERIALS

2.1 REQUIREMENTS

A. Contractor cannot commence construction work without prior review and approval of the required submittals by the Project Engineer

B. Contractor to provide Project Engineer and Owner any and all submittals, shop drawings, regular field inspections, and other project communications and coordination not specifically mentioned elsewhere but necessary to perform the work as per the project documents.

PART 3 – EXECUTION

3.1 SURVEY VERIFICATION

A. Locations of all above ground and subsurface utilities, structures, inverts, and grades should be field verified by the contractor prior to construction.

A. Any discrepancies should be immediately reported to the Project Engineer. No work shall commence until further direction from Project Engineer.

B. All right-of-way lines, property boundaries, and easements are to be staked as directed by the Engineer.

C. Survey work is to be performed by a Professionally Licensed Surveyor.

3.2 STAGING AND STOCKPILING

A. General: Comply with the following:
   a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

3.3 ENVIRONMENTAL PROTECTION

A. Comply with requirements of authorities having jurisdiction.
B. Comply with Section 015719 “Environmental Protection”.

3.4 TEMPORARY FACILITIES

A. Comply with section 015000 “Temporary Facilities and Controls”.

3.5 PHOTOGRAPHIC DOCUMENTATION

A. Comply with Section 013233 “Photographic Documentation”.

3.6 TRAFFIC CONTROLS

A. Comply with requirements of authorities having jurisdiction.
B. Protect existing site improvements to remain including curbs, pavement, and utilities.
C. Maintain access for fire-fighting equipment and access to fire hydrants.
D. Comply with Section 015526 “Traffic Control”.

3.7 CONSTRUCTION LAYOUT

A. At the request of the Contractor the Engineer will supply digital maps of the construction plans for use in the placement of construction stakes, lines and grades. The maps will be supplied in a vertical datum of NAVD 88.
B. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the existing benchmarks. If discrepancies are discovered, notify Project Engineer promptly.
C. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
D. Establish benchmarks and control points to set lines and levels at each level as needed to locate each element of Project.
E. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
F. Inform installers of lines and levels to which they must comply.
G. Check the location, level and plumb, of every major element as the Work progresses.
H. Notify Project Engineer when deviations from existing and proposed conditions occur.

I. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill, utility slopes, and invert elevations.

J. Prior to construction, barriers shall be installed to inhibit the migration of turtles into the construction zone.

K. Sediment Removal Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.
    b. For excavation and fills including sediment removal, one stake at a grid spacing of 25 feet along the centerline of the Conservation Pool' longest dimension, locating a stake at each outer edge of sediment removal (waters edge), centerline of sediment removal and halfway between the centerline of sediment removal and the outer edge of sediment removal. The extent of sediment removal depth shall be noted on each stake.
    c. Top of sediment points for the entire work area shall be submitted to the Engineer for review prior to starting the sediment removal. The points shall have x, y, and z data.
    d. As depicted on the plans, the estimated bottom of sediment and horizontal sediment removal limits as identified on the cross sections and proposed conditions sheets of the Contract Plans is the project limit beyond which must not be excavated, unless approved in writing by the Engineer prior to the commencement of such additional excavation. The contactor shall not be compensated for sediment removal beyond these limits, if not approved by the Owner in writing beforehand.

L. Field/Disposal Area Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.
    b. For excavation and fills including dewatering sediment and berms, one stake at a grid spacing of 25 feet along the centerline of the field's longest dimension, locating a stake at each outer edge of the field, centerline of the field and halfway between the centerline of the field and the outer edge of field. The extent of dewatering sediment depth shall be noted on each stake.
    c. Stakes shall be laid out in the field area prior to the creation of the berms, prior to the addition of the dewatering sediment, and before and after the sediment has been dewatered and is spread throughout the field.

M. Conservation Pool Enhancement Area Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.

b. For habitat enhancement including tree vanes and turtle habitats, offset from the banks of the Conservation Pool to determine placement.

N. As-Built Survey

1. At the completion of the project and prior to the final payment, the Engineer will supply the Contractor with originals of the contract plans including the construction plans, profile sheets, cross-sections, bridge plans and construction details of the project. The Contractor shall prepare As-Built drawings utilizing these plans. The Contractor will place all as-built dimensions and elevations as determined from the construction work on these plans and profile sheets. This will include completed bottom of lake elevations, centerline, field elevations, channel inverts, road dimensions, etc. The certified As-Built plans, signed and sealed by a Pennsylvania Licensed Professional Land Surveyor, shall be submitted to the Engineer. The payment for as-built plans shall be included in the item entitled, "As-Built Survey."
    a. Grade layout shall be performed every 100 feet ahead of sediment removal. The contractor shall also provide as built elevations and sediment removed volumes every 100 feet of completed sediment removal, and as preparation of the as-built plan. The contractor shall provide the Engineer at a minimum a point file with x, y, and z data when requested. The progress surveys shall be submitted to the Engineer within 3 business days of completion of the progress survey.

PART 4 – MEASUREMENT AND PAYMENT

Bid items described in this section shall be paid for via the following bid items. The contract cost shall include any repairs or enhancements to these items in order for use during construction, compliance with regulations, and restoration to preconstruction conditions.

MOBILIZATION/DEMOBILZATION	LUMP SUM
AS-BUILT SURVEY	LUMP SUM

END OF SECTION - 017113

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Starting and adjusting.
   3. Protection of installed construction.
   4. Correction of the Work.

1.2 INFORMATIONAL SUBMITTALS

A. Delivery Manifests for all materials brought onsite.

B. Disposal Manifests for any material exported offsite and disposed of.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated, as per Section 017113 “Mobilization/Demobilization”.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

B. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

C. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to the Project Representative that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Project Engineer.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

3.4 CORRECTION OF THE WORK

B. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

C. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

D. Restore permanent facilities used during construction to their specified condition.

E. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

F. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

PART 4 MEASUREMENT AND PAYMENT (Not Used)

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Final completion procedures.
   2. Warranties.
   3. Final cleaning.
   4. Final site restoration of the entire project activities.

1.2 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment.
   2. Submit copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list). The list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit copy of completed surveyed as-built drawing.
   4. Submit site restoration project upon completion of the project.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Project Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.

C. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.3 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

B. Organize items by major element, including categories.

1.4 WARRANTY

A. All work performed is subject to a 1 year Contractor’s warranty of workmanship and materials.

B. Plants are subject to a 1 year Contractor’s warranty as detailed in Section 329300 “Plants”.

C. Disclaimers and Limitations: Manufacturer’s disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products.

D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

E. Reinstatement of Warranty: When Work covered by the warranty has failed and been corrected, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment of depreciation.

F. Replacement of Cost: On determination that Work covered by warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through part of its useful service life.

PART 1 - PRODUCT (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

2. Remove tools, construction equipment, machinery, and surplus material from Project site.

3.2 FINAL SITE RESTORATION

A. General: Perform final restoration to all disturbed area. Conduct cleaning and contaminated sediment waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Restore project site to pre-existing conditions and to the satisfaction of owners, Project Engineer, and Bucks County Conservation District.

1. Contractor to be responsible to restore any damages to structure, pavements, trees, and vegetations as result of the construction activities.

2. Contractor to re-establish all areas disturbed during the construction activities to comply with regulatory requirements.

PART 4 – MEASUREMENT AND PAYMENT (Not Used)

END OF SECTION 017700

SECTION 311200 - SELECTIVE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation as necessary.

1.2 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. Any trees removed during site clearing may be used for habitat features in the Conservation Pool.

1.4 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig! at 1-800-242-1776 for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Needed)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. The project shall be first staked out by a surveyor prior to flagging. Contractor shall locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground. The project engineer and the Owner representative shall jointly review the flagging prior to tree removal.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.3 EXISTING UTILITIES

A. There are one proposed or existing utilities as part of this project.

B. The contractor shall have the site marked out and cleared by PA One Call. A copy of the clearance certificates shall be provided to the Engineer.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

3.4 SELECTIVE CLEARING

A. Remove obstructions, trees, shrubs, and other vegetation as needed for construction access.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site. Tree logs should be used for tree vanes as directed by Engineer.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 12 inches, and compact each layer to a density equal to adjacent original ground.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

PART 4 – MEASUREMENT AND PAYMENT

SELECTIVE CLEARING	LUMP SUM

END OF SECTION 311000

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation to complete Conservation Pool sediment removal as shown on design plans.
   2. Stripping of topsoil and creation of berms.
   3. Grading of disposal material on agricultural field.

1.2 Definitions

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Removed Sediment: This is the sediment, organic matter, rock and other material removed from the lake bottom.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Fill: Soil materials used to raise existing grades.

H. High Piling: A stockpile of material within a lake or pond intended for dewatering of material prior to transport and disposal.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

M. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 SCOPE

A. The work shall include the removal of sediment from the Conservation Pool and dewatering in preparation to move the dewatering sediment to the Field. This work is encompassed in the "Sediment Removal" line item.

B. The work shall include the stripping of topsoil within the farm field designated for sediment placement. The stripped material shall be used to construct berms approximately every 50 feet as shown on the plans. The berms shall be constructed as shown in the design plans. This work is encompassed in the "Interim Grading – Berms" line item.

C. The Work shall include the removal of sediment from the Conservation Pool, trucking and hauling of removed sediment to adjacent field, and placement behind the topsoil berms. This shall include the effort necessary to move material within the Project Area to stockpile and disposal locations. All necessary means and methods for the purpose of sediment removal including, but not limited to the construction of in-lake roads, mud mats, matting with in the field, and high piling of material within the Conservation Pool limits shall be included in this section. This work is encompassed in the "Interim Grading – Dewatering Sediment" line item.

D. The contractor is responsible to use means of access which will minimize the short and long term impacts to the access areas. These shall include but not limited to:
   1. In-lake roads
   2. Mud Mats
   3. 4 by 8 feet sheathing board or approved equal beneath the access roads along the trees and within the field to minimize rutting, no excavation shall occur in order to install matting and/or to protect large trees from root damage.

E. The work shall include the final grading of the agricultural field as shown on the plans. This shall include the removal of compaction to a minimum of 24 inches below grade, the intermixing of removed sediment with native subsoils, the respreading of the topsoil over the spoils and intermixed to meet final grade. All necessary means and methods for the purpose of intermix the soils, remove compaction, and preparing final grade. This work is encompassed in the "Grading of Sediment Materials" line item.

   1. Additionally, the contractor is responsible for the blending of a sample (subsoils, stripped topsoil, and dewatered sediment) which shall be tested for the purpose of establishing a Nutrient Management Plan (i.e., agricultural testing) to be implemented as part of soil intermixing in order to assure successful vegetation establishment. These labs may include Penn State Cooperative Extension or Rutgers.

1.4 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig! 1800-242-1776 for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion and sedimentation control measures are in place.

1.5 SUBMITTALS

A. Material Test Reports: For representative intermixed fill soils as follows:

1. Classification according to ASTM D 2487.

2. Laboratory compaction curve according to ASTM D 698.

B. Waste Characterization: For any soil or sediment material being removed from the site as follows:

1. Testing according to PADEP Soil Remediation Standards.

C. Nutrient Management Plan that includes agricultural testing of the intermixed fill soils.

D. Sediment Incorporation Plan for integrating dewatered sediment into the agricultural field.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. The lake shall be lowered to 1 foot below the proposed grading with the Conservation Pool prior to the removal of accumulated sediment. Refer to the Section 312319 “Dewatering” for more details. The contractor shall maintain the lowered water surface elevation for the duration of the sediment removal.

3.2 DEWATERING

A. Refer to Section 312319 “Dewatering” for additional information on the control of water during construction operations.

B. Stream Bypasses shall be constructed as necessary to divert base flow and storm flows through and around the work area. Refer to Section 312319 “Dewatering” for additional information.

C. Dewatering shall be conducted as described in the Hydrologic and Hydraulic Modeling Report, dated May 2019, included as Attachment 4.

3.3 CONSTRUCTION

A. Accumulated Sediment and debris is the only material subject to removal from the Project Area to the extent indicated on the design plans. Other excavated Materials, including materials excavated from below the bottom of sediment/proposed grade, as identified in the Project Plan documents, shall not be removed, and if so removed will be replaced at the Contractor’s sole cost and expense, unless otherwise approved, in writing by the Engineer.

B. The sediment removal shall be performed “in the dry” as specified under Dewatering using conventional construction equipment. Conventional construction equipment may include track-mounted excavators, long-reach excavators, draglines, bulldozers and track-mounted front loaders. As required, the Contractor may employ the use of “mud mats” or construct in-lakes roads with imported materials. The phasing of the sediment removal shall be left up to the Contractor. The contractor shall not have equipment onsite and operating during the bald eagle timing restriction (January 1 through July 31) of each year.

C. The contractor shall construct the topsoil berms as per the design plans within the agricultural field located adjacent to the site. The sediment shall be placed up gradient of the berm to dewater fully prior incorporating the sediment with the subsoil and then re-installing the topsoil from the berm over the field.

D. The incorporation of the sediment shall be completed with agricultural practices such as tilling, plowing or similar. The contractor shall provide a written plan of the approach for the work efforts within the agricultural field.

E. Contractor to comply with all requirements specified in all permits and approvals.

F. Contractor to minimize the discharge of sediment, sediment-laden water or turbid waters at the Project’s discharge point at the downstream-most location of the Project’s limit of disturbance.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. The area to be excavated shall sufficiently dewatered by stream bypasses and dewatering pumps, as discussed in Section 312319 "Dewatering" in order to minimize sediment transport to areas downstream of the work area and reduce water being transported to the disposal area.

3.5 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.6 LIMITS OF SEDIMENT REMOVAL

A. No payment will be made to the Contractor for the excavation below the bottom of sediment/proposed grade as identified on the Plans. The Contractor acknowledges and agrees that excavation below the bottom of sediment/proposed grade is not allowed by the issued permits or approvals obtained for the Project. Additionally, no sediment removal shall be progressed outside of the lakes' limits of disturbance as identified on the Plans.

B. No excavation shall be progressed within 10 feet horizontally of any structure within the lake beds including, but not limited to bulkheads, retaining walls, docks, storm water outfalls, bridges, culverts, or utilities, provided however, that the Contractor shall remove all surface vegetative growth only within 10 feet horizontally of such structures if such removal can be accomplished without damaging such structures, as determined by the Contractor. The Contractor shall be solely responsible for any and all damage to such structures as set forth in the Contract.

3.7 STOCKPILING OF SEDIMENT

A. The Contractor shall stockpile the Accumulated Sediment at the locations designated on the Plans. The stockpile height and slope shall be dictated by the materials ability to be high-piled. As the material dewaters, the Contractor may re-grade the stockpiles to allow for the accommodation of additional excavated material. Silt fencing shall be placed down-slope of the stockpiles, between the stockpile and the downhill stream running to the Conservation Pool. The location of silt fence on the Plans is tentative and shall be configured depending on the field located stockpiles and placed in sufficient lengths to preclude sediment from running into the stream.

3.8 EXCAVATION IN CONSERVATION POOL

A. The Contractor shall be responsible to remove from the Conservation Pool any excavated unsuitable materials or other material as may be directed by the Project Engineer. Excavated material shall be placed in the Field for onsite disposal. Excavated material shall not be deposited outside the limits of construction, either temporarily or permanently, without written authorization from the property owner. Such authorization shall be in a form satisfactory to the Project Engineer and shall protect the Bucks County Conservation District against claims or actions of the owner with respect to the presence of such materials or excavations.

B. The removed sediment shall be deposited onsite in the agricultural field to the southeast of the Conservation Pool. The material shall be dewatered in place to the greatest extent possible prior to hauling and disposal onsite. The removed sediment shall be allowed to dry once placed in the field prior to intermixing with native substrate and before spreading the topsoil.

C. Rock and boulders shall be excavated to the bottom limits shown on the Contract Drawings. Rock shall be excavated and finished to a uniform slope, parallel to the prescribed slope lines. All pieces of rock outside the slope surfaces as excavated which have been loosened or may become loose, in the opinion of the Project Engineer, on account of the Contractor's operations, shall be remain in place or be relocated as part of the habitat enhancement.

D. Boulders extending beyond the prescribed limits of excavation shall remain in place as part of the habitat enhancement.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

B. Removed sediment can be stockpiled within the lake for dewatering prior to hauling to the disposal location.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL FOR SOIL BACKFILLS AND FILLS

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before placement of another lift to within 2 percent of optimum moisture content in accordance with ASTM D698.
B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth.

B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.

C. The agricultural field in which sediment has been placed shall be visually inspected for excessively wet areas and stability for the future use of agricultural equipment in the area.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to be within specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Project Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Project Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

2. Removal of material offsite is NOT anticipated for this project. If unforeseen conditions are identified the contractor shall promptly notify the project representatives. The Project representatives shall determine the appropriate action. These actions may include:

a. Material to be left in place

b. Remove per plan and place in a specified area approved by the property owner

c. Offsite disposal.

PART 4 – MEASUREMENT AND PAYMENT

SEDIMENT REMOVAL	CUBIC YARDS
INTERIM GRADING – BERMS	CUBIC YARDS
INTERIM GRADING – DEWATERING SEDIMENT	LUMP SUM
GRADING OF SEDIMENT MATERIALS	SQUARE FEET

Construction Access Roads are incidental to Sediment Removal & Interim Grading – Dewatering Sediment, Excavation bid items above.

END OF SECTION 312316

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes initial lowering of the water in the Conservation Pool.

B. Section includes construction dewatering and the installation of a bypass system to allow the waters of the streams to move through the work area with minimal disruption to sediment removal activities.

C. This section includes the continued efforts to keep the lake lowered and control of water through and within the work area during construction activities.

D. This section includes the water control during the habitat enhancement operations.

1.2 SCOPE

A. The Work shall include the dewatering of Accumulated Sediment; segregation of work area (area being excavated) and base flow through the lake; dewatering of infiltrating or flood water from areas being excavated; and gravity draining of sediment via “high piling”. The primary objective of this pay item is to mitigate turbid water from leaving the site, and facilitate the transportation of such sediment and materials for disposal.

B. Contractor to be responsible for the design of the stream bypass system. The design layout should be submitted and approved by the Project Engineer prior to installation.

C. Contractor to be responsible for design of bypass and dewatering system during habitat enhancement efforts. The contractor shall submit a plan for dewatering efforts to the Project Engineer prior to installation. The bypass system shall be designed in such a way to reduce impacts to proposed structures during construction and rain events.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

C. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

D. Accomplish dewatering without compromising constructed work.

E. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system and bypass system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
B. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
C. Include a design plan for the stream bypass system. Show arrangement, locations, layout, and details of pipe, pump, sediment control, disposal of water, and any other means necessary to convey water.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEWATERING

A. Lake Lowering
    1. The contractor shall provide the means and methods to maintain the lake at its lowest feasible elevation during all phases of the project.
        a. These shall be denoted within the Contractor's dewatering plan.
        b. This shall include pumps and/or siphons, diversions, and planning of the decommissioning of the existing secondary and tertiary outlet structures, as well as reasonable mitigation for anticipated storm events.
        c. Lake lowering shall begin during the last half of July 2020 and shall be maintained as needed throughout the project duration.

B. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

C. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

D. Remove snow and ice as required to minimize accumulations.

E. Maintaining Turbid Free Water
    1. The Contractor is obligated, in accordance with all Federal, State, County and Local permits, approvals, and regulations to maintain relatively turbid free water leaving the downstream discharge point of the project site. This downstream location is identified as the downstream-most limit of disturbance of the Conservation Pool. The subsections

below outline methods for minimizing turbid waters that the Contractor should use to accomplish this requirement of the Work.

F. Segregation of Work Areas from Base Flow

1. Prior to initiating sediment removal and other construction activities, the Contractor shall ensure that the base flow running through the lake is segregated from the area to be excavated and worked in. This can be accomplished by the diversion of the *stream* via mechanical methods (i.e. excavating) or directing the stream to areas already excavated to proposed grades. The Contractor must maintain separation of the sediment removal area and the stream at all times. During times of flooding, the Contractor shall cease operations until the stream flow returns to base flow conditions.

G. Removal of Infiltrating and Flood Waters from the Work Area

1. The Contractor shall maintain a dry work area at all times. Specifically, areas to be excavated shall be maintained in a dewatered condition with the use of pumps or siphons as necessary. No work or excavation shall be conducted within areas pooled with water. All water shall be pumped either to a previously excavated area that remains segregated from the baseflow or to a dewatering basin.

H. Draining of Accumulated Sediment and Approved Excavated Materials

To facilitate the dewatering of Accumulated Sediment prior to transport to the Field, all such materials shall be “high piled” for a period of at least 7 days to allow for the drainage of excess water from the sediment. The sediment shall be deemed to be adequate for loading and transportation when the material, in the opinion of the Project Engineer, can be transported without spilling through the gaskets of the watertight dump trucks or splashing over the top of the dump onto construction access roads within the transportation route.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

B. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

C. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

D. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

E. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

F. Provide temporary grading to facilitate dewatering and control of surface water.

G. Monitor dewatering systems continuously.

H. Promptly repair damages to adjacent facilities caused by dewatering.

1.5 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Space well points or wells at intervals required to provide sufficient dewatering.

C. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

D. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

E. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

F. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

H. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

I. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

PART 4 – MEASUREMENT AND PAYMENT

LAKE LOWERING	LUMP SUM
STREAM BYPASS AND CONTROL OF WATER	LUMP SUM

END OF SECTION 312319

SECTION 312500 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This work consists of the construction and maintenance of various temporary soil erosion and sediment control measures, including relocating them as required for stage construction.

B. This work includes Turtle Exclusion Fencing constructed of Super Silt Fence.

C. All work shall be in conformance with the contract documents and the Federal, State, County and Local regulations, and the latest revision thereof.

PART 2 - PRODUCTS

2.1 MATERIAL

A. All materials shall be as specified on the contract drawings and by the project permits.

B. Materials shall include but are not limited to:
1. Stabilized Construction Entrance
2. Temporary Construction Access and Access Roads
3. Rock Access Ramps
4. Silt Fences
5. Turtle Exclusion Fencing
6. Temporary Stream Crossing(s)
7. Temporary Turbidity Barrier
8. Filter Socks

C. Stabilized Construction Entrance shall comply with the following:
1. Construction plans.
2. Stone size for the construction entrance shall be ASTM C-33, size no. 2 or 3. The stone shall consist of clean crushed angular particles.
3. A geotextile fabric underlayment will be used.
4. A 6” thickness of the structure shall be consistently maintained.

D. Materials for Temporary Construction Access shall comply with the following:
1. Requirements of the Soil Erosion and Sediment Control Certification, Details A and C on Sheet 11 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans, and Detail B on Sheet 14 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
2. Construction Access shall use existing maintenance roads to the greatest extent possible.

3. Modification to these access roads may be necessary for construction equipment and use. These modifications shall be included within the pay items.
4. Temporary access roads shall be installed at contractor's discretion only in locations specified on the plans.

E. Rock Access Ramp shall comply with the following:
1. Details on the design plans.
2. Rock access ramp shall be located as shown on design plans.
3. Rock shall be 3.5" to 1.5" diameter with no material smaller than ¾". Recycled concrete may be substituted for stone as long as the gradation requirements are the same and the material is free from reinforcement and other deleterious material that could puncture a tire.
4. To facilitate smaller vehicles and pedestrians on the ramp, the Contractor may also place a 6" inch course of dense graded aggregate on the ramp's surface.
5. The ramps shall be placed at a grade no greater than 10:1 with side slopes of at least 1.5 to 1.
6. The top width for two-way traffic shall be 30 feet, while the top width shall be 15 feet for one-way traffic.
7. The ramp shall be constructed so as to facilitate the loading of dump trucks with the excavated material.
8. The contractor may reuse the rock from one ramp to build others if the sediment removal is phased or sequenced.
9. The contractor at all times provides a flag man at the ramp to the position of loading.
10. At the completion of the project or once the ramp is no longer needed by the contractor, it shall be removed and the ramp areas restored.

F. Silt Fence shall comply with the following:
1. Shall be installed as detailed in Detail E on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
2. Fence posts shall be spaced 8 feet center to center or closer.
3. The post shall extend 2 feet into the ground and extend at least 2 feet above the ground.
4. Posts should be constructed of hardwoods with minimum diameter thickness of 1.5 inches.
5. Geotextile fabric recommended for such use by the manufacturer shall be buried at least 6 inches deep in the ground and extend 2 feet above the ground.
6. The fabric shall incorporate a drawstring in the top portion of the fence for added strength.
7. Sediments shall be removed when the accumulation height reaches one quarter the ground height of the fence.

G. Super Silt Fence Shall Comply with the following:
1. Shall be installed as detailed in Detail D on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
2. Fence posts shall be spaced a maximum of 10 feet center to center or closer.
3. The post shall extend 36 inches into the ground and 33 inches above the ground.

4. Posts should be constructed of heavy duty galvanized or aluminum posts with diameter thickness of 2.5 inches.
5. Geotextile fabric width shall be a minimum of 42 inches.
6. Sediments shall be removed when the accumulation height reaches one half the ground height of the fence.

H. Turtle Exclusion Fencing shall comply with the following:
1. The Turtle Exclusion Fence must be installed prior to January 1, 2020 and fully entrenched per the installation standards. The contractor shall inspect and repair the fence in April prior to the turtle nesting season. Additional inspections for turtles within the work area shall be completed in May, June and July. Refer to Section 312500 "Soil Erosion and Sediment Control" above for additional details.
2. The contractor shall include the substitution for super silt fence to silt fence with a coir logs or similar to be placed across the construction entrance areas once construction operations have begun.
3. The contractor shall also provide the means and methods to extend the exclusion fence across the temporary stream crossing once installed.
4. The Turtle Exclusion Fencing shall be installed as detailed in Detail D and E on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
5. Super Silt Fence shall be used for Turtle Exclusion Fencing in Phase A, while Silt Fence shall be used for Turtle Exclusion Fencing access closures in Phase B
6. In locations where the Silt Fence and Turtle Exclusion Fence coexist, the Turtle Exclusion Fence shall be installed and maintained.

I. Temporary Stream Crossing shall comply with the following:
1. Stream crossing shall be installed as necessary for equipment to cross streams and other bodies of water during construction.
2. The crossings shall be constructed to pass base flow and the 10-year storm event.
3. The crossing shall be in compliance with all Federal, State, County, and local regulations.
4. The crossing(s) shall be installed in accordance with the Detail A provided on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design plans or as approved by the Project Engineer.

J. Temporary Turbidity Barrier shall comply with the following:
1. Details and locations on the design plans.
2. The barrier shall be placed so as to effectively control silt dispersion.

K. Filter Socks shall comply with the following:
1. Details and locations on the design plans.
2. Accumulated sediment shall be removed when it reaches ½ the above ground height of the barrier and disposed of in compliance with all federal, state, county, and local regulations.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Construction of stabilized construction entrance, rock access ramp, silt fence, dust control, temporary stream crossing, turbidity barrier, and filter sock shall be in conformance with the Regulations, Plans, and Details.

B. All soil erosion and sediment control devices shall be constructed prior to any work at the site. During the length of the entire project, the Contractor shall be responsible for maintaining all soil erosion and sediment control devices in an efficient workable condition.

C. The smallest practicable area of land shall be exposed at any one time. Wherever feasible, natural vegetation shall be retained and protected. Stripping of vegetation, grading or other soil disturbance shall be executed in a manner which will minimize soil disturbance.

D. A schedule of construction operations shall be submitted to the Engineer for his approval.

E. All soil erosion and sediment control devices shall be in place prior to any soil disturbance. Such devices shall be installed and removed in their proper sequence to allow for further operations on the site.

F. The Contractor shall inspect and maintain all sediment control measures on a regular basis. He shall also remove sedimentation from all basins when storage capacity is affected.

G. Soil erosion and sediment controls shall be left in place until all disturbed areas are stabilized. Any additional control measures as deemed necessary to control erosion or sedimentation beyond those measures shown on the approved drawings or included in this specification shall be executed at the direction of the Engineer.

H. Drainage swales and other structures shall be located in the field so as to retain as much of the original vegetation as possible. All drainage swales shall be parabolic in shape unless otherwise noted and shall conform to design standards.

I. Permanent vegetation shall be seeded or sodded on all exposed areas within 10 days after final grading, weather and seasonal considerations permitting.

J. The Contractor shall construct the dense-graded aggregate base course immediately upon receiving approval of the subgrade and approval of the underground facilities in order to stabilize streets, roads, driveways, and parking areas.

3.2 CONSTRUCTION ACCESS

A. General: Comply with the following:
   a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.
   b. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
      i. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
      ii. Remove temporary facilities after Substantial Completion.
   c. Temporary Roads in Field: Construct and maintain temporary roads in the farm field adequate for construction operations and in a way that minimizes compaction.
      i. Plywood or similar matting is to be used for construction access in the field to

reduce compaction when transporting sediment to the field for dewatering.

ii. Remove temporary facilities after Substantial Completion.

d. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

i. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

ii. Prepare subgrade and install subbase and base for temporary roads according to Division 31 Section "Earth Moving."

e. Temporary Use of Timber Matting: Use Timber Matting or Mud Mat as needed to access areas within the Conservation Pool and impoundment. Construct and maintain timber matting adequate for construction operations.

i. Install Timber Matting as detailed in Detail A on Sheet 11 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

f. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

3.3 TEMPORARY ROCK RAMP

A. General: Comply with the following:

a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

b. Construct and maintain Temporary Rock Ramp adequate for construction operations.

c. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3.4 CHANNEL CROSSING

A. General: Comply with the following:

a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

b. Construct and maintain Channel Crossing adequate for construction operations.

c. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3.5 LIMITATIONS OF OPERATIONS

A. Clearing and grubbing operations shall be so scheduled and performed that grading, and mulching, seeding and other permanent pollution control features can follow immediately thereafter according to the approved progress schedule. Should seasonal limitations make such coordination unrealistic, additional temporary soil erosion and sediment control measures shall be required between successive construction stages, as directed.

B. The amount of surface area of erodible earth material exposed at one time by clearing

and grubbing, excavation, borrow or fill operations, without stabilization, shall be minimized to the greatest extent practicable and limited to areas actively being graded.

3.6 SOIL EROSION AND EDIMENT CONTROL MEASURES

A. Soil erosion and sediment control measures shall be maintained during the construction season as well as during winter months and other times when the project is closed down, throughout the life of the project, to ensure that the measures function properly. Soil erosion and sediment controls shall be immediately inspected after each rain and any corrective work shall immediately be performed to return the soil erosion and sediment control measures to proper function, as directed. Riprap stones, coarse aggregate, silt fence, or hay bales damaged due to washouts or siltation shall be replaced as directed.

3.7 DISPOSAL OF EXCESS WASTE MATERIALS

A. Remove excess material, and dispose of same off the Owner's property.

3.8 CLEANUP

A. The work area should be restored to the pre-construction conditions and to the satisfaction of the Owner.

PART 4 - MEASUREMENT AND PAYMENT

CONSTRUCTION ACCESS ROADS (incidental to Sediment Removal & Interim Grading – Dewatering Sediment, Excavation bid items)	N/A
TEMPORARY STREAM CROSSING	EACH
TEMPORARY ROCK RAMP	EACH
CONSTRUCTION ENTRANCE	EACH
FILTER SOCK	LINEAR FEET
SUPER SILT FENCE	LINEAR FEET
TURTLE EXCLUSION FENCE (SUPER SILT FENCE)	LINEAR FEET
TURBIDITY BARRIER	LINEAR FEET

END OF SECTION - 312500

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Farm Field Erosion seeding.

2. Wetland Restoration seeding.

1.2 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of each seed mixture for grass and wetland seed mixes as well as any temporary or permanent stabilization seed mixes. Include identification of source and name and telephone number of the supplier.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. These materials shall be stored and handled in a manner not to introduce moisture to the contents prior to installation.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 FARM FIELD EROSION SEED

A. Farm Field Erosion Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. Seed shall meet the specifications noted in Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

2.2 WETLAND RESTORATION SEED

A. Wetland Restoration Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. Seed shall meet the specifications noted in Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

C. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

D. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

E. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Project Engineer and replace with new planting soil.

3.2 PREPARATION

A. Limit subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½ inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.3 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

B. Do not use wet seed or seed that is moldy or otherwise damaged.

C. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

D. Optimum seeding time: Between March 1 – May 15 and August 15 – October 15.

E. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

F. Protect seeded areas beyond 12 feet from the top of bank with straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket. Spread by hand, blower, or other suitable equipment.

3.4 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Mix slurry with manufacturer's recommended tackifier.
C. Apply slurry uniformly to all areas to be seeded in a one-step process.

3.5 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

PART 4 – MEASUREMENTS AND PAYMENTS

WETLAND RESTORATION SEED MIX	SQUARE YARD
FARM FIELD EROSION SEED MIX	SQUARE YARD

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. Trees

b. Plugs

1.2 DEFINITIONS

A. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

B. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

C. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Watering Plan (As necessary): Contractor shall furnish and execute a watering plan as necessary after construction completion pending the weather conditions to ensure establishment and warranty.

3. Any cost associated with watering and/or other plant survivability techniques (watering, mulching, pruning, etc.) shall be included in the contract price.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

B. Handle and pack plants to prevent injuries during transit. Do not dump or drop plants while unloading. Protect the roots of all plants from freezing or desiccating by heeling-in, watering,

covering or keeping shaded, or placing in a climate-controlled building or trailer.

1.5 WARRANTY

A. The contractor will be responsible for all plant material replacement guarantees to extend for one (1) full year from date of installation. This guarantee shall cover a 100 percent survival rate of the woody and herbaceous plant materials listed on the attached construction plans.

B. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within one (1) calendar year warranty period. Failures include, but are not limited to, the following:

1. Death and unsatisfactory growth.

2. Structural failures including plantings falling or blowing over.

C. Provide extended warranty for period equal to original warranty period, for replaced plant material. Include the following remedial actions as a minimum:

1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

2. Replace plants that are more than twenty-five (25) percent dead or in an unhealthy condition at the end of warranty period.

3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

4. Provide extended warranty for period equal to original warranty period, for replaced plant material.

D. The warranty shall also guarantee 80% cover from specified seed mix species after 1-year.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Engineer, with a proportionate increase in size of roots or balls.

2.2 LIST OF PLANTS

A. Contractor must abide by Plant List as shown on sheet 10 of 16 of the Plan entitled “Lake Luxembourg Conservation Pool Habitat Enhancement Design”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Engineer's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Engineer. Stake locations of individual shrubs and outline areas for multiple plantings.

3.3 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Beds: Before excavating for plant pits and beds, ensure that the areas conform to the specified lines and grades. On slopes steeper than 4H:1V, excavate pits no more than 5 days in advance of planting.

   1. Excavate pits for balled and burlapped plants to a minimum of 2 times the width of the root ball and no deeper than the root ball as measured from the bottom of the trunk flare to the bottom of the ball. Excavate pits for containerized plants to a minimum of 2 times the width of the container and no deeper than the actual height of the root mass within the container. Ensure that side slopes of all pits taper down from the rim of the pit to the outer edge of the bottom of the ball. Ensure that the sides of the pits are loosened and roughened to promote root penetration.

   2. Dispose of sod, weeds, roots, and other objectionable material.

3.4 SETTING PLANTS

A. Set plants plumb and at the same depth at which they were grown in the nursery, except set trees with a trunk flare 1/2 to 1 inch above the surrounding grade to allow for settling. Set roots for the various conditions as follows:

   1. Containerized Plants. Immediately before planting, remove the container, and make 3 vertical cuts equidistantly spaced around the perimeter of the root mass. Make each cut 1/2 inch deep from the top of the root-earth mass to the bottom. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements and backfill.

B. Backfill with topsoil around the root system. Hand-tamp the topsoil and water at the rate of 15 gallons per square yard of pit area to settle the topsoil and to remove air pockets. Ensure that the topsoil is not frozen at the time of backfilling. Where necessary, backfill areas that have settled with topsoil. Form a 4-inch high compacted berm using topsoil around individual plants to a diameter equal to that of the pit. Ensure that the berm functions properly throughout the plant establishment period.

3.5 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.6 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

PART 4 - MEASUREMENT AND PAYMENT

The cost for each tree or shrub species listed here shall include the installation of a tree cage for protection from deer and other animals.

CAREX STRICTA	EACH
CAREX VULPINOIDEA	EACH
IRIS VERISCOLOR	EACH
LEERSIA ORYZOIDES	EACH
PELTANDRA VIRGINICA	EACH
PONTEDERIA CORDATA	EACH
SAGITTARIA LATIFOLIA	EACH
SCHOENOPLECTUS TABERNAEMONTANI	EACH
SCIRPIS ATROVIRENS	EACH
PLATANUS OCCIDENTALIS	EACH
QUERCUS BICOLOR	EACH
QUERCUS PALUSTRIS	EACH

END OF SECTION 329300

SECTION 354900 - WATERWAY STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

The work to be done under this section consists of providing all labor, equipment, and materials in order to construct waterway structures for the Lake Luxembourg Conservation Pool Habitat Enhancement Design project.

A. Section Includes:

1. Tree vanes proposed in the Conservation Pool.

2. Turtle habitats proposed in the Conservation Pool

PART 2 – PRODUCTS

2.1 MATERIALS

A. Satisfactory Tree Material: Conifer trees with a minimum length of 6 feet for tree vanes.

B. Satisfactory Stumps and Branches: Branches shall have a diameter of 2 to 4 inches and stumps shall have a diameter of 10 to 12 inches.

1. Those removed in Section “311200” Selective Clearing which meet the specification shall be used for habitat within the conservation pool.

PART 3 - EXECUTION

3.1 General

The Contractor will furnish and maintain loading, unloading, staging, hauling, drainage, and such material handling equipment and facilities as may be necessary for conducting operations. The Contractor will be solely responsible for site safety. The Contractor shall provide appropriate measures to ensure that persons working in or near the construction area are protected.

3.2 Offloading

The Contractor is responsible for the protection of roads and utilities in the off-loading, staging, hauling, and construction areas, and for coordinating this protection with local agencies and entities. The Contractor is responsible for any damage resulting from the construction.

3.3 PREPARATION

A. Protect existing site improvements to remain from damage during construction.

B. Restore damaged improvements to their original condition, as acceptable to Owner.

3.4 PLACEMENT

A. Placement will not deviate from the locations identified on the design plans by more than the tolerances discussed below unless approved in writing by the Project Engineer and Project Sponsor. Equipment suitable for handling the tree material will be used. The material will be anchored in such a way to ensure they are secure against flood flows. Damage to any tree material will be the Contractor's sole responsibility.

B. The turtle habitats shall be installed as detailed in Detail B on Sheet 11 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Tree vane structures shall be installed as detailed in Detail D on sheet 11 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

PART 4 – MEASUREMENT AND PAYMENT

TURTLE HABITAT FEATURES	EACH
TREE VANE	LINEAR FEET

END OF SECTION 354900

ATTACHMENTS

ATTACHMENT A:

PERMITS

ATTACMENT B:

DESIGN PLANS

(EXTERNALLY ATTACHED)

ATTACHMENT C:

BALD EAGLE MONITORING GUIDELINES

BALD EAGLE MONITORING GUIDELINES

Prepared For

United States Fish and Wildlife Service

September 2007

(Revision of Bald Eagle Monitoring Guidelines Issued September 2006)

PREFACE

The U.S. Fish and Wildlife Service's (Service) Florida Ecological Services Field Offices (FO's) in Jacksonville, Panama City and Vero Beach received and reviewed monitoring reports for more than five years as prescribed by our Bald Eagle Monitoring Guidelines (pre-2002 draft, 2002, 2005) (Monitoring Guidelines) for applicants proposing construction activities occurring within 1500 feet of an active bald eagle nest during the nesting season. The cumulative result of those monitoring reports was that the Service did not observe from the data any indicators of disturbance, abnormal or atypical behavior, or nest abandonment that would have caused the applicant and/or the Service to halt construction activities during the nesting season. Consequently, the Service and the Florida Fish and Wildlife Conservation Commission (FWC) jointly concluded that monitoring of construction and nesting activities occurring from 750 feet to 1500 feet (secondary zone) was no longer warranted for projects involving construction within those distances from an active nest during nesting season.

The Service's Florida FO's revised the 2005 Monitoring Guidelines again in September 2006 to incorporate modifications that would be applicable to the draft National Bald Eagle Management Guidelines that would be implemented under the Bald and Golden Eagle Protection Act (Eagle Act) once delisting of the bald eagle was finalized. These National Management Guidelines addressed construction and a variety of other human activities that can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young.

The Service published a notice of availability in the Federal Register (72 Fed.Reg. 31332) on June 5, 2007, finalizing the National Management Guidelines (dated May 2007), followed by the announcement on June 28, 2007 to remove the bald eagle from the Federal List of Endangered and Threatened species effective August 8, 2007. As such, it is necessary to make additional revisions to the September 2006 Monitoring Guidelines to assure consistency with these recent policy and regulatory changes.

These revised 2007 Monitoring Guidelines accordingly are now applicable for human activities that have potential to cause disturbance within 660 feet of an active nest. Additional criteria for disturbance are defined by the codified definition of "disturb" under the Eagle Act at 50 CFR 22.3. Monitoring generally is not recommended for projects when activities occur beyond 660 feet of an active nest, as those data are no longer required. However, additional criteria for

monitoring may be indicated in previously issued Biological Opinions that reference these Monitoring Guidelines, or in such cases where public safety issues exist related to airport operations and activities, electrical facilities and communication tower facilities where monitoring is required in order to determine the most appropriate action to avoid a safety hazard to both the public and the bald eagles. A number of Federal and State laws and/or regulations prohibit, cumulatively, such acts as harassing, harming, disturbing, molesting, pursuing, etc. bald eagles, or destroying their nests. The purpose of these Monitoring Guidelines is to provide a scientific standard for documenting and evaluating bald eagle response to human activities. Such activities may lead to an alteration of otherwise normal nesting behavior and ultimately to nest abandonment and/or death of eggs or eaglets. These Monitoring Guidelines are advisory in nature.

The FWC maintains a database of all known bald eagle territories in Florida (http://wld.fwc.state.fl.us/eagle/eaglenests/), which should be consulted to determine the specific nest number and nesting history. It should be noted that: 1) the nest locations (latitude/longitude coordinates) in this database are approximate and should not be relied upon to establish accurate distances from proposed construction activities, 2) some territories have alternate nests that may not be reported in the database, and 3) many bald eagle territories are unknown and/or may support new active nests that have been established in recent years. Any bald eagle nest discrepancies or new nest locations should be reported to the FWC bald eagle database coordinator at 352-955-2230.

The development of this document is a collaborative effort by Federal, State and private biologists who have extensive experience in the research and management of bald eagles in the Southeastern United States. J. Steve Godley[1] prepared the initial draft and all attachments, while Tom H. Logan[2, 3] served as editor and coordinator of technical and editorial reviews of subsequent drafts. Candace Martino[4] provided invaluable coordination to facilitate necessary input from each of the authors, and contributed technical and editorial comments for this latest edition. Dan Sullivan[2] provided editorial comments that were critical to the completion and technical quality of this document, as did Stephen A. Nesbitt[2], John H. White[2], Al Begazo[4], and Tony Steffer[5] for earlier editions of these Monitoring Guidelines.

[1] Biological Research Associates, LLC
[2] Florida Fish and Wildlife Conservation Commission
[3] Breedlove, Dennis & Associates, Inc.
[4] U.S. Fish and Wildlife Service
[5] Raptor Management Consultants. Inc.

BALD EAGLE MONITORING GUIDELINES

A. Introduction

The Service and FWC recommend biological monitoring of the nesting territory if new activities which include construction of buildings, roads, trails, canals, power lines, and other linear utilities; new or expanded operations of agriculture and aquaculture, alteration of shorelines or wetlands, installation of docks or moorings, marinas, water impoundment, and mining and associated activities is proposed to occur within 660 feet of the nest tree during the nesting season (October 1 - May 15, Service 1987). The Service also recommends that monitoring be conducted where an eagle's nest is located on or adjacent to, in close proximity of, electrical transmission towers, communication towers, airport runways, or other locations where they may create hazards to themselves or humans. These circumstances may require more intense monitoring, which may include increased frequency and hours of monitoring. These resulting data are deemed necessary for the Service to make appropriate decisions as to whether nest removal or relocation is warranted and subsequently permitable under new proposed regulations under 50 CRF 22.27 for Eagle Nest Take under the Eagle Act.

These Monitoring Guidelines have been developed to provide agency personnel and others a scientific standard for gathering data that may be used to evaluate eagle responses to human and development activities, which may indicate an alteration of otherwise normal nesting behavior. The Monitoring Guidelines 1) describe normal nesting behavior of bald eagles, 2) identify specific behavioral responses of adult and young eagles that may warrant cessation of activities, 3) propose the type and level of monitoring necessary to detect a change in normal behavior, and 4) develop a procedure for reporting the observations to the USFWS/FWC, which may be used for halting or modifying the above described activities, if necessary.

Buehler (2000) and references cited therein provide excellent summaries of the biology and nesting behavior of bald eagles. Nesting behavior and response of individual eagle pairs to human activities may vary, but nesting chronology and otherwise normal behavior are relatively fixed and predictable. The probability that a pair of bald eagles will abandon their nest increases with the intensity and proximity of human activities to their nest, and decreases with the time and energy the adult eagles have invested in the eggs or young and to what extent the adult birds may habituate to human activities. This is based upon the ecological parental investment theory (e.g., Trivers 1972, Wilson 1975, Dawkins 1977) and practical experience gained from observing bald eagle/human interactions over the past two decades in Florida (e.g., Wood 1992, Nesbitt et al. 1993, Wood and Collopy 1995, Millsap et al. 2004). Accordingly, the need for appropriate monitoring and concern for disturbance is highest prior to egg laying, the closer and more intense development activities occur to the nest tree, and for nesting territories in more rural environments.

All infrastructure development, exterior building construction, and other referenced activities within 660 feet of the nest tree should, as a general rule, be completed during the non-nesting season. Infrastructure construction includes all land and lot clearing; fill work; construction of roads, drainage, sewer and storm water facilities; and installation of water, electricity and other

utilities. However, it often is not possible to complete these above-referenced activities and other human related actions during the non-nesting season. These guidelines are applicable to those circumstances where these activities must be conducted during nesting season from 330-660 feet of the nest tree**. Please Note: The Service recommends that none of the above-referenced activities be conducted from 0-330 feet during nesting season, even when a buffer zone of less than 330 feet is established in accordance with the National Bald Eagle Management Guidelines; therefore, monitoring in these instances is not applicable.**

B. Monitoring Requirements

The Monitor is defined as personnel formally educated in the biological sciences, well experienced in recognizing specific patterns and changes of eagle behavior and capable of recording those observations in a scientific manner, and is contracted by the landowner, company or entity (Responsible Party) responsible for having the activity monitored. Continuity of monitoring, data collection and reporting is best maintained if one person conducts all monitoring for a specific project site. Close coordination is essential if more than one monitor is required. Monitoring should be conducted from a location that provides a clear vantage point of the nest and the surroundings (including the referenced activities), yet far enough from the nest (e.g., > 660 feet where possible) to ensure monitoring does not cause disturbance to the eagles. Monitoring from closer locations could cause disturbance and should be avoided. Conducting the monitoring from inside a parked vehicle or from a portable blind can further minimize observer disturbance. Monitoring should be conducted using both binoculars and a high-powered spotting scope during periods when referenced activity is occurring during the nesting season (generally October 1 – May 15) and within 660 feet of the nest tree, or as specified otherwise, by Service or FWC technical assistance.

The purpose of monitoring is to detect any abnormal behavior of the adult eagles or their chicks that may be elicited in response to human activities occurring within 660 feet of the nest tree and that potentially could result in disturbance as defined under 50 CFR 22, abandonment of the nest (and/or territory), or death of the eggs or eaglets. **In cases where the Responsible Party is relying upon conditions/recommendations specified in a Biological Opinion or agency document, procedures should be established between the Monitor and the Responsible Party for suspension of work and immediate notification to the Service and FWC upon observation of such abnormal behavior of nesting eagles (see Section D for details)**. Once an applicant agrees to monitor in accordance with these Monitoring Guidelines, they are held to *all* requirements of these Monitoring Guidelines.

Monitoring should begin no later than October 1 and continue through fledging, if activity is anticipated or planned to occur within 660 feet of the nest tree during the nesting season. Fledging is considered to have occurred at that age when young of the year have achieved the ability to sustain flight (see Section C.7 for details).

- **Initial Monitoring to Confirm Occupancy of the Nesting Territory:** Bald eagles are considered to have returned to the territory when one or both members of the pair appears, flies, perches, roosts, exhibits courtship, carries nest material, begins repair of the existing nest and/or begins construction of a new nest on the territory. The regulated

protection zone is considered to be the area within a 660-foot radius of the nest tree; although, some pairs may construct a new, alternate nest at farther distances. All eagle nests are protected unless declared ”abandoned” in accordance with provisions of the National Bald Eagle Management Guidelines (May 2007). All alternate nests should be monitored until such time as the eagles have been observed incubating in one of the nests on the territory. Monitoring can then cease for the alternate nests in which nesting does not occur. However, if the nest in which nesting begins is lost prior to February 1, monitoring of all alternate nests should be re-initiated to determine if re-nesting occurs on the territory.

Initial monitoring of eagles to determine territory occupancy shall be conducted a minimum of one day per week and consist of in sequence: 1) nest tree observations for a minimum of two hours starting ½ hour before sunrise, followed by 2) nest tree inspection for indirect evidence of eagle use if no adults are observed. *Never* approach a nest tree if adult eagles are observed on the territory on that day. The following shall constitute positive indirect evidence that bald eagles have returned to the nesting territory: 1) fresh moss or green tree branches placed or interwoven into the nest top, or 2) fresh droppings ("whitewash") on vegetation or the ground beneath the nest tree. Such droppings typically are deposited below the nest cup or favored perch branches. Do not confuse white, dried pine resin with eagle droppings: droppings rub off upon touch, whereas resin does not. Direct or indirect evidence of territory occupancy by adult eagles triggers the requirement for more intensive monitoring (see Monitoring During Early Phases of the Nesting Cycle, below). The results of both direct bald eagle observations and nest tree inspections must be recorded each week on the Bald Eagle Monitoring Data Sheet (Figure 1). A Confirmation of Nest Territory Occupancy Report describing the basis for the determination shall be submitted to the Service and the FWC (see Section D for reporting details) within one week of finding positive evidence of bald eagle nest territory occupancy. **This report also shall include a specific schedule of dates planned for monitoring during the next month.** Each subsequent monthly report submitted to the Service and FWC shall contain a schedule of monitoring dates for the upcoming month, with the understanding that any scheduling changes shall be reported to the agencies by email as soon as possible.

- **Monitoring During Early Phases of the Nesting Cycle:** The normal cycle of bald eagle nesting behavior is described below. Once a territory is determined to be occupied, it should be considered active, and nesting eagles should, at that time, be monitored a minimum of three days each week and four hours each day (beginning at 1/2 hour before sunrise) from onset of nesting behavior through the fourth week post-hatching and care of eaglets. **Monitoring is ***not*** required on days when no infrastructure development, exterior building construction, or other human activities referenced in the National Management Guidelines occurs within 660 feet of the nest tree.** Monitoring should be scheduled to occur on the days that are representative of all major phases of these activities at times when they will occur.

- **Monitoring During Last Phase of the Nesting Cycle:** Monitoring frequency for activities may be reduced to one day each week (four hours beginning 1/2 hour before sunrise) beginning five weeks post-hatching and continue until fledging occurs or May

15, whichever occurs first. However, this once a week monitoring event should occur on days that are representative of all major phases of these activities at times when they will occur.

- **Special Circumstances:** Additional monitoring may be appropriate should special circumstances arise as described in Section C.6. The monitoring and construction plans for any nesting territory may be re-evaluated for modifications during any year. Weekly nest territory monitoring may cease after February 1 of that nesting season if: 1) no adult bald eagles are observed on the territory or 2) if an eagle was observed on the territory, but nesting was not attempted, or a nest attempt was documented to have failed and re-nesting was not attempted. Additionally, monitoring may cease if great horned owls (*Bubo virginianus*) are documented to have occupied the nest and there are no alternate nest sites available to the eagles within 660 feet of the project, and no evidence of eagles constructing a new nest within 660 feet of the project. Evidence must be clear from information recorded in the Bald Eagle Monitoring Data Sheets and/or provision of additional data, that circumstances exist that would warrant any modification of planned monitoring (i.e. increase, decrease or termination of monitoring).

- **General Comments:** Residential and commercial development is the most common form of human activity that requires monitoring. Single-family homes typically may require a minimum of 5 months for completion of construction, and all major stages of construction (described below), except truss placement, occur over multiple days. Monitoring should be timed to include truss placement. In all cases, the Monitor should use a site plan of the project to prepare weekly maps on which to document the specific construction activities that are occurring within 660 feet of the nest tree. Recorded construction activities should include, but not be limited to, the stage of construction of each home (i.e., fill placement, slab pouring, sidewall construction, truss placement, roofing, external finish work, internal finish work and landscaping). All observations of construction and eagle behavior *must* be recorded using the attached data sheet (Figure 1).

The following nest cycle activities must be documented and monitored for comparison with normal nesting behavior (see Section C for details) and for detecting and evaluating behavior that may be indicative of disturbance and/or pending risk:

1. Temporal patterns of nest attendance by the adults.
2. Observations of courtship, mating and nest building/maintenance.
3. Incubation and brooding behavior.
4. Feeding, growth and care of the eaglet(s).
5. Flight patterns to and from the nest tree.
6. Fledging of the eaglet(s).

All behavioral data and construction activities should be recorded within 15 minute intervals to facilitate analysis as a basis for detecting and evaluating behavior which may indicate pending risk. Figure 2 summarizes the typical nesting chronology of bald eagles in Florida. Please note that egg laying typically occurs during mid-December in Florida, but may vary by year, pair and latitude, and can extend from October through April, with most late nesters likely representing

second breeding attempts (Buehler 2000). Figure 3 provides a typical pattern of nest attendance and phenology of a pair of eagles in Sarasota County, Florida, monitored over a three-year period during one 4-hour observation period each week from October through May.

Nesting behavior which may be interpreted as abnormal, a response to construction activities and/or indicative of pending risk may include, but not be limited to: 1) adults raising or standing up over the nest, 2) increased time spent away from the nest by the adults that is not associated with normal nesting phenology, 3) changes in flight patterns or perch tree use, 4) distress calls, 5) flushing behavior from the nest tree or perch trees, 6) changes in the feeding schedule of the eaglet(s) and 7) premature fledging of the eaglet(s). Descriptions of specific behaviors that would warrant concern and may be indicative of pending risk are described below. Such behaviors occasionally result from factors other than human disturbance, such as death of an adult, sterility or immaturity (i.e., one member of the pair not in definitive plumage), entrance of a foreign adult eagle or great horned owls into the territory, inadequate food supply for the number of eaglets present, etc. Therefore, it is very important that observations of any abnormal behavior be reported immediately to assure proper interpretation and appropriate courses of action (see Section D for details).

C. Normal Nesting Behavior and Indicators of Disturbance

1. Adult Behavior at the Nest

Eagles often assume an alert posture in response to an unusual event. This behavior also may be accompanied by distress calls and ultimately result in flushing behavior (Fraser et al. 1985, Buehler et al. 1991, McGerigal et al. 1991). Incubating adults may react to a distraction or an annoyance by rising from their incubation posture and standing over their eggs. They also may step off the eggs and stand on the side of the nest. They may or may not vocalize in conjunction with this behavior. Such standing behavior may be seen prior to flying and as an indication that the bird may flush from the nest in response to a distraction. The bird also may settle back down into incubation posture without flying, once the distraction has passed or the bird has decided the distraction is not a sufficient threat to warrant flushing from the nest. This behavior (whether the adult flushes or not) does indicate that the disturbance is great enough to interfere with normal behavior and is of concern. This posture could be confused with stretching or egg turning which are normal parts of incubation behavior. It will be the responsibility of the monitoring biologist to accurately judge whether a bird is exhibiting normal behavior or is reacting to a distraction or an annoyance that could be interpreted as “disturbance.”

2. Patterns of Nest Attendance

Figure 3 provides a representative example of normal baseline nest attendance by at least one adult eagle during the nesting season. Please note that attendance may be sporadic early in the nesting season, but increases dramatically immediately prior to egg-laying. At least one adult is present almost 100% of the time during the 35-day incubation period and the first 2-3 weeks post-hatching (Fraser 1981, Wallin 1982). Females average about 1/5 larger in size than males, and the sexes are distinguishable when the pair is together. The female does the majority of the incubation and early nestling attendance, although the male participates in both activities. One

adult (usually female) broods constantly during inclement (i.e., cool or rainy) weather, and will shade the young to avoid heat stress until a chick(s) is approximately 4 weeks of age (Jenkins 1989, Herrick 1924). Nest attendance declines sharply after 5-6 weeks, and the adults often roost and loaf away from the nest.

Nest attendance would be considered abnormal if: 1) at least one adult is not present during two consecutive, 4-hour (minimum) monitoring days prior to egg laying or 2) both adults are absent for more than two consecutive 15-minute periods during incubation, early brooding or inclement weather prior to 4 weeks post-hatch.

3. Flight Patterns Between Nest and Feeding Areas

Florida eagles generally nest in proximity to water, and flight paths to and from the nest often are relatively direct to their feeding areas. Flight information should include recording the direction of each flight to and from the nest in the eight cardinal directions. Simple chi-square or other non-parametric statistics can be used to test if flight patterns are random, directed towards foraging areas or away from on-going human activity.

4. Vocalizations on the Nesting Territory

Verner and Lehman (1982) describe three distinctive calls of nesting birds that are typical responses to human approaches: 1) a "chatter call" described as consisting of 3-4 introductory notes separated by short gasps of silence (<1s) followed by a rapid sequence of descending notes, usually 6-9 notes in sequence (*kwit kwit kwit kwit kee-kee-kee-kee-kee*), 2) a "peal" consisting of a high-pitched, prolonged, gull-like cry, often repeated 3-5 times and 3) a "wails" call that is seldom given (Buehler 2000). Variants of these calls may also be given in response to an intruding adult eagle or other raptors, such as great horned owls, and the chatter call also is often given upon approach to the nest tree by a member of the pair, independent of human disturbance. Any distress call must be investigated to determine cause, and **any construction or human activity that may be responsible for the distress call, must be halted or modified immediately**.

5. Flushing Behavior

Adult eagles may flush from the nest tree, particularly if humans are on foot (Fraser et al. 1985, Buehler et al. 1991, Grubb and King 1991, McGarigal et al. 1991, Grubb et al. 1992). Risk increases with the duration and frequency of events. The sensitivity of eagles to human disturbance varies between individuals and across populations, as measured by experimental flushing studies (e.g., Stalmaster and Newman 1978, Knight and Knight 1984, Fraser et al. 1985, Buehler et al. 1991, McGarigal et al. 1991). Unfortunately, no similar studies have been conducted in Florida. The response of individual eagles may range from temporary agitation (alert posture) to flushing from the nest or perch tree, to permanent displacement. Humans in vehicles generally elicit a much lower response than those on foot. Additionally, eagles that nest in proximity to existing human activities may habituate and be more tolerant to forms of human activity than they may have previously experienced.

Flushing behavior is more typically in response to human approach to the nest on foot; therefore, it is imperative that the monitor attempt to stop all such approaches. **Any construction or other human activities that appear to have caused flushing should be halted immediately**.

6. Feeding Schedule of the Eaglet(s)

Although both sexes secure food and feed the young, the male provides most of the food in the first two weeks, while the female tends the young in the nest (Wallen 1982, Gerrard and Bortolotti 1988). The female often delivers as much prey as the male after 3-4 weeks. Adults typically bring the food to the nest and tear off small pieces to feed the young. Eaglets are able to tear off food and feed themselves at approximately 6 weeks of age, although the adults often dismember larger prey (Palmer et al. 1988). Adults typically deliver food 2-8 times per day (mean = 4), and the early morning period accounts for proportionately more food deliveries (Herrick 1924). Food delivery rates also typically decrease as eaglets mature and or eaglet numbers decline with normal attrition. Therefore, deliveries may not be observed during some monitoring periods for older broods. The nutritional requirements of eaglets have not been reported in the literature (Buehler 2000), but free ranging adult bald eagles in Washington at 5ºC were reported to consume about 77.3 g/kg per day (425.5 kJ/kg per day), slightly less than 10% of their body weight per day (Stalmaster and Gessaman 1984). Nestlings may use food that accumulates at the nest for more than one day, unless fresh food is provided (Herrick 1993). Both adults and chicks are capable of storing food in their crop, then digesting the food over time. **Additional monitoring may be appropriate should an abnormal reduction in feeding rates be observed; if accompanied by other behavioral indicators of stress (i.e., flushing and/or distress calls), the Monitor should suspend construction or other human activities and report these observations** (see Section D).

Mean brood size for successful nests in Florida bald eagles is 1.55 young per brood, with 3 young not uncommon (Nesbitt et al. 2002). One egg is laid per day, although often not always on successive days. Hatching is asynchronous and differential growth between the sexes can lead to differential mass among siblings, facilitating competition and fratricide (Bortollotti 1986). Sibling competition and mortality is greatest early in the nestling period, when size differences are greatest. The largest chick typically gets the majority of food in clutches with more than one chick. Brood reduction from starvation of the youngest chick may occur in broods of any size, unless food is abundant (Gerrard and Bortollotti 1988).

It is important to quantify, to the extent possible, the size and type of prey brought to the nest during all observation periods. These data may be useful for determining if the eaglet(s) is receiving adequate food and if human activity may be interfering with food delivery schedules.

7. Fledging of the Eaglet(s)

Eaglets typically fledge at approximately 11 weeks of age in Florida (Wood 1992), but nest departure can occur at 8-14 weeks (Buehler 2000). The eaglets usually begin to move about the nest and branches of the nest tree at least 2 weeks before fledging, flapping and developing muscle strength, flight coordination and landing ability in preparation for their first flight from the nest tree. These eaglets are referred to as “branchers.” Fledging typically is considered to have occurred when the eaglets have begun to make extended flights from the nest to adjacent

trees, have begun to soar and/or are seen flying around the territory with the parents. It is not uncommon for up to half of initial nest departures to be unsuccessful, with the eaglet falling to and remaining on the ground for days or weeks before regaining flight ability; in most cases, the parents will continue to feed these young (Kussman 1977, Fraser 1981). **Successful fledging**, for purposes of these Guidelines, **is defined as the time at which the eaglet(s) has near fully developed primaries and is capable of strong, coordinated, independent flight**.

Care must be taken to confirm that any premature fledging is, in fact, human related, since premature fledging is a common occurrence that may be independent of human activity.

D. Reporting Requirements

The **purpose of monitoring** bald eagles and eaglets at their nests under these Guidelines **is to minimize the occurrence of disturbance leading to nest abandonment and/or death of eggs or eaglets**, and avoid potential violations of the Eagle Act. As such, monitoring is a serious obligation. Falsification of monitoring reports can lead to criminal prosecution of both the Monitor and the Responsible Party that is contracted to conduct the monitoring. The Monitor and their supervisor *must* sign and date each completed monitoring sheet (Figure 1) beneath the statement, which reads: "I have read and understand the Bald Eagle Monitoring Guidelines. This report represents a true, accurate and representative description of the site conditions and eagle behavior at the time of monitoring".

As long as the Monitor has not detected any, irregularities or abnormalities as described above, then **Only** a summary report of monitoring results (See Figure 4) should be mailed via hardcopy or email to the appropriate Service Field Office and FWC (Endangered Species Coordinator, Tallahassee) on a monthly basis when the Monitor has not detected any irregularities, or abnormalities as described above. Individual Bald Eagle Monitoring Data Sheets should be retained on file by the Monitor for a minimum of 3 years for reference, should such need occur. **A final report that summarizes monitoring results and the fate of any reproductive effort must be sent to the reviewing agencies within one month of the conclusion of monitoring**. The Monitor has the obligation to immediately report any suspension of work activities and/or any documented abnormal behavior, as defined in Section C above, to the Responsible Party and the Service and FWC**, and subsequently send the individual Bald Eagle Monitoring Data Sheets describing all relevant activities to all parties.** The Service and FWC will coordinate a review within a week of the reported behavior and circumstances associated with any suspension of work activities. A verbal determination followed by a written recommendation will be issued in a timely manner as to whether construction should resume or be modified, or if monitoring frequency should be increased.

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Bald Eagle Monitoring Data Report

Nest #: Start Time: Name of Monitor: ___________________________

Date: End Time: Name of Supervisor: ________________________

Tree Status[1]: Tree type[2]: # Adult Present: # Young Present:

Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				

Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

______________________ ______________________ _________________

Signature of Monitor Signature of Supervisor Date

Nest #: Monitoring Date: Monitor's signature: ___________________________

Supervisor's signature: ________________________

Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				

Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

_____________________ _____________________ ________________

Signature of Monitor Signature of Supervisor Date

Nest #: Monitoring Date: Monitor's signature: ___________________________

Supervisor's signature: ________________________

Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				

Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

_____________________ Signature of Monitor

_____________________ Signature of Supervisor

________________ Date

Nest #: Monitoring Date:

<table>
<tr><td rowspan="4">Time</td><td colspan="5">Behavioral activity observed (list all that apply):</td></tr>
<tr><td>Weather conditions</td><td>T:</td><td>W:</td><td>C:</td><td>P:</td></tr>
<tr><td colspan="5">Description of ongoing construction events:</td></tr>
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<tr><td>Weather conditions</td><td>T:</td><td>W:</td><td>C:</td><td>P:</td></tr>
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<tr><td colspan="5">Notes/Comments:</td></tr>
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Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

Signature of Monitor ____________________ Signature of Supervisor ____________________ Date ____________________

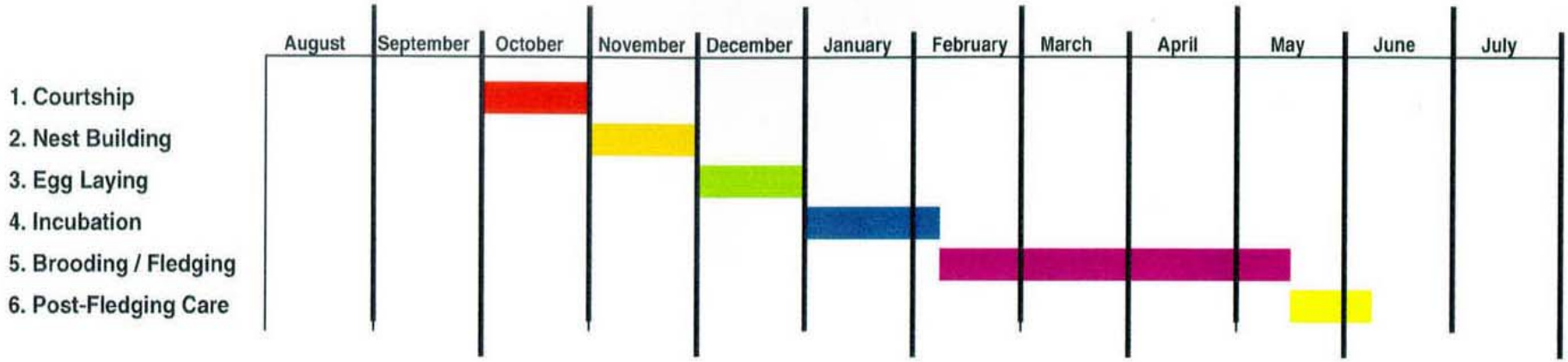
Instruction for completing the Bald Eagle Monitoring Data Report

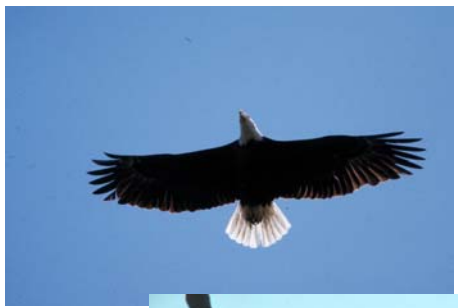
1. Insert the nest identification number, date for which the monitoring is occurring, Start time is the time at which monitoring is initiated, and end time is when the daily monitoring is completed. The monitor and the monitor's supervisor should print their name on the first page, a sign all other pages.
2. Tree Status is either L = live, D = dead, or A = artificial structure.
3. Tree type is either P = native pine, H = native hardwood, E = exotic.
4. All data reports should have an attached map of the nest territory that includes the location of the project. Major territory flights, including the time of the flight, should be drawn on this map.
5. Record all behavior events observed during the monitoring period. The following abbreviations should be used. CT = courtship; MAT = breeding/mating; NR = nest repair; INC = incubating; BRO = brooding; AF = adult feeding; YF = young being fed; TD = territory defense; STD/DV going from incubation to standing associated with distress calls; FL/DV = flushing with distress calls; DC = distress calls not associated with standing or flushing; PF = premature fledging. A monitoring event that observed nest repair, courtship and adult feeding may be recorded as NR-CT-AF. Any other behavior can be listed or described. Any abnormal behavior should be noted and described in the notes section if more space is required.
6. Enter the current weather conditions for each observation period in the appropriate place. On the data report, T = Temperature (EF); W = Wind speed & direction; C = Cloud Cover (%); P = Precipitation.
7. Record all ongoing construction/project activities that occur during the monitoring period. The following abbreviations should be used for common activities (unlisted activities should be described):
    - **FP** = fill placement,
    - **SP** = slab pouring,
    - **SC** = sidewall construction,
    - **TP** = truss placement,
    - **R** = roofing,
    - **EW** = external finish work,
    - **IW** = internal finish work;
    - **IFR** = infrastructure work;
    - **HE** = heavy equipment work;
    - **CRN** = work involving a crane.

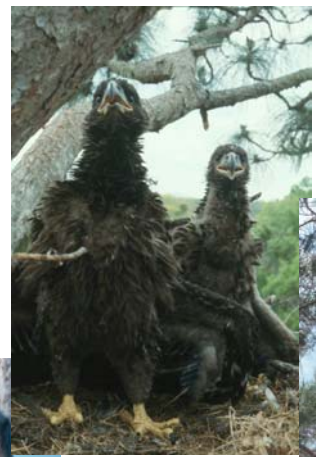
    Provide details on infrastructure and heavy equipment work.
8. Any information that needs further explanation or any unusual event should be record in the Notes/Comments section. If more space is required, a supplemental sheet can be attached to this monitoring report. This supplemental sheet should clearly indicate the nest involved, the date of the monitoring, the monitoring time period to which the comment belongs (especially if needed for more than one monitoring time period), and should be signed by the monitor and supervisor.
9. In the appropriate place at the top of page 1, record the number of adults present at the nest during the entire monitoring period.
10. In the appropriate place at the top of page 1, record the number of young present at the nest during the entire monitoring period.

Nesting Chronology of Bald Eagles in Florida (typical)

Figure 2







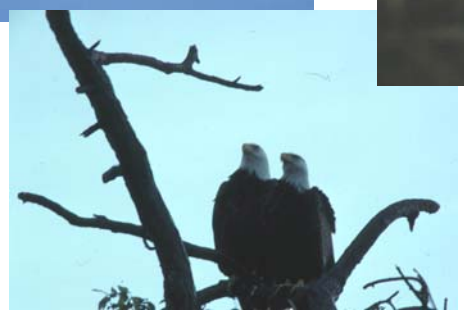
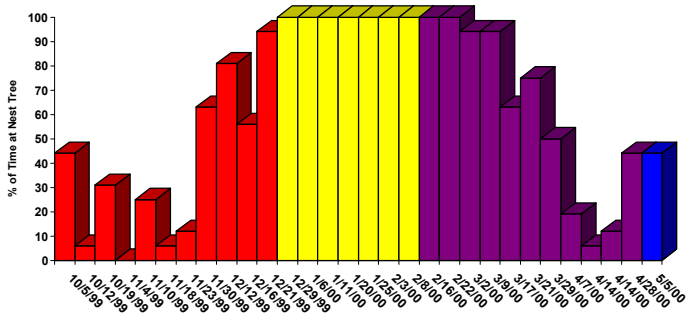


Figure 3: NEST ATTENDANCE BY AT LEAST ONE ADULT EAGLE DURING 15-MINUTE INCREMENTS OF 4-HOUR OBSERVATIONAL PERIODS

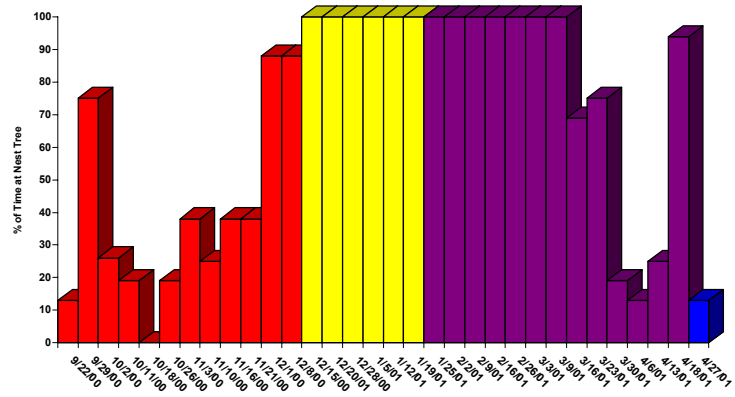
1999 - 2000 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	8
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	0	26



2000 - 2001 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	34
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	0	8



2001 - 2002 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	42
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	17	61

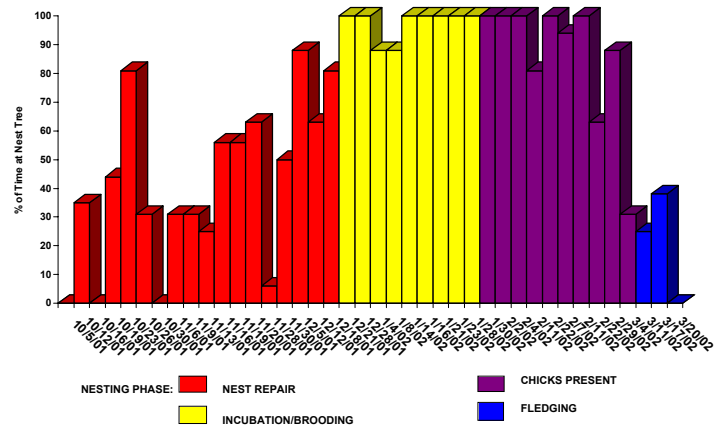


Figure 4

Please send monitoring reports by facsimile or e-mail to the appropriate USFWS Field Office and FWC (Endangered Species Coordinator, Tallahassee) on a monthly basis to:

U. S. Fish and Wildlife Service North Florida
Candace Martino
Tel: (904) 232-2580, ext. 129
Fax: (904) 232-2404
E-mail: candace_martino@fws.gov

U. S. Fish and Wildlife Service South Florida
Alfredo Begazo
Tel: (772) 562-3909 ext. 234
Fax: (772) 562-4288
E-mail: aflredo_begazo@fws.gov

U. S. Fish and Wildlife Service Florida Panhandle
Stan Simpkins
Tel: (850) 769-0552 ext. 234
Fax: (850) 763-2177
E-mail: stan_simpkins@fws.gov

Florida Fish and Wildlife Conservation Commission
Brad Gruver
Tel: (850) 488-3831
Fax: (850) 921-7793
E-mail: brad.gruver@myfwc.com

ATTACHMENT D:

HYDROLOGIC AND HYDRAULIC MODELING REPORT

PRINCETON HYDRO

SCIENCE ENGINEERING DESIGN

Hydrologic and Hydraulic Modeling Report

Lake Luxembourg Conservation Pool Habitat Enhancement

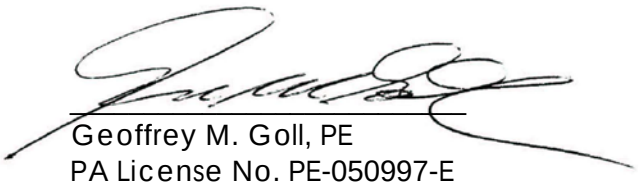
Township of Middletown, Bucks County, Pennsylvania

Prepared for:

Bucks County Conservation District
ATTN: Meghan Rogalus
1456 Ferry Road
Suite 704
Doylestown, Pennsylvania 18901

Prepared by:

Princeton Hydro, LLC
1108 Old York Road
Suite 1, PO Box 720
Ringoes, New Jersey 08551
www.princetonhydro.com
Offices in New Jersey, Maryland, Pennsylvania and Connecticut



Geoffrey M. Goll, PE
PA License No. PE-050997-E

May 2019; Revised June 2019

Project No. 0121.016

Contents

1.0 Introduction

1.1 Project Background

The Bucks County Conservation District contracted Princeton Hydro, LLC to prepare design and permitting documentation for the Lake Luxembourg (Lake) Conservation Pool Habitat Enhancement Project. This project involves the development and enhancement of wetlands in the Conservation Pool. Along with the development and enhancement of wetlands, accumulated material shall be removed from the existing Conservation Pool is proposed to reestablish a forebay for the Lake and restore the intended habitat of the conservation pool by increasing the water depth. The following report details the engineering design elements of the project which pertain to hydrologic and hydraulic analysis as well as regulatory compliance, dewatering and placement.

1.2 Site Background

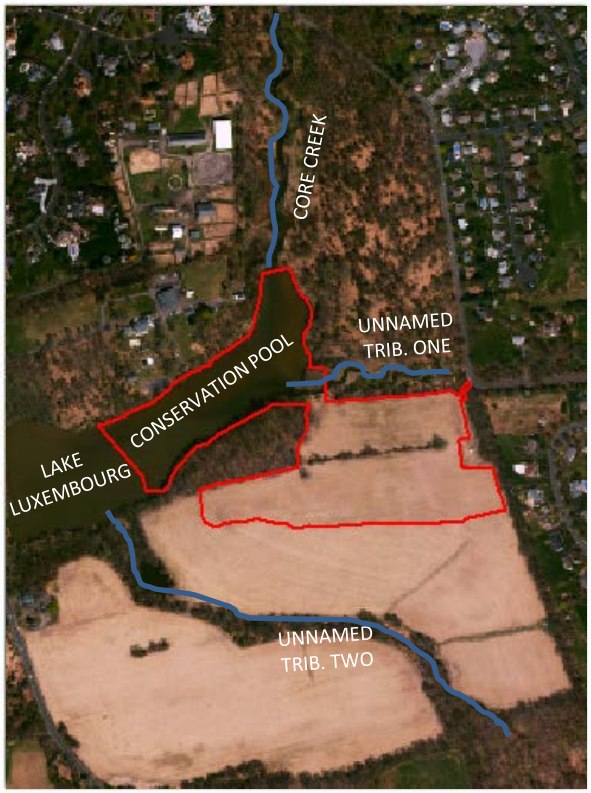


Figure One – Overview map

Lake Luxembourg, located in Bucks County, PA, serves as the focal point of Core Creek County Park. Under Public Law 566 funding, PA Dam 620 (D09-172 and NID#PA00802) was constructed across Core Creek to create a multi-purpose (e.g. flood control, recreation) reservoir. The Dam was completed in June 1976; and the reservoir, named Lake Luxembourg, was filled in the summer of 1977. Core Creek is the primary inlet and sole outlet of Lake Luxembourg. Core Creek is a subwatershed within HUC 02040201 (Crosswicks – Neshaminy) in Bucks County, Pennsylvania, and is designated as a Trout Stocking Fishery and Migratory Fishes water body. Core Creek enters the Neshaminy Creek approximately 13.5 miles upstream of the confluence of the Neshaminy Creek with the Delaware River. As a multi-use reservoir, Lake Luxembourg is important in the community for recreation and serves a vital ecological role as well.

Lake Luxembourg and Core Creek are both listed on Sublist 4a of Pennsylvania's '2016 Integrated Water Quality Monitoring and Assessment Report,' indicating that these waterbodies have approved Total Maximum Daily Loads (TMDLs). The sources of impairment targeted by the TMDLs are total phosphorus (TP) and total suspended solids (TSS). As mentioned above, the Core Creek / Lake Luxembourg watershed drains to the Neshaminy Creek, which it should also be noted, also has a TMDL for TSS.

When Lake Luxembourg was created, a 17-acre 'Conservation Pool' settling basin was established immediately upgradient of the main body of lake, east of Woodbourne Road. The Conservation Pool was intended to store 100 years of sediment while maintaining the full flood storage capacity of the main reservoir, and is currently designated as a Trout Stocking Fishery and Migratory Fishes water body. Unfortunately, due to rapid land use changes in the Core Creek watershed beginning in the early 1980s, the Conservation Pool reached its sediment storage capacity by 1986. Since then, although land use changes in the watershed have stabilized, sediment in the pool is resuspended and transported to the main body of the lake with each storm. Consequently, the Conservation Pool is currently contributing to the sediment load in Lake Luxembourg.

1.3 Review of Existing Information

Documentation

Documentation on the design and construction of the Dam and Conservation Pool were reviewed in order to develop an understanding of the original design intent and collect pertinent information for modeling hydrologic and hydraulic conditions. A file review at the Pennsylvania DEP Division of Dam Safety produced copies of the following documents, which were used to gather information on the design of the Dam and Conservation Pool.

- Final Design Report Dam PA-620 Neshaminy Creek Watershed, March 1971 (Incomplete copy)
- Neshaminy Creek Water Resources Development Plan Multiple-Purpose Dam No. PA-620 Core Creek As-Built Plans, 1971
- SCS Sedimentation Design Summary, December 1964
- PA-620 Reservoir Sediment Data Summary, August 1988
- Real Estate Evaluation Report PA 620 Core Creek Dam, WM G Major Associates, 1979

The current condition of the Conservation Pool was assessed through review of the following recent studies and survey prepared for the Lake and Conservation Pool.

- Lake Luxembourg Dredging Feasibility Report, Princeton Hydro, June 2013
- Topographic Survey of the Conservation Pool, BANC3, 2016

Information expressed in the documents listed above, along with publicly available information (e.g. regional elevation datasets, land use and land cover, etc.) are the basis of the analyses discussed in this report.

Summary of Pertinent Data

As the forebay for Lake Luxembourg the Conservation Pool accepts flow and sediment from Core Creek and two smaller tributaries.

All elevation data prior illustrated in reports prior to 1988 have been converted to NAVD88 via the following conversion:

$$Elevation\ (NAVD88) = Elevation\ (NGVD29) - 1.024\ FT$$

This elevation conversion was determined through the use of the VERTCON software maintained by NOAA.

Conservation Pool

Normal Pool Elevation:	101.48 Feet
Storage at Normal Pool (2013):	22.1 Acre Feet
Sediment Storage (2013):	77,000 Cubic Yards

PA Dam 620

Primary Spillway: Vertical concrete conduit with interior dimensions of 12-ft by 5-ft

Primary Spillway Inlet Invert Elevations:

Inlet Structure	Elevation
2 – 12-ft Ungated Weirs	101.48
36"x42" Sluice Gate	89.98
36"x48" Sluice Gate	86.98
60"x60" Sluice Gate	69.98

Primary Spillway Conduit through Dam:	60-in RCP
Inlet Invert Elevation:	69.98 Feet
Outlet Invert Elevation:	68.98 Feet
Slope:	0.00445 ft/ft
Emergency Spillway:	Trapezoidal Earth/Rock Channel with Riprap Control Section
Riprap Control Width:	550 Feet
Riprap Control Breadth:	600 Feet

Inlet Invert Elevation: 110.88 Feet

1.4 Design Goals and Objectives

This project has the following goals:

- Enhance the Conservation Pool so it functions as a regional constructed wetland Best Management Practice (BMP)
- Reduce amount of sediment being transported to Lake Luxembourg
- Maintain stability of the Conservation Pool
- Make future maintenance and sediment removal easier to implement
- Uplift the habitat quality of the Conservation Pool

These goals will be achieved through completing the following objectives:

- Selective removal of accumulated sediment from the Conservation Pool
- Restore Conservation Pool vegetation

As the Conservation Pool no longer serves its function due to being filled with sediment and lack of maintenance, the project goals serve to create a more functional space that is easier to maintain and reduces sediment load to Lake Luxembourg. To meet the project goals, Princeton Hydro proposes to remove accumulated sediment from the Conservation Pool to restore the available sediment storage, create settling pools to create smaller pockets of sediment storage that will allow for easier maintenance and stabilize the pool, and restoring the Conservation Pool. A Post Construction Stormwater Management (PCSM) Plan is not applicable because this is a restoration project, and no structural stormwater management best management practices (BMPs) are proposed. An antidegradation analysis is also not applicable because this restoration project is not proposed in a High Quality or Exceptional Value watershed.

2.0 Existing Conditions

Lake Luxembourg and its surrounding area is currently in use as a county park (Core Creek Park) in Bucks County, Pennsylvania. To the north and the east of the project location are residential areas, to the south are farm fields, and to the east is Woodbourne Road and the Conservation Pool. The land use has not changed significantly over the past 15 years, with the exception of a few additional residential areas to the northeast. As discussed earlier, Core Creek was dammed and filled to become Lake Luxembourg by 1977 which greatly altered the hydrology of the area. Aerial photographs from 1971 show that the area was primarily farmland and no lake was present at that time. The lake was created as a means for water supply, recreation, and flood control.

The Lake Luxembourg Conservation Pool discharges via a culvert under Woodbourne Road, into Lake Luxembourg, and has an area of approximately 836,000 square feet. The Conservation Pool was designed to store accumulating sediments before entering Lake Luxembourg, though as stated previously it reached its storage capacity by 1986. A bathymetry study performed by Princeton Hydro in May 2013 shows a sediment depth of up to 7 feet in the Conservation Pool.

2.1 Drainage Area

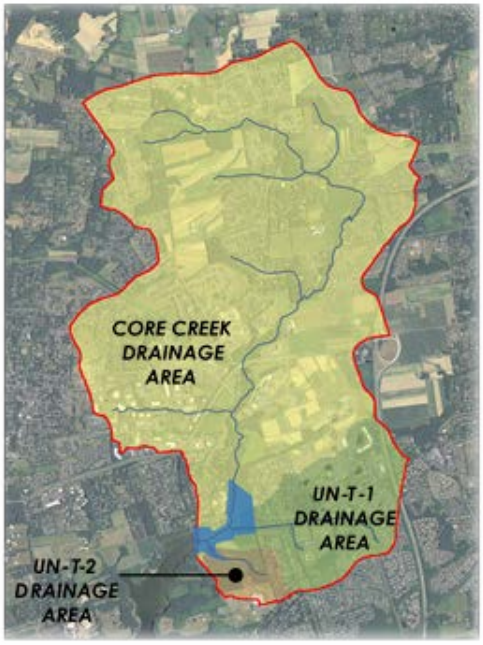


Figure Two – Drainage Overview map

In order to analyze the effects of proposed conditions, watersheds draining to the Conservation Pool were delineated. Watersheds were delineated for Core Creek, Unnamed Tributary 1, and Unnamed Tributary 2 to where they discharge at the Conservation Pool. As stated previously, the outlet of the Conservation Pool is the Woodbourne Road Culvert where it then discharges to the main body of Lake Luxembourg. The areas of the delineated watersheds are listed below.

Table 1 – *Watershed Area Review Table*

Watershed Name	Area (sq. miles)
Core Creek	6.12
Unnamed Tributary One (UN-T-1)	0.96
Unnamed Tributary Two (UN-T-2)	0.21
Total	7.29

2.2 Soils

The National Resource Conservation Service (NRCS) Web Soil Survey indicates that native onsite soils are:

- Bowmansville-Knaurs silt loams (Bo), Hydrologic Soil Group (HSG) C/D,
- Chalfont silt loam, 3 to 8 percent slopes (CbB), HSG D,
- Lansdale loam, 3 to 8 percent slopes (LgB), HSG B,
- Lawrenceville silt loam, 3 to 8 percent slopes (LkB), HSG C,
- Steinsburg gravelly loam, 3 to 8 percent slopes (StB), HSG B, and
- Steinsburg gravelly loam, 8 to 15 percent slopes (StC), HSG B.

Included in Appendix B is the NRCS soil report for the project site. The NRCS provides the following description and limitations for the soil series found on site:

Bowmansville Series

The Bowmansville series consists of very deep, poorly and somewhat poorly drained soils. They formed in recent alluvial deposits derived from upland soil materials weathered from dolerite or basalt. They are on floodplains with smooth slopes of 0 to 3 percent. Saturated hydraulic conductivity is moderately high above stratified sand and gravel and high in stratified sand and gravel.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Knauers Series

The Knauers series consists of very deep, poorly drained soils formed in recent alluvial deposits derived from sandstones and shales. They are on the backwater areas of floodplains with slightly depressed slopes of 0 to 3 percent. Saturated Hydraulic conductivity is moderately high and high in the A and B horizons, and high to very high in the C horizon.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Chalfont Series

The Chalfont series consists of deep and very deep, somewhat poorly drained soils formed in a loess mantle and the underlying residuum of shale and sandstone. Slopes range from 0 to 25 percent.

Very limited for dwellings and small commercial buildings. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Lansdale Series

The Lansdale series consists of deep and very deep, well drained soils on uplands. They formed in residuum weathered from sandstone and/or conglomerate. Slopes are 0 to 25 percent. Saturated hydraulic conductivity is moderately high to high.

Not limited for dwellings without basements, somewhat limited for dwellings with basements and small commercial buildings. Somewhat limited for roads and streets, shallow excavations, and lawns and landscaping. All areas are prime farmland.

Lawrenceville Series

The Lawrenceville series consists of deep and very deep, moderately well drained soils formed in silty transported materials. Slopes range from 0 to 15 percent. Permeability is moderately slow.

Somewhat limited for dwellings without basements and small commercial buildings, very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Steinsburg Series

Soils of the Steinsburg series are moderately deep and well drained with moderately rapid permeability. They formed in residuum mostly from weakly cemented acid sandstone, arkosic sandstone, and conglomerate. They are on upland slopes of 0 to 70 percent.

Somewhat limited for dwellings without basements, somewhat to very limited for small commercial buildings, and very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Also included in Appendix B are the NRCS soil reports for the drainage areas into the conservation pool.

3.0 Proposed Conditions

Proposed conditions include the removal accumulated material from the Conservation Pool, creation of settling pools using tree vane structures, and restoring vegetation within the conservation pool. No new channels are proposed. These proposed conditions will restore the capacity of the conservation pool and allow for ease of maintenance, while also enhancing the existing habitat. The amount of sediment entering Lake Luxembourg should decrease and the conservation pool should become more stabilized in proposed conditions.

The material to be removed is high in organic content and can be beneficial for reuse. It is proposed to place the material in the adjacent farm field for further dewatering and to be incorporated into the existing soils as an amendment.

All proposed sediment placement and soil erosion & sediment control features are located at elevations above the top of the dam, which has an elevation of 116.98 feet NAVD 88. This elevation was obtained by converting the NGVD 29 elevation of 118 feet provided on Sheet 10 of 43 of the Neshaminy Creek Water Resources Development Plan As-Builts, dated March 1971. The dam elevation conversion is included in Appendix D. The sediment placement will result in no flood storage loss, as the sediment will not be placed within the floodplain.

4.0 Soil Erosion and Sediment Control Compliance

An Erosion and Sediment Control Plan has been prepared for this project and is shown on sheets 12 and 13 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design plans, prepared by Princeton Hydro and dated October 31, 2018. This E&S plan meets the following goals:

- Minimizes extent and duration of earth disturbance.
- Maximizes protection of existing drainage features and vegetation.
- Minimizes soil compaction.

- Utilizes other measures or controls that prevent or minimize generation of increased stormwater runoff.

For this project, two soil erosion and sediment control plans have been prepared to protect the site during interim conditions and proposed conditions. The interim plan is for the sediment removal and dewatering components of the project and associated dewatering activities. The proposed plan covers the site restoration.

4.1 Methods

Soil erosion and sediment control measures are proposed in accordance with the design and performance standards contained in the Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual dated March 2012.

The following permanent soil erosion control measures will be utilized:

1. Permanent seeding will be applied to permanently stabilize the soil, assure conservation of soil and water, and enhance the environment. A permanent seeding mixture will be applied as specified on the planting plans. All seed mixtures will be specific to the region and site conditions.

The following temporary soil erosion control measures will be utilized during construction:

1. Silt fence will be placed at the toe of slopes where the existing ground slopes away from the embankment.
2. Dust generated during the course of construction activities will be controlled in areas subject to dust blowing and movement where on-site and off-site damage is likely to occur without treatment. These control measures will prevent the blowing and movement of dust from exposed soil surfaces thus reducing on-site and off-site damage and health hazards, and improving traffic safety.
3. Temporary vegetative or stabilization cover will be established on soils where earthwork is delayed or stopped for a period a four (4) days which are not being graded, not under active construction or not scheduled for permanent seeding within sixty (60) days. This temporary vegetative cover will be consistent with the permanent seeding specifications as described on the plans and will temporarily stabilize the soil and reduce damage from wind and water erosion until construction is resumed at the site. During non-germinating seasons mulching shall be used for temporary stabilization.

The interim plan includes several erosion and sediment controls, such as a stabilized construction entrance, filter socks, super silt fence, and turbidity barriers. The interim plan covers Phase 1, Phase 2A, and Phase 2B of the project. The major difference between the interim and proposed plan are the fields to be used to dewater the soil removed from the Conservation Pool. In interim conditions, the fields will have a series of 21 berms that will be used to dewater sediment. Compost filter sock and super silt fence are proposed

throughout the fields at the toes of the berms to prevent sediment from leaving the area. The berms will be stabilized with seeding & mulching and erosion control blankets will be installed on slopes steeper than 3:1. Plywood or other similar matting will be used in the field area for construction access to reduce compaction when transporting sediment to the field for dewatering.

The proposed plan covers Phase 3 of the project, which covers restoration of the project site. During this phase, the fields used for dewatering will be restored by incorporating the dewatered sediment into them existing soil. Several of the erosion and sediment controls in the field area will be removed for this to occur, though the super silt fence at the toe of the slope will remain during the incorporation of the dewatered sediment to prevent sediment from leaving the area. Upon completion of the incorporation of the soils, the area will be restored with seeding and plantings as detailed in the Plans. Once stabilized with vegetative cover all soil erosion controls shall be removed.

Overall, these plans utilize various erosion and sediment controls, use the minimum area required for the proposed work, and are proposed for the minimum extent and duration possible while also meeting timing constraints.

4.2 Temporary Crossing

A temporary stream crossing is proposed to cross one of the tributaries to the conservation pool in order to maximize distance from the bald eagle nest, minimize wetland and vegetation disturbance, and to most effectively access the portions of the conservation pool to be restored. This crossing shall span bank to bank and have the capacity for all proposed trucks and equipment to cross in a stable manner. If a large storm event is forecasted during the construction time period, the temporary crossing shall be removed so there is no restriction to flow. The crossing would then be reinstalled post the event for the duration of the work effort.

5.0 Stormwater Management

As there is no permanent change in land use proposed as part of this project, there is no net change in volume and rate of stormwater requirements. This is confirmed in Worksheet 4 of the Pennsylvania Stormwater BMP Manual and Summary Table 3 of the Application, with relevant calculations included in Appendix D. The site Limit of Disturbance was used for these calculations to show no net change in the site runoff. Summary Table 4 is not applicable as no SWM facilities are proposed for this restoration plan.

6.0 Lake Lowering and Dewatering

Lake Luxembourg will first be dewatered using the low-level outlet to 3.25 feet below normal pool elevation (Elevation ~97), at a rate no greater than 1 foot per day. In addition, a series of dewatering sumps will be used to further dewater the sediment removal area and they will discharge to a sediment trap prior to entering the

downstream waterway as deemed necessary. A stream bypass will also be constructed to divert incoming flows away from the work.

6.1 Stream Bypass

Stream bypasses were sized for both the Core Creek inflow and the Unnamed Tributary 1 inflow. The 2-year 24-hour peak flow from the StreamStats output was used to size the bypass channels, and a geotextile liner was assumed as that is what is required at minimum for a temporary swale per the PADEP Erosion and Sediment Pollution Control Program Manual.

Table 5 - Bypass Channel Summary

Description	Drainage Area (Sq. Mi.)	2-Yr Flow (cfs)	Side Slope XH:1V (ft)	Bottom Width (ft)	Channel Depth (ft)	Cross Sectional Area (sf)	Channel Slope (%)
Core Creek	6.12	646	5	20	2	60	0.02
UN-T-1	0.21	58	5	10	1	15	0.02

6.2 Dewatering

As mentioned above, the water surface elevation will be lowered to elevation 97 which is approximately 1 foot below the bottom of the proposed material to be removed. This will result in the material to be removed to partially dewater in place. Typical mechanical material removal contractors will start at the farthest point from access and high pile material closer to the truck access area for loading and transport to disposal location. This high piling will allow for water to flow from the sediment while remaining in the lake bed. No high piles will be left in the lake bed if a storm event is forecasted. The material will then be trucked to the adjacent field for further dewatering and disposal.

7.0 Conclusion

In conclusion, the proposed conditions will meet the project objectives, while reducing and avoiding negative impacts to the project area and downstream waterbodies. This project proposes to remove accumulated sediment from the existing Conservation Pool, create settling pools, and restoration of vegetation in order to achieve the goals of enhancing the Conservation Pool, reducing sediment transport to Lake Luxembourg, maintain stability of the Pool, making future maintenance easier, and uplifting the habitat of the Pool. No pollution or thermal impacts are anticipated in proposed conditions.

Appendix B. Draft Technical Specifications

REQUEST FOR BIDS - PUBLIC NOTICE:

The Bucks County Conservation District is accepting sealed bids online via the PennBid Program for the Lake Luxembourg Conservation Pool Habitat Enhancement Project until September 5, 2019 at 11am. The project is located in Middletown Township, Bucks County.

The Mandatory Pre-Bid Meeting shall be held on August 7th, 2019 at Pavilion 10 at Core Creek Park, off of North Woodbourne Road, Middletown Township, PA 19047.

Latitude: 40° 12’ 13.53” N
Longitude: 74° 54’ 19.86” W

Questions shall be submitted via PennBid or in writing (email or facsimile) to Meghan Rogalus at mrogalus@bucksccd.org by August 14th, 2019 at 5 pm.

The project has a specific proposed timeline due to threatened and endangered species within the work area and park. The anticipated start is on or before December 1, 2019. The following is a more detailed breakdown of the construction sequencing:

- Turtle exclusion fence shall be installed prior to December 31, 2019,
- Lake Lowering may start in mid-July 2020 in accordance with Permits,
- Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and
- Restoration shall occur between April 2021 and September 2021. Only restoration within the agricultural fields may commence prior to July 31, any restoration activities within open water or access areas shall be completed post the Bald Eagle timing restriction (January 1-July 31).

All Bidding Documents and details are available online at no cost at www.PennBid.net.

The District reserves the right, at its option, to waive any informalities, defects, errors or omissions in any or all bids, and to reject any or all bids.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
BID INSTRUCTIONS

INFORMATION AVAILABLE TO ALL INTERESTED PARTIES AT www.PennBid.net

A. General Instructions for Bidders

B. Proposed Scope of Work

C. Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan Set

D. Bid Sheet

E. Rate Schedule Sheet
    1. Prevailing Wage Rate Determination

F. Non-Collusion Affidavit

G. Contractor Responsibility Certification Form

H. Public Works Employment Verification Form

I. Contractor Qualifications and Experience

J. Sample Contract
    1. Commonwealth Nondiscrimination/Sexual Harassment Clause

K. Technical Specifications for Lake Luxembourg Conservation Pool Habitat Enhancement Project at Core Creek County Park.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
A - GENERAL INSTRUCTIONS FOR BIDDERS

1. The Contractor shall provide a bid to build project as described in Scope of Work and Plans.
   (a) The Contractor shall provide a detailed project budget and timeline for tasks listed in the Scope of Work and as per the Contract Documents.
   (b) The Contractor shall provide all equipment, labor, and supplies necessary to complete the work. Coordination of equipment, materials, and supplies is the responsibility of the Contractor.
   (c) The Contractor shall be responsible for locating and protecting all utilities in a manner consistent with PA Act 287 "The Underground Utility Line Protection Law."

2. A Mandatory Pre-Bid Meeting shall be held on August 7th, 2019 at Pavilion 10 at the Core Creek Park, off of North Woodbourne Road, Middletown Township, PA 19047.
   (a) Latitude: 40° 12' 13.53" N
   (b) Longitude: 74° 54' 19.86" W

3. The Bucks County Conservation District (BCCD) is not obligated to accept the lowest bid. BCCD shall consider the cost estimate and qualifications and experience of the Contractor when making its final decision in selecting a successful proposal. Contractor is to submit details (i.e., bid items, dollar value of work, and company information) for any work proposed to be subcontracted as part of the project for BCCD review.

4. Award of a contract shall be made within sixty (60) days of the bid closing date. In the event no satisfactory bids are received, all submitters will be so notified within the same time period.

5. The Contractor to whom award is made shall provide the following information to BCCD with the signed contract
   (a) Standard Accord Certificate(s) of Insurance (Contractual Liability Type)
      i. Worker's Compensation Insurance
      ii. Public Liability and Property Damage Insurance
      iii. Automobile Bodily Injury and Property Damage Insurance
   (b) Performance Bond (100% of the contract amount)
   (c) Material and Labor Bond (100% of the contract amount)
   (d) Failure to provide the bonds or irrevocable letter of credit within twenty-one (21) days of notification of award may result in cancellation of contract award.
   (e) The Contractor will execute and return all copies of the Agreement, within seven (7) days after the notice of award of contract. The Contractor further agrees to execute the work with speed and diligence so as to ensure completion of the contract by as defined in the technical specification but no later than September 30th, 2021.

6. The contracted work described as part of this proposal shall be completed no later than September 30th, 2021. It is anticipated that the project may be started as soon as the weather permits and agreed to by BCCD and the Contractor, provided all contracts are finalized.
   (a) Portions of the project have specific completion timing restrictions based on Threatened and Endangered species within or close proximity to the project area. The district nor its project partner do not have any authority to be flexible with these restrictions.

7. Upon acceptance of the work at the Final Inspection of each site, the contractor shall submit a final invoice for the amount due. Payment shall be made by BCCD not later than thirty (30) days after receipt of the invoice.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
B - PROPOSED SCOPE OF WORK

Bucks County Conservation District has partnered with Bucks County Department of Parks and Recreation to remove accumulated sediment and enhance the habitat of the Lake Luxembourg Conservation Pool. The goal of the proposed projects is to improve water quality in the Core Creek watershed.

The proposed Lake Luxembourg Conservation Pool Habitat Enhancement Project includes the removal of 15,000 cubic yards of sediment from the Conservation Pool and dewatering the sediment in an adjacent field, which will then be incorporated into the field and seeded. In addition, turtle habitat features, and tree vanes will be installed within the Conservation Pool, and native shrubs will be planted throughout the Conservation Pool area and protected with wildlife exclusion fencing. The areas used for access will also be restored, including a small portion of forest and wetland that will be temporarily impacted.

The project has a specific proposed timeline due to threatened and endangered species within the work area and park. The anticipated start is on or before December 1, 2019. The following is a more detailed breakdown of the construction sequencing:

- Turtle exclusion fence shall be installed prior to December 31, 2019,
- Lake Lowering may start in mid-July 2020 in accordance with Permits,
- Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and
- Restoration shall occur between April 2021 and September 2021. Only restoration within the agricultural fields may commence prior to July 31, any restoration activities within open water or access areas shall be completed post the Bald Eagle timing restriction (January 1-July 31).

The project is located on public land and is funded by a grant through the U.S. EPA and Pennsylvania DEP NonPoint Source Program (Clean Water Act Section 319). Therefore, the selected contractor must provide a Non-Collusion Affidavit and adhere to the provisions of Pennsylvania Prevailing Wage Rates, Contractor Integrity, and Nondiscrimination & Sexual Harassment Policy.

The selected contractor will be responsible for implementing all components listed below:

- Installation and maintenance of all Erosion and Sediment Controls
- Site excavation and stabilization
- Grading of berms and dewatering of excavated material
- Spreading of excavated material on the adjacent field
- Installation of native plant materials and animal exclusion fencing
- Installation of turtle habitat features and tree vanes

- Site Restoration
- Final site stabilization

Please refer to attached Plans and Design Specifications for more details.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
D - BID SHEET

PROJECT LOCATION – Core Creek County Park
MUNICIPALITY – Middletown Township
COUNTY – Bucks
BID OPENING: July 15, 2019; 8:00 a.m.
BID CLOSING: September 5, 2019; 11:00 a.m.

Item No.	Specification Section	Item	Unit	Quantity	Unit Price	Total Amount
Construction						
1	017113	Mobilization/Demobilization (includes photographic documentation, temporary facilities and controls, traffic control, and environmental protection)	L.S	1		
2	312500	Temporary Stream Crossing	EA.	1		
3	312500	Temporary Rock Ramp	EA.	1		
4	311000	Selective Clearing	LS.	1		
5	015639	High Visibility Fence	L.F.	2,350		
6	017113	As-built Survey	L.S.	1		
Earthwork						
7	312316	Sediment Removal	C.Y.	15,000		
8	312316	Interim Grading - Berms	L.F.	7,220		
9	312316	Interim Grading - Dewatering Sediment	L.S.	1		
10	312316	Grading of Sediment Materials	S.F.	550,000		
Erosion and Sediment Control						
11	312500	Construction Entrance	EA.	1		
12	312500	Filter Sock	L.F.	1,740		
13	312500	Super Silt Fence	L.F.	1,610		
14	312500	Turtle Exclusion Fence (Super Silt Fence)	L.F.	2,010		
15	312500	Turbidity Barrier	L.F.	500		
16	312319	Lake Lowering	L.S.	1		
17	312319	Stream Bypass and Control of Water	L.S.	1		

Planting & Enhancement						
18	354900	Turtle Habitat Features	EA.	13		
19	354900	Tree Vane	L.F.	800		
20	329200	Wetland Mitigation Seed Mix	S.Y.	1,300		
21	329200	Farm Field Erosion Seed Mix	S.Y.	68,120		
22	329300	*Carex stricta* (Tussock Sedge)	EA.	4,300		
23	329300	*Carex vulpinoidea* (Fox Sedge)	EA.	2,200		
24	329300	*Iris versicolor* (Blueflag Iris)	EA.	4,300		
25	329300	*Leersia oryzoides* (Rice Cutgrass)	EA.	3,250		
26	329300	*Peltandra virginica* (Green Arrow Arum)	EA.	3,250		
27	329300	*Pontederia cordata* (Pickerelweed)	EA.	4,300		
28	329300	*Sagittaria latifolia* (Broad-Leaved Arrowhead)	EA.	3,550		
29	329300	*Schoenoplectus tabernaemontani* (Softstem Bulrush)	EA.	5,350		
30	329300	*Scirpus atrovirens* (Green Bulrush)	EA.	5,350		
31	329300	*Platanus occidentalis* (Sycamore) including tree cages	EA.	6		
32	329300	*Quercus bicolor* (Swamp White Oak) including tree cages	EA.	6		
33	329300	Quercus palustris *(Pin Oak) including tree cages*	EA.	8		
34	015639	Goose fencing	L.F.	8,275		

In compliance with the Bid Instructions, General Instructions for Bidders, Drawings and Specifications, the undersigned proposes to complete the entire project at the Contract Amount of $ _____based on the unit pricing provided above.

The undersigned agrees to complete all work identified no later than September 30, 2021 and to provide a Standard Certificate of Insurance, Performance Bond and Materials & Labor Bond as stipulated in the General Instructions for Bidders.

Bidding Firm Name and Address**: _____

_____

_____

_____ _____ _____
Signature Title Date

Contractor Federal Identification No.:_____

Contractor Social Security No.:_____

Witnessed by:

_____ _____ _____
Signature Title Date

** *For individuals, the Proposal must be signed by the Owner and the signature witnessed. For Partnerships, the Proposal must be signed by a Partner and the signature witnessed. For Corporations, the Proposal must be signed by the President, Vice President or Secretary or other Representative of the Corporation authorized to sign and the signature witnessed.*

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
E - RATE SCHEDULE SHEET

_____(CONTRACTOR) RATE SCHEDULE

(Complete as applicable to project appropriateness)

1.	PROJECT MANAGEMENT	$_____/HR
2.	LABOR	$_____/HR[1]
3.	EXCAVATOR	$_____/HR
4.	WHEEL LOADER	$_____/HR
5.	TRACK LOADER	$_____/HR
6.	DOZER	$_____/HR
7.	DUMP TRUCK	$_____/HR
8.	BACKHOE	$_____/HR
9.	MOBILIZATION	$_____/HR
10.	OTHER_____	$_____/HR
11.	OTHER_____	$_____/HR
12.	OTHER_____	$_____/HR

_____ _____

Witness Signature

_____ _____

Date Printed Name & Title

_____

Date

Note: 1. Prevailing wage applies per Commonwealth law.

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Lake Luxembourg Conservation Pool Habitat Enhancement Design
Awarding Agency:	Bucks County Conservation District
Contract Award Date:	9/11/2019
Serial Number:	19-05132
Project Classification:	Heavy
Determination Date:	6/25/2019
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Bucks County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	5/29/2017		$47.30	$34.85	$82.15
Asbestos & Insulation Workers	5/1/2018		$49.30	$35.85	$85.15
Asbestos & Insulation Workers	5/1/2019		$51.20	$36.95	$88.15
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2017		$28.52	$18.22	$46.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2018		$29.52	$18.22	$47.74
Boilermaker (Commercial, Institutional, and Minor Repair Work)	1/1/2019		$29.26	$18.48	$47.74
Boilermakers	1/1/2017		$44.26	$33.36	$77.62
Boilermakers	1/1/2018		$46.26	$33.36	$79.62
Boilermakers	3/1/2018		$45.89	$33.73	$79.62
Boilermakers	1/1/2019		$45.51	$34.11	$79.62
Bricklayer	5/1/2017		$40.98	$26.78	$67.76
Bricklayer	5/1/2018		$43.73	$26.78	$70.51
Bricklayer	5/1/2019		$46.48	$26.78	$73.26
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		$45.25	$27.59	$72.84
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	$45.83	$27.59	$73.42
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019	4/30/2020	$46.54	$27.59	$74.13
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020		$47.73	$27.59	$75.32
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		$39.35	$27.59	$66.94
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	$39.85	$27.59	$67.44
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019	4/30/2020	$40.47	$27.59	$68.06
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020		$41.50	$27.59	$69.09
Carpenter - Rodman (Surveying & Layout)	5/1/2017		$19.68	$19.64	$39.32
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	$19.93	$19.49	$39.42
Carpenter - Rodman (Surveying & Layout)	5/1/2019	4/30/2020	$20.24	$19.69	$39.93
Carpenter - Rodman (Surveying & Layout)	5/1/2020		$20.75	$19.49	$40.24
Carpenters	5/1/2017		$39.35	$27.59	$66.94
Carpenters	5/1/2018	4/30/2019	$39.85	$27.59	$67.44
Carpenters	5/1/2019	4/30/2020	$40.87	$27.59	$68.46
Carpenters	5/1/2020		$41.90	$27.59	$69.49
Cement Masons	5/1/2017		$36.45	$31.76	$68.21
Cement Masons	5/1/2018		$37.50	$32.26	$69.76
Cement Masons	5/1/2019		$38.50	$32.81	$71.31
DockBuilder/Pile Drivers (Building, Heavy & Highway)	5/1/2018		$43.45	$34.47	$77.92
Dockbuilder/Piledriver (Building, Heavy, Highway)	11/1/2017		$43.45	$33.22	$76.67
Dockbuilder/Piledriver (Building, Heavy, Highway)	5/1/2018		$44.70	$33.22	$77.92
Drapery Installers	5/1/2009		$31.09	$21.34	$52.43
Drywall Finisher	5/1/2017		$37.11	$26.75	$63.86
Drywall Finisher	5/1/2018		$39.27	$27.49	$66.76
Electricians	12/1/2018		$41.06	$19.38	$60.44
Electricians	6/1/2019	5/31/2020	$42.86	$19.38	$62.24
Electricians	6/1/2020		$44.72	$19.38	$64.10
Elevator Constructor	1/1/2016		$52.79	$30.29	$83.08

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Elevator Constructor	1/1/2018		$55.76	$33.05	$88.81
Floor Coverer	5/1/2019		$44.37	$28.44	$72.81
Floor Coverer	5/1/2020		$46.01	$28.44	$74.45
Floor Layer	5/1/2017		$42.51	$27.91	$70.42
Floor Layer	5/1/2018		$43.11	$28.09	$71.20
Glazier	5/1/2017		$41.30	$30.80	$72.10
Glazier	5/1/2018		$43.32	$32.33	$75.65
Glazier	5/1/2019		$43.87	$33.38	$77.25
Iron Workers - Reinforcing Steel Mesh - Rebar	7/1/2017		$42.56	$29.30	$71.86
Iron Workers - Reinforcing Steel Mesh - Rebar	7/1/2018		$51.46	$30.60	$82.06
Iron Workers (Riggers)	7/1/2017		$39.83	$27.92	$67.75
Iron Workers	1/1/2017		$46.20	$31.26	$77.46
Iron Workers	7/1/2017		$47.30	$32.91	$80.21
Iron Workers	7/1/2018		$42.88	$30.60	$73.48
Iron Workers	7/1/2019		$32.76	$29.88	$62.64
Laborers (Class 01 - See notes)	5/1/2017		$28.65	$24.95	$53.60
Laborers (Class 02 - See notes)	5/1/2017		$30.85	$25.65	$56.50
Laborers (Class 03 - See notes)	5/1/2017		$28.92	$25.18	$54.10
Laborers (Class 04 - See notes)	5/1/2017		$28.95	$24.95	$53.90
Laborers (Class 05 - See notes)	5/1/2017		$28.65	$24.95	$53.60
Landscape Laborer	5/1/2017		$22.71	$23.08	$45.79
Marble Finisher	5/1/2017		$35.55	$24.17	$59.72
Marble Finisher	5/1/2018		$37.55	$24.17	$61.72
Marble Finisher	5/1/2019		$39.75	$24.17	$63.92
Marble Mason	5/1/2017		$40.36	$26.99	$67.35
Marble Mason	5/1/2018		$43.11	$26.99	$70.10
Marble Mason	5/1/2019		$45.86	$26.99	$72.85
Millwright	7/1/2017		$41.35	$32.24	$73.59
Millwright	5/1/2018		$43.33	$32.96	$76.29
Millwright	5/1/2019		$45.50	$33.29	$78.79
Operators (Building, Class 01 - See Notes)	5/1/2017		$44.87	$28.14	$73.01
Operators (Building, Class 01 - See Notes)	5/1/2017		$44.87	$28.14	$73.01
Operators (Building, Class 01 - See Notes)	5/1/2018		$46.41	$28.60	$75.01
Operators (Building, Class 01 - See Notes)	5/1/2019		$47.95	$29.06	$77.01
Operators (Building, Class 01 - See Notes)	5/1/2020		$49.50	$29.51	$79.01
Operators (Building, Class 01 - See Notes)	5/1/2021		$51.04	$29.97	$81.01
Operators (Building, Class 01A - See Notes)	5/1/2017		$47.86	$29.03	$76.89
Operators (Building, Class 01A - See Notes)	5/1/2018		$49.41	$29.49	$78.90
Operators (Building, Class 01A - See Notes)	5/1/2019		$50.96	$29.94	$80.90
Operators (Building, Class 01A - See Notes)	5/1/2020		$52.50	$30.40	$82.90
Operators (Building, Class 01A - See Notes)	5/1/2021		$54.05	$30.85	$84.90
Operators (Building, Class 02 - See Notes)	5/1/2017		$44.62	$28.07	$72.69
Operators (Building, Class 02 - See Notes)	5/1/2018		$46.16	$28.53	$74.69
Operators (Building, Class 02 - See Notes)	5/1/2019		$47.70	$28.99	$76.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 02 - See Notes)	5/1/2020		$49.25	$29.44	$78.69
Operators (Building, Class 02 - See Notes)	5/1/2021		$50.80	$29.89	$80.69
Operators (Building, Class 02A - See Notes)	5/1/2017		$47.61	$28.97	$76.58
Operators (Building, Class 02A - See Notes)	5/1/2018		$49.16	$29.42	$78.58
Operators (Building, Class 02A - See Notes)	5/1/2019		$50.71	$29.87	$80.58
Operators (Building, Class 02A - See Notes)	5/1/2020		$52.26	$30.31	$82.57
Operators (Building, Class 02A - See Notes)	5/1/2021		$53.81	$30.77	$84.58
Operators (Building, Class 03 - See Notes)	5/1/2017		$40.53	$26.87	$67.40
Operators (Building, Class 03 - See Notes)	5/1/2018		$42.07	$27.33	$69.40
Operators (Building, Class 03 - See Notes)	5/1/2019		$43.62	$27.78	$71.40
Operators (Building, Class 03 - See Notes)	5/1/2020		$45.17	$28.24	$73.41
Operators (Building, Class 03 - See Notes)	5/1/2021		$46.71	$28.69	$75.40
Operators (Building, Class 04 - See Notes)	5/1/2017		$40.24	$26.78	$67.02
Operators (Building, Class 04 - See Notes)	5/1/2018		$41.78	$27.22	$69.00
Operators (Building, Class 04 - See Notes)	5/1/2019		$43.32	$27.69	$71.01
Operators (Building, Class 04 - See Notes)	5/1/2020		$44.86	$28.14	$73.00
Operators (Building, Class 04 - See Notes)	5/1/2021		$46.41	$28.60	$75.01
Operators (Building, Class 05 - See Notes)	5/1/2017		$38.51	$26.27	$64.78
Operators (Building, Class 05 - See Notes)	5/1/2018		$40.05	$26.73	$66.78
Operators (Building, Class 05 - See Notes)	5/1/2019		$41.60	$27.18	$68.78
Operators (Building, Class 05 - See Notes)	5/1/2020		$43.14	$27.64	$70.78
Operators (Building, Class 05 - See Notes)	5/1/2021		$44.69	$28.10	$72.79
Operators (Building, Class 06 - See Notes)	5/1/2017		$37.52	$25.98	$63.50
Operators (Building, Class 06 - See Notes)	5/1/2018		$39.07	$26.43	$65.50
Operators (Building, Class 06 - See Notes)	5/1/2019		$40.61	$26.89	$67.50
Operators (Building, Class 06 - See Notes)	5/1/2020		$42.16	$27.35	$69.51
Operators (Building, Class 06 - See Notes)	5/1/2021		$43.70	$27.80	$71.50
Operators (Building, Class 07A- See Notes)	5/1/2017		$54.14	$32.47	$86.61
Operators (Building, Class 07A- See Notes)	5/1/2018		$55.99	$33.02	$89.01
Operators (Building, Class 07A- See Notes)	5/1/2019		$57.84	$33.57	$91.41
Operators (Building, Class 07A- See Notes)	5/1/2020		$59.70	$34.10	$93.80
Operators (Building, Class 07A- See Notes)	5/1/2021		$61.55	$34.65	$96.20
Operators (Building, Class 07B- See Notes)	5/1/2017		$53.84	$32.40	$86.24
Operators (Building, Class 07B- See Notes)	5/1/2018		$55.70	$32.92	$88.62
Operators (Building, Class 07B- See Notes)	5/1/2019		$56.00	$35.03	$91.03
Operators (Building, Class 07B- See Notes)	5/1/2020		$59.40	$34.03	$93.43
Operators (Building, Class 07B- See Notes)	5/1/2021		$61.26	$34.58	$95.84
Painter	5/1/2018		$38.64	$27.64	$66.28
Painter	5/1/2019		$39.04	$28.99	$68.03
Painters Class 1 (see notes)	5/1/2017		$37.82	$26.46	$64.28
Painters Class 1 (see notes)	2/1/2018		$43.18	$27.23	$70.41
Painters Class 1 (see notes)	2/1/2019		$44.56	$28.35	$72.91
Painters (Bridges, Stacks, Towers)	2/1/2018		$54.15	$27.52	$81.67
Painters (Bridges, Stacks, Towers)	2/1/2019		$55.52	$28.39	$83.91

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Painters (Brush and Roller)(Industrial)	2/1/2018		$43.18	$27.23	$70.41
Painters (Brush and Roller)(Industrial)	2/1/2019		$44.56	$28.35	$72.91
Painters Class 2 (see notes)	5/1/2017		$53.67	$26.09	$79.76
Painters Class 2 (see notes)	2/1/2018		$54.14	$27.27	$81.41
Painters Class 2 (see notes)	2/1/2019		$55.52	$28.39	$83.91
Painters Class 3 (see notes)	5/1/2017		$38.20	$26.46	$64.66
Plasterers	5/1/2017		$37.42	$28.83	$66.25
Plasterers	5/1/2018		$37.42	$30.04	$67.46
Plasterers	5/1/2019		$37.72	$30.74	$68.46
plumber	5/1/2018		$53.45	$33.54	$86.99
plumber	5/1/2019		$55.45	$34.54	$89.99
Plumbers	5/1/2017		$51.42	$32.57	$83.99
Pointers, Caulkers, Cleaners	5/1/2017		$42.26	$25.69	$67.95
Pointers, Caulkers, Cleaners	5/1/2018		$45.01	$25.69	$70.70
Pointers, Caulkers, Cleaners	5/1/2019		$47.76	$25.69	$73.45
Roofers (Composition)	5/1/2017		$36.15	$30.22	$66.37
Roofers (Composition)	5/1/2018		$37.15	$31.27	$68.42
Roofers (Shingle)	5/1/2016		$25.70	$19.17	$44.87
Roofers (Shingle, Slate, Tile)	5/1/2018		$27.50	$20.37	$47.87
Roofers (Slate & Tile)	5/1/2016		$28.70	$19.17	$47.87
Roofers (Slate & Tile)	5/1/2018		$30.50	$20.37	$50.87
Sheet Metal Workers	5/1/2017		$46.42	$39.51	$85.93
Sheet Metal Workers	5/1/2018		$47.58	$41.60	$89.18
Sheet Metal Workers	5/1/2019		$49.79	$42.89	$92.68
Sprinklerfitters	4/1/2017		$37.40	$21.74	$59.14
Sprinklerfitters	4/1/2018		$38.80	$22.74	$61.54
Sprinklerfitters	5/1/2019		$57.20	$28.32	$85.52
Steamfitters	5/1/2017		$54.64	$32.53	$87.17
Steamfitters	5/1/2018		$56.37	$34.39	$90.76
Steamfitters	5/1/2019		$58.17	$35.99	$94.16
Stone Masons	5/1/2017		$40.36	$26.99	$67.35
Stone Masons	5/1/2018		$43.11	$26.99	$70.10
Stone Masons	5/1/2019		$45.86	$26.99	$72.85
Terrazzo Finisher	5/1/2017		$39.06	$22.73	$61.79
Terrazzo Finisher	5/1/2018		$41.31	$22.73	$64.04
Terrazzo Finisher	5/1/2019		$43.61	$22.73	$66.34
Terrazzo Grinder	5/1/2017		$39.33	$22.73	$62.06
Terrazzo Grinder	5/1/2018		$41.58	$22.73	$64.31
Terrazzo Grinder	5/1/2019		$43.98	$22.73	$66.71
Terrazzo Mechanics	5/1/2017		$43.71	$24.81	$68.52
Terrazzo Mechanics	5/1/2018		$46.46	$24.81	$71.27
Terrazzo Mechanics	5/1/2019		$49.21	$24.81	$74.02
Tile Finisher	5/1/2017		$35.55	$24.17	$59.72
Tile Finisher	5/1/2018		$37.55	$24.17	$61.72

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Tile Finisher	5/1/2019		$39.75	$24.17	$63.92
Tile Setter	5/1/2017		$43.71	$24.81	$68.52
Tile Setter	5/1/2018		$46.46	$24.81	$71.27
Tile Setter	5/1/2019		$49.21	$24.81	$74.02
Truckdriver class 1(see notes)	5/1/2017		$30.46	$17.96	$48.42
Truckdriver class 1(see notes)	5/1/2018		$31.93	$17.96	$49.89
Truckdriver class 1(see notes)	5/1/2019		$32.21	$19.19	$51.40
Truckdriver class 1(see notes)	5/1/2020		$34.93	$17.96	$52.89
Truckdriver class 1(see notes)	5/1/2021		$36.48	$17.96	$54.44
Truckdriver class 2 (see notes)	5/1/2017		$30.56	$17.96	$48.52
Truckdriver class 2 (see notes)	5/1/2018		$32.03	$17.96	$49.99
Truckdriver class 2 (see notes)	5/1/2019		$32.31	$19.19	$51.50
Truckdriver class 2 (see notes)	5/1/2020		$35.03	$17.96	$52.99
Truckdriver class 2 (see notes)	5/1/2021		$36.58	$17.96	$54.54
Truckdriver class 3 (see notes)	5/1/2017		$30.81	$17.96	$48.77
Truckdriver class 3 (see notes)	5/1/2018		$32.28	$17.96	$50.24
Truckdriver class 3 (see notes)	5/1/2019		$32.56	$19.19	$51.75
Truckdriver class 3 (see notes)	5/1/2020		$35.28	$17.96	$53.24
Truckdriver class 3 (see notes)	5/1/2021		$36.83	$17.96	$54.79

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2017		$51.42	$27.39	$78.81
Carpenter - Chief of Party (Surveying & Layout)	5/1/2018	4/30/2019	$53.20	$27.69	$80.89
Carpenter - Chief of Party (Surveying & Layout)	5/1/2019	4/30/2020	$55.38	$27.69	$83.07
Carpenter - Chief of Party (Surveying & Layout)	5/1/2020	4/30/2021	$57.63	$27.69	$85.32
Carpenter - Chief of Party (Surveying & Layout)	5/1/2021		$59.93	$27.69	$87.62
Carpenter - Instrument Person (Surveying & Layout)	5/1/2017		$44.71	$27.39	$72.10
Carpenter - Instrument Person (Surveying & Layout)	5/1/2018	4/30/2019	$46.26	$27.69	$73.95
Carpenter - Instrument Person (Surveying & Layout)	5/1/2019	4/30/2020	$48.16	$27.69	$75.85
Carpenter - Instrument Person (Surveying & Layout)	5/1/2020	4/30/2021	$50.11	$27.69	$77.80
Carpenter - Instrument Person (Surveying & Layout)	5/1/2021		$52.11	$27.69	$79.80
Carpenter - Rodman (Surveying & Layout)	5/1/2017		$35.77	$21.19	$56.96
Carpenter - Rodman (Surveying & Layout)	5/1/2018	4/30/2019	$37.01	$21.34	$58.35
Carpenter - Rodman (Surveying & Layout)	5/1/2019	4/30/2020	$38.53	$21.34	$59.87
Carpenter - Rodman (Surveying & Layout)	5/1/2020	4/30/2021	$40.09	$21.34	$61.43
Carpenter - Rodman (Surveying & Layout)	5/1/2021		$41.69	$21.34	$63.03
Carpenter	5/1/2018	4/30/2019	$46.26	$27.69	$73.95
Carpenter	5/1/2019	4/30/2020	$47.81	$28.04	$75.85
Carpenter	5/1/2020	4/30/2021	$49.76	$28.04	$77.80
Carpenter	5/1/2021		$51.76	$28.04	$79.80
Carpenters	5/1/2017		$44.71	$27.39	$72.10
Carpenters	5/1/2018		$46.56	$27.39	$73.95
Carpenters	5/1/2019		$48.46	$27.39	$75.85
Carpenters	5/1/2020		$50.41	$27.39	$77.80
Carpenters	5/1/2021		$52.41	$27.39	$79.80
Cement Masons	5/1/2017		$34.45	$31.51	$65.96
Cement Masons	5/1/2018		$35.65	$32.01	$67.66
Cement Masons	5/1/2019		$37.90	$31.51	$69.41
Cement Masons	5/1/2020		$39.70	$31.51	$71.21
Cement Masons	5/1/2021		$41.55	$31.51	$73.06
Electric Lineman	5/29/2017		$52.60	$26.37	$78.97
Electric Lineman	5/28/2018		$53.64	$27.45	$81.09
Electric Lineman	5/27/2019		$54.66	$28.56	$83.22
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2016		$46.20	$31.26	$77.46
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	1/1/2017		$46.20	$31.26	$77.46
Iron Workers	7/1/2017		$47.30	$32.91	$80.21
Laborers (Class 01 - See notes)	5/1/2017		$29.75	$25.65	$55.40
Laborers (Class 01 - See notes)	5/1/2018		$31.25	$25.65	$56.90
Laborers (Class 01 - See notes)	5/1/2019		$32.80	$25.65	$58.45
Laborers (Class 01 - See notes)	5/1/2020		$34.45	$25.65	$60.10
Laborers (Class 01 - See notes)	5/1/2021		$36.20	$25.65	$61.85
Laborers (Class 02 - See notes)	5/1/2017		$29.95	$25.65	$55.60
Laborers (Class 02 - See notes)	5/1/2018		$31.45	$25.65	$57.10
Laborers (Class 02 - See notes)	5/1/2019		$33.00	$25.65	$58.65

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 02 - See notes)	5/1/2020		$34.65	$25.65	$60.30
Laborers (Class 02 - See notes)	5/1/2021		$36.40	$25.65	$62.05
Laborers (Class 03 - See notes)	5/1/2017		$29.95	$25.65	$55.60
Laborers (Class 03 - See notes)	5/1/2018		$31.45	$25.65	$57.10
Laborers (Class 03 - See notes)	5/1/2019		$33.00	$25.65	$58.65
Laborers (Class 03 - See notes)	5/1/2020		$34.65	$25.65	$60.30
Laborers (Class 03 - See notes)	5/1/2021		$36.40	$25.65	$62.05
Laborers (Class 04 - See notes)	5/1/2017		$24.55	$25.65	$50.20
Laborers (Class 04 - See notes)	5/1/2018		$26.05	$25.65	$51.70
Laborers (Class 04 - See notes)	5/1/2019		$27.60	$25.65	$53.25
Laborers (Class 04 - See notes)	5/1/2020		$29.25	$25.65	$54.90
Laborers (Class 04 - See notes)	5/1/2021		$31.00	$25.65	$56.65
Laborers (Class 05 - See notes)	5/1/2017		$30.60	$25.65	$56.25
Laborers (Class 05 - See notes)	5/1/2018		$32.10	$25.65	$57.75
Laborers (Class 05 - See notes)	5/1/2019		$33.65	$25.65	$59.30
Laborers (Class 05 - See notes)	5/1/2020		$35.30	$25.65	$60.95
Laborers (Class 05 - See notes)	5/1/2021		$37.05	$25.65	$62.70
Laborers (Class 06 - See notes)	5/1/2017		$30.65	$25.65	$56.30
Laborers (Class 06 - See notes)	5/1/2018		$32.15	$25.65	$57.80
Laborers (Class 06 - See notes)	5/1/2019		$33.70	$25.65	$59.35
Laborers (Class 06 - See notes)	5/1/2020		$35.35	$25.65	$61.00
Laborers (Class 06 - See notes)	5/1/2021		$37.10	$25.65	$62.75
Laborers (Class 07 - See notes)	5/1/2017		$30.50	$25.65	$56.15
Laborers (Class 07 - See notes)	5/1/2018		$32.00	$25.65	$57.65
Laborers (Class 07 - See notes)	5/1/2019		$33.55	$25.65	$59.20
Laborers (Class 07 - See notes)	5/1/2020		$35.20	$25.65	$60.85
Laborers (Class 07 - See notes)	5/1/2021		$36.95	$25.65	$62.60
Laborers (Class 08 - See notes)	5/1/2017		$30.25	$25.65	$55.90
Laborers (Class 08 - See notes)	5/1/2018		$31.75	$25.65	$57.40
Laborers (Class 08 - See notes)	5/1/2019		$33.30	$25.65	$58.95
Laborers (Class 08 - See notes)	5/1/2020		$34.95	$25.65	$60.60
Laborers (Class 08 - See notes)	5/1/2021		$36.70	$25.65	$62.35
Laborers (Class 09 - See notes)	5/1/2017		$30.10	$25.65	$55.75
Laborers (Class 09 - See notes)	5/1/2018		$31.60	$25.65	$57.25
Laborers (Class 09 - See notes)	5/1/2019		$33.15	$25.65	$58.80
Laborers (Class 09 - See notes)	5/1/2020		$34.80	$25.65	$60.45
Laborers (Class 09 - See notes)	5/1/2021		$36.55	$25.65	$62.20
Laborers (Class 10- See notes)	5/1/2017		$30.25	$25.65	$55.90
Laborers (Class 10- See notes)	5/1/2018		$33.30	$25.65	$58.95
Laborers (Class 10- See notes)	5/1/2018		$31.75	$25.65	$57.40
Laborers (Class 10- See notes)	5/1/2020		$34.95	$25.65	$60.60
Laborers (Class 10- See notes)	5/1/2021		$36.70	$25.65	$62.35
Laborers (Class 11 -See Notes)	5/1/2017		$30.15	$25.65	$55.80
Laborers (Class 11 -See Notes)	5/1/2018		$31.55	$25.65	$57.20

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 11 -See Notes)	5/1/2019		$33.10	$25.65	$58.75
Laborers (Class 11 -See Notes)	5/1/2020		$34.75	$25.65	$60.40
Laborers (Class 11 -See Notes)	5/1/2021		$36.50	$25.65	$62.15
Laborers (Class 12 -See Notes)	5/1/2017		$31.85	$25.65	$57.50
Laborers (Class 12 -See Notes)	5/1/2018		$32.45	$25.65	$58.10
Laborers (Class 12 -See Notes)	5/1/2019		$34.00	$25.65	$59.65
Laborers (Class 12 -See Notes)	5/1/2020		$35.65	$25.65	$61.30
Laborers (Class 12 -See Notes)	5/1/2021		$37.40	$25.65	$63.05
Laborers (Class 13 -See Notes)	5/1/2017		$33.88	$25.65	$59.53
Laborers (Class 13 -See Notes)	5/1/2018		$35.38	$25.65	$61.03
Laborers (Class 13 -See Notes)	5/1/2019		$36.93	$25.65	$62.58
Laborers (Class 13 -See Notes)	5/1/2020		$38.58	$25.65	$64.23
Laborers (Class 13 -See Notes)	5/1/2021		$40.33	$25.65	$65.98
Laborers (Class 14 -See Notes)	5/1/2017		$30.00	$25.65	$55.65
Laborers (Class 14 -See Notes)	5/1/2018		$31.50	$25.65	$57.15
Laborers (Class 14 -See Notes)	5/1/2019		$33.05	$25.65	$58.70
Laborers (Class 14 -See Notes)	5/1/2020		$34.70	$25.65	$60.35
Laborers (Class 14 -See Notes)	5/1/2021		$36.45	$25.65	$62.10
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2017		$23.52	$17.58	$41.10
Laborers Utility (PGW ONLY)	5/1/2017		$30.55	$17.58	$48.13
Landscape Laborer	5/1/2016		$21.19	$22.65	$43.84
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2017		$44.87	$28.14	$73.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2018		$46.41	$28.60	$75.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2019		$47.95	$29.06	$77.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2020		$49.50	$29.51	$79.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2021		$51.04	$29.97	$81.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2017		$47.86	$29.03	$76.89
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2018		$49.41	$29.49	$78.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2019		$50.96	$29.94	$80.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2020		$52.50	$30.40	$82.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2021		$54.05	$30.85	$84.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2017		$44.62	$28.07	$72.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2018		$46.16	$28.53	$74.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2019		$47.70	$28.99	$76.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2020		$49.25	$29.44	$78.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2021		$50.80	$29.89	$80.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2017		$47.61	$28.97	$76.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2018		$49.16	$29.42	$78.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2020		$52.26	$30.31	$82.57
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2021		$53.81	$30.77	$84.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2017		$40.53	$26.87	$67.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2018		$42.07	$27.33	$69.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2019		$43.62	$27.78	$71.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2020		$45.17	$28.24	$73.41
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2021		$46.71	$28.69	$75.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2017		$40.24	$26.78	$67.02
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2018		$41.78	$27.22	$69.00
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2019		$43.32	$27.69	$71.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2020		$44.86	$28.14	$73.00
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2021		$46.41	$28.60	$75.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2017		$38.51	$26.27	$64.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2018		$40.05	$26.73	$66.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2019		$41.60	$27.18	$68.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2020		$43.14	$27.64	$70.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2021		$44.69	$28.10	$72.79
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2017		$37.52	$25.98	$63.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2018		$39.07	$26.43	$65.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2019		$40.61	$26.89	$67.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2020		$42.16	$27.35	$69.51
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2021		$43.70	$27.80	$71.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2017		$54.14	$32.47	$86.61
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2018		$55.99	$33.02	$89.01

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 19-05132 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2019		$57.84	$33.57	$91.41
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2020		$59.70	$34.10	$93.80
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2021		$61.55	$34.65	$96.20
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2017		$53.84	$32.40	$86.24
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2018		$55.70	$32.92	$88.62
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2019		$56.00	$35.03	$91.03
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2020		$59.40	$34.03	$93.43
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2021		$61.28	$34.58	$95.86
Painters (Bridges, Stacks, Towers)	2/1/2017		$53.67	$26.09	$79.76
Painters (Bridges, Stacks, Towers)	2/1/2018		$54.14	$27.27	$81.41
Painters (Bridges, Stacks, Towers)	2/1/2019		$55.52	$28.39	$83.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2017		$51.91	$32.53	$84.44
Steamfitters	5/1/2018		$56.37	$34.39	$90.76
Truckdriver class 1(see notes)	5/1/2017		$30.31	$17.96	$48.27
Truckdriver class 1(see notes)	5/1/2018		$31.78	$17.96	$49.74
Truckdriver class 1(see notes)	5/1/2019		$32.06	$19.19	$51.25
Truckdriver class 1(see notes)	5/1/2020		$34.78	$17.96	$52.74
Truckdriver class 1(see notes)	5/1/2021		$36.33	$17.96	$54.29
Truckdriver class 2 (see notes)	5/1/2017		$30.41	$17.96	$48.37
Truckdriver class 2 (see notes)	5/1/2018		$31.88	$17.96	$49.84
Truckdriver class 2 (see notes)	5/1/2019		$32.16	$19.19	$51.35
Truckdriver class 2 (see notes)	5/1/2020		$34.88	$17.96	$52.84
Truckdriver class 2 (see notes)	5/1/2021		$36.43	$17.96	$54.39
Truckdriver class 3 (see notes)	5/1/2017		$30.66	$17.96	$48.62
Truckdriver class 3 (see notes)	5/1/2018		$32.13	$17.96	$50.09
Truckdriver class 3 (see notes)	5/1/2019		$32.41	$19.19	$51.60
Truckdriver class 3 (see notes)	5/1/2020		$35.13	$17.96	$53.09
Truckdriver class 3 (see notes)	5/1/2021		$36.68	$17.96	$54.64

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
F - INSTRUCTIONS FOR NON-COLLUSION AFFIDAVIT

1. This Non-Collusion Affidavit is material to any contract awarded pursuant to this proposal.

2. This Non-Collusion Affidavit must be executed by the member, officer, or employee of the Proposer who makes the final decision on prices and the amount quoted in the proposal.

3. Bid rigging and other efforts to restrain competition, and the making of false sworn statements in connection with the submission of proposals are unlawful and may be subject to criminal prosecution. The person who signs the affidavit should examine it carefully before signing and assure himself or herself that each statement is true and accurate, making diligent inquiry, as necessary, of all other persons employed by or associated with the Proposer and responsibilities for the preparation, approval or submission of the proposal.

4. In the case of a proposal submitted by a joint venture, each party to the venture must be identified in the proposal documents and an affidavit must be submitted separately on behalf of each party to the joint venture.

5. The term “complementary proposal” as used in the affidavit has the meaning commonly associated with that term in the proposal process, and includes the knowing submission of proposals higher than the proposal of another firm, any intentionally high or noncompetitive proposal, and any other form of proposal submitted for the purpose of giving a false appearance of competition.

6. Failure to submit an affidavit with the Proposal in compliance with these instructions may result in disqualification of the proposal.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
NON-COLLUSION AFFIDAVIT

State of _____:

County of _____:

I state that I am the _____(Title) of _____(Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the price(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer or potential proposer.
2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.
3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.
4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.
5. _____(Name of Firm), its affiliates, subsidiaries, officers, directors, and employees are not currently under investigation by any governmental agency and have not in the last four (4) years been convicted or found liable for any act prohibited by state or federal law in any jurisdiction, involving conspiracy or collusion with respect to proposing and/or bidding on any public contract, except as follows:

_____

I state that _____(Name of Firm) understands and acknowledges that the above representations are material and important, and will be relied upon by the Bucks County Conservation District in awarding the contract for which this proposal is submitted. I understand, and my firm understands, that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the Bucks County Conservation District of the true facts relating to the submission of this proposal.

_____
(Signature)

_____
(Signatory's Printed Name)

_____
(Signatory's Title)

SWORN TO AND SUBSCRIBED
BEFORE ME THIS _____ DAY OF
_____, 20___.

_____
Notary Public

My Commission Expires_____

G - Contractor Responsibility Certification
For
Middletown Township, Bucks County, PA

Firm Name: _____
Firm Address: _____
Contact Name: _____
Telephone No.: _____ Fax No.: _____
Email Address: _____

The submitting firm is required to certify compliance with the contractor responsibility standards set forth below by checking appropriate boxes. Specifically, submitting firms must legitimately answer "Yes" to Questions 1, 2 and 9, 10, 11, 12, 13 and 14 and answer "No" to Questions 3 through 8, in order to be considered for the award of the contract for this project.

☐ Yes ☐ No (1) Does the firm have all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, including, but not limited to, licenses, registrations or certificates required to : (a) do business in the designated locale; and (b) perform the contract work it seeks to perform, including but not be limited to, licenses, registrations or certificates for any type of trade work or specialty work which the firm proposes to self-perform?

☐ Yes ☐ No (2) Does the firm meet bonding requirements for the contract, as required by applicable law or contract specifications and any insurance requirements, as required by applicable law or contract specifications, including general liability insurance, workers compensation insurance and unemployment insurance requirements?

☐ Yes ☐ No (3) Has the firm been debarred by any federal, state or local government agency or authority in the past three (3) years?

☐ Yes ☐ No (4) Has the firm defaulted on any project in the past three (3) years?

☐ Yes ☐ No (5) Has the firm had any type of business, contracting or trade license, registration, or other certification suspended or revoked in the past three (3) years?

☐ Yes ☐ No (6) Has the firm committed a willful violation of federal or state safety laws as determined by a final decision of a court or government agency in the past three (3) years?

☐ Yes ☐ No (7) Has the firm or its owners been convicted of any crime relating to the contracting business by a final decision of a court or government agency in the past ten (10) years?

☐ Yes ☐ No (8) Has the firm within the past three (3) years, been found by a final decision of a court or government agency in violation of any law applicable to its contracting business, but not limited to, licensing laws, tax laws, prompt payment laws, wage and hour laws, prevailing wage laws, environmental laws or others, where the result of such violation was the imposition of a fine, back pay damages or any other type of penalty in the amount of $1,000.00 or more?

☐ Yes ☐ No (9) Does the firm agree to pay all craft employees that it employs on the project the current wage rates and benefits as required under the Pennsylvania Prevailing Wage Act for the duration of the referenced project?

☐ Yes ☐ No (10) Does the firm have all other technical qualifications and resources, including equipment, personnel and financial resources, to perform the referenced contract or agree to obtain same through the use of qualified, responsible subcontractors?

☐ Yes ☐ No (11) Does the firm agree to notify the Owner of any material changes to any matters attested to in this certification within the seven (7) days?

☐ Yes ☐ No (12) Does the firm understand and agree that, if it receives a Notice of Intent to Award Contract, it shall provide the Owner within seven (7) days a Subcontractor List that identifies any subcontractors it will use in connection with the project and furnish Contractor Responsibility Certifications for all identified subcontractors with all required supporting documentation.

☐ Yes ☐ No (13) Does the firm understand and agree that this certification must be executed by an authorized representative of the firm who has sufficient knowledge to address all matter addressed herein, and attests, under penalty of perjury, that all information submitted is true, complete and accurate?

In executing this Responsibility Certification, the submitting firm understands and agrees that if Middletown Township determines that this certification contains false or misleading material information that was provided knowingly or with reckless disregard for the truth or omits material information knowingly or with reckless disregard of the truth, the firm shall be prohibited from performing work for Middletown Township for a period of three (3) years. Such circumstances shall also subject the firm to any other penalties and sanctions, including contract termination, available to the Township under law. A contract terminated under these circumstances shall further entitle Middletown Township to withhold payment of any monies due to the firm as damages.

I certify that the foregoing representations regarding the past performance and present qualifications of the undersigned firm are true and correct.

_____
Print and Sign Name

_____
Title

_____
Name of Firm

_____
Date

Subscribed and sworn to
before me this_____day
of_____, 20____

_____
Notary Public
My Commission Expires: _____

COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer)_____

Address _____

City _____ State_____ Zip Code _____

☐ Contractor ☐ Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

_____

Authorized Representative Signature

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
I - CONTRACTOR QUALIFICATIONS AND EXPERIENCE

I. EVALUATION CRITERIA

All Bids will be evaluated on the following:

A. Technical qualifications.
B. Past experience with this kind of project: list previous projects including total project cost.
C. Recommendations of previous clients.
D. Capability to meet time schedules and project budget requirements.

II. QUALIFICATIONS AND EXPERIENCE

The following items shall be covered and included in your bid package submittal:

A. Key contractor project personnel:
   1. Professional/technical training record
   2. Project history of personnel, and
   3. Other applicable information

B. Three past project references and contact information
   1. The contractor shall provide a minimum of three (3) projects of similar scope.
   2. The contractor and subcontractor(s) shall provide three (3) references for work which was completed by the contractor within the last 5 years.

C. Failure to submit technical qualifications, experience and references for similar past projects may result in disqualification of this proposal.

III. SUBCONTRACTORS

A. The prime contractor shall provide a list and qualification for each subcontractor intended to be used on this project.
B. The prime contractor shall submit a list of responsibilities for each subcontractor and submit with the proposal.

LAKE LUXEMBOURG CONSERVATION POOL HABITAT ENHANCEMENT PROJECT
J - SAMPLE CONTRACT

This Contract is entered into the _____ day of _____, 2019 by and between the Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA 18901, hereinafter referred to as **"District",** and _____**,** hereinafter **"Contractor".**

WHEREAS, the District has determined a need for habitat enhancement of the Lake Luxembourg Conservation Pool at Core Creek County Park, Middletown Township, Pennsylvania, to address pollution and water quality issues in the area; and

WHEREAS, the District has accepted the Contractor's bid to remove sediment and enhance the habitat of the Lake Luxembourg Conservation Pool.

NOW, THEREFORE, in consideration of the mutual promises and undertakings of the parties, they hereby agree as follows:

1. **"Contract Documents."** Attached hereto and incorporated as if fully set forth herein are the following documents:
    A. General Instructions for Bidders
    B. Proposed Scope of Work
    C. Design Drawings, Titled "Lake Luxembourg Conservation Pool Habitat Enhancement Design", Dated October 31, 2018.
    D. Bid Sheet
    E. Rate Schedule
    F. Non-Collusion Affidavit
    G. Contractor Responsibility Certification
    H. Public Works Employment Verification
    I. Contractor Qualifications and Experience
    J. Sample Contract
        1. Commonwealth Nondiscrimination/Sexual Harassment Clause
    K. Technical Specifications for Lake Luxembourg Conservation Pool Habitat Enhancement Project at Core Creek County Park, Dated July 2019.

2. **"Work."** The term Work means the construction and services required by the Contract documents and includes all other labor, equipment and services provided or to be provided by the **Contractor** to fulfill the **Contractor's** obligations.

3. **Contractor** agrees to perform all Work set forth in the Contract Documents. In consideration of the work performed, the District agrees to pay Contractor a Fixed Amount of $[AWARD AMOUNT].

4. **District's Responsibility**. **District** will assure access and provide all assessment and other information that it has about the site including, but not limited to, surveys, maps, elevations, flow rates and hazards as may be necessary for **Contractor** to complete the Work.

5. **Contractor's Responsibility**. The Contractor is responsible for the equipment, materials, labor, site preparation, stakeout, earthmoving, construction management, restoration, stabilization, site closeout, and any and all work not specifically mentioned in the contract documents but typical of that required in order to provide a fully complete and functional project delivery as described within the project documents.

6. **Acts of God -** If the Project is delayed due to adverse weather conditions, by an Act of God, strikes, war, riot, terrorism or other acts resulting directly or indirectly from other conditions beyond the control of District or the Contractor, then the contract completion date will be adjusted to reflect the new completion date without additional cost to either party. The Project Inspector for the District reserves the right to determine when weather or other unforeseen circumstances warrant a delay or suspension in work. The contractor will not be held responsible for any damage to portions of the project that have already been completed and approved by the Project Inspector.

7. **District's right to stop the Work**. If the Contractor fails to complete the Work within the Contract time or correct Work which is not in accordance with the requirements of

the Contract documents, the District, by written order, may order the Contractor to stop the Work.

8. **District's right to carry out the Work**. If the Contractor fails or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven (7) day period after receipt of a written notice from District to commence and continue correction of such default or neglect with diligence and promptness, District may after such seven (7) day period, without prejudice to other remedies, correct such deficiencies. In such case, the appropriate Change Order shall be issued, deducting from the payments then or thereafter due the Contractor, the cost of correcting such deficiencies.

9. **Time of the Essence**. Time is of the essence in this Contract and, in particular, the completion of the Work on or before September 30, 2021. A final project inspection shall be completed by the District Project Inspector by September 30, 2021. Turtle exclusion fence shall be installed prior to December 31, 2019, Lake Lowering may start in mid-July 2020 in accordance with Permits, Sediment Removal and Dewatering shall be completed between August 1, 2020 and December 31, 2020, and Restoration shall occur between April 2021 and July 2021.

10. **Payment Terms**. District shall, within thirty (30) days of the date of invoice receipt, inspect the Work, and remit payment to Contractor, upon approval of the Work.

11. **Dispute Resolution**. All claims, disputes and other matters in question arising out of, or relating to, this Agreement shall be referred to statutory arbitration under the Pennsylvania Uniform Arbitration Act, 42 Pa.C.S. Sections 7301 et seq. (the "Uniform Arbitration Act"). Such arbitration shall be by a panel of three arbitrators, with District and Contractor each to choose an arbitrator, and together the first two arbitrators shall choose a third arbitrator. Costs for the arbitration shall be shared equally by the parties. The arbitration shall take place in Bucks County, Pennsylvania. Arbitration shall occur within sixty (60) days from the date the written request for appointment of arbitrators is made by either party unless an extension is mutually agreed upon by the parties. This

Agreement to arbitrate shall be specifically enforceable under the prevailing Arbitration Law. The award rendered by the arbitrators shall have the effect provided in the Uniform Arbitration Act. The prevailing party shall be entitled to recover all reasonable attorney's fees.

12. Indemnification. Contractor shall be responsible for and agrees to indemnify, defend and hold harmless District from and against damages to property or injuries (including death) to any persons and other losses, damages, expenses (including all attorney's fees and expert costs), claims, demands, suits, and actions by any party against District in connection with the work performed by Contractor. Said indemnity shall be insured without interruption by an acceptable insurance carrier with limits as follows:

(a) Workers' Compensation Employers' Liability Insurance as required by Pennsylvania law with an aggregate limit of One Million Dollars ($1,000,000);

(b) General Liability Insurance on an occurrence basis in the amount of One Million Dollars ($1,000,000) combined single limit for bodily injuries and/or property damage liability; and

(c) Automotive Liability Insurance with limits of One Million ($1,000,000) Dollars per occurrence and One Million Dollars ($1,000,000) combined single limit.

Contractor shall deliver to District Certificates of Insurance evidencing coverage in the above-stated amounts and naming "Bucks County Conservation District" as an additional insured.

13. Performance Bond Contractor is required to furnish a performance bond in the amount of $[AWARD AMOUNT]. Such bond must be furnished upon notification by the District, and prior to contract award. The performance bond shall be furnished by a company licensed to do business in the Commonwealth of Pennsylvania. The performance bond shall be for the entire contract period. Failure to provide the bond

within twenty-one (21) days of notification of award may result in cancellation of contract award.

14. **Labor and Material Payment Bond** Contractor is required to furnish a labor and material payment bond in the amount of $[AWARD AMOUNT]. Such bond must be furnished upon notification by the District, and prior to contract award. The labor and material payment bond shall be furnished by a company licensed to do business in the Commonwealth of Pennsylvania. The labor and material payment bond shall be for the entire contract period. Failure to provide the bond within twenty-one (21) days of notification of award may result in cancellation of contract award.

15. **Delays and Extensions of Time**. If the Contractor is delayed at any time in progress of the Work by an act or neglect of District or by changes ordered in the Work or by labor disputes, fire, unusual delays in deliveries, unavoidable casualties or other causes beyond the Contractor's control which the Project Inspector determines may justify delay, then the time for completion shall be extended by a Change Order.

16. **Notices.** All notices required or permitted to be given under this Agreement shall be in writing and shall be deemed given when delivered personally, by facsimile, or when sent by registered or certified mail, return receipt requested, addressed to the address set forth below. If notice is sent by registered or certified mail, postage will be prepaid. Notices may also be transmitted electronically between the parties provided that proper arrangements are made in advance to facilitate such communications and provide for their security and verification.

[Contractor Mailing Address]

Bucks County Conservation District
1456 Ferry Road, Ste. 704
Doylestown, PA 18901

17. Governing Laws. This Contract shall be governed in accordance with the laws of the Commonwealth of Pennsylvania. Venue and jurisdiction for any claims arising out of this Agreement shall be exclusively in Bucks County, Pennsylvania.

18. Permits. This Contract shall abide by all relevant permits pertaining to this Project. This includes the Joint Permit for Pennsylvania Chapter 105 Water Obstruction and Encroachment Permit and U.S. Army Corps of Engineers Section 404 Permit, General (PAG-02) NPDES Permit, and Erosion and Sediment Control Certification from Bucks County Conservation District.

18. Severability. In the event any provision of this Agreement is found to be invalid, illegal, or unenforceable by a court of competent jurisdiction, the remaining provisions of this Agreement shall nevertheless be binding upon the parties with the same effect as though the void or unenforceable part had been severed and deleted.

19. Entire Agreement. This Agreement constitutes the entire agreement between the parties with respect to this Agreement, and all prior agreements relating to the Work hereunder, express or implied, written or oral, are nullified and superseded hereby.

20. Amendments. This Agreement may not be modified, amended, assigned, supplemented, or rescinded, nor any provision hereof waived, except by an instrument in writing executed by both parties.

21. Binding Agreement. This Agreement shall be binding upon the parties and their respective successors and assigns.

22. **Counterparts**. This Agreement, and any amendment or supplement hereto, may be executed in several counterparts, each of which shall be deemed an original, and all of which taken together shall constitute one and the same instrument.

23. Authority. Each Party to the Contract states and affirms that it has full power and authority to execute, deliver and perform this Agreement and that each has obtained any and all approvals or consents required for the actions contemplated herein. Each Party to the Agreement states and affirms that its signatory has full authority to sign for the Party, and that his/her signature binds the Party to the Agreement.

IN WITNESS WHEREOF, and intending to be legally bound, the parties have executed this Agreement the day and year first above written.

Bucks County Conservation District

_____

_____ _____

Witness Name and Title (Please Print)

Contractor

_____

_____ _____

Witness Name & Title (Please Print)

ATTACHMENT B
Rev. 7/99

NONDISCRIMINATION/SEXUAL HARASSMENT CLAUSE

During the term of the Contract, the Contractor agrees as follows:

a. In the hiring of any employees for the manufacture of supplies, performance of work, or any other activity required under the Contract or any subcontract, the Contractor, subcontractor or any person acting on behalf of the Contractor or subcontractor shall not by reason of gender, race, creed, or color discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

b. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of work or any other activity required under the Contract on account of gender, race, creed, or color.

c. The Contractor and any subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

d. The Contractor shall not discriminate by reason of gender, race, creed, or color against any subcontractor or supplier who is qualified to perform the work to which the Contract relates.

e. The Contractor and each subcontractor shall furnish all necessary employment documents and records to and permit access to its books, records, and accounts by the contracting officer and the Department of General Services' Bureau of Contract Administration and Business Development for purposes of investigation to ascertain compliance with the provisions of this Nondiscrimination/Sexual Harassment Clause. If the Contractor or any subcontractor does not possess documents or records reflecting the necessary information requested, it shall furnish such information on reporting forms supplied by the contracting officer or the Bureau of Contract Administration and Business Development.

f. The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that such provisions will be binding upon each subcontractor.

g. The Commonwealth may cancel or terminate the Contract, and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the agency may proceed with debarment or suspension and may place the Contractor in the Contractor Responsibility File.

TECHNICAL SPECIFICATIONS

FOR

Lake Luxembourg Conservation Pool Habitat Enhancement Project

AT

CORE CREEK COUNTY PARK
1900 N WOODBOURNE ROAD
MIDDLETOWN TOWNSHIP, PA 19047

FOR

BUCKS COUNTY CONSERVATION DISTRICT
1456 FERRY ROAD, SUITE 704
DOYLESTOWN, PA 18901

PREPARED BY:

PRINCETON HYDRO, LLC
1108 OLD YORK ROAD, SUITE 1
P.O. BOX 720
RINGOES, NEW JERSEY 08551

JULY 2019

Geoffrey M. Goll, P.E.
Pennsylvania Professional Engineer
License No. PE-050997-E

TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

Attachments:

Attachment 1: Permits
- **Joint Permit – PADEP and USACE**
- **General NPDES Permit**
- **Erosion and Sediment Control Certification**

Attachment 2: Design Plans
Attachment 3: Bald Eagle Monitoring Guidelines
Attachment 4: Hydrologic and Hydraulic Modeling Report

SECTION K – TECHNICAL SPECIFICATIONS

SECTION 011000 - SUMMARY

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Work restrictions.
   5. Specification and drawing conventions.

B. Related Section:
   1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: **Lake Luxembourg Conservation Pool Habitat Enhancement Design Project**

All references to “Project Location,” “Property Owner,” “Project Sponsor,” “Project Engineer,” and “Project Representative “in this document shall be as defined below:

1. Project Location: Property is located in Core Creek Park west of North Woodbourne Road, Langhorne, Pennsylvania.

2. Project Sponsor: Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA 18901.

3. Property Owner: Bucks County Parks and Recreation, 901 East Bridgetown Pike, Langhorne, PA 19047.

4. Project Engineer: Princeton Hydro, 1108 Old York Road, Suite 1 P.O. Box 720, Ringoes, NJ 08551

5. Project Biologist: Ecological Associates, LLC, P.O. Box 181 Oley, PA 19547

6. Project Representatives:

   a. Project Sponsor: Ms. Gretchen Schatschneider, Bucks County Conservation District, 1456 Ferry Road, Suite 704, Doylestown, PA, 18901.

b. Property Owner: Mr. Bill Mitchell, Bucks County Parks and Recreation

c. Project Engineer: Mr. Geoffrey M. Goll, P.E., Princeton Hydro, LLC, 1108 Old York Road, Ringoes, NJ 08551.

d. Project Contacts

1) Project Sponsor Representative: Ms. Meghan Rogalus, Bucks County Conservation District; 1456 Ferry Road, Suite 704, Doylestown, PA, 18901.

2) Project Engineer Representative: Ms. Amy McNamara, E.I.T., Princeton Hydro, LLC, 1108 Old York Road, Ringoes, NJ 08551.

3) Project Biologist: Mr. Marlin Corn, Ecological Associates, LLC, 315 Swamp Road, Newtown, PA 18940.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. The project involves removal of sediment from the Lake Luxembourg Conservation Pool in Langhorne, Bucks County, Pennsylvania.
2. The project involves habitat enhancement of the Conservation Pool area via, vegetation establishment, tree stump habitat features, and tree vanes.
3. The project involves dewatering of sediment removed from the Conservation Pool in an adjacent agricultural field, and integrating sediment into the field once dewatering has been completed.
4. The project involves the restoration of disturbed forest and wetlands.
5. The project consists of compliance with the design plans and all jurisdictional approvals obtained for this project.

B. Specific details on the construction can be found in the plans titled “Lake Luxembourg Conservation Pool Habitat Enhancement Design”, dated October 31, 2018, last revised May 10, 2019 as signed by Geoffrey M. Goll.

C. All unit pricing and submitted bids shall reflect a Fall/Winter 2019 through Spring/Summer 2021 construction schedule.

D. The project is broken into three (3) main parts:

1. Endangered Species Protection and Lake Lowering/Preparation for Construction,
   a. Super Silt fence around the perimeter of the project site to restrict turtles from nesting in the work zone to be installed prior to January 1, 2020 timing restriction for the Bald Eagle.
   b. Vehicular inspection of the fence in mid-April to insure it is in intact. Repairs shall be made as necessary however, direct site from the eagle nest shall be minimized and the sound muffled.

c. May, June and July vehicular inspections for damaged fence and turtles trapped within the fence. The fence shall be repaired as above and trapped turtles shall be relocated outside the work area.
d. The lake can start to be lowered at a rate of 1 foot per day in mid-July in accordance with the permits obtained for this project.
e. A separate contract between Buck's County Conservation District and Ecological Associates, LLC has been entered into. They are responsible for the inspections in April, May, June, and July. They will NOT be performing any repairs to the fence installed under this contract. They are responsible for communicating any necessary repairs to the selected contractor via the owner.

2. Sediment Removal and Dewatering, and
   a. The removal of the accumulated material, creation of the dewatering berms, and placement of the accumulated material in the farm field shall be completed August 1 and December 31st, 2020.
   b. This installation of the habitat features shall be completed between August 1 and December 31st, 2020.
3. Restoration.
   a. Work in the agricultural field can occur from April 1 through the end of July. The contractor shall respread the topsoil over the dewatered material and till them together.
   b. The installation of the vegetation within the Conservation Pool shall be installed as per the design plans post July 31, 2021.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas identified within the Limit of Disturbance indicated on the attached construction plans. Do not disturb portions of Project site beyond areas in which the Work is indicated.

C. Limits: Confine construction operations to areas within the Limit of Disturbance as shown on the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

D. Access to the work area during the bald eagle timing restriction (January 1 through July 31) shall be via closed vehicles, i.e. no ATVs or by foot to the greatest extent practical. This is especially necessary for the inspections of the turtle exclusion fence. Refer to Attachment 3 Bald Eagle Monitoring Guidelines for signs of distress to the bald eagle.

1.5 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

B. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

C. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, except as otherwise approved by the Property Owner or Authorized Project Representative.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Noise outside of standard daily traffic on Woodbourne Road and agricultural practices within the fields adjacent to the forebay shall be avoided between January 1 and July 31 of each year.

2. Notify Bucks County Conservation District and Bucks County Parks and Recreation not less than two (2) days in advance of proposed disruptive operations.

3. Obtain the Bucks County Conservation District and Bucks County Parks and Recreation's written permission before proceeding with disruptive operations.

F. Inspections during bald eagle timing restrictions shall follow this protocol as provided by U.S. Fish and Wildlife Services' Northeast Region Eagle Coordinator:

1. Monitors must be made aware of the nest's precise location;

2. Monitors must be familiar with bald eagle behavior and able to recognize signs of agitation and stress (See Section C of the Bald Eagle Monitoring Guidelines for reference included in attachment 3 of the specification);

3. Monitors must perform inspections from closed-cab vehicles to the maximum extent practicable;

4. When monitors must exit the vehicle, they must attempt to obscure their visibility to the nest using the vehicle or natural features as screens;

5. Monitors must never approach the nest directly on foot or walk within 100 feet of the nest;

6. Monitors must travel outside the 330-foot buffer to relocate collected turtles;

7. While traveling within the 330-foot buffer, monitors must not make unnecessary loud noises, such as honking horns or shouting;

8. Monitors must limit inspections to daylight hours; and

9. If monitors witness signs of stress or agitation from the eagles, they must immediately exit the 660-foot buffer. The project representative must then contact U.S. Fish & Wildlife Service and Pennsylvania Game Commission for further guidance.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)
PART 4 – MEASUREMENTS AND PAYMENTS (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.2 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

B. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

1. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
2. Coordination information, including a list of changes or modifications needed to other parts of the Work, which will be necessary to accommodate proposed substitution.
3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
5. Samples, where applicable or requested.
6. Certificates and qualification data, where applicable or requested.
7. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
8. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
9. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

10. Cost information, including a proposal of change, if any, in the Contract Sum.
11. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
12. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

C. Engineer's Action: If necessary, Project Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Project Engineer will notify Contractor of acceptance or rejection of proposed substitution within seven (7) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

1. Forms of Acceptance: Change Order, Construction Change Directive, or Project Engineer's Supplemental Instructions for minor changes in the Work.
2. Use product specified if Project Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.3 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

B. Approval: All substitution must be approved by the Project Engineer, Property Owner, and Project Sponsor.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than seven (7) days prior to time required for preparation and review of related submittals.

B. Conditions: Project Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Project Engineer will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution is consistent with the Contract Documents and will produce indicated results.

2. Substitution request is fully documented and properly submitted.
3. Requested substitution will not adversely affect Contractor's construction schedule.
4. Requested substitution has received necessary approvals of authorities having jurisdiction.
5. Requested substitution is compatible with other portions of the Work.
6. Requested substitution has been coordinated with other portions of the Work.
7. Requested substitution provides specified warranty.
8. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

C. Substitutions for Convenience: Shall follow the same procedure and protocol as described above.

PART 3 - EXECUTION (Not Used)
PART 4 – MEASUREMENTS AND PAYMENTS (Not Used)

END OF SECTION 012500

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Pre-construction photographs.
2. Final completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site with notation of vantage points marked for location and direction of each photograph. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three (3) days of taking photographs.

C. Digital Camera: Minimum sensor resolution of eight (8) megapixels.

D. Format: Minimum 1600 by 1200 pixels, 400 dpi minimum, in unaltered original files, with same aspect ratio as the sensor, uncropped, date- and time- stamped, in folder named by date of photograph, accompanied by key plan file.

E. Identification: Provide the following information with each image description in file metadata tag:

1. Name of Project.
2. Name of Contractor.
3. Date photograph was taken.
4. Description of vantage point, indicating location, direction (by compass point).
5. Unique sequential identifier keyed to accompanying key plan.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of eight (8) megapixels, and at an image resolution of not less than 1600 by 1200 pixels and 400 dpi.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

B. Flag construction limits before taking construction photographs.

C. Take at least 10 photographs to show existing conditions before starting the Work.

D. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Final Completion Construction Photographs: Take at least 10 color photographs after date of Substantial Completion for submission as project record documents.

PART 4 – MEASUREMENTS AND PAYMENTS

Completions of efforts described above shall be included in the mobilization/demobilization bid item.

END OF SECTION 013233

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

A. Site Access: Accessing site as outlined on Sheets 3 of 16 entitled Overview, Access, and Turtle Barrier Plan of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
C. Temporary facilities should be installed per the Plans to provide adequate access and protection for the Work.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until construction is nearly complete and removal is approved by Applicant's Representative and Civil Engineer.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

a. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

b. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape

development, remove soil and aggregate fill that do not comply with requirements as specified in that subsection of this document. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

c. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified by the Property Owner.

PART 4 – MEASUREMENTS AND PAYMENTS

Payment for Temporary Facilities and Controls efforts shall be incorporated in the bid item for Mobilization/Demobilization.

END OF SECTION 015000

SECTION 015526 - TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All means necessary to warn and protect the public's ingress and egress from the construction site as well as access for emergency vehicle access. All construction access shall be from the intersection of Silver Lake Road and Village Road located to the eastern side of the site.
2. It is not anticipated that there will be regular construction traffic exiting the site as the material will disposed of onsite.

1.2 GENERAL

A. The Contractor shall maintain traffic and provide safety for motorist, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipments.

B. The contractor shall route road users through the Temporary Traffic Control zones using roadside signs.

C. The contractor shall provide adequate warning, delineation, and channelization to assist guiding road users in advance of and through the Temporary Traffic Control zones and detours.

D. The Contractor shall provide positive guidance to road users traversing the Temporary Traffic Control zone.

E. Contractor should routinely inspect and monitor the temporary traffic devices.

F. The Temporary Traffic Control zones shall be divided into four areas: advance warning area, transition area, activity area, and termination area.

G. All traffic control shall meet the requirements of the "Manual on Uniform Traffic Control Devices."

H. The contractor shall provide flaggers as necessary for equipment ingress and egress to ensure safety of the public, workers, equipment, and adjacent property.

I. The contractor shall plan delivery routes which minimize the use of local and neighborhood roads to the greatest extent possible.

J. At a minimum the contractor shall install warning signs for the construction entrance along Silver Lake Road and Village Road.

PART 2 - PROCEDURES

2.1 MATERIALS

A. The Contractor shall erect and maintain in good condition temporary traffic control devices in accordance to the codes and requirements of “Manual on Uniform Traffic Control Devices” (MUTCD).

B. The colors for the warning signs shall follow the Standards in Table 2A-5 and Chapter 5G of the MUTCD manual.

C. All signs and traffic control devices shall conform to the MUTCD standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. All signs shall be erected and maintained in a substantial manner acceptable to the Project Engineer or Owner and shall be maintained so as to provide maximum visibility and legibility at all times.

B. Any damage to newly constructed or existing pavements caused by the Contractor’s operations shall be repaired by the Contractor where and as directed by the Project Engineer or Owner, at the Contractor’s expense, or the repairs will be made by others and the cost of such repairs will be charged against the Contractor.

C. The Contractor shall provide for prompt removal from existing roadways and sidewalks of all dirt and other materials that have been spilled, washed, tracked or otherwise deposited thereon by this hauling and other operations whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements or create a traffic hazard.

D. The Contractor shall provide means of access for pedestrian and vehicular traffic at all private driveways and occupied buildings affected by the work of this contract. During construction in the vicinity of a driveway, the access at the driveway entrance shall be plainly marked as meet with the acceptance of the Owner.

PART 4 - MEASUREMENTS AND PAYMENTS

Payment for Traffic Control efforts shall be incorporated in the bid item for Mobilization/Demobilization.

END OF SECTION 015526

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary High Visibility Fence for tree protection and project security fence shall be installed around the perimeter of the work area as depicted on Sheet 5 of 16 “Interim Grading Plan Viewport 2”.

2. Goose Fencing shall be installed to protect plantings within the conservation pool. The goose fence installation shall be completed immediately following the installation of plant material and outside the bald eagle timing restriction.

3. Tree Cages shall be installed around all trees and shrubs to protect for herbivore browsing.

PART 2 - PRODUCTS

A. Materials for High Visibility Fence shall comply with the following:

1. The fencing shall be installed in the locations identified on Sheet 5 of 16 “Interim Grading Plan Viewport 2”.
2. Detail D and E provided on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
3. The fence shall be a minimum of four (4) feet high with stakes installed at eight (8) foot on center.
4. The fence shall be constructed of UV stabilized high visibility orange polyethylene safety fence for use as tree protection and/or security identifying the project limit.

B. Materials for Goose Fencing shall comply with the following:

1. The fence shall be installed where plantings are proposed in the Conservation Pool as shown on Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
2. Detail F provided on Sheet 11 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Materials for Tree Cages shall comply with the following:

1. Tree cages shall be installed around each tree or shrub installed as part of this project.

2. The contractor shall cage the vegetation promptly after installation to avoid any damage from deer in the area.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fencing and cages for defects and problems that might affect performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install High Visibility Fence in accordance with Detail E on Sheet 14 of 16 and around active work area as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

B. Install Goose Fencing so as to protect the Conservation Pool plantings proposed on Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Install temporary fencing outside the drip line of trees to be saved to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion, as described in Section 312500 “Erosion and Sediment Control”. Install in accordance with Detail E on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

3.3 REPAIRS

A. Repair fencing as necessary throughout construction period and as requested by Engineer.

PART 4 – MEASUREMENTS AND PAYMENTS

HIGH VISIBILITY FENCE	LINEAR FEET
GOOSE FENCING	LINEAR FEET

Payment for tree cages shall be included in the unit price for the trees and shrubs in Section 329300 “Plants”.

END OF SECTION 015639

SECTION 015719 - ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.1 SCOPE

A. This section covers the furnishing of all labor, materials and equipment to perform all work required for the protection of the environment during construction operations except for those measures set forth in other Section of these specifications.

1.2 GENERAL

A. For the purpose of this specification, environment protection is defined as the retention of the environment in its natural state to the greatest possible extent during project construction and to enhance the natural appearance after project completion. Environment protection requires consideration of air, water, and land, and involves noise, solid waste-management and management of radiant energy and radioactive materials, as well as other pollutants. In order to prevent, and to provide for abatement and control of, any environmental pollution arising from the construction activities in the performance of this contract, the Contractor and his subcontractors shall comply with all applicable Federal, State and local laws and regulation concerning environmental pollution control and abatement. The contractor and his subcontractors shall also comply with any existing environmental permits.

1.3 SUBCONTRACTORS

A. Compliance with the provisions of this section by subcontractors will be the responsibility of the Contractor.

1.4 IMPLEMENTATION

A. At the pre-construction conference, the Contractor will meet with the Project Applicant/Property Owner to develop mutual understandings relative to compliance with this provision and administration of the environmental program.

1.5 PROTECTION OF LAND RESOURCES

A. The land resources with the project boundaries shall be preserved in their present condition or be restored to a condition after completion of construction which will appear to be natural and not distract from the appearance of the project. The Contractor shall confine the construction activities to limits of disturbance defined by the plans.

1.6 PROTECTION OF WATER RESOURCES

A. The Contractor shall not pollute waterways with any harmful materials. The Contractor shall comply with all applicable Federal, State, County and Municipal laws concerning pollution of waterways.

1.7 DISPOSAL OF WASTE MATERIALS

A. Contractor shall provide for proper disposal or recycling of all materials generated by the site demolition. Disposal shall be at a Pennsylvania Department of Environmental Protection (PADEP) licensed and approved hazardous waste, recycling or other appropriate facility. Owner shall receive any proceeds from sale or recycling of recycled materials. Prior to payment for any waste disposal, the contractor shall provide certifications as required by the PADEP indicating the receiving facility for the material and the method of disposal. In the event that there is no relevant PADEP regulation governing disposal and/or recycling of the material, Contractor shall supply at a minimum documentation indicating the location of the facility where disposal occurred, name of the hauling company and date that the material was delivered. If the material was considered "hazardous material', a copy of the hazardous material bill of lading shall be provided.

1.8 DUST CONTROL

A. The Contractor shall be required to maintain all work areas within the project boundaries free from dust which would cause a hazard or nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs. No separate or direct payment will be made for dust control and the cost thereof shall be considered incidental to, and included in the contract. The Contractor will bear all costs associated with any damages resulting from any dust nuisance and agrees to hold the Bucks County Conservation District harmless in any related action.

PART 2 – MATERIALS (Not Used)

PART 3 – EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

There are no specific line items for this section and any effort to protect the environment as per this subsection shall be incorporated into the project via Mobilization/Demobilization.

END OF SECTION - 015719

SECTION 017113 - MOBILIZATION/DEMOBILIZATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the Contract. It shall include transportation of personnel, equipment, and operating supplies to the site; establishment of necessary facilities at the site; and other preparatory work at the site.

B. It shall include the construction staging and stockpiling areas for equipment and materials.

C. It shall include all equipment and material transport.

D. It shall include construction layout by the contractor for verification of construction quantities.

E. It shall include completion of a survey as-built of the completed sediment removal and habitat enhancement work to verify construction was completed as designed.

F. It shall include transportation and demobilization of personnel, and equipment off the site at the conclusion of the project.

G. It shall include the items described in the specification sections for Environmental Protection, Traffic Control, Temporary Facilities & Controls, and Photographic Documentation.

H. It shall include all work not specifically mentioned in the contract documents but typical of that required in order to provide a fully complete and functional project delivery as described within the project documents.

1.2 DEFINITIONS

A. High Pile: A stockpile of material within a lake or pond intended for dewatering of material prior to transport and disposal.

1.3 SUBMITTALS

A. Health and Safety Plan prepared for work on the site. Items should include but not limited to the following:

1. Compliance with all affected federal, state, and local environmental, safety and health requirements applicable to the scope of work.

2. Compliance with all current OSHA regulations, requirements, and training.

3. Designated a safety representative and/or alternate personal to be onsite during construction to oversee all safety matters.

4. Summary of the responsibilities of the contractor and subcontractors hired by the contractor.

5. All personnel should be trained in construction safety policies, regulations, and procedures for the project prior to start of work.

6. The employees and subcontractors are being informed of all known hazardous materials.

7. Individual contractors or subcontractor competent in performing construction work

8. Detailed direction to the nearest hospitals and/or emergency facilities.

9. First Aid Kit shall be maintained onsite at all times.

10. Fire extinguisher should be provided and properly maintained near the job site.

11. Implementation of the project-specific plan.

B. Survey verification performed by the contractor or an approved subcontractor

C. Shop drawings and/or material specifications as required or identified in later sections of this Specification.

PART 2 – MATERIALS

2.1 REQUIREMENTS

A. Contractor cannot commence construction work without prior review and approval of the required submittals by the Project Engineer

B. Contractor to provide Project Engineer and Owner any and all submittals, shop drawings, regular field inspections, and other project communications and coordination not specifically mentioned elsewhere but necessary to perform the work as per the project documents.

PART 3 – EXECUTION

3.1 SURVEY VERIFICATION

A. Locations of all above ground and subsurface utilities, structures, inverts, and grades should be field verified by the contractor prior to construction.

A. Any discrepancies should be immediately reported to the Project Engineer. No work shall commence until further direction from Project Engineer.

B. All right-of-way lines, property boundaries, and easements are to be staked as directed by the Engineer.

C. Survey work is to be performed by a Professionally Licensed Surveyor.

3.2 STAGING AND STOCKPILING

A. General: Comply with the following:
   a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

3.3 ENVIRONMENTAL PROTECTION

A. Comply with requirements of authorities having jurisdiction.
B. Comply with Section 015719 “Environmental Protection”.

3.4 TEMPORARY FACILITIES

A. Comply with section 015000 “Temporary Facilities and Controls”.

3.5 PHOTOGRAPHIC DOCUMENTATION

A. Comply with Section 013233 “Photographic Documentation”.

3.6 TRAFFIC CONTROLS

A. Comply with requirements of authorities having jurisdiction.
B. Protect existing site improvements to remain including curbs, pavement, and utilities.
C. Maintain access for fire-fighting equipment and access to fire hydrants.
D. Comply with Section 015526 “Traffic Control”.

3.7 CONSTRUCTION LAYOUT

A. At the request of the Contractor the Engineer will supply digital maps of the construction plans for use in the placement of construction stakes, lines and grades. The maps will be supplied in a vertical datum of NAVD 88.
B. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the existing benchmarks. If discrepancies are discovered, notify Project Engineer promptly.
C. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
D. Establish benchmarks and control points to set lines and levels at each level as needed to locate each element of Project.
E. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
F. Inform installers of lines and levels to which they must comply.
G. Check the location, level and plumb, of every major element as the Work progresses.
H. Notify Project Engineer when deviations from existing and proposed conditions occur.

I. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill, utility slopes, and invert elevations.

J. Prior to construction, barriers shall be installed to inhibit the migration of turtles into the construction zone.

K. Sediment Removal Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.
    b. For excavation and fills including sediment removal, one stake at a grid spacing of 25 feet along the centerline of the Conservation Pool' longest dimension, locating a stake at each outer edge of sediment removal (waters edge), centerline of sediment removal and halfway between the centerline of sediment removal and the outer edge of sediment removal. The extent of sediment removal depth shall be noted on each stake.
    c. Top of sediment points for the entire work area shall be submitted to the Engineer for review prior to starting the sediment removal. The points shall have x, y, and z data.
    d. As depicted on the plans, the estimated bottom of sediment and horizontal sediment removal limits as identified on the cross sections and proposed conditions sheets of the Contract Plans is the project limit beyond which must not be excavated, unless approved in writing by the Engineer prior to the commencement of such additional excavation. The contactor shall not be compensated for sediment removal beyond these limits, if not approved by the Owner in writing beforehand.

L. Field/Disposal Area Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.
    b. For excavation and fills including dewatering sediment and berms, one stake at a grid spacing of 25 feet along the centerline of the field's longest dimension, locating a stake at each outer edge of the field, centerline of the field and halfway between the centerline of the field and the outer edge of field. The extent of dewatering sediment depth shall be noted on each stake.
    c. Stakes shall be laid out in the field area prior to the creation of the berms, prior to the addition of the dewatering sediment, and before and after the sediment has been dewatered and is spread throughout the field.

M. Conservation Pool Enhancement Area Layout:

1. As a minimum, the Contractor shall provide the following stakes for laying out work on the project:
    a. All benchmarks provided on Survey Ties and Grade sheets shall be verified by a licensed surveyor prior to progressing with the remaining construction layout.

b. For habitat enhancement including tree vanes and turtle habitats, offset from the banks of the Conservation Pool to determine placement.

N. As-Built Survey

1. At the completion of the project and prior to the final payment, the Engineer will supply the Contractor with originals of the contract plans including the construction plans, profile sheets, cross-sections, bridge plans and construction details of the project. The Contractor shall prepare As-Built drawings utilizing these plans. The Contractor will place all as-built dimensions and elevations as determined from the construction work on these plans and profile sheets. This will include completed bottom of lake elevations, centerline, field elevations, channel inverts, road dimensions, etc. The certified As-Built plans, signed and sealed by a Pennsylvania Licensed Professional Land Surveyor, shall be submitted to the Engineer. The payment for as-built plans shall be included in the item entitled, "As-Built Survey."
    a. Grade layout shall be performed every 100 feet ahead of sediment removal. The contractor shall also provide as built elevations and sediment removed volumes every 100 feet of completed sediment removal, and as preparation of the as-built plan. The contractor shall provide the Engineer at a minimum a point file with x, y, and z data when requested. The progress surveys shall be submitted to the Engineer within 3 business days of completion of the progress survey.

PART 4 – MEASUREMENT AND PAYMENT

Bid items described in this section shall be paid for via the following bid items. The contract cost shall include any repairs or enhancements to these items in order for use during construction, compliance with regulations, and restoration to preconstruction conditions.

MOBILIZATION/DEMOBILZATION	LUMP SUM
AS-BUILT SURVEY	LUMP SUM

END OF SECTION - 017113

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Starting and adjusting.
   3. Protection of installed construction.
   4. Correction of the Work.

1.2 INFORMATIONAL SUBMITTALS

A. Delivery Manifests for all materials brought onsite.

B. Disposal Manifests for any material exported offsite and disposed of.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated, as per Section 017113 “Mobilization/Demobilization”.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

B. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

C. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to the Project Representative that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Project Engineer.

3.3 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

3.4 CORRECTION OF THE WORK

B. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

C. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

D. Restore permanent facilities used during construction to their specified condition.

E. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

F. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

PART 4 MEASUREMENT AND PAYMENT (Not Used)

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Final completion procedures.
   2. Warranties.
   3. Final cleaning.
   4. Final site restoration of the entire project activities.

1.2 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment.
   2. Submit copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list). The list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit copy of completed surveyed as-built drawing.
   4. Submit site restoration project upon completion of the project.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Project Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.

C. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.3 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

B. Organize items by major element, including categories.

1.4 WARRANTY

A. All work performed is subject to a 1 year Contractor’s warranty of workmanship and materials.

B. Plants are subject to a 1 year Contractor’s warranty as detailed in Section 329300 “Plants”.

C. Disclaimers and Limitations: Manufacturer’s disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products.

D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.

E. Reinstatement of Warranty: When Work covered by the warranty has failed and been corrected, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment of depreciation.

F. Replacement of Cost: On determination that Work covered by warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through part of its useful service life.

PART 1 - PRODUCT (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

2. Remove tools, construction equipment, machinery, and surplus material from Project site.

3.2 FINAL SITE RESTORATION

A. General: Perform final restoration to all disturbed area. Conduct cleaning and contaminated sediment waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Restore project site to pre-existing conditions and to the satisfaction of owners, Project Engineer, and Bucks County Conservation District.

1. Contractor to be responsible to restore any damages to structure, pavements, trees, and vegetations as result of the construction activities.

2. Contractor to re-establish all areas disturbed during the construction activities to comply with regulatory requirements.

PART 4 – MEASUREMENT AND PAYMENT (Not Used)

END OF SECTION 017700

SECTION 311200 - SELECTIVE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation as necessary.

1.2 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. Any trees removed during site clearing may be used for habitat features in the Conservation Pool.

1.4 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig! at 1-800-242-1776 for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Needed)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. The project shall be first staked out by a surveyor prior to flagging. Contractor shall locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground. The project engineer and the Owner representative shall jointly review the flagging prior to tree removal.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Engineer.

3.3 EXISTING UTILITIES

A. There are one proposed or existing utilities as part of this project.

B. The contractor shall have the site marked out and cleared by PA One Call. A copy of the clearance certificates shall be provided to the Engineer.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

3.4 SELECTIVE CLEARING

A. Remove obstructions, trees, shrubs, and other vegetation as needed for construction access.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site. Tree logs should be used for tree vanes as directed by Engineer.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 12 inches, and compact each layer to a density equal to adjacent original ground.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

PART 4 – MEASUREMENT AND PAYMENT

SELECTIVE CLEARING	LUMP SUM

END OF SECTION 311000

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation to complete Conservation Pool sediment removal as shown on design plans.
   2. Stripping of topsoil and creation of berms.
   3. Grading of disposal material on agricultural field.

1.2 Definitions

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Removed Sediment: This is the sediment, organic matter, rock and other material removed from the lake bottom.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Fill: Soil materials used to raise existing grades.

H. High Piling: A stockpile of material within a lake or pond intended for dewatering of material prior to transport and disposal.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

M. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 SCOPE

A. The work shall include the removal of sediment from the Conservation Pool and dewatering in preparation to move the dewatering sediment to the Field. This work is encompassed in the "Sediment Removal" line item.

B. The work shall include the stripping of topsoil within the farm field designated for sediment placement. The stripped material shall be used to construct berms approximately every 50 feet as shown on the plans. The berms shall be constructed as shown in the design plans. This work is encompassed in the "Interim Grading – Berms" line item.

C. The Work shall include the removal of sediment from the Conservation Pool, trucking and hauling of removed sediment to adjacent field, and placement behind the topsoil berms. This shall include the effort necessary to move material within the Project Area to stockpile and disposal locations. All necessary means and methods for the purpose of sediment removal including, but not limited to the construction of in-lake roads, mud mats, matting with in the field, and high piling of material within the Conservation Pool limits shall be included in this section. This work is encompassed in the "Interim Grading – Dewatering Sediment" line item.

D. The contractor is responsible to use means of access which will minimize the short and long term impacts to the access areas. These shall include but not limited to:
   1. In-lake roads
   2. Mud Mats
   3. 4 by 8 feet sheathing board or approved equal beneath the access roads along the trees and within the field to minimize rutting, no excavation shall occur in order to install matting and/or to protect large trees from root damage.

E. The work shall include the final grading of the agricultural field as shown on the plans. This shall include the removal of compaction to a minimum of 24 inches below grade, the intermixing of removed sediment with native subsoils, the respreading of the topsoil over the spoils and intermixed to meet final grade. All necessary means and methods for the purpose of intermix the soils, remove compaction, and preparing final grade. This work is encompassed in the "Grading of Sediment Materials" line item.

   1. Additionally, the contractor is responsible for the blending of a sample (subsoils, stripped topsoil, and dewatered sediment) which shall be tested for the purpose of establishing a Nutrient Management Plan (i.e., agricultural testing) to be implemented as part of soil intermixing in order to assure successful vegetation establishment. These labs may include Penn State Cooperative Extension or Rutgers.

1.4 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Call Before You Dig! 1800-242-1776 for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion and sedimentation control measures are in place.

1.5 SUBMITTALS

A. Material Test Reports: For representative intermixed fill soils as follows:

1. Classification according to ASTM D 2487.

2. Laboratory compaction curve according to ASTM D 698.

B. Waste Characterization: For any soil or sediment material being removed from the site as follows:

1. Testing according to PADEP Soil Remediation Standards.

C. Nutrient Management Plan that includes agricultural testing of the intermixed fill soils.

D. Sediment Incorporation Plan for integrating dewatered sediment into the agricultural field.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. The lake shall be lowered to 1 foot below the proposed grading with the Conservation Pool prior to the removal of accumulated sediment. Refer to the Section 312319 “Dewatering” for more details. The contractor shall maintain the lowered water surface elevation for the duration of the sediment removal.

3.2 DEWATERING

A. Refer to Section 312319 “Dewatering” for additional information on the control of water during construction operations.

B. Stream Bypasses shall be constructed as necessary to divert base flow and storm flows through and around the work area. Refer to Section 312319 “Dewatering” for additional information.

C. Dewatering shall be conducted as described in the Hydrologic and Hydraulic Modeling Report, dated May 2019, included as Attachment 4.

3.3 CONSTRUCTION

A. Accumulated Sediment and debris is the only material subject to removal from the Project Area to the extent indicated on the design plans. Other excavated Materials, including materials excavated from below the bottom of sediment/proposed grade, as identified in the Project Plan documents, shall not be removed, and if so removed will be replaced at the Contractor’s sole cost and expense, unless otherwise approved, in writing by the Engineer.

B. The sediment removal shall be performed “in the dry” as specified under Dewatering using conventional construction equipment. Conventional construction equipment may include track-mounted excavators, long-reach excavators, draglines, bulldozers and track-mounted front loaders. As required, the Contractor may employ the use of “mud mats” or construct in-lakes roads with imported materials. The phasing of the sediment removal shall be left up to the Contractor. The contractor shall not have equipment onsite and operating during the bald eagle timing restriction (January 1 through July 31) of each year.

C. The contractor shall construct the topsoil berms as per the design plans within the agricultural field located adjacent to the site. The sediment shall be placed up gradient of the berm to dewater fully prior incorporating the sediment with the subsoil and then re-installing the topsoil from the berm over the field.

D. The incorporation of the sediment shall be completed with agricultural practices such as tilling, plowing or similar. The contractor shall provide a written plan of the approach for the work efforts within the agricultural field.

E. Contractor to comply with all requirements specified in all permits and approvals.

F. Contractor to minimize the discharge of sediment, sediment-laden water or turbid waters at the Project’s discharge point at the downstream-most location of the Project’s limit of disturbance.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. The area to be excavated shall sufficiently dewatered by stream bypasses and dewatering pumps, as discussed in Section 312319 "Dewatering" in order to minimize sediment transport to areas downstream of the work area and reduce water being transported to the disposal area.

3.5 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.6 LIMITS OF SEDIMENT REMOVAL

A. No payment will be made to the Contractor for the excavation below the bottom of sediment/proposed grade as identified on the Plans. The Contractor acknowledges and agrees that excavation below the bottom of sediment/proposed grade is not allowed by the issued permits or approvals obtained for the Project. Additionally, no sediment removal shall be progressed outside of the lakes' limits of disturbance as identified on the Plans.

B. No excavation shall be progressed within 10 feet horizontally of any structure within the lake beds including, but not limited to bulkheads, retaining walls, docks, storm water outfalls, bridges, culverts, or utilities, provided however, that the Contractor shall remove all surface vegetative growth only within 10 feet horizontally of such structures if such removal can be accomplished without damaging such structures, as determined by the Contractor. The Contractor shall be solely responsible for any and all damage to such structures as set forth in the Contract.

3.7 STOCKPILING OF SEDIMENT

A. The Contractor shall stockpile the Accumulated Sediment at the locations designated on the Plans. The stockpile height and slope shall be dictated by the materials ability to be high-piled. As the material dewaters, the Contractor may re-grade the stockpiles to allow for the accommodation of additional excavated material. Silt fencing shall be placed down-slope of the stockpiles, between the stockpile and the downhill stream running to the Conservation Pool. The location of silt fence on the Plans is tentative and shall be configured depending on the field located stockpiles and placed in sufficient lengths to preclude sediment from running into the stream.

3.8 EXCAVATION IN CONSERVATION POOL

A. The Contractor shall be responsible to remove from the Conservation Pool any excavated unsuitable materials or other material as may be directed by the Project Engineer. Excavated material shall be placed in the Field for onsite disposal. Excavated material shall not be deposited outside the limits of construction, either temporarily or permanently, without written authorization from the property owner. Such authorization shall be in a form satisfactory to the Project Engineer and shall protect the Bucks County Conservation District against claims or actions of the owner with respect to the presence of such materials or excavations.

B. The removed sediment shall be deposited onsite in the agricultural field to the southeast of the Conservation Pool. The material shall be dewatered in place to the greatest extent possible prior to hauling and disposal onsite. The removed sediment shall be allowed to dry once placed in the field prior to intermixing with native substrate and before spreading the topsoil.

C. Rock and boulders shall be excavated to the bottom limits shown on the Contract Drawings. Rock shall be excavated and finished to a uniform slope, parallel to the prescribed slope lines. All pieces of rock outside the slope surfaces as excavated which have been loosened or may become loose, in the opinion of the Project Engineer, on account of the Contractor's operations, shall be remain in place or be relocated as part of the habitat enhancement.

D. Boulders extending beyond the prescribed limits of excavation shall remain in place as part of the habitat enhancement.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

B. Removed sediment can be stockpiled within the lake for dewatering prior to hauling to the disposal location.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL FOR SOIL BACKFILLS AND FILLS

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before placement of another lift to within 2 percent of optimum moisture content in accordance with ASTM D698.
B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth.

B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.

C. The agricultural field in which sediment has been placed shall be visually inspected for excessively wet areas and stability for the future use of agricultural equipment in the area.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to be within specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Project Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Project Engineer.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

2. Removal of material offsite is NOT anticipated for this project. If unforeseen conditions are identified the contractor shall promptly notify the project representatives. The Project representatives shall determine the appropriate action. These actions may include:

a. Material to be left in place

b. Remove per plan and place in a specified area approved by the property owner

c. Offsite disposal.

PART 4 – MEASUREMENT AND PAYMENT

SEDIMENT REMOVAL	CUBIC YARDS
INTERIM GRADING – BERMS	CUBIC YARDS
INTERIM GRADING – DEWATERING SEDIMENT	LUMP SUM
GRADING OF SEDIMENT MATERIALS	SQUARE FEET

Construction Access Roads are incidental to Sediment Removal & Interim Grading – Dewatering Sediment, Excavation bid items above.

END OF SECTION 312316

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes initial lowering of the water in the Conservation Pool.

B. Section includes construction dewatering and the installation of a bypass system to allow the waters of the streams to move through the work area with minimal disruption to sediment removal activities.

C. This section includes the continued efforts to keep the lake lowered and control of water through and within the work area during construction activities.

D. This section includes the water control during the habitat enhancement operations.

1.2 SCOPE

A. The Work shall include the dewatering of Accumulated Sediment; segregation of work area (area being excavated) and base flow through the lake; dewatering of infiltrating or flood water from areas being excavated; and gravity draining of sediment via “high piling”. The primary objective of this pay item is to mitigate turbid water from leaving the site, and facilitate the transportation of such sediment and materials for disposal.

B. Contractor to be responsible for the design of the stream bypass system. The design layout should be submitted and approved by the Project Engineer prior to installation.

C. Contractor to be responsible for design of bypass and dewatering system during habitat enhancement efforts. The contractor shall submit a plan for dewatering efforts to the Project Engineer prior to installation. The bypass system shall be designed in such a way to reduce impacts to proposed structures during construction and rain events.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

C. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

D. Accomplish dewatering without compromising constructed work.

E. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system and bypass system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
B. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
C. Include a design plan for the stream bypass system. Show arrangement, locations, layout, and details of pipe, pump, sediment control, disposal of water, and any other means necessary to convey water.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEWATERING

A. Lake Lowering
    1. The contractor shall provide the means and methods to maintain the lake at its lowest feasible elevation during all phases of the project.
        a. These shall be denoted within the Contractor's dewatering plan.
        b. This shall include pumps and/or siphons, diversions, and planning of the decommissioning of the existing secondary and tertiary outlet structures, as well as reasonable mitigation for anticipated storm events.
        c. Lake lowering shall begin during the last half of July 2020 and shall be maintained as needed throughout the project duration.

B. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

C. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

D. Remove snow and ice as required to minimize accumulations.

E. Maintaining Turbid Free Water
    1. The Contractor is obligated, in accordance with all Federal, State, County and Local permits, approvals, and regulations to maintain relatively turbid free water leaving the downstream discharge point of the project site. This downstream location is identified as the downstream-most limit of disturbance of the Conservation Pool. The subsections

below outline methods for minimizing turbid waters that the Contractor should use to accomplish this requirement of the Work.

F. Segregation of Work Areas from Base Flow

1. Prior to initiating sediment removal and other construction activities, the Contractor shall ensure that the base flow running through the lake is segregated from the area to be excavated and worked in. This can be accomplished by the diversion of the *stream* via mechanical methods (i.e. excavating) or directing the stream to areas already excavated to proposed grades. The Contractor must maintain separation of the sediment removal area and the stream at all times. During times of flooding, the Contractor shall cease operations until the stream flow returns to base flow conditions.

G. Removal of Infiltrating and Flood Waters from the Work Area

1. The Contractor shall maintain a dry work area at all times. Specifically, areas to be excavated shall be maintained in a dewatered condition with the use of pumps or siphons as necessary. No work or excavation shall be conducted within areas pooled with water. All water shall be pumped either to a previously excavated area that remains segregated from the baseflow or to a dewatering basin.

H. Draining of Accumulated Sediment and Approved Excavated Materials

To facilitate the dewatering of Accumulated Sediment prior to transport to the Field, all such materials shall be “high piled” for a period of at least 7 days to allow for the drainage of excess water from the sediment. The sediment shall be deemed to be adequate for loading and transportation when the material, in the opinion of the Project Engineer, can be transported without spilling through the gaskets of the watertight dump trucks or splashing over the top of the dump onto construction access roads within the transportation route.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

B. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

C. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

D. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

E. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

F. Provide temporary grading to facilitate dewatering and control of surface water.

G. Monitor dewatering systems continuously.

H. Promptly repair damages to adjacent facilities caused by dewatering.

1.5 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Space well points or wells at intervals required to provide sufficient dewatering.

C. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

D. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

E. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

F. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

H. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

I. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

PART 4 – MEASUREMENT AND PAYMENT

LAKE LOWERING	LUMP SUM
STREAM BYPASS AND CONTROL OF WATER	LUMP SUM

END OF SECTION 312319

SECTION 312500 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This work consists of the construction and maintenance of various temporary soil erosion and sediment control measures, including relocating them as required for stage construction.

B. This work includes Turtle Exclusion Fencing constructed of Super Silt Fence.

C. All work shall be in conformance with the contract documents and the Federal, State, County and Local regulations, and the latest revision thereof.

PART 2 - PRODUCTS

2.1 MATERIAL

A. All materials shall be as specified on the contract drawings and by the project permits.

B. Materials shall include but are not limited to:
1. Stabilized Construction Entrance
2. Temporary Construction Access and Access Roads
3. Rock Access Ramps
4. Silt Fences
5. Turtle Exclusion Fencing
6. Temporary Stream Crossing(s)
7. Temporary Turbidity Barrier
8. Filter Socks

C. Stabilized Construction Entrance shall comply with the following:
1. Construction plans.
2. Stone size for the construction entrance shall be ASTM C-33, size no. 2 or 3. The stone shall consist of clean crushed angular particles.
3. A geotextile fabric underlayment will be used.
4. A 6” thickness of the structure shall be consistently maintained.

D. Materials for Temporary Construction Access shall comply with the following:
1. Requirements of the Soil Erosion and Sediment Control Certification, Details A and C on Sheet 11 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans, and Detail B on Sheet 14 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.
2. Construction Access shall use existing maintenance roads to the greatest extent possible.

3. Modification to these access roads may be necessary for construction equipment and use. These modifications shall be included within the pay items.
4. Temporary access roads shall be installed at contractor's discretion only in locations specified on the plans.

E. Rock Access Ramp shall comply with the following:
1. Details on the design plans.
2. Rock access ramp shall be located as shown on design plans.
3. Rock shall be 3.5" to 1.5" diameter with no material smaller than ¾". Recycled concrete may be substituted for stone as long as the gradation requirements are the same and the material is free from reinforcement and other deleterious material that could puncture a tire.
4. To facilitate smaller vehicles and pedestrians on the ramp, the Contractor may also place a 6" inch course of dense graded aggregate on the ramp's surface.
5. The ramps shall be placed at a grade no greater than 10:1 with side slopes of at least 1.5 to 1.
6. The top width for two-way traffic shall be 30 feet, while the top width shall be 15 feet for one-way traffic.
7. The ramp shall be constructed so as to facilitate the loading of dump trucks with the excavated material.
8. The contractor may reuse the rock from one ramp to build others if the sediment removal is phased or sequenced.
9. The contractor at all times provides a flag man at the ramp to the position of loading.
10. At the completion of the project or once the ramp is no longer needed by the contractor, it shall be removed and the ramp areas restored.

F. Silt Fence shall comply with the following:
1. Shall be installed as detailed in Detail E on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
2. Fence posts shall be spaced 8 feet center to center or closer.
3. The post shall extend 2 feet into the ground and extend at least 2 feet above the ground.
4. Posts should be constructed of hardwoods with minimum diameter thickness of 1.5 inches.
5. Geotextile fabric recommended for such use by the manufacturer shall be buried at least 6 inches deep in the ground and extend 2 feet above the ground.
6. The fabric shall incorporate a drawstring in the top portion of the fence for added strength.
7. Sediments shall be removed when the accumulation height reaches one quarter the ground height of the fence.

G. Super Silt Fence Shall Comply with the following:
1. Shall be installed as detailed in Detail D on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
2. Fence posts shall be spaced a maximum of 10 feet center to center or closer.
3. The post shall extend 36 inches into the ground and 33 inches above the ground.

4. Posts should be constructed of heavy duty galvanized or aluminum posts with diameter thickness of 2.5 inches.
5. Geotextile fabric width shall be a minimum of 42 inches.
6. Sediments shall be removed when the accumulation height reaches one half the ground height of the fence.

H. Turtle Exclusion Fencing shall comply with the following:
1. The Turtle Exclusion Fence must be installed prior to January 1, 2020 and fully entrenched per the installation standards. The contractor shall inspect and repair the fence in April prior to the turtle nesting season. Additional inspections for turtles within the work area shall be completed in May, June and July. Refer to Section 312500 "Soil Erosion and Sediment Control" above for additional details.
2. The contractor shall include the substitution for super silt fence to silt fence with a coir logs or similar to be placed across the construction entrance areas once construction operations have begun.
3. The contractor shall also provide the means and methods to extend the exclusion fence across the temporary stream crossing once installed.
4. The Turtle Exclusion Fencing shall be installed as detailed in Detail D and E on Sheet 15 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plan.
5. Super Silt Fence shall be used for Turtle Exclusion Fencing in Phase A, while Silt Fence shall be used for Turtle Exclusion Fencing access closures in Phase B
6. In locations where the Silt Fence and Turtle Exclusion Fence coexist, the Turtle Exclusion Fence shall be installed and maintained.

I. Temporary Stream Crossing shall comply with the following:
1. Stream crossing shall be installed as necessary for equipment to cross streams and other bodies of water during construction.
2. The crossings shall be constructed to pass base flow and the 10-year storm event.
3. The crossing shall be in compliance with all Federal, State, County, and local regulations.
4. The crossing(s) shall be installed in accordance with the Detail A provided on Sheet 14 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design plans or as approved by the Project Engineer.

J. Temporary Turbidity Barrier shall comply with the following:
1. Details and locations on the design plans.
2. The barrier shall be placed so as to effectively control silt dispersion.

K. Filter Socks shall comply with the following:
1. Details and locations on the design plans.
2. Accumulated sediment shall be removed when it reaches ½ the above ground height of the barrier and disposed of in compliance with all federal, state, county, and local regulations.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Construction of stabilized construction entrance, rock access ramp, silt fence, dust control, temporary stream crossing, turbidity barrier, and filter sock shall be in conformance with the Regulations, Plans, and Details.

B. All soil erosion and sediment control devices shall be constructed prior to any work at the site. During the length of the entire project, the Contractor shall be responsible for maintaining all soil erosion and sediment control devices in an efficient workable condition.

C. The smallest practicable area of land shall be exposed at any one time. Wherever feasible, natural vegetation shall be retained and protected. Stripping of vegetation, grading or other soil disturbance shall be executed in a manner which will minimize soil disturbance.

D. A schedule of construction operations shall be submitted to the Engineer for his approval.

E. All soil erosion and sediment control devices shall be in place prior to any soil disturbance. Such devices shall be installed and removed in their proper sequence to allow for further operations on the site.

F. The Contractor shall inspect and maintain all sediment control measures on a regular basis. He shall also remove sedimentation from all basins when storage capacity is affected.

G. Soil erosion and sediment controls shall be left in place until all disturbed areas are stabilized. Any additional control measures as deemed necessary to control erosion or sedimentation beyond those measures shown on the approved drawings or included in this specification shall be executed at the direction of the Engineer.

H. Drainage swales and other structures shall be located in the field so as to retain as much of the original vegetation as possible. All drainage swales shall be parabolic in shape unless otherwise noted and shall conform to design standards.

I. Permanent vegetation shall be seeded or sodded on all exposed areas within 10 days after final grading, weather and seasonal considerations permitting.

J. The Contractor shall construct the dense-graded aggregate base course immediately upon receiving approval of the subgrade and approval of the underground facilities in order to stabilize streets, roads, driveways, and parking areas.

3.2 CONSTRUCTION ACCESS

A. General: Comply with the following:
   a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.
   b. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
      i. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
      ii. Remove temporary facilities after Substantial Completion.
   c. Temporary Roads in Field: Construct and maintain temporary roads in the farm field adequate for construction operations and in a way that minimizes compaction.
      i. Plywood or similar matting is to be used for construction access in the field to

reduce compaction when transporting sediment to the field for dewatering.

ii. Remove temporary facilities after Substantial Completion.

d. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

i. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

ii. Prepare subgrade and install subbase and base for temporary roads according to Division 31 Section "Earth Moving."

e. Temporary Use of Timber Matting: Use Timber Matting or Mud Mat as needed to access areas within the Conservation Pool and impoundment. Construct and maintain timber matting adequate for construction operations.

i. Install Timber Matting as detailed in Detail A on Sheet 11 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

f. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

3.3 TEMPORARY ROCK RAMP

A. General: Comply with the following:

a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

b. Construct and maintain Temporary Rock Ramp adequate for construction operations.

c. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3.4 CHANNEL CROSSING

A. General: Comply with the following:

a. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion.

b. Construct and maintain Channel Crossing adequate for construction operations.

c. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3.5 LIMITATIONS OF OPERATIONS

A. Clearing and grubbing operations shall be so scheduled and performed that grading, and mulching, seeding and other permanent pollution control features can follow immediately thereafter according to the approved progress schedule. Should seasonal limitations make such coordination unrealistic, additional temporary soil erosion and sediment control measures shall be required between successive construction stages, as directed.

B. The amount of surface area of erodible earth material exposed at one time by clearing

and grubbing, excavation, borrow or fill operations, without stabilization, shall be minimized to the greatest extent practicable and limited to areas actively being graded.

3.6 SOIL EROSION AND EDIMENT CONTROL MEASURES

A. Soil erosion and sediment control measures shall be maintained during the construction season as well as during winter months and other times when the project is closed down, throughout the life of the project, to ensure that the measures function properly. Soil erosion and sediment controls shall be immediately inspected after each rain and any corrective work shall immediately be performed to return the soil erosion and sediment control measures to proper function, as directed. Riprap stones, coarse aggregate, silt fence, or hay bales damaged due to washouts or siltation shall be replaced as directed.

3.7 DISPOSAL OF EXCESS WASTE MATERIALS

A. Remove excess material, and dispose of same off the Owner's property.

3.8 CLEANUP

A. The work area should be restored to the pre-construction conditions and to the satisfaction of the Owner.

PART 4 - MEASUREMENT AND PAYMENT

CONSTRUCTION ACCESS ROADS (incidental to Sediment Removal & Interim Grading – Dewatering Sediment, Excavation bid items)	N/A
TEMPORARY STREAM CROSSING	EACH
TEMPORARY ROCK RAMP	EACH
CONSTRUCTION ENTRANCE	EACH
FILTER SOCK	LINEAR FEET
SUPER SILT FENCE	LINEAR FEET
TURTLE EXCLUSION FENCE (SUPER SILT FENCE)	LINEAR FEET
TURBIDITY BARRIER	LINEAR FEET

END OF SECTION - 312500

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Farm Field Erosion seeding.

2. Wetland Restoration seeding.

1.2 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of each seed mixture for grass and wetland seed mixes as well as any temporary or permanent stabilization seed mixes. Include identification of source and name and telephone number of the supplier.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. These materials shall be stored and handled in a manner not to introduce moisture to the contents prior to installation.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 FARM FIELD EROSION SEED

A. Farm Field Erosion Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. Seed shall meet the specifications noted in Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

2.2 WETLAND RESTORATION SEED

A. Wetland Restoration Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances. Seed shall meet the specifications noted in Sheet 10 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

2.3 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

C. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

D. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

E. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Project Engineer and replace with new planting soil.

3.2 PREPARATION

A. Limit subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1-1/2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus ½ inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.3 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

B. Do not use wet seed or seed that is moldy or otherwise damaged.

C. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

D. Optimum seeding time: Between March 1 – May 15 and August 15 – October 15.

E. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

F. Protect seeded areas beyond 12 feet from the top of bank with straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket. Spread by hand, blower, or other suitable equipment.

3.4 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Mix slurry with manufacturer's recommended tackifier.
C. Apply slurry uniformly to all areas to be seeded in a one-step process.

3.5 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

PART 4 – MEASUREMENTS AND PAYMENTS

WETLAND RESTORATION SEED MIX	SQUARE YARD
FARM FIELD EROSION SEED MIX	SQUARE YARD

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

a. Trees

b. Plugs

1.2 DEFINITIONS

A. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

B. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

C. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Watering Plan (As necessary): Contractor shall furnish and execute a watering plan as necessary after construction completion pending the weather conditions to ensure establishment and warranty.

3. Any cost associated with watering and/or other plant survivability techniques (watering, mulching, pruning, etc.) shall be included in the contract price.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

B. Handle and pack plants to prevent injuries during transit. Do not dump or drop plants while unloading. Protect the roots of all plants from freezing or desiccating by heeling-in, watering,

covering or keeping shaded, or placing in a climate-controlled building or trailer.

1.5 WARRANTY

A. The contractor will be responsible for all plant material replacement guarantees to extend for one (1) full year from date of installation. This guarantee shall cover a 100 percent survival rate of the woody and herbaceous plant materials listed on the attached construction plans.

B. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within one (1) calendar year warranty period. Failures include, but are not limited to, the following:

1. Death and unsatisfactory growth.

2. Structural failures including plantings falling or blowing over.

C. Provide extended warranty for period equal to original warranty period, for replaced plant material. Include the following remedial actions as a minimum:

1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

2. Replace plants that are more than twenty-five (25) percent dead or in an unhealthy condition at the end of warranty period.

3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

4. Provide extended warranty for period equal to original warranty period, for replaced plant material.

D. The warranty shall also guarantee 80% cover from specified seed mix species after 1-year.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Engineer, with a proportionate increase in size of roots or balls.

2.2 LIST OF PLANTS

A. Contractor must abide by Plant List as shown on sheet 10 of 16 of the Plan entitled “Lake Luxembourg Conservation Pool Habitat Enhancement Design”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Engineer's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Engineer. Stake locations of individual shrubs and outline areas for multiple plantings.

3.3 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Beds: Before excavating for plant pits and beds, ensure that the areas conform to the specified lines and grades. On slopes steeper than 4H:1V, excavate pits no more than 5 days in advance of planting.

   1. Excavate pits for balled and burlapped plants to a minimum of 2 times the width of the root ball and no deeper than the root ball as measured from the bottom of the trunk flare to the bottom of the ball. Excavate pits for containerized plants to a minimum of 2 times the width of the container and no deeper than the actual height of the root mass within the container. Ensure that side slopes of all pits taper down from the rim of the pit to the outer edge of the bottom of the ball. Ensure that the sides of the pits are loosened and roughened to promote root penetration.

   2. Dispose of sod, weeds, roots, and other objectionable material.

3.4 SETTING PLANTS

A. Set plants plumb and at the same depth at which they were grown in the nursery, except set trees with a trunk flare 1/2 to 1 inch above the surrounding grade to allow for settling. Set roots for the various conditions as follows:

   1. Containerized Plants. Immediately before planting, remove the container, and make 3 vertical cuts equidistantly spaced around the perimeter of the root mass. Make each cut 1/2 inch deep from the top of the root-earth mass to the bottom. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements and backfill.

B. Backfill with topsoil around the root system. Hand-tamp the topsoil and water at the rate of 15 gallons per square yard of pit area to settle the topsoil and to remove air pockets. Ensure that the topsoil is not frozen at the time of backfilling. Where necessary, backfill areas that have settled with topsoil. Form a 4-inch high compacted berm using topsoil around individual plants to a diameter equal to that of the pit. Ensure that the berm functions properly throughout the plant establishment period.

3.5 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.6 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

PART 4 - MEASUREMENT AND PAYMENT

The cost for each tree or shrub species listed here shall include the installation of a tree cage for protection from deer and other animals.

CAREX STRICTA	EACH
CAREX VULPINOIDEA	EACH
IRIS VERISCOLOR	EACH
LEERSIA ORYZOIDES	EACH
PELTANDRA VIRGINICA	EACH
PONTEDERIA CORDATA	EACH
SAGITTARIA LATIFOLIA	EACH
SCHOENOPLECTUS TABERNAEMONTANI	EACH
SCIRPIS ATROVIRENS	EACH
PLATANUS OCCIDENTALIS	EACH
QUERCUS BICOLOR	EACH
QUERCUS PALUSTRIS	EACH

END OF SECTION 329300

SECTION 354900 - WATERWAY STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

The work to be done under this section consists of providing all labor, equipment, and materials in order to construct waterway structures for the Lake Luxembourg Conservation Pool Habitat Enhancement Design project.

A. Section Includes:

1. Tree vanes proposed in the Conservation Pool.

2. Turtle habitats proposed in the Conservation Pool

PART 2 – PRODUCTS

2.1 MATERIALS

A. Satisfactory Tree Material: Conifer trees with a minimum length of 6 feet for tree vanes.

B. Satisfactory Stumps and Branches: Branches shall have a diameter of 2 to 4 inches and stumps shall have a diameter of 10 to 12 inches.

1. Those removed in Section “311200” Selective Clearing which meet the specification shall be used for habitat within the conservation pool.

PART 3 - EXECUTION

3.1 General

The Contractor will furnish and maintain loading, unloading, staging, hauling, drainage, and such material handling equipment and facilities as may be necessary for conducting operations. The Contractor will be solely responsible for site safety. The Contractor shall provide appropriate measures to ensure that persons working in or near the construction area are protected.

3.2 Offloading

The Contractor is responsible for the protection of roads and utilities in the off-loading, staging, hauling, and construction areas, and for coordinating this protection with local agencies and entities. The Contractor is responsible for any damage resulting from the construction.

3.3 PREPARATION

A. Protect existing site improvements to remain from damage during construction.

B. Restore damaged improvements to their original condition, as acceptable to Owner.

3.4 PLACEMENT

A. Placement will not deviate from the locations identified on the design plans by more than the tolerances discussed below unless approved in writing by the Project Engineer and Project Sponsor. Equipment suitable for handling the tree material will be used. The material will be anchored in such a way to ensure they are secure against flood flows. Damage to any tree material will be the Contractor's sole responsibility.

B. The turtle habitats shall be installed as detailed in Detail B on Sheet 11 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

C. Tree vane structures shall be installed as detailed in Detail D on sheet 11 of 16 and as shown on Sheet 3 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design Plans.

3.5 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

PART 4 – MEASUREMENT AND PAYMENT

TURTLE HABITAT FEATURES	EACH
TREE VANE	LINEAR FEET

END OF SECTION 354900

ATTACHMENTS

ATTACHMENT A:

PERMITS

ATTACMENT B:

DESIGN PLANS

(EXTERNALLY ATTACHED)

ATTACHMENT C:

BALD EAGLE MONITORING GUIDELINES

BALD EAGLE MONITORING GUIDELINES

Prepared For

United States Fish and Wildlife Service

September 2007

(Revision of Bald Eagle Monitoring Guidelines Issued September 2006)

PREFACE

The U.S. Fish and Wildlife Service's (Service) Florida Ecological Services Field Offices (FO's) in Jacksonville, Panama City and Vero Beach received and reviewed monitoring reports for more than five years as prescribed by our Bald Eagle Monitoring Guidelines (pre-2002 draft, 2002, 2005) (Monitoring Guidelines) for applicants proposing construction activities occurring within 1500 feet of an active bald eagle nest during the nesting season. The cumulative result of those monitoring reports was that the Service did not observe from the data any indicators of disturbance, abnormal or atypical behavior, or nest abandonment that would have caused the applicant and/or the Service to halt construction activities during the nesting season. Consequently, the Service and the Florida Fish and Wildlife Conservation Commission (FWC) jointly concluded that monitoring of construction and nesting activities occurring from 750 feet to 1500 feet (secondary zone) was no longer warranted for projects involving construction within those distances from an active nest during nesting season.

The Service's Florida FO's revised the 2005 Monitoring Guidelines again in September 2006 to incorporate modifications that would be applicable to the draft National Bald Eagle Management Guidelines that would be implemented under the Bald and Golden Eagle Protection Act (Eagle Act) once delisting of the bald eagle was finalized. These National Management Guidelines addressed construction and a variety of other human activities that can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young.

The Service published a notice of availability in the Federal Register (72 Fed.Reg. 31332) on June 5, 2007, finalizing the National Management Guidelines (dated May 2007), followed by the announcement on June 28, 2007 to remove the bald eagle from the Federal List of Endangered and Threatened species effective August 8, 2007. As such, it is necessary to make additional revisions to the September 2006 Monitoring Guidelines to assure consistency with these recent policy and regulatory changes.

These revised 2007 Monitoring Guidelines accordingly are now applicable for human activities that have potential to cause disturbance within 660 feet of an active nest. Additional criteria for disturbance are defined by the codified definition of "disturb" under the Eagle Act at 50 CFR 22.3. Monitoring generally is not recommended for projects when activities occur beyond 660 feet of an active nest, as those data are no longer required. However, additional criteria for

monitoring may be indicated in previously issued Biological Opinions that reference these Monitoring Guidelines, or in such cases where public safety issues exist related to airport operations and activities, electrical facilities and communication tower facilities where monitoring is required in order to determine the most appropriate action to avoid a safety hazard to both the public and the bald eagles. A number of Federal and State laws and/or regulations prohibit, cumulatively, such acts as harassing, harming, disturbing, molesting, pursuing, etc. bald eagles, or destroying their nests. The purpose of these Monitoring Guidelines is to provide a scientific standard for documenting and evaluating bald eagle response to human activities. Such activities may lead to an alteration of otherwise normal nesting behavior and ultimately to nest abandonment and/or death of eggs or eaglets. These Monitoring Guidelines are advisory in nature.

The FWC maintains a database of all known bald eagle territories in Florida (http://wld.fwc.state.fl.us/eagle/eaglenests/), which should be consulted to determine the specific nest number and nesting history. It should be noted that: 1) the nest locations (latitude/longitude coordinates) in this database are approximate and should not be relied upon to establish accurate distances from proposed construction activities, 2) some territories have alternate nests that may not be reported in the database, and 3) many bald eagle territories are unknown and/or may support new active nests that have been established in recent years. Any bald eagle nest discrepancies or new nest locations should be reported to the FWC bald eagle database coordinator at 352-955-2230.

The development of this document is a collaborative effort by Federal, State and private biologists who have extensive experience in the research and management of bald eagles in the Southeastern United States. J. Steve Godley[1] prepared the initial draft and all attachments, while Tom H. Logan[2, 3] served as editor and coordinator of technical and editorial reviews of subsequent drafts. Candace Martino[4] provided invaluable coordination to facilitate necessary input from each of the authors, and contributed technical and editorial comments for this latest edition. Dan Sullivan[2] provided editorial comments that were critical to the completion and technical quality of this document, as did Stephen A. Nesbitt[2], John H. White[2], Al Begazo[4], and Tony Steffer[5] for earlier editions of these Monitoring Guidelines.

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BALD EAGLE MONITORING GUIDELINES

A. Introduction

The Service and FWC recommend biological monitoring of the nesting territory if new activities which include construction of buildings, roads, trails, canals, power lines, and other linear utilities; new or expanded operations of agriculture and aquaculture, alteration of shorelines or wetlands, installation of docks or moorings, marinas, water impoundment, and mining and associated activities is proposed to occur within 660 feet of the nest tree during the nesting season (October 1 - May 15, Service 1987). The Service also recommends that monitoring be conducted where an eagle's nest is located on or adjacent to, in close proximity of, electrical transmission towers, communication towers, airport runways, or other locations where they may create hazards to themselves or humans. These circumstances may require more intense monitoring, which may include increased frequency and hours of monitoring. These resulting data are deemed necessary for the Service to make appropriate decisions as to whether nest removal or relocation is warranted and subsequently permitable under new proposed regulations under 50 CRF 22.27 for Eagle Nest Take under the Eagle Act.

These Monitoring Guidelines have been developed to provide agency personnel and others a scientific standard for gathering data that may be used to evaluate eagle responses to human and development activities, which may indicate an alteration of otherwise normal nesting behavior. The Monitoring Guidelines 1) describe normal nesting behavior of bald eagles, 2) identify specific behavioral responses of adult and young eagles that may warrant cessation of activities, 3) propose the type and level of monitoring necessary to detect a change in normal behavior, and 4) develop a procedure for reporting the observations to the USFWS/FWC, which may be used for halting or modifying the above described activities, if necessary.

Buehler (2000) and references cited therein provide excellent summaries of the biology and nesting behavior of bald eagles. Nesting behavior and response of individual eagle pairs to human activities may vary, but nesting chronology and otherwise normal behavior are relatively fixed and predictable. The probability that a pair of bald eagles will abandon their nest increases with the intensity and proximity of human activities to their nest, and decreases with the time and energy the adult eagles have invested in the eggs or young and to what extent the adult birds may habituate to human activities. This is based upon the ecological parental investment theory (e.g., Trivers 1972, Wilson 1975, Dawkins 1977) and practical experience gained from observing bald eagle/human interactions over the past two decades in Florida (e.g., Wood 1992, Nesbitt et al. 1993, Wood and Collopy 1995, Millsap et al. 2004). Accordingly, the need for appropriate monitoring and concern for disturbance is highest prior to egg laying, the closer and more intense development activities occur to the nest tree, and for nesting territories in more rural environments.

All infrastructure development, exterior building construction, and other referenced activities within 660 feet of the nest tree should, as a general rule, be completed during the non-nesting season. Infrastructure construction includes all land and lot clearing; fill work; construction of roads, drainage, sewer and storm water facilities; and installation of water, electricity and other

utilities. However, it often is not possible to complete these above-referenced activities and other human related actions during the non-nesting season. These guidelines are applicable to those circumstances where these activities must be conducted during nesting season from 330-660 feet of the nest tree**. Please Note: The Service recommends that none of the above-referenced activities be conducted from 0-330 feet during nesting season, even when a buffer zone of less than 330 feet is established in accordance with the National Bald Eagle Management Guidelines; therefore, monitoring in these instances is not applicable.**

B. Monitoring Requirements

The Monitor is defined as personnel formally educated in the biological sciences, well experienced in recognizing specific patterns and changes of eagle behavior and capable of recording those observations in a scientific manner, and is contracted by the landowner, company or entity (Responsible Party) responsible for having the activity monitored. Continuity of monitoring, data collection and reporting is best maintained if one person conducts all monitoring for a specific project site. Close coordination is essential if more than one monitor is required. Monitoring should be conducted from a location that provides a clear vantage point of the nest and the surroundings (including the referenced activities), yet far enough from the nest (e.g., > 660 feet where possible) to ensure monitoring does not cause disturbance to the eagles. Monitoring from closer locations could cause disturbance and should be avoided. Conducting the monitoring from inside a parked vehicle or from a portable blind can further minimize observer disturbance. Monitoring should be conducted using both binoculars and a high-powered spotting scope during periods when referenced activity is occurring during the nesting season (generally October 1 – May 15) and within 660 feet of the nest tree, or as specified otherwise, by Service or FWC technical assistance.

The purpose of monitoring is to detect any abnormal behavior of the adult eagles or their chicks that may be elicited in response to human activities occurring within 660 feet of the nest tree and that potentially could result in disturbance as defined under 50 CFR 22, abandonment of the nest (and/or territory), or death of the eggs or eaglets. **In cases where the Responsible Party is relying upon conditions/recommendations specified in a Biological Opinion or agency document, procedures should be established between the Monitor and the Responsible Party for suspension of work and immediate notification to the Service and FWC upon observation of such abnormal behavior of nesting eagles (see Section D for details)**. Once an applicant agrees to monitor in accordance with these Monitoring Guidelines, they are held to *all* requirements of these Monitoring Guidelines.

Monitoring should begin no later than October 1 and continue through fledging, if activity is anticipated or planned to occur within 660 feet of the nest tree during the nesting season. Fledging is considered to have occurred at that age when young of the year have achieved the ability to sustain flight (see Section C.7 for details).

- **Initial Monitoring to Confirm Occupancy of the Nesting Territory:** Bald eagles are considered to have returned to the territory when one or both members of the pair appears, flies, perches, roosts, exhibits courtship, carries nest material, begins repair of the existing nest and/or begins construction of a new nest on the territory. The regulated

protection zone is considered to be the area within a 660-foot radius of the nest tree; although, some pairs may construct a new, alternate nest at farther distances. All eagle nests are protected unless declared ”abandoned” in accordance with provisions of the National Bald Eagle Management Guidelines (May 2007). All alternate nests should be monitored until such time as the eagles have been observed incubating in one of the nests on the territory. Monitoring can then cease for the alternate nests in which nesting does not occur. However, if the nest in which nesting begins is lost prior to February 1, monitoring of all alternate nests should be re-initiated to determine if re-nesting occurs on the territory.

Initial monitoring of eagles to determine territory occupancy shall be conducted a minimum of one day per week and consist of in sequence: 1) nest tree observations for a minimum of two hours starting ½ hour before sunrise, followed by 2) nest tree inspection for indirect evidence of eagle use if no adults are observed. *Never* approach a nest tree if adult eagles are observed on the territory on that day. The following shall constitute positive indirect evidence that bald eagles have returned to the nesting territory: 1) fresh moss or green tree branches placed or interwoven into the nest top, or 2) fresh droppings ("whitewash") on vegetation or the ground beneath the nest tree. Such droppings typically are deposited below the nest cup or favored perch branches. Do not confuse white, dried pine resin with eagle droppings: droppings rub off upon touch, whereas resin does not. Direct or indirect evidence of territory occupancy by adult eagles triggers the requirement for more intensive monitoring (see Monitoring During Early Phases of the Nesting Cycle, below). The results of both direct bald eagle observations and nest tree inspections must be recorded each week on the Bald Eagle Monitoring Data Sheet (Figure 1). A Confirmation of Nest Territory Occupancy Report describing the basis for the determination shall be submitted to the Service and the FWC (see Section D for reporting details) within one week of finding positive evidence of bald eagle nest territory occupancy. **This report also shall include a specific schedule of dates planned for monitoring during the next month.** Each subsequent monthly report submitted to the Service and FWC shall contain a schedule of monitoring dates for the upcoming month, with the understanding that any scheduling changes shall be reported to the agencies by email as soon as possible.

- **Monitoring During Early Phases of the Nesting Cycle:** The normal cycle of bald eagle nesting behavior is described below. Once a territory is determined to be occupied, it should be considered active, and nesting eagles should, at that time, be monitored a minimum of three days each week and four hours each day (beginning at 1/2 hour before sunrise) from onset of nesting behavior through the fourth week post-hatching and care of eaglets. **Monitoring is ***not*** required on days when no infrastructure development, exterior building construction, or other human activities referenced in the National Management Guidelines occurs within 660 feet of the nest tree.** Monitoring should be scheduled to occur on the days that are representative of all major phases of these activities at times when they will occur.

- **Monitoring During Last Phase of the Nesting Cycle:** Monitoring frequency for activities may be reduced to one day each week (four hours beginning 1/2 hour before sunrise) beginning five weeks post-hatching and continue until fledging occurs or May

15, whichever occurs first. However, this once a week monitoring event should occur on days that are representative of all major phases of these activities at times when they will occur.

- **Special Circumstances:** Additional monitoring may be appropriate should special circumstances arise as described in Section C.6. The monitoring and construction plans for any nesting territory may be re-evaluated for modifications during any year. Weekly nest territory monitoring may cease after February 1 of that nesting season if: 1) no adult bald eagles are observed on the territory or 2) if an eagle was observed on the territory, but nesting was not attempted, or a nest attempt was documented to have failed and re-nesting was not attempted. Additionally, monitoring may cease if great horned owls (*Bubo virginianus*) are documented to have occupied the nest and there are no alternate nest sites available to the eagles within 660 feet of the project, and no evidence of eagles constructing a new nest within 660 feet of the project. Evidence must be clear from information recorded in the Bald Eagle Monitoring Data Sheets and/or provision of additional data, that circumstances exist that would warrant any modification of planned monitoring (i.e. increase, decrease or termination of monitoring).

- **General Comments:** Residential and commercial development is the most common form of human activity that requires monitoring. Single-family homes typically may require a minimum of 5 months for completion of construction, and all major stages of construction (described below), except truss placement, occur over multiple days. Monitoring should be timed to include truss placement. In all cases, the Monitor should use a site plan of the project to prepare weekly maps on which to document the specific construction activities that are occurring within 660 feet of the nest tree. Recorded construction activities should include, but not be limited to, the stage of construction of each home (i.e., fill placement, slab pouring, sidewall construction, truss placement, roofing, external finish work, internal finish work and landscaping). All observations of construction and eagle behavior *must* be recorded using the attached data sheet (Figure 1).

The following nest cycle activities must be documented and monitored for comparison with normal nesting behavior (see Section C for details) and for detecting and evaluating behavior that may be indicative of disturbance and/or pending risk:

1. Temporal patterns of nest attendance by the adults.
2. Observations of courtship, mating and nest building/maintenance.
3. Incubation and brooding behavior.
4. Feeding, growth and care of the eaglet(s).
5. Flight patterns to and from the nest tree.
6. Fledging of the eaglet(s).

All behavioral data and construction activities should be recorded within 15 minute intervals to facilitate analysis as a basis for detecting and evaluating behavior which may indicate pending risk. Figure 2 summarizes the typical nesting chronology of bald eagles in Florida. Please note that egg laying typically occurs during mid-December in Florida, but may vary by year, pair and latitude, and can extend from October through April, with most late nesters likely representing

second breeding attempts (Buehler 2000). Figure 3 provides a typical pattern of nest attendance and phenology of a pair of eagles in Sarasota County, Florida, monitored over a three-year period during one 4-hour observation period each week from October through May.

Nesting behavior which may be interpreted as abnormal, a response to construction activities and/or indicative of pending risk may include, but not be limited to: 1) adults raising or standing up over the nest, 2) increased time spent away from the nest by the adults that is not associated with normal nesting phenology, 3) changes in flight patterns or perch tree use, 4) distress calls, 5) flushing behavior from the nest tree or perch trees, 6) changes in the feeding schedule of the eaglet(s) and 7) premature fledging of the eaglet(s). Descriptions of specific behaviors that would warrant concern and may be indicative of pending risk are described below. Such behaviors occasionally result from factors other than human disturbance, such as death of an adult, sterility or immaturity (i.e., one member of the pair not in definitive plumage), entrance of a foreign adult eagle or great horned owls into the territory, inadequate food supply for the number of eaglets present, etc. Therefore, it is very important that observations of any abnormal behavior be reported immediately to assure proper interpretation and appropriate courses of action (see Section D for details).

C. Normal Nesting Behavior and Indicators of Disturbance

1. Adult Behavior at the Nest

Eagles often assume an alert posture in response to an unusual event. This behavior also may be accompanied by distress calls and ultimately result in flushing behavior (Fraser et al. 1985, Buehler et al. 1991, McGerigal et al. 1991). Incubating adults may react to a distraction or an annoyance by rising from their incubation posture and standing over their eggs. They also may step off the eggs and stand on the side of the nest. They may or may not vocalize in conjunction with this behavior. Such standing behavior may be seen prior to flying and as an indication that the bird may flush from the nest in response to a distraction. The bird also may settle back down into incubation posture without flying, once the distraction has passed or the bird has decided the distraction is not a sufficient threat to warrant flushing from the nest. This behavior (whether the adult flushes or not) does indicate that the disturbance is great enough to interfere with normal behavior and is of concern. This posture could be confused with stretching or egg turning which are normal parts of incubation behavior. It will be the responsibility of the monitoring biologist to accurately judge whether a bird is exhibiting normal behavior or is reacting to a distraction or an annoyance that could be interpreted as “disturbance.”

2. Patterns of Nest Attendance

Figure 3 provides a representative example of normal baseline nest attendance by at least one adult eagle during the nesting season. Please note that attendance may be sporadic early in the nesting season, but increases dramatically immediately prior to egg-laying. At least one adult is present almost 100% of the time during the 35-day incubation period and the first 2-3 weeks post-hatching (Fraser 1981, Wallin 1982). Females average about 1/5 larger in size than males, and the sexes are distinguishable when the pair is together. The female does the majority of the incubation and early nestling attendance, although the male participates in both activities. One

adult (usually female) broods constantly during inclement (i.e., cool or rainy) weather, and will shade the young to avoid heat stress until a chick(s) is approximately 4 weeks of age (Jenkins 1989, Herrick 1924). Nest attendance declines sharply after 5-6 weeks, and the adults often roost and loaf away from the nest.

Nest attendance would be considered abnormal if: 1) at least one adult is not present during two consecutive, 4-hour (minimum) monitoring days prior to egg laying or 2) both adults are absent for more than two consecutive 15-minute periods during incubation, early brooding or inclement weather prior to 4 weeks post-hatch.

3. Flight Patterns Between Nest and Feeding Areas

Florida eagles generally nest in proximity to water, and flight paths to and from the nest often are relatively direct to their feeding areas. Flight information should include recording the direction of each flight to and from the nest in the eight cardinal directions. Simple chi-square or other non-parametric statistics can be used to test if flight patterns are random, directed towards foraging areas or away from on-going human activity.

4. Vocalizations on the Nesting Territory

Verner and Lehman (1982) describe three distinctive calls of nesting birds that are typical responses to human approaches: 1) a "chatter call" described as consisting of 3-4 introductory notes separated by short gasps of silence (<1s) followed by a rapid sequence of descending notes, usually 6-9 notes in sequence (*kwit kwit kwit kwit kee-kee-kee-kee-kee*), 2) a "peal" consisting of a high-pitched, prolonged, gull-like cry, often repeated 3-5 times and 3) a "wails" call that is seldom given (Buehler 2000). Variants of these calls may also be given in response to an intruding adult eagle or other raptors, such as great horned owls, and the chatter call also is often given upon approach to the nest tree by a member of the pair, independent of human disturbance. Any distress call must be investigated to determine cause, and **any construction or human activity that may be responsible for the distress call, must be halted or modified immediately**.

5. Flushing Behavior

Adult eagles may flush from the nest tree, particularly if humans are on foot (Fraser et al. 1985, Buehler et al. 1991, Grubb and King 1991, McGarigal et al. 1991, Grubb et al. 1992). Risk increases with the duration and frequency of events. The sensitivity of eagles to human disturbance varies between individuals and across populations, as measured by experimental flushing studies (e.g., Stalmaster and Newman 1978, Knight and Knight 1984, Fraser et al. 1985, Buehler et al. 1991, McGarigal et al. 1991). Unfortunately, no similar studies have been conducted in Florida. The response of individual eagles may range from temporary agitation (alert posture) to flushing from the nest or perch tree, to permanent displacement. Humans in vehicles generally elicit a much lower response than those on foot. Additionally, eagles that nest in proximity to existing human activities may habituate and be more tolerant to forms of human activity than they may have previously experienced.

Flushing behavior is more typically in response to human approach to the nest on foot; therefore, it is imperative that the monitor attempt to stop all such approaches. **Any construction or other human activities that appear to have caused flushing should be halted immediately**.

6. Feeding Schedule of the Eaglet(s)

Although both sexes secure food and feed the young, the male provides most of the food in the first two weeks, while the female tends the young in the nest (Wallen 1982, Gerrard and Bortolotti 1988). The female often delivers as much prey as the male after 3-4 weeks. Adults typically bring the food to the nest and tear off small pieces to feed the young. Eaglets are able to tear off food and feed themselves at approximately 6 weeks of age, although the adults often dismember larger prey (Palmer et al. 1988). Adults typically deliver food 2-8 times per day (mean = 4), and the early morning period accounts for proportionately more food deliveries (Herrick 1924). Food delivery rates also typically decrease as eaglets mature and or eaglet numbers decline with normal attrition. Therefore, deliveries may not be observed during some monitoring periods for older broods. The nutritional requirements of eaglets have not been reported in the literature (Buehler 2000), but free ranging adult bald eagles in Washington at 5ºC were reported to consume about 77.3 g/kg per day (425.5 kJ/kg per day), slightly less than 10% of their body weight per day (Stalmaster and Gessaman 1984). Nestlings may use food that accumulates at the nest for more than one day, unless fresh food is provided (Herrick 1993). Both adults and chicks are capable of storing food in their crop, then digesting the food over time. **Additional monitoring may be appropriate should an abnormal reduction in feeding rates be observed; if accompanied by other behavioral indicators of stress (i.e., flushing and/or distress calls), the Monitor should suspend construction or other human activities and report these observations** (see Section D).

Mean brood size for successful nests in Florida bald eagles is 1.55 young per brood, with 3 young not uncommon (Nesbitt et al. 2002). One egg is laid per day, although often not always on successive days. Hatching is asynchronous and differential growth between the sexes can lead to differential mass among siblings, facilitating competition and fratricide (Bortollotti 1986). Sibling competition and mortality is greatest early in the nestling period, when size differences are greatest. The largest chick typically gets the majority of food in clutches with more than one chick. Brood reduction from starvation of the youngest chick may occur in broods of any size, unless food is abundant (Gerrard and Bortollotti 1988).

It is important to quantify, to the extent possible, the size and type of prey brought to the nest during all observation periods. These data may be useful for determining if the eaglet(s) is receiving adequate food and if human activity may be interfering with food delivery schedules.

7. Fledging of the Eaglet(s)

Eaglets typically fledge at approximately 11 weeks of age in Florida (Wood 1992), but nest departure can occur at 8-14 weeks (Buehler 2000). The eaglets usually begin to move about the nest and branches of the nest tree at least 2 weeks before fledging, flapping and developing muscle strength, flight coordination and landing ability in preparation for their first flight from the nest tree. These eaglets are referred to as “branchers.” Fledging typically is considered to have occurred when the eaglets have begun to make extended flights from the nest to adjacent

trees, have begun to soar and/or are seen flying around the territory with the parents. It is not uncommon for up to half of initial nest departures to be unsuccessful, with the eaglet falling to and remaining on the ground for days or weeks before regaining flight ability; in most cases, the parents will continue to feed these young (Kussman 1977, Fraser 1981). **Successful fledging**, for purposes of these Guidelines, **is defined as the time at which the eaglet(s) has near fully developed primaries and is capable of strong, coordinated, independent flight**.

Care must be taken to confirm that any premature fledging is, in fact, human related, since premature fledging is a common occurrence that may be independent of human activity.

D. Reporting Requirements

The **purpose of monitoring** bald eagles and eaglets at their nests under these Guidelines **is to minimize the occurrence of disturbance leading to nest abandonment and/or death of eggs or eaglets**, and avoid potential violations of the Eagle Act. As such, monitoring is a serious obligation. Falsification of monitoring reports can lead to criminal prosecution of both the Monitor and the Responsible Party that is contracted to conduct the monitoring. The Monitor and their supervisor *must* sign and date each completed monitoring sheet (Figure 1) beneath the statement, which reads: "I have read and understand the Bald Eagle Monitoring Guidelines. This report represents a true, accurate and representative description of the site conditions and eagle behavior at the time of monitoring".

As long as the Monitor has not detected any, irregularities or abnormalities as described above, then **Only** a summary report of monitoring results (See Figure 4) should be mailed via hardcopy or email to the appropriate Service Field Office and FWC (Endangered Species Coordinator, Tallahassee) on a monthly basis when the Monitor has not detected any irregularities, or abnormalities as described above. Individual Bald Eagle Monitoring Data Sheets should be retained on file by the Monitor for a minimum of 3 years for reference, should such need occur. **A final report that summarizes monitoring results and the fate of any reproductive effort must be sent to the reviewing agencies within one month of the conclusion of monitoring**. The Monitor has the obligation to immediately report any suspension of work activities and/or any documented abnormal behavior, as defined in Section C above, to the Responsible Party and the Service and FWC**, and subsequently send the individual Bald Eagle Monitoring Data Sheets describing all relevant activities to all parties.** The Service and FWC will coordinate a review within a week of the reported behavior and circumstances associated with any suspension of work activities. A verbal determination followed by a written recommendation will be issued in a timely manner as to whether construction should resume or be modified, or if monitoring frequency should be increased.

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Bald Eagle Monitoring Data Report

Nest #: Start Time: Name of Monitor: ___________________________

Date: End Time: Name of Supervisor: ________________________

Tree Status[1]: Tree type[2]: # Adult Present: # Young Present:

Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				

Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

______________________ ______________________ _________________

Signature of Monitor Signature of Supervisor Date

Nest #: Monitoring Date: Monitor's signature: ___________________________

Supervisor's signature: ________________________

Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
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Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				
Time	Behavioral activity observed (list all that apply):				
	Weather conditions	T:	W:	C:	P:
	Description of ongoing construction events:				
	Notes/Comments:				

Sworn Affidavit: I have read and understand the USFWS Bald Eagle Monitoring Guidelines. This report represents a true, accurate, and representative description of the site conditions and eagle behavior at the time of monitoring.

Signature of Monitor   Signature of Supervisor   Date

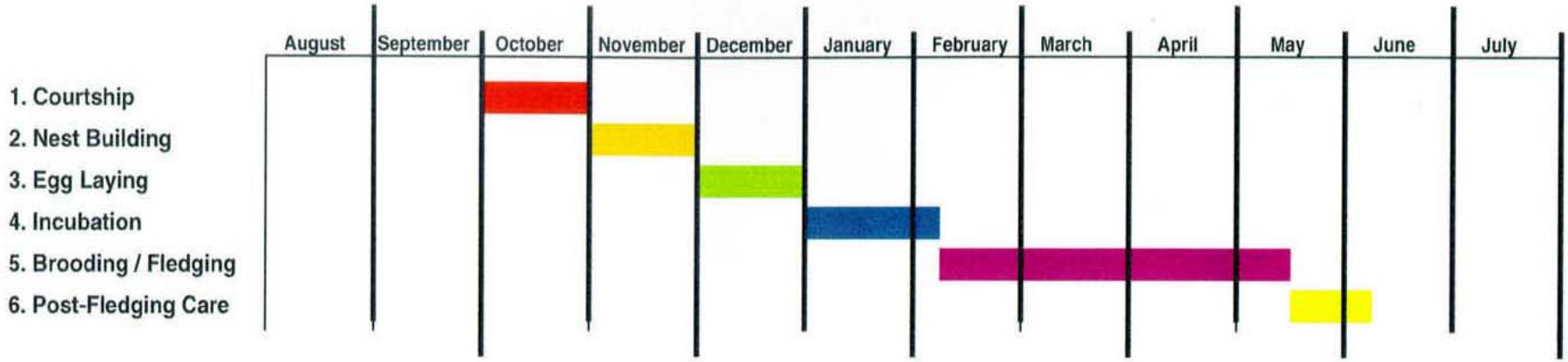
Instruction for completing the Bald Eagle Monitoring Data Report

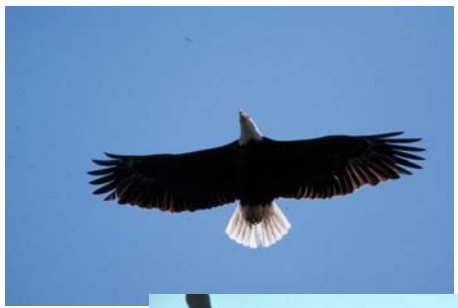
1. Insert the nest identification number, date for which the monitoring is occurring, Start time is the time at which monitoring is initiated, and end time is when the daily monitoring is completed. The monitor and the monitor's supervisor should print their name on the first page, a sign all other pages.
2. Tree Status is either L = live, D = dead, or A = artificial structure.
3. Tree type is either P = native pine, H = native hardwood, E = exotic.
4. All data reports should have an attached map of the nest territory that includes the location of the project. Major territory flights, including the time of the flight, should be drawn on this map.
5. Record all behavior events observed during the monitoring period. The following abbreviations should be used. CT = courtship; MAT = breeding/mating; NR = nest repair; INC = incubating; BRO = brooding; AF = adult feeding; YF = young being fed; TD = territory defense; STD/DV going from incubation to standing associated with distress calls; FL/DV = flushing with distress calls; DC = distress calls not associated with standing or flushing; PF = premature fledging. A monitoring event that observed nest repair, courtship and adult feeding may be recorded as NR-CT-AF. Any other behavior can be listed or described. Any abnormal behavior should be noted and described in the notes section if more space is required.
6. Enter the current weather conditions for each observation period in the appropriate place. On the data report, T = Temperature (EF); W = Wind speed & direction; C = Cloud Cover (%); P = Precipitation.
7. Record all ongoing construction/project activities that occur during the monitoring period. The following abbreviations should be used for common activities (unlisted activities should be described):
    - **FP** = fill placement,
    - **SP** = slab pouring,
    - **SC** = sidewall construction,
    - **TP** = truss placement,
    - **R** = roofing,
    - **EW** = external finish work,
    - **IW** = internal finish work;
    - **IFR** = infrastructure work;
    - **HE** = heavy equipment work;
    - **CRN** = work involving a crane.

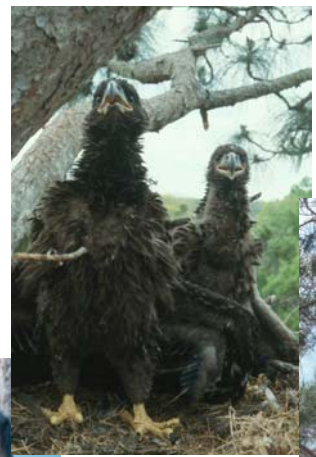
    Provide details on infrastructure and heavy equipment work.
8. Any information that needs further explanation or any unusual event should be record in the Notes/Comments section. If more space is required, a supplemental sheet can be attached to this monitoring report. This supplemental sheet should clearly indicate the nest involved, the date of the monitoring, the monitoring time period to which the comment belongs (especially if needed for more than one monitoring time period), and should be signed by the monitor and supervisor.
9. In the appropriate place at the top of page 1, record the number of adults present at the nest during the entire monitoring period.
10. In the appropriate place at the top of page 1, record the number of young present at the nest during the entire monitoring period.

Nesting Chronology of Bald Eagles in Florida (typical)

Figure 2







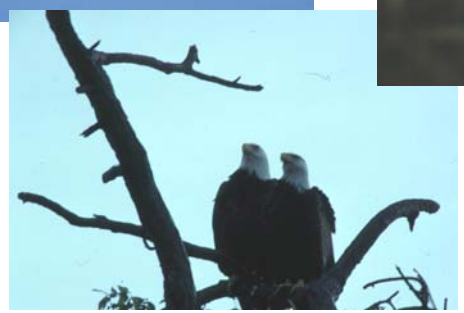
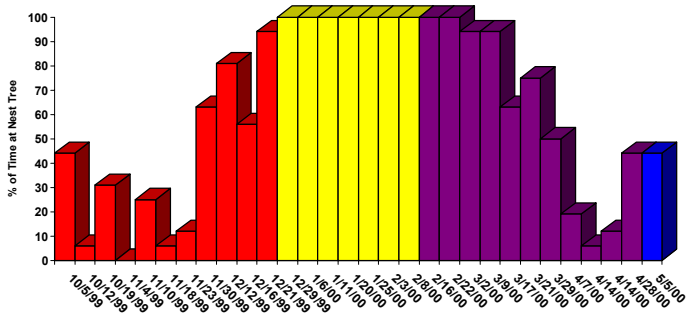


Figure 3: NEST ATTENDANCE BY AT LEAST ONE ADULT EAGLE DURING 15-MINUTE INCREMENTS OF 4-HOUR OBSERVATIONAL PERIODS

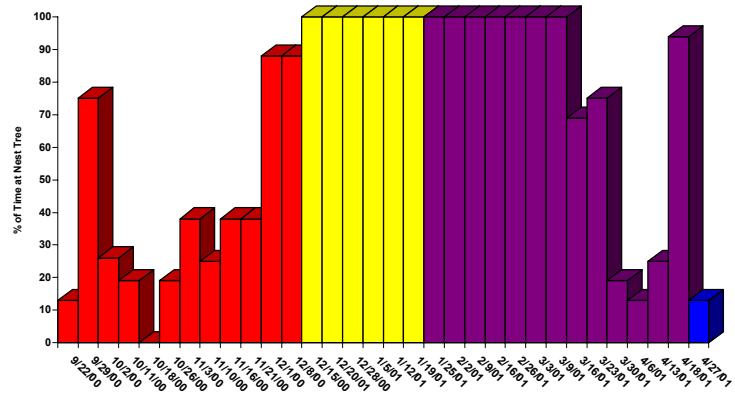
1999 - 2000 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	8
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	0	26



2000 - 2001 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	34
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	0	8



2001 - 2002 NESTING SEASON

	WITHIN 750' PRIMARY ZONE	WITHIN 1500' SECONDARY ZONE
EXISTING HOMES	0	42
HOMES UNDER CONSTRUCTION DURING NESTING SEASON	17	61

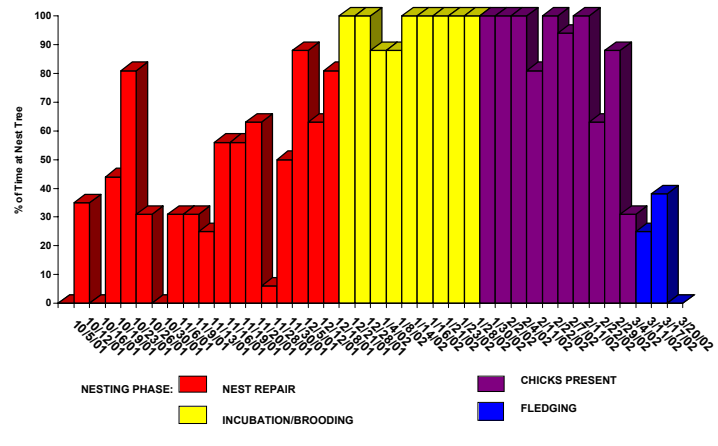


Figure 4

Please send monitoring reports by facsimile or e-mail to the appropriate USFWS Field Office and FWC (Endangered Species Coordinator, Tallahassee) on a monthly basis to:

U. S. Fish and Wildlife Service North Florida
Candace Martino
Tel: (904) 232-2580, ext. 129
Fax: (904) 232-2404
E-mail: candace_martino@fws.gov

U. S. Fish and Wildlife Service South Florida
Alfredo Begazo
Tel: (772) 562-3909 ext. 234
Fax: (772) 562-4288
E-mail: aflredo_begazo@fws.gov

U. S. Fish and Wildlife Service Florida Panhandle
Stan Simpkins
Tel: (850) 769-0552 ext. 234
Fax: (850) 763-2177
E-mail: stan_simpkins@fws.gov

Florida Fish and Wildlife Conservation Commission
Brad Gruver
Tel: (850) 488-3831
Fax: (850) 921-7793
E-mail: brad.gruver@myfwc.com

ATTACHMENT D:

HYDROLOGIC AND HYDRAULIC MODELING REPORT

PRINCETON HYDRO

SCIENCE ENGINEERING DESIGN

Hydrologic and Hydraulic Modeling Report

Lake Luxembourg Conservation Pool Habitat Enhancement

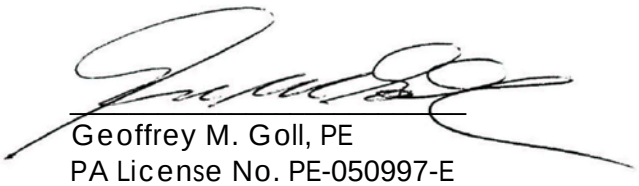
Township of Middletown, Bucks County, Pennsylvania

Prepared for:

Bucks County Conservation District
ATTN: Meghan Rogalus
1456 Ferry Road
Suite 704
Doylestown, Pennsylvania 18901

Prepared by:

Princeton Hydro, LLC
1108 Old York Road
Suite 1, PO Box 720
Ringoes, New Jersey 08551
www.princetonhydro.com
Offices in New Jersey, Maryland, Pennsylvania and Connecticut



Geoffrey M. Goll, PE
PA License No. PE-050997-E

May 2019; Revised June 2019

Project No. 0121.016

Contents

1.0 Introduction

1.1 Project Background

The Bucks County Conservation District contracted Princeton Hydro, LLC to prepare design and permitting documentation for the Lake Luxembourg (Lake) Conservation Pool Habitat Enhancement Project. This project involves the development and enhancement of wetlands in the Conservation Pool. Along with the development and enhancement of wetlands, accumulated material shall be removed from the existing Conservation Pool is proposed to reestablish a forebay for the Lake and restore the intended habitat of the conservation pool by increasing the water depth. The following report details the engineering design elements of the project which pertain to hydrologic and hydraulic analysis as well as regulatory compliance, dewatering and placement.

1.2 Site Background

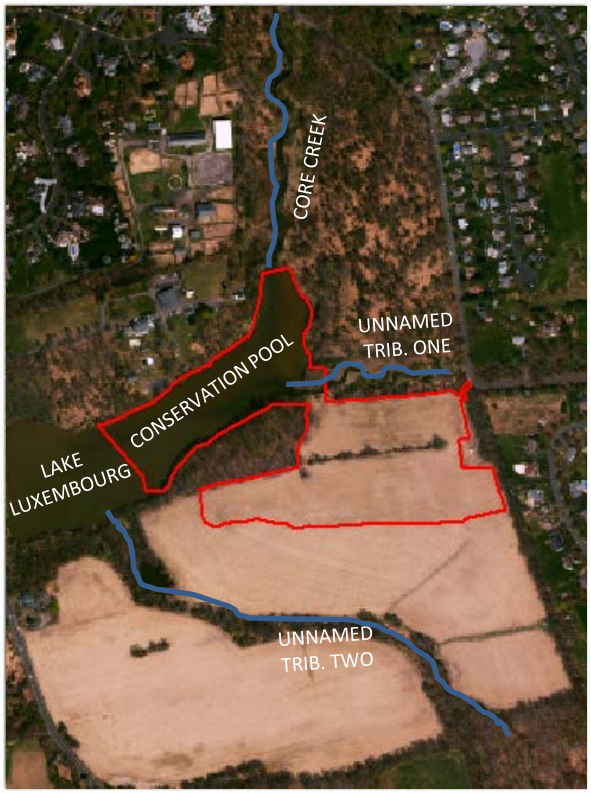


Figure One – Overview map

Lake Luxembourg, located in Bucks County, PA, serves as the focal point of Core Creek County Park. Under Public Law 566 funding, PA Dam 620 (D09-172 and NID#PA00802) was constructed across Core Creek to create a multi-purpose (e.g. flood control, recreation) reservoir. The Dam was completed in June 1976; and the reservoir, named Lake Luxembourg, was filled in the summer of 1977. Core Creek is the primary inlet and sole outlet of Lake Luxembourg. Core Creek is a subwatershed within HUC 02040201 (Crosswicks – Neshaminy) in Bucks County, Pennsylvania, and is designated as a Trout Stocking Fishery and Migratory Fishes water body. Core Creek enters the Neshaminy Creek approximately 13.5 miles upstream of the confluence of the Neshaminy Creek with the Delaware River. As a multi-use reservoir, Lake Luxembourg is important in the community for recreation and serves a vital ecological role as well.

Lake Luxembourg and Core Creek are both listed on Sublist 4a of Pennsylvania's '2016 Integrated Water Quality Monitoring and Assessment Report,' indicating that these waterbodies have approved Total Maximum Daily Loads (TMDLs). The sources of impairment targeted by the TMDLs are total phosphorus (TP) and total suspended solids (TSS). As mentioned above, the Core Creek / Lake Luxembourg watershed drains to the Neshaminy Creek, which it should also be noted, also has a TMDL for TSS.

When Lake Luxembourg was created, a 17-acre 'Conservation Pool' settling basin was established immediately upgradient of the main body of lake, east of Woodbourne Road. The Conservation Pool was intended to store 100 years of sediment while maintaining the full flood storage capacity of the main reservoir, and is currently designated as a Trout Stocking Fishery and Migratory Fishes water body. Unfortunately, due to rapid land use changes in the Core Creek watershed beginning in the early 1980s, the Conservation Pool reached its sediment storage capacity by 1986. Since then, although land use changes in the watershed have stabilized, sediment in the pool is resuspended and transported to the main body of the lake with each storm. Consequently, the Conservation Pool is currently contributing to the sediment load in Lake Luxembourg.

1.3 Review of Existing Information

Documentation

Documentation on the design and construction of the Dam and Conservation Pool were reviewed in order to develop an understanding of the original design intent and collect pertinent information for modeling hydrologic and hydraulic conditions. A file review at the Pennsylvania DEP Division of Dam Safety produced copies of the following documents, which were used to gather information on the design of the Dam and Conservation Pool.

- Final Design Report Dam PA-620 Neshaminy Creek Watershed, March 1971 (Incomplete copy)
- Neshaminy Creek Water Resources Development Plan Multiple-Purpose Dam No. PA-620 Core Creek As-Built Plans, 1971
- SCS Sedimentation Design Summary, December 1964
- PA-620 Reservoir Sediment Data Summary, August 1988
- Real Estate Evaluation Report PA 620 Core Creek Dam, WM G Major Associates, 1979

The current condition of the Conservation Pool was assessed through review of the following recent studies and survey prepared for the Lake and Conservation Pool.

- Lake Luxembourg Dredging Feasibility Report, Princeton Hydro, June 2013
- Topographic Survey of the Conservation Pool, BANC3, 2016

Information expressed in the documents listed above, along with publicly available information (e.g. regional elevation datasets, land use and land cover, etc.) are the basis of the analyses discussed in this report.

Summary of Pertinent Data

As the forebay for Lake Luxembourg the Conservation Pool accepts flow and sediment from Core Creek and two smaller tributaries.

All elevation data prior illustrated in reports prior to 1988 have been converted to NAVD88 via the following conversion:

$$Elevation\ (NAVD88) = Elevation\ (NGVD29) - 1.024\ FT$$

This elevation conversion was determined through the use of the VERTCON software maintained by NOAA.

Conservation Pool

Normal Pool Elevation:	101.48 Feet
Storage at Normal Pool (2013):	22.1 Acre Feet
Sediment Storage (2013):	77,000 Cubic Yards

PA Dam 620

Primary Spillway: Vertical concrete conduit with interior dimensions of 12-ft by 5-ft

Primary Spillway Inlet Invert Elevations:

Inlet Structure	Elevation
2 – 12-ft Ungated Weirs	101.48
36"x42" Sluice Gate	89.98
36"x48" Sluice Gate	86.98
60"x60" Sluice Gate	69.98

Primary Spillway Conduit through Dam:	60-in RCP
Inlet Invert Elevation:	69.98 Feet
Outlet Invert Elevation:	68.98 Feet
Slope:	0.00445 ft/ft
Emergency Spillway:	Trapezoidal Earth/Rock Channel with Riprap Control Section
Riprap Control Width:	550 Feet
Riprap Control Breadth:	600 Feet

Inlet Invert Elevation: 110.88 Feet

1.4 Design Goals and Objectives

This project has the following goals:

- Enhance the Conservation Pool so it functions as a regional constructed wetland Best Management Practice (BMP)
- Reduce amount of sediment being transported to Lake Luxembourg
- Maintain stability of the Conservation Pool
- Make future maintenance and sediment removal easier to implement
- Uplift the habitat quality of the Conservation Pool

These goals will be achieved through completing the following objectives:

- Selective removal of accumulated sediment from the Conservation Pool
- Restore Conservation Pool vegetation

As the Conservation Pool no longer serves its function due to being filled with sediment and lack of maintenance, the project goals serve to create a more functional space that is easier to maintain and reduces sediment load to Lake Luxembourg. To meet the project goals, Princeton Hydro proposes to remove accumulated sediment from the Conservation Pool to restore the available sediment storage, create settling pools to create smaller pockets of sediment storage that will allow for easier maintenance and stabilize the pool, and restoring the Conservation Pool. A Post Construction Stormwater Management (PCSM) Plan is not applicable because this is a restoration project, and no structural stormwater management best management practices (BMPs) are proposed. An antidegradation analysis is also not applicable because this restoration project is not proposed in a High Quality or Exceptional Value watershed.

2.0 Existing Conditions

Lake Luxembourg and its surrounding area is currently in use as a county park (Core Creek Park) in Bucks County, Pennsylvania. To the north and the east of the project location are residential areas, to the south are farm fields, and to the east is Woodbourne Road and the Conservation Pool. The land use has not changed significantly over the past 15 years, with the exception of a few additional residential areas to the northeast. As discussed earlier, Core Creek was dammed and filled to become Lake Luxembourg by 1977 which greatly altered the hydrology of the area. Aerial photographs from 1971 show that the area was primarily farmland and no lake was present at that time. The lake was created as a means for water supply, recreation, and flood control.

The Lake Luxembourg Conservation Pool discharges via a culvert under Woodbourne Road, into Lake Luxembourg, and has an area of approximately 836,000 square feet. The Conservation Pool was designed to store accumulating sediments before entering Lake Luxembourg, though as stated previously it reached its storage capacity by 1986. A bathymetry study performed by Princeton Hydro in May 2013 shows a sediment depth of up to 7 feet in the Conservation Pool.

2.1 Drainage Area

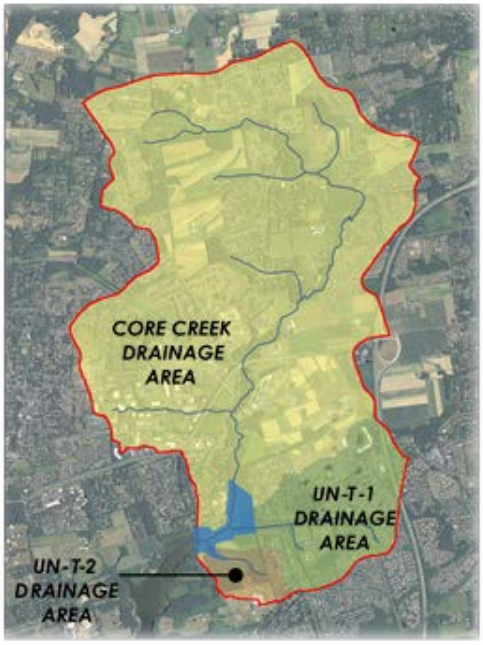


Figure Two – Drainage Overview map

In order to analyze the effects of proposed conditions, watersheds draining to the Conservation Pool were delineated. Watersheds were delineated for Core Creek, Unnamed Tributary 1, and Unnamed Tributary 2 to where they discharge at the Conservation Pool. As stated previously, the outlet of the Conservation Pool is the Woodbourne Road Culvert where it then discharges to the main body of Lake Luxembourg. The areas of the delineated watersheds are listed below.

Table 1 – *Watershed Area Review Table*

Watershed Name	Area (sq. miles)
Core Creek	6.12
Unnamed Tributary One (UN-T-1)	0.96
Unnamed Tributary Two (UN-T-2)	0.21
Total	7.29

2.2 Soils

The National Resource Conservation Service (NRCS) Web Soil Survey indicates that native onsite soils are:

- Bowmansville-Knaurs silt loams (Bo), Hydrologic Soil Group (HSG) C/D,
- Chalfont silt loam, 3 to 8 percent slopes (CbB), HSG D,
- Lansdale loam, 3 to 8 percent slopes (LgB), HSG B,
- Lawrenceville silt loam, 3 to 8 percent slopes (LkB), HSG C,
- Steinsburg gravelly loam, 3 to 8 percent slopes (StB), HSG B, and
- Steinsburg gravelly loam, 8 to 15 percent slopes (StC), HSG B.

Included in Appendix B is the NRCS soil report for the project site. The NRCS provides the following description and limitations for the soil series found on site:

Bowmansville Series

The Bowmansville series consists of very deep, poorly and somewhat poorly drained soils. They formed in recent alluvial deposits derived from upland soil materials weathered from dolerite or basalt. They are on floodplains with smooth slopes of 0 to 3 percent. Saturated hydraulic conductivity is moderately high above stratified sand and gravel and high in stratified sand and gravel.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Knauers Series

The Knauers series consists of very deep, poorly drained soils formed in recent alluvial deposits derived from sandstones and shales. They are on the backwater areas of floodplains with slightly depressed slopes of 0 to 3 percent. Saturated Hydraulic conductivity is moderately high and high in the A and B horizons, and high to very high in the C horizon.

Very limited for dwellings and small commercial buildings. Very limited for roads and streets, shallow excavations, and lawns and landscaping. Not prime farmland.

Chalfont Series

The Chalfont series consists of deep and very deep, somewhat poorly drained soils formed in a loess mantle and the underlying residuum of shale and sandstone. Slopes range from 0 to 25 percent.

Very limited for dwellings and small commercial buildings. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Lansdale Series

The Lansdale series consists of deep and very deep, well drained soils on uplands. They formed in residuum weathered from sandstone and/or conglomerate. Slopes are 0 to 25 percent. Saturated hydraulic conductivity is moderately high to high.

Not limited for dwellings without basements, somewhat limited for dwellings with basements and small commercial buildings. Somewhat limited for roads and streets, shallow excavations, and lawns and landscaping. All areas are prime farmland.

Lawrenceville Series

The Lawrenceville series consists of deep and very deep, moderately well drained soils formed in silty transported materials. Slopes range from 0 to 15 percent. Permeability is moderately slow.

Somewhat limited for dwellings without basements and small commercial buildings, very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Steinsburg Series

Soils of the Steinsburg series are moderately deep and well drained with moderately rapid permeability. They formed in residuum mostly from weakly cemented acid sandstone, arkosic sandstone, and conglomerate. They are on upland slopes of 0 to 70 percent.

Somewhat limited for dwellings without basements, somewhat to very limited for small commercial buildings, and very limited for dwellings with basements. Somewhat limited for lawns and landscaping, very limited for roads and streets, and lawns and landscaping. Farmland of statewide importance.

Also included in Appendix B are the NRCS soil reports for the drainage areas into the conservation pool.

3.0 Proposed Conditions

Proposed conditions include the removal accumulated material from the Conservation Pool, creation of settling pools using tree vane structures, and restoring vegetation within the conservation pool. No new channels are proposed. These proposed conditions will restore the capacity of the conservation pool and allow for ease of maintenance, while also enhancing the existing habitat. The amount of sediment entering Lake Luxembourg should decrease and the conservation pool should become more stabilized in proposed conditions.

The material to be removed is high in organic content and can be beneficial for reuse. It is proposed to place the material in the adjacent farm field for further dewatering and to be incorporated into the existing soils as an amendment.

All proposed sediment placement and soil erosion & sediment control features are located at elevations above the top of the dam, which has an elevation of 116.98 feet NAVD 88. This elevation was obtained by converting the NGVD 29 elevation of 118 feet provided on Sheet 10 of 43 of the Neshaminy Creek Water Resources Development Plan As-Builts, dated March 1971. The dam elevation conversion is included in Appendix D. The sediment placement will result in no flood storage loss, as the sediment will not be placed within the floodplain.

4.0 Soil Erosion and Sediment Control Compliance

An Erosion and Sediment Control Plan has been prepared for this project and is shown on sheets 12 and 13 of 16 of the Lake Luxembourg Conservation Pool Habitat Enhancement Design plans, prepared by Princeton Hydro and dated October 31, 2018. This E&S plan meets the following goals:

- Minimizes extent and duration of earth disturbance.
- Maximizes protection of existing drainage features and vegetation.
- Minimizes soil compaction.

- Utilizes other measures or controls that prevent or minimize generation of increased stormwater runoff.

For this project, two soil erosion and sediment control plans have been prepared to protect the site during interim conditions and proposed conditions. The interim plan is for the sediment removal and dewatering components of the project and associated dewatering activities. The proposed plan covers the site restoration.

4.1 Methods

Soil erosion and sediment control measures are proposed in accordance with the design and performance standards contained in the Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual dated March 2012.

The following permanent soil erosion control measures will be utilized:

1. Permanent seeding will be applied to permanently stabilize the soil, assure conservation of soil and water, and enhance the environment. A permanent seeding mixture will be applied as specified on the planting plans. All seed mixtures will be specific to the region and site conditions.

The following temporary soil erosion control measures will be utilized during construction:

1. Silt fence will be placed at the toe of slopes where the existing ground slopes away from the embankment.
2. Dust generated during the course of construction activities will be controlled in areas subject to dust blowing and movement where on-site and off-site damage is likely to occur without treatment. These control measures will prevent the blowing and movement of dust from exposed soil surfaces thus reducing on-site and off-site damage and health hazards, and improving traffic safety.
3. Temporary vegetative or stabilization cover will be established on soils where earthwork is delayed or stopped for a period a four (4) days which are not being graded, not under active construction or not scheduled for permanent seeding within sixty (60) days. This temporary vegetative cover will be consistent with the permanent seeding specifications as described on the plans and will temporarily stabilize the soil and reduce damage from wind and water erosion until construction is resumed at the site. During non-germinating seasons mulching shall be used for temporary stabilization.

The interim plan includes several erosion and sediment controls, such as a stabilized construction entrance, filter socks, super silt fence, and turbidity barriers. The interim plan covers Phase 1, Phase 2A, and Phase 2B of the project. The major difference between the interim and proposed plan are the fields to be used to dewater the soil removed from the Conservation Pool. In interim conditions, the fields will have a series of 21 berms that will be used to dewater sediment. Compost filter sock and super silt fence are proposed

throughout the fields at the toes of the berms to prevent sediment from leaving the area. The berms will be stabilized with seeding & mulching and erosion control blankets will be installed on slopes steeper than 3:1. Plywood or other similar matting will be used in the field area for construction access to reduce compaction when transporting sediment to the field for dewatering.

The proposed plan covers Phase 3 of the project, which covers restoration of the project site. During this phase, the fields used for dewatering will be restored by incorporating the dewatered sediment into them existing soil. Several of the erosion and sediment controls in the field area will be removed for this to occur, though the super silt fence at the toe of the slope will remain during the incorporation of the dewatered sediment to prevent sediment from leaving the area. Upon completion of the incorporation of the soils, the area will be restored with seeding and plantings as detailed in the Plans. Once stabilized with vegetative cover all soil erosion controls shall be removed.

Overall, these plans utilize various erosion and sediment controls, use the minimum area required for the proposed work, and are proposed for the minimum extent and duration possible while also meeting timing constraints.

4.2 Temporary Crossing

A temporary stream crossing is proposed to cross one of the tributaries to the conservation pool in order to maximize distance from the bald eagle nest, minimize wetland and vegetation disturbance, and to most effectively access the portions of the conservation pool to be restored. This crossing shall span bank to bank and have the capacity for all proposed trucks and equipment to cross in a stable manner. If a large storm event is forecasted during the construction time period, the temporary crossing shall be removed so there is no restriction to flow. The crossing would then be reinstalled post the event for the duration of the work effort.

5.0 Stormwater Management

As there is no permanent change in land use proposed as part of this project, there is no net change in volume and rate of stormwater requirements. This is confirmed in Worksheet 4 of the Pennsylvania Stormwater BMP Manual and Summary Table 3 of the Application, with relevant calculations included in Appendix D. The site Limit of Disturbance was used for these calculations to show no net change in the site runoff. Summary Table 4 is not applicable as no SWM facilities are proposed for this restoration plan.

6.0 Lake Lowering and Dewatering

Lake Luxembourg will first be dewatered using the low-level outlet to 3.25 feet below normal pool elevation (Elevation ~97), at a rate no greater than 1 foot per day. In addition, a series of dewatering sumps will be used to further dewater the sediment removal area and they will discharge to a sediment trap prior to entering the

downstream waterway as deemed necessary. A stream bypass will also be constructed to divert incoming flows away from the work.

6.1 Stream Bypass

Stream bypasses were sized for both the Core Creek inflow and the Unnamed Tributary 1 inflow. The 2-year 24-hour peak flow from the StreamStats output was used to size the bypass channels, and a geotextile liner was assumed as that is what is required at minimum for a temporary swale per the PADEP Erosion and Sediment Pollution Control Program Manual.

Table 5 - Bypass Channel Summary

Description	Drainage Area (Sq. Mi.)	2-Yr Flow (cfs)	Side Slope XH:1V (ft)	Bottom Width (ft)	Channel Depth (ft)	Cross Sectional Area (sf)	Channel Slope (%)
Core Creek	6.12	646	5	20	2	60	0.02
UN-T-1	0.21	58	5	10	1	15	0.02

6.2 Dewatering

As mentioned above, the water surface elevation will be lowered to elevation 97 which is approximately 1 foot below the bottom of the proposed material to be removed. This will result in the material to be removed to partially dewater in place. Typical mechanical material removal contractors will start at the farthest point from access and high pile material closer to the truck access area for loading and transport to disposal location. This high piling will allow for water to flow from the sediment while remaining in the lake bed. No high piles will be left in the lake bed if a storm event is forecasted. The material will then be trucked to the adjacent field for further dewatering and disposal.

7.0 Conclusion

In conclusion, the proposed conditions will meet the project objectives, while reducing and avoiding negative impacts to the project area and downstream waterbodies. This project proposes to remove accumulated sediment from the existing Conservation Pool, create settling pools, and restoration of vegetation in order to achieve the goals of enhancing the Conservation Pool, reducing sediment transport to Lake Luxembourg, maintain stability of the Pool, making future maintenance easier, and uplifting the habitat of the Pool. No pollution or thermal impacts are anticipated in proposed conditions.

Appendix C. Joint Permit Application Package

Appendix D. Lake Luxembourg Dredging Request

Appendix E. National Point Discharge Elimination System (NPDES) for Construction Activities Application Package

Appendix F. Water Quality Monitoring Report