POQUESSING CREEK STREAM ASSESSMENT STUDY

Philadelphia Water Department Office of Watersheds 2013

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Office of Watersheds
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APPENDICES

1 INTRODUCTION

1.1 PROJECT PURPOSE

The purpose of the Poquessing Creek Watershed Stream Assessment Report was to provide the Philadelphia Water Department (PWD), local watershed partnership groups, and other interested parties with an analysis and summary of the existing physical conditions within the watersheds of Poquessing Creek Watershed inclusive of both stream networks and riparian corridors. Specifically, the goals of this assessment were to provide:

- a characterization and documentation of existing conditions
- a reference point for evaluating changes over time
- a tool for prioritizing stream and habitat restoration sites
- insight into appropriate restoration strategies
- a land use planning and redevelopment tool
- an aid in determining the effects of urbanization

With the insight gained from this assessment, it will be possible to strategically plan and coordinate restoration activities throughout the watershed as well as within individual watersheds. The ultimate goals of these restoration efforts will include: improving water quality, managing or replanting riparian vegetation, enhancing in-stream habitat, providing increased fish passage and finally, facilitating stream bank stabilization.

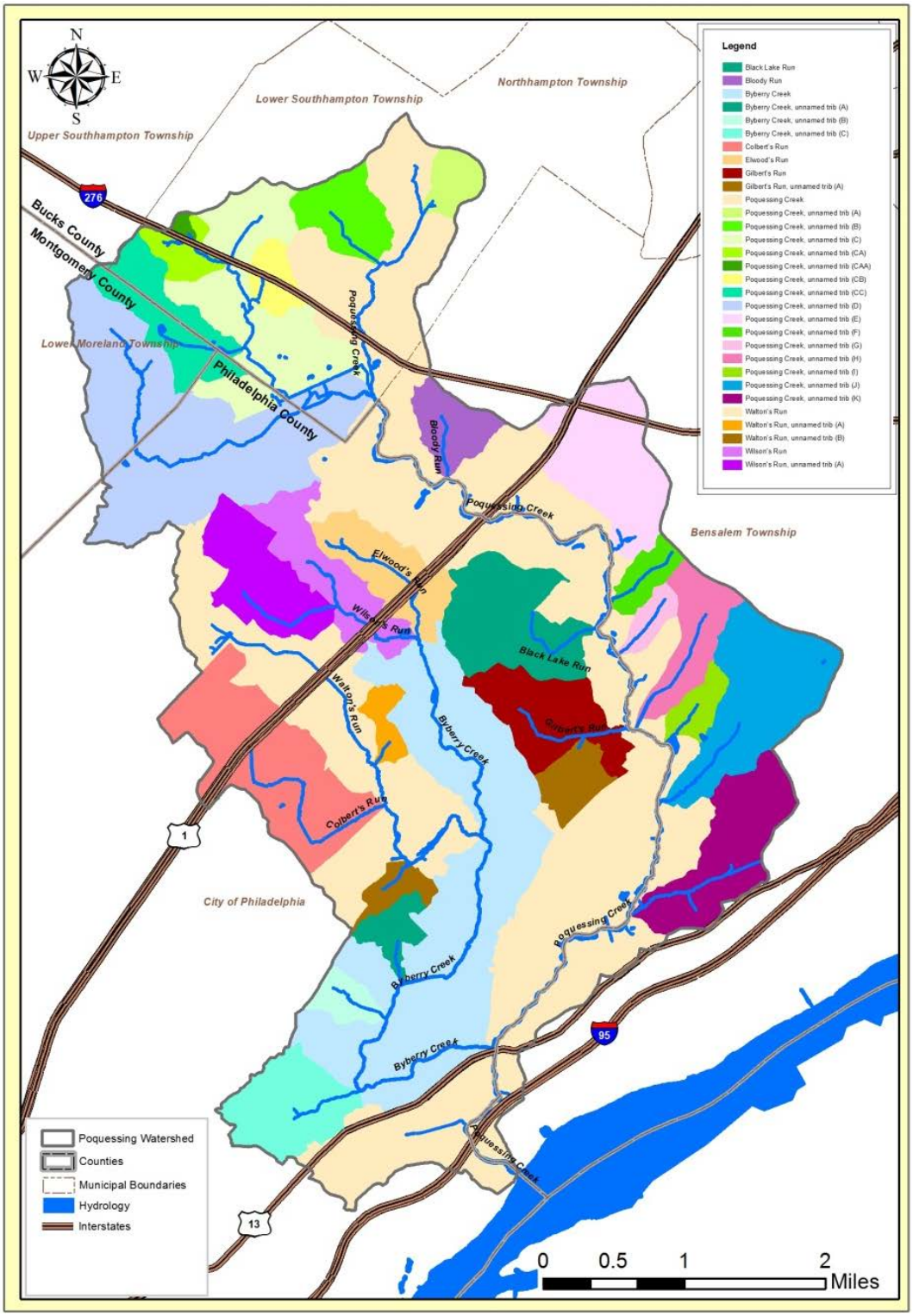
1.1.1 REPORT STRUCTURE

Each watershed section has been written to be a stand-alone document. The methodologies described in the beginning of the report apply to all the data collection and processing techniques mentioned in each of the watershed assessments.

1.2 PROJECT DESCRIPTION

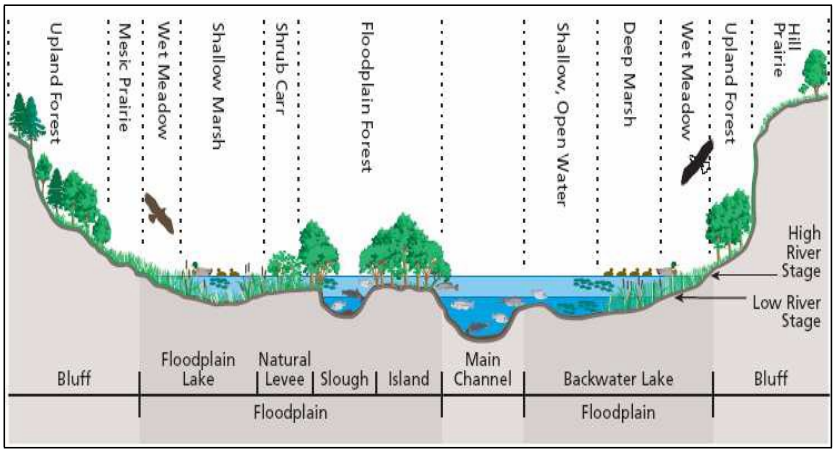
The Poquessing Creek Watershed Stream Assessment consisted of an evaluation of approximately 46 miles of stream channel within the 22 square mile watershed by members of the Philadelphia Water Department's Office of Watersheds (PWDOOW) in 2007 and GTS Technologies, Inc. in 2012. The assessment involved walking the entire length of mainstem Poquessing Creek and 35 of its tributaries (Figure 1-1), to record specific information about the channel, surrounding habitat, and infrastructure located in or near the creeks.

Figure 1-1: Poquessing Creek Watershed



PWD completed a suite of field surveys and desktop analyses to summarize existing stream and riparian conditions in the Poquessing Creek Watershed. Field surveys were focused on the characterization of channel morphology and in-stream hydraulics through the use of surveyed cross-section data and substrate particle size distribution. The physical processes that determine channel morphology, instream hydraulics, channel slope and sediment load are dependent on the physical conditions within the respective sub-catchments that drain into the Poquessing Creek stream network. Factors that influence these conditions include valley slope, land-use and local geology as well as the potential impacts of infrastructure. Thus, to thoroughly characterize instream conditions, it was necessary to examine the physical conditions within respective watershed stream corridors as well (Figure 1-2).

Figure 1-2: Generalized Cross Section of a Stream Corridor



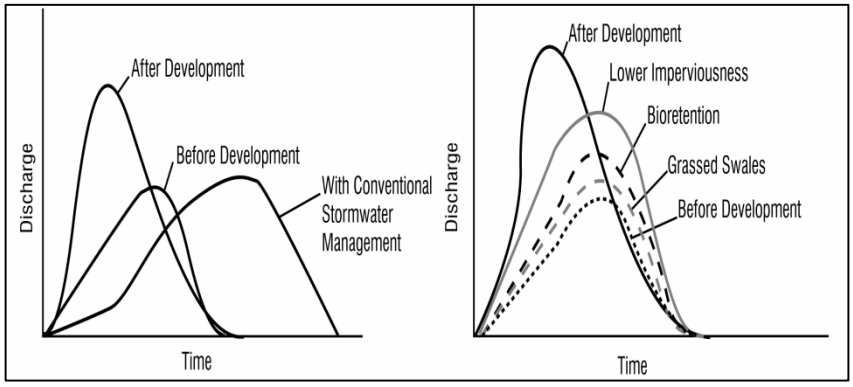
*adapted from Bioscience, vol. 45, p. 170, March 1995.

Conceptually, stream corridors are extended watershed cross-sections consisting of three main components, which are the stream channel, flood plain and an upland transitional zone or terrace. The stream channel lies at the lowest elevation of this system and conveys water at least part of the year. The floodplain exists on one or both sides of the channel and is inundated by floodwaters at an interval determined by the regional hydrologic regime. The transitional upland portion of the river corridor exists on one or both sides of the floodplain and serves as the transition between the floodplain and the surrounding landscape (FISRWG 1998).

These three components are dynamically linked through the transport and storage of water, nutrients and sediment, such that alterations to one component will over time influence another component. An example of this process is evident in the change in hydraulic, hydrologic and sediment regimes of watersheds that undergo urbanization or have changes in land use.

Land cover is intrinsically linked to a watershed's hydrologic regime through the conversion of precipitation and throughfall to runoff. As a watershed is converted from a natural, forested land cover to a more impervious and urbanized land cover, runoff increases and concomitantly increases the volume of water transported or stored by the stream channel and floodplain (Figure 1-3).

Figure 1-3: Comparison of Volume and Duration of Stormwater Runoff Before and After Land Development and Reductions in Runoff from BMPs.



*Source: Prince George's County Department of Environmental Resources et. al. (undated)

1.3 WATERSHED DESCRIPTION

Poquessing Creek is located in southeastern Pennsylvania in Bucks, Montgomery, and Philadelphia Counties. The headwaters of the Poquessing Creek originate in a suburban neighborhood in Lower Southampton Township, Bucks County. The mainstem of the creek flows for approximately 2 miles through Lower Southampton Township and then forms the border between the city of Philadelphia and Bensalem Township, Bucks County for the remaining 10 miles before reaching its confluence with the Delaware River. The Poquessing Creek Watershed has a total drainage area of approximately 22 square miles and drains portions of 4 municipalities as well as the City of Philadelphia (Table 1-1). Numerous tributaries converge into mainstem Poquessing Creek. The total number of stream miles contributing to the Poquessing Creek stream network is roughly 47 miles (Table 1-2). Portions of Poquessing Creek tributaries are buried or culverted for considerable distances.

Table 1-1: Municipalities with Contributing Drainage Area to the Poquessing Creek Watershed

Municipality	% of Poquessing Drainage in each Municipality
Upper Southampton Township, Bucks County	0.01
Lower Southampton Township, Bucks County	13.83
Bensalem Township, Bucks County	21.90
Lower Moreland Township, Montgomery County	3.91
City of Philadelphia, Philadelphia County	60.34

Table 1-2: Stream Lengths for Poquessing Creek Mainstem and Tributaries

Hydrologic Feature	Length (mi)	Hydrologic Feature	Length (mi)
Black Lake Run	0.8	Poquessing Creek, Unnamed Tributary CAA	0.1
Bloody Run	0.5	Poquessing Creek, Unnamed Tributary CB	0.4
Byberry Creek	5.3	Poquessing Creek, Unnamed Tributary CC	0.7
Byberry Creek, Unnamed Tributary	0.1	Poquessing Creek, Unnamed Tributary D	3.5
Byberry Creek, Unnamed Tributary A	0.3	Poquessing Creek, Unnamed Tributary E	0.2
Byberry Creek, Unnamed Tributary B	0.5	Poquessing Creek, Unnamed Tributary(F	0.7
Byberry Creek, Unnamed Tributary C	0.5	Poquessing Creek, Unnamed Tributary G	0.6
Colbert's Run	1.7	Poquessing Creek, Unnamed Tributary H	1.0
Elwood's Run	1.2	Poquessing Creek, Unnamed Tributary I	0.4
Elwood's Run, Unnamed Tributary	0.1	Poquessing Creek, Unnamed Tributary J	0.9
Gilbert's Run	0.9	Poquessing Creek, Unnamed Tributary K	1.0
Gilbert's Run, Unnamed Tributary A	0.9	Walton's Run	3.4
Poquessing Creek	11.6	Walton's Run, Unnamed Tributary	0.8
Poquessing Creek, Unnamed Tributary	2.5	Walton's Run, Unnamed Tributary A	0.2
Poquessing Creek, Unnamed Tributary A	0.1	Walton's Run, Unnamed Tributary B	0.3
Poquessing Creek, Unnamed Tributary B	0.6	Wilson's Run	1.2
Poquessing Creek, Unnamed Tributary C	2.5	Wilson's Run, Unnamed Tributary A	0.8
Poquessing Creek, Unnamed Tributary CA	0.6		
Total	**47**		

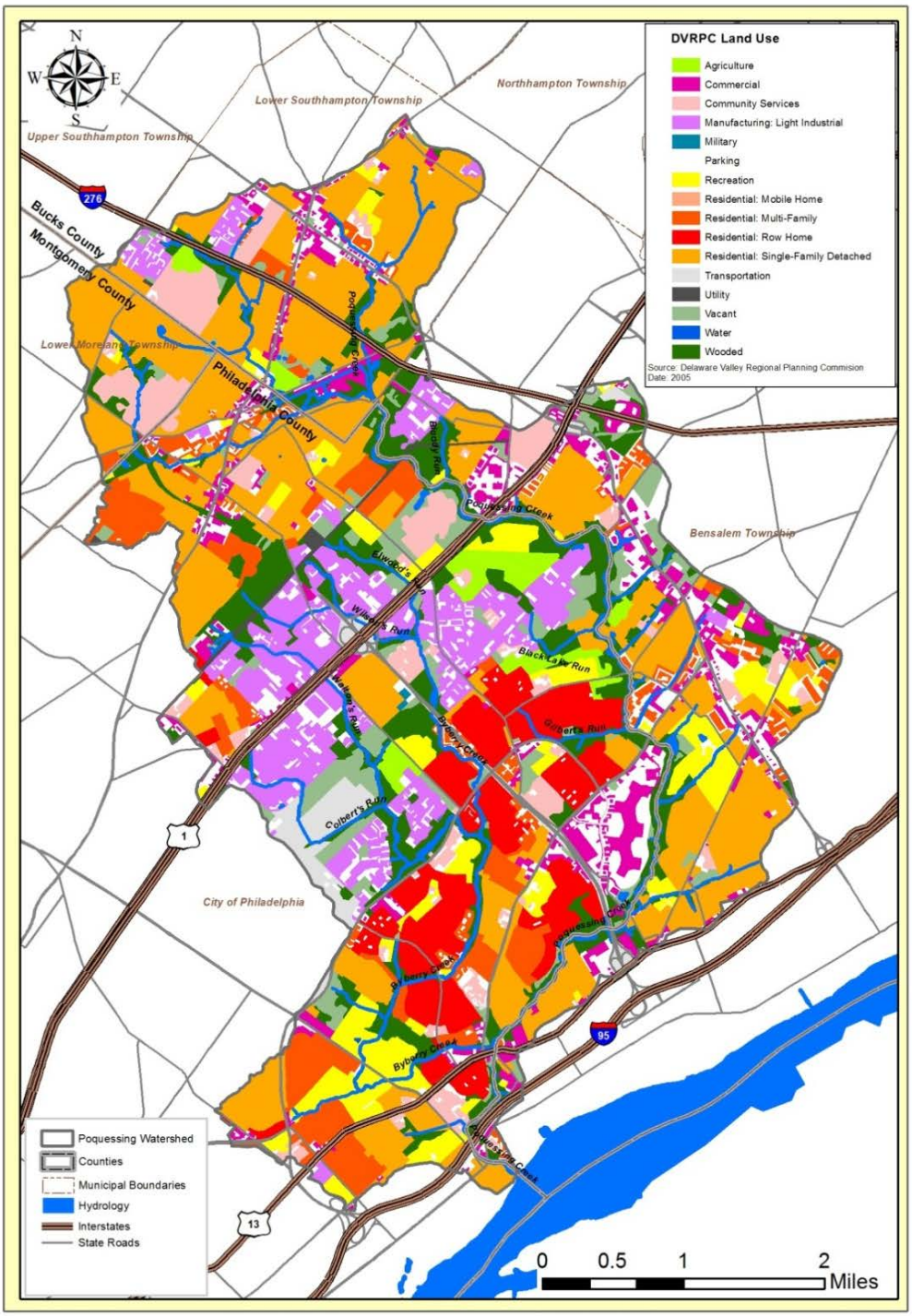
1.4 LAND USE

Land use information for the Poquessing Creek Watershed (Figure 1-4) was obtained from the Delaware Valley Regional Planning Commission (DVRPC, 2000). Over time, the Poquessing Creek watershed has experienced continual and extensive urban and suburban development. The drainage area is characterized by a mixture of various land uses, but residential development covers nearly half of the watershed with single-family detached residential making up the majority (26.83%) of that development (Table 1-3).

Several major arterial roads cross this watershed, including the Pennsylvania Turnpike (Interstate-276), Roosevelt Boulevard/Lincoln Highway (US Route 1), Woodhaven Road (State Route 63), and Bustleton Avenue/Bustleton Pike. Residential, commercial, and industrial development loosely follows these major transportation corridors. SEPTA regional railroad lines also have stops within the watershed.

A modest riparian corridor along Poquessing Creek and its tributaries has remained wooded land, mostly protected through long-term preservation efforts of the Fairmount Park Commission and Benjamin Rush State Park, but the Poquessing Creek Watershed generally has the smallest and narrowest riparian zone as preserved land among Philadelphia area watersheds. While there are a few large tracts of privately owned open space, such as recreational land and golf courses, most of the watershed has been developed.

Figure 1-4: Poquessing Creek Watershed Land Use



Source: DVRPC 2005 Land Use Data

Table 1-3: Land Use within the Poquessing Watershed

Land Use Category	Percentage
Agriculture	1.73
Commercial	5.76
Community Services	5.30
Manufacturing: Light Industrial	8.45
Military	0.03
Parking	8.26
Recreation	6.15
Residential: Mobile Home	0.01
Residential: Multi-Family	7.39
Residential: Row Home	7.30
Residential: Single-Family Detached	26.83
Transportation	4.60
Utility	0.43
Vacant	4.83
Water	0.43
Wooded	12.49

Source: DVRPC 2005 Land Use Data

1.5 GEOLOGY AND SOILS

Geology and soils play a significant role in the hydrology, water quality, and ecology of a watershed.

1.5.1 GEOLOGY

The northern portion of the Poquessing Creek Watershed is located within the Piedmont Upland Section of the Piedmont Physiographic Province, which is underlain primarily by metamorphic rocks called schists. The southern portion of the watershed is within the Lowland and Intermediate Upland Section of the Atlantic Coastal Plain Physiographic Province, which is underlain by unconsolidated to poorly consolidated sand and gravel deposits which rest on various metamorphic rocks (Pennsylvania Department of Conservation and Natural Resources, 2000). As one moves from the northern most point in the watershed through the physiographic regions, the topography changes to reflect the differences in the underlying geology. Most notable are the change from moderately rolling hills and valleys in the upper watershed to the very gently sloping coastal plain. A description of the geologic formations present throughout the Poquessing Creek Watershed is presented in Table 1-4.

Figure 1-5: Poquessing Creek Watershed Geology

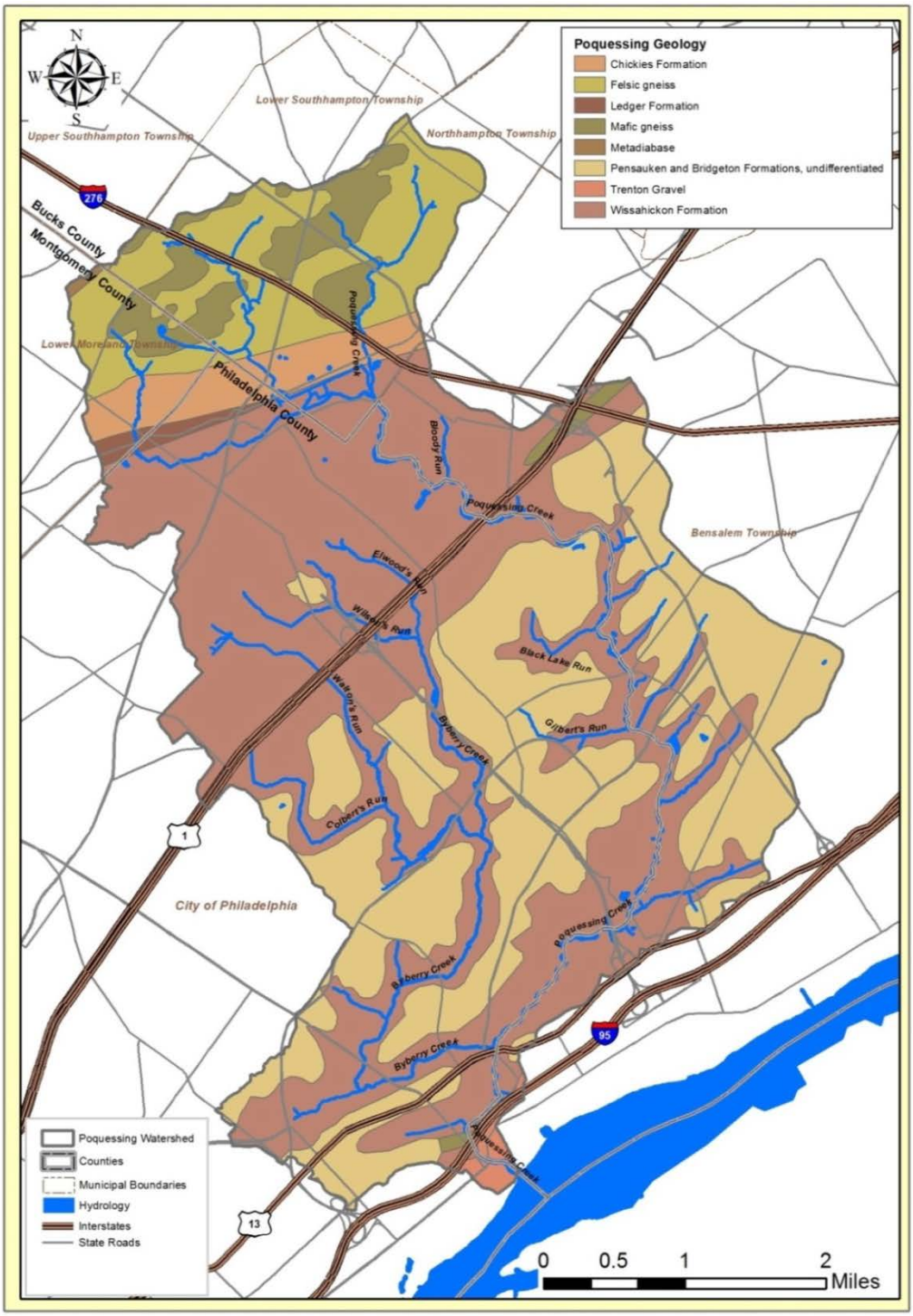


Table 1-4: Generalized Descriptions of Geologic Formations within the Poquessing Creek Watershed

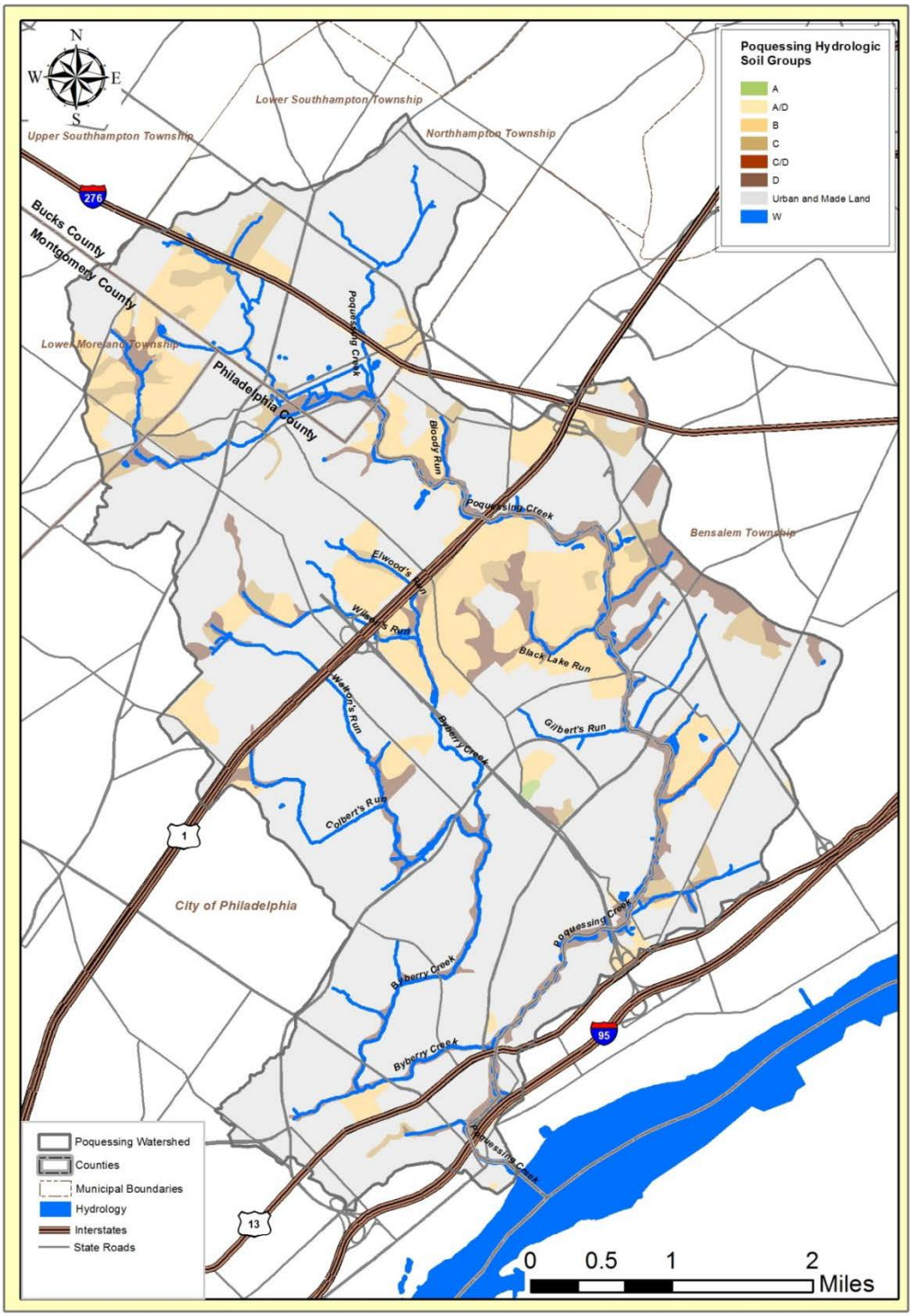
Formation	Description
Chickies Formation	This formation is created when sandstone is exposed to extreme heat and pressure. Composed of quartzite and quartz schist. This hard, dense rock weathers slowly. This formation has good surface drainage. A narrow band of quartzite extends westward across Bucks County from Morrisville. By virtue of its erosion-resistant nature it has formed a series of prominent ridges as seen along the Pennsylvania Turnpike in the eastern portion of the county.
Felsic Gneiss, Pyroxene Bearing	This formation consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage.
Ledger Dolomite	This formation consists of limestone valley that extends eastward from Lancaster County through Chester County, tapering off within Abington Township. The limestone and dolomite formations yield good trap rock and calcium-rich rock which has been quarried for various industrial and construction uses. Sinkholes can form in the limestone formation when water dissolves portions of the rock, resulting in underground cavities. Care must be taken in the development of buildings and the management of stormwater in these locations.
Mafic Gneiss	This formation consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz. It is highly resistant to weathering, but shows good surface drainage.
Metadiabase	Dark-gray, fine-grained intrusives; locally, mineralogy is altered and unit has greenish color.
Pennsauken Formation	This formation consists of sand and gravel yellow to dark reddish brown, mostly comprised of quartz, quartzite, and chert. It is a deeply weathered floodplain formation.
Trenton Gravel	Gray or pale reddish-brown, very gravelly sand interstratified with cross-bedded sand and clay-silt beds; includes areas of Holocene alluvium and swamp deposits.
Wissahickon Formation	This formation is composed of mica schist, gneiss and quartzite. The schists are softer rock and are highly weathered near the surface. This formation consists mostly of metamorphosed sedimentary rocks, but also includes rocks of igneous origin.

Source: U.S. Department of Agriculture, Natural Resource Conservation Service, 2005, and Poquessing Creek Watershed Rivers Conservation Plan, 2007

1.5.2 SOILS

Soils in the United States have been assigned to Hydrologic Soil Groups (HSG). The assigned groups are listed in Natural Resources Conservation Service (NRCS) Field Office Technical Guides, published soil surveys, and local, state, and national soil databases. The HSGs, as defined by NRCS engineers, are A, B, C, D, and dual groups A/D, B/D, and C/D. The HSG rating can be useful in assessing the ability of the soils in an area to recharge stormwater or to accept recharge of treated wastewater or to allow for effective use of septic systems. Figure 1-6 shows the hydrologic soil groups in the study area. The map indicates that most of the study area contains urban or made lands, with some areas shown as categories B, C, and D. This has implications for the design of stormwater infiltration systems, and also affects the amount of water that needs to be infiltrated in newly developed areas to maintain predevelopment or natural infiltration rates.

Figure 1-6: Poquessing Creek Watershed (NRCS) Soil Types



Soils in hydrologic group A have low runoff potential. These soils have a high rate of infiltration (Table 1-5) when saturated. The depth to any restrictive layer is greater than 100 cm (40 inches) and to a permanent water table is deeper than 150 cm (5 feet).

Table 1-5: NRCS Soil Group Characteristics

Hydrologic Soil Group	Average Infiltration Rates (inches/hour)
A	1.00 - 8.3
B	0.50 -1.00
C	0.17 - 0.27
D	0.02 - 0.10
Urban/Made Land	Widely varies

Source: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Field Indicators of Hydric Soils in the United States, Version 6.0.

Soils that have a moderate rate of infiltration (Table 1-5) when saturated are in hydrologic group B. Water movement through these soils is moderately rapid. The depth to any restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet).

Hydrologic group C soils have a slow rate of infiltration (Table 1-5) when saturated. Water movement through these soils is moderate or moderately slow; they generally have a restrictive layer that impedes the downward movement of water. The depth to the restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet).

Soils in hydrologic group D have a high runoff potential. These soils have a very slow infiltration rate (Table 1-5) when saturated. Water movement through the soil is slow or very slow. A restrictive layer of nearly impervious material may be within 50 cm (20 inches) of the soil surface and the depth to the permanent water table is shallower than 60 cm (2 feet). Dual Hydrologic Soil Groups (A/D, B/D, and C/D) are given for certain wet soils that could be adequately drained. The first letter applies to the drained and the second to the saturated condition. Soils are assigned to dual groups if the depth to a permanent water table is the sole criteria for assigning a soil to hydrologic group D.

Most soils in Poquessing Creek Watershed are categorized as urban and made land. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

2 METHODS

2.1 METHODS OVERVIEW

The individual stream networks assessed in this study were divided into one or several representative reaches, depending on the size and complexity of the stream network. One representative stream channel cross section, including local slope, was measured per reach. Measured field data was compiled to determine stream channel types for each reach and to help evaluate channel stability. Qualitative habitat data was compiled and used to determine habitat types adjacent to the stream channel. In addition, a full infrastructure assessment was conducted to survey all manholes, pipes, outfalls, culverts, channels, and bridges that were within the stream corridor. Both quantitative and qualitative datasets were evaluated for correlations between the natural and urbanized watersheds.

All of this data aided in the calculation of a reach-scale ranking metric which allowed for comparison between reaches and subwatersheds. Besides being used to make comparisons between reaches, the ranking scheme could also be used to prioritize restoration efforts and provide recommendations for each subwatershed.

Results of the assessments were grouped by subwatershed. These were defined in three ways. First, the areas that contain the mainstem of Poquessing Creek and Byberry Creek and the drainage areas that runs directly into the mainstem creeks without forming a base flow channel. Second, drainage areas that form direct tributaries to the mainstem creek were considered subwatersheds. However, the direct tributaries may have smaller tributaries that were not described in a separate section of this report but lumped into the direct tributary section. Third, all named tributaries were given a separate report section. For example since Colbert Run is named, it was described in a separate report section even though it is tributary to Walton's Run, which is a tributary to Byberry Creek.

2.2 CROSS SECTION LOCATION

Cross section locations were chosen according to multiple channel stability and geometry parameters that were representative of the entire reach. The appropriate location of a cross section in a channel exhibiting riffle/pool sequences is at the cross over reach (Rosgen, 1996). A cross over reach is a straight riffle section of channel between two meander bends. This riffle is used since it is a hydraulic control. Cross sections were placed in this location when the following criteria were satisfied:

- Presence of bankfull indicators, or active floodplain
- Representative of reach
- No debris or obstructions such as rock, logs, outfalls, or in-stream structures

Debris or obstructions such as rocks, logs, outfalls, or in-stream structures were avoided because they would influence bankfull indicators and yield a false bankfull width. In some cases, reaches were so strongly influenced, degraded and/or altered such that there were no crossover reaches or riffle sections. Criteria used to determine the cross section location in these situations consisted of:

- Representative of reach
- Presence of best bankfull indicators
- Least amount of debris, obstructions, and alterations
- Safe wading water levels

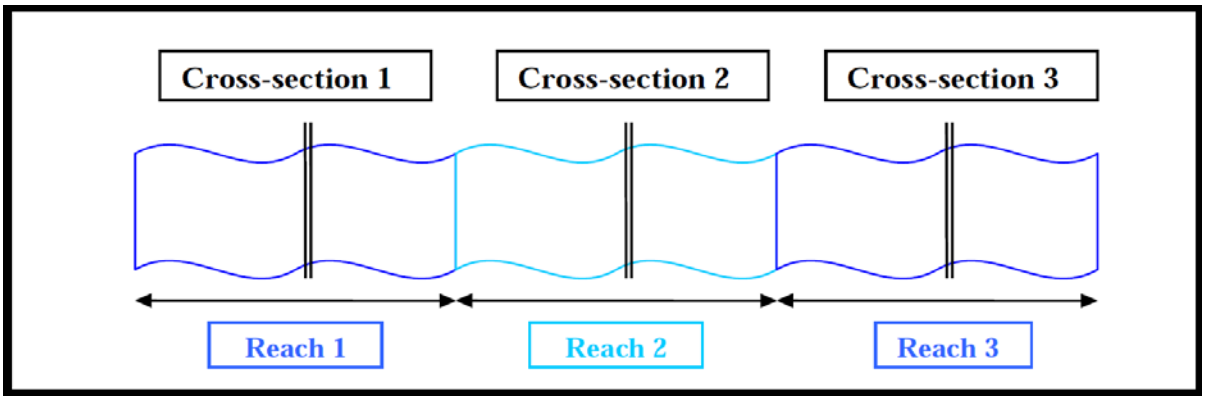
Cross section locations were demarcated on the downstream right and downstream left banks with 2' long, 1/2"-5/8" diameter rebar that was installed flush with the ground, when possible. At some sites where substrate consisted of large rocks, or tree roots or at sites where concrete debris was encountered, rebar could not be installed flush with the ground. After ensuring that the rebar could not be pulled out of the ground, the length of exposed rebar was noted on the data sheet. One inch yellow survey caps imprinted with the letters "PWD" were placed on each rebar as well as orange and black flagging. Flagging was also placed on the tree branch closest to the rebar to ensure that the rebar could be easily located upon subsequent field visits. The location (Northing, Easting, and Elevation) of each rebar was then surveyed using a Total Station (Topcon GT235) in Pennsylvania South State Plane Coordinates and City of Philadelphia Datum.

A second cross section survey was conducted approximately 5 years after the initial survey to determine channel erosion and/or deposition rates. Some rebars were found to be missing during the second cross section survey. In this case, rebars were reinstalled in approximately the same location utilizing GPS equipment. Also, several cross sections were no longer located at riffle locations during the second cross section survey. Therefore, the original cross section location was surveyed but a new cross section was established in the reach at a nearby, representative riffle location.

2.3 REACH SELECTION

The reaches within each subwatershed were defined after all of the cross sections had been completed. The distance between two cross sections was then split in half and the distance upstream and downstream of a single cross section was combined to form one single reach (Figure 2-1). There was minimal geomorphic significance for the reach delineation. The distance between cross sections averaged 1200 feet. Collecting channel cross section data at this increment ensured that all possible Rosgen channel types would be measured and that hydraulic and hydrologic models would be more reliable.

Figure 2-1: Diagram of Reach Delineation Procedure



2.4 STREAM SURVEY

The stream assessment consisted of field crews performing a field reconnaissance of the Poquessing Creek Watershed under protocols established by the Unified Stream Assessment Method (USAM) (Center for Watershed Protection, 2004). The Unified Stream Assessment is a tool used to quickly and systematically evaluate the physical conditions within stream corridors in urbanized streams and watersheds. These conditions include habitat quality, riparian condition, floodplain function as well as the potential for man-made structures and other anthropogenic factors to adversely impact stream corridor quality. Reach assessments were performed to get an overall picture of stream corridor conditions over defined reaches and to compare reach quality across the watershed. The Overall Stream Condition (Figure 2-2) form was used to characterize the average conditions present within a reach, such as bank stability and vegetative protection, instream and riparian habitat availability, and flood plain connectivity. Using this form, sites were given a standardized metric score (0-160) which allowed for comparison of total scores and individual component scores between assessed reaches.

Approximately 47 miles of stream channel were assessed on the mainstem of the Poquessing Creek, and the majority of its contributing tributaries. The field reconnaissance included walking the entire length of stream, choosing and marking cross section locations, while also making general observations of the surrounding watershed. All initial field observations and cross section locations were noted on datasheets and large scale field maps respectively. Field data was later transferred to Mecklenburg spreadsheets in order to calculate stream channel morphology and hydraulic parameters. The initial field reconnaissance was completed throughout the year of 2007. The follow-up reconnaissance was completed in the spring of 2012.

Figure 2-2: Overall Stream Condition Field Sheet (Source: Center for Watershed Protection, 2004)

OVERALL STREAM CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
OVERALL BUFFER AND FLOODPLAIN CONDITION				
	Optimal	**Suboptimal**	**Marginal**	**Poor**
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sub Total In-stream: _____ /80 + Buffer/Floodplain: _____ /80 = **Total** Survey Reach _____ /160				

2.5 MEASURED STREAM SURVEY AND CROSS SECTION PARAMETERS

Based on results of the stream assessment/field reconnaissance and following additional planning and base map preparation, the measured reach portion of the stream survey was completed. Measured reach stream surveys consisted of collecting data for channel morphology, disturbance, stability, and habitat parameters. Data for this analysis was based on results of stream surveys and field reconnaissance which were used to prepared watershed-scale base maps. Specific channel and habitat parameters included:

Channel Habitat
- Riparian Width
- Riparian Composition
- Canopy Cover
- Bed Materials
- Sediment Supply
- Sinuosity
- Woody Debris
- Substrate Attachment Sites

Channel Morphology
- Stream Bed Materials Sinuosity
- Sinuosity
- Water Surface Slope
- Bankfull Width
- Flood Prone Area Width
- Entrenchment Ratio
- Bankfull Cross-sectional Area
- Rosgen Stream Classification Type

Channel Disturbance
- Anthropogenic Channels
- Culverts
- Utilities (Manholes and Sewers)
- Fish Blockages
- Road, Railroad, Mass Transit Crossings

The measured reach stream survey also consisted of surveying channel cross sections at each location previously chosen during the field reconnaissance. Appendix A contains a summary of the results of the surveyed cross sections and local longitudinal profiles. Digital photographs were taken at every cross section location as a means of verification for field identified parameters. The photos consisted of an upstream view, a downstream view, views of the left and right banks, and views of the left and right floodplains (Appendix A). Cross section locations are shown in Figure 2-3. An example of the reach break locations (for the Byberry Creek Watershed) is shown on Figure 2-4.

Figure 2-3: Poquessing Creek Watershed Cross Section Locations

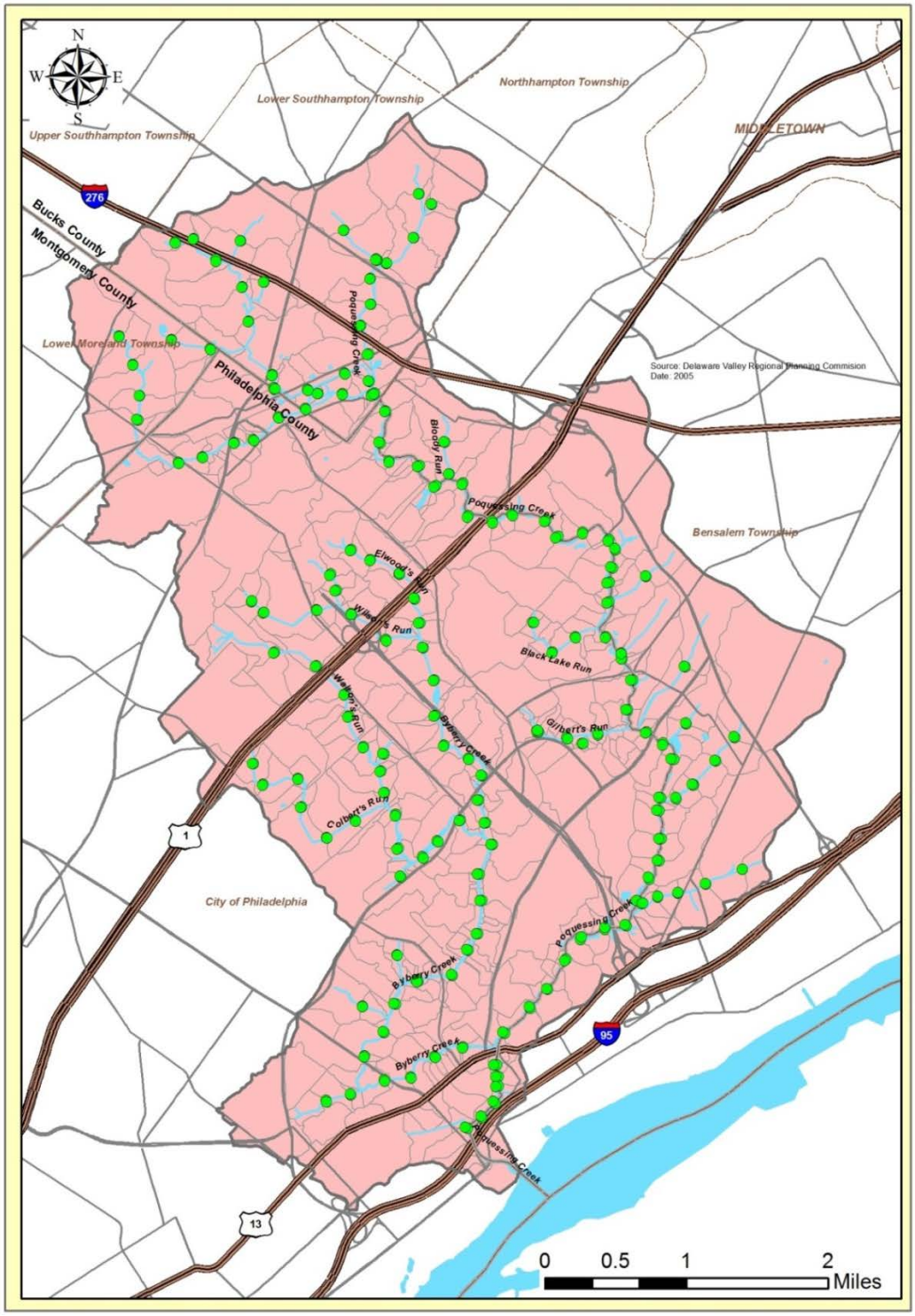
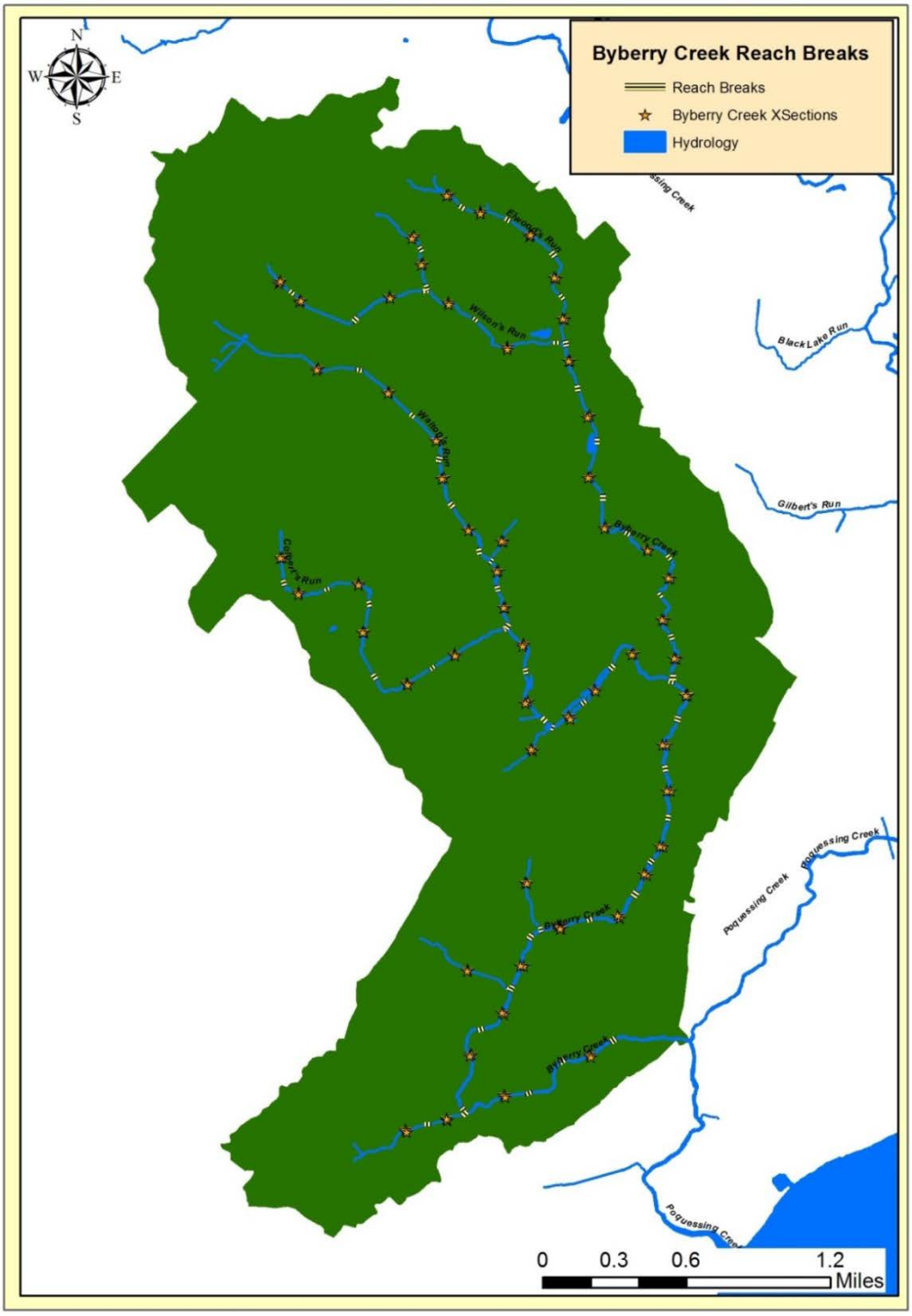


Figure 2-4: Byberry Creek Reach Breaks.



2.6 CROSS SECTION SURVEY PROTOCOL

Each stream cross section was measured in 2007 by extending a 100 foot measuring tape across the channel. Where possible, a measuring tape was extended a minimum of twice the bankfull width for each cross section and a maximum of the entire valley width according to the estimated flood prone width. A transit level was used to record survey rod readings from the downstream left bank across the channel to the end of the measuring tape on the downstream right bank. In 2012 the cross section survey information was collected with total stations and data collectors using the rebar coordinates collected following the 2007 survey. In cases where the rebars were lost or destroyed, new rebars were set using the coordinates from the original survey and GPS observations. Rod readings were taken at all significant channel features, or changes in channel features, such as the thalweg, bed materials, vegetation, slope, and flow lines including field identified bankfull. From the survey data, field data, and topographic base map, the following items were calculated:

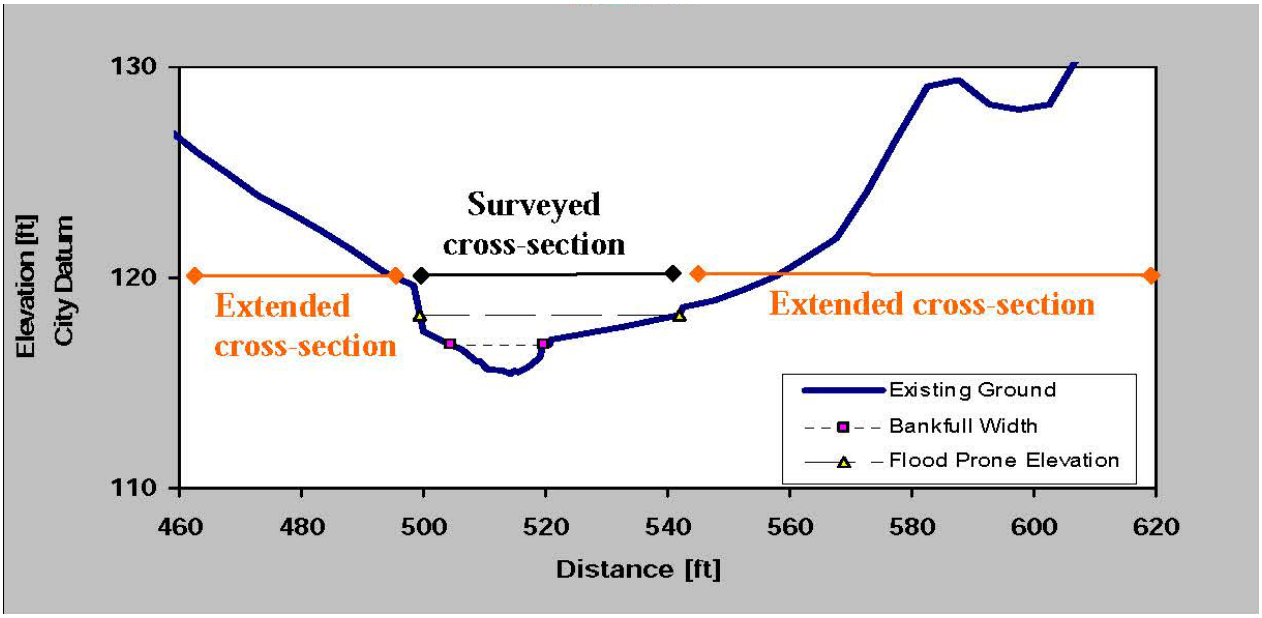
- Bankfull Area
- Width to Depth Ratio
- Entrenchment ratio
- Shear Stress
- Velocity
- Water Surface/Channel slope
- Sinuosity
- Median particle size (D50)
- Bankfull Discharge

2.6.1 EXTENDED CROSS SECTION PROCEDURE

Surveyed cross sections were positioned at the center of the stream corridor and cross sections were then extended by hand beyond the flood prone width to the valley wall, where the flood prone width was defined as the width flooded at a stage equal to twice the bankfull channel depth. Extended cross sections allowed for the estimation of entrenchment ratio (Equation 1). Lines were drawn from the last surveyed point on each side of the cross section perpendicular to 2-foot topographic contour line coverage (City of Philadelphia, Mayor's Office of Information Services, 2004). The extended cross sections were then plotted in excel and corrected if any obvious elevation discontinuities existed between the two data sets (Figure 2-5). Upstream cross sections are assumed to be representative of the stream channel geometry until the next downstream surveyed cross section.

$$\text{Entrenchment Ratio} = \frac{\text{Flood Prone Width}}{\text{Bankfull Width}} \qquad \text{(Equation1)}$$

Figure 2-5: Sample Extended Cross Section



2.7 LONGITUDINAL PROFILE SURVEY PROCEDURE

To estimate the local water surface slope at each cross section, the difference between the water surface elevation (WSEL) at the thalweg at the cross section immediately upstream and the water surface elevation at the thalweg at the cross section immediately downstream was divided by the stream distance measured between those two points as shown in Equation 2.

$$\text{Slope} = \frac{\text{(Upstream WSEL at Thalweg – Downstream Cross Section WSEL at Thalweg)}}{\text{Creek Distance}} \quad \text{(Equation 2)}$$

In instances where there was no cross section present either upstream or downstream from the reach of interest, Equation 3 was utilized.

$$\text{Slope} = \frac{\text{(Upstream Channel Elev. at Thalweg – Downstream Channel Elev. at Thalweg)}}{\text{Creek Distance}} \quad \text{(Equation 3)}$$

In instances where there was no cross section present both upstream and downstream from the reach of interest, an alternate procedure was implemented. A channel profile was completed at these cross section locations by remotely determining channel bed elevation upstream and downstream of the cross section, at varying distances depending on the total length of the reach. Channel bed elevations at these locations were determined from 2-foot topographic contour line coverage (City of Philadelphia, Mayor's Office of Information Services, 2004). The differences in these elevations were then divided by the channel distance between elevations measurements. These profile measurements were used as an estimate of bankfull slope and also for the calculation of a local slope for each cross section (Appendix A).

2.8 BANKFULL ELEVATION AND DISCHARGE CALIBRATION

In an ideal channel, bankfull elevation is at the top of the bank and is the point where the stream begins to overflow onto the floodplain. The bankfull discharge, defined by Manning's Equation (Equation 4), has the ability to transport sediment, alter a channel's morphology and eventually change the plan form of the channel. The bankfull stage has been defined in many ways, but the commonly accepted definition provided here (Dunne and Leopold, 1978) was used for this study:

> "The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels."

$$Q = \frac{1.49}{n} * R_h^{2/3} * S^{1/2} * A \qquad \text{(Equation 4)}$$

where:
Q = Discharge
R_h = hydraulic radius (cross sectional area (A)/ wetted perimeter)
S= slope
A=Bankfull Cross Sectional Area
n= Manning's Roughness coefficient

2.8.1 CALIBRATION OF BANKFULL DISCHARGE

Most regional curve studies to date have been conducted on streams in non-urban environments where bankfull indicators, such as the existence of terraces, fine sediment deposition, bank slope, and vegetation, are fairly easy to determine. The recurrence interval of a bankfull event is typically between 1 to 2 years; however, these events occur more frequently in urbanized streams due to altered (i.e. impervious) land cover patterns. As such, non-urban regional curves may not be directly applicable to urban systems. Several studies have been successful in creating regional curves that are fairly applicable to this region (e.g. Chaplin, 2005), although the predominance of impervious surfaces often precludes the use of regional curves in watersheds with greater than 20% imperviousness. As such, alternate methods must be used in urban, ungaged streams.

The bankfull discharge was calibrated using multiple methods: field cross section calculations, gage station data, regional drainage area to peak discharge curves, and bankfull regression equations. Regression equations were fit to drainage area versus peak discharge curves and those equations with the highest coefficients of determination (i.e. R^2) were generally considered the most reliable bankfull calibration estimate. All preliminary bankfull discharge values for respective calibration methods were compared and evaluated based on factors such as the reliability of bankfull indicators and strength of coefficients of determination in order to determine the most appropriate discharge.

Personnel identified bankfull elevations in the field at varied locations as part of the Poquessing Creek

Watershed FGM study in both 2007 and 2012. As a result of channel disequilibrium, bankfull indicators were not easily identified. Depositional features were the primary indicator used in the final determination of bankfull elevation. Bankfull discharge was estimated by solving Manning's equation for discharge given the estimated bankfull elevation and measurements of the local channel geometry, slope, and roughness. Channel roughness, represented by Manning's "n," was approximated using the results of the Limerinos equation (Equation 5)

$$n = \frac{1.49 * R_h^{2/3} * (S/100)^{1/2}}{F * u} \quad \text{(Equation 5)}$$

where:
n = Manning's roughness coefficient
R_h = hydraulic radius
S = slope
F= Friction factor
u= shear velocity

where:
$F= 2.83 + 5.7*\log(d/D84)$ (Equation 6)
d= mean depth
D_{84} = measured particle size where 84% of the particles are this size or smaller

Predicted discharges from the following studies were used for comparison and calibration of the Poquessing Creek Watershed bankfull discharges:

- U.S. Fish & Wildlife Service. "Maryland Stream Survey Bankfull Discharge and Channel Characteristics of Streams in the Piedmont Hydrologic Region." March 2002 (referred to as USFWS Maryland curve in this study)

- Gemmill, E. and Powell, R. "The Development of Regional Regression Curves from Rural and Urban Stream Reaches in the Piedmont of Maryland and Delaware." 2003. (referred to as Baltimore urban curve in this study, only urban curve numbers were used for this study)

- Chaplin, J. United States Geological Survey. "Development of Regional Curves Relating Bankfull-Channel Geometry and Discharge to Drainage Area for Streams in Pennsylvania and Selected Areas of Maryland." 2005. (referred to as the USGS Chaplin curve in this study)

- Preliminary results of Poquessing Creek Act 167 Plan hydrologic model developed by the Philadelphia Water Department in cooperation with NTM Engineering. Flows from the 1-year storm at locations throughout the watershed were used for comparison. (referred to as the Act 167 flows in this study)

- Tacony Creek 1.01-yr regression equation developed by PWD. Tacony Creek is the watershed south of Poquessing Creek in the City of Philadelphia. Watershed characteristics are very similar between the Poquessing Creek Watershed and the Tacony Creek Watershed. (referred to as the Tacony Creek regression equation in this this study)

The discharges predicted by these studies were compared against the flows associated with the field identified bankfull features in 2007 and 2012 and the gaged flows at the outlet of the Poquessing Watershed.

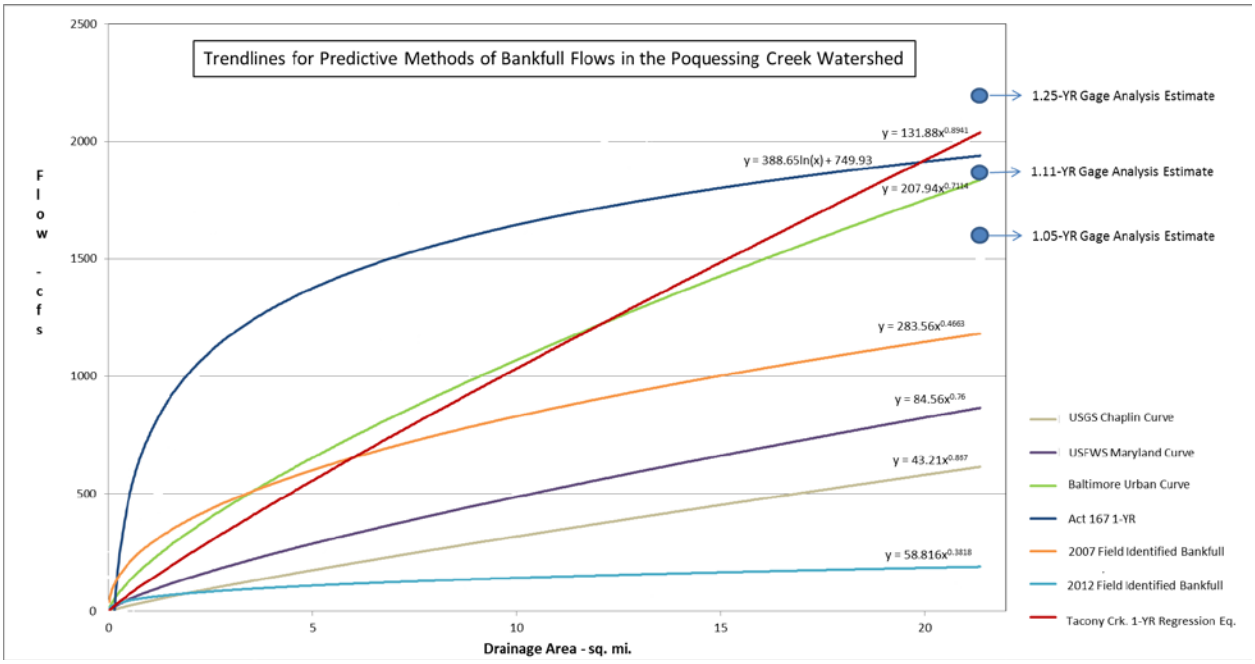
The USFWS Maryland curve, the USGS Chaplin curve, and the 2012 field identified bankfull features predicted significantly lower bankfull flows than the Baltimore urban curve, Act 167 flows, Tacony Creek regression equation, gage analysis, and 2007 field identified bankfull indicators. It was determined that regression equations associated with the USFWS Maryland curve and the USGS Chaplin curve were developed for less urban watersheds than the Poquessing Watershed. It was also determined that field staff were identifying inner berm features that developed due to the flashy flows in the watershed rather than bankfull features during the 2012 field study. Therefore, the USFWS Maryland curve, the USGS Chaplin curve, and the 2012 field identified bankfull features were not used for calibration.

The Act 167, 1-yr hydrologic model generally predicted higher flows for the smaller drainage areas in the watershed than the Baltimore Urban Curve and the Tacony Creek regression equation. Flows predicted by the Act 167 model also varied significantly and did not lend themselves to the development of a curve that could be used for bankfull calibration. Therefore, the Act 167 flows were not used for bankfull calibration.

2007 field identified bankfull features matched some of the bankfull flows predicted by the Baltimore urban curve and the Tacony regression equation. However, there was significant variability in flows predicted by the identified bankfull features and bankfull indicators were generally identified as inner channel features for cross sections located in the lower portions of the Poquessing and Byberry Creek Watersheds. As a result of channel disequilibrium, bankfull indicators were not easily identified which resulted in the variability. Because of this variability the 2007 were not used exclusively for bankfull calibration.

The Tacony Creek regression equation and the Baltimore urban curve were found to predict similar bankfull flows. Both equations were developed in watersheds that have similar characteristics to the Poquessing Creek Watershed. The flows predicted by these equations also provide an approximate match to the 1.1-year flood provided by the Poquessing Creek gage analysis. When the flows predicted by these equations are plotted on the cross section, they generally provide a match to a “top of bank” feature. For the above reasons, both the Tacony Creek regression equation and the Baltimore urban curve were found to be acceptable predictors of bankfull discharge in the Poquessing Creek Watershed. The Tacony Creek regression equation was used for final bankfull flow calibration since it was developed for the Tacony watershed, which has similar watershed characteristics as well as more data points as compared to watersheds that were used in the Baltimore urban curve study. The graph below shows the trend lines of flows predicted by the various methods described.

Figure 2-6: Trend Lines for Various Predictive Methods of Bankfull Flows in the Poquessing Creek Watershed



2.9 PEBBLE COUNT PROCEDURE

Pebble counts were conducted at approximately 80% of the reach cross sections in the watershed during the 2007 field studies using the Wolman Pebble Count procedure (Wolman, 1954). Intermediate axis lengths were then entered into Mecklenburg sheets to plot particle size frequency distributions used to extract D_{50} and D_{84} parameters for use in channel hydraulic calculations. For cross sections without pebble counts, the pebble count was interpolated based on pebble counts actually performed upstream, downstream, or both. During the 2012 survey, a visual estimation of particle size was conducted to verify that no significant changes had occurred.

2.10 BANK AND BED EROSION AND DEPOSITION CALCULATION

Bank and bed erosion and deposition was calculated by comparing the cross section survey data from 2007 and 2012. This comparison allows for the calculation of erosion and/or deposition rates for the left bank, right bank, and streambed.

To calculate the erosion rates based on the change in cross sectional area, the first step was to input the survey data into RIVERMorph. After all the survey data (Easting, Northing, and Elevation) has been entered, the RIVERMorph program was used to "cut" the cross sections. The cross sections are then formatted and the surveyed width is normalized so that when subsequent years of cross sections are overlain, they line up in a meaningful way.

Since the dual processes of stream bank degradation and stream bed aggradation are observed in urban streams, it was determined that breaking up left bank, right bank and stream bed into 3 separate erosion rate calculations would yield more informative data than simply comparing the changes in total cross sectional area. The parameters that served as the boundaries for each cell (left bank, right bank and stream bed) were the 2007 edge of water points. The distance along the tape from the left bank rebar to the left edge of water served as the boundary for the left bank for both the 2007 and 2012 cross sections. This was also applied respectively to the right bank. The stream bed cell was the remaining area between the 2007 edge of water points. The upper limit of all cells was determined by the 2007 bankfull discharge elevation.

Once the boundaries of the cells are created, values were obtained for the parameters that were entered into the bank erosion calculations (see below). The parameters for each cell were area, depth for the stream bank cells, and width for the stream bed cell. The values for the area of each cell were calculated by using the Stages feature in RIVERMorph. Once the cells are created using the tape (distance) values for the boundaries as described above, the values for area are calculated by RIVERMorph in 0.1 foot elevation intervals. The value that aligns with the bankfull elevation is used for area. The depth of the stream bank cells (cells 1 and 3) was determined by subtracting the 2007 elevation of the edge of water from the 2007 bankfull elevation. The width of the stream bed cell is the distance between to the two edge of water points.

The calculation used to determine the erosion rates based on the change in area of the three cells was the 2007 area, minus the 2012 area, divided by the 2007 maximum depth of the cell. This equation was structured so that a negative quotient would indicate that erosion was occurring. The resulting unit is feet. The following equation was used to calculate the erosion rates of the left and right bank cells.

Stream bank erosion calculation:

$$E_r = \frac{A_{07} - A_{12}}{D_{07}} \qquad \text{(Equation 7)}$$

Where:
E_r = the erosion rate in feet
A_{07} = the area of the cell from the 2007 survey
A_{12} = the area of the cell from the 2012 survey
D_{07} = the maximum depth of the cell based on the 2007 edge of water elevation

The equation for the stream bed (cell 2) is slightly different. Instead of the max depth of the cell being used as the divisor, it is replaced with the width of the cell. Like the maximum depth in the stream bank equation, the width is based on the 2007 EOW points. The equation is as follows:

Stream bed erosion calculation:

$$E_r = \frac{A_{07} - A_{12}}{W_{07}} \quad \text{(Equation 8)}$$

Where:
E_r = the erosion rate in feet
A_{07} = the area of the cell from the 2007 survey
A_{12} = the area of the cell from the 2012 survey
W_{07} = the width of the cell based on the 2007 edge of water

The final calculation quantified the erosion rates for the entire cross section and is based on the wetted perimeter value. To achieve this value, sum the total area of all three cells for 2007, subtract the sum of the area for the 2012 cells, and divide by the wetted perimeter measurement. The wetted perimeter is the length of stream bed that is in contact with water at the time of survey. The formula for this equation is as follows:

Entire cross section erosion calculation:

$$E_r = \frac{A_{07} - A_{12}}{WP_{07}} \quad \text{(Equation 9)}$$

Where:
E_r = the erosion rate in feet
A_{07} = the area of all cells from the 2007 survey
A_{12} = the area of all cells from the 2012 survey
WP_{07} = the wetted perimeter

The graphical representations of all erosion calculation results are included in Appendix A.

2.11 INFRASTRUCTURE TRACKDOWN

The infrastructure trackdown was conducted by walking the entire length of the stream and taking note of the infrastructure encountered along the way. Data was collected on outfalls, bridges, manholes, culverts, pipes, dams, and channels. The amount and type of information collected for each point of infrastructure varied depending on type. Basic information included the date on which the data was collected, the names of crew members, and the weather conditions.

For each infrastructure point identified and mapped, photos were taken and documented, along with

important notes which included the GPS point number, approximate dimensions, location, and any other miscellaneous characteristics. Photographs of each infrastructure point can be found in Appendix B. Maps with the location of Poquessing Creek infrastructure locations can be found in Appendix C. The naming convention used to describe infrastructure elements used the following format: PQ to denote "Poquessing"; a three letter descriptor indicting the type of infrastructure element being described (i.e. "out" for outfall, "bri" for bridge' or "cha" for a channelized segment); and a unique numerical identifier. For example, outfall 100 would be called "PQout100."

2.11.1 OUTFALLS

An outfall was defined as the end of a pipe which releases either stormwater, combined sewage, or an encapsulated creek into the waterway (Figure 2-9). Data was collected on outfalls larger than 12 inches. The data collected for each outfall included the dimension or pipe diameter, the construction material (i.e. metal, concrete, terra cotta, etc.), structural condition (i.e. good, fair, or poor), presence of, and quality of dry weather flow, and bank location (right or left).

Figure 2-7: Example of an outfall point assessed in infrastructure trackdown

2.11.2 BRIDGES

A bridge was defined as a structure that spanned a stream over which a road or walkway passes (Figure 2-10). Bridges mapped in this report are shown as one point at the center of the bridge along the creek. The data collected for each bridge included the approximate height, width and depth (or length) of the bridge opening and structural condition (i.e. good, fair, or poor).

Figure 2-8: Examples of bridges assessed in infrastructure trackdown

2.11.3 MANHOLES

A manhole was defined as the covered opening that allows access to an existing utility (Figure 2-11). Data was collected for manholes either located within the creek or in close proximity to the stream banks. The data collected for each manhole included the construction material (i.e. concrete or terra cotta), the height of the portion of manhole exposed above the ground or water surface, and bank location (left or right).

Figure 2-9: Examples of manholes assessed in infrastructure trackdown.

2.11.4 CULVERTS

A culvert was defined as a conduit which carried the stream under a roadway, sidewalk, building, or miscellaneous structure (Figure 2-12). Culverts were mapped by taking GPS coordinates at the start and end of the culvert with photos taken at each point. The data collected for each culvert included the approximate dimensions, construction material (e.g. stone, concrete, brick, etc.), and structural condition

(i.e. good, fair, or poor).

Figure 2-10: Examples of culverts assessed in infrastructure trackdown.

2.11.5 DAMS

A dam was defined as an obstruction that impounded stream flow (Figure 2-13). Data was only collected for manmade dams and did not include natural debris jams caused by coarse woody debris (CWD). The data collected for each dam included the approximate dimension, structural condition (good, fair, or poor), and height exposed above the stream bed.

Figure 2-11: Examples of dams assessed in infrastructure trackdown.

2.11.6 CHANNELS (armored or altered)

A channel was defined as a straightening and reinforcement of stream bed and/or banks with manmade materials such as concrete (Figure 2-14). Channels were located on one or both banks, as well as on the

bottom of the stream bed. Each channel was mapped by taking GPS coordinates at the start and end of the channel with photos taken at each point. The data collected for each channel included approximate dimensions, structural condition (good, fair, or poor), the portion of stream that was channelized (i.e. left bank, right bank or bottom), and construction material (stone or concrete).

Figure 2-12: Examples of channels assessed in infrastructure trackdown.

2.11.7 PIPES

A pipe was defined as a conduit for carrying a utility across the stream (Figure 2-16). The data collected for each pipe included the approximate diameter, construction material (i.e. concrete, metal, terra cotta, etc.), the length and height above the water or ground surface of the exposed portion, structural condition (i.e. good, fair, or poor), and bank location (i.e. left, right or across the creek).

Figure 2-13: Example of a pipe assessed in infrastructure trackdown.

2.11.8 MISCELLANEOUS

Miscellaneous infrastructure consists of structures not falling within the previously listed categories (Figure 2-17). For example, storm sewer inlets and grates make up the majority of this category. Descriptions of the miscellaneous infrastructure were collected.

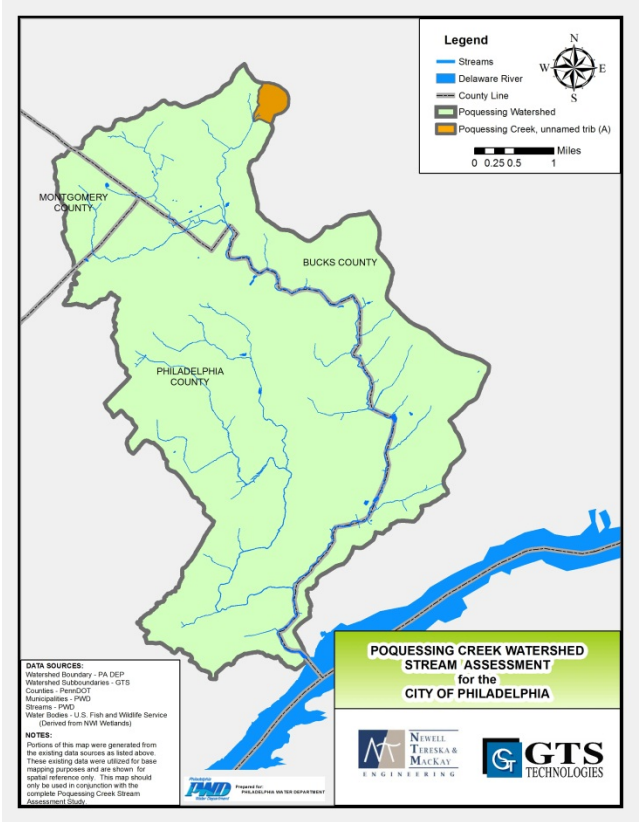
Figure 2-14: Example of a miscellaneous item (i.e. an inlet or sewer grate

3. WATERSHED ASSESSMENTS

3.1 POQUESSING CREEK TRIBUTARY WATERSHEDS

Poquessing Creek Tributaries are defined as direct tributaries to the mainstem of Poquessing Creek. The watershed characteristics of each direct tributary are described in the following section. Small Tributaries to the Poquessing Creek were defined as those having only one cross section and representative reach. In the subsequent section, "Small Tributary Average" refers to the average USAM score of the respective metric.

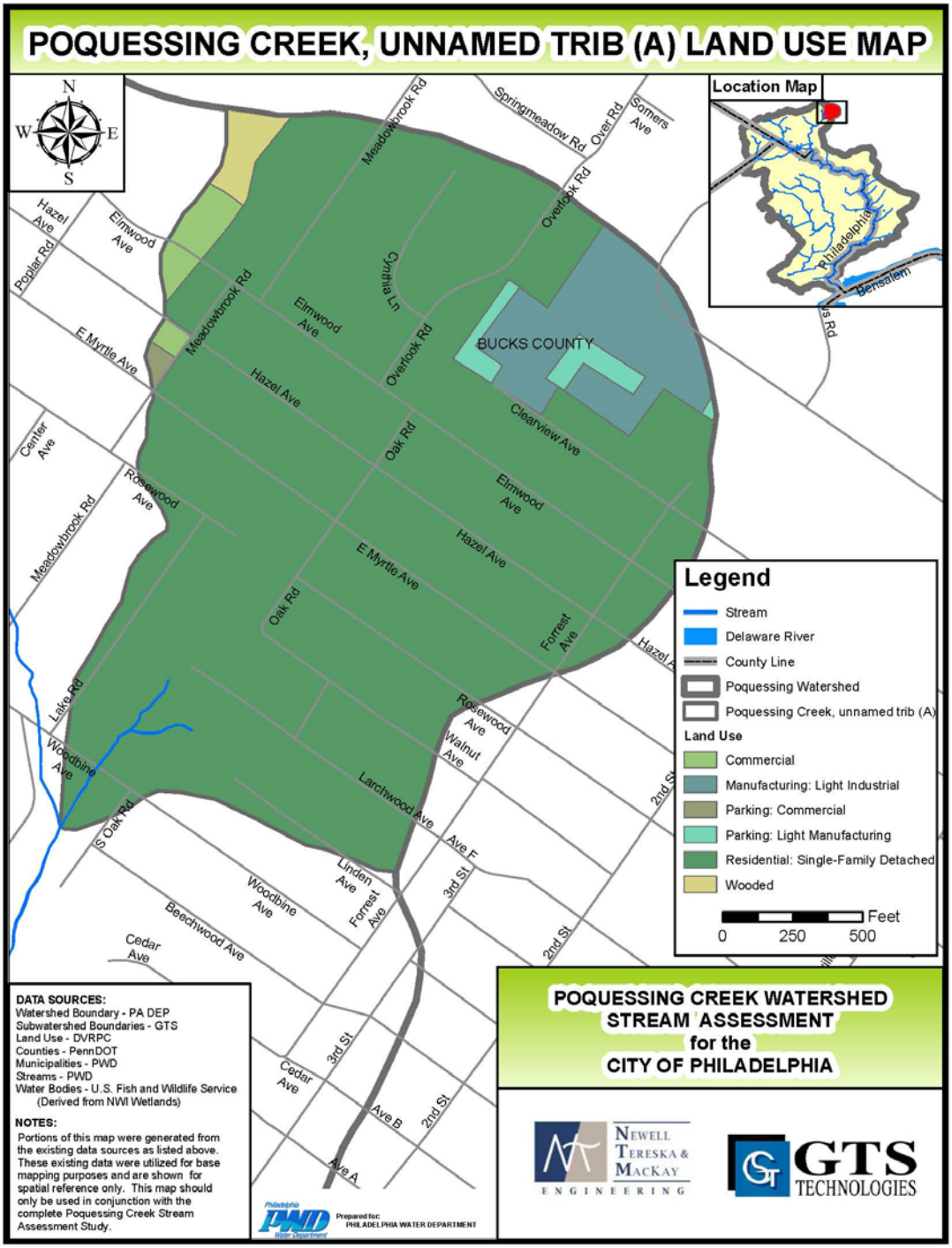
3.1.1 POQUESSING CREEK UNNAMED TRIBUTARY A WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary A is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary A originates from a stormwater outfall in a primarily residential area near Larchwood Avenue. Poquessing Creek Unnamed Tributary A is a second-order tributary that flows for approximately 500 feet before reaching the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary A Watershed is 96.6 acres. Major land use types within the watershed are residential: single-family detached (88%) and manufacturing: light industrial (8%). Poquessing Creek Unnamed Tributary A is surrounded by residential land on both sides.

Figure 3-1: Poquessing Creek, Unnamed Tributary A Watershed Land Use



3.1.1.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary A Watershed is underlain by the Felsic Gneiss formation. This formation consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage.

3.1.1.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Poquessing Creek Unnamed Tributary A Watershed are classified as hydrologic group Urban and made land. This soil classification is soil that has been altered from its native state and cleared for homes, farms, and businesses. Urban soil infiltration characteristics vary widely throughout this classification.

Table 3-1: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary A Watershed

Group	Area (acres)	Percent of Total Area
Urban	96.6	100%
Total Area	96.6	100%

Figure 3-2: Geology of Poquessing Creek, Unnamed Tributary A Watershed

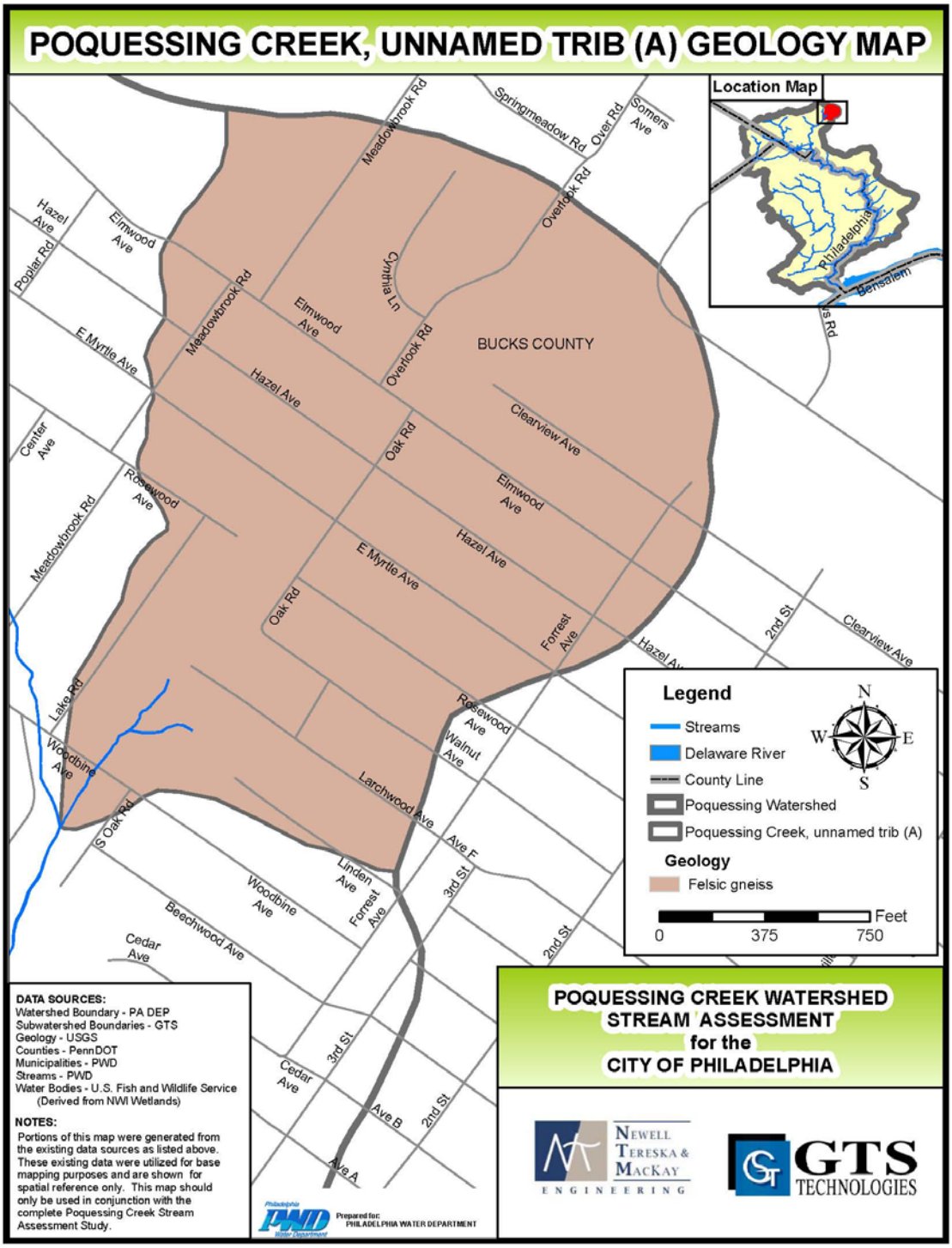
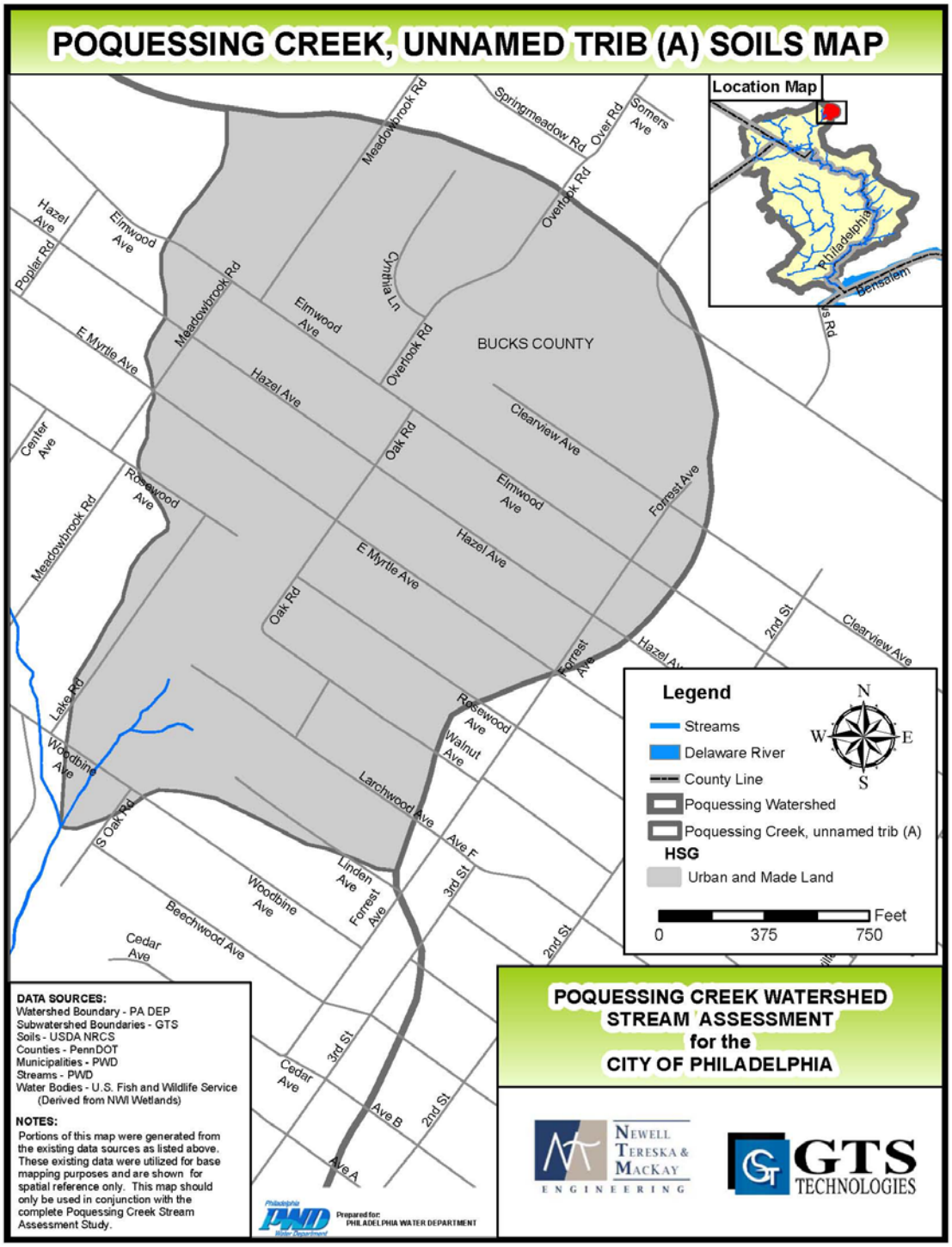


Figure 3-3: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary A Watershed



3.1.1.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary A (Table 3-2). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary A was less than the average for all Poquessing Creek subwatersheds (Table 3-3). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-2: Erosion Rates for Poquessing Creek Unnamed Tributary A Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSA02	1.360	-0.137	-1.288	-0.088	-0.018	E

Table 3-3: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.1.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary A is a small tributary the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek, Unnamed Tributary A lies in a mainly residential area with a very small wooded buffer in some areas along the tributary. The reach extends approximately 500 feet from headwaters to confluence with the Poquessing Creek and infrastructure is distributed consistently along the reach. One cross section is found along this reach (PQMSA02). This cross section is located between Larchwood and Woodbine Avenues. Infrastructure is found in the forms of 2 outfalls, 2 channels, 1 culvert and other (3 sewer grates). All infrastructure is identified as being in good condition along the reach. Both stormwater outfalls are made of corrugated metal and are identified as being in good condition. The channels are identified as being in good condition. One portion of channel (PQchan016) is constructed of stone material at a height of 4 feet and a length of 256 feet. The other portion of channel (PQchan017) is constructed of unidentified material at a height of 4 feet and a length of 72 feet. The identified culvert (PQcul005) is a 5ft by 4 ft. corrugated metal pipe with a length of 23 feet. Two of the sewer grates are located at the upstream end of the reach. The other sewer grate is located approximately 200 feet upstream of the confluence with Poquessing Creek. Please refer to Appendix C for Infrastructure Reach Maps. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-4: Summary of Poquessing Creek, Unnamed Tributary A Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSA02	1	0	2	2	0	0	0	3	8

3.1.1.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream section of the Poquessing Creek, Unnamed Tributary A stream channel is a second-order, single thread channel with one small unnamed tributary. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-4: Results for Poquessing Creek, Unnamed Tributary (A) Watershed USAM Components

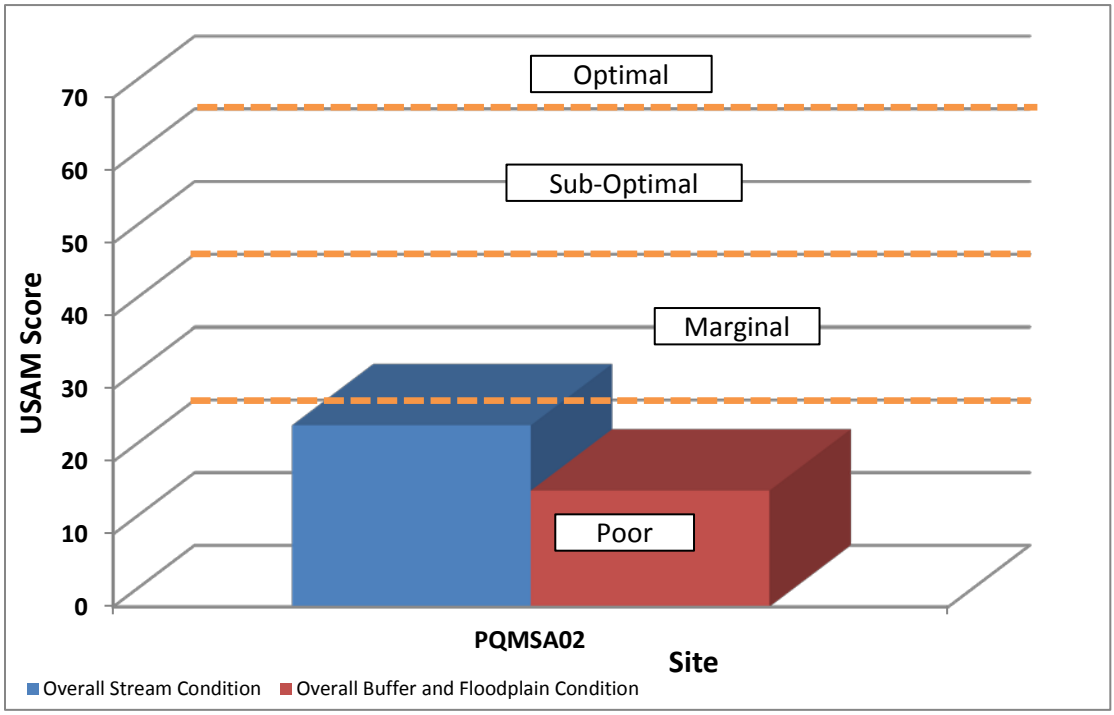
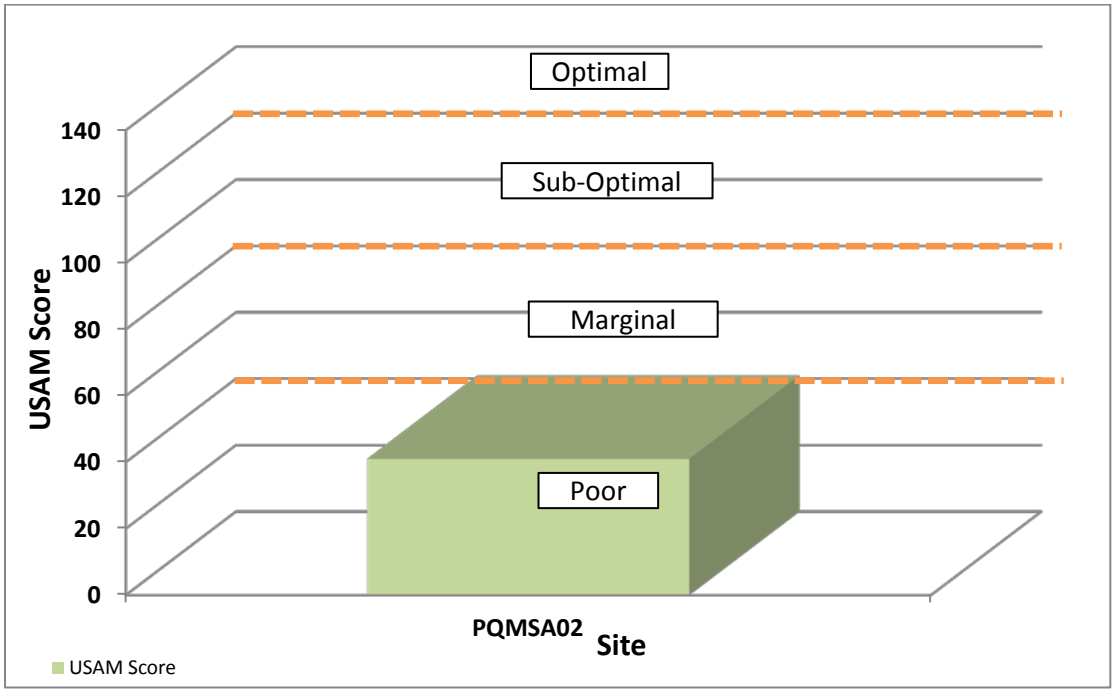


Figure 3-5: Poquessing Creek, Unnamed Tributary A Watershed USAM Results



3.1.1.5.1 PQMSA02

Reach PQMSA02 is the entire length of Poquessing Creek, Unnamed Tributary A. The headwaters of this tributary begin at a stormwater outfall in a residential neighborhood near Larchwood Avenue. Reach PQMSA02 is characterized by a moderate slope (2.0%), low width to depth ratio (11.6), a moderately entrenched channel (ER = 2.0), low sinuosity (1.03), and gravel substrate. The reach was classified as a B4a type stream. The composite USAM score for reach PQMSA02 was marginal (41/160).

3.1.1.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary A: PQMSA02. The score for the Overall Stream Condition components as well as the composite USAM score were classified as marginal. The score for the Overall Buffer and Floodplain Condition was rated as poor. Average conditions within the Poquessing Creek, Unnamed Tributary A Watershed's stream channels were slightly better than conditions observed within the buffers and floodplains. The Small Tributary average for the Overall Stream Condition component, Overall Buffer and Floodplain Condition, as well as the composite USAM were higher than the respective values for reach PQMSA02. The scores for individual parameters only reached the poor to marginal levels. Graphs of each USAM category rating are in Appendix D.

Table 3-5: USAM Results for Poquessing Creek, Unnamed Tributary A Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSA02	PQ, Unnamed. Tributary A	25	16	41
Small Tributary Average		30.6	33.1	63.8

3.1.1.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY A WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were poor to marginal. The Small Tributary average score (30.6/80) was rated as marginal, just slightly higher than the rating for the unnamed tributary rating (25.0/80), also marginal.

Table 3-6: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary A Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQMSA02	PQ, Unnamed. Tributary A	5	3	2	2	3	10	25
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.1.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary A Watershed was rated as poor (5.0/20), indicating less than 20% stable habitat due to lacking or unstable substrate. The Small Tributary average was rated slightly higher at 5.6/20, deserving a rating of marginal. While only a slight difference, a marginal rating reflects 20-40% mix of stable habitat with the substrate whether frequently disturbed or removed. The channel was highly eroded and sediment choked throughout this reach.

3.1.1.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSA02 had poor vegetative protection which indicates less than 50% of the streambanks are covered by vegetation and the area appeared very disturbed. The Small Tributary average was rated marginal (4.0/10) for both the left and right banks. The poor scores for this parameter are attributed to the lack of stabilizing vegetation on both banks.

3.1.1.6.1.3 BANK EROSION

Reach PQMSA02 had a score of poor (2.0/10) for the left bank in the bank erosion category and a score of moderate for the right bank (3.0/10). A rating of marginal indicates active stream widening and erosion at a moderate rate and a poor rating indicates active downcutting with tall banks and significant sediment contributed to the stream. The Small Tributary average for the left and right banks rated as marginal (4.0/10 and 4.3/10, respectively).

3.1.1.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary A Watershed was marginal with reach PQMSA02 receiving a rating of 10/20. A marginal rating indicates high flows not able to enter the floodplain and deep stream entrenchment. The Small Tributary average was slightly less than that for PQMSA02, with a rating of 8.8/20, also rating as marginal.

3.1.1.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY A RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were all poor to marginal. The Overall Buffer and Floodplain Condition score for PQMSA02 (16.0/80) was much lower than that for the Small Tributary average (33.1/80). The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being the adjacent residential development.

Table 3-7: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary A Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSA02	PQ, Unnamed Tributary A	3	2	4	2	5	16
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.1.6.2.1 VEGETATED BUFFER WIDTH

The width of the left bank vegetated buffer was rated as marginal (3.0/10), reflecting a buffer zone of 10-25 feet and significant human impact. The width of the vegetated buffer zone of the right bank of reach PQMSA02 was rated as poor (2.0/10), indicated a buffer zone width of less than 10 feet and no riparian vegetation as a result of human activity. The Small Tributary average was rated as marginal for both the left and right banks (4.3/10 and 4.5/10, respectively).

3.1.1.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQMSA02 was turf, with a poor score of 4.0/20. The Small Tributary average rating was marginal (9.1/20), reflecting a predominant vegetation type of scrub/shrub.

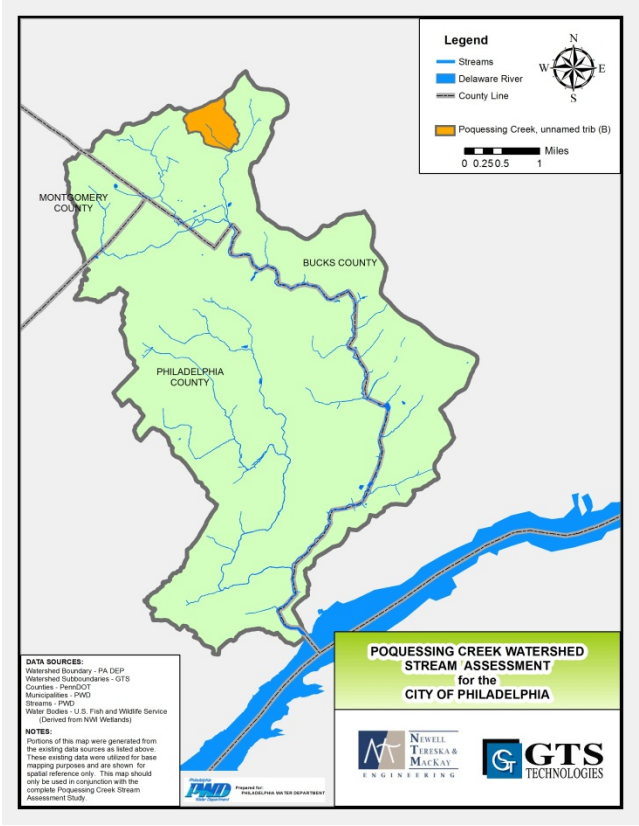
3.1.1.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated poor (2.0/20) for the reach PQMSA02, indicating either all wetland or non-wetland habitat and no evidence of standing or ponded water. The Small Tributary average was rated as marginal (6.5/20), also indicated either all wetland or non-wetland habitat but with the presence of standing or ponded water.

3.1.1.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSA02 was poor (5.0/20) indicating significant floodplain encroachment with resulting significant effect on floodplain function. The Small Tributary average was rated as marginal (8.8/20), showing only moderate floodplain encroachment.

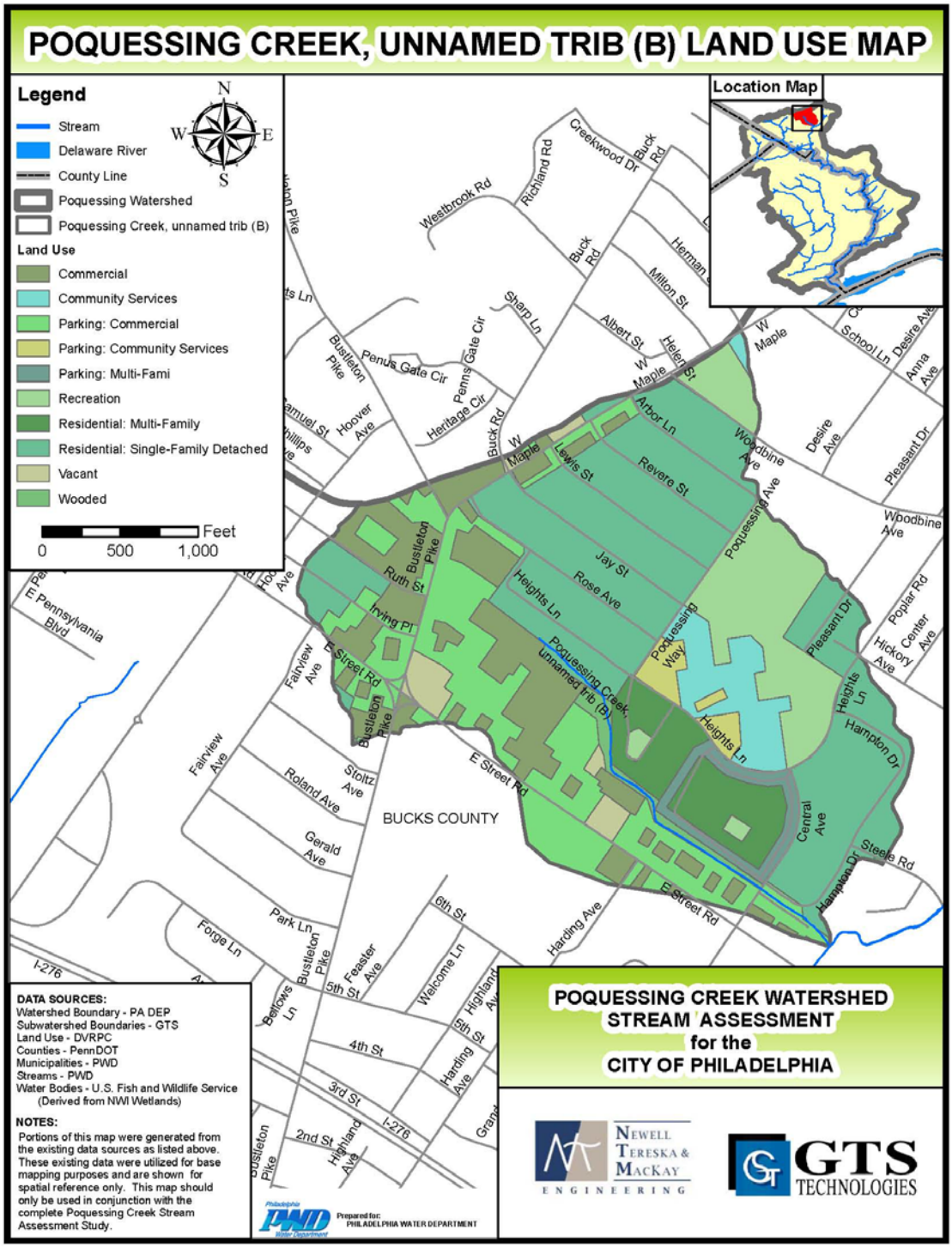
3.1.2 POQUESSING CREEK UNNAMED TRIBUTARY B WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary B is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary B originates from stormwater outfalls from surrounding parking areas and residential development. Poquessing Creek Unnamed Tributary B is a first-order tributary for approximately 3000 feet until meeting the confluence with the Poquessing Creek mainstem. The dominant substrate is identified as gravel. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary B Watershed is 198 acres. Major land use types within the watershed include: residential: single family detached (38%) and parking: commercial (18%). Poquessing Creek Unnamed Tributary B is surrounded by a very small buffer of wooded land on both sides. The reach is heavily surrounded by commercial parking and residential development outside of the small wooded buffer. The wooded buffer ranges from about 25 feet to about 100 feet wide.

Figure 3-6: Poquessing Creek, Unnamed Tributary B Land Use



3.1.2.1 GEOLOGY

The Poquessing Creek Unnamed Tributary B Watershed is underlain by the Felsic Gneiss and Mafic Gneiss Formations. The Felsic Gneiss Formation consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage. The Mafic Gneiss Formation consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz. It is highly resistant to weathering, but shows good surface drainage.

3.1.2.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Poquessing Creek Unnamed Tributary B Watershed are classified as Urban. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-8: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary B Watershed

Group	Area (acres)	Percent of Total Area
Urban	198.5	100%
Total Area	198.5	100%

Figure 3-7: Geology of Poquessing Creek, Unnamed Tributary B Watershed

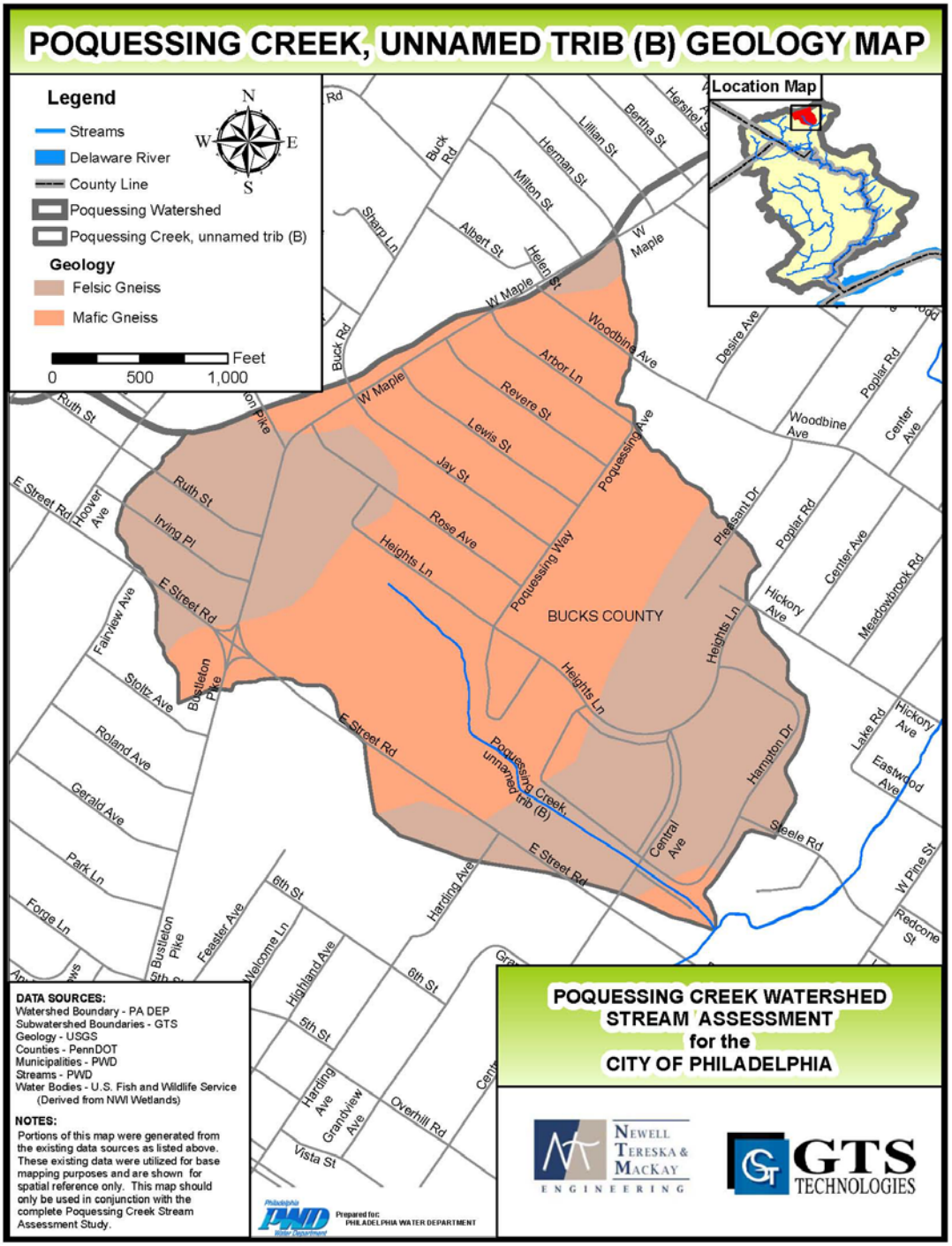
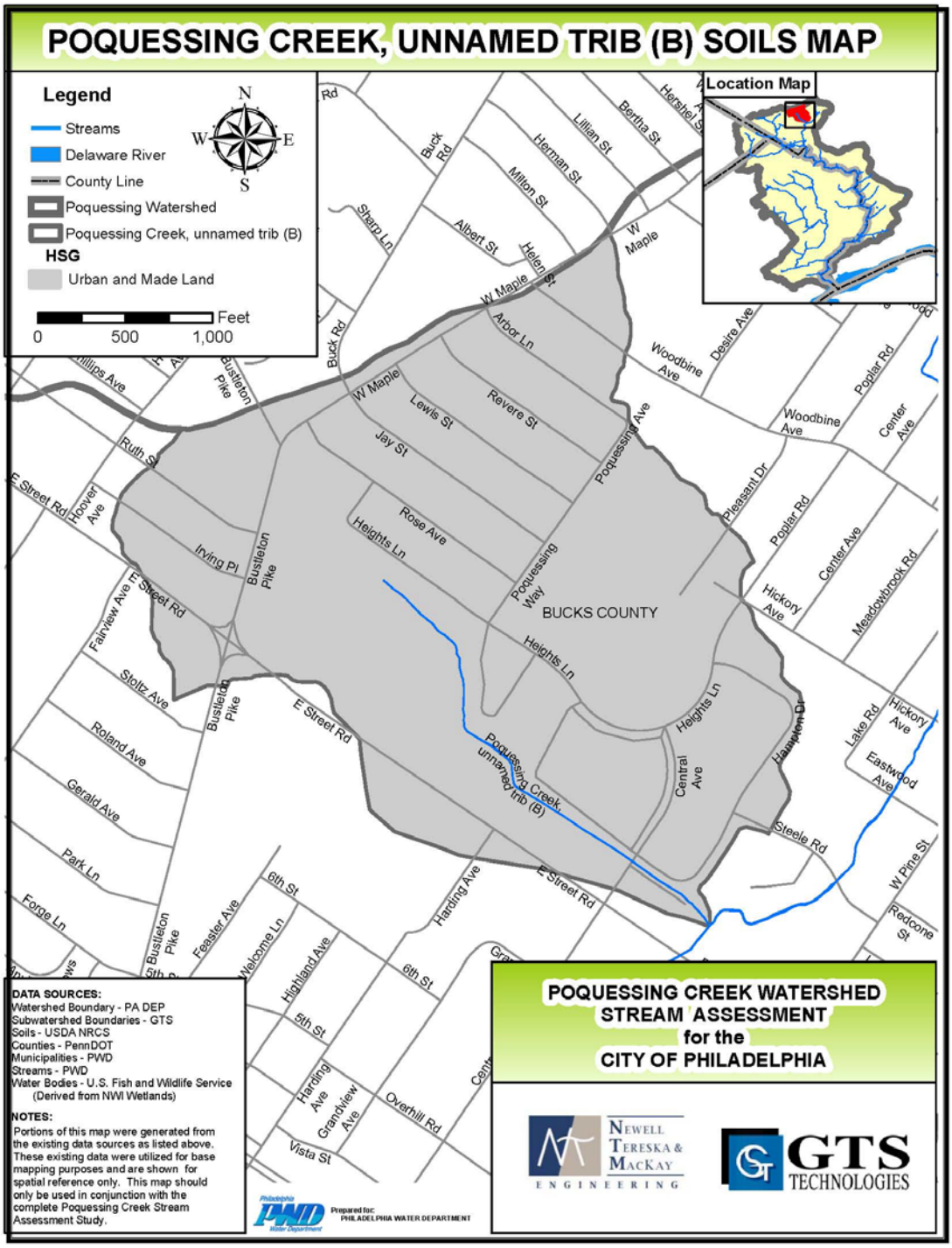


Figure 3-8: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary B Watershed



3.1.2.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for two reaches in Poquessing Creek, Unnamed Tributary B (Table 3-9). These reaches were found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reaches in Poquessing Creek, Unnamed Tributary B was greater than twice the average for all Poquessing Creek subwatersheds (Table 3-10). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-9: Erosion Rates for Poquessing Creek Unnamed Tributary B Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSB02	-1.067	-0.504	-0.935	-0.525	-0.105	E
PQMSB04	-0.495	-0.326	-0.682	-0.320	-0.064	E
Average	-0.781	-0.415	-0.808	-0.423	-0.085	E

Table 3-10: Erosion Rate Comparison for All Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.2.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary B is a tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary B are located in a small wooded area that is fed by stormwater from adjacent commercial and residential development. The entirety of the reach is surrounded by a narrow wooded buffer with dense commercial parking and residential development on each side of the buffer. The entire reach of Poquessing Creek Unnamed Tributary B exhibits some of the impairments associated with urban streams given its location and proximity to commercial and residential development. Infrastructure is consistently dispersed throughout the reach. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.8 to 3.0 feet in diameter. The number of headwater outfalls (Table 3-8) on this stream indicates that it is heavily influenced by stormwater discharges along the entire reach.

There is one culvert along Poquessing Creek Unnamed Tributary B (PQcul009) that conveys the stream under Central Avenue and is described as being in good condition. Along Poquessing Creek Unnamed Tributary B, most infrastructure elements were considered in good condition or better. There is one culvert along Poquessing Creek Unnamed Tributary B (PQcul009) that conveys the stream under Central Avenue and is described as being in good condition. Thirteen out of the fourteen outfalls were described as being in good overall condition. Two outfalls (PQout 013 and PQout019) located along the reach are identified as being in fair condition. One 4 feet corrugated metal Sewer Pipe (PQpip002), identified as being in fair condition, has an exposed length of 42 ft. and is located at section PQMSB02. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-11: Summary of Poquessing Creek Unnamed Tributary B Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSB02	0	0	6	1	1	2	0	0	10
PQMSB04	1	0	8	1	0	0	0	0	10
TOTAL	1	0	14	2	1	2	0	0	20

Figure 3-9: Results for Poquessing Creek, Unnamed Tributary B Watershed USAM Components

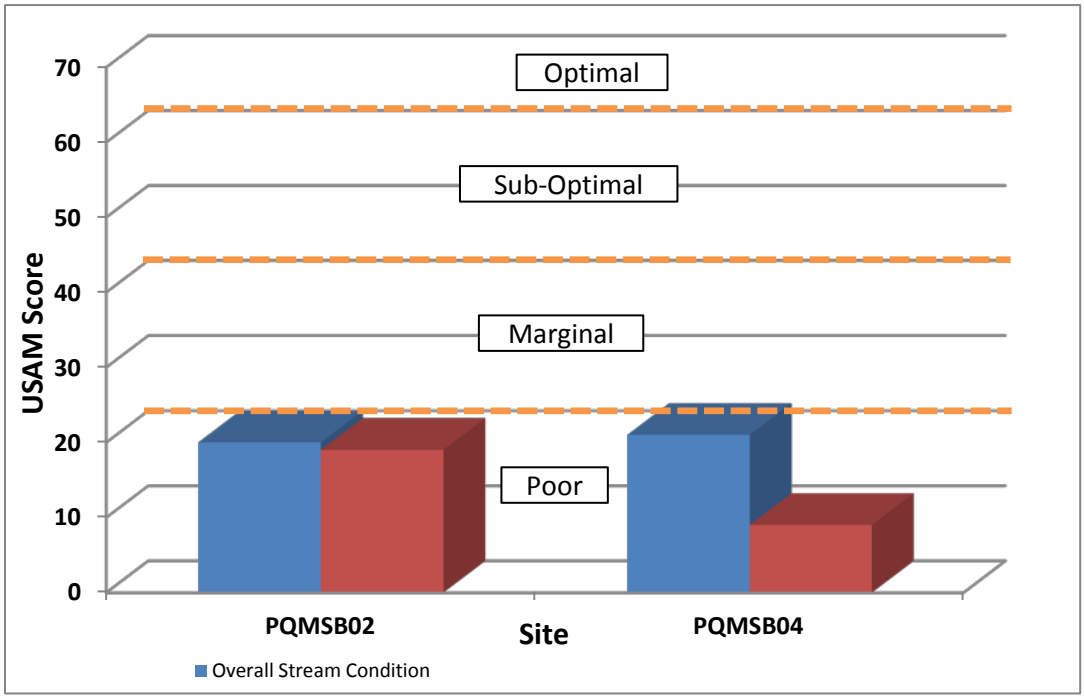
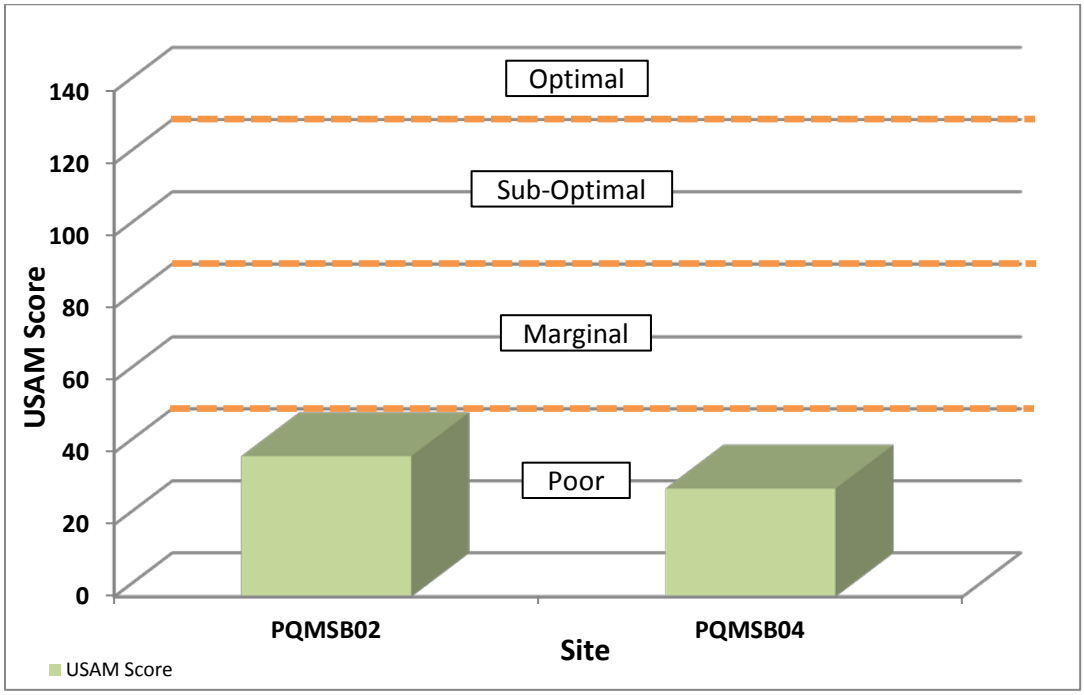


Figure 3-10: Poquessing Creek, Unnamed Tributary B Watershed USAM Results



3.1.2.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary B stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

3.1.2.5.1 PQMSB02

Reach PQMSB02 is the first reach of Poquessing Creek, Unnamed Tributary B. The headwaters of this tributary begin at a stormwater outfall between a residential neighborhood and commercial area near Heights Lane. Reach PQMSB02 is characterized by a shallow slope (1.5%), moderate to high width to depth ratio (14.6), a highly entrenched channel (ER = 1.2), low sinuosity (1.07), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSB02 was poor (39/160).

3.1.2.5.2 PQMSB04

Reach PQMSB04 begins approximately 900 feet upstream of cross section PQMSB04. This reach runs between a residential neighborhood and a commercial area along East Street Road before reaching the mainstem of Poquessing Creek. Reach PQMSB04 is characterized by a shallow slope (1.3%), low width to depth ratio (9.5), a moderately entrenched channel (ER = 1.6), low sinuosity (1.01), and gravel substrate. The reach was classified as an A4 type stream. The composite USAM score for reach PQMSB04 was poor (30/160).

3.1.2.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean scores for the Overall Stream Condition components were classified as marginal (Table 3-12). The mean scores for both the Overall Buffer and Floodplain Condition were both classified as poor. Average conditions within the Poquessing Creek, Unnamed Tributary B Watershed's stream channels were better than conditions observed within the buffers and floodplains. The watershed averages for the Overall Stream Condition and Overall Buffer and Floodplain component as well as the composite USAM were much lower than the respective All Reaches averages. The scores for individual parameters ranged from poor to marginal. Graphs of each USAM category rating are in Appendix D.

Table 3-12: USAM Results for Poquessing Creek, Unnamed Tributary B Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSB02	Poquessing Creek, Unnamed Tributary B	20	19	39
PQMSB04	Poquessing Creek, Unnamed Tributary B	21	9	30
PQMSB Mean		20.5	14	34.5
All Reaches Average		37.1	37.4	74.4

3.1.2.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK UNNAMED TRIBUTARY B WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were either poor or marginal. The mean watershed score (20.5/80.0) was rated as marginal and was lower than the All Reaches average score (37.1/80.0) which was also considered marginal.

Table 3-13: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary B Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQMSB02	PQ, Unnamed Tributary B	6	3	5	2	2	2	20
PQMSB04	PQ, Unnamed Tributary B	7	3	3	1	1	6	21
PQMSB Mean		6.5	3	4	1.5	1.5	4	20.5
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.2.6.1.1 INSTREAM HABITAT

For the two reaches analyzed for the Poquessing Creek, Unnamed Tributary B Watershed, scores were both marginal, reflecting a mix of 20-40% stable habitat but with less than desired habitat availability. The watershed mean (6.5/20.0) was slightly lower than the All Reaches average (8.2/20.0), although both scores are considered within the marginal range. Habitat was impacted by excess sediments and trash in the stream channel.

3.1.2.6.1.2 VEGETATIVE PROTECTION

Both banks of the two reaches analyzed (PQMSB02 and PQMSB04) were rated as marginal, reflecting 50-70% streambank coverage by vegetation with some disruption obvious such as bare soil or cut down vegetation. The All Reaches average for the left bank was slightly higher than the Poquessing Creek, Unnamed Tributary B Watershed (4.0 vs. 3.0) while the All Reaches average for the right bank was slightly lower than the watershed mean (3.9 vs. 4.0). Both the All Reaches average and the watershed mean were considered marginal.

3.1.2.6.1.3 BANK EROSION

Both reaches analyzed for Poquessing Creek, Unnamed Tributary B Watershed scored poor for both left and right banks. A poor rating reflects active downcutting with tall banks and fast erosion rates and the subsequent significant sediment contribution to the stream. The mean watershed scores for the left and right banks were both (1.5/10.0 and 1.5/10.0), rated as poor. The All Reaches average for both the left and right banks (3.9 and 4.0) were rated as marginal. A rating of marginal indicates active stream widening and erosion at a moderate rate.

3.1.2.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary B Watershed was poor to marginal. Reach PQMSB02 was rated as poor (2.0/20.0) and Reach PQMSB04 was rated as marginal (6.0/20.0). A poor rating indicates that this reach was deeply entrenched and high flows were not making it into the floodplain while a marginal rating reflects the same, just to a lesser degree. The mean for the Poquessing Creek, Unnamed Tributary B Watershed was much lower than for all reaches with a score of 4.0 as compared to 13.0, giving this watershed an overall poor rating.

3.1.2.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY B WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were mostly low with a few scores in the marginal range. The mean component score for the Poquessing Creek, Unnamed Tributary B Watershed (14.0/80.0) was far less than the All Reaches average (37.4/80.0). The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being development and its associated infrastructure.

Table 3-14: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary B Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSB02	PQ, Unnamed Tributary B	2	3	6	6	2	19
PQMSB04	PQ, Unnamed Tributary B	2	2	2	2	1	9
PQMSB Mean		2	2.5	4	4	1.5	14
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.2.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank vegetated buffer for both reaches was rated as poor, reflecting a buffer zone of less than 10 feet and no riparian vegetation due to human activity. The right bank of reach PQMSB04 was also rated as poor. The right bank of reach PQMSB02 fared a little better with a rating of marginal, reflecting a buffer zone width of 10-25 feet with a great deal of impact from human activities. The mean watershed score was poor for both the right and left banks (2.0/10.0, LB and 2.5/10.0, RB). The All Reaches average for the left bank was marginal for the left bank (5.3/10.0) and suboptimal for the right bank (6.0/10.0).

3.1.2.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQMSB02 was shrub, with a marginal score of 6.0/20.0. Reach PQMSB04 had a poor rating (2.0/20.0) indicating that the dominant vegetation type was turf. The mean Poquessing Creek, Unnamed Tributary B Watershed score (4.0/20.0) was rated as poor, which was lower than the All Reaches average (9.7/20) which was rated as marginal.

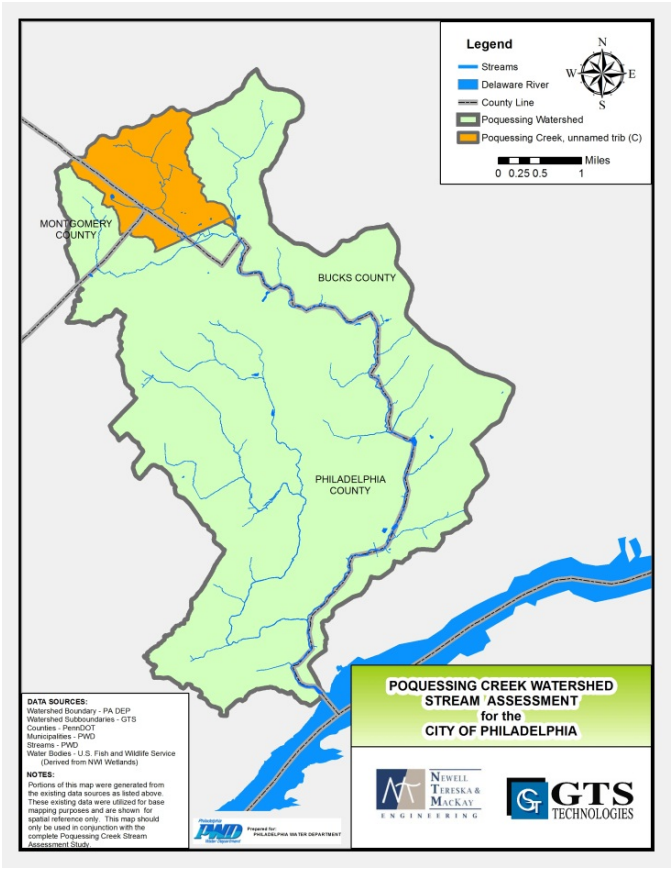
3.1.2.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was limited throughout the Poquessing Creek, Unnamed Tributary B Watershed. One of the primary causes of habitat limitation was development adjacent to the stream channel. Reach PQMSB02 was marginal, with a score of 6.0/20.0. This reach was characterized by all wetland or non-wetland habitat, with evidence of ponding or standing water. Reach PQMSB04 was characterized as poor (2.0/10.0), indicating all wetland or non-wetland habitat with no evidence of ponding or standing water. The mean watershed score for this parameter (4.0/20.0) was rated as poor and was much lower than the All Reaches average score (8.3/20.0) which was considered marginal.

3.1.2.6.2.4 FLOODPLAIN ENCROACHMENT

Both reaches analyzed for the Poquessing Creek, Unnamed Tributary B Watershed scored within the poor range (2.0/20.0 and 1.0/20.0). A poor rating indicates that there is significant floodplain encroachment with significant effect on floodplain function. The mean score for the watershed was (1.5/20.0) which was much lower than the All Reaches average score of 8.2/20.0, considered marginal. This gives the Poquessing Creek, Unnamed Tributary B Watershed an overall rating of poor.

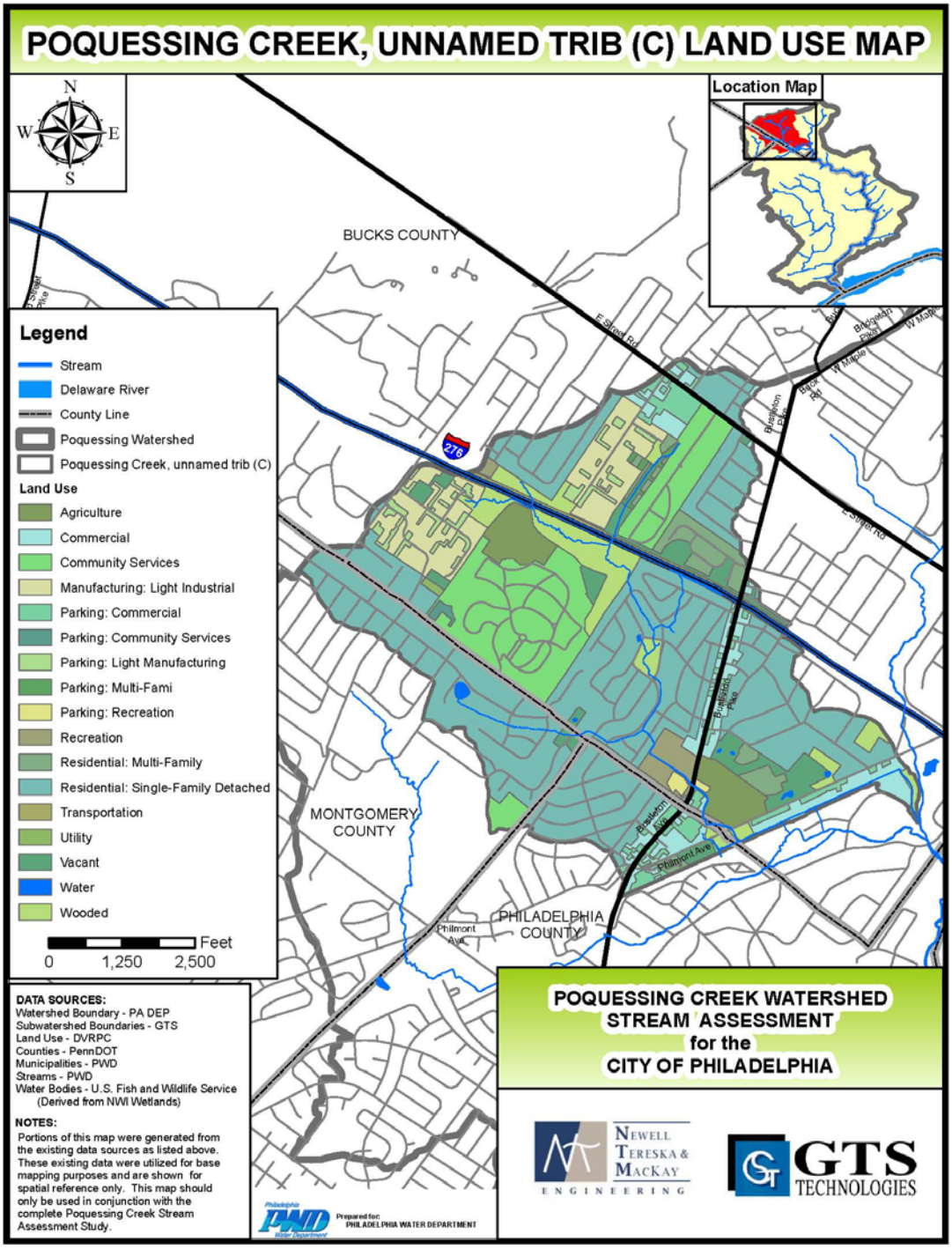
3.1.3 POQUESSING CREEK UNNAMED TRIBUTARY C WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary C is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary C originates from a stormwater outfall and stormwater runoff from nearby commercial development. Poquessing Creek Unnamed Tributary C flows for approximately 13,000 feet before meeting with the confluence with the Poquessing mainstem. The dominant substrate varies from cobbles to silt and clay material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary C Watershed is 1,123 acres. Major land use types within the watershed include: residential: Single Family Detached (47%) and community services (14%). Poquessing Creek Unnamed Tributary C is surrounded by a narrow wooded buffer in the upstream portion and flowing through a mixture of commercial, residential development and along busy transportation routes.

Figure 3-11: Poquessing Creek, Unnamed Tributary C Land Use



3.1.3.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary C Watershed is underlain by the Felsic Gneiss. The Felsic Gneiss consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage.

Other geologic formations within the Poquessing Creek Unnamed Tributary C Watershed are the Chickies Formation, Wissahickon Formation, Ledger Formation, Mafic Gneiss and Metadiabase. The Chickies Formation is composed of quartzite and quartz schist. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks. The Ledger Formation consists of limestone and dolomite formations yielding good trap rock and calcium-rich rock and is sinkhole prone. Mafic Gneiss consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz. Metadiabase consists of Dark-gray, fine-grained intrusives.

3.1.3.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the Poquessing Creek Unnamed Tributary C Watershed vary and are classified as follows: hydrologic group A (3%), hydrologic group B (16%), hydrologic group C, (13%), hydrologic group D (1%) and Urban (67%). The majority of the soils found in this watershed are classified under the category Urban Soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-15: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary C Watershed

Group	Area (acres)	Percent of Total Area
A/D	34.5	3%
B	177.3	16%
C	147.2	13%
D	6.4	1%
Urban	756.4	67%
Water	1.1	0.1%
Total Area	1123.1	100%

Figure 3-12: Geology of Poquessing Creek, Unnamed Tributary C Watershed

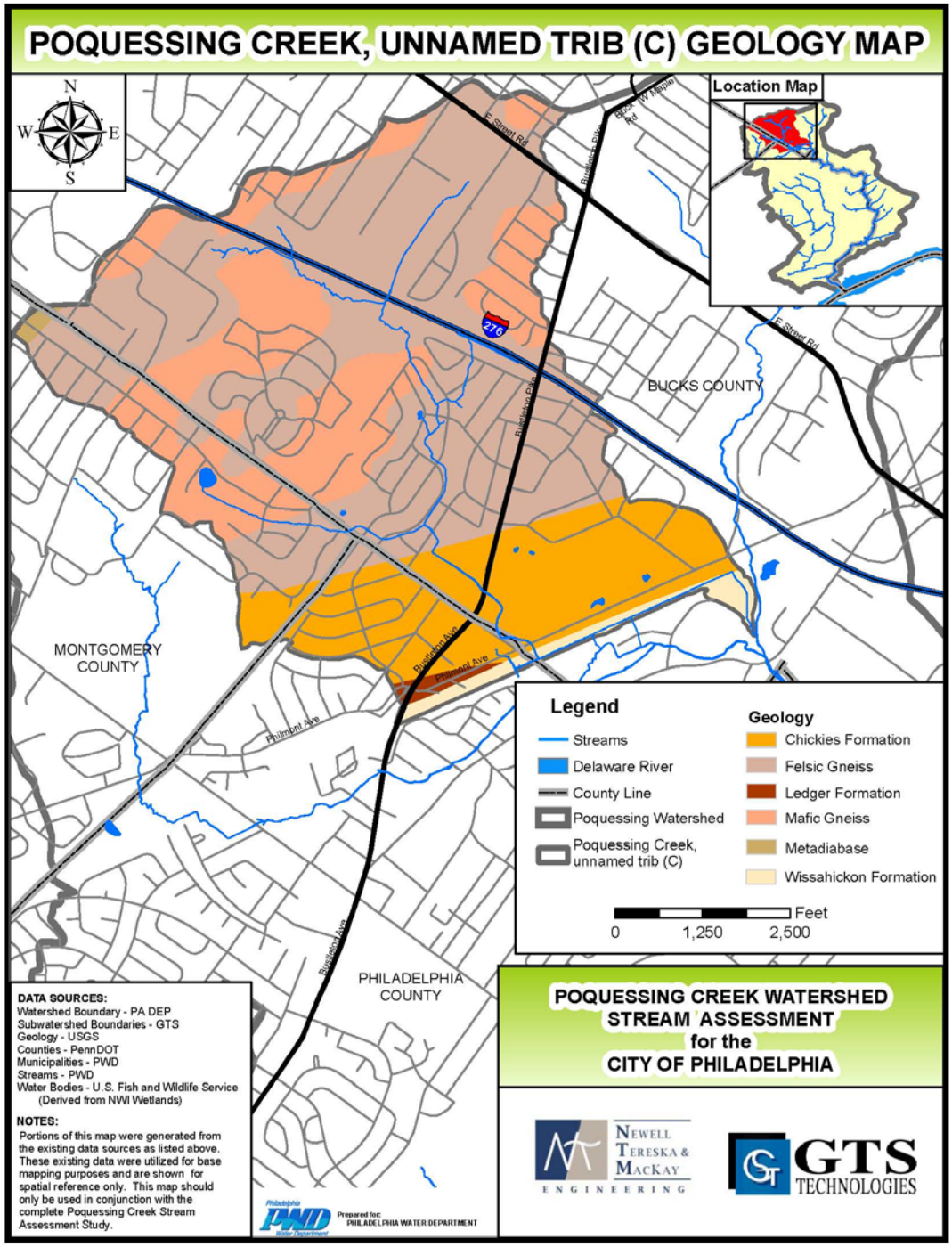
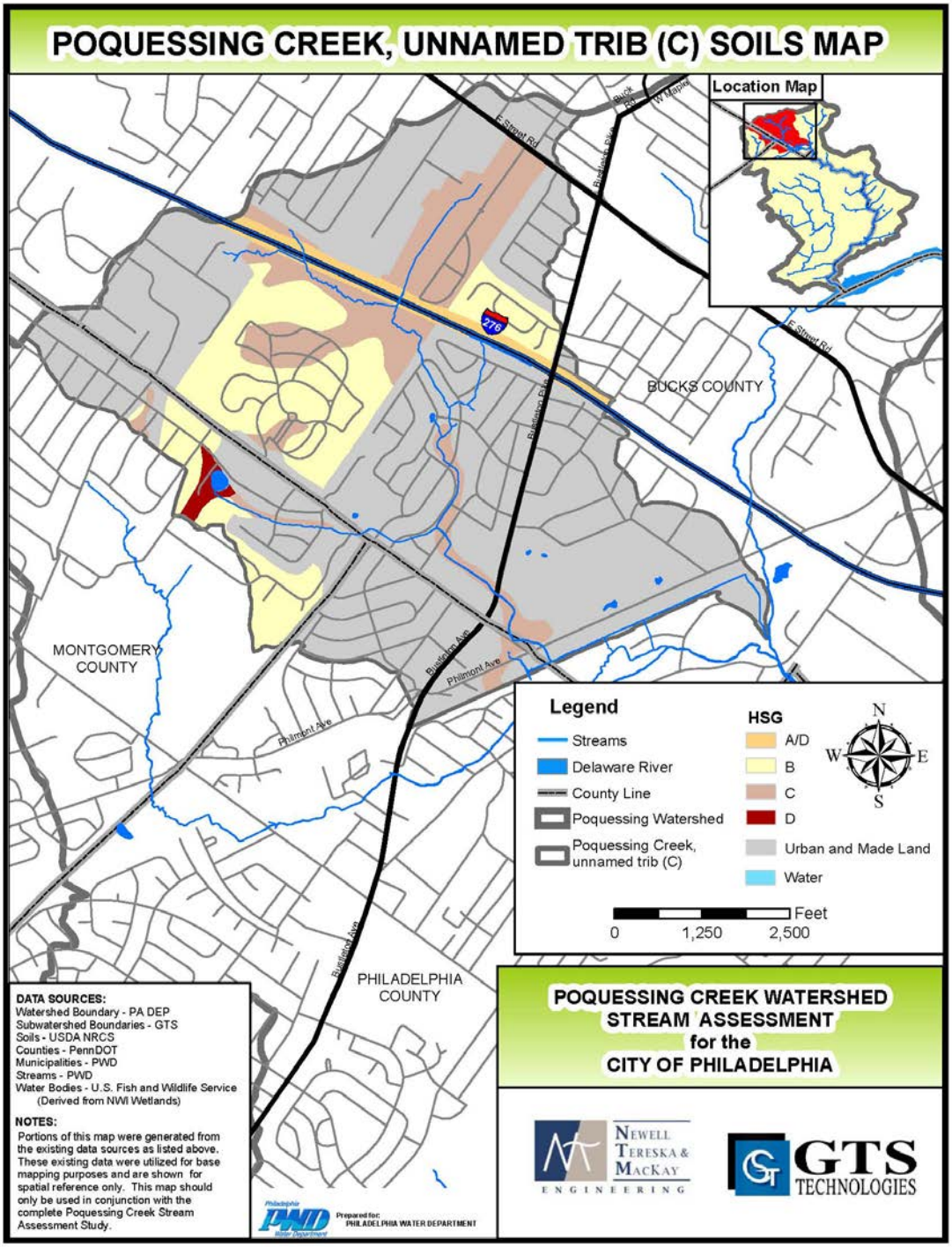


Figure 3-13: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary C Watershed



3.1.3.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for 12 reaches in Poquessing Creek, Unnamed Tributary C Watershed (Table 3-16). Nine reaches were found to be eroding based on the total wetted perimeter calculation, while three were aggrading. The average total erosion rate for all reaches in the Poquessing Creek, Unnamed Tributary C Watershed was less than the average for all Poquessing Creek subwatersheds (Table 3-17). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-16: Erosion Rates for Poquessing Creek, Unnamed Tributary C Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSC02	-0.914	-0.493	-0.526	-0.294	-0.059	E
PQMSC04	0.453	0.040	-0.079	0.063	0.013	A
PQMSC06	-1.662	-0.440	-0.027	-0.310	-0.062	E
PQMSC08	1.872	-0.342	-0.686	-0.068	-0.014	E
PQMSC10	-3.718	-0.104	0.316	-0.356	-0.071	E
PQMSC12	1.093	0.329	-0.151	0.198	0.040	A
PQMSC14	-0.163	0.020	-0.494	-0.079	-0.016	E
PQMSC16	-0.430	0.138	-0.581	-0.084	-0.017	E
PQMSCA04	0.209	0.698	17.014	0.274	0.055	A
PQMSCAA02	-1.912	-0.733	-7.091	-0.767	-0.153	E
PQMSCB02	0.112	-0.196	-0.883	-0.180	-0.036	`
PQMSCC02	-1.653	-0.429	0.198	-0.402	-0.080	E
PQMSCC04	0.245	-0.100	-0.118	-0.022	-0.004	E
Average	-0.498	-0.124	0.530	-0.156	-0.031	E

Table 3-17: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary C	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.3.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary C is a small tributary to the Poquessing Creek located within Bucks, Montgomery, and Philadelphia Counties. The headwaters of Poquessing Creek Unnamed Tributary C lies in a mainly wooded area with commercial or light manufacturing development close by. These land use patterns remain consistent along the reach and small tributaries of Poquessing Creek Unnamed Tributary C with clusters of residential development throughout. The entire length of Poquessing Creek Unnamed Tributary C and its tributaries exhibit some of the impairments associated with urban streams given its location and proximity to commercial development and major transportation

routes that surround the stream channel. The majority of infrastructure was located at cross section PQMSCB02 mainly in the form of channelization, outfalls and culverts. This cross section is in the area of I-276 and much of the infrastructure is a direct result of the presence of this road. At this cross section, Poquessing Creek Unnamed Tributary CB runs parallel to I-276 for approximately 1,000 feet.

Along Poquessing Creek Unnamed Tributary C, the most predominant infrastructure elements in the watershed were stormwater outfalls (38 total) ranging in dimension from 0.7 to 5.0 feet in diameter and culverts (37 total). The number of headwater outfalls (Table 3-18) on this stream indicates that it is heavily influenced by stormwater discharges along the length of Poquessing Creek Unnamed Tributary C.

There were three culverts along Poquessing Creek Unnamed Tributary C that conveyed the stream under large crossings. The culverts are a 238-foot long, 5-foot high, 8-foot wide concrete box culvert under I-276 (PQcul017), a 98-foot long, 5-foot high, 8-foot wide concrete box culvert under Bustleton Pike (PQcul042), and a 52-foot long, 5-foot high, 8-foot wide concrete box culvert under Philmont Avenue (PQcul043). Each culvert is identified as being in good condition. Along Poquessing Creek Unnamed Tributary C, all infrastructure elements were considered in good condition or better. Four dams are located along the reaches. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-18: Summary of Poquessing Creek Unnamed Tributary C Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSC02	3	0	2	0	1	0	0	0	6
PQMSC04	1	2	1	5	0	0	0	0	9
PQMSC06	5	0	7	1	0	0	1	1	15
PQMSC08	2	5	5	2	1	0	0	0	15
PQMSC10	3	0	4	1	0	0	0	0	8
PQMSC12	1	0	1	1	0	0	0	0	3
PQMSC16	1	0	1	0	0	0	0	0	2
PQMSCA02	3	0	5	3	1	0	0	0	12
PQMSCA04	1	0	0	0	0	0	0	0	1
PQMSCB02	9	3	8	10	0	0	1	1	32
PQMSCC02	2	0	0	1	0	0	0	0	3
PQMSCC04	6	3	4	8	1	0	4	6	32
PQMSCAA02	0	0	0	0	0	0	0	0	0
Total	37	13	38	32	4	0	6	8	138

3.1.3.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream reach of the Poquessing Creek, Unnamed Tributary C stream channel is a third-order, single thread channel with three direct tributaries. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-14: Results for Poquessing Creek, Unnamed Tributary C Watershed USAM Components

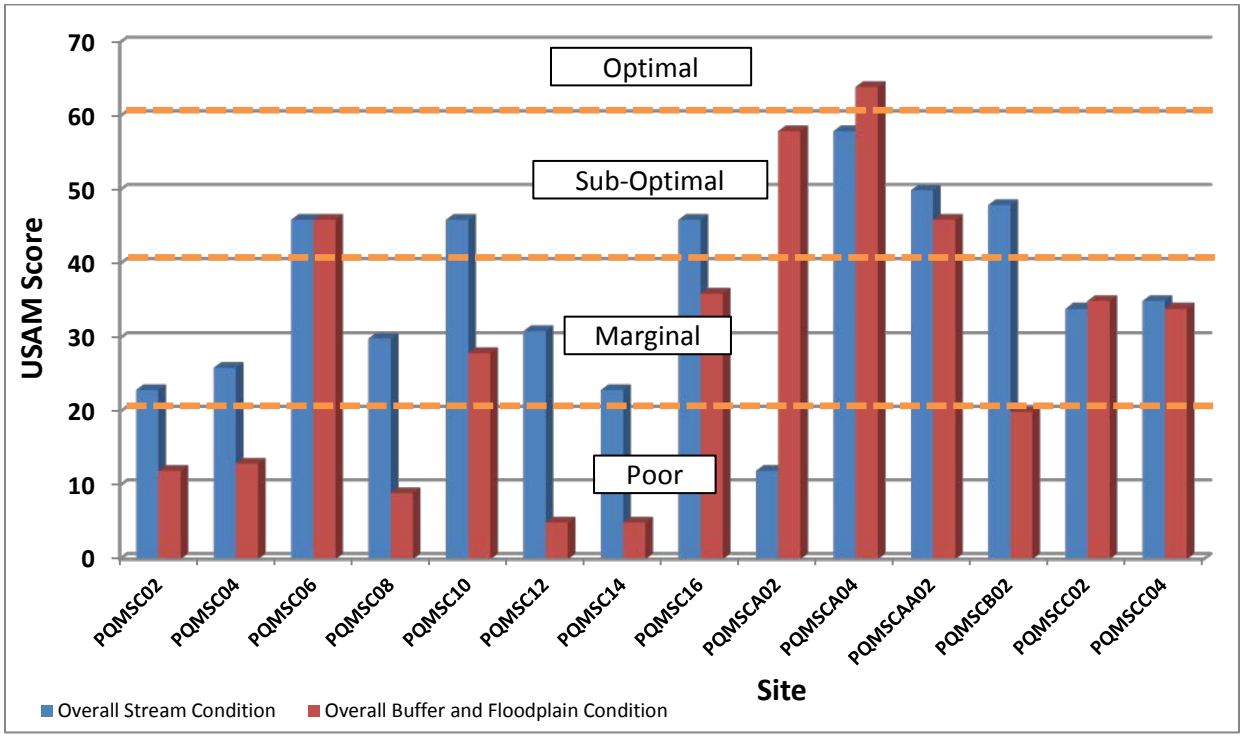
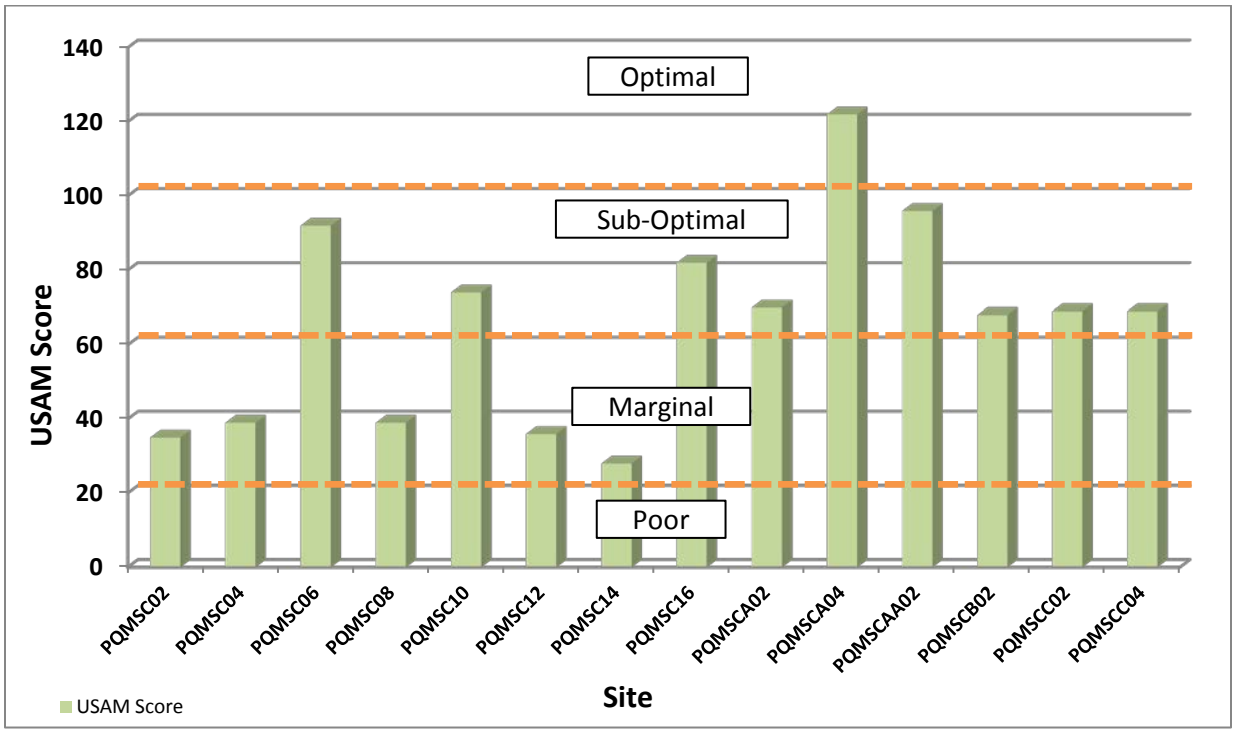


Figure 3-15: Poquessing Creek, Unnamed Tributary C Watershed USAM Results



3.1.3.5.1 PQMSC02

Reach PQMSC02 is the first reach of Poquessing Creek, Unnamed Tributary C. The headwaters of this tributary begin at a stormwater outfall in an industrial and commercial area near Pennsylvania Boulevard. The end of the reach passes under the Pennsylvania Turnpike (I-276). Reach PQMSC02 is characterized by a shallow slope (1.0%), low width to depth ratio (5.10), a highly entrenched channel (ER = 2.2), low sinuosity (1.04), and gravel substrate. The reach was classified as an E4 type stream. The composite USAM score for reach PQMSC02 was poor (35/160).

3.1.3.5.2 PQMSC04

Reach PQMSC04 begins approximately 1100 feet upstream of cross section PQMSC04. The upper half of this reach runs through a wooded area and the lower half run through a residential neighborhood. Reach PQMSC04 is characterized by a shallow slope (1.0%), low width to depth ratio (8.3), a moderately entrenched channel (ER = 1.5), low sinuosity (1.14), and gravel substrate. The reach was classified as a G4c type stream. The composite USAM score for reach PQMSC04 was poor (39/160).

3.1.3.5.3 PQMSC06

Reach PQMSC06 begins approximately 800 feet upstream of cross section PQMSC06. The upper half of this reach runs through a wooded area and the lower half run through a residential neighborhood. This reach receives runoff from a pond in a residential neighborhood. Reach PQMSC06 is characterized by a shallow slope (0.8%), low width to depth ratio (11.8), a slightly entrenched channel (ER = 6.7), moderate sinuosity (1.23), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSC06 was sub-optimal (92/160).

3.1.3.5.4 PQMSC08

Reach PQMSC08 begins approximately 1400 feet upstream of cross section PQMSC08. The upper half of this reach is channelized through a commercial area until it passes under Bustleton Avenue. The lower half also runs between commercial areas. Reach PQMSC08 is characterized by a shallow slope (0.7%), low width to depth ratio (11.3), a highly entrenched channel (ER = 1.4), low sinuosity (1.15), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSC08 was poor (39/160).

3.1.3.5.5 PQMSC10

Reach PQMSC10 begins approximately 300 feet upstream of cross section PQMSC10. This reach runs primarily through a wooded area and receives runoff from adjacent commercial and residential areas. The lower end of this reach goes under Philmont Avenue and turns east once it reaches the toe of the SEPTA rail line embankment. Reach PQMSC10 is characterized by a shallow slope (0.6%), low width to depth ratio (9.0), a slightly entrenched channel (ER = 3.5), moderate sinuosity (1.24), and gravel substrate. The reach was classified as an E4 type stream. The composite USAM score for reach PQMSC10 was marginal (74/160).

3.1.3.5.6 PQMSC12

Reach PQMSC12 begins approximately 800 feet upstream of cross section PQMSC12. This reach runs entirely between a commercial area and the SEPTA rail line embankment. This reach was straightened and has highly channelized portions. Reach PQMSC12 is characterized by a shallow slope (0.4%), low width to depth ratio (9.5), a slightly entrenched channel (ER = 3.9), low sinuosity (1.01), and sand substrate. The reach was classified as a C5 type stream. The composite USAM score for reach PQMSC12 was poor (36/160).

3.1.3.5.7 PQMSC14

Reach PQMSC14 begins approximately 800 feet upstream of cross section PQMSC14. This reach runs entirely between a commercial area and the SEPTA rail line embankment. This reach was straightened and has highly channelized portions. Reach PQMSC14 is characterized by a shallow slope (0.4%), low width to depth ratio (8.2), a moderately entrenched channel (ER = 2.0), low sinuosity (1.01), and

sand substrate. The reach was classified as a B5c type stream. The composite USAM score for reach PQMSC14 was poor (28/160).

3.1.3.5.8 PQMSC16

Reach PQMSC16 begins approximately 700 feet upstream of cross section PQMSC16. This reach runs between a wooded floodplain area and an industrial area before joining the mainstem of Poquessing Creek. Reach PQMSC16 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (14.1), a slightly entrenched channel (ER = 9.7), low sinuosity (1.08), and silt/clay substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMSC16 was sub-optimal (82/160).

3.1.3.5.9 PQMSCA02

Reach PQMSCA02 is the first reach of Poquessing Creek, Unnamed Tributary CA. The headwaters of this tributary begin behind an industrial area and the majority of the reach runs through a wooded area. This tributary is an intermittent stream prior to flow contributions from Poquessing Creek, Unnamed Tributary (CAA). The channel was dry at the time of the 2012 field inspection. Reach PQMSCA02 is characterized by a moderate slope (2.4%), moderate to high width to depth ratio (32.4), a slightly entrenched channel (ER = 1.2), low sinuosity (1.04), and sand substrate. The reach was classified as an F5b type stream. The composite USAM score for reach PQMSCA02 was marginal (70/160).

3.1.3.5.10 PQMSCA04

Reach PQMSCA04 begins approximately 1000 feet upstream of cross section PQMSCA04. This reach runs through a wooded, wetland area before joining Poquessing Creek, Unnamed Tributary C. Reach PQMSCA04 is characterized by a moderate slope (2.1%), moderate to high width to depth ratio (18.4), a slightly entrenched channel (ER = 44.2), low sinuosity (1.06), and sand substrate. The reach was classified as a C5b type stream. The composite USAM score for reach PQMSCA04 was optimal (122/160).

3.1.3.5.11 PQMSCAA02

Reach PQMSCAA02 is the only reach of Poquessing Creek, Unnamed Tributary CAA. The headwaters of this tributary begin behind a residential area and the majority of the reach runs through a wooded area until it passes underneath the Pennsylvania Turnpike (I-276) and joins Poquessing Creek, Unnamed Tributary (CA). Reach PQMSCAA02 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (14.1), a slightly entrenched channel (ER = 9.7), low sinuosity (1.08), and silt/clay substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMSCAA02 was sub-optimal (96/160).

3.1.3.5.12 PQMSCB02

Reach PQMSCB02 is the only reach of Poquessing Creek, Unnamed Tributary CB. The headwaters of this tributary begin beside the Pennsylvania Turnpike embankment and the reach runs through a residential neighborhood until it joins Poquessing Creek, Unnamed Tributary C. Reach PQMSCB02 is characterized by a shallow slope (1.6%), low width to depth ratio (8.4), a slightly entrenched channel (ER = 3.4), low sinuosity (1.09), and sand. The reach was classified as a C5 type stream. The composite USAM score for reach PQMSCB02 was marginal (68/160).

3.1.3.5.13 PQMSCC02

Reach PQMSCC02 is the first reach of Poquessing Creek, Unnamed Tributary CC. The headwaters of this tributary begin at a pond in a residential neighborhood. The reach runs through this residential area with wooded buffer on the downstream, left side. Reach PQMSCC02 is characterized by a moderate slope (2.2%), low width to depth ratio (6.6), a slightly entrenched channel (ER = 2.4), low sinuosity (1.04), and cobble substrate. The reach was classified as an E6b type stream. The composite USAM score for reach PQMSCC02 was marginal (69/160).

3.1.3.5.14 PQMSCC04

Reach PQMSCC04 begins approximately 800 feet upstream of cross section PQMSCC04. This reach runs through a residential area and under County Line Road. before joining Poquessing Creek, Unnamed Tributary C. Reach PQMSCC04 is characterized by a moderate slope (2.2%), low width to depth ratio (11.5), a moderately entrenched channel (ER = 1.7), low sinuosity (1.07), and gravel substrate. The reach was classified as a B4a type stream. The composite USAM score for reach PQMSCC04 was marginal (69/160).

3.1.3.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

A total of fourteen reaches were completed for the Poquessing Creek, Unnamed Tributary C Watershed. The mean scores for both the Overall Stream Condition components as well as the Overall Buffer and Floodplain Condition components were classified as marginal. Average conditions within the Poquessing Creek, Unnamed Tributary C Watershed's stream channels were slightly better than conditions observed within the buffers and floodplains, as there were more poor ratings observed in association with the buffers and floodplains. The watershed averages for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM were slightly lower than the respective All Reaches averages, though the watershed means and the All Reaches averages ended up being in the same ratings categories. The scores for individual parameters ranged from poor to optimal, displaying similar levels of variability between reaches. Graphs of each USAM category rating are in Appendix D.

Table 3-19: USAM Results for Poquessing Creek, Unnamed Tributary C Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSC02	PQ, Unnamed Tributary C	23	12	35
PQMSC04	PQ, Unnamed Tributary C	26	13	39
PQMSC06	PQ, Unnamed Tributary C	46	46	92
PQMSC08	PQ, Unnamed Tributary C	30	9	39
PQMSC10	PQ, Unnamed Tributary C	46	28	74
PQMSC12	PQ, Unnamed Tributary C	31	5	36
PQMSC14	PQ, Unnamed Tributary C	23	5	28
PQMSC16	PQ, Unnamed Tributary C	46	36	82
PQMSCA02	PQ, Unnamed Tributary C	12	58	70
PQMSCA04	PQ, Unnamed Tributary C	58	64	122
PQMSCAA02	PQ, Unnamed Tributary C	50	46	96
PQMSCB02	PQ, Unnamed Tributary C	48	20	68
PQMSCC02	PQ, Unnamed Tributary C	34	35	69
PQMSCC04	PQ, Unnamed Tributary C	35	34	69
PQMSC Mean		36.3	29.4	65.6
All Reaches Average		37.1	37.4	74.4

3.1.3.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY C WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged widely from poor to optimal. The mean watershed score (36.3/80.0) was rated as marginal and was slightly lower than the All Reaches average score (37.1/80.0) which was also considered marginal.

Some reaches of the tributary went through very densely developed areas with little vegetative bank protection and were highly channelized. These segments represent the lower scores for vegetative protection and floodplain connection. Other portions with better stream condition scores had a vegetated buffer and a connected floodplain. The portion of the tributary that parallels Philmont Avenue had very poor instream habitat and was highly channelized. This segment is confined to a channel between the SEPTA line and a commercial area along Philmont Avenue. Moderate channel erosion exists throughout the entire tributary.

Table 3-20: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary C Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQMSC02	PQ, Unnamed Tributary C	1	2	2	3	3	12	23
PQMSC04	PQ, Unnamed Tributary C	8	4	4	2	3	5	26
PQMSC06	PQ, Unnamed Tributary C	9	5	4	4	4	20	46
PQMSC08	PQ, Unnamed Tributary C	8	3	2	7	6	4	30
PQMSC10	PQ, Unnamed Tributary C	11	5	3	5	2	20	46
PQMSC12	PQ, Unnamed Tributary C	0	1	0	5	5	20	31
PQMSC14	PQ, Unnamed Tributary C	1	1	1	5	5	10	23
PQMSC16	PQ, Unnamed Tributary C	2	7	4	7	6	20	46
PQMSCA02	PQ, Unnamed Tributary C	0	3	3	2	2	2	12
PQMSCA04	PQ, Unnamed Tributary C	11	7	6	7	7	20	58
PQMSCAA02	PQ, Unnamed Tributary C	9	5	6	5	5	20	50
PQMSCB02	PQ, Unnamed Tributary C	9	4	3	5	7	20	48
PQMSCC02	PQ, Unnamed Tributary C	5	3	5	4	3	14	34
PQMSCC04	PQ, Unnamed Tributary C	11	4	4	5	4	7	35
PQMSC Mean		6.1	3.9	3.4	4.7	4.4	13.9	36.3
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.3.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to suboptimal for the fourteen reaches analyzed in the Poquessing Creek, Unnamed Tributary C Watershed. Six reaches (PQMSC02, PQMSC12, PQMSC14, PQMSC16, PQMSCA02, and PQMSCC02) were rated as poor, indicating less than 20% stable habitat with an unstable or lacking substrate. This reach was highly channelized between a commercial area along Philmont Avenue and the SEPTA rail line. The

channel was sediment choked and stagnant throughout this reach. Three reaches (PQMSC10, PQMSCA04, and PQMSCC04) were characterized as suboptimal, with a 40-70% mix of stable habitat, well suited for colonization and adequate for maintaining populations. The five remaining reaches were scored as marginal, indicating a 20-40% mix of stable habitat, less than desirable availability and a disturbed or removed substrate. The watershed mean was lower than the All Reaches average (6.1/20.0 vs. 8.2/20.0), though both were characterized as marginal.

3.1.3.6.1.2 VEGETATIVE PROTECTION

Vegetative protection of banks observed within the Poquessing Creek, Unnamed Tributary C Watershed ranged from poor to suboptimal, with most reaches scoring within the marginal range. Three reaches (PQMSC02, PQMSC12, and PQMSC14) had both banks score in the poor category. This indicates that less than 50% of the streambanks were covered by vegetation and the area appeared very disturbed. These reaches run through highly commercial areas with minimal buffer zones. Only two reaches (PQMSC16 and PQMSCA04) were characterized as suboptimal, indicating 70-90% coverage of the streambank surfaces, but not all plant strata were well represented. Disruption is also evident, but is not impeding colonization of vegetation. The remaining reaches were classified as marginal for both banks with the exception of Reach PQMSC08 (marginal left bank, poor right bank), Reach PQMSC16 (suboptimal left bank, marginal right bank), and PQMSCAA02 (marginal left bank, suboptimal right bank). A marginal rating reflects 50-70% coverage of the streambank with vegetation and obvious areas of disruption. The All Reaches averages for both banks were slightly higher than the Poquessing Creek, Unnamed Tributary C Watershed mean (3.9/10.0 vs. 4.0/10.0, left bank and 3.4/10.0 vs. 3.9/10.0, right bank). The overall marginal scores for this parameter are attributed to the encroachment of commercial and residential along streambanks which has resulted in significant removal of adjacent vegetated buffer zones.

3.1.3.6.1.3 BANK EROSION

All fourteen reaches analyzed for Poquessing Creek, Unnamed Tributary C Watershed scored between poor and suboptimal for both left and right banks. As with vegetative protection, bank erosion scores saw little variability between banks of the same reach, with most scoring within the same range. Only one reach (PQMSCA02) had scores of poor for both banks. A poor rating reflects active downcutting, tall banks, fast erosion rates, and significant sediment contribution to the stream. The only other reach scoring within the poor range was the right bank of Reach PQMSC10. Reach PQMSC08, PQMSC16, and PQMSCA04 scored within the suboptimal range for both banks. Reach PQMSCB02 had a suboptimal rating for the right bank but only marginal for the left bank. A suboptimal rating indicates stable width and grade with only isolated areas of erosion. The remainder of the reaches were marginal, indicating past downcutting, active stream widening, and moderate erosion rates. The mean watershed scores for the left and right banks were both (4.7/10 and 4.0/10) rated as marginal and were slightly higher than the corresponding All Reaches averages (3.9/10.0 and 4.0/10.0), also rated marginal.

3.1.3.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary C Watershed ranged from poor to optimal, with many in the optimal category. Three reaches (PQMSC04, PQMSC08, and PQMSCA02) were characterized as poor. A poor rating signifies high flows that are not able to enter the floodplain due to deep entrenchment. Two reaches (PQMSC14 and PQMSCC04) were rated as marginal, similar to poor, just to a lesser degree. Two reaches (PQMSC02 and PQMSCC02) were characterized as suboptimal, reflecting high flows able to enter the floodplain and no deep entrenchment. The remaining reaches were rated as optimal, similar to marginal, just to a greater degree. The mean for the Poquessing Creek, Unnamed Tributary C Watershed was just slightly higher than for all reaches with a score of 13.9/20.0 as compared to 13.0/20.0, giving this watershed an overall suboptimal rating.

Floodplain connection scores are based on the ratio of flood prone width to bankfull width. This is also known as entrenchment ratio. The relatively high bankfull flow predictions in the watershed result in a prediction of a wide flood prone width in many cases. Therefore, it is predicted that relatively frequent flood events will exceed the channel capacity and reach adjacent floodplains.

3.1.3.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY C WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to optimal. The mean component score for the Poquessing Creek, Unnamed Tributary C Watershed (29.4/80.0) was lower than the All Reaches average (37.4/80.0). The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being development and its associated infrastructure. There are also numerous bridges, culverts and channelized segments on this tributary, all with distinct impacts on the hydraulic regime of the reach.

Table 3-21: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary C Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSC02	PQ, Unnamed Tributary C	2	2	3	2	3	12
PQMSC04	PQ, Unnamed Tributary C	3	2	2	2	4	13
PQMSC06	PQ, Unnamed Tributary C	7	5	11	13	10	46
PQMSC08	PQ, Unnamed Tributary C	2	1	2	2	2	9
PQMSC10	PQ, Unnamed Tributary C	6	3	8	7	4	28
PQMSC12	PQ, Unnamed Tributary C	1	1	1	1	1	5
PQMSC14	PQ, Unnamed Tributary C	1	1	1	1	1	5
PQMSC16	PQ, Unnamed Tributary C	9	4	10	8	5	36
PQMSCA02	PQ, Unnamed Tributary C	8	9	16	10	15	58
PQMSCA04	PQ, Unnamed Tributary C	8	9	15	17	15	64
PQMSCAA02	PQ, Unnamed Tributary C	6	8	13	10	9	46
PQMSCB02	PQ, Unnamed Tributary C	3	4	4	4	5	20
PQMSCC02	PQ, Unnamed Tributary C	5	3	8	10	9	35
PQMSCC04	PQ, Unnamed Tributary C	5	5	8	11	5	34
PQMSC Mean		4.7	4.1	7.3	7.0	6.3	29.4
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.3.6.2.1 VEGETATED BUFFER WIDTH

The scores for the vegetated buffer widths ranged from poor to optimal. Four reaches (PQMSC02, PQMSC08, PQMSC12, and PQMSC14) scored at the low end of the poor category for both banks. A poor rating indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. Three reaches achieved a marginal rating (PQMSCB02, PQMSCC02, and PQMSCC04) for both banks, indicating a buffer width of 10-25 feet and a great deal of human impact. One reach (PQMSCAA02) had a rating of suboptimal, meaning the buffer zone is 25-50 feet wide with minimal human impact. No reaches had optimal scores for both banks, but three reaches (PQMSC16, PQMSCA02, and PQMSCA04) had optimal ratings for one bank. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity. The remaining reaches were a mix of suboptimal and marginal

quality. The mean watershed score of 4.7/10.0 (marginal) for the left bank was less than 5.3/10.0 (marginal) for the all reaches average. The mean watershed score for the right bank was 4.1/10.0 (marginal), also less than the all reaches average (6.0/10.0 or suboptimal) for right banks.

3.1.3.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type within the Poquessing Creek, Unnamed Tributary C Watershed was turf, with six of fourteen reaches scoring within the poor category. Four reaches (PQMSC10, PQMSC16, PQMSCC02, and PQMSCC04) were rated as marginal, indicating shrub as the dominant vegetation type. Three reaches (PQMSC06, PQMSCA04, and PQMSCAA02) were rated as suboptimal, reflecting a dominance of young forest while the only mature forest was found in association with Reach PQMSCA02, warranting the only optimal rating for the watershed. The mean Poquessing Creek, Unnamed Tributary C Watershed score (7.3/20.0) was rated as marginal, which was lower than the All Reaches average (9.7/20.0) also considered marginal.

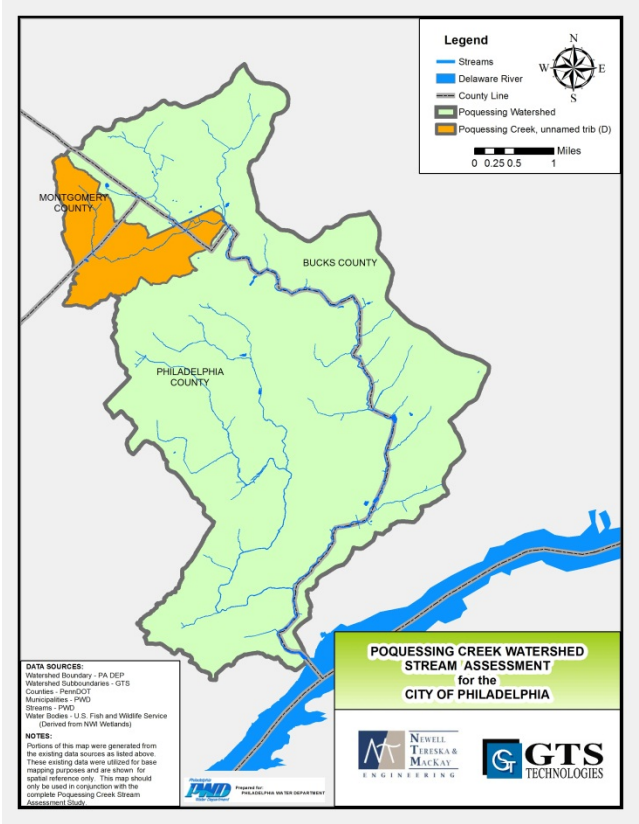
3.1.3.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was varied throughout the Poquessing Creek, Unnamed Tributary C Watershed. Scores ranged from poor to optimal, although the majority of reaches scored within the poor to marginal range. One of the primary causes of habitat limitation was the extent of artificial channelization and encroachment of development observed throughout the watershed. Six reaches (PQMSC02, PQMSC04, PQMSC08, PQMSC12, PQMSC14, and PQMSCB02) achieved poor scores, indicating all wetland or non-wetland habitat, with no evidence of ponding or standing water. Five reaches were considered marginal, or similar to poor, but with some evidence of standing or ponded water. Two reaches (PQMSC06 and PQMSCC04) were considered suboptimal or characterized by an even mix of both wetland and non-wetland habitat and no standing water observed. Only Reach PQMSCA04 was considered optimal, with an even mix of habitat and evidence of standing water. The mean watershed score for this parameter (7.0/20.0) was rated as marginal and was lower than the All Reaches average score (8.3/20) which was also considered marginal.

3.1.3.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter were low for the Poquessing Creek, Unnamed Tributary C Watershed. Nine reaches scored within the poor category, indicating significant floodplain encroachment and resulting significant effect on floodplain function. Three reaches were characterized as marginal (PQMSC06, PQMSCAA02, and PQMSCC02), or characterized by moderate floodplain encroachment and some effect on floodplain function. Two reaches (PQMSCA02 and PQMSCA04) scored in the suboptimal range, reflecting minor floodplain encroachment without affecting floodplain function. The mean score for the watershed was (6.3/20.0, marginal) which was lower than the All Reaches average score of (8.2/20.0, marginal).

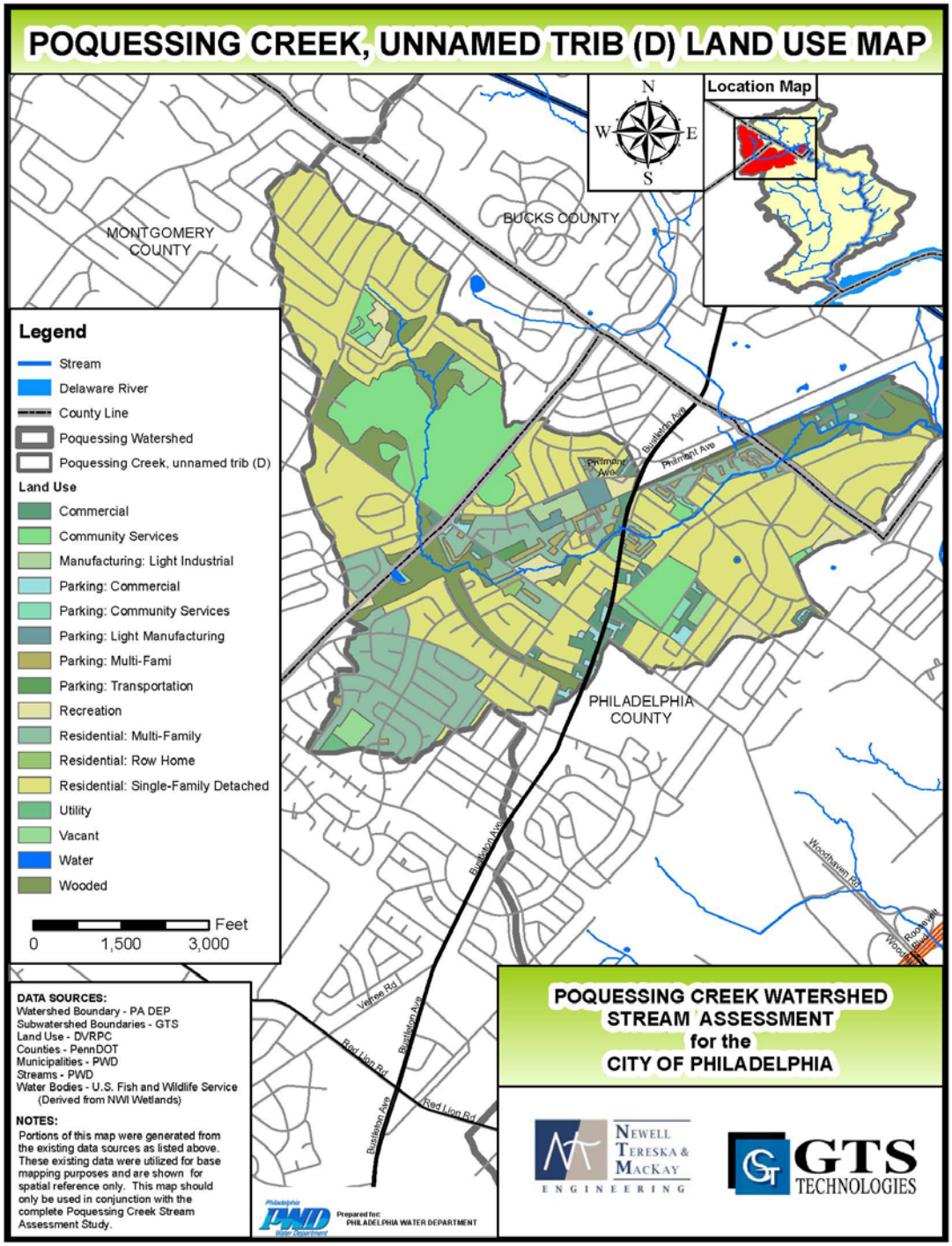
3.1.4 POQUESSING CREEK UNNAMED TRIBUTARY D WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary D is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary D originates from two stormwater outfalls at Pine Road and Brookdale Drive. Poquessing Creek Unnamed Tributary D flows for approximately 14,000 feet from the headwaters to the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel with some cobbles present. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary D Watershed is 1,179 acres. Major land use types within the watershed include: residential: single family detached (51%), residential: multi-family (14%), community services (12%) and wooded (10%). Poquessing Creek Unnamed Tributary D is surrounded by a small wooded buffer on both sides. The buffer ranges from about 20 feet to about 2,000 feet wide.

Figure 3-16: Poquessing Creek, Unnamed Tributary D Watershed Land Use



3.1.4.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary D Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

Other geologic formations within the Poquessing Creek Unnamed Tributary D Watershed are the Chickies Formation, Flesic Gneiss, Ledger Formation, Mafic Gneiss and Metadiabase. The Chickies Formation is composed of quartzite and quartz schist. The Felsic Gneiss consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage. The Ledger Formation consists of limestone and dolomite formations yielding good trap rock and calcium-rich rock and is sinkhole prone. Mafic Gneiss consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz. Metadiabase consists of dark-gray, fine-grained intrusives.

3.1.4.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Poquessing Creek Unnamed Tributary D Watershed vary and are classified as follows: hydrologic group B (16%), hydrologic group C, (12%), hydrologic group D (9%) and Urban (63%). The majority of the soils found in this watershed are classified under the category Urban Soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-22: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary D Watershed

Group	Area (acres)	Percent of Total Area
B	184.4	16%
C	138.4	12%
D	110.1	9%
Urban	746.7	63%
Total Area	1179.6	100%

Figure 3-17: Geology of Poquessing Creek, Unnamed Tributary D Watershed

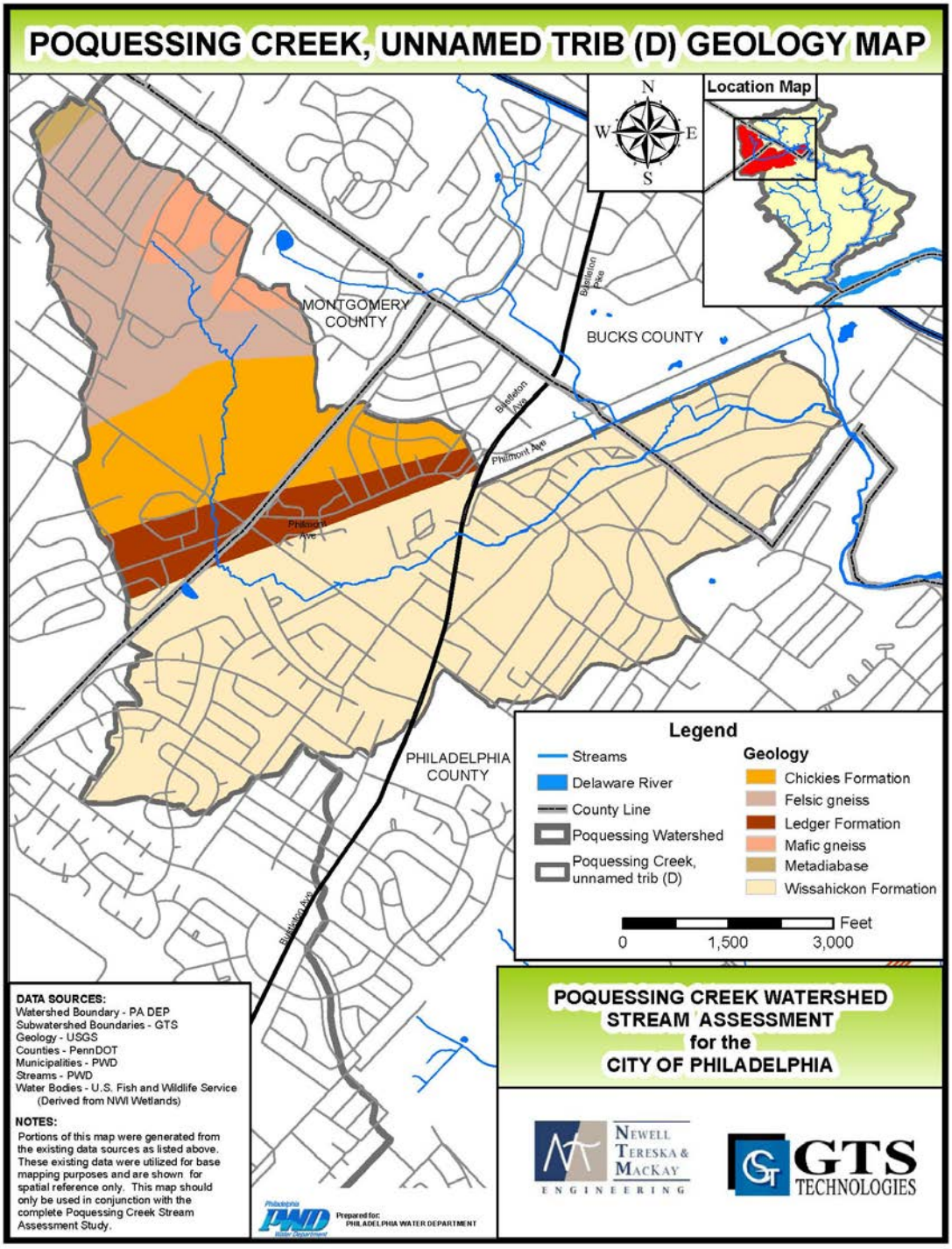
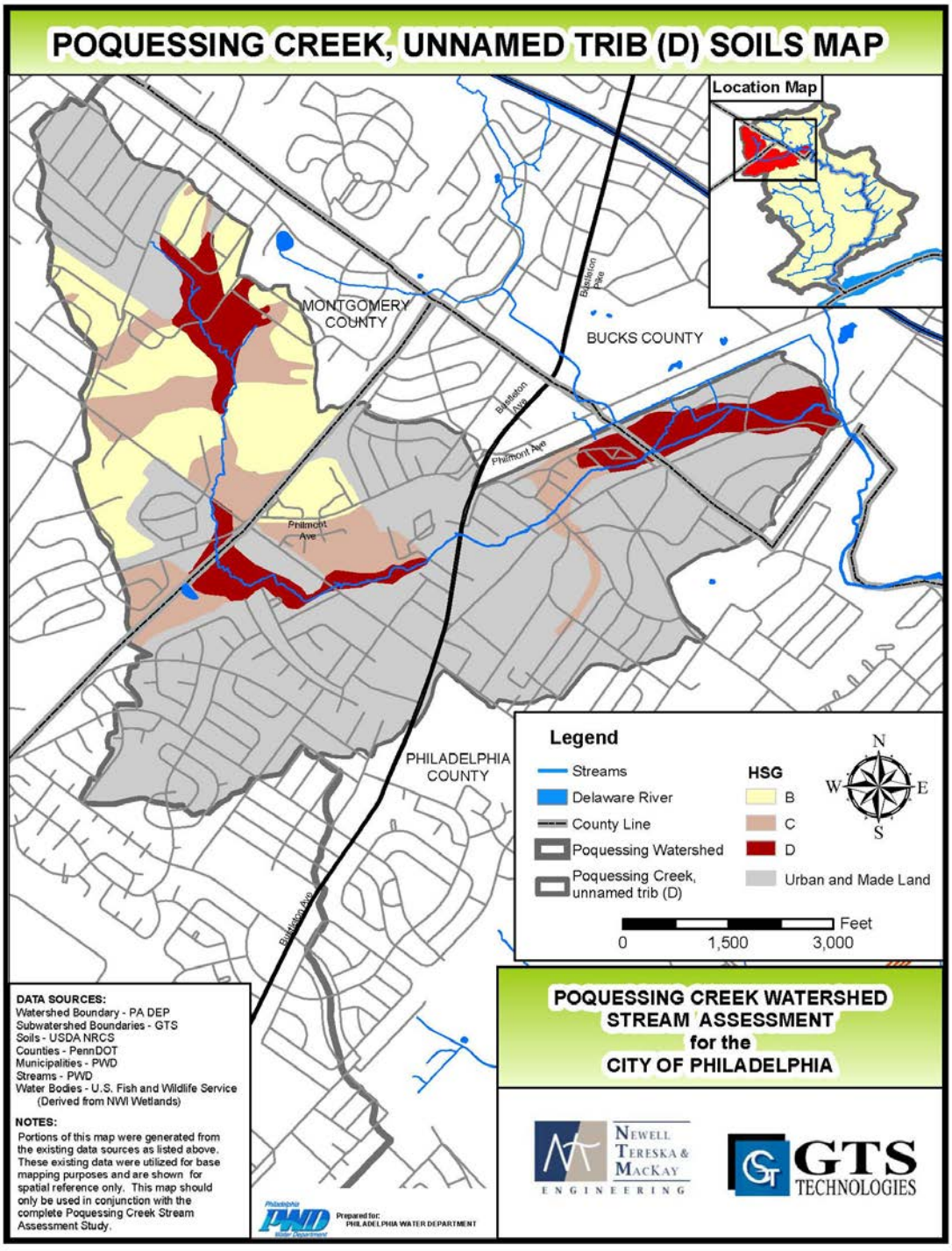


Figure 3-18: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary D Watershed



3.1.4.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for 13 reaches in Poquessing Creek, Unnamed Tributary D (Table 3-23). Eleven reaches were found to be eroding based on the total wetted perimeter calculation, while two were aggrading. The average total erosion rate for all reaches in the Poquessing Creek, Unnamed Tributary D was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-24). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-23: Erosion Rates for Poquessing Creek, Unnamed Tributary D Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSD02	-0.193	-0.029	-0.659	-0.085	-0.017	E
PQMSD04	-2.173	-0.252	-1.988	-0.490	-0.098	E
PQMSD06	-0.734	-0.281	-1.534	-0.291	-0.058	E
PQMSD08	-0.192	-0.139	-0.426	-0.119	-0.024	E
PQMSD12	-0.202	-0.156	-0.044	-0.070	-0.014	E
PQMSD14	-0.646	-0.083	-0.714	-0.138	-0.028	E
PQMSD16	-0.360	-0.139	-0.675	-0.167	-0.033	E
PQMSD18	-3.516	0.078	-2.428	-0.278	-0.056	E
PQMSD20	-1.162	-0.016	-1.077	-0.154	-0.031	E
PQMSD22	-0.210	0.119	-1.980	-0.163	-0.033	E
PQMSD23	0.178	-0.079	1.230	0.022	0.004	A
PQMSD24	-1.139	0.044	1.451	0.052	0.010	A
PQMSD26	-0.654	-0.074	0.519	-0.068	-0.014	E
Average	-0.846	-0.078	-0.640	-0.150	-0.030	E

Table 3-24: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.4.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary D is a small tributary to the Poquessing Creek that flows through Montgomery, Bucks and Philadelphia Counties. The headwaters of Poquessing Creek Unnamed Tributary D lies in a mainly wooded area with residential development close by. At the downstream end and closer to the confluence, the land use patterns remain a mix of residential, light manufacturing and commercial development before reaching the confluence with the Poquessing Creek. The downstream portion of Poquessing Creek Unnamed Tributary D exhibits some of the impairments associated with urban streams given its location and proximity to commercial and dense

residential areas that surrounds the stream channel. The majority of infrastructure was located around the middle portion of the reach at cross section PQMSD12 mainly in the form of outfalls and channelization. This cross section is in the area of Byberry Road. There were 60 outfalls located along Poquessing Creek Unnamed Tributary D. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.7 to 6.0 feet in diameter. The number of headwater outfalls (Table 3-25) on this stream indicates that it is heavily influenced by stormwater discharges. Channelization is another dominant infrastructure element along this reach.

There are 17 culverts along Poquessing Creek Unnamed Tributary D that convey the stream under transportation corridors. Major crossings include Byberry Road (PQcul056) and Bustleton Avenue (PQcul061). Along Poquessing Creek Unnamed Tributary D, infrastructure elements vary from poor to good. A total of 18 infrastructure elements were identified as being in poor condition. The majority of the poor condition infrastructure is constructed channels including PQchan081, PQchan082, PQchan083, PQchan087, PQchan088, PQchan107, PQchan109, PQchan110, PQchan111, PQchan112, PQchan113, PQchan114, PQchan116 and PQchan117. These channels cover approximately 1,145 feet of channel length. The poor condition channels are constructed of stone or concrete and range in height from 2 to 6 feet. Dam PQdam009 located in upstream section PQMSD02 is identified as being in poor condition. This dam is 15 feet in length and has a 2 feet exposed height. Sewer pipe PQpip003, located in section PQMSD06 is a clay/terra cotta sewer pipe with a 7 feet exposed portion is identified as being in poor condition. Outfall PQout91, located at PQMSD12 is a clay/terra cotta outfall pipe in poor condition with a 1 foot opening. The flow at the time of observance was identified as a trickle and the appearance was clear. Lastly, a culvert at PQMSD24 was identified to be in poor condition. Culvert PQcul065 is a 6-foot long by 18-inch diameter corrugated metal pipe located on private property not accessible to any major transportation routes. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-25: Summary of Poquessing Creek Unnamed Tributary D Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSD02	0	0	3	7	0	0	1	0	11
PQMSD04	1	1	6	1	0	0	0	0	9
PQMSD06	0	0	2	2	2	2	0	0	8
PQMSD08	2	0	1	7	0	0	3	0	13
PQMSD12	2	2	6	8	2	0	0	0	20
PQMSD14	1	2	3	5	3	0	0	0	14
PQMSD16	3	2	12	0	1	0	0	0	18
PQMSD18	2	0	10	0	0	0	0	0	12
PQMSD20	1	1	8	5	0	0	0	0	15
PQMSD22	0	1	4	3	1	0	0	0	9
PQMSD23	3	0	2	1	0	0	0	0	6
PQMSD24	2	3	2	5	0	0	0	0	12
PQMSD26	0	0	1	2	0	0	0	0	3
TOTAL	17	12	60	46	9	2	4	0	150

3.1.4.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream reach of Poquessing Creek, Unnamed Tributary D stream channel is a second-order channel with two small unnamed tributaries. Most of the channel is a single thread however a split of the channel occurs at the lower end of the watershed. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-19: Results for Poquessing Creek, Unnamed Tributary D Watershed USAM Components

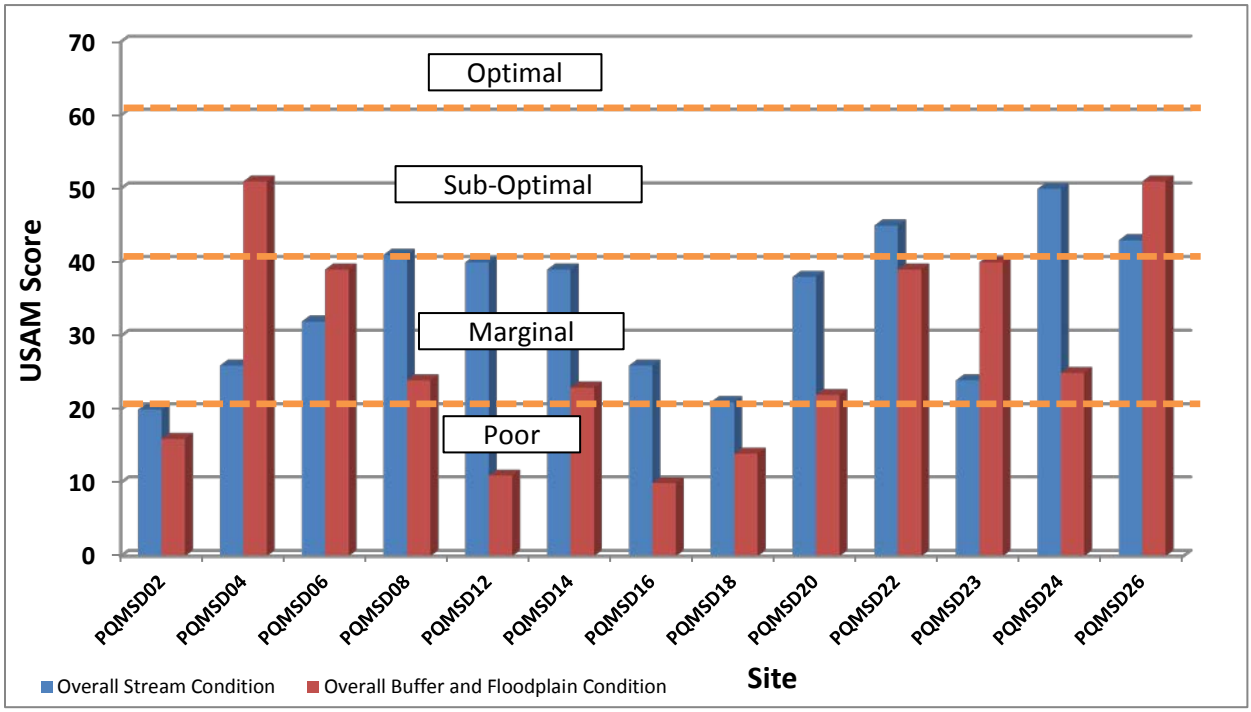
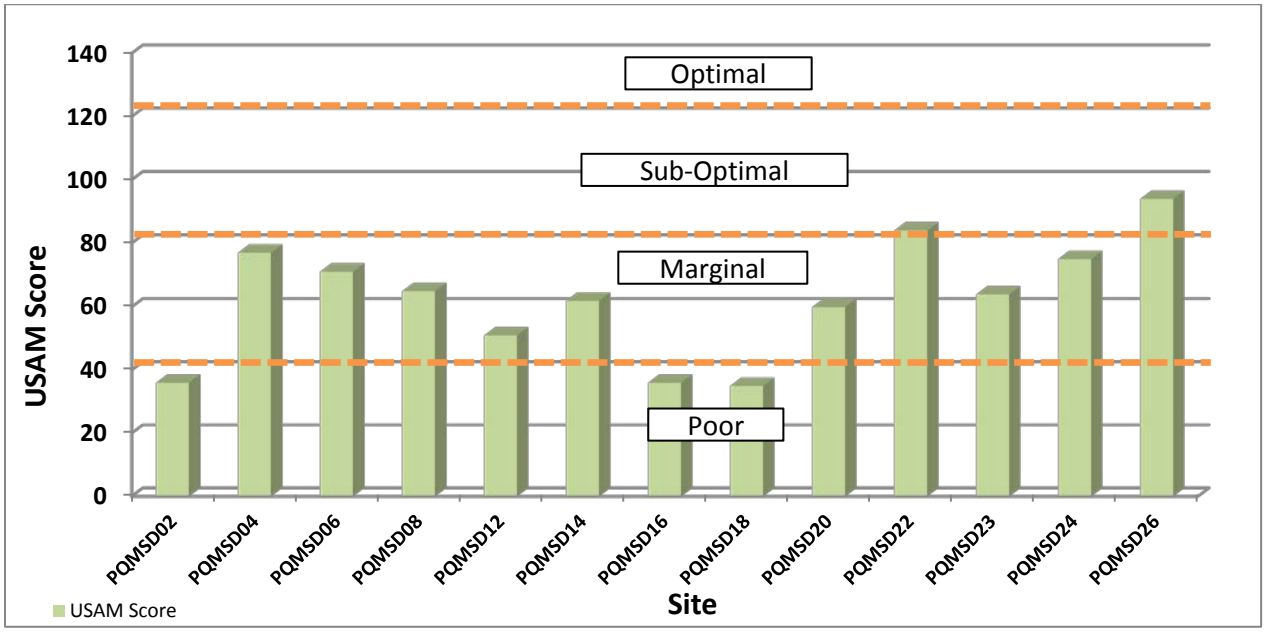


Figure 3-20: Poquessing Creek, Unnamed Tributary D Watershed USAM Results



3.1.4.5.1 PQMSD02

Reach PQMSD02 is the first reach of Poquessing Creek, Unnamed Tributary D. The headwaters of this tributary begin at a stormwater outfall and runs between a residential area and a school near Pine Road. Reach PQMSD02 is characterized by a shallow slope (1.2%), low width to depth ratio (11.9), a highly entrenched channel (ER = 1.7), low sinuosity (1.15), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSD02 was poor (36/160).

3.1.4.5.2 PQMSD04

Reach PQMSD04 begins approximately 300 feet upstream of cross section PQMSD04. The upper half of this reach runs through a residential area and the lower half runs behind a cemetery. However, the majority of the reach has a wide forested buffer on both sides of the stream. Reach PQMSD04 is characterized by a shallow slope (0.6%), moderate width to depth ratio (12.1), a highly entrenched channel (ER = 1.4), moderate sinuosity (1.20), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSD04 was marginal (77/160).

3.1.4.5.3 PQMSD06

Reach PQMSD06 begins approximately 1100 feet upstream of cross section PQMSD06. This entire reach runs through a cemetery with the upper portion having a wider forested buffer. Reach PQMSD06 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (14.1), a highly entrenched channel (ER = 1.3), low sinuosity (1.13), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSD06 was marginal (71/160).

3.1.4.5.4 PQMSD08

Reach PQMSD08 begins approximately 500 feet upstream of cross section PQMSD08. The upper half of this reach travels through cemetery and lower half runs between commercial and residential areas. Reach PQMSD08 is characterized by a shallow slope (1.5%), moderate to high width to depth ratio (15.2), a slightly entrenched channel (ER = 3.4), low sinuosity (1.12), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD08 was marginal (65/160).

3.1.4.5.5 PQMSD12

Reach PQMSD12 begins approximately 1700 feet upstream of cross section PQMSD12. This reach runs primarily through a dense residential area and is bisected by Byberry Road. Reach PQMSD12 is characterized by a shallow slope (0.5%), low width to depth ratio (10.8), a slightly entrenched channel (ER = 2.5), moderate sinuosity (1.12), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMSD12 was marginal (51/160).

3.1.4.5.6 PQMSD14

Reach PQMSD14 begins approximately 500 feet upstream of cross section PQMSD14. This reach runs entirely through dense residential neighborhoods. Reach PQMSD14 is characterized by a shallow slope (0.5%), moderate to high width to depth ratio (17.6), a slightly entrenched channel (ER = 2.6), low sinuosity (1.10), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD14 was marginal (62/160).

3.1.4.5.7 PQMSD16

Reach PQMSD16 begins approximately 700 feet upstream of cross section PQMSD16. This reach runs through a densely developed residential neighborhood and is bisected by Bustleton Avenue. Reach PQMSD16 is characterized by a shallow slope (0.5%), moderate width to depth ratio (13.6), a highly entrenched channel (ER = 1.2), low sinuosity (1.15), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSD16 was poor (36/160).

3.1.4.5.8 PQMSD18

Reach PQMSD18 begins approximately 400 feet upstream of cross section PQMSD18. This reach runs through a residential area. Reach PQMSD18 is characterized by a shallow slope (0.5%), high width to depth ratio (24.2), a highly entrenched channel (ER = 1.4), low sinuosity (1.03), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSD18 was poor (35/160).

3.1.4.5.9 PQMSD20

Reach PQMSD20 begins approximately 600 feet upstream of cross section PQMSD20. This reach runs through a residential area. Reach PQMSD20 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (15.40), a slightly entrenched channel (ER = 3.3), low sinuosity (1.06), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD20 was marginal (60/160).

3.1.4.5.10 PQMSD22

Reach PQMSD22 begins approximately 500 feet upstream of cross section PQMSD22. This reach runs through a residential and wooded area. This reach splits into two channels (reaches PQMSD22 and PQMD23) for a significant distance and later joins in Reach PQMSD24. This channel split made the estimating hydrologic/hydraulic parameters and geomorphic characterization challenging without a hydraulic model. Reach PQMSD22 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (14.6), a slightly entrenched channel (ER = 5.8), low sinuosity (1.10), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD22 was sub-optimal (84/160).

3.1.4.5.11 PQMSD23

Reach PQMSD23 begins approximately 500 feet upstream of cross section PQMSD23. The upper end of this reach runs through a wooded area and lower end through a mostly commercial area. This reach is formed by the split of Poquessing Creek, Unnamed Tributary D into two channels (reaches PQMSD22 and PQMD23) for a significant distance and later joins in Reach PQMSD24. There are also a few culverts under the SEPTA rail line which connect this reach to Poquessing Creek, Unnamed Tributary C. The channel split and connections made estimating hydrologic/hydraulic parameters and geomorphic characterization challenging without a hydraulic model. Reach PQMSD23 is characterized by a shallow slope (0.4%), moderate width to depth ratio (13.5), a highly entrenched channel (ER = 1.4), moderate sinuosity (1.31), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSD23 was sub-optimal (64/160).

3.1.4.5.12 PQMSD24

Reach PQMSD24 begins approximately 300 feet upstream of cross section PQMSD24. This upper end of this reach runs through a commercial area and enters a residential area after going through the Sterner Mill Road culvert. Reach PQMSD24 is characterized by a shallow slope (0.3%), moderate width to depth ratio (13.7), a slightly entrenched channel (ER = 7.6), low sinuosity (1.08), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD24 was marginal (75/160).

3.1.4.5.13 PQMSD26

Reach PQMSD26 begins approximately 600 feet upstream of cross section PQMSD26. This reach runs through a wooded and residential area before joining the mainstem of Poquessing Creek immediately upstream of Trevose Road Reach PQMSD26 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (14.3), a slightly entrenched channel (ER = 14.1), moderate sinuosity (1.27), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSD26 was sub-optimal (94/160).

3.1.4.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Thirteen separate reaches were analyzed for the Poquessing Creek, Unnamed Tributary D Watershed. The mean scores for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM score were classified as marginal (Table 3-26). Average conditions within the Poquessing Creek, Unnamed Tributary D Watershed's stream channels were similar to those observed within the buffers and floodplains, with scores for individual reaches ranging from poor to suboptimal. The watershed averages for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM were lower than their respective All Reaches averages. Graphs of each USAM category rating are in Appendix D.

Table 3-26: USAM Results for Poquessing Creek, Unnamed Tributary D Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSD02	PQ, Unnamed Tributary D	20	16	36
PQMSD04	PQ, Unnamed Tributary D	26	51	77
PQMSD06	PQ, Unnamed Tributary D	32	39	71
PQMSD08	PQ, Unnamed Tributary D	41	24	65
PQMSD12	PQ, Unnamed Tributary D	40	11	51
PQMSD14	PQ, Unnamed Tributary D	39	23	62
PQMSD16	PQ, Unnamed Tributary D	26	10	36
PQMSD18	PQ, Unnamed Tributary D	21	14	35
PQMSD20	PQ, Unnamed Tributary D	38	22	60
PQMSD22	PQ, Unnamed Tributary D	45	39	84
PQMSD23	PQ, Unnamed Tributary D	24	40	64
PQMSD24	PQ, Unnamed Tributary D	50	25	75
PQMSD26	PQ, Unnamed Tributary D	43	51	94
PQMSD Mean		34.2	28.1	62.3
All Reaches Average		37.1	37.4	74.4

3.1.4.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY D WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal, with most scores occurring within the marginal range. The mean watershed score (34.2/80.0) was rated as marginal and was slightly lower than the All Reaches average score (37.1/80.0) which also scored within the marginal range.

Table 3-27: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary D Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQMSD02	PQ, Unnamed Tributary D	5	2	3	1	2	7	20
PQMSD04	PQ, Unnamed Tributary D	7	4	5	3	3	4	26
PQMSD06	PQ, Unnamed Tributary D	12	5	4	4	4	3	32
PQMSD08	PQ, Unnamed Tributary D	9	4	2	4	2	20	41
PQMSD12	PQ, Unnamed Tributary D	8	2	2	7	6	15	40
PQMSD14	PQ, Unnamed Tributary D	10	2	3	4	4	16	39
PQMSD16	PQ, Unnamed Tributary D	10	4	5	2	3	2	26
PQMSD18	PQ, Unnamed Tributary D	7	2	3	2	3	4	21
PQMSD20	PQ, Unnamed Tributary D	6	3	3	3	3	20	38
PQMSD22	PQ, Unnamed Tributary D	12	5	2	4	2	20	45
PQMSD23	PQ, Unnamed Tributary D	5	4	5	3	3	4	24
PQMSD24	PQ, Unnamed Tributary D	13	3	4	4	6	20	50
PQMSD26	PQ, Unnamed Tributary D	9	4	4	3	3	20	43
PQMSD Mean		8.7	3.4	3.5	3.4	3.4	11.9	34.2
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.4.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to suboptimal for the thirteen reaches analyzed in the Poquessing Creek, Unnamed Tributary D Watershed, although eight of the reaches scored within the marginal range. Two reaches (PQMSD02 and PQMSD23) were characterized as poor and three reaches (PQMSD06, PQMSD22, and PQMSD24) were classified as suboptimal. A poor rating reflects less than 20% stable habitat and an unstable or lacking substrate. A marginal instream habitat is described as a 20-40% mix of stable habitat with less than desired availability

and a disturbed substrate. A suboptimal rating reflects a 40-70% mix of stable habitat, well suited for colonization but not yet prepared for new colonization. The watershed mean was slightly higher than the All Reaches average (8.7/20/0 vs. 8.2/20.0) although both were characterized as marginal. Sediment deposition and channelization has affected many of the impaired reaches.

3.1.4.6.1.2 VEGETATIVE PROTECTION

Vegetative protection within the Poquessing Creek, Unnamed Tributary D Watershed was marginal overall with seven reaches having both the left and right banks score within the marginal range. One reach (PQMSD12) had a poor rating for both the left and right banks. Reaches PQMSD02, PQMSD14, and PQMSD18 had poor ratings for the left banks and marginal ratings for the right banks. Reach PQMSD22 had marginal rating for the left bank and a poor rating for the right bank. A marginal rating indicates that 50-70% of the streambank is covered with vegetation with obvious areas of disturbance and patches of bare soil. A poor rating reflects less than 50% coverage by vegetation and high rates of vegetation disturbance. The watershed mean for both the left and right banks were slightly lower than the All Reaches averages (3.4/10.0 vs. 4.0/10.0, LB and 3.5/10.0 vs. 3.9/10.0, RB), although both left and right banks for the watershed mean and All Reaches average were classified as marginal. The marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks due to encroachment from development and channel erosion.

3.1.4.6.1.3 BANK EROSION

Scores for bank erosion for the thirteen reaches analyzed for Poquessing Creek, Unnamed Tributary D ranged from poor to suboptimal with the majority of reaches scoring within the marginal range. A marginal score reflects past downcutting events, active stream widening and erosion at a moderate rate. Six reaches had both the left and right banks both classified as marginal. Reach PQMSD02 had poor ratings for both the left and right banks. Reach PQMSD12 had suboptimal ratings for both banks. Reach PQMSD08 and PQMSD 22 had marginal ratings for the left bank and poor ratings for the right bank while reaches PQMSD16 and PQMSD18 had poor ratings for the left bank and marginal ratings for the right banks. Reach PQMSD24 had a marginal left bank and a suboptimal right bank. The mean watershed scores for the left and right banks were both (3.4/10.0) rated as marginal and were slightly lower than the All Reaches averages of 3.9/10.0 and 4.0/10.0 (left and right banks, respectively), also considered marginal.

3.1.4.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary D Watershed contained the highest scores of the Overall Stream Condition components. Five reaches (PQMSD08, PQMSD20, PQMSD22, PQMSD24, and PQMSD26) all scored within the optimal range. Optimal floodplain connection is characterized by high flows able to enter the floodplain and no deep stream entrenchment. Two reaches (PQMSD12 and PQWMSD14) were characterized as suboptimal, also reflecting high flows able to enter the floodplain and no deep entrenchment, just to a lesser degree than the optimal rating. Reach

PQMSD02 as the only reach with a marginal rating, indicating high flows not able to enter the floodplain and deep entrenchment. This reach was channelized between a school and a residential area. The remaining five reaches scored within the poor range, with a similar characterization as marginal, just to a greater degree. The mean for the Poquessing Creek, Unnamed Tributary D Watershed was just slightly lower than for all reaches with a score of 11.9/20.0 as compared to 13.0/20.0, giving this watershed an overall suboptimal rating.

Floodplain connection scores are based on the ratio of flood prone width to bankfull width. This is also known as entrenchment ratio. The relatively high bankfull flow predictions in the watershed result in a prediction of a wide flood prone width in many cases. Therefore, it is predicted that relatively frequent flood events will exceed the channel capacity and reach adjacent floodplains in most reaches.

3.1.4.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY D WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to suboptimal. The mean component score for the Poquessing Run, Unnamed Tributary D Watershed (28.1/80.0) was less than the All Reaches average (37.4/80.0), although both are classified as marginal. The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being development and its associated infrastructure.

Table 3-28: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary D Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSD02	PQ, Unnamed Tributary D	1	5	5	3	2	16
PQMSD04	PQ, Unnamed Tributary D	7	7	12	14	11	51
PQMSD06	PQ, Unnamed Tributary D	5	5	8	11	10	39
PQMSD08	PQ, Unnamed Tributary D	5	2	4	4	9	24
PQMSD12	PQ, Unnamed Tributary D	2	2	2	2	3	11
PQMSD14	PQ, Unnamed Tributary D	2	4	5	3	9	23
PQMSD16	PQ, Unnamed Tributary D	2	3	2	2	1	10
PQMSD18	PQ, Unnamed Tributary D	2	3	2	2	5	14
PQMSD20	PQ, Unnamed Tributary D	3	3	4	4	8	22
PQMSD22	PQ, Unnamed Tributary D	8	2	11	8	10	39
PQMSD23	PQ, Unnamed Tributary D	3	8	11	8	10	40
PQMSD24	PQ, Unnamed Tributary D	4	4	5	4	8	25
PQMSD26	PQ, Unnamed Tributary D	8	7	13	9	14	51
PQMSD Mean		4.0	4.2	6.5	5.7	7.7	28.1
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.4.6.2.1 VEGETATED BUFFER WIDTH

Vegetated buffer width for the thirteen reaches analyzed ranged from poor to suboptimal. Two reaches (PQMSD04 and PQMSD26) had ratings of suboptimal for both the left and right banks. Three reaches (PQMSD06, PQMSD20, and PQMSD24) had marginal ratings for both banks. Reach PQMSD12 had poor ratings for both banks. The remaining reaches were mixes of poor, marginal and suboptimal. A poor rating indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. A marginal rating reflects a buffer zone 10-25 feet in width with a great deal of human impact, while a suboptimal rating indicates a buffer 25-50 feet in width and minimal human impact. The mean

watershed score of 4.0/10.0 for the left bank was less than 5.3/10.0 for the All Reaches average, although both are classified as marginal. The mean watershed score of 4.2/10.0 for the right bank (marginal) was lower than 6.0/10, the all reaches average for right banks, considered suboptimal.

3.1.4.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in the Poquessing Creek, Unnamed Tributary D Watershed was turf, with eight reaches scoring in the poor range. Reaches PQMSD04, PQMSD20, PQMSD22, and PQMSD26 had ratings of suboptimal, indicating dominant vegetation of young floodplain forest. Reach PQMSD06 was the only reach to score in the marginal range, indicating a dominant vegetation type of shrub. The mean Poquessing Creek, Unnamed Tributary D Watershed score (6.5/20.0) was rated as marginal, which was slightly lower than the All Reaches average (9.7/20.0), also rated as marginal.

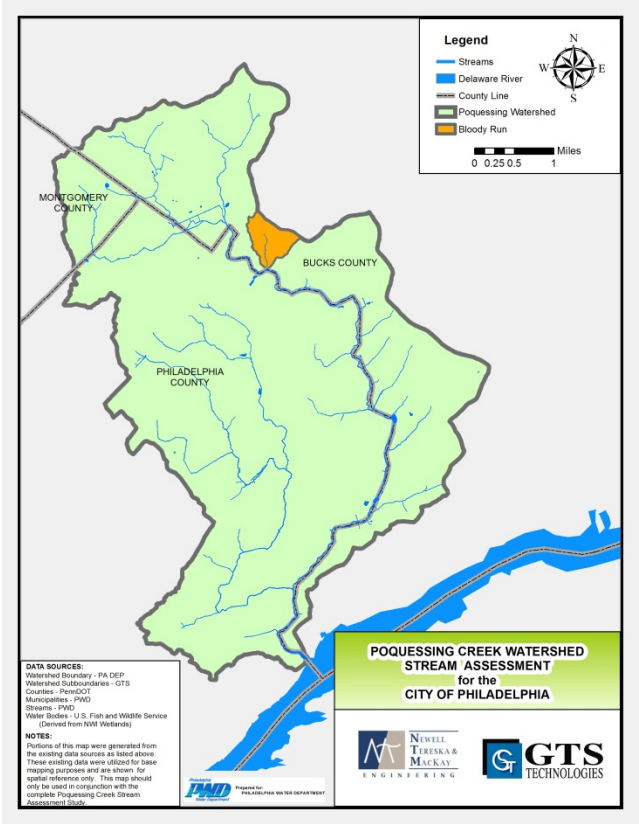
3.1.4.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was limited throughout the Poquessing Creek, Unnamed Tributary D Watershed with eight reaches scoring in the poor range. A poor rating is characterized by either all wetland or non-wetland habitat and no evidence of standing or ponded water. One of the primary causes of habitat limitation was the extent of artificial channelization and encroachment of development observed throughout the watershed. Three reaches (PQMSD22, PQMSD23, and PQMSD26) were characterized as marginal, indicating wither all wetland or non-wetland habitat but with evidence of standing or ponded water. Two reaches (PQMSD04 and PQMSD06) were rated as suboptimal, reflecting an even mix of wetland and non-wetland habitat, but no evidence of standing or ponded water. The mean watershed score for this parameter (5.7/20.0) was rated as poor and was lower than the All Reaches average score (8.3/20.0) which was considered marginal.

3.1.4.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter ranged from poor to suboptimal with over half of the reaches scoring within the marginal range. A total of seven reaches were characterized as having marginal floodplain encroachment with some effect on floodplain function. Two reaches (PQMSD04 and PQMSD26) were rated as suboptimal, indicating minor floodplain encroachment with no effect on floodplain function. Four reaches (PQMSD02, PQMSD12, PQMSD16, and PQMSD18) achieved poor ratings, reflecting significant floodplain encroachment and resulting significant effect on floodplain function. The mean score for the watershed was (7.7/20.0) which was slightly lower than the All Reaches average score of (8.2/20.0, marginal), giving the Poquessing Creek, Unnamed Tributary D Watershed an overall rating of marginal.

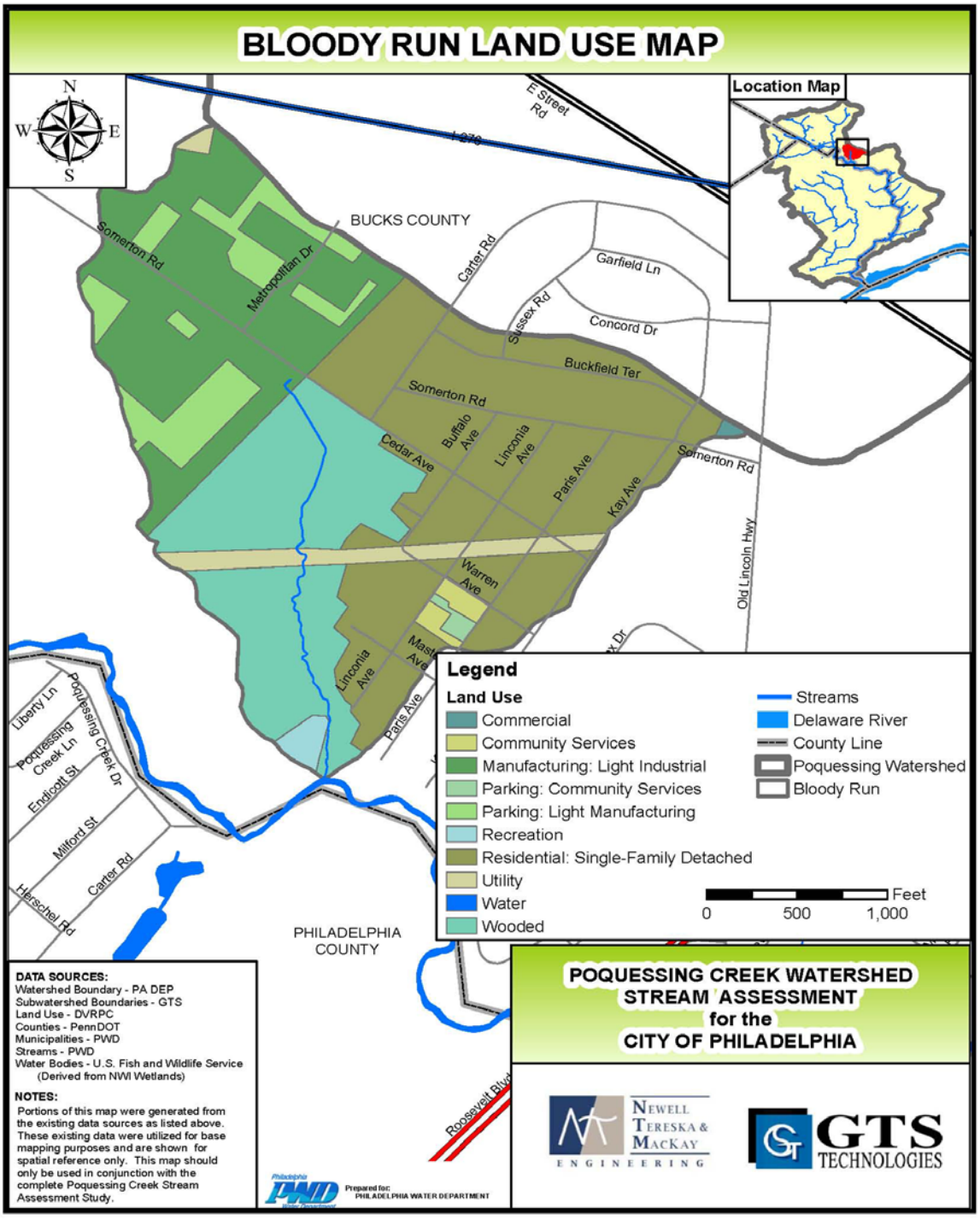
3.1.5 BLOODY RUN WATERSHED AND REACH CHARACTERISTICS



Bloody Run is a tributary to the mainstem of the Poquessing Creek. Bloody Run originates from a privately-owned stormwater outfall. Bloody Run is a first-order tributary and flows for approximately 2,500 feet before the confluence with the Poquessing mainstem. The dominant substrate varies from course gravel to silt and clay material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Bloody Run Watershed is 158 acres. Major land use types within the watershed include: residential: Single Family Detached (41%) manufacturing: light industrial (23%) and wooded (22%). Bloody Run is surrounded by wooded land on both sides. The buffer ranges from about 20 feet to about 2,000 feet wide.

Figure 3-21: Bloody Run Watershed Land Use



3.1.5.1 GEOLOGY

The Bloody Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.5.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the Bloody Run Watershed vary and are classified as follows: hydrologic group B (15%), hydrologic group C, (14%), hydrologic group D (8%) and Urban (66%). The soils for the majority of the Bloody Run Watershed are classified as urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-29: Distribution of NRCS Soil Types in Bloody Run Watershed

Group	Area (acres)	Percent of Total Area
B	24.2	15%
C	18.4	12%
D	12.1	8%
Urban	104.1	66%
Total Area	158.8	100%

Figure 3-22: Geology of Bloody Run Watershed

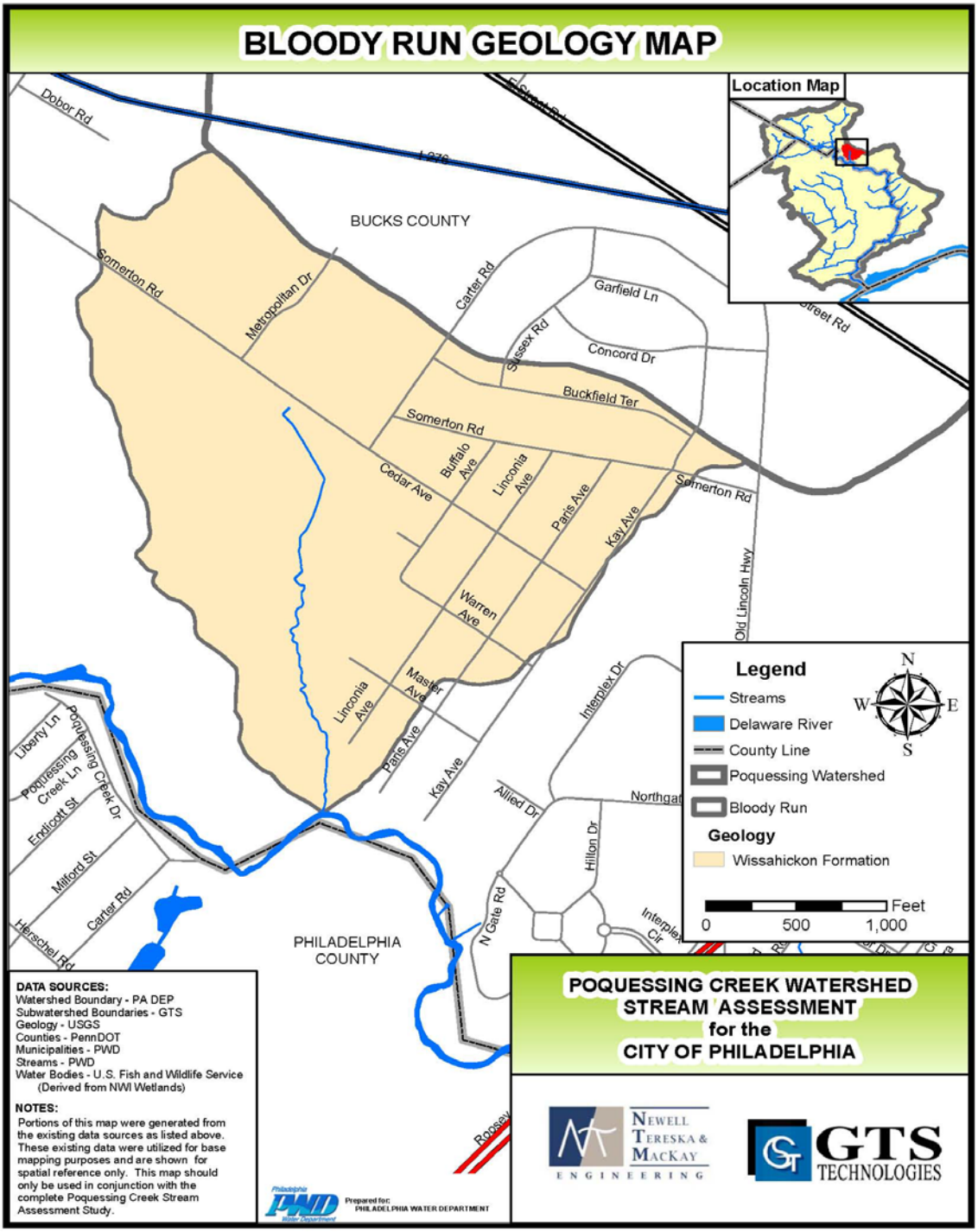
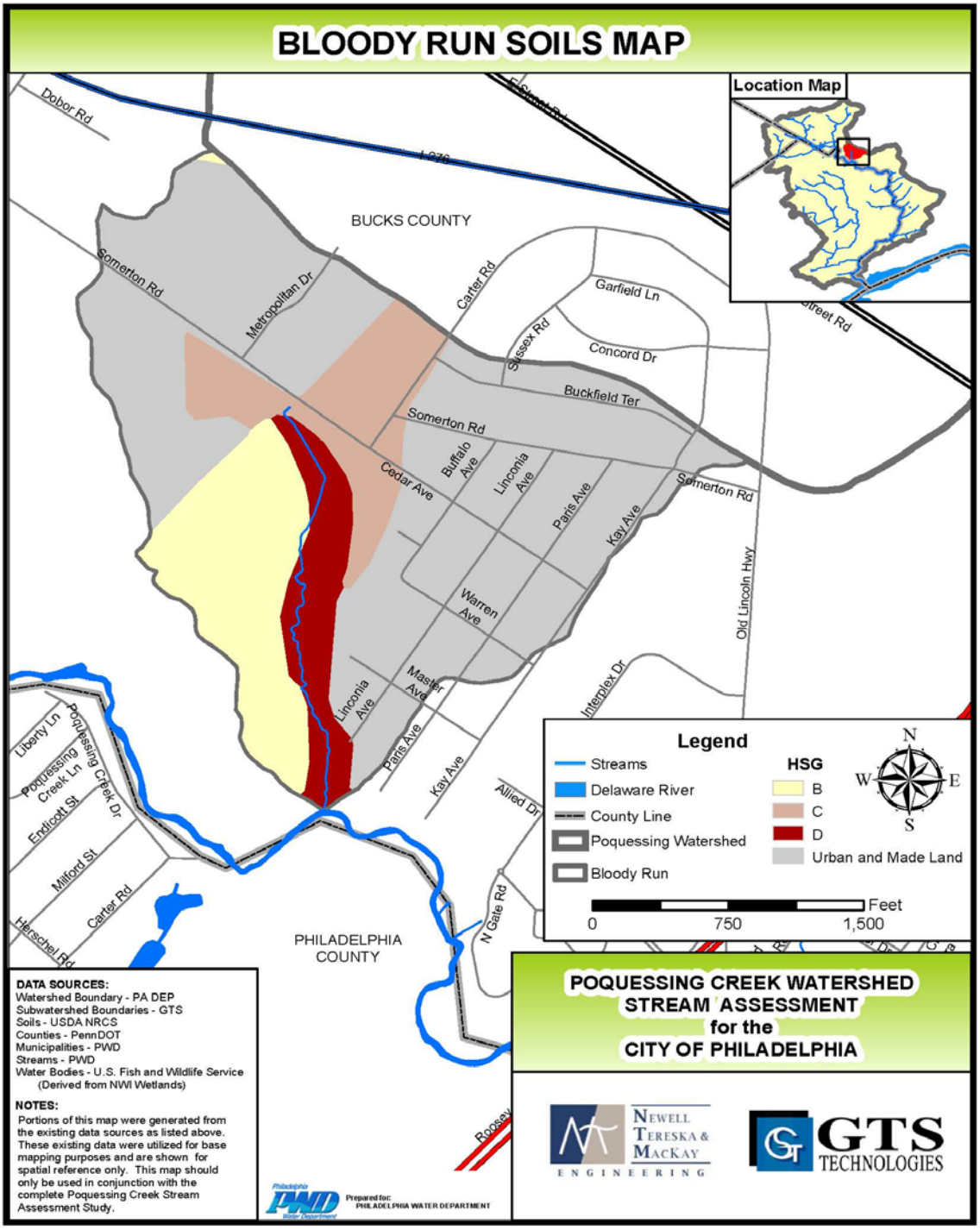


Figure 3-23: Distribution of NRCS Soil Types in Bloody Run Watershed



3.1.5.3 BANK EROSION

Erosion rates for the left bank, stream bed, right bank, and total wetted perimeter were calculated for two reaches in Bloody Run (Table 3-30). Two reaches were found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for all reaches in Bloody Run was nearly twice the average for all Poquessing Creek subwatersheds (Table 3-31). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-30 Erosion Rates for Bloody Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBR02	-2.540	-0.833	-1.946	-0.962	-0.192	E
PQBR04	-0.155	-0.156	-0.394	-0.246	-0.049	E
Average	-1.348	-0.330	-0.780	-0.403	-0.081	E

Table 3-31: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.5.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Bloody Run is a small tributary to Poquessing Creek located within Bucks County. The headwaters of Bloody Run lies in a mainly wooded area with residential development close by. At the downstream end and closer to the confluence, the land use patterns remain mainly residential with some recreational development, before reaching the confluence with the Poquessing Creek. The downstream portion of Bloody Run exhibits some of the impairments associated with urban streams given its location and proximity to residential and commercial development in the watershed. The majority of infrastructure was located in reach PQBR04 mainly in the form of outfalls. This reach is located in close proximity to residential development. There were 3 outfalls located along Bloody Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.5 to 4.0 feet in diameter. The number of headwater outfalls (Table 3-32) on this stream indicates that it is influenced by stormwater discharges in the downstream-most segments of PQBY04.

There were three culverts (PQcul067, PQcul068, and PQcul069) that conveyed Bloody Run under transportation routes. Along Bloody Run, most infrastructure elements were considered in fair condition or better. The outfall identified as PQout146 located at cross section PQBR04 is a 2.5 ft. Corrugated Metal outfall pipe located at the downstream left bank and exhibits intermittent flow and has been determined to be in poor condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-32: Summary of Bloody Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBR02	2	0	1	0	0	0	0	0	3
PQBR04	1	1	2	0	0	0	0	0	4
TOTAL	3	1	3	0	0	0	0	0	7

3.1.5.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Bloody Run stream channel is a first-order, single thread channel with no tributaries. Bloody Run is a direct tributary to the mainstem of Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-24: Results for Bloody Run Watershed USAM Components

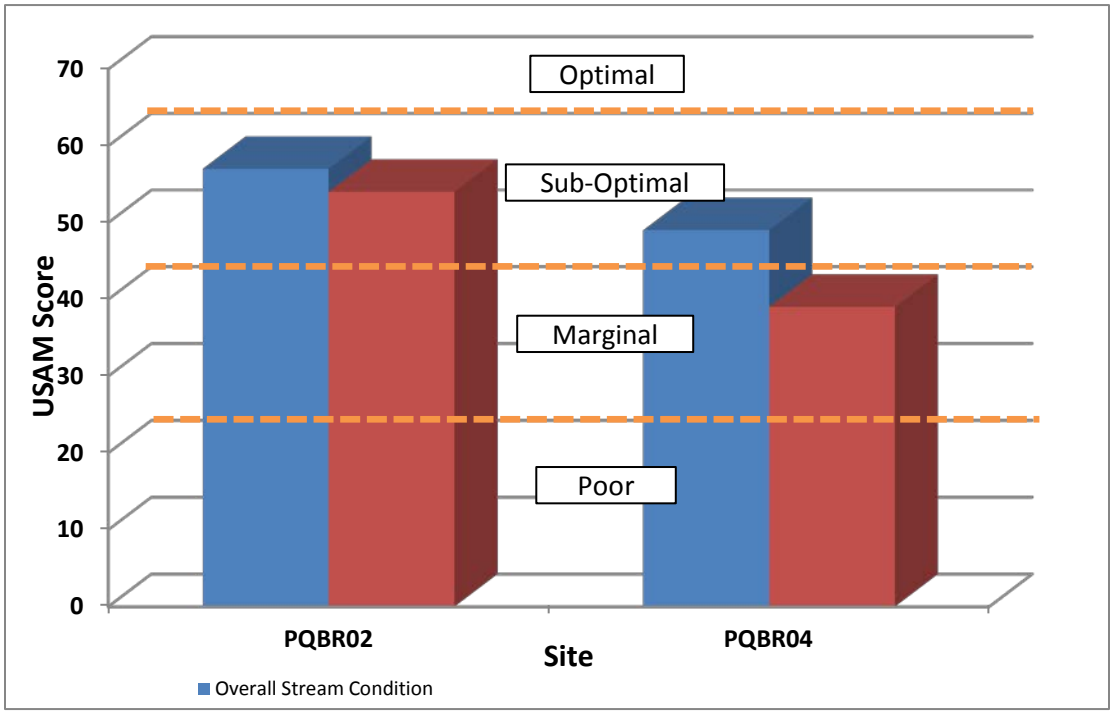
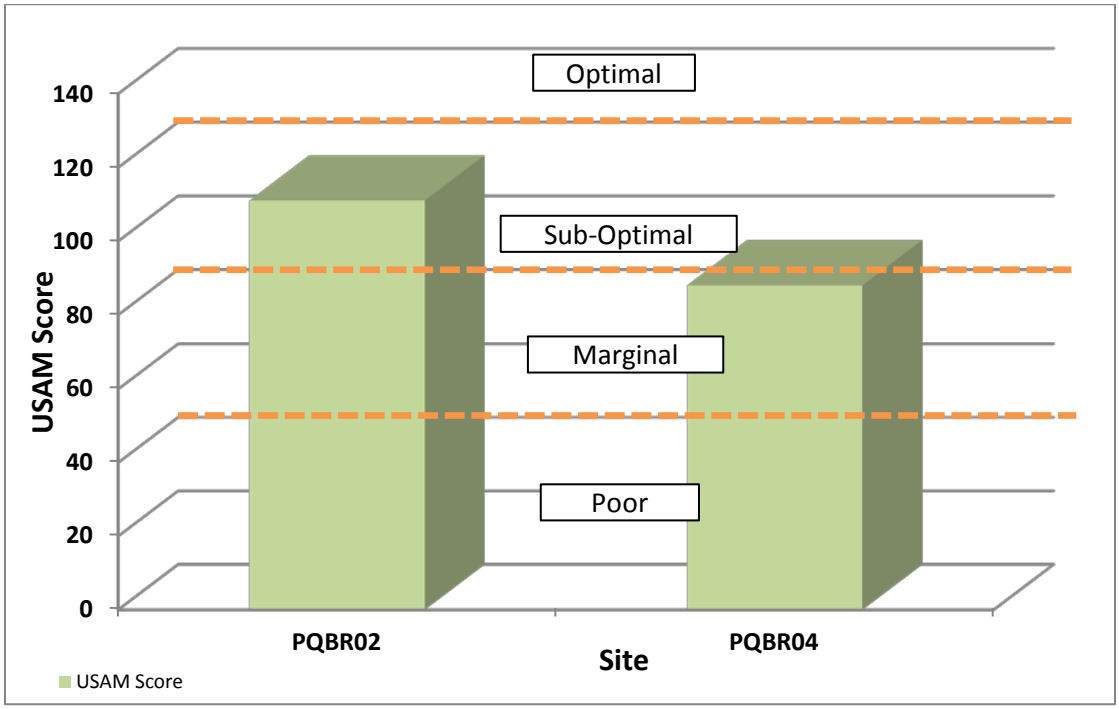


Figure 3-25: Bloody Run Watershed USAM Results



3.1.5.5.1 PQBR02

Reach PQBR02 is the first reach of Bloody Run. The headwaters of this tributary begin at a stormwater outfall and culvert near the SEPTA rail line. The remaining portion of the reach travels through a wooded area that receives runoff from adjacent residential areas. Reach PQBR02 is characterized by a shallow slope (1.1%), moderate to high width to depth ratio (15.5), a slightly entrenched channel (ER = 14.9), low sinuosity (1.14), and silt/clay substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQBR02 was sub-optimal (111/160).

3.1.5.5.2 PQBR04

Reach PQBR04 begins approximately 700 feet upstream of cross section PQBR04. This reach runs through a wooded corridor that receives runoff from residential areas and a park at the lower end before joining the mainstream of Poquessing Creek. Reach PQBR04 is characterized by a shallow slope (1.2%), low width to depth ratio (8.8), a moderately entrenched channel (ER = 1.9), low sinuosity (1.03), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBR04 was suboptimal (88/160).

3.1.5.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean scores for both the Overall Stream Condition components as well as the composite USAM score were classified as "suboptimal" (Table 3-33). Average conditions within the Bloody Run Watershed's stream channels were better than conditions observed within the buffers and floodplains. The watershed averages for the Overall Stream Condition component as well as the composite USAM were much higher than the respective All Reaches averages. The Overall Buffer and Floodplain component was rated as suboptimal and was also higher than that for the All Reaches average. The scores for individual parameters ranged from marginal to optimal, displaying similar levels of variability between reaches. Graphs of each USAM category rating are in Appendix D.

Table 3-33: USAM Results for Bloody Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBR02	Bloody Run	57	54	111
PQBR04	Bloody Run	49	39	88
PQBR Mean		53.0	46.5	99.5
All Reaches Average		37.1	37.4	74.4

3.1.5.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE BLOODY RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were generally moderate with most scoring in the suboptimal range. The mean watershed score

(53/80) was rated as suboptimal and was considerably higher than the All Reaches average score (37.1/80) which was rated marginal. A beneficial riparian buffer exists along much of Bloody Run which helps to contribute to above average USAM scores.

Table 3-34: USAM Overall Stream Condition Scoring for Bloody Run Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQBR02	Bloody Run	14	5	7	5	6	20	57
PQBR04	Bloody Run	14	8	6	6	6	9	49
PQBR Mean		14.0	6.5	6.5	5.5	6.0	14.5	53.0
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.5.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter were suboptimal for the two reaches analyzed in the Bloody Run Watershed. The watershed mean was greater than the All Reaches average (8.2/20). Both reaches characterized for Bloody Run were described as a 40-70% mix of stable habitat, well suited for full colonization potential and with adequate habitat for maintenance of populations. Some coarse woody debris and channel substrate suitable for colonization was found in Bloody Run.

3.1.5.6.1.2 VEGETATIVE PROTECTION

Both banks of the two reaches analyzed for the Bloody Run Watershed had suboptimal vegetative protection. Both reaches had 70-90% of the streambank surfaces covered by native vegetation however, the shrub strata was not well represented. Disruption may be evident but is not affecting full plant growth potential. The All Reaches averages for both banks were lower than the Bloody Run Watershed (4.0 vs. 6.5 and 3.9 vs. 6.5).

3.1.5.6.1.3 BANK EROSION

Bank erosion for the Bloody Run Watershed rated as marginal for the left bank and suboptimal for the right bank. The mean watershed scores for the left and right banks were 5.5/10 and 6.0/10. A rating of marginal indicates active stream widening and erosion at a moderate rate and a rating of suboptimal indicates a stream with a stable grade and width with only isolated areas of bank failure or erosion. The All Reaches average was slightly lower for the left and right banks, 3.9/10 and 4.0/10 respectively, which is considered marginal.

3.1.5.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Bloody Run Watershed ranged from marginal to optimal. Reach PQBR04 had the lower Floodplain Connection Score of 9/20, indicating that this reach was deeply entrenched and

high flows were not making it into the floodplain. Reach PQBR02 had an optimal rating of 20/20 indicating very little entrenchment and floodwaters easily entering the floodplain. The mean for the Bloody Run Watershed was slightly higher than for all reaches with a score of 14.5 as compared to 13, giving this watershed an overall suboptimal rating.

3.1.5.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BLOODY RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis rated as either marginal or suboptimal. The mean component score for the Bloody Run Watershed (46.5/80) was greater than the All Reaches average (37.4/80). The improved function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being the presence of a vegetated buffer and floodplain.

Table 3-35: USAM Buffer and Floodplain Condition Scoring for Bloody Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBR02	Bloody Run	7	8	11	16	12	54
PQBR04	Bloody Run	8	5	10	8	8	39
PQBR Mean		7.5	6.5	10.5	12.0	10.0	46.5
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.5.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank vegetated buffer for both reaches was rated as suboptimal, reflecting a buffer zone of 25-50 feet and minimal human activity. The width of the vegetated buffer zone of the right bank of reach PQBR02 was also rated as suboptimal, however the right bank of reach PQBR04 was only rated as marginal. A rating of marginal reflects a buffer zone of only 10-25 and significant impact by humans on the buffer zone. The mean watershed score of 7.5/10.0 for the left bank was greater than 5.3/10.0 for the All Reaches average. The mean watershed score for the right bank was the same 6.6/10, just slightly greater than the all reaches average for right banks.

3.1.5.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQBR02 was young forest, with a suboptimal score of 11/20. Reach PQBR04 scored marginal with 10/20, reflecting a dominant vegetation type of shrub or old field. The mean Bloody Run Watershed score (10.5/20) was rated as marginal, which was slightly higher than the All Reaches average (9.7/20) which was also rated as marginal.

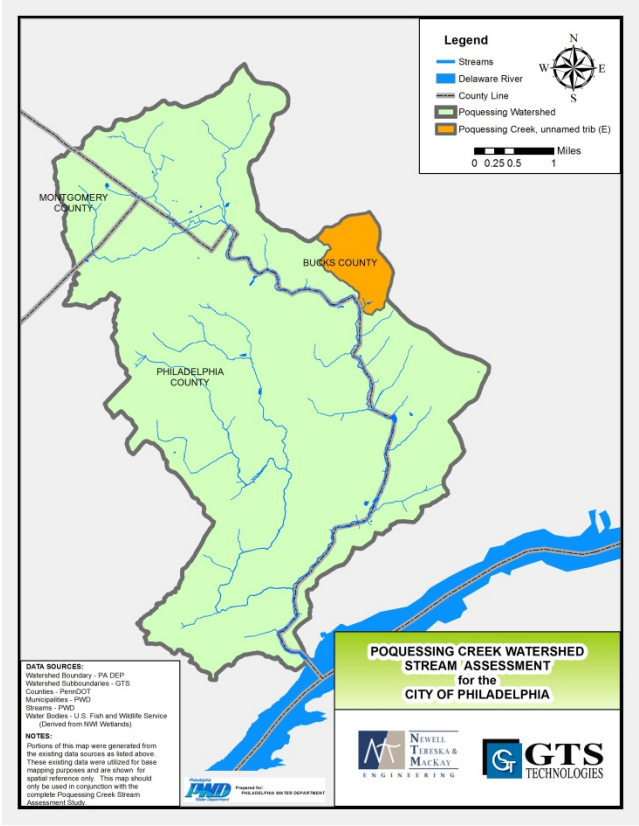
3.1.5.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was suboptimal throughout the Bloody Run Watershed. Reach PQBR02 was optimal, with a score of 16/20. This reach was characterized by an even mix of wetland and non-wetland habitats, and evidence of standing and/or ponded water. Reach PQBR04 had a rating of marginal (8/20), characterized by either all wetland or no wetland habitat and evidence of standing or ponded water. The mean watershed score for this parameter (12.0/20) was rated as suboptimal and was higher than the All Reaches average score (8.3/20) which was considered marginal.

3.1.5.6.2.4 FLOODPLAIN ENCROACHMENT

Reach PQBR02 was rated as suboptimal, with a score of 12/20, indicating minor floodplain encroachment in the form of fill material, land development or manmade structures but not greatly impacting floodplain function. Reach PQBR04 had a score of 8/20 or marginal, indicating moderate floodplain encroachment by the aforementioned items, having some effect on floodplain function. The mean score for the watershed was (10.0/20) which was slightly higher than the All Reaches average score of (8.2/20), giving the Bloody Run Watershed an overall rating of marginal.

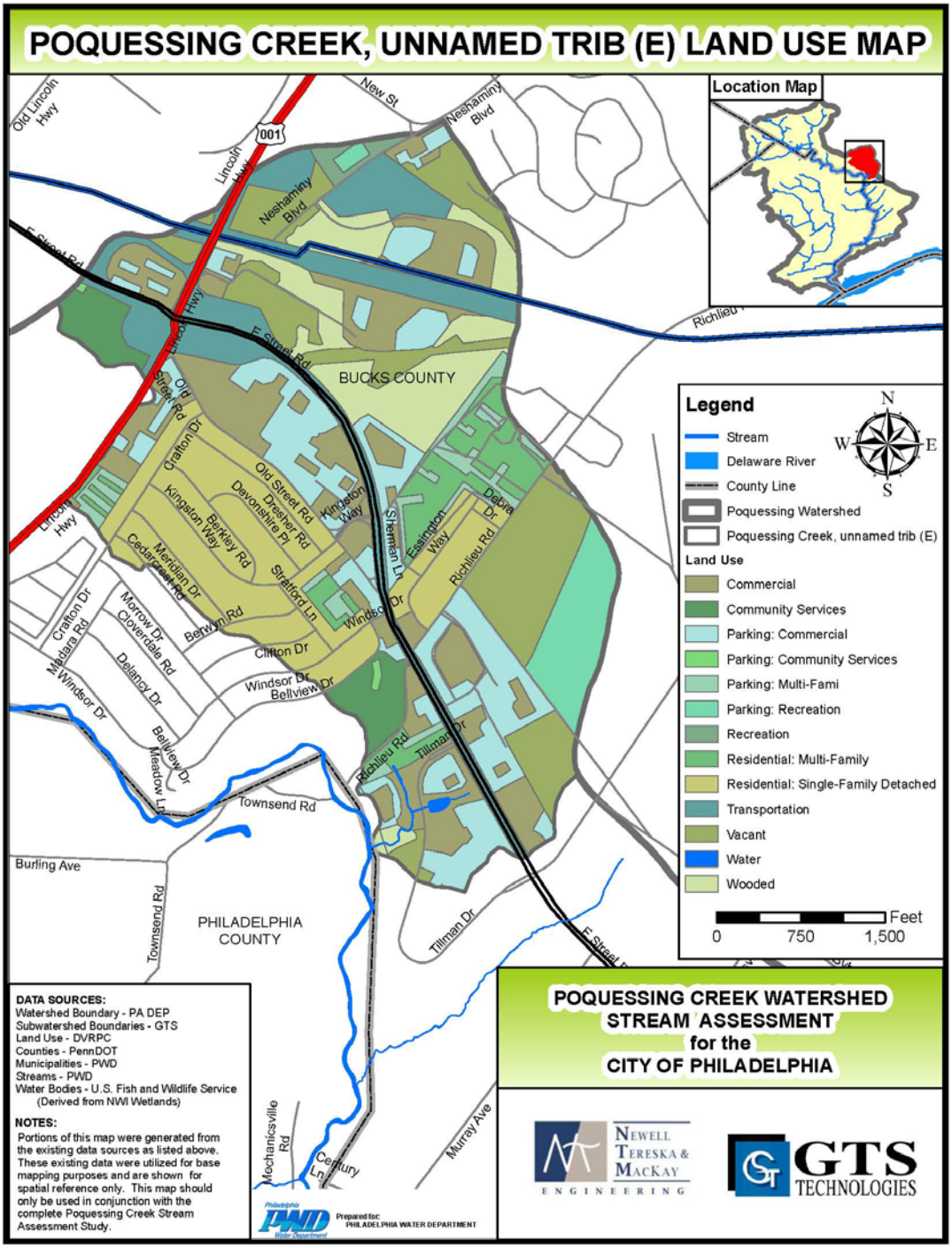
3.1.6 POQUESSING CREEK UNNAMED TRIBUTARY E WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary E is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary E originates from a stormwater outfall. Poquessing Creek Unnamed Tributary E is a first-order tributary which flows for approximately 1,000 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary E watershed is 458 acres. Major land use types within the watershed include: residential: Single Family Detached (18%) commercial (17%) and commercial parking (14%). Poquessing Creek Unnamed Tributary E is surrounded by a wooded buffer at the headwaters and downstream end. A portion of the reach flows through a wooded area at the downstream end of the reach before flowing into the Poquessing Creek mainstem.

Figure 3-26: Poquessing Creek, Unnamed Tributary E Land Use



3.1.6.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary E watershed is underlain by the Pennsauken. The Pennsauken Formation consists of quartz and sand.

There are small sections within the Poquessing Creek Unnamed Tributary E watershed that are underlain by the Wissahickon and Mafic Gneiss Formations. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks. Mafic Gneiss consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz.

3.1.6.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the Poquessing Creek Unnamed Tributary E watershed vary and are classified as follows: hydrologic group A (1%), hydrologic group B (17%), hydrologic group C, (13%), hydrologic group D (8%) and Urban (61%). The largest percentage of soils in the Poquessing Creek Unnamed Tributary E watershed are classified as urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely. Hydrologic group B and Hydrologic group C also make up a significant portion of the soils in the watershed. In hydrologic group B, water movement through these soils is moderately rapid. The depth to any restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet). Soils in hydrologic group C have a slow rate of infiltration when saturated. Water movement through these soils is moderate or moderately slow; they generally have a restrictive layer that impedes the downward movement of water. The depth to the restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet).

Table 3-36: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary E Watershed

Group	Area (acres)	Percent of Total Area
A/D	4.7	1%
B	77.2	17%
C	61.0	13%
D	38.0	8%
Urban	277.4	61%
Total Area	458.3	100%

Figure 3-27: Geology of Poquessing Creek, Unnamed Tributary E Watershed

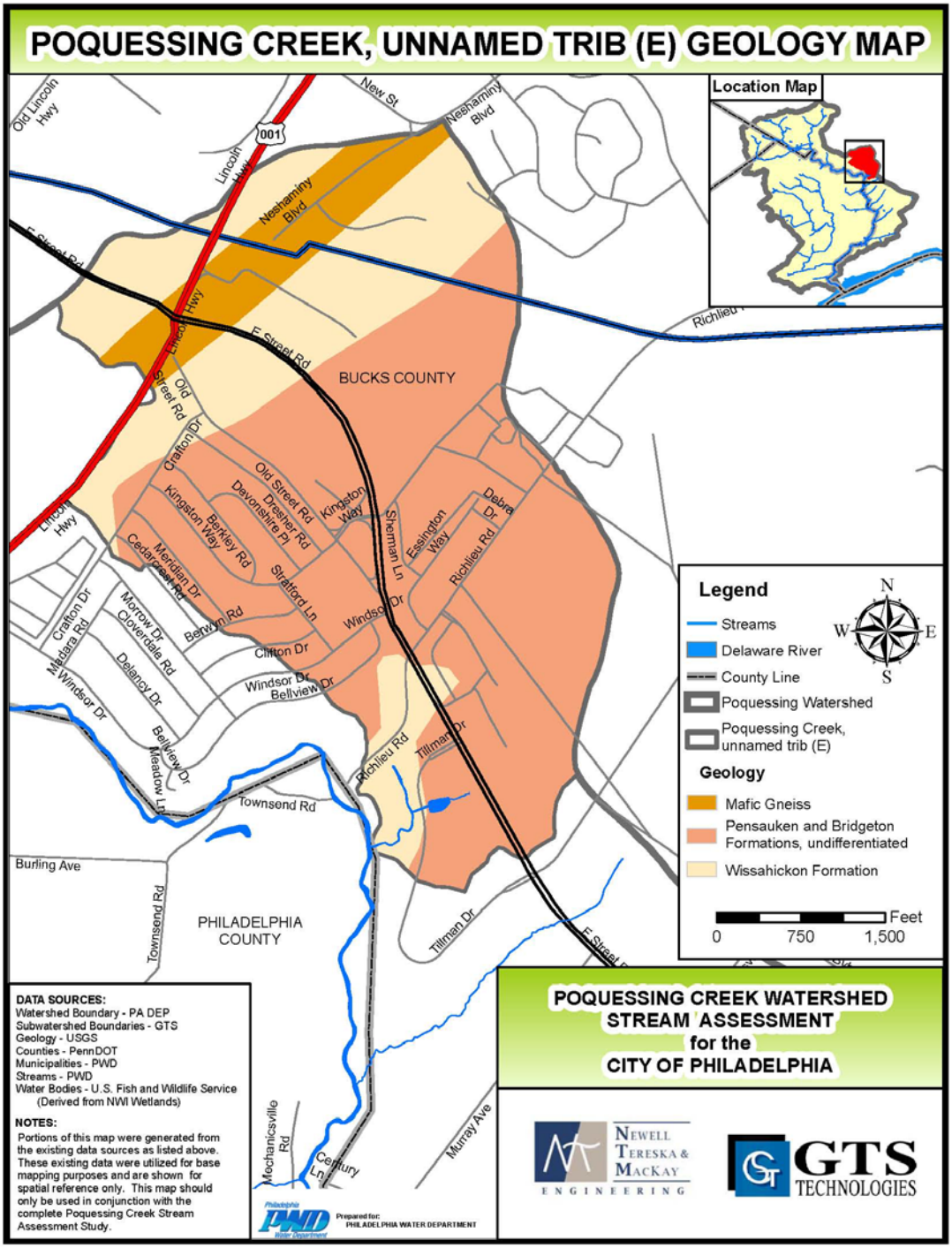
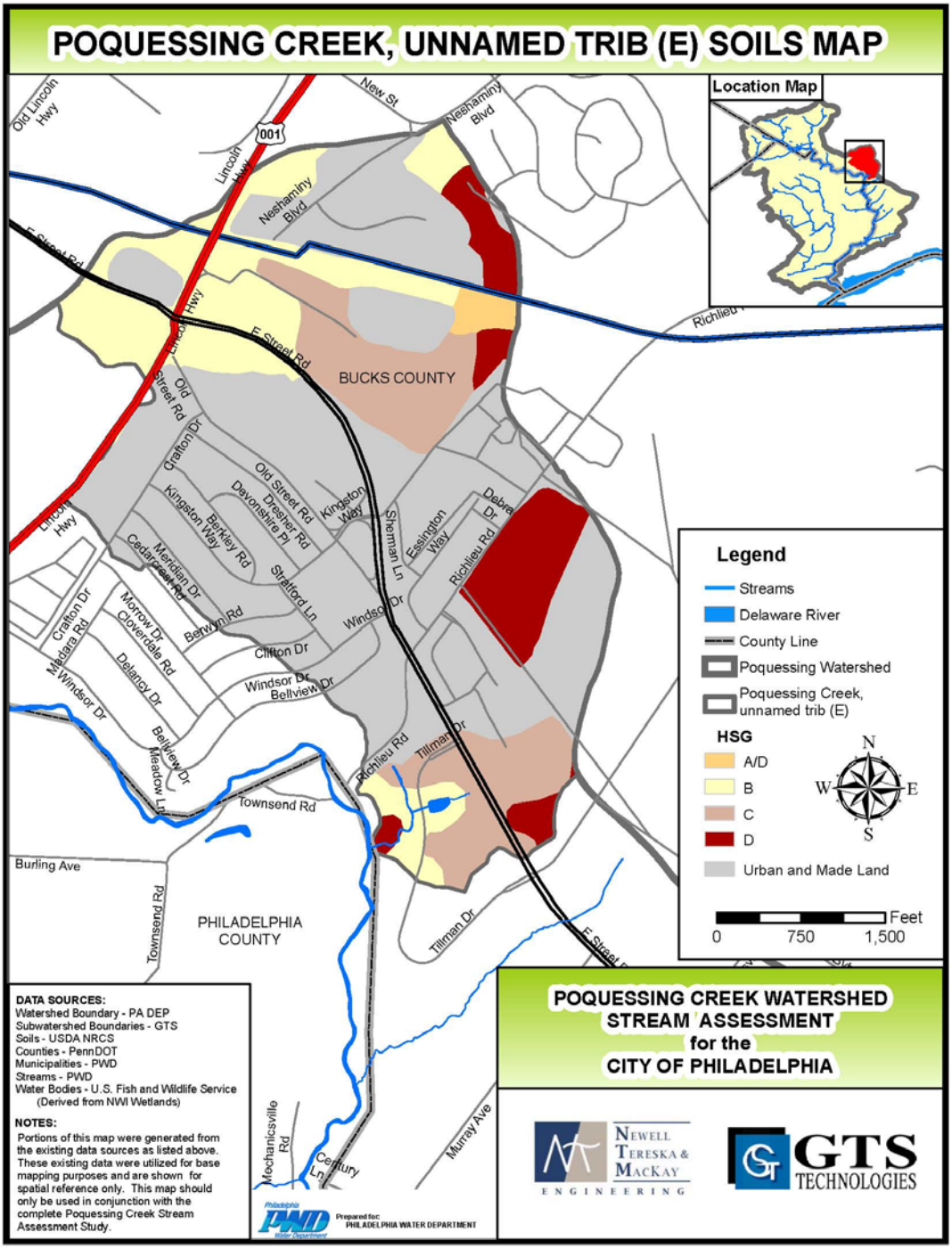


Figure 3-28: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary E Watershed



3.1.6.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary E (Table 3-37). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary E was less than the average for all Poquessing Creek subwatersheds (Table 3-38). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-37: Erosion Rates for Poquessing Creek Unnamed Tributary E Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSE08	-2.377	0.191	-0.565	-0.094	-0.019	E

Table 3-38: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.6.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary E is a small tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary E lie in a mainly residential area followed by commercial development with commercial parking and a stormwater detention basin. The downstream end at the confluence is primarily wooded. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 2.0 to 5.0 feet in diameter. The number of headwater outfalls (Table 3-39) on this stream indicates that it is heavily influenced by stormwater discharges in the upstream-most segments of PQMSE08. All infrastructure elements found in Poquessing Creek Unnamed Tributary E are described as being in good condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-39: Summary of Poquessing Creek Unnamed Tributary E Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSE08	2	0	8	0	5	0	0	2	17

3.1.6.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream reach of Poquessing Creek, Unnamed Tributary E stream thread channel is a second-order, single channel with one small unnamed tributary. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-29: Results for Poquessing Creek, Unnamed Tributary E Watershed USAM Components

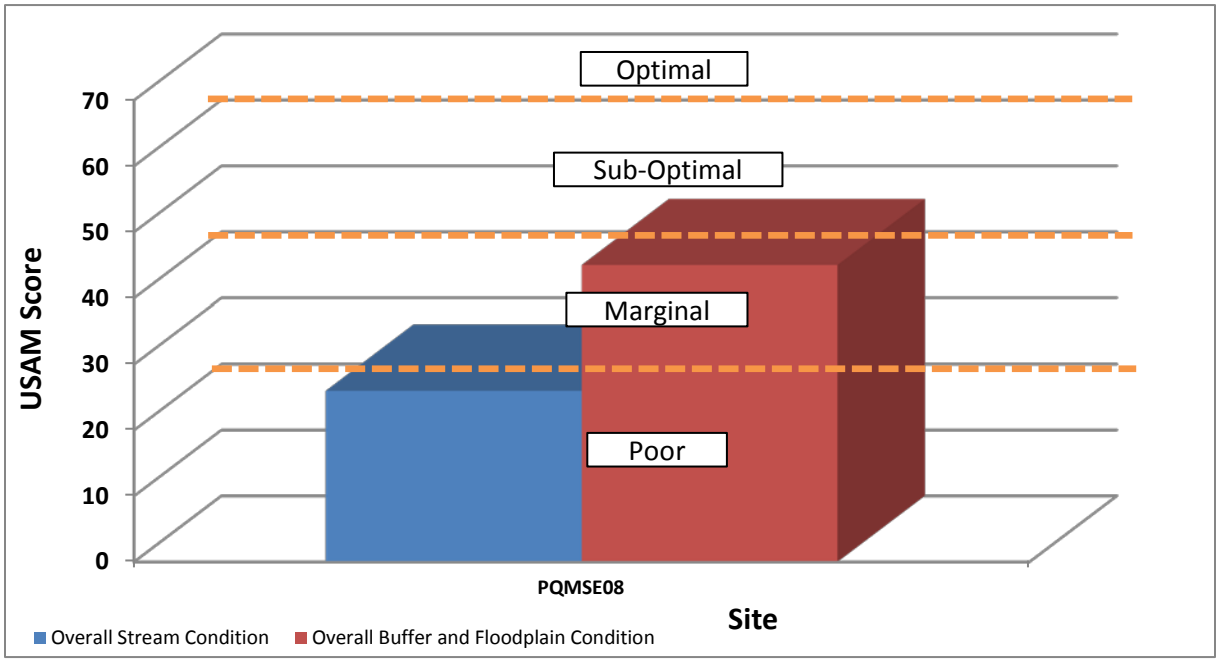
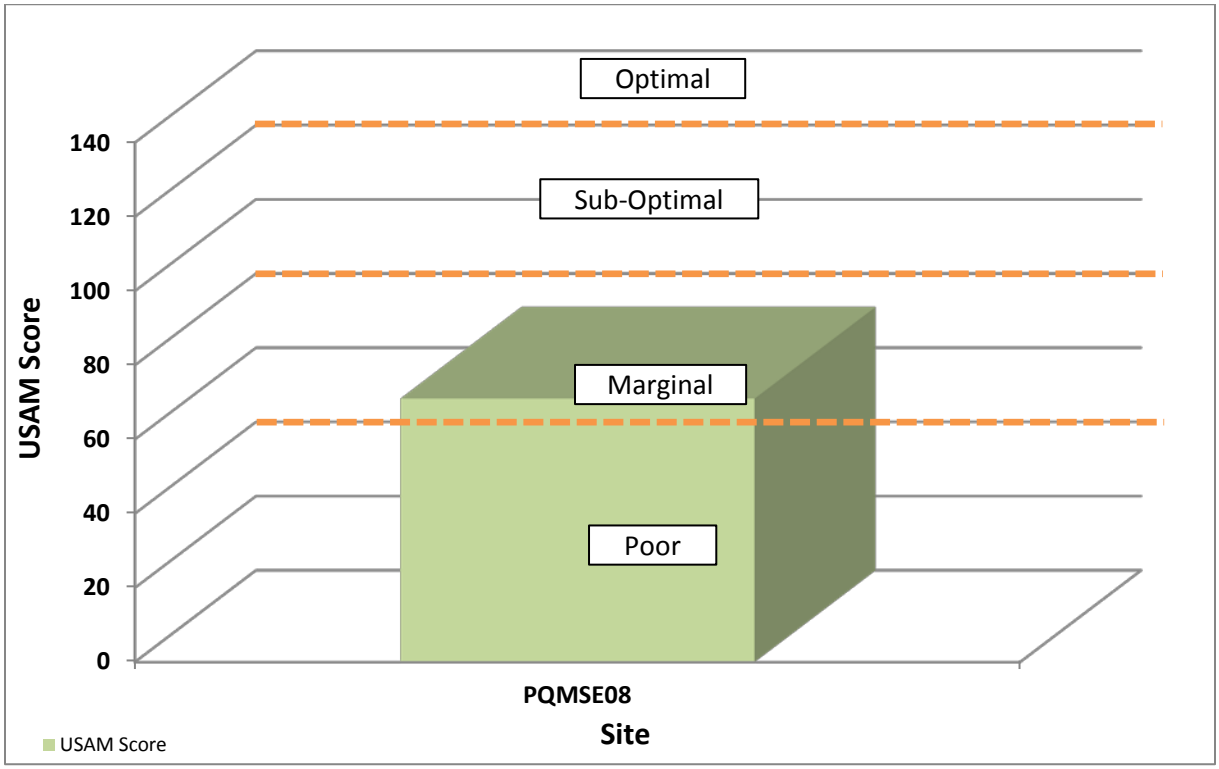


Figure 3-30: Poquessing Creek, Unnamed Tributary E Watershed USAM Results



3.1.6.5.1 PQMSE08

Reach PQMSE08 is the entire length of Poquessing Creek, Unnamed Tributary E. The headwaters of this tributary begin at a stormwater outfall in a residential neighborhood near Richlieu Road. This upper half of this reach runs through a mostly commercial area with a large amount of impervious cover and also receives flow from a large stormwater detention pond at the mid-point of the reach. The lower portion of the reach runs through a wooded floodplain before reaching the mainstream of Poquessing Creek. Reach PQMSE08 is characterized by a shallow slope (1.2%), moderate width to depth ratio (13.2), a highly entrenched channel (ER = 1.2), moderate sinuosity (1.23), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSE08 was marginal (71/160).

3.1.6.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary E: PQMSE08. The score for the Overall Stream Condition components as well as the composite USAM score were classified as marginal (Table 3-46). The score for the Overall Buffer and Floodplain Condition was rated as suboptimal. Average conditions within the Poquessing Creek, Unnamed Tributary E watershed's stream channels were slightly worse than conditions observed within the buffers and floodplains. The Small Tributary average for the Overall Stream Condition component was higher than the score for reach PQMSE08 but lower for the Overall Buffer and Floodplain Condition and the composite USAM. The scores for individual parameters ranged from poor to suboptimal. Graphs of each USAM category rating are in Appendix D.

Table 3-40: USAM Results for Poquessing Creek, Unnamed Tributary E Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSE08	PQ, Unnamed Tributary. E	26	45	71
Small Tributary Average		30.6	33.1	63.8

3.1.6.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE HILLCREST RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were poor to moderate. The Small Tributary average score (30.6/80) was rated as marginal, just slightly higher than the rating for the unnamed tributary rating (26.0/80), also marginal.

Table 3-41: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary E Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	Right	Left	Right		
PQMSE08	PQ, Unnamed Tributary. E	7	5	5	3	4	2	26
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.6.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary E Watershed was marginal (7.0/20), indicating 20-40% mix of stable habitat with the substrate either frequently disturbed or removed. The Small Tributary average was rated slightly lower at 5.6/20, deserving a rating of poor, or reflecting less than 20% stable habitat due to lacking or unstable substrate.

3.1.6.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSE08 had marginal vegetative protection which indicates less than 50%-70% of the streambanks are covered by vegetation and the area has some evidence of disruption such as bare soil patches or closely cropped vegetation. The Small Tributary average was also rated marginal (4.0/10) for both the left and right banks. The marginal scores for this parameter are attributed to the highly eroded stream banks which have impacted vegetation growth.

3.1.6.6.1.3 BANK EROSION

Reach PQMSE08 had a score of marginal for both the left and right banks (3.0/10 and 4.0/10, respectively). A rating of marginal indicates active stream widening and erosion at a moderate rate with no threat to property or infrastructure. The Small Tributary averages for the left and right banks were also rated as marginal (4.0/10 and 4.3/10, respectively).

3.1.6.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary E Watershed was poor with reach PQMSE08 receiving a rating of 2.0/20. A poor rating indicates high flows not able to enter the floodplain and deep stream entrenchment. The Small Tributary average was higher than that for PQMSE08, with a rating of 8.8/20, or marginal. A marginal rating also indicates high flows not able to enter the floodplain and deep stream entrenchment, but to a lesser degree.

3.1.6.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY E WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were marginal to suboptimal. The Overall Buffer and Floodplain Condition score for PQMSE08 (45.0/80) was somewhat higher than that for the Small Tributary average (33.1/80). The improved function of the floodplains in this watershed can be attributed to the forested buffer that exists in the lower portion of the reach.

Table 3-42: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary E Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSE08	PQ, Unnamed Tributary E	6	6	13	10	10	45
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.6.6.2.1 VEGETATED BUFFER WIDTH

The width of the left bank vegetated buffer was rated as suboptimal (6.0/10), reflecting a buffer zone of 25-50 feet and minimal human impact. The width of the vegetated buffer zone of the right bank of reach PQMSE08 was also rated as suboptimal (6.0/10). The Small Tributary average was rated as marginal for both the left and right banks (4.3/10 and 4.5/10, respectively). A marginal rating indicates a buffer zone of 10-25 feet with significant human impact.

3.1.6.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQMSE08 was young forest, with a suboptimal score of 13.0/20. The Small Tributary average rating was marginal (9.1/20), reflecting a predominant vegetation type of scrub/shrub.

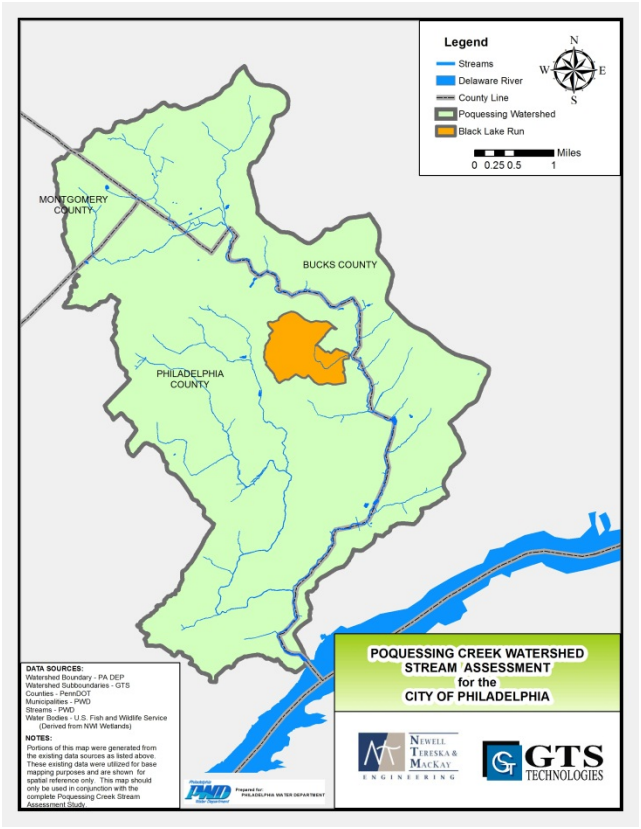
3.1.6.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated marginal (10.0/20) for reach PQMSE08, indicating either all wetland or non-wetland habitat and some evidence of standing or ponded water. The Small Tributary average was also rated as marginal (6.5/20).

3.1.6.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSE08 was marginal (10.0/20) showing only moderate floodplain encroachment and only some effect on floodplain function. The Small Tributary average was also rated as marginal (8.8/20), although with a slightly lower score.

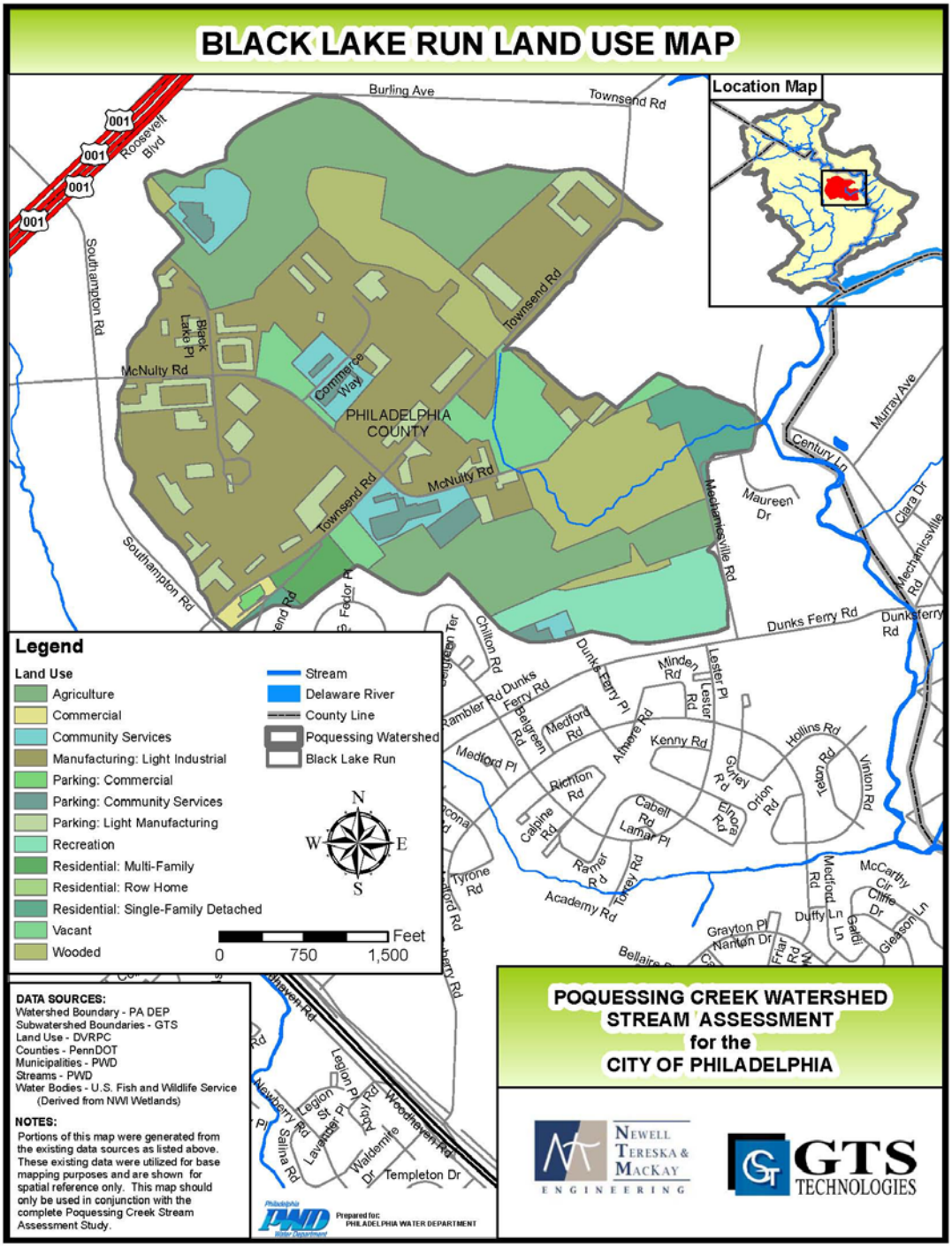
3.1.7 BLACK LAKE RUN WATERSHED AND REACH CHARACTERISTICS



Black Lake Run is a tributary to the mainstem of the Poquessing Creek. Black Lake Run originates from surrounding development stormwater drainage. Black Lake Run is a first-order tributary and flows for approximately 3,300 feet before meeting the confluence of the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Black Lake Run Watershed is 423 acres. Major land use types within the watershed include: manufacturing: light industrial (37%), agriculture (22%) and wooded (13%). Black Lake Run is surrounded by wooded land on both sides. The wooded buffer ranges from about 50 feet to about 300 feet wide.

Figure 3-31: Black Lake Run Watershed Land Use



3.1.7.1 GEOLOGY

The majority of the Black Lake Run Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A large section of the Black Lake Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.7.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the majority of the soils in the Black Lake Run Watershed are classified as hydrologic group B. Soils in hydrologic group B have a moderate rate of infiltration when saturated. Water movement through these soils is moderately rapid. The depth to any restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet). Soils classified as hydrologic group D are also prominent in this watershed making up 22 percent of the watershed. Soils in hydrologic group D have a high runoff potential. These soils have a very slow infiltration rate when saturated. Water movement through the soil is slow or very slow. A restrictive layer of nearly impervious material may be within 50 cm (20 inches) of the soil surface and the depth to the permanent water table is shallower than 60 cm (2 feet).

Table 3-43: Distribution of NRCS Soil Types in Black Lake Run Watershed

Group	Area (acres)	Percent of Total Area
B	235.1	56%
C	38.8	9%
D	92.0	22%
Urban	57.6	14%
Total Area	423.4	100%

3.1.7.3 BANK EROSION

Erosion rates for the left bank, stream bed, right bank, and total wetted perimeter were calculated for three reaches in Black Lake Run (Table 3-44). Two reaches were found to be eroding based on the total wetted perimeter calculation, while one was aggrading. The average total erosion rate for all reaches in Black Lake Run was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-45). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-32: Geology of Black Lake Run Watershed

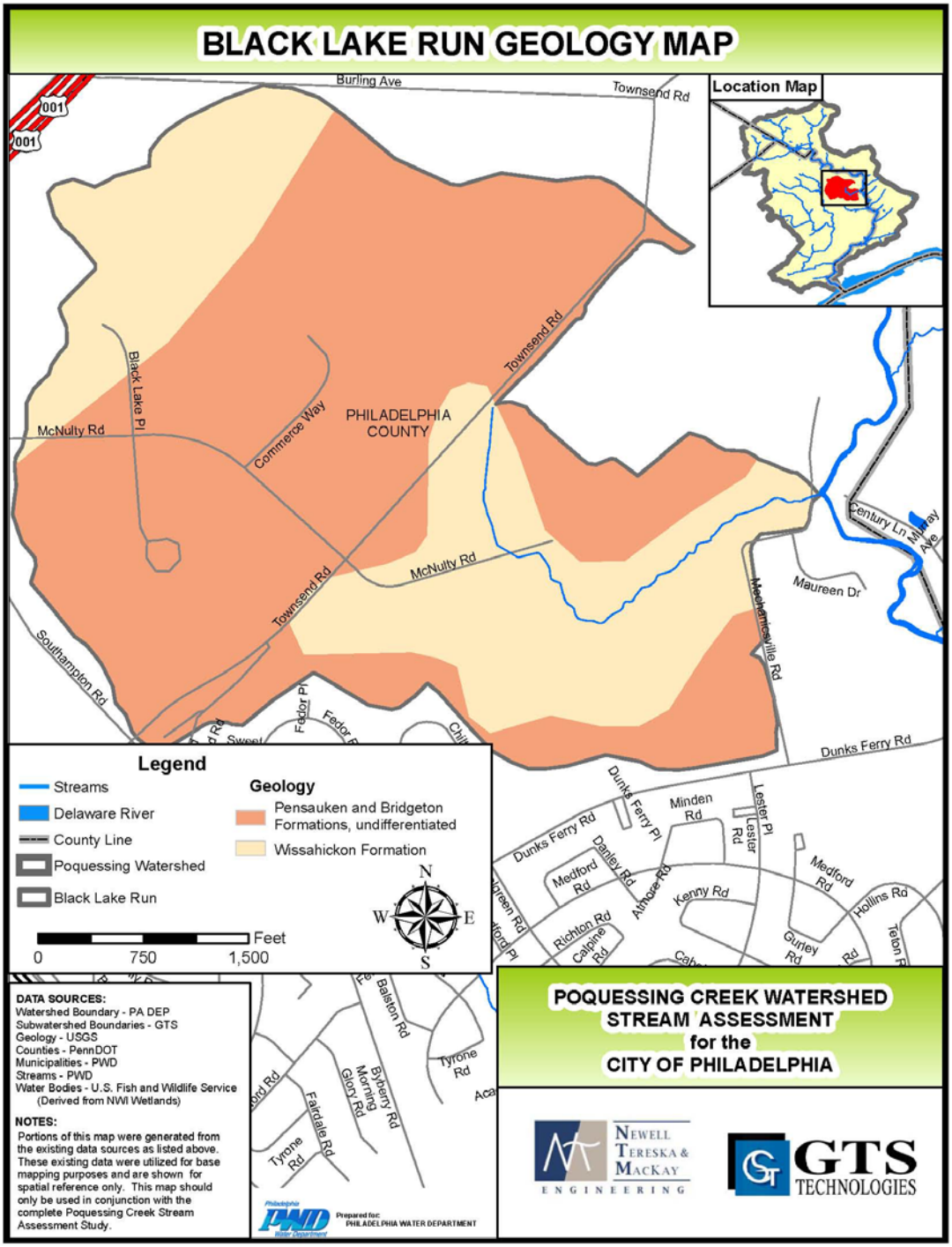


Figure 3-33: Distribution of NRCS Soil Types in Black Lake Run Watershed

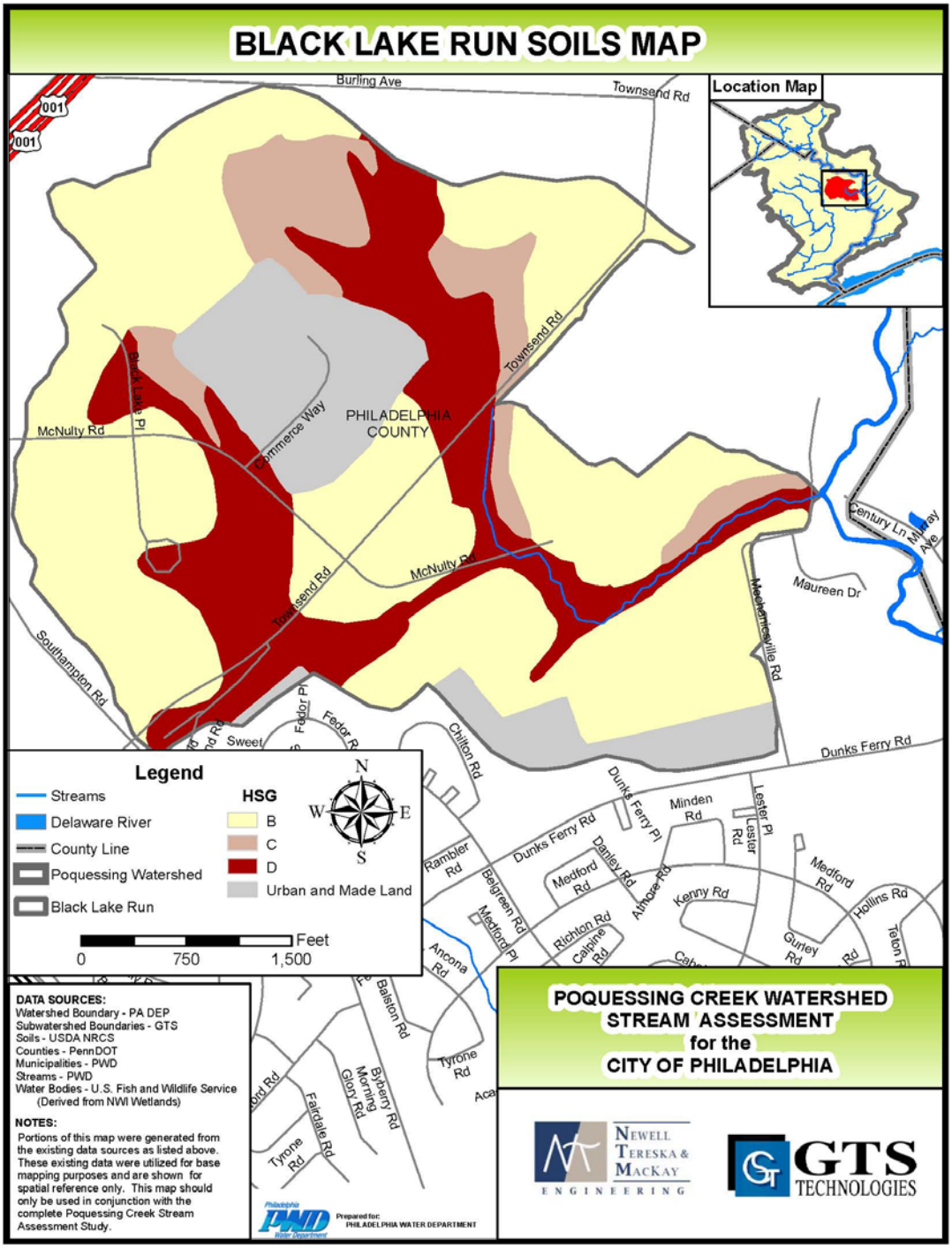


Table 3-44: Erosion Rates for Black Lake Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBL02	-3.033	-0.092	-0.934	-0.226	-0.045	E
PQBL04	-0.979	-0.196	0.705	-0.177	-0.035	E
PQBL06	-0.294	0.054	-0.221	0.001	0.000	A
Average	-1.435	-0.078	-0.150	-0.134	-0.027	E

Table 3-45: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.7.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Black Lake Run is a small tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Black Lake Run lie in a wooded area with light industrial manufacturing development mixed in. At the downstream end and closer to the confluence, the land use patterns become mainly residential development before reaching the confluence with Poquessing Creek. Black Lake Run exhibits some of the impairments associated with urban streams given its location and proximity to light industrial manufacturing and commercial parking that surrounds the stream channel. The majority of infrastructure was located at cross section PQBL04 mixed in the form of culverts (2), constructed channels (1), manholes (2) and storm sewer grates/other (2). All infrastructure at PQBL04 is in good or fair condition.

Constructed channel PQchan134 is a poor condition stone channel with a height of 4 feet and a length of 158 feet. It is located at PQBL06 approximately 50 to 200 feet upstream of the confluence with Poquessing Creek. All other infrastructure elements along Black Lake Run are in good or fair condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-46: Summary of Black Lake Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBL02	0	0	1	0	0	0	0	2	3
PQBL04	2	0	0	1	2	0	0	2	7
PQBL06	1	0	1	2	0	0	1	0	5
TOTAL	3	0	2	3	2	0	1	4	15

3.1.7.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Black Lake Run stream channel is a first-order, single thread channel with no tributaries. Black Lake Run is a direct tributary to the main stem of Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-34: Results for Black Lake Run Watershed USAM Components

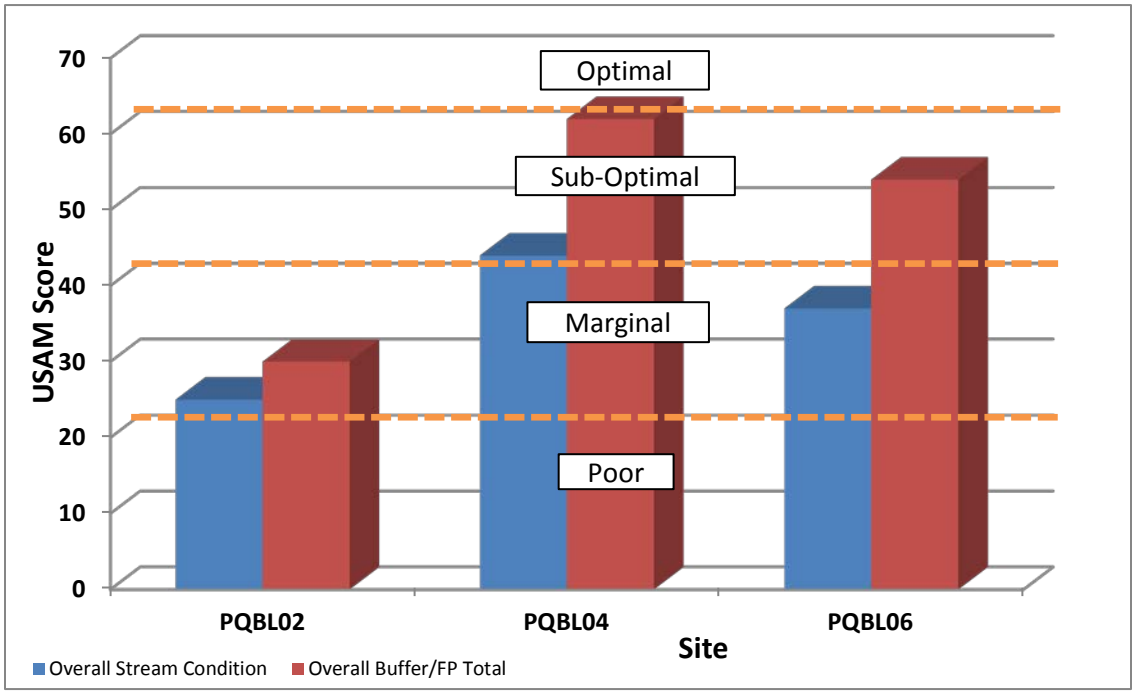
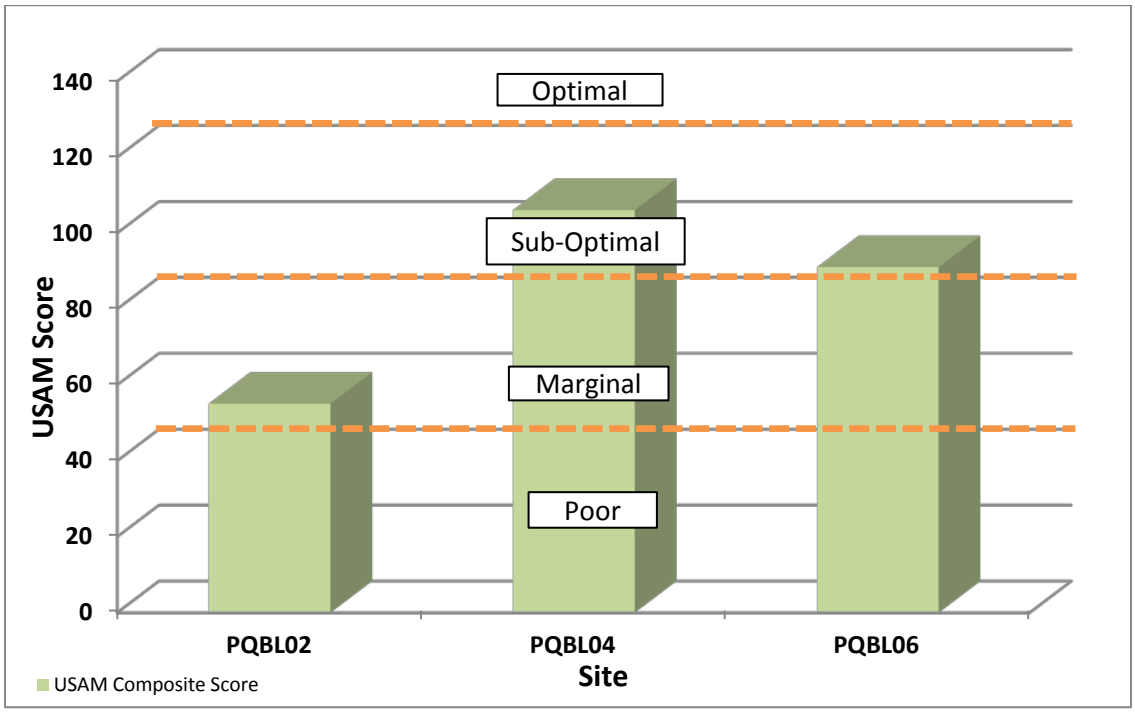


Figure 3-35: Black Lake Run Watershed USAM results



3.1.7.5.1 PQBL02

Reach PQBL02 is the first reach of Black Lake Run. The headwaters of this tributary begin at a stormwater outfall near Townsend Road. This reach is closely paralleled on the right side by an industrial area. The downstream left side has a significant wooded buffer. Reach PQBL02 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (23.8), a highly entrenched channel (ER = 1.4), low sinuosity (1.09), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBL02 was marginal (55/160).

3.1.7.5.2 PQBL04

Reach PQBL04 begins approximately 800 feet upstream of cross section PQBL04. This reach runs through a mostly wooded area. Reach PQBL04 is characterized by a shallow slope (0.8%), moderate to high width to depth ratio (18.5), a slightly entrenched channel (ER = 3.2), moderate sinuosity (1.45), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBL04 was suboptimal (106/160).

3.1.7.5.3 PQBL06

Reach PQBL06 begins approximately 600 feet upstream of cross section PQBL06. The upper portion of this reach runs through a wooded area and the lower half through a residential area before reaching the mainstream of Poquessing Creek. Reach PQBL06 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (17.0), a moderately entrenched channel (ER = 2.1), low sinuosity (1.13), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBL06 was suboptimal (91/160).

3.1.7.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean scores for the Overall Stream Condition components rated as marginal, while the Overall Buffer/Floodplain and Overall USAM scores rated as sub-optimal (Table 3-47). Average conditions within the Black Lake Run Watershed's buffers and floodplains were higher than those conditions observed for the stream condition. The watershed average for the Overall Stream Condition component was slightly lower than the all reaches average and the Overall Buffer/Floodplain and overall USAM Score were higher than that for the all reaches average. The scores for individual parameters ranged from poor to optimal, displaying similar levels of variability between reaches. Graphs of each USAM category rating are in Appendix D.

Table 3-47: USAM Results for Black Lake Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBL02	Black Lake Run	25	30	55
PQBL04	Black Lake Run	44	62	106
PQBL06	Black Lake Run	37	54	91
PQBL Mean		35.3	48.6	84.0
All Reaches Average		37.1	37.4	74.4

3.1.7.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE HILLCREST RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal The mean watershed score (35.3/80) was rated as marginal and was about the same as the All Reaches average score (37.1/80) which also was marginal.

Stream condition was degraded in the upper reach as a result of impacts from adjacent development. The downstream reaches had considerably better stream conditions.

Table 3-48: USAM Overall Stream Condition Scoring for Black Lake Run Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQBL02	Black Lake Run	1	5	4	6	5	4	25
PQBL04	Black Lake Run	5	5	4	5	5	20	44
PQBL06	Black Lake Run	9	5	5	4	3	11	37
PQBL Mean		5	5.0	4.3	5.0	4.3	11.6	35.3
All Reaches Average		8.2	4.0	3.9	3.9	4.0	1	37

3.1.7.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to marginal for the three reaches analyzed in the Black Lake Run Watershed. The watershed mean was lower than the All Reaches average (5/8.2). Two of the reaches within the Black Lake Run Watershed (PQBL02 and PQBL04) were characterized by unstable or lacking substrate and less than 20% stable habitat. The third reach (PQBL06) fared slightly better, showing marginal stable habitat (20-40%). The upper reach (PQBL02) habitat was impacted from excessive sediments and trash.

3.1.7.6.1.2 VEGETATIVE PROTECTION

Both banks of all three reaches analyzed for the Black Lake Run Watershed (PQBL02-06) had marginal vegetative protection. All three had a marginal rating which reflects 50-70% coverage and the area was impacted by erosion. The All Reaches averages for both banks were slightly lower than the Black Lake Run Watershed (7.9 vs. 9.3).

3.1.7.6.1.3 BANK EROSION

All three reaches analyzed for Black Lake Run Watershed scored between poor and marginal for both left and right banks, with the exception of the right bank of reach PQBL06, which scored just below poor. The mean watershed scores for the left and right banks were both (5.0/10 and 4.3/10) rated as "marginal." A rating of marginal indicates active stream widening and erosion at a moderate rate.

3.1.7.6.1.4 FLOODPLAIN CONNECTION

Floodplain connections for the Black Lake Run Watershed were varied. Reach PQBL02 had a very low Floodplain Connection Score of 4/20 (poor), indicating that this reach was deeply entrenched and high flows were not making it into the floodplain. This reach is confined by floodplain filling. Reach PQBL04 had an optimal rating of 20/20 indicating very little entrenchment and floodwaters easily entering the floodplain. Reach PQBL06 was suboptimal, with a score of 11/20. Some entrenchment was observed but high waters were eventually able to enter the floodplain. The mean for the Black Lake Run Watershed was just slightly lower than for all reaches with a score of 11.7 as compared to 13, giving this watershed an overall suboptimal rating.

3.1.7.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BLACK LAKE RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from marginal to optimal. The mean component score for the Black Lake Run Watershed (48.7/80) was higher than the All Reaches average (37.4/80). The improved function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being the wooded buffer that exists along the lower reaches of this watershed.

Table 3-49: USAM Buffer and Floodplain Condition Scoring for Black Lake Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBL02	Black Lake Run	9	2	7	8	4	30
PQBL04	Black Lake Run	9	8	13	14	18	62
PQBL06	Black Lake Run	9	8	12	11	14	54
PQBL Mean		9.0	6.0	10.6	11.0	12.0	48.7
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.7.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank vegetated buffer for all three reaches was rated as optimal, reflecting a buffer zone of greater than 50 feet and little human activity. The widths of the vegetated buffer zones of the right banks of reaches PQBL04 and PQBL06 were also rated as optimal. The right bank of Reach PQBL02 however, was rated as poor, indicating a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. The mean watershed score of 9.0/10.0 for the left bank was greater than 5.3/10.0 for the all reaches average. The mean watershed score for the right bank was the same 6.0/10 as the all reaches average for right banks.

3.1.7.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQBL02 was shrub, with a marginal score of 7/20. Reaches PQBL04 and PQBL06 scored suboptimal with 13/20 and 12/20, respectively. This reflects a predominant floodplain vegetation type of young trees. The mean Black Lake Run Watershed score (11/20) was rated as "suboptimal", which was slightly higher than the All Reaches average (8.3/20) which was rated as "marginal."

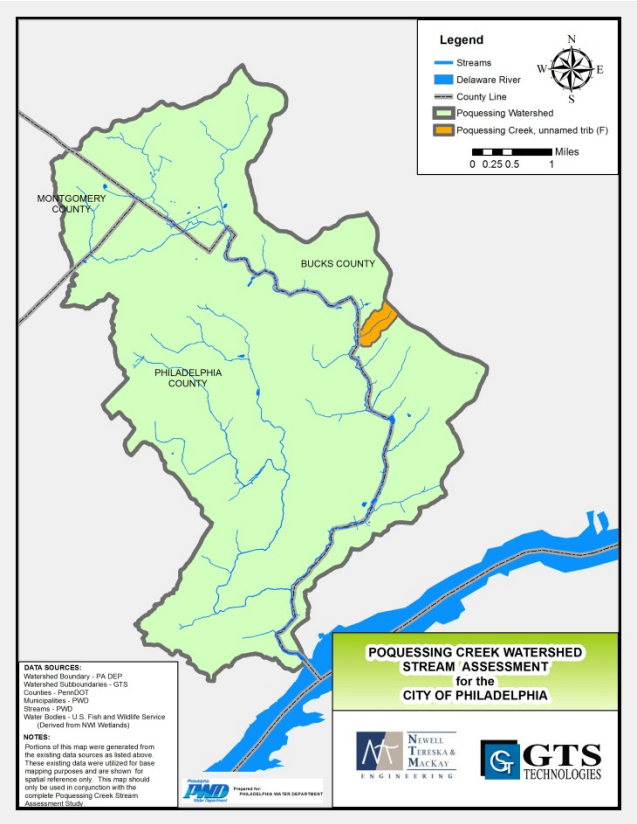
3.1.7.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was varied throughout the Black Lake Run Watershed. Reach PQBL02 was marginal due to adjacent development and floodplain filling, with a score of 8/20. This reach was characterized by non-wetland habitat, with evidence of ponding or standing water. Reaches PQBL04 and PQBL06 had a rating of suboptimal (14/20 and 11/20), characterized by an even mix of both wetland and non-wetland habitat and no standing water observed. The mean watershed score for this parameter (11/20) was rated as suboptimal and was slightly higher than the All Reaches average score (8.3/20) which was considered marginal.

3.1.7.6.2.4 FLOODPLAIN NCROACHMENT

Scores for the Floodplain Encroachment parameter were wide ranging throughout the Black Lake Run Watershed. Reach PQBL02 was rated poor, with a score of 4/20, indicating significant floodplain encroachment and resulting significant effect on floodplain function. Reach PQBL04 had a score of 18/20 or optimal, indicating little or no evidence of floodplain encroachment in the form of fill material or human intervention. Reach PQBL06 was rated sub-optimal with a score of 14/20, reflecting minor floodplain encroachment without affecting floodplain function. The mean score for the watershed was (12/20) which was slightly higher than the All Reaches average score of (8.2/20), giving the Black Lake Run Watershed an overall rating of sub-optimal.

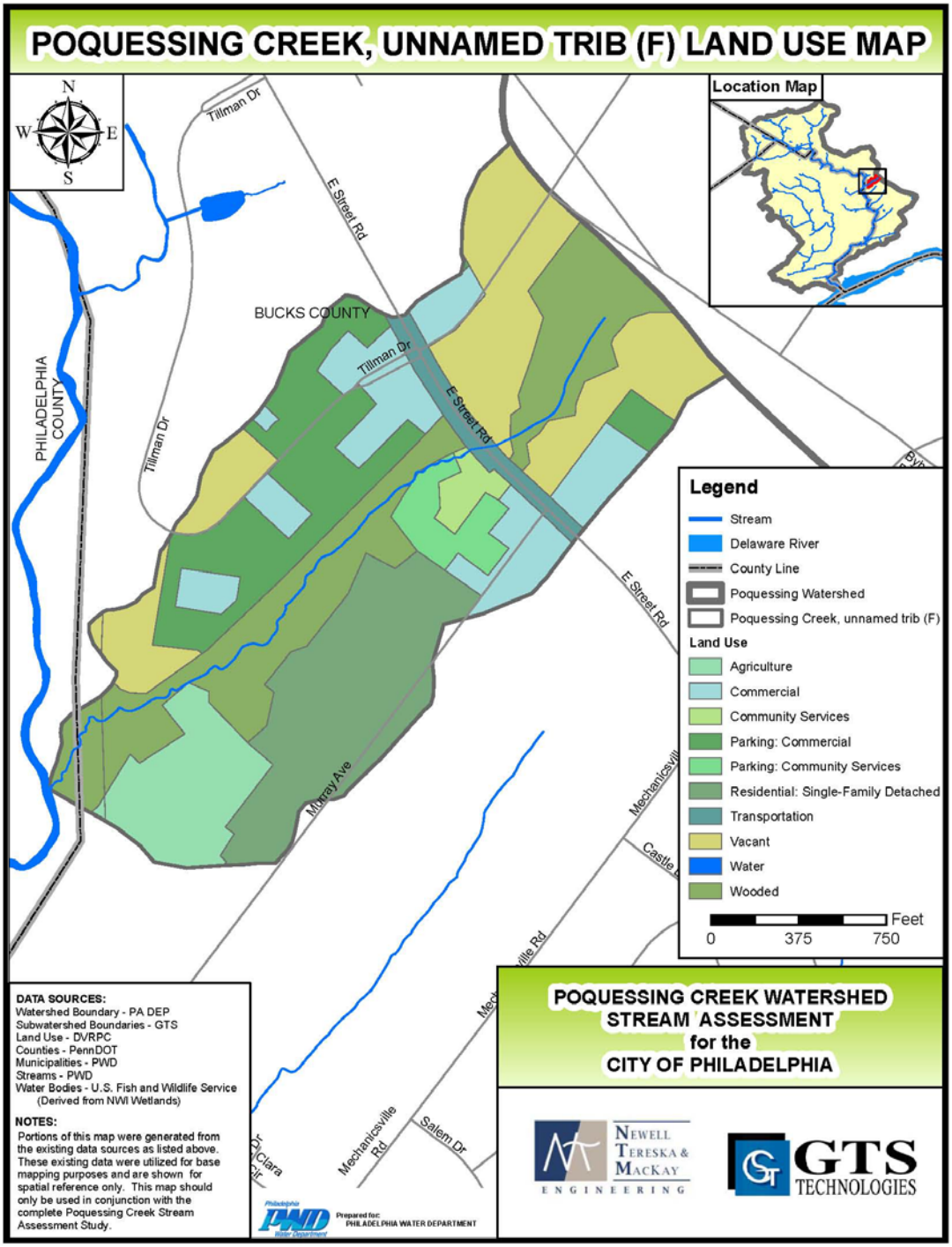
3.1.8 POQUESSING CREEK UNNAMED TRIBUTARY F WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary F is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary F originates from a privately-owned stormwater outfall. Poquessing Creek Unnamed Tributary F is a first-order tributary that flows for approximately 3,000 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary F Watershed is 92 acres. Major land use types within the watershed include: wooded (23%), vacant (20%), residential: single-family detached (16%) and parking. Poquessing Creek Unnamed Tributary F flows through vacant land, for approximately 600 feet before crossing under Street Road. After the crossing with Street Road and downstream to the confluence, Poquessing Creek Unnamed Tributary F is surrounded by wooded land on both sides. The wooded buffer ranges from about 100 feet to about 600 feet wide.

Figure 3-36: Poquessing Creek, Unnamed Tributary F Watershed Land Use



3.1.8.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary F Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary F Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.8.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the Poquessing Creek Unnamed Tributary F Watershed vary between hydrologic group B, hydrologic group C, hydrologic group D and Urban Soils. The predominant soil in the watershed is hydrologic group D soils. Soils in hydrologic group D have a high runoff potential. These soils have a very slow infiltration rate when saturated. Water movement through the soil is slow or very slow. A restrictive layer of nearly impervious material may be within 50 cm (20 inches) of the soil surface and the depth to the permanent water table is shallower than 60 cm (2 feet).

Urban soils and hydrologic group B also make up a significant portion of the watershed. Urban soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely. Soils classified as hydrologic group B are soils that have a moderate rate of infiltration when saturated. Water movement through these soils is moderately rapid. The depth to any restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet).

Table 3-50: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary F Watershed

Group	Area (acres)	Percent of Total Area
B	15.5	17%
C	4.2	5%
D	51.2	56%
Urban	20.9	23%
Total Area	91.8	100%

Figure 3-37: Geology of Poquessing Creek, Unnamed Tributary F Watershed

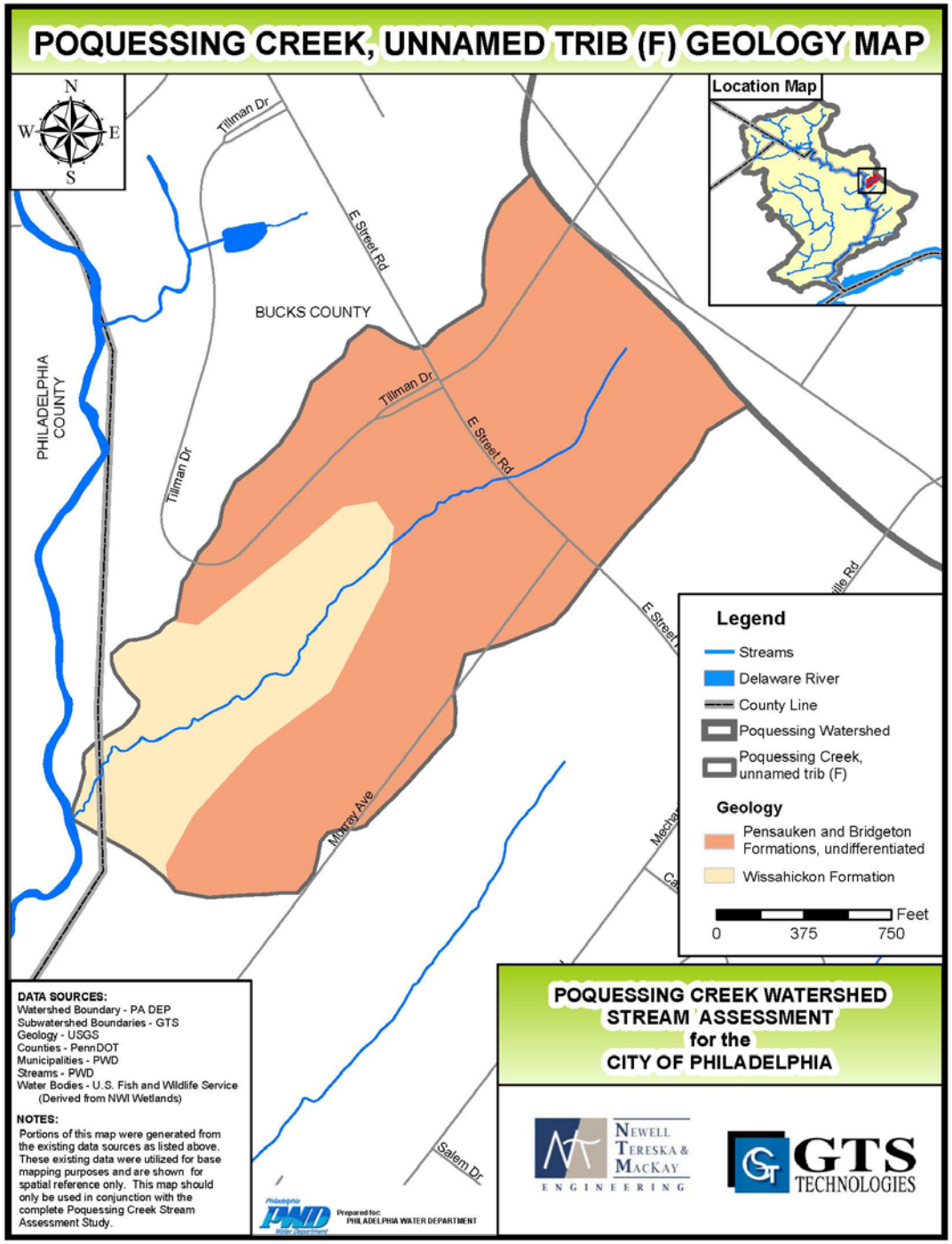
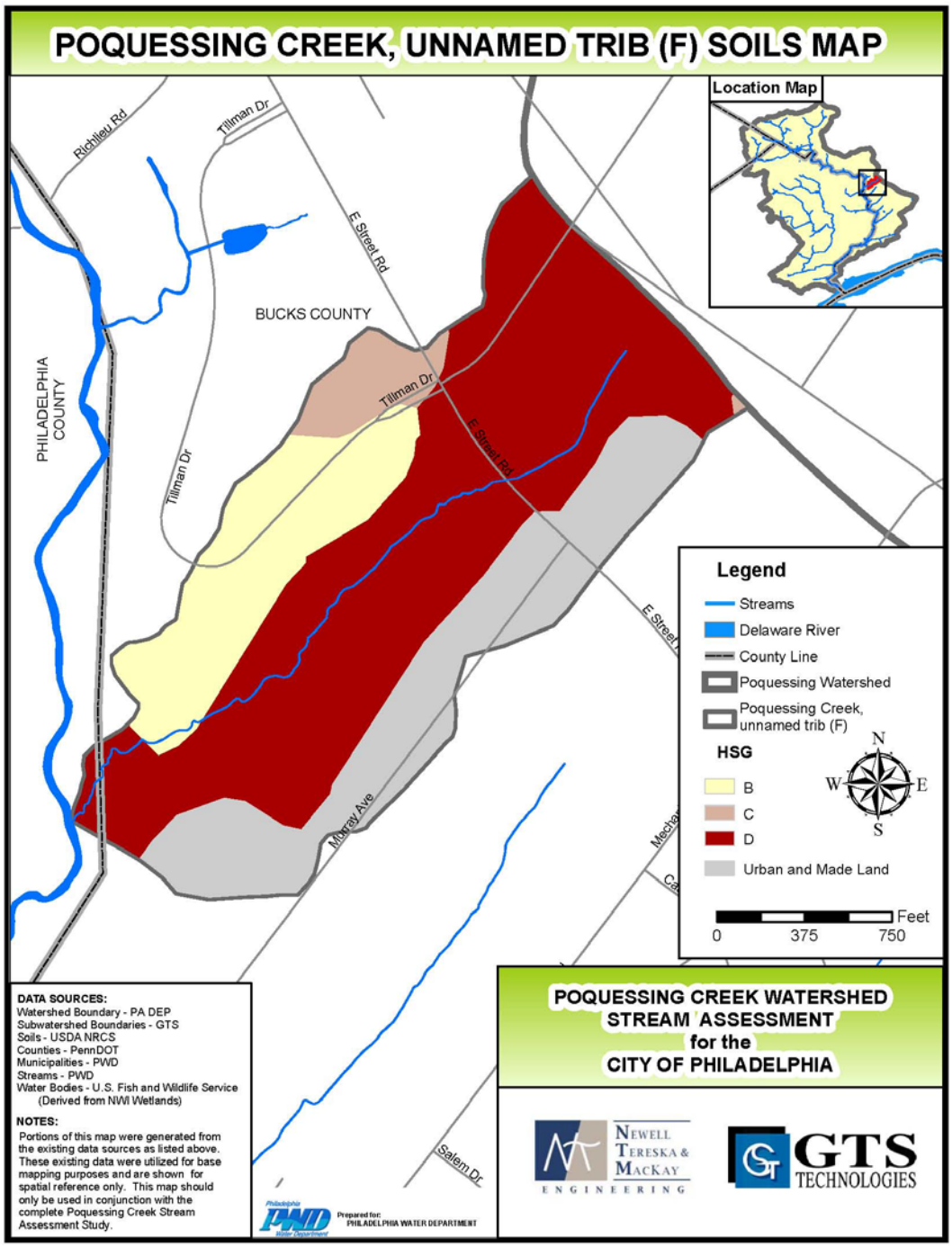


Figure 3-38: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary F Watershed



3.1.8.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary F (Table 3-51). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary F was greater than seven times the average for all Poquessing Creek subwatersheds (Table 3-52). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-51: Erosion Rates for Poquessing Creek Unnamed Tributary F Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSF04	-3.197	-1.234	-7.139	-1.680	-0.336	E

Table 3-52: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary F	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.8.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary F is a small tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary F lies in a vacant area with commercial development and parking close by. At the downstream end and closer to the confluence, the land use patterns become more wooded with single family residential and commercial development surrounding the wooded buffer before reaching the confluence with Poquessing Creek. There is little infrastructure along this reach. All infrastructure elements are described as being in good condition. Three outfalls exist along the reach and range in size from 2.0 feet to 2.5 feet. Two culverts are located along the reach. Culvert PQcul075 is a 121 feet long 52 box culvert that conveys flow under Street Road, a major transportation route in this area. Just downstream of Street Road is another small culvert (PQcul076). A small private footbridge can also be located approximately 250 feet downstream of Street Road. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-53: Summary of Poquessing Creek Unnamed Tributary F Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSF04	2	1	3	0	0	0	0	0	6

3.1.8.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary F stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-39: Results for Poquessing Creek, Unnamed Tributary F Watershed

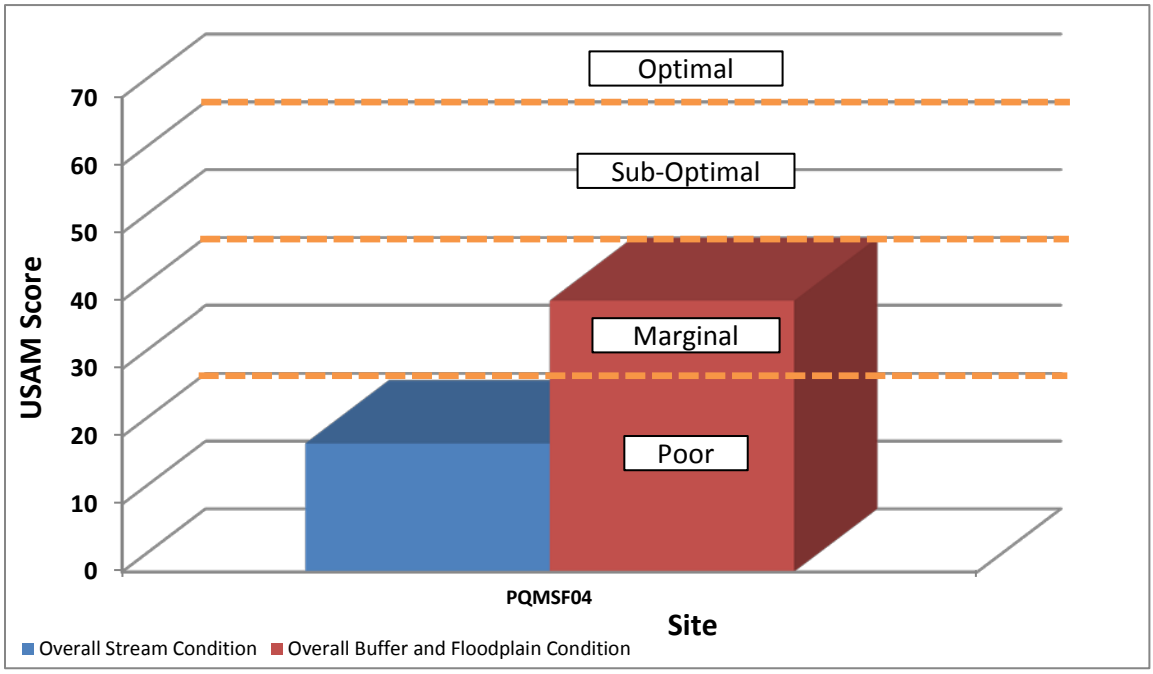
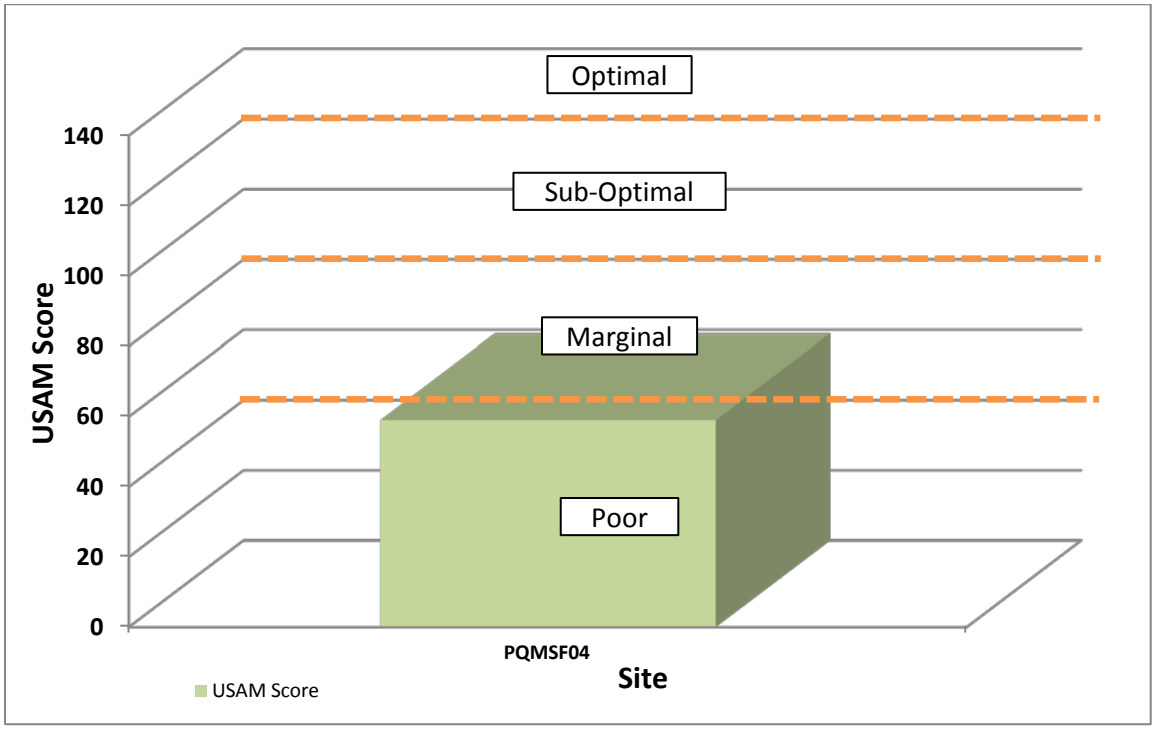


Figure 3-40: Poquessing Creek, Unnamed Tributary F Watershed USAM Results



3.1.8.5.1 PQMSF04

Reach PQMSF04 is the entire length of Poquessing Creek, Unnamed Tributary F. The headwaters of this tributary begin at a stormwater pond in a commercial area near East Street Road. This upper half of this reach runs through a mostly commercial area with a large amount of impervious surface area. The lower portion of the reach runs through a wooded corridor between a commercial and residential area before reaching the mainstream of Poquessing Creek. Reach PQMSF04 is characterized by a shallow slope (1.1%), low width to depth ratio (6.6), a moderately entrenched channel (ER = 2.0), low sinuosity (1.05), and gravel substrate. The reach was classified as an E4 type stream. The composite USAM score for reach PQMSF04 was marginal (59/160).

3.1.8.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary F: PQMSF04. The score for the Overall Stream Condition components was rated as poor, while the scores for the Overall Buffer and Floodplain Condition as well as the composite USAM score were classified as marginal (Table 3-46). Average conditions within the Poquessing Creek, Unnamed Tributary F Watershed's stream channels were worse than conditions observed within the buffers and floodplains. The Small Tributary average for the Overall Stream Condition component was higher than the score for reach PQMSF04 but lower for the Overall Buffer and Floodplain Condition. The Small Tributary Average USAM Score was slightly higher than that for reach PQMSF04. The scores for individual parameters ranged from poor to suboptimal. Graphs of each USAM category rating are in Appendix D.

Table 3-54: USAM Results for Poquessing Creek, Unnamed Tributary F Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSF04	PQ, Unnamed Tributary F	19	40	59
Small Tributary Average		30.6	33.1	63.8

3.1.8.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE HILLCREST RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to marginal. The Small Tributary average score (30.6/80) was rated as marginal, higher than the rating for the Unnamed Tributary (19.0/80), which was considered poor.

Table 3-55: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary F Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	Right	Left	Right		
PQMSF	PQ, Unnamed Tributary. F	1	3	3	1	1	10	19
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.8.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary F Watershed was poor (1.0/20), reflecting less than 20% stable habitat due to lacking or unstable substrate. The Small Tributary average was rated slightly higher at 5.6/20, but also receiving a rating of poor.

3.1.8.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSF04 had marginal (3.0/10) vegetative protection which indicates less than 50%-70% of the streambanks are covered by vegetation and the area has some evidence of disruption such as bare soil patches or closely cropped vegetation. The Small Tributary average was also rated marginal (4.0/10) for both the left and right banks. The marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks. Furthermore, the highly eroded channel prevents most vegetation from developing along the banks.

3.1.8.6.1.3 BANK EROSION

Reach PQMSF04 had a poor rating for both the left and right banks (1.0/10), reflecting active downcutting and fast erosion rates, resulting in tall banks and significant sediment contribution to the stream. The Small Tributary average for the left and right banks were rated as marginal (4.0/10 and 4.3/10, respectively). A rating of marginal indicates active stream widening and erosion at a moderate rate with no threat to property or infrastructure.

3.1.8.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary F Watershed was marginal with reach PQMSF04 receiving a rating of 10.0/20. The Small Tributary average was slightly lower than that for PQMSF04, with a rating of 8.8/20, also marginal. A marginal rating also indicates high flows not able to enter the floodplain and deep stream entrenchment, but to a lesser degree.

3.1.8.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY F WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were all marginal to suboptimal. The Overall Buffer and Floodplain Condition score for PQMSF04 (40.0/80) was somewhat higher than that for the Small Tributary average (33.1/80). The improved function of the floodplains in this watershed can be attributed to the wooded, floodplain buffer in the lower portion of the reach.

Table 3-56: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary F Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSF04	PQ, Unnamed Tributary. F	6	6	11	8	9	40
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.8.6.2.1 VEGETATED BUFFER WIDTH

The width of both the left and right bank vegetated buffers for reach PQMSF04 was rated as suboptimal (both 6.0/10), reflecting a buffer zone of 25-50 feet and minimal human impact. The Small Tributary average was rated as marginal for both the left and right banks (4.3/10 and 4.5/10, respectively). A marginal rating indicates a buffer zone of 10-25 feet with significant human impact.

3.1.8.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQMSF04 was young forest, with a suboptimal score of 11.0/20. The Small Tributary average rating was marginal (9.1/20), reflecting a predominant vegetation type of scrub/shrub.

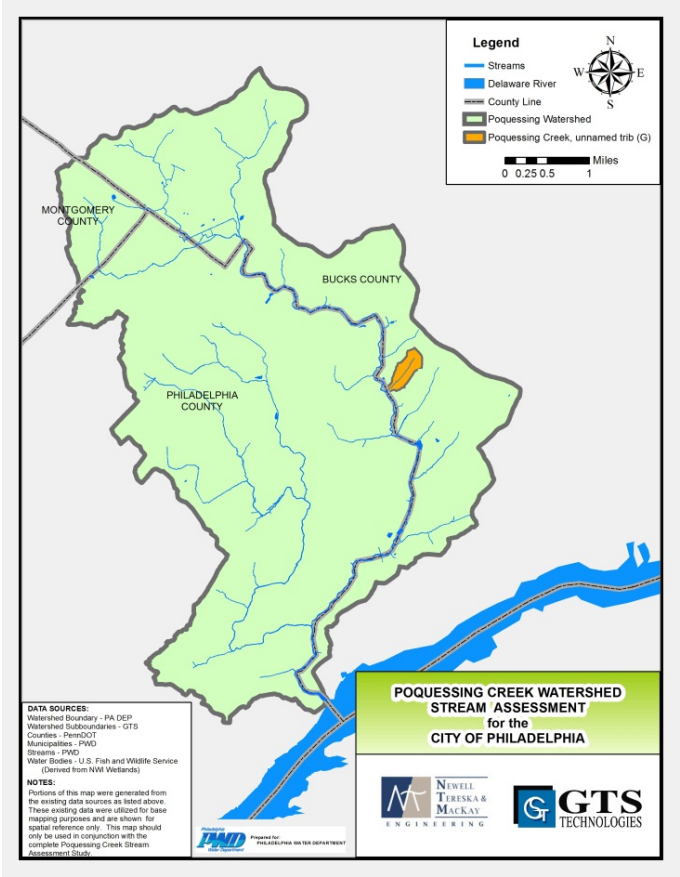
3.1.8.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated marginal (8.0/20) for the reach PQMSF04, indicating either all wetland or non-wetland habitat and some evidence of standing or ponded water. The Small Tributary average was also rated as marginal (6.5/20).

3.1.8.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSF04 was marginal (9.0/20) showing only moderate floodplain encroachment and only some effect on floodplain function. The Small Tributary average was also rated as marginal (8.8/20), although with a slightly lower score.

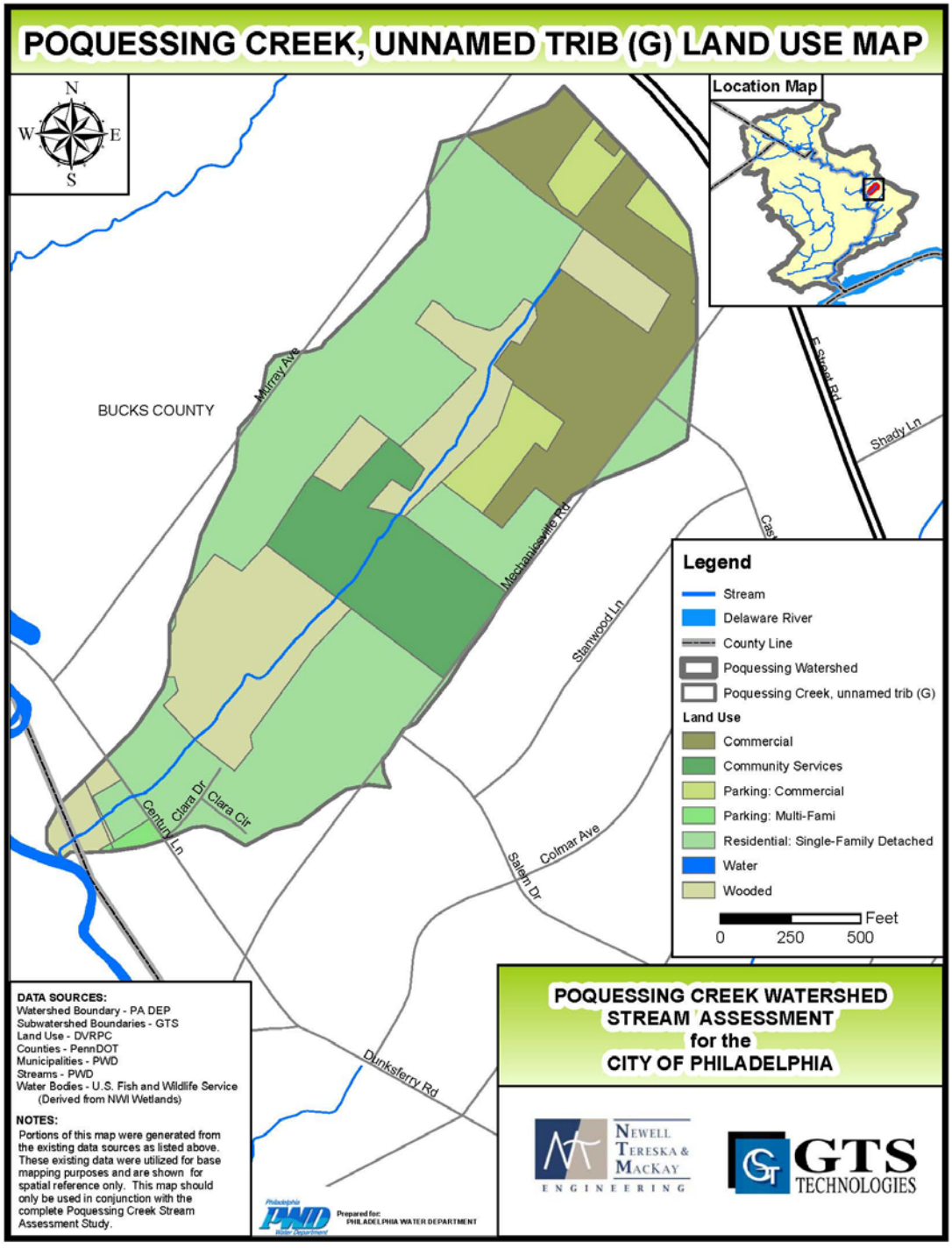
3.1.9 POQUESSING CREEK UNNAMED TRIBUTARY G WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary G is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary G originates from stormwater drainage from surrounding development. Poquessing Creek Unnamed Tributary G is a first-order tributary that flows for approximately 1,800 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate is identified as silt and clay material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary G Watershed is 66 acres. Major land use types within the watershed include: residential: single family detached (45%), wooded (21%) and commercial (11%). Poquessing Creek Unnamed Tributary G is surrounded by wooded land and some areas of residential development surround the reach. The wooded buffer ranges from about 50 feet to about 300 feet wide in some areas.

Figure 3-41: Poquessing Creek, Unnamed Tributary G Watershed Land Use



3.1.9.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary G Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary G Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.9.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Poquessing Creek Unnamed Tributary G Watershed are classified as a mix of urban soils and hydrologic group D. Soils classified as urban soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely. Soils in hydrologic group D have a high runoff potential. These soils have a very slow infiltration rate when saturated. Water movement through the soil is slow or very slow.

Table 3-57: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary G Watershed

Group	Area (acres)	Percent of Total Area
D	27.9	42%
Urban	38.4	58%
Total Area	66.3	100%

Figure 3-42: Geology of Poquessing Creek, Unnamed Tributary G Watershed

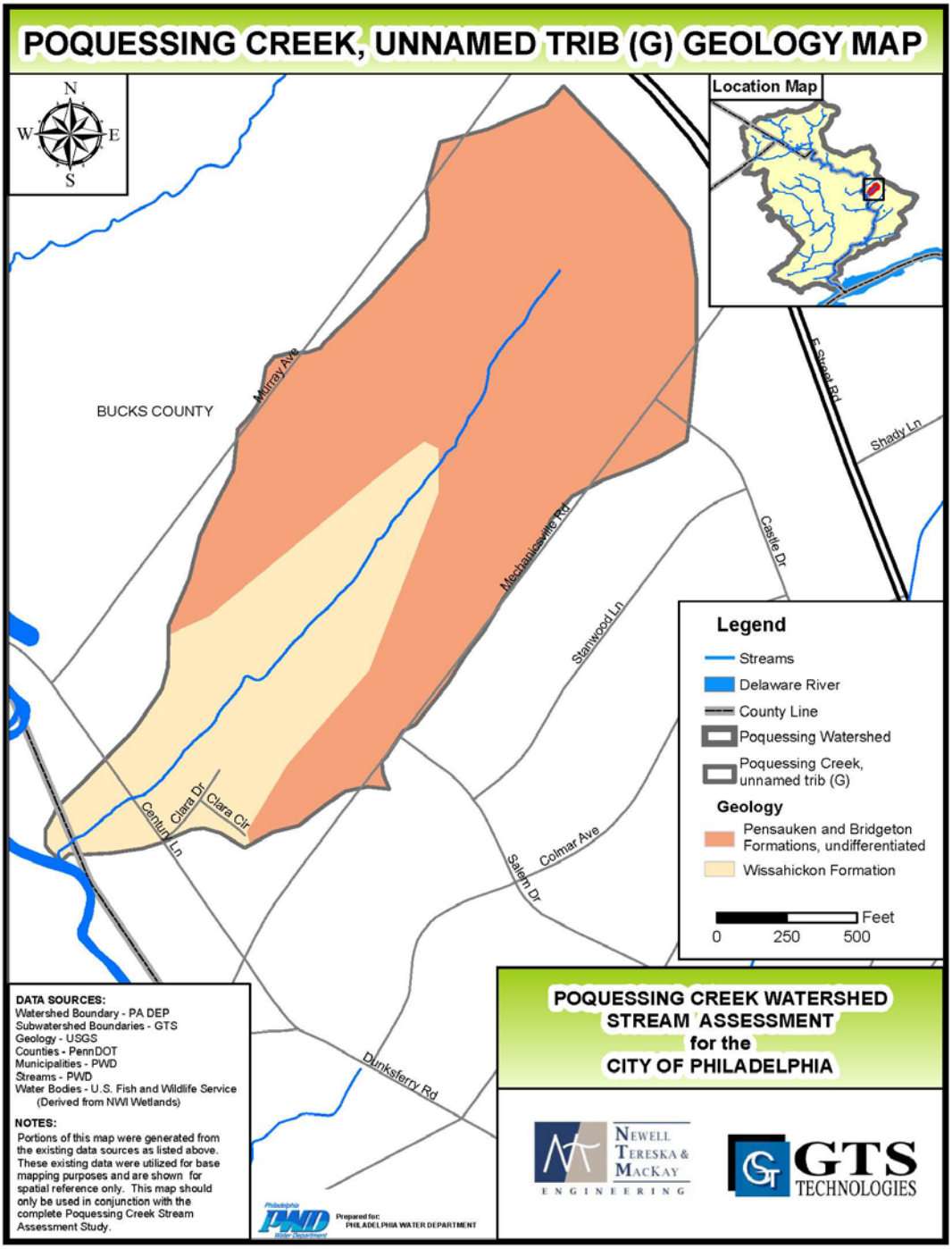
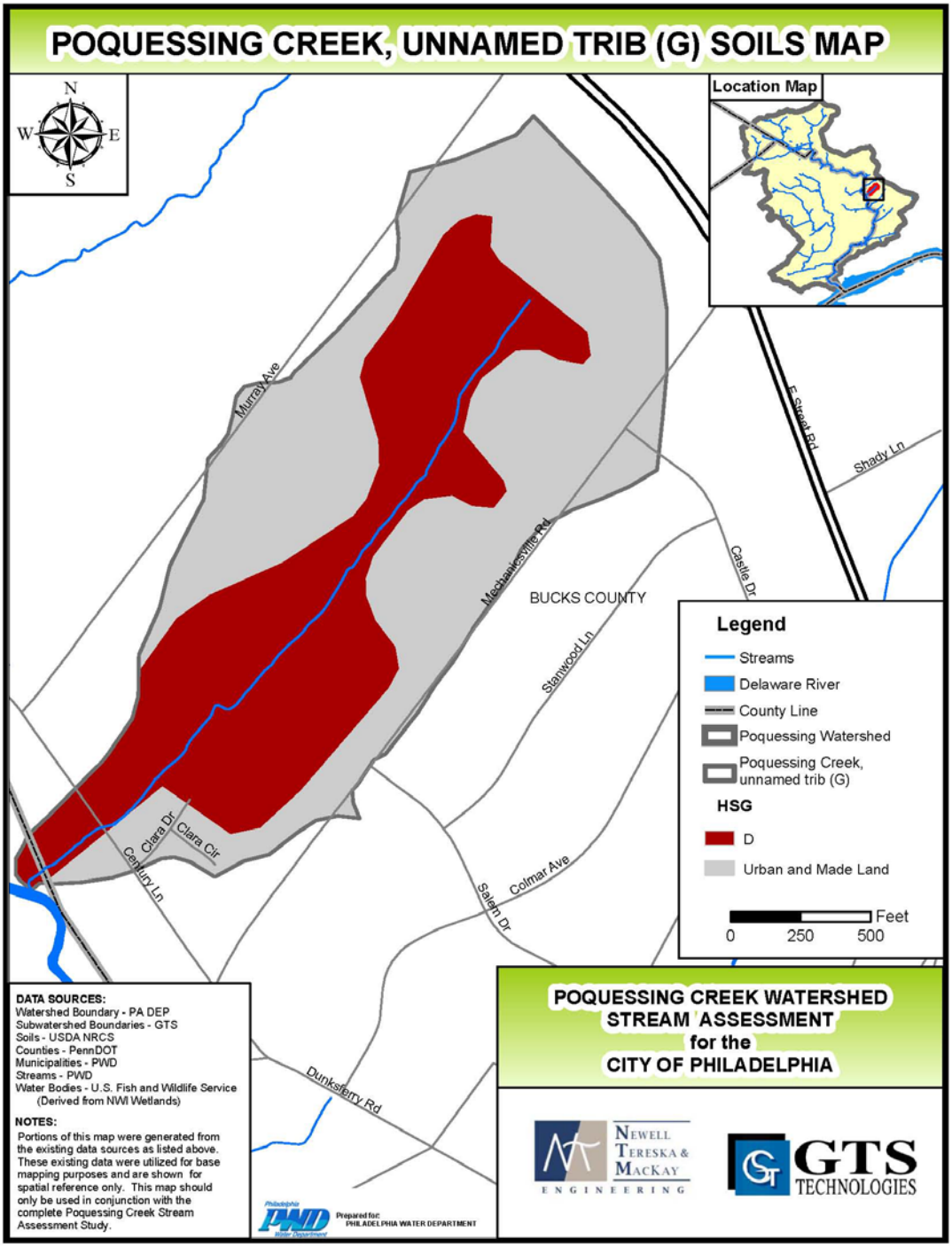


Figure 3-43: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary G Watershed



3.1.9.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary G (Table 3-58). This reach was found to be aggrading based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary G was significantly lower than the average for all Poquessing Creek subwatersheds (Table 3-59). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-58: Erosion Rates for Poquessing Creek Unnamed Tributary G Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSG04	-0.141	0.030	0.193	0.026	0.005	A

Table 3-59: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.9.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary G is a small tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary G lies in a residential area with some wooded buffers in the upstream. At the downstream end and closer to the confluence, the land use patterns become denser residential with some commercial development surrounding the wooded buffer before reaching the confluence with Poquessing Creek. There is little infrastructure along this reach. All infrastructure elements are described as being in good condition. Two culverts are located along the reach. Culvert PQcul080 is an 83-foot long by 5-foot wide by 4-foot high corrugated metal arch culvert that conveys flow under Century Road. Just downstream of Century Road is another small culvert (PQcul081). A small private footbridge was located approximately 600 feet upstream of the confluence. Two areas of constructed stone channels are located approximately 300 feet to 600 feet upstream of the confluence. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-60: Summary of Poquessing Creek Unnamed Tributary G Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSG04	2	1	0	2	0	0	0	0	5

3.1.9.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary G stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-44: Result for Poquessing Creek, Unnamed Tributary G Watershed USAM Components

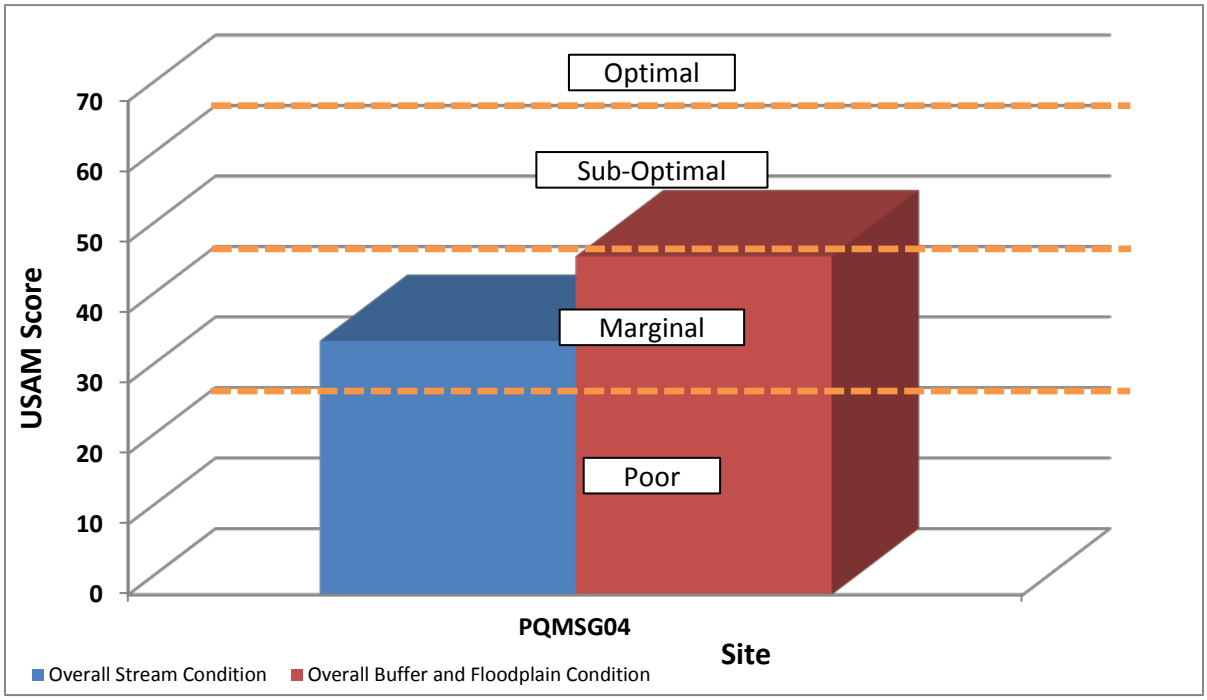
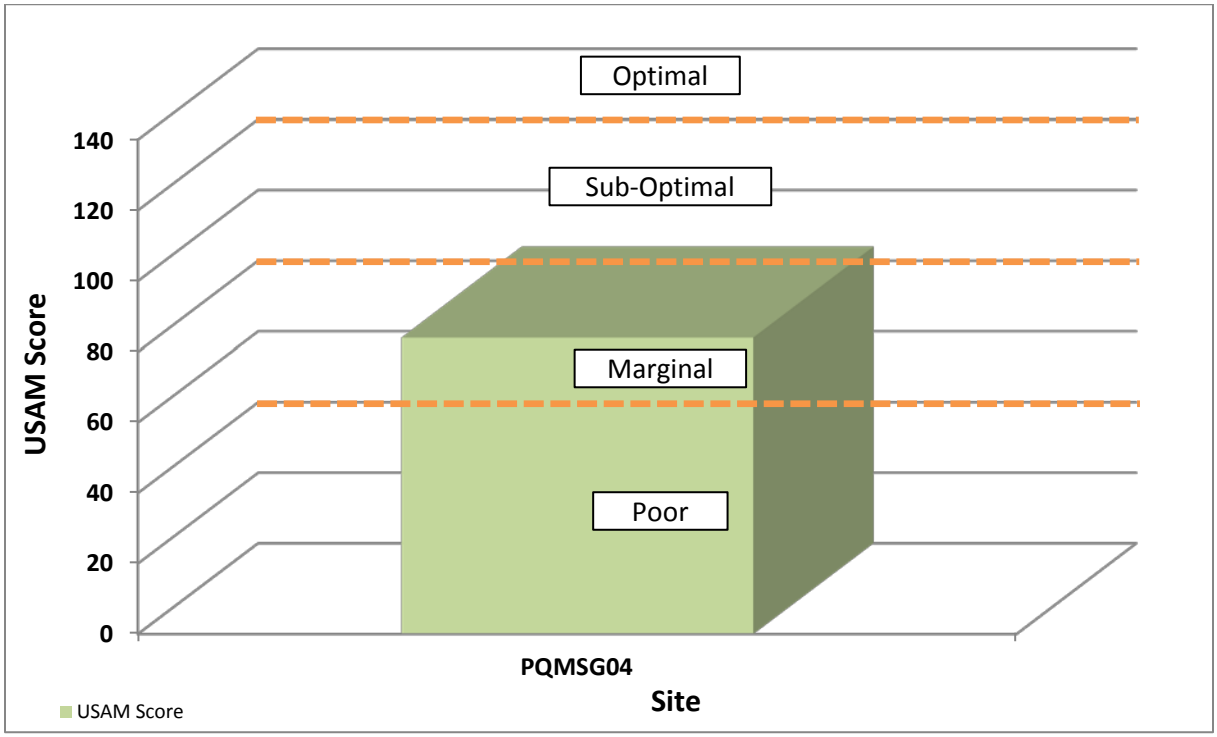


Figure 3-45: Poquessing Creek, Unnamed Tributary G Watershed USAM Results



3.1.9.5.1 PQMSG04

Reach PQMSG04 is the entire length of Poquessing Creek, Unnamed Tributary G. This reach runs through a residential area with a wooded tract in the middle of the reach, before reaching the mainstem of Poquessing Creek. Reach PQMSG04 is characterized by a moderate slope (2.0%), low width to depth ratio (10.6), a slightly entrenched channel (ER = 2.2), low sinuosity (1.07), and silt/clay substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMSG04 was suboptimal (84/160).

3.1.9.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary G: PQMSG04. The score for the Overall Stream Condition components was rated as marginal, while the scores for the Overall Buffer and Floodplain Condition as well as the composite USAM score were classified as suboptimal (Table 3-61). Average conditions within the Poquessing Creek, Unnamed Tributary G Watershed's stream channels were worse than conditions observed within the buffers and floodplains. The Small Tributary averages for the Overall Stream Condition, Overall Buffer and Floodplain Condition and USAM Score components were lower than those scores for reach PQMSG04. The scores for individual parameters ranged from poor to optimal. Graphs of each USAM category rating are in Appendix D.

Table 3-61: USAM Results for Poquessing Creek, Unnamed Tributary G Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSG04	PQ, Unnamed Tributary G	36	48	84
Small Tributary Average		30.6	33.1	63.8

3.1.9.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY G WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to suboptimal. The Small Tributary average score (30.6/80) was rated as marginal, slightly lower than the rating for the Unnamed Tributary G (36.0/80), also considered marginal.

Table 3-62: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary G Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQMSG04	PQ, Unnamed Tributary G	5	4	5	5	5	12	36
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.9.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary G Watershed was poor (5.0/20), reflecting less than 20% stable habitat due to lacking or unstable substrate. The Small Tributary average was rated slightly higher at 5.6/20, but also received a rating of poor.

3.1.9.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSG04 had marginal (4.0/10, left and 5.0/10, right) vegetative protection which indicates less than 50%-70% of the streambanks are covered by vegetation and the area has some evidence of disruption such as bare soil patches or closely cropped vegetation. The Small Tributary average was also rated marginal (4.0/10) for both the left and right banks. The marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks.

3.1.9.6.1.3 BANK EROSION

Reach PQMSG04 had a marginal rating for the left and right banks (5.0/10), reflecting active stream widening and erosion at a moderate rate with no threat to property or infrastructure. The Small Tributary averages for the left and right banks were also rated as marginal (4.0/10 and 4.3/10, respectively).

3.1.9.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary G Watershed was suboptimal with reach PQMSG04 receiving a rating of 12.0/20. A suboptimal rating indicates that high flows are able to enter the floodplain and that the stream is not deeply entrenched. The Small Tributary average was slightly lower than that for PQMSG04, with a rating of 8.8/20, considered marginal. A marginal rating indicates high flows not able to enter the floodplain and deep stream entrenchment.

3.1.9.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY G WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to optimal. The Overall Buffer and Floodplain Condition score for

PQMSG04 (48.0/80, suboptimal) was much higher than that for the Small Tributary average (33.1/80, marginal). The improved function of the floodplains in this watershed can be attributed wooded buffers that exist along much of this reach.

Table 3-63: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary G Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSG04	PQ, Unnamed Tributary G	5	9	16	13	5	48
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.9.6.2.1 VEGETATED BUFFER WIDTH

The width of the left bank of reach PQMSG04 was rated as marginal (5.0/10) while the right bank was rated as optimal (9.0/10). A marginal rating indicates a buffer zone of 10-25 feet with significant human impact while an optimal rating reflects a buffer greater than 50 feet in width with little to no human activity impact. The Small Tributary average was rated as marginal for both the left and right banks (4.3/10 and 4.5/10, respectively).

3.1.9.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQMSG04 was mature forest, with an optimal score of 16.0/20. The Small Tributary average rating was marginal (9.1/20), reflecting a predominant vegetation type of scrub/shrub.

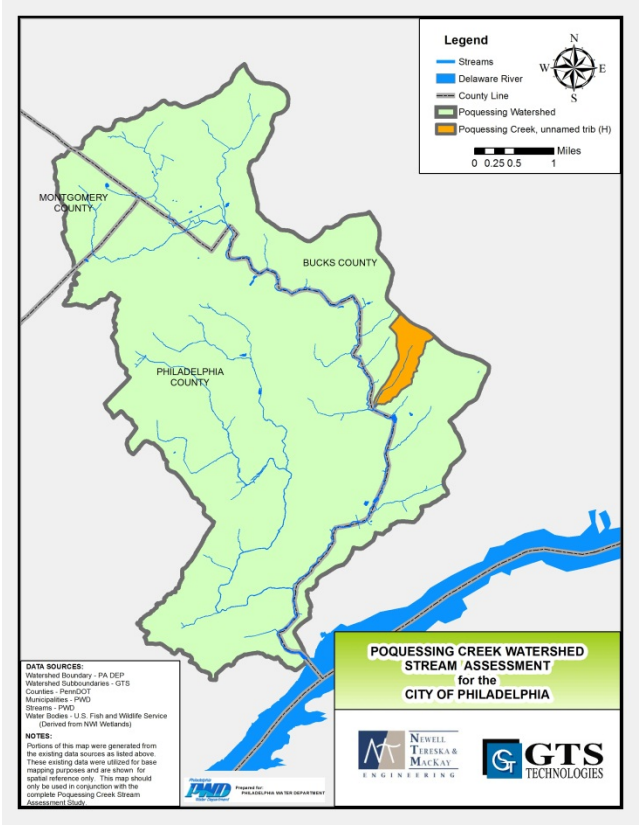
3.1.9.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated suboptimal (13.0/20) for the reach PQMSG04, indicating an even mix of wetland and non-wetland habitat but no evidence of standing or ponded water. The Small Tributary average was rated as marginal (6.5/20) reflecting a habitat of all wetland or non-wetland and some evidence of standing or ponded water.

3.1.9.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSG04 was poor (5.0/20) showing significant floodplain encroachment and significant effect on floodplain function. The Small Tributary average was rated as marginal (8.8/20), reflecting only moderate floodplain encroachment and some effect on floodplain function.

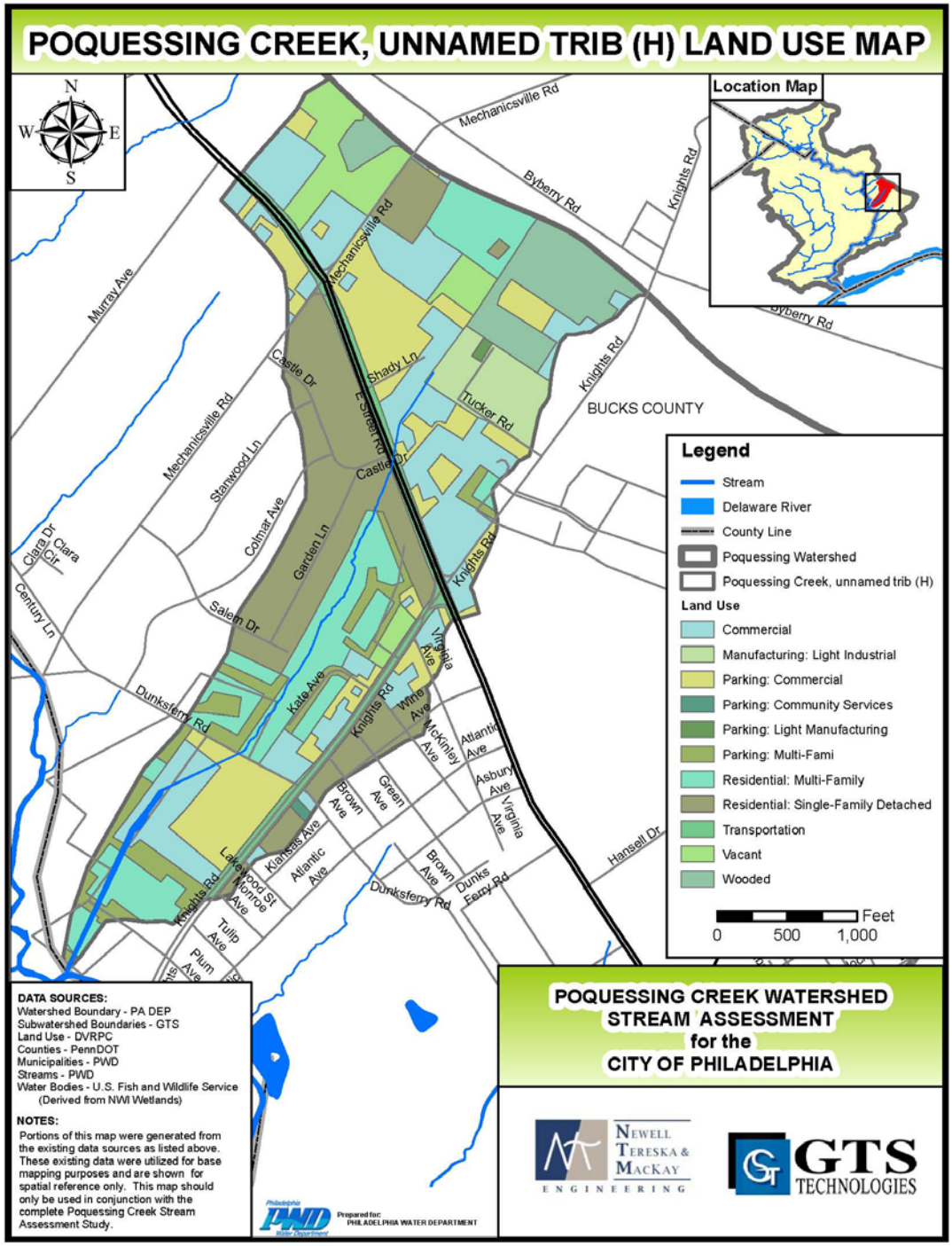
3.1.10 POQUESSING CREEK UNNAMED TRIBUTARY H WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary H is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary H originates from a privately-owned stormwater outfall. Poquessing Creek Unnamed Tributary H is a first-order tributary for approximately 0.3 miles until a smaller 0.25 mile tributary enters Elwood's Run approximately 0.2 miles from the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary H Watershed is 216 acres. Major land use types within the watershed include: residential: single family detached (21%), commercial (21%) and parking commercial (16%). Poquessing Creek Unnamed Tributary H is surrounded by dense residential and commercial development along the reach. A wooded buffer exists along the portion of Poquessing Creek Unnamed Tributary H between Dunks Ferry Road and Street Road. The wooded buffer ranges from about 40 feet to about 150 feet wide.

Figure 3-46: Poquessing Creek, Unnamed Tributary H Watershed Land Use



3.1.10.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary H Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary H Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.10.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority Poquessing Creek Unnamed Tributary H Watershed are classified as urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

A small portion of the soils throughout the watershed are classified as hydrologic group D and hydrologic group C soils. Soils in hydrologic group D have a high runoff potential. These soils have a very slow infiltration rate when saturated. Hydrologic group C soils have a slow rate of infiltration when saturated. Water movement through these soils is moderate or moderately slow; they generally have a restrictive layer that impedes the downward movement of water.

Table 3-64: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary H Watershed

Group	Area (acres)	Percent of Total Area
C	0.2	0.1%
D	48.3	22%
Urban	168.1	78%
Total Area	216.6	100%

Figure 3-47: Geology of Poquessing Creek, Unnamed Tributary H Watershed

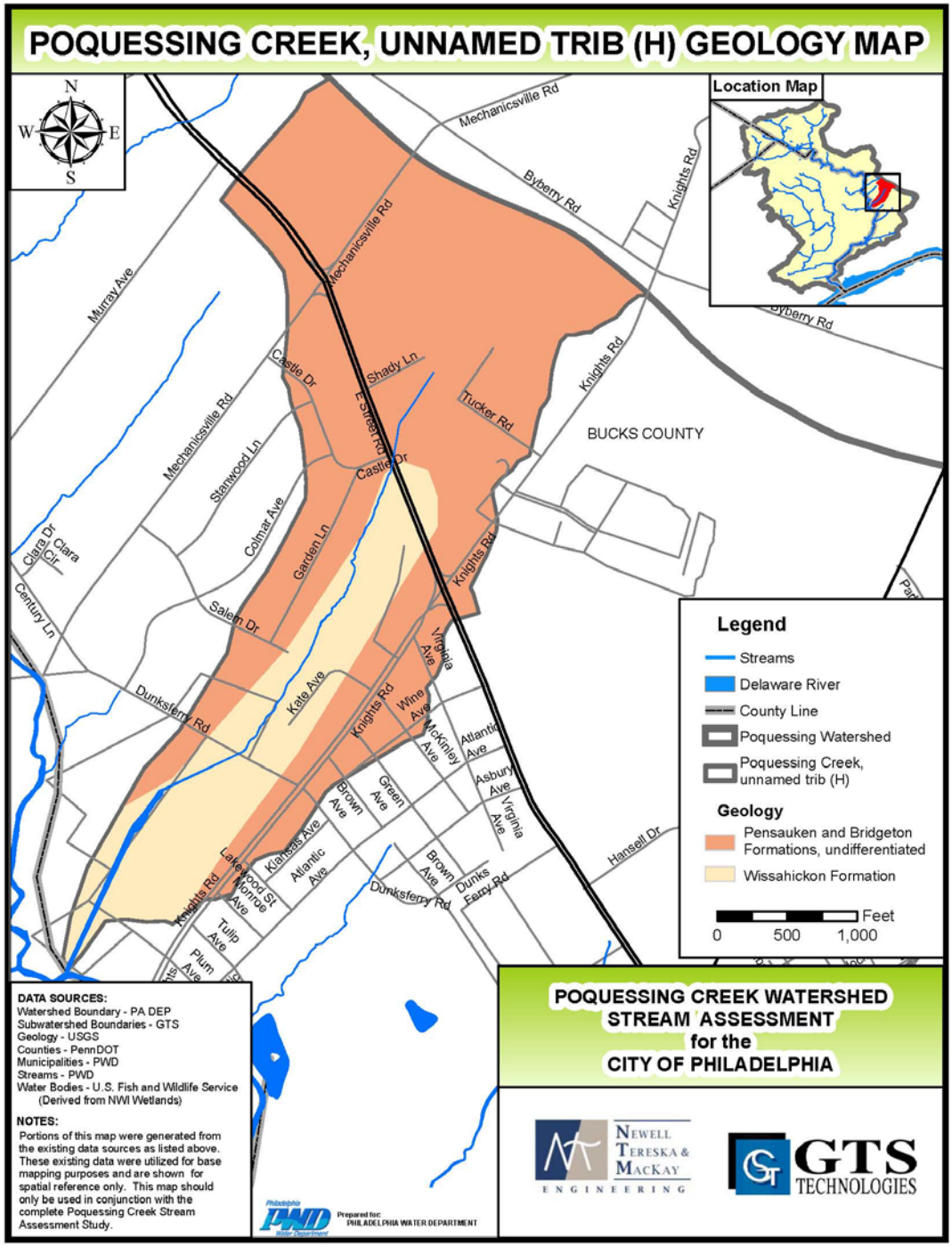
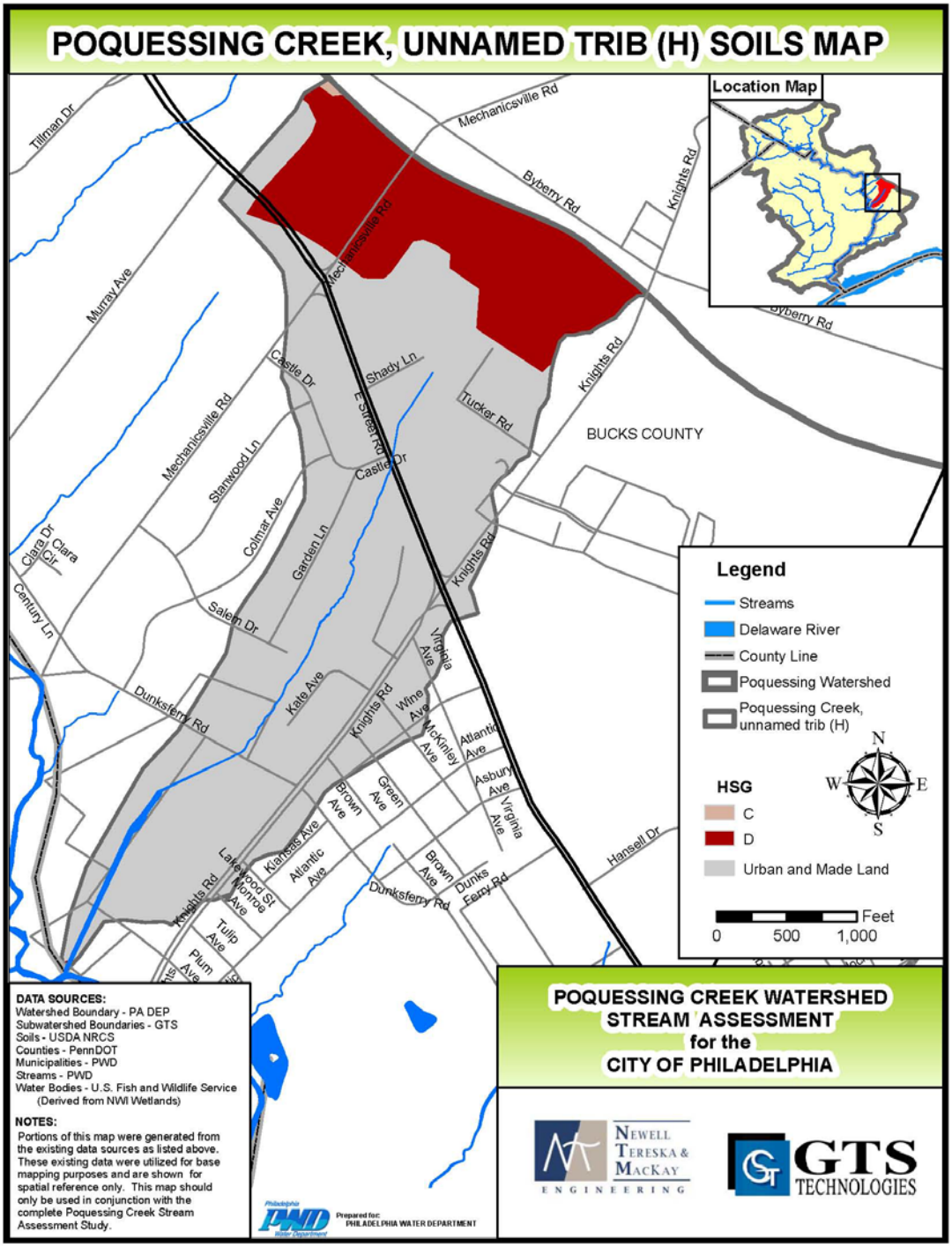


Figure 3-48: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary H Watershed



3.1.10.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary H (Table 3-65). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary H was higher than the average for all Poquessing Creek subwatersheds (Table 3-66). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-65: Erosion Rates for Poquessing Creek Unnamed Tributary H Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSH06	0.852	0.506	-0.137	0.361	0.072	A

Table 3-66: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.10.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary H is a tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary H lie in a dense residential and commercial area. At the downstream end and closer to the confluence, the land use patterns become denser residential with some commercial development surrounding before reaching the confluence with Poquessing Creek.

One infrastructure element along Poquessing Creek Unnamed Tributary H is described as being in poor condition. PQcul086 is a 23-foot long by 3-foot high by 5-foot wide concrete culvert in poor condition located approximately 2,200 feet upstream of the confluence. Two other culverts are located along the reach and are significant in size. Culvert PQcul085 is a 279-foot long by 2-foot high by 5-foot wide concrete culvert that conveys flow under Street Road. Culvert PQcul087 is a 605-foot long by 2-foot high by 5-foot wide corrugated metal pipe culvert that conveys flow under Dunks Ferry Road and an adjacent shopping center. Five outfalls exist along the reach and are the most predominant infrastructure element due to the large amounts of stormwater drainage throughout the watershed. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-67: Summary of Poquessing Creek Unnamed Tributary H Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSH06	3	3	5	0	0	1	0	0	12

3.1.10.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary H stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-49: Results for Poquessing Creek, Unnamed Tributary H Watershed USAM Components

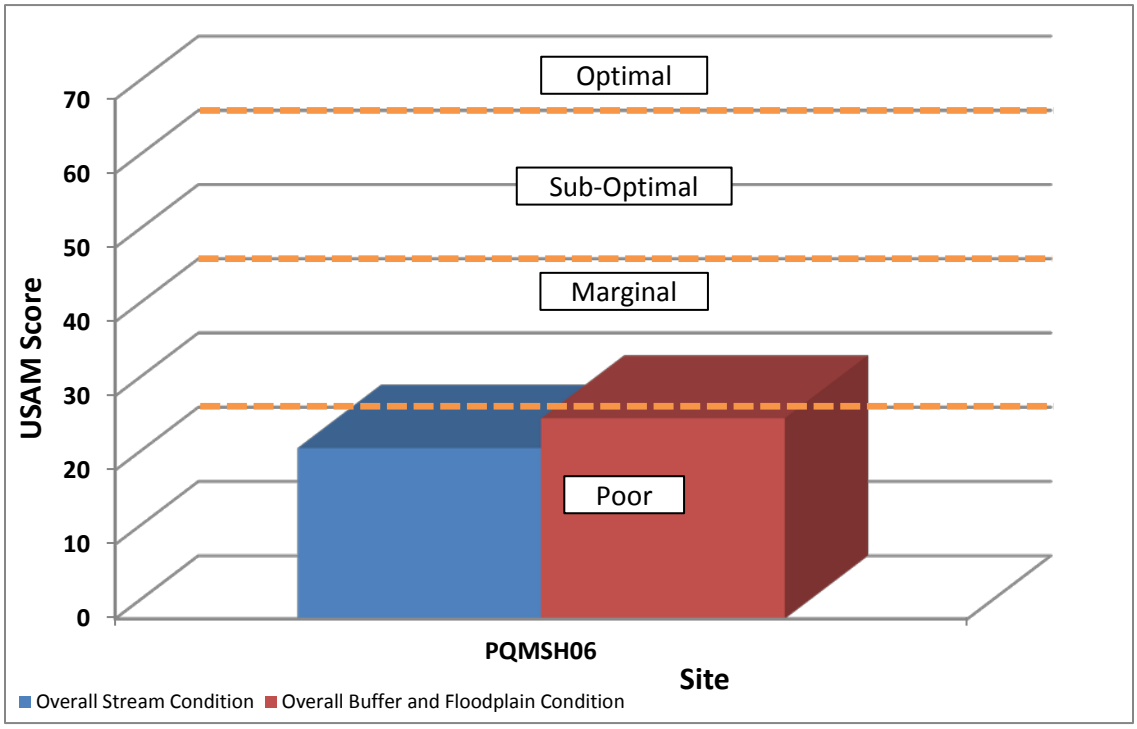
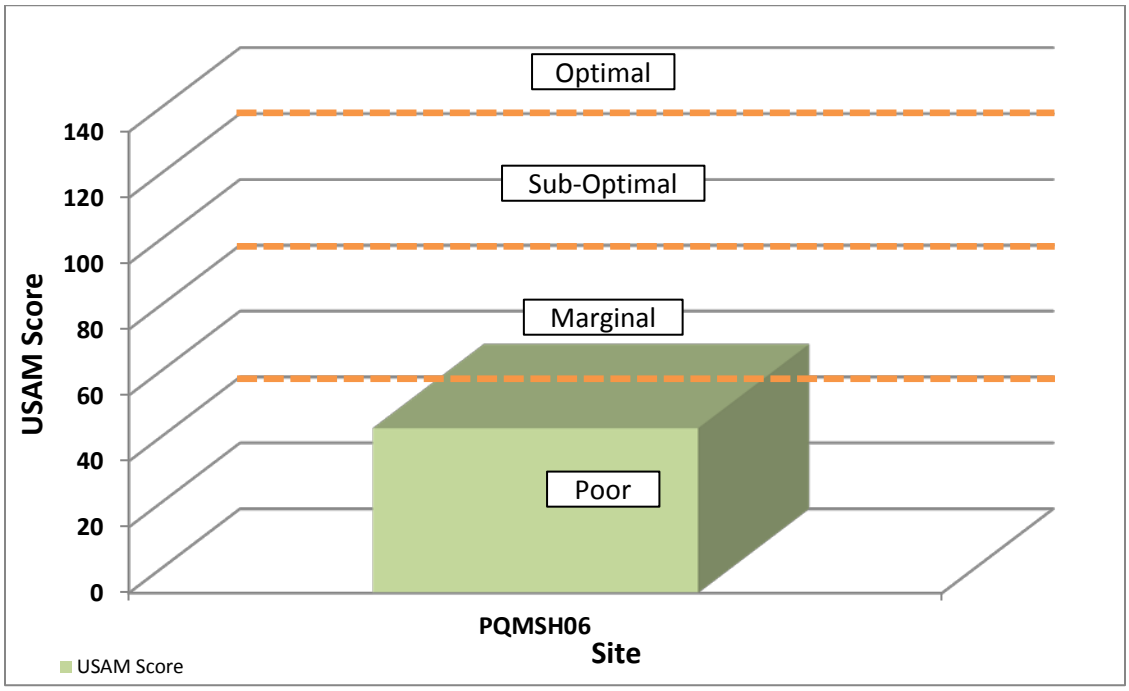


Figure 3-50: Poquessing Creek, Unnamed Tributary H Watershed USAM Results



3.1.10.5.1 PQMSH06

Reach PQMSH06 is the entire length of Poquessing Creek, Unnamed Tributary H. The headwaters of this tributary begin in a highly impervious commercial area near E Street Road. The upper half of this reach runs through a mostly commercial and residential area. The lower portion of the reach is mostly culverted under an industrial and residential area before reaching the mainstream of Poquessing Creek. Reach PQMSH06 is characterized by a shallow slope (1.1%), moderate width to depth ratio (12.3), a moderately entrenched channel (ER = 1.7), low sinuosity (1.04), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSH06 was marginal (50/160).

3.1.10.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary H: PQMSH06. The scores for the Overall Stream Condition components, Overall Buffer and Floodplain Conditions and the composite USAM score were rated as marginal (Table 3-68). Average conditions within the Poquessing Creek, Unnamed Tributary H Watershed's stream channels were slightly worse than the conditions observed within the buffers and floodplains. The Small Tributary averages for the Overall Stream Condition, Overall Buffer and Floodplain Condition and USAM Score components were higher than those scores for reach PQMSH06. The scores for individual parameters ranged from poor to suboptimal. Graphs of each USAM category rating are in Appendix D.

Table 3-68: USAM Results for Poquessing Creek, Unnamed Tributary H Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSH06	PQ, Unnamed Tributary H	23	27	50
Small Tributary Average		30.6	33.1	63.8

3.1.10.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY H WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to marginal. The Small Tributary average score (30.6/80.0) was rated as marginal, slightly higher than the rating for the Unnamed Tributary H (23.0/80.0), also considered marginal.

Table 3-69: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary H Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	Right	Left	Right		
PQMSH06	PQ, Unnamed Tributary H	4	2	2	4	4	7	23
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.10.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary H Watershed was poor (4.0/20.0), reflecting less than 20% stable habitat with an unstable or lacking substrate. The Small Tributary average was rated slightly lower at 5.6/20, receiving a rating of poor.

3.1.10.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSH06 had poor (2.0/10) vegetative protection which indicates less than 50% of the streambanks are covered by vegetation and the area has high rates of disruption such as bare soil patches or closely cropped vegetation. The Small Tributary average was rated marginal (4.0/10) for both the left and right banks. The poor scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks due to adjacent development and streambank erosion.

3.1.10.6.1.3 BANK EROSION

Reach PQMSH06 had a marginal rating for the left and right banks (4.0/10), reflecting active stream widening and erosion at a moderate rate with no threat to property or infrastructure. The Small Tributary averages for the left and right banks were also rated as marginal (4.0/10 and 4.3/10, respectively).

3.1.10.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary H Watershed was marginal with reach PQMSH06 receiving a rating of 7.0/20.0. A marginal rating indicates that high flows are not able to enter the floodplain and that the stream is deeply entrenched. The Small Tributary average was slightly higher than that for PQMSH06, with a rating of 8.8/20, also considered marginal.

3.1.10.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY H WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to suboptimal, with the majority of scores falling in the marginal range. The Overall Buffer and Floodplain Condition score for PQMSH06 (27.0/80.0, marginal) was slightly lower than that for the Small Tributary average (33.1/80.0, also marginal).

The degraded function of the floodplains in this watershed can be attributed to the development in the adjacent floodplains.

Table 3-70: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary H Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSH06	PQ, Unnamed Tributary H	3	3	6	4	11	27
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.10.6.2.1 VEGETATED BUFFER WIDTH

The widths of both banks of reach PQMSH06 were rated as marginal (3.0/10.0). A marginal rating indicates a buffer zone of 10-25 feet with significant human impact while an optimal rating reflects a buffer greater than 50 feet in width with little to no human activity impact. The Small Tributary average was also rated as marginal for both the left and right banks (4.3/10.0 and 4.5/10.0, respectively).

3.1.10.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in reach PQMSH06 was shrub or old field, with a marginal score of 6.0/20.0. The Small Tributary average rating was marginal (9.1/20), also reflecting a predominant vegetation type of shrub.

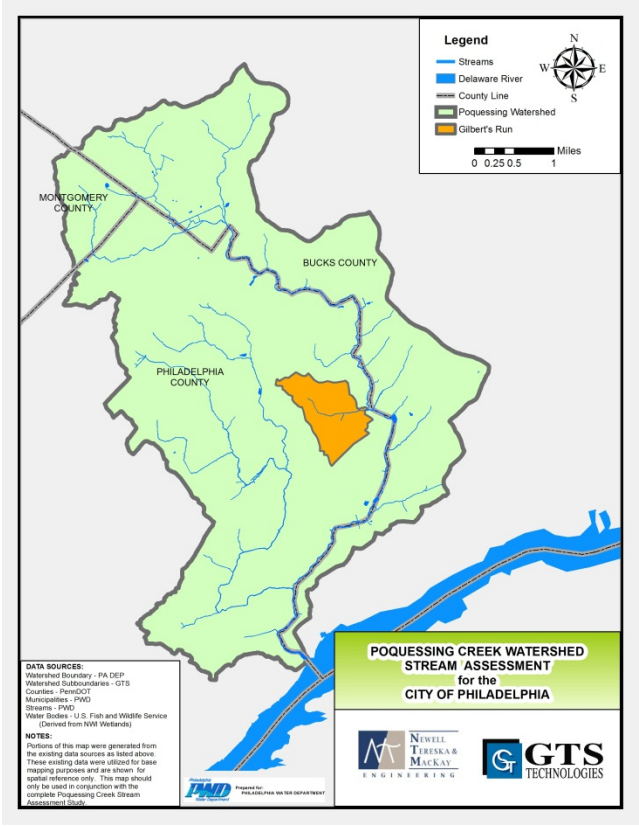
3.1.10.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated poor (4.0/20.0) for the reach PQMSH06, indicating either all wetland and non-wetland habitat but no evidence of standing or ponded water. The Small Tributary average was rated as marginal (6.5/20) reflecting a habitat of all wetland or non-wetland and some evidence of standing or ponded water.

3.1.10.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSH06 was suboptimal (11.0/20.0) showing minor floodplain encroachment with no effect on floodplain function. The Small Tributary average was rated as marginal (8.8/20), reflecting only moderate floodplain encroachment and some effect on floodplain function.

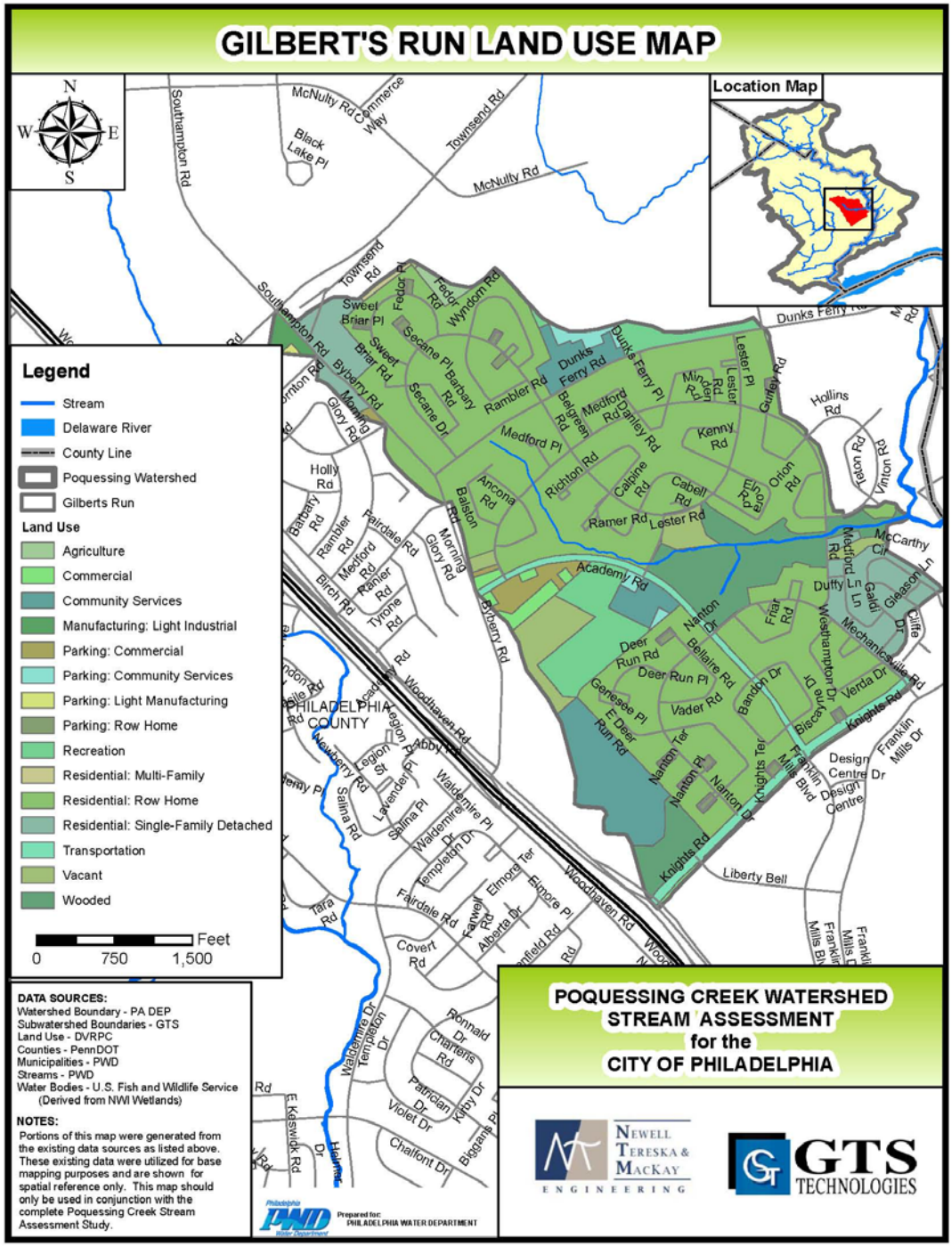
3.1.11 GILBERT'S RUN WATERSHED AND REACH CHARACTERISTICS



Gilbert's Run is a tributary to the mainstem of the Poquessing Creek. Gilbert's Run originates from a stormwater outfall draining surrounding residential development. Gilbert's Run is a first-order tributary for approximately 2,500 feet until a smaller 500-foot tributary (Gilbert's Run Unnamed Tributary A) enters Gilbert's Run approximately 1,300 feet from the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Gilbert's Run Watershed is 433 acres. Major land use types within the watershed include: residential: row home (64%) and wooded (7%). Gilbert's Run is surrounded by wooded land on both sides. The park buffer ranges from about 20 feet to about 2,000 feet wide.

Figure 3-51: Gilbert's Run Watershed Land Use



3.1.11.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary (J) watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary (J) watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.11.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the majority of soils for the Gilbert's Run Watershed are classified as urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-71: Distribution of NRCS Soil Types in Gilbert's Run Watershed

Group	Area (acres)	Percent of Total Area
A	0.5	0.1%
B	22.3	5%
C	8.0	2%
D	3.8	1%
Urban	399.2	92%
Total Area	433.8	100%

3.1.11.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for three reaches in Gilbert's Run Watershed (Table 3-72). All three reaches were found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for all reaches in the Gilbert's Run Watershed was near the average for all Poquessing Creek subwatersheds (Table 3-73). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-52: Geology of Gilbert's Run Watershed

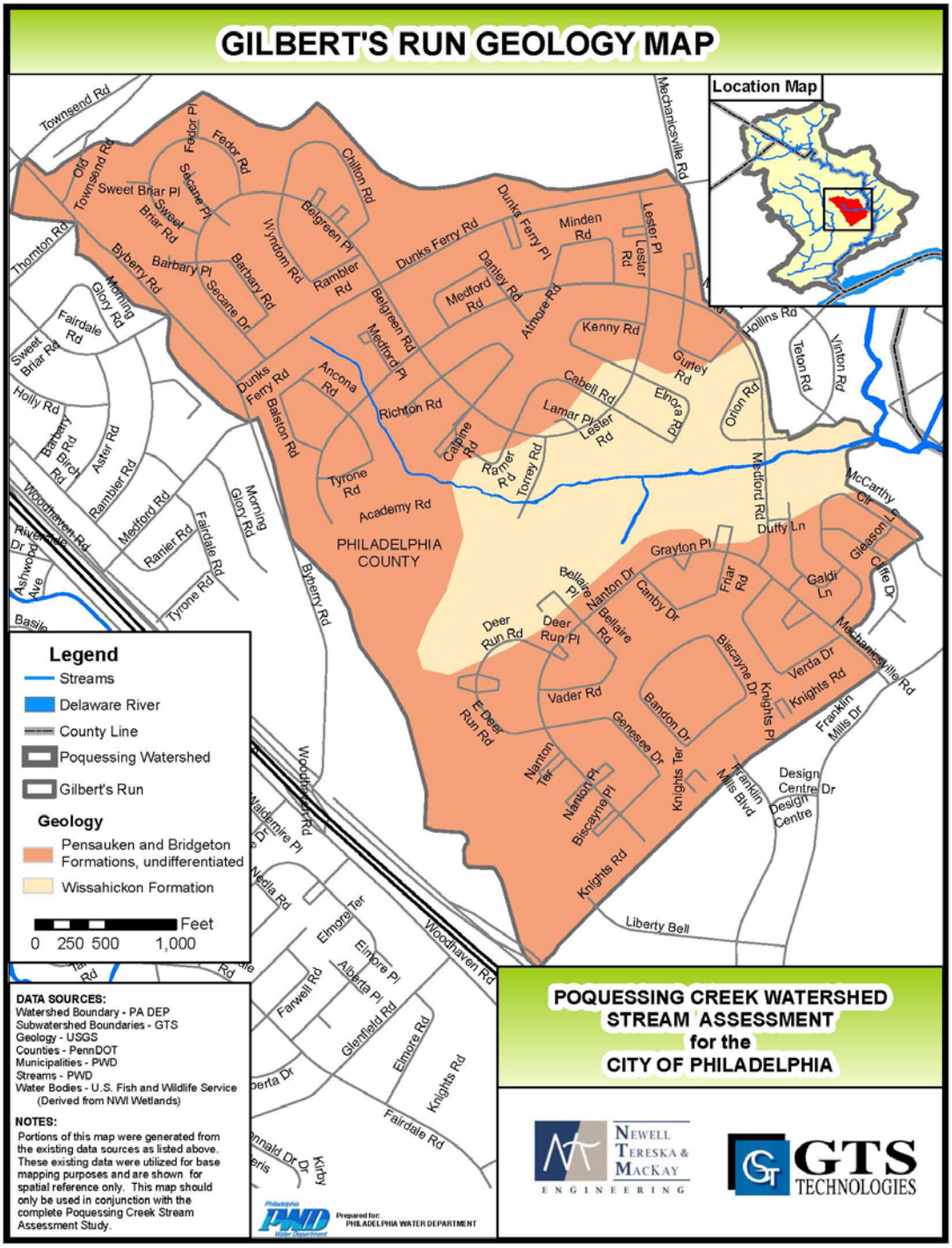


Figure 3-53: Distribution of NRCS Soil Types in Gilbert's Run Watershed

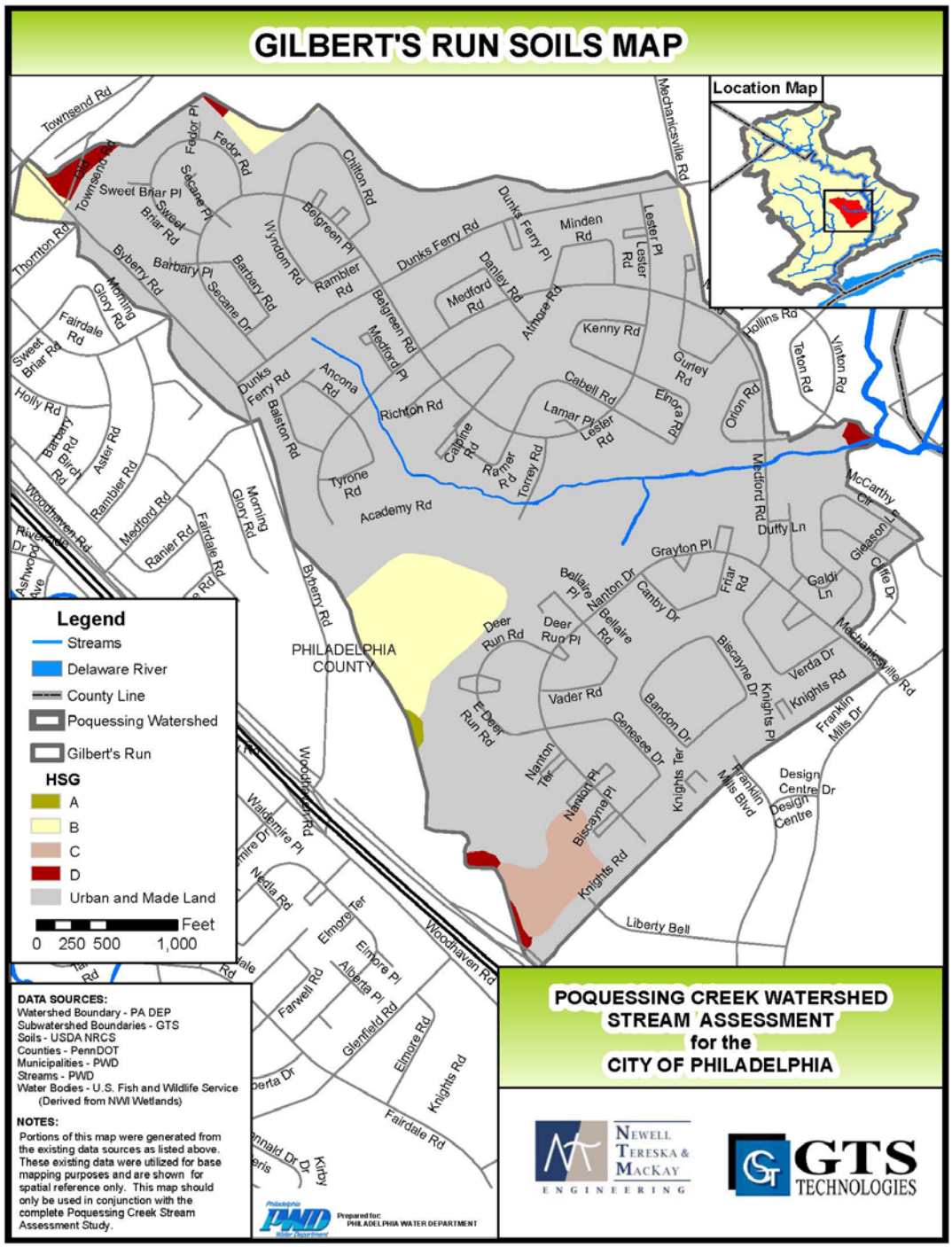


Table 3-72: Erosion Rates for Gilbert's Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQGR02	-2.756	-0.664	0.693	-0.481	-0.096	E
PQGR04	-0.492	0.030	-0.768	-0.081	-0.016	E
PQGR06	-2.909	-0.663	-2.222	-0.587	-0.117	E
PQGRA02	0.271	-0.032	-1.222	-0.055	-0.011	E
Average	-1.472	-0.332	-0.880	-0.301	-0.060	E

Table 3-73: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.11.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Gilbert's Run is a small tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Gilbert's Run begin at Dunks Ferry Road and flow South east through Parkwood Manor, a narrow wooded area surrounded mainly by residential with some commercial development before reaching the confluence with the Poquessing Creek. The majority of Gilbert's Run exhibits some of the impairments associated with urban streams given its location and proximity to dense residential and commercial development surrounding the stream channel. The majority of infrastructure was located in reach PQGR02 mainly in the form of outfalls with a culvert, 4 sewer grates, channel and a manhole present at this location. This reach is located at the headwaters of Gilbert's Run which is fed mainly through stormwater outfalls. There were 5 outfalls located at the upstream end of Gilbert's Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 2.5 to 4.0 feet in diameter. The number of headwater outfalls (Table 3-74) on this stream indicates that it is heavily influenced by stormwater discharges in the upstream-most segments of Gilbert's Run (Figure 3-5).

There were three culverts along Gilbert's Run that conveyed the stream under transportation corridors. Gilbert's Run passes under Medford Road (PQcul082), Torrey Road (PQcul083), and again crossing under Medford Road (PQcul084). All culverts are considered in good condition. An outfall at PQGR02 (PQout200) is considered to be in fair condition. At PQGR04, outfall PQout203 is considered in fair condition. A manhole (PQman040) at PQGR06 is considered to be in Poor condition and sits just upstream of Gilbert's Run's confluence with the Poquessing Creek.

The headwaters of Gilbert's Run Tributary A begin just north of the intersection of Academy Road and Nanton Drive and flow north through wooded area before reaching the confluence with Gilbert's Run. The majority of Gilbert's Run Unnamed Tributary A exhibits some of the impairments associated with urban streams given its location and proximity to dense residential and commercial development surrounding the stream channel. The stream channel is short, flowing less than 500 feet through a small wooded area in Parkwood Manor. The channel begins as a 6 ft. concrete pipe outfall (PQout206), in good condition. One manhole (3 feet exposed and cemented over) is located approximate 150 feet upstream of the confluence with Gilbert's Run and is considered to be in poor condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-74: Summary of Gilbert's Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQGR02	1	0	5	1	1	0	0	4	12
PQGR04	1	0	4	0	0	0	0	0	5
PQGR06	1	0	1	0	2	0	0	1	5
PQGRA02	0	0	1	0	1	0	0	0	2
TOTAL	3	0	11	1	4	0	0	5	24

3.1.11.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream section of Gilbert's Run stream channel is a second-order, single thread channel with one, short unnamed tributary. Gilbert's Run is a direct tributary to the mainstem of Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-54: Results for Gilbert's Run Watershed USAM Components

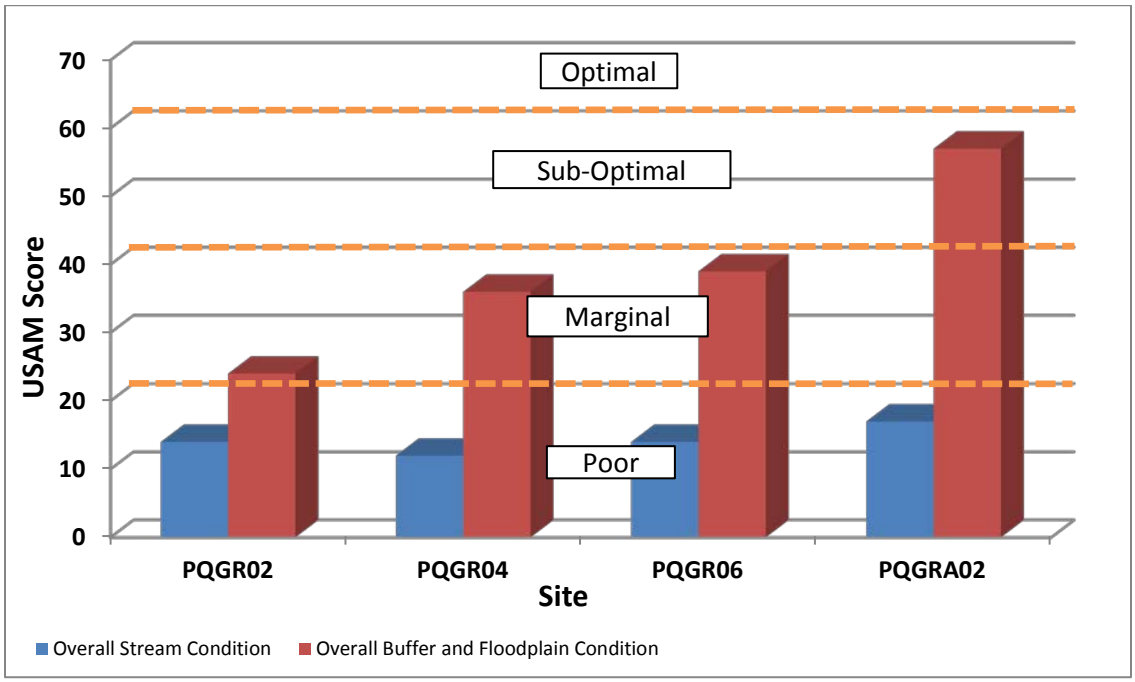
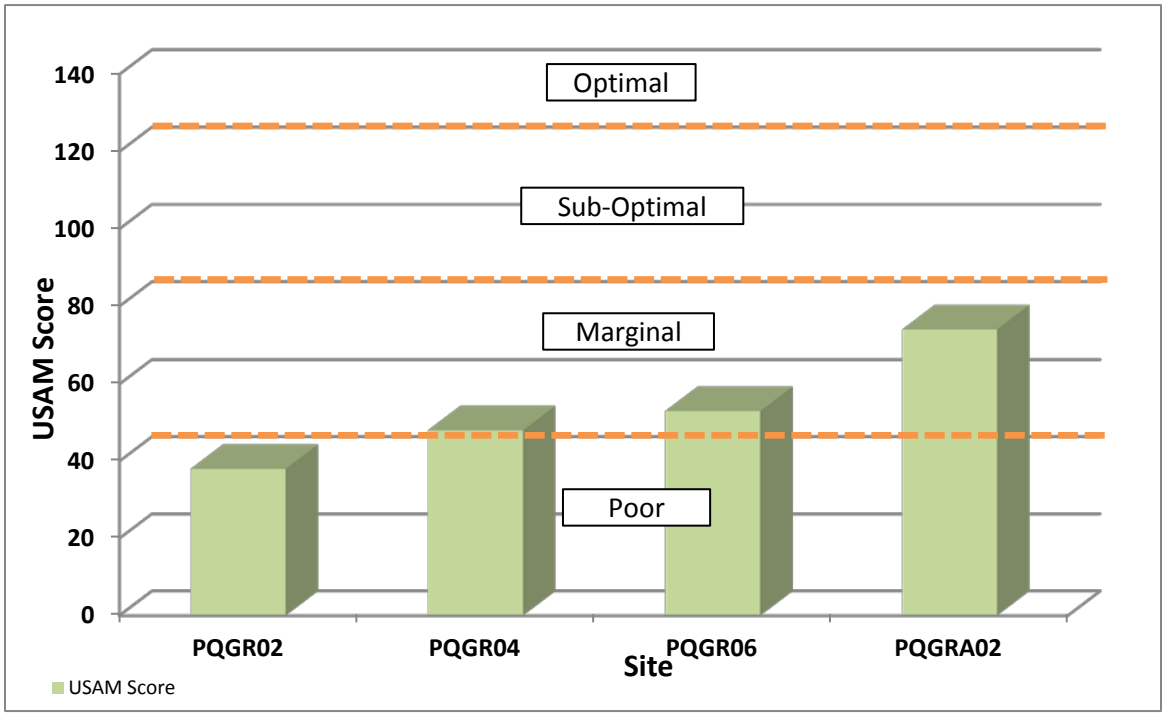


Figure 3-55: Gilbert's Run Watershed USAM Results



3.1.11.5.1 PQGR02

Reach PQGR02 is the first reach of Gilbert's Run. The headwaters of this tributary begin at a stormwater outfall near Dunks Ferry Road. This reach passes through a thin strip of parkland between two densely developed urban areas. Reach PQGR02 is characterized by a shallow slope (1.1%), moderate to high width to depth ratio (14.1), a highly entrenched channel (ER = 1.3), low sinuosity (1.11), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQGR02 was poor (38/160).

3.1.11.5.2 PQGR04

Reach PQGR04 begins approximately 600 feet upstream of cross section PQGR04. The upper portion of this reach runs through a thin strip of parkland in an urban area. The lower portion of the reach runs through a fairly wide parkland forest and field (Poquessing Valley Park). Reach PQGR04 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (19.0), a highly entrenched channel (ER = 1.1), low sinuosity (1.05), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQGR04 was marginal (48/160).

3.1.11.5.3 PQGR06

Reach PQGR06 begins approximately 600 feet upstream of cross section PQGR06. This reach runs through a wooded corridor between urban areas before joining the mainstream of Poquessing Creek. Reach PQGR06 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (19.2), a highly entrenched channel (ER = 1.2), low sinuosity (1.02), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQGR06 was marginal (53/160).

3.1.11.5.4 PQGRA02

Reach PQGRA02 is the entire length of Gilbert's Run, Unnamed Tributary A. The headwaters of this tributary begin at a stormwater outfall from a dense urban area. This reach runs through a wooded tract of parkland before joining Gilbert's Run. Reach PQGRA02 is characterized by a shallow slope (0.9%), high width to depth ratio (33.1), a highly entrenched channel (ER = 1.1), low sinuosity (1.04), and gravel substrate. The reach was classified as an F4 type stream. The composite USAM score for reach PQMSCA02 was marginal (74/160).

3.1.11.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean score for the Overall Stream Condition component for Gilbert's Run Watershed was classified as poor. The mean score for the Overall Buffer and Floodplain Condition was classified as marginal, as was the composite USAM score (Table 3-75). Average conditions within the Gilbert's Run Watershed's stream channels were considerably worse than conditions observed within the buffers and floodplains. The watershed averages for the Overall Stream Condition component as well as the composite USAM were much lower than the respective All Reaches averages, however the Overall Buffer and Floodplain component scored slightly higher than the All Reaches average. The scores for individual parameters were mostly in the poor and marginal categories with a few suboptimal and one optimal rating in the Overall Buffer and Floodplain Condition category. Graphs of each USAM category rating are in Appendix D.

Table 3-75: USAM Results for Gilbert's Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQGR02	Gilbert's Run	14	24	38
PQGR04	Gilbert's Run	12	36	48
PQGR06	Gilbert's Run	14	39	53
PQGRA02	Gilbert's Run	17	57	74
PQGR Mean		14.2	39.0	53.2
All Reaches Average		37.1	37.4	74.4

3.1.11.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE GILBERT'S RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were entirely poor to marginal as some parameters were ranked among the lowest scores recorded for the Poquessing Creek tributaries. The stream channels were extremely overwidened and baseflow was minimal which resulted in extremely shallow baseflow. The stream channels were also extremely eroded and entrenched resulting in little vegetative protection.

Table 3-76: USAM Overall Stream Condition Scoring for Gilbert's Run Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	Right	Left	Right		
PQGR02	Gilbert's Run	2	3	2	2	2	3	14
PQGR04	Gilbert's Run	1	2	2	3	3	1	12
PQGR06	Gilbert's Run	2	2	3	2	3	2	14
PQGRA02	Gilbert's Run	2	4	3	4	3	1	17
PQGR Mean		1.7	2.7	2.5	2.7	2.7	1.7	14.2
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.11.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter for the four reaches analyzed in the Gilbert's Run Watershed all were classified as poor. A rating of poor indicates less than 20% stable habitat with unstable or lacking substrate. The Gilbert's Run Watershed mean (1.7/20) was much lower than the All Reaches average (8.2/20). Stream channels had minimal baseflow and were sediment choked.

3.1.11.6.1.2 VEGETATIVE PROTECTION

Both banks of all four reaches analyzed for the Gilbert's Run Watershed scored only poor to marginal ratings. Reach PQGR02 had a marginal left bank and a poor right bank. Reach PQGR04 had poor left and right banks and reach PQGRA02 had marginal left and right banks. Reach PQGR06 had a poor left bank and a marginal right bank. The All Reaches averages for both banks were higher than the Gilbert's Run Watershed (2.7/10 vs. 4.0/10.0, LB and 2.5/10 vs. 3.9/10.0, RB). The poor scores for this parameter are attributed to the sparse vegetation along the stream banks as a result of vertical eroded banks. Invasives were also prevalent along the Gilbert's Run channel.

3.1.11.6.1.3 BANK EROSION

One reach analyzed for Gilbert's Run Watershed scored poor for both banks (PQGR02) and two reaches scored marginal for both banks (PQGR04 and PQGRA02). Reach PQGR06 scored poor for the left bank

and marginal for the right bank. A poor rating is indicative of active downcutting and erosion at a fast rate with significant sediment contribution to the stream. A rating of marginal indicates active stream widening and erosion at a moderate rate with past downcutting evident and active stream widening occurring. The mean watershed scores for the left and right banks were both 2.7/10, or marginal. The All Reaches average was slightly higher for both the left and right banks, 3.9/10 and 4.0/10 respectively, also considered marginal. Bank erosion was prevalent throughout the channel which is indicative of a flashy flow regime.

3.1.11.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for all four of the reaches analyzed within the Gilbert's Run Watershed were rated as poor, indicating deep entrenchment and high flows not making it into the floodplain. The mean for the Gilbert's Run Watershed was much lower than for all reaches with a score of 1.7/20.0 as compared to 13.0/20.0, giving this watershed an overall poor rating. The stream channel was extremely overwidened and entrenched. The channel was also very large for the relatively small upstream drainage area.

3.1.11.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE GILBERT'S RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to optimal, with most scoring in the marginal to suboptimal range, an improvement from the Overall Stream Condition parameters. The mean component score for the Gilbert's Run Watershed (39.0/80.0) was slightly greater than the All Reaches average (37.4/80). The improved function of the floodplains in this watershed can be attributed to a number of factors, wide wooded buffers that exist in the mid and lower portions of the watershed. The channel is surrounded by parkland in these areas.

Table 3-77: USAM Buffer and Floodplain Condition Scoring for Gilbert's Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQGR02	Gilbert's Run	6	2	7	3	6	24
PQGR04	Gilbert's Run	4	6	7	7	12	36
PQGR06	Gilbert's Run	3	7	10	8	11	39
PQGRA02	Gilbert's Run	9	9	15	10	14	57
PQGR Mean		5.5	6.0	9.7	7.0	10.7	39.0
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.11.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left and right vegetated buffers for all four reaches analyzed ranged from poor to optimal. Reach PQGR02 had a suboptimal left bank and a poor right bank vegetated width. Reaches PQGR04 and PQGR06 had marginal left banks and suboptimal right banks. Reach PQGRA02 had optimal left and right banks. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity. A poor rating reflects a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. The mean watershed score of 5.3/10.0 for the left bank was the same as for the all reaches average. The mean watershed score for the right bank was also the same (6.0/10.0) as the all reaches average for right banks.

3.1.11.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type for three of the reaches analyzed for the Gilbert's Run Watershed (PQGR02, PQGR04, and PQGR06) was shrub, with marginal scores of 7.0/20.0, 7.0/20.0, and 10.0/20/0, respectively. Reach PQGRA02 had a score of 15.0/20.0 which is classified as suboptimal, or a dominant vegetation type of young forest. The mean Gilbert's Run Watershed score was the same as the All Reaches average (9.7/20) which is classified as "marginal."

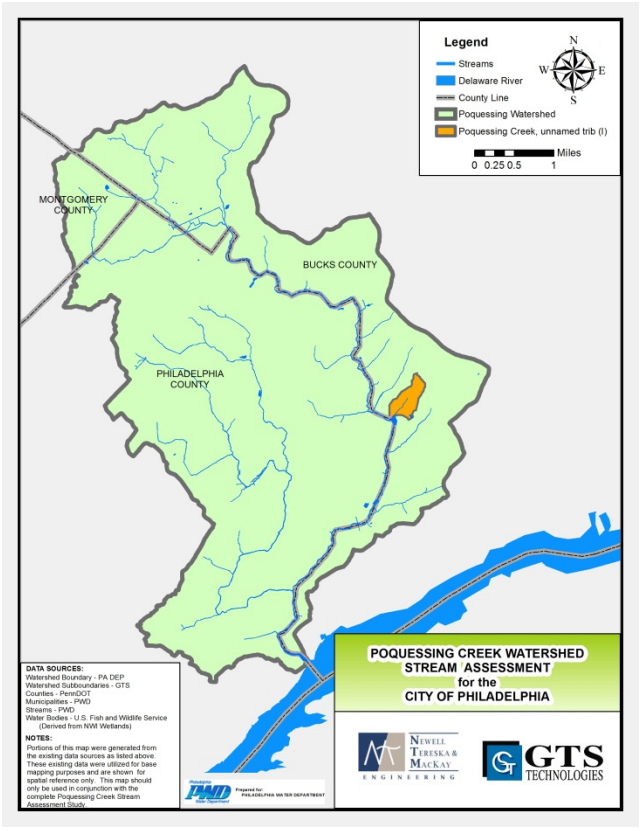
3.1.11.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was limited throughout the Gilbert's Run Watershed. One of the primary causes of habitat limitation was the extent of channel entrenchment observed throughout the watershed. Reach PQGR02 had a score of 3.0/20.0, classified as poor. A poor rating indicates either all wetland or non-wetland habitat with no evidence of standing or ponded water. Reaches PQGR04, PQGR06, and PQGRA02 all were rated as marginal with scores of 7.0/20.0, 8.0/20.0, and 10.0/20.0, respectively. A marginal classification is characterized by all wetland or non-wetland habitat, with evidence of ponding or standing water. The mean watershed score for this parameter (7.0/20) was slightly lower than the All Reaches average scoring (8.3/20); however both are classified as marginal.

3.1.11.6.2.4 FLOODPLAIN ENCROACHMENT

Three reaches (PQGR04, PQGR06, and PQGRA02) were classified as suboptimal, reflecting minor floodplain encroachment without affecting floodplain function. Reach PQGR02 was rated marginal, with a score of 6/20, indicating moderate floodplain encroachment in the form of filling, land development, or manmade structures with resulting effect on floodplain function. The mean score for the watershed was (10.7/20) which was slightly higher than the All Reaches average score of (8.2/20), giving the Gilbert's Run Watershed an overall rating of marginal.

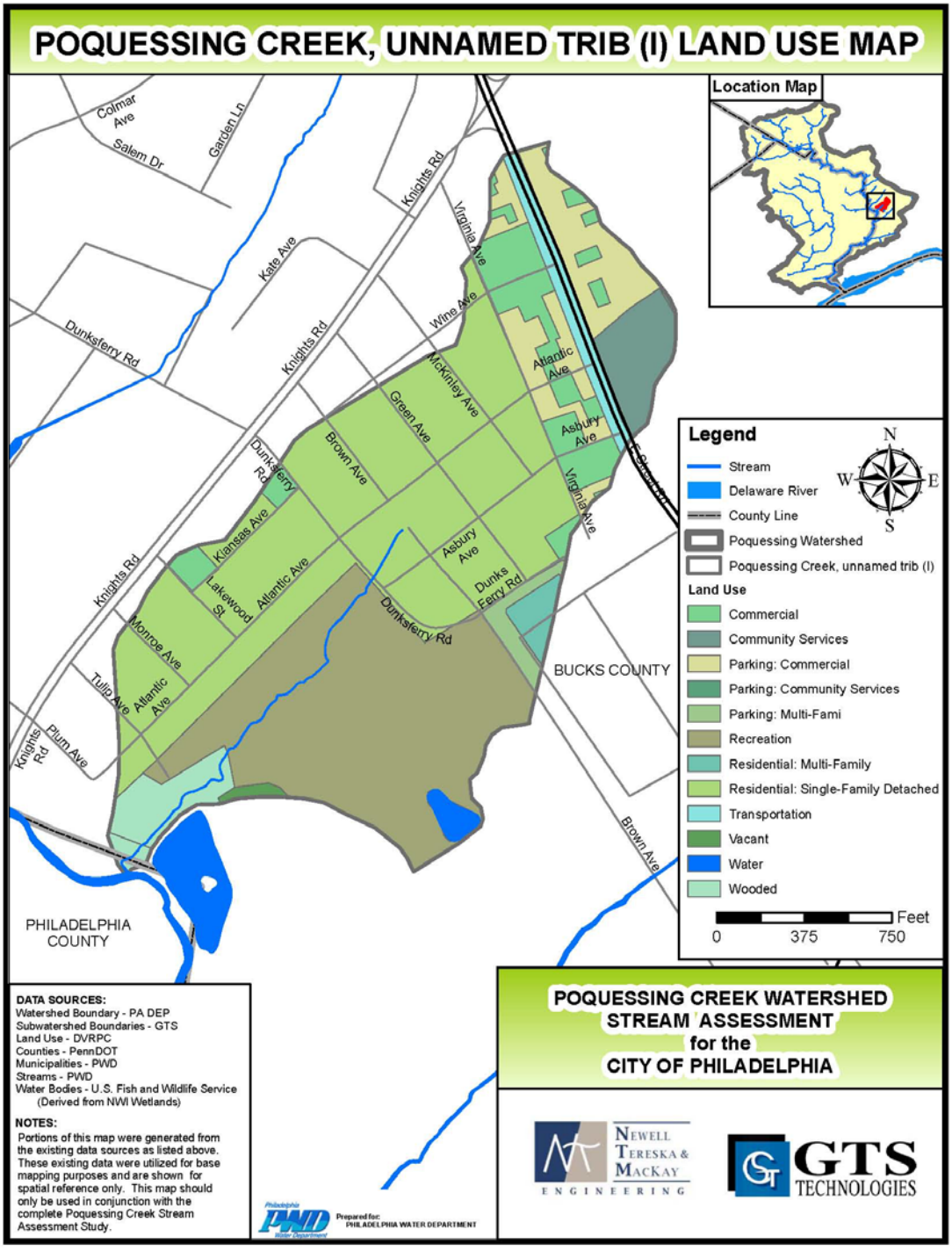
3.1.12 POQUESSING CREEK UNNAMED TRIBUTARY I WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary I is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary I originates from a privately-owned stormwater outfall. Poquessing Creek Unnamed Tributary I is a first-order tributary that flows for approximately 1,700 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary I Watershed is 85 acres. Major land use types within the watershed include: residential: single family detached (43%) and recreation (28%). Poquessing Creek Unnamed Tributary I is surrounded by wooded land downstream of Dunks Ferry Road. The wooded buffer ranges from about 20 feet to about 200 feet wide.

Figure 3-56: Poquessing Creek, Unnamed Tributary I Watershed Land Use



3.1.12.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary I Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

A large portion of the Poquessing Creek Unnamed Tributary I Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand. The Bryn Mawr Formation is considered a deeply weathered formation.

3.1.12.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Poquessing Creek Unnamed Tributary I Watershed are classified as hydrologic group B (30%), hydrologic group D (2%), and Urban (68%). The majority of soils fall into the urban classification. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-78: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary I Watershed

Group	Area (acres)	Percent of Total Area
B	25.6	30%
D	1.4	2%
Urban	58.0	68%
Water	0.001	0.001%
Total Area	85.0	100%

Figure 3-57: Geology of Poquessing Creek, Unnamed Tributary I Watershed

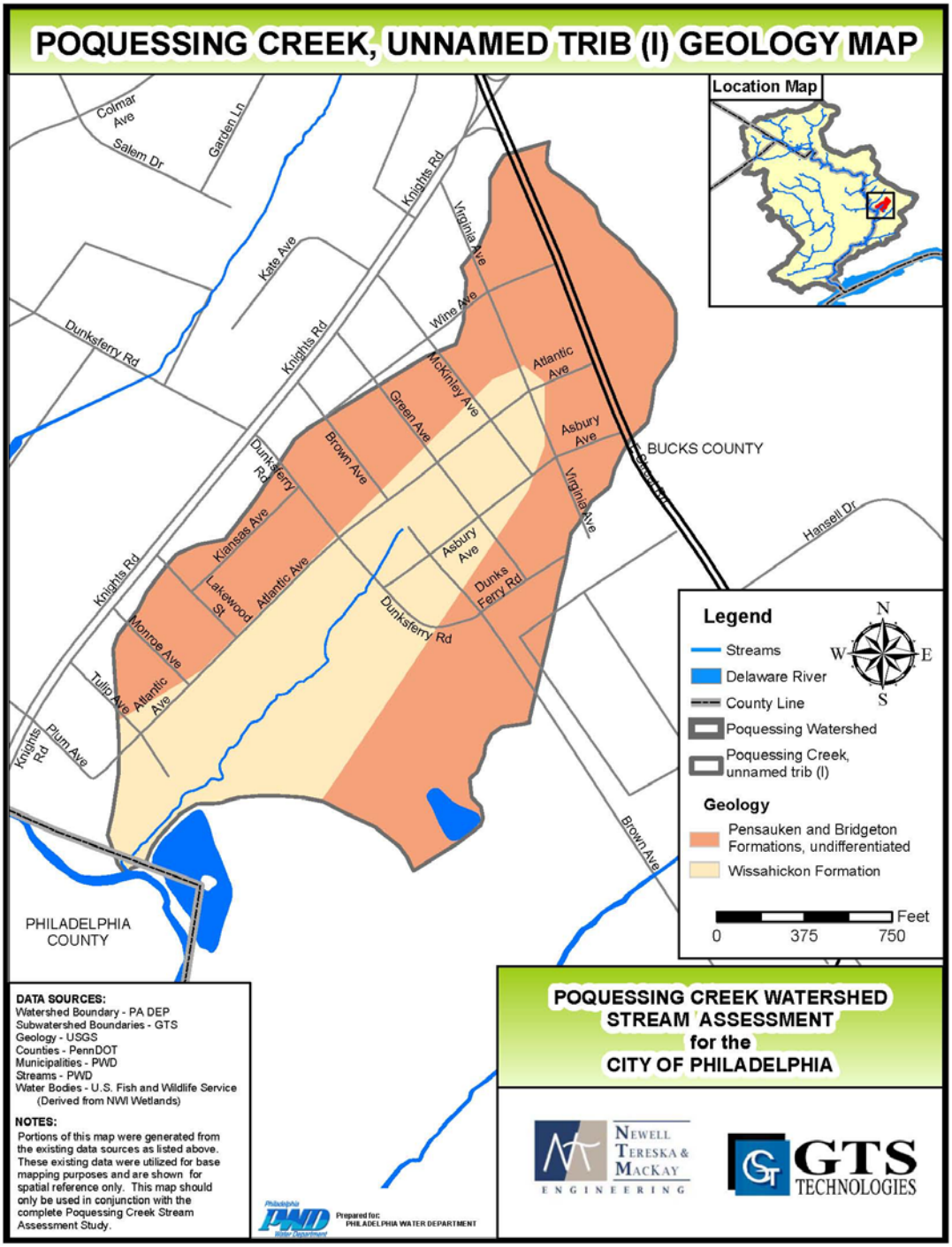
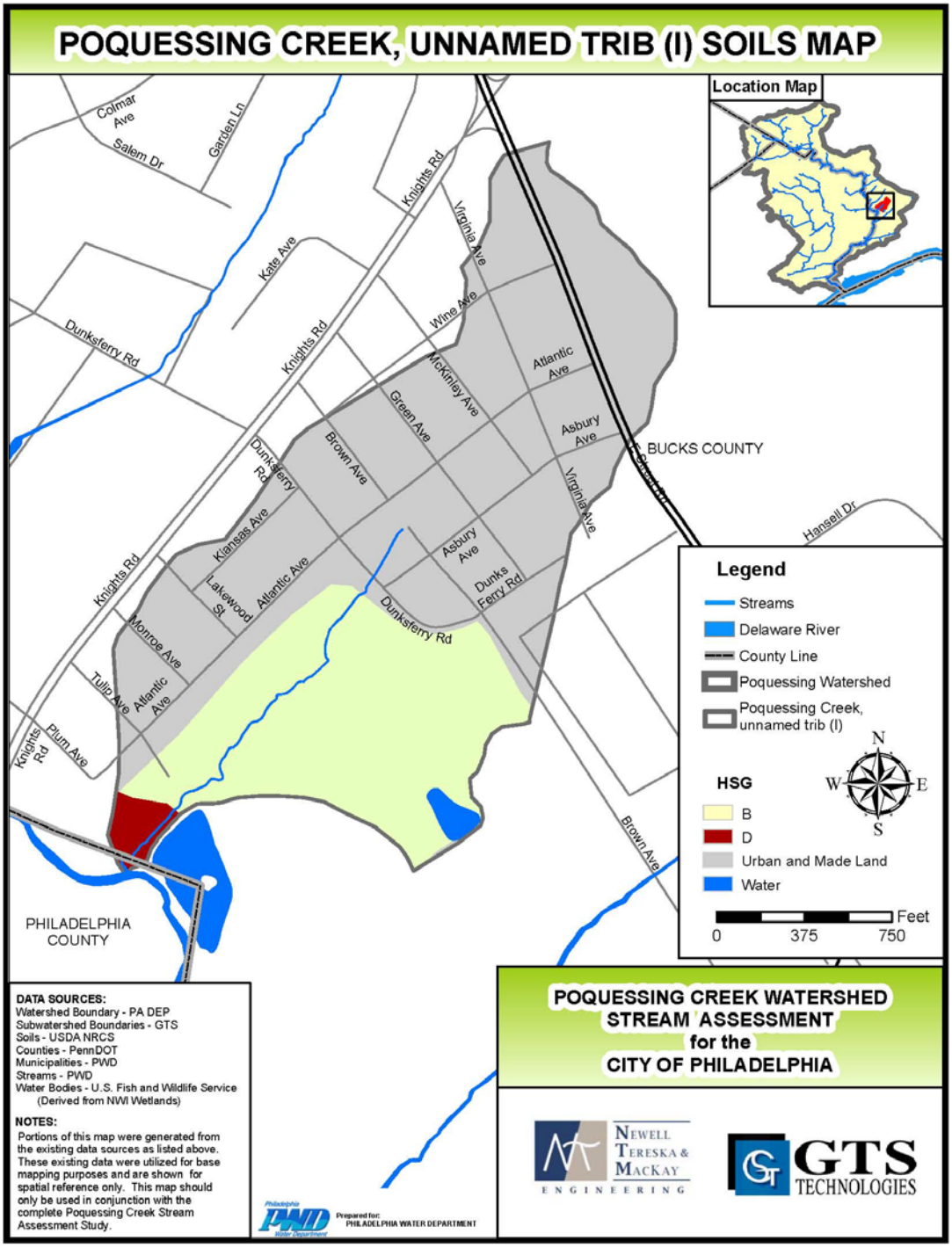


Figure 3-58: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary I Watershed



3.1.12.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Poquessing Creek, Unnamed Tributary I (Table 3-79). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Poquessing Creek, Unnamed Tributary I was nearly twice the average for all Poquessing Creek subwatersheds (Table 3-80). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-79: Erosion Rates for Poquessing Creek, Unnamed Tributary I

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSI02	-2.460	-0.458	-0.531	-0.429	-0.086	E

Table 3-80: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary(K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.12.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary I is a tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary I originates from a stormwater outfall draining a residential area. Downstream of Dunks Ferry Road and down to the confluence, the land use patterns become recreational as the reach flows through the Bensalem Township Country Club before reaching the confluence with Poquessing Creek. There is little infrastructure along this reach. All infrastructure elements are described as being in good condition. Three culverts are located along the reach. Culvert PQcul088 is a 34-foot long by 5-foot high by 7-foot wide concrete culvert that conveys flow under Dunks Ferry Road and is described as being in fair condition. Just downstream of Dunks Ferry Road is the Bensalem Township Country Club. All infrastructure elements occurring on this property are in good or fair condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-81: Summary of Poquessing Creek Unnamed Tributary I Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSI02	3	3	2	0	0	0	0	1	9

3.1.12.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary I stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-59: Results for Poquessing Creek, Unnamed Tributary I Watershed USAM Components

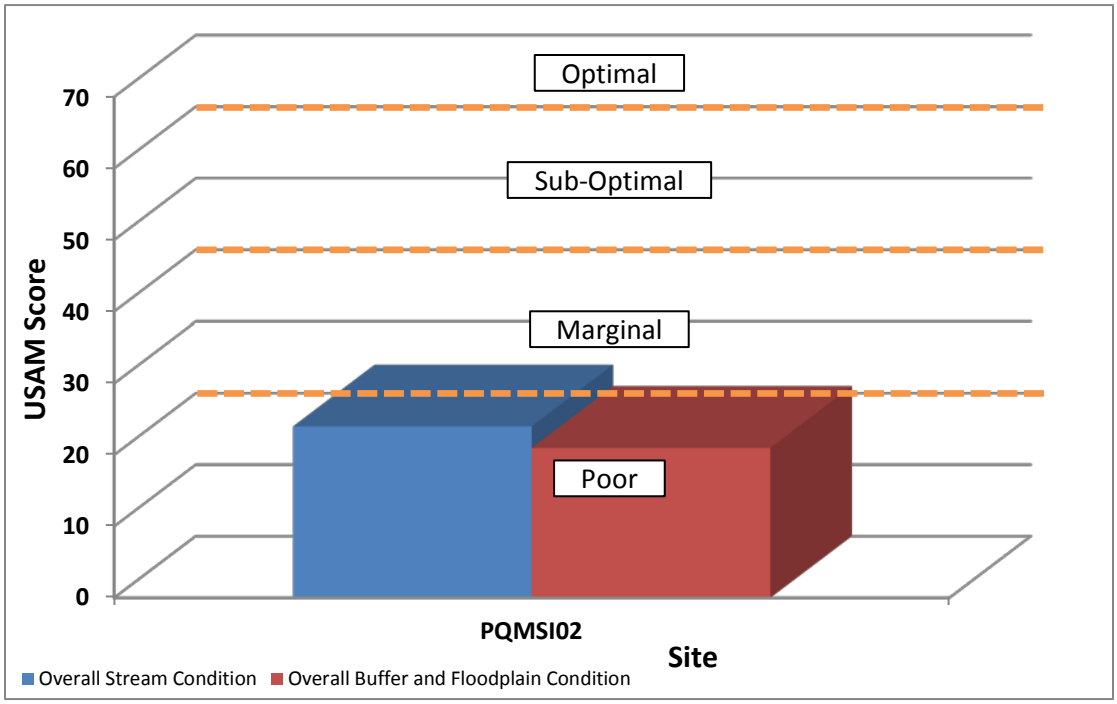
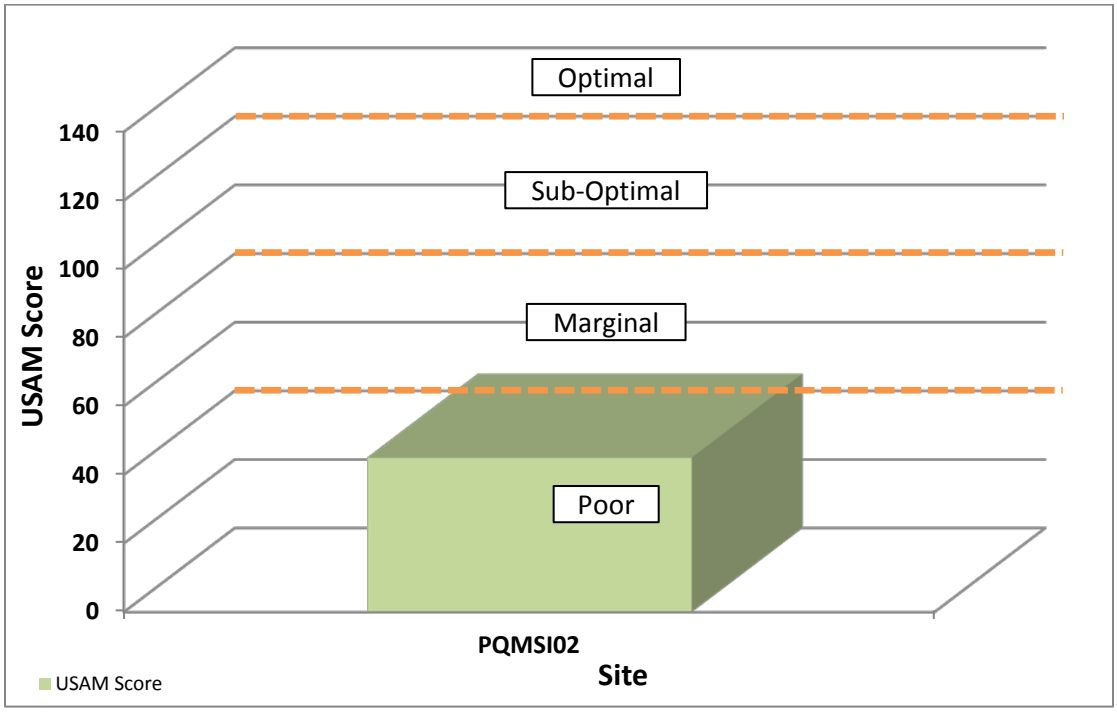


Figure 3-60: Poquessing Creek, Unnamed Tributary I Watershed USAM Results



3.1.12.5.1 PQMSI02

Reach PQMSI02 is the entire length of Poquessing Creek, Unnamed Tributary I. The headwaters of this tributary begin at a stormwater outfall in a residential area near Dunksferry Road. However, the majority of this reach runs through the Bensalem Country Club Golf Course before reaching the mainstream of Poquessing Creek. Reach PQMSI02 is characterized by a shallow slope (1.4%), moderate width to depth ratio (13.9), a moderately entrenched channel (ER = 1.6), low sinuosity (1.07), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSI02 was marginal (45/160).

3.1.12.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach was analyzed for Poquessing Creek, Unnamed Tributary I: PQMSI02. The scores for the Overall Stream Condition components, Overall Buffer and Floodplain Conditions and the composite USAM score were rated as marginal (Table 3-82). Average conditions within the Poquessing Creek, Unnamed Tributary I Watershed's stream channels were slightly better than the conditions observed within the buffers and floodplains. The Small Tributary averages for the Overall Stream Condition, Overall Buffer and Floodplain Condition and USAM Score components were higher than those scores for reach PQMSI02. The scores for individual parameters ranged from poor to marginal. Graphs of each USAM category rating are in Appendix D.

Table 3-82: USAM Results for Poquessing Creek, Unnamed Tributary I Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSI02	PQ, Unnamed Tributary I	24	21	45
Small Tributary Average		30.6	33.1	63.8

3.1.12.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY I WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were all rated as marginal. The Small Tributary average score (30.6/80.0) was rated as marginal, slightly higher than the rating for the unnamed tributary (24.0/80.0), also considered marginal.

Table 3-83: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary I Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	Right	Left	Right		
PQMSI02	PQ, Unnamed Tributary I	6	3	3	3	3	6	24
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.1.12.6.1.1 INSTREAM HABITAT

The score for the Instream Habitat parameter for Poquessing Creek, Unnamed Tributary I Watershed was marginal (6.0/2.0), reflecting 20-40% stable habitat but with an availability that is less than desired and a disturbed substrate. The Small Tributary average was rated slightly lower at 5.6/20.0, receiving a rating of poor.

3.1.12.6.1.2 VEGETATIVE PROTECTION

Both banks of reach PQMSI02 had marginal (3.0/10.0) vegetative protection which indicates 50-70% of the streambanks are covered by vegetation and the area has obvious disruption such as bare soil patches or closely cropped vegetation. The Small Tributary average was also rated marginal (4.0/10.0) for both the left and right banks. The marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks. Invasive plants are also prevalent along the stream channel.

3.1.12.6.1.3 BANK EROSION

Reach PQMSI02 had a marginal rating for the left and right banks (3.0/10.0), reflecting active stream widening and erosion at a moderate rate with no threat to property or infrastructure. The Small Tributary averages for the left and right banks were also rated as marginal (4.0/10.0 and 4.3/10.0, respectively).

3.1.12.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary I Watershed was marginal with reach PQMSI02 receiving a rating of 6.0/20.0. A marginal rating indicates that high flows are not able to enter the floodplain and that the stream is deeply entrenched. The Small Tributary average was slightly higher than that for PQMSI02, with a rating of 8.8/20.0, also considered marginal.

3.1.12.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY H WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to marginal. The Overall Buffer and Floodplain Condition score for PQMSI02 (21.0/80.0, marginal) was lower than that for the Small Tributary average (33.1/80.0, also

marginal). The impaired function of the floodplains in this watershed can be attributed to the lack of wooded buffers along the channel as the Bensalem Township Country Club Golf course makes up the majority of the buffer and floodplain area.

Table 3-84: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary I Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSI02	PQ, Unnamed Tributary I	3	3	4	3	8	21
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.1.12.6.2.1 VEGETATED BUFFER WIDTH

The width of both banks of reach PQMSI02 were rated as marginal (3.0/10.0). A marginal rating indicates a buffer zone of 10-25 feet with significant human impact while an optimal rating reflects a buffer greater than 50 feet in width with little to no human activity impact. The Small Tributary average was also rated as marginal for both the left and right banks (4.3/10.0 and 4.5/10.0, respectively).

3.1.12.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in reach PQMSI02 was turf or cropland, with a poor score of 4.0/20.0. The Small Tributary average rating was marginal (9.1/20.0), reflecting a predominant vegetation type of shrub.

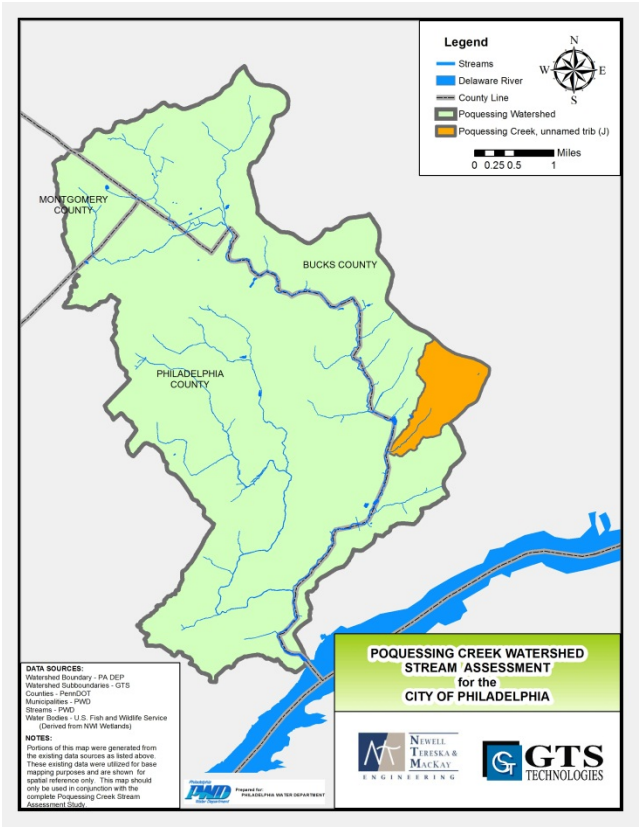
3.1.12.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was rated poor (3.0/20.0) for the reach PQMSI02, indicating either all wetland and non-wetland habitat but no evidence of standing or ponded water. The Small Tributary average was rated as marginal (6.5/20) reflecting a habitat of all wetland or non-wetland and some evidence of standing or ponded water.

3.1.12.6.2.4 FLOODPLAIN ENCROACHMENT

The floodplain encroachment score for reach PQMSI02 was marginal (8.0/20.0) showing moderate floodplain encroachment with some effect on floodplain function. The Small Tributary average was rated as marginal (8.8/20), reflecting only moderate floodplain encroachment and some effect on floodplain function.

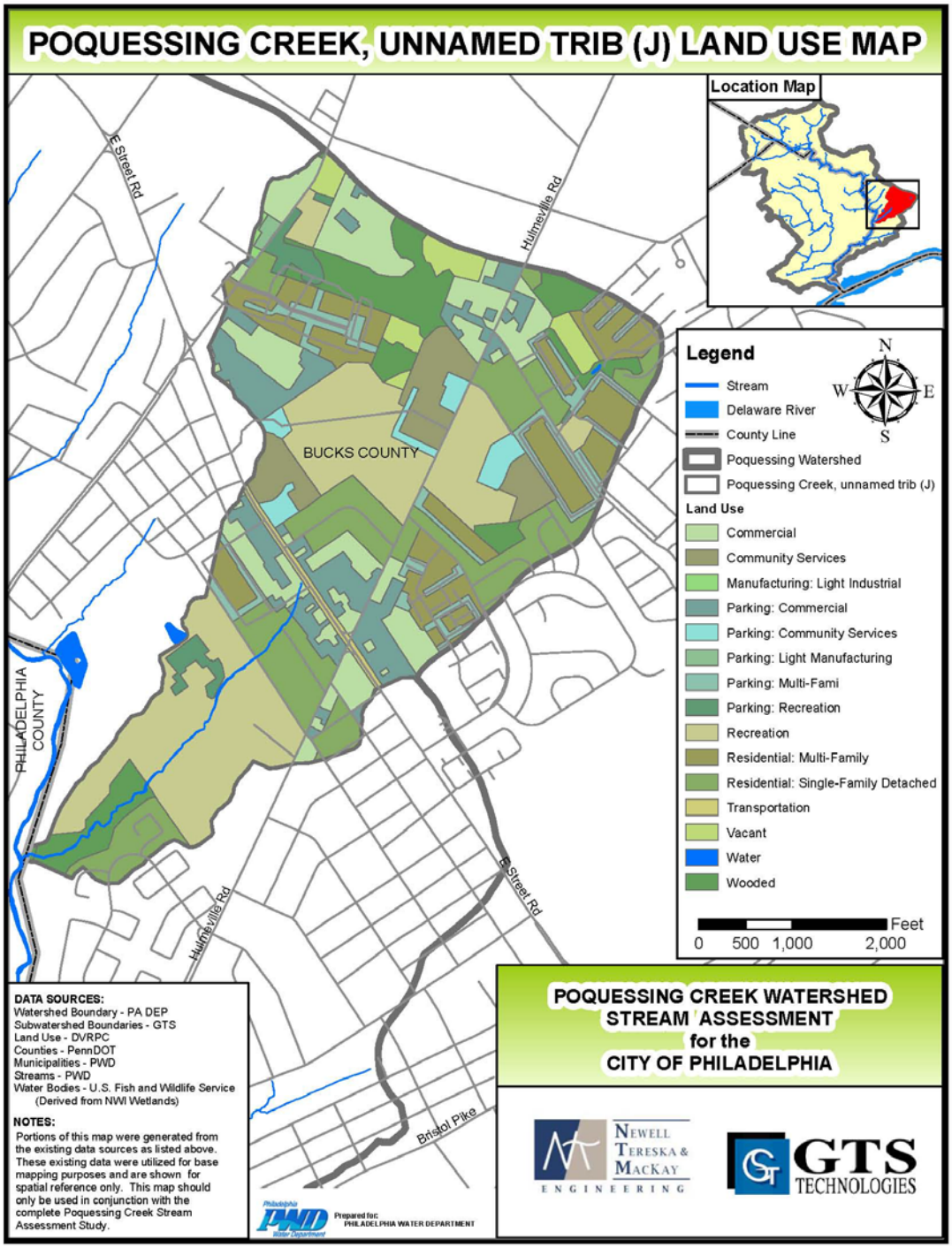
3.1.13 POQUESSING CREEK UNNAMED TRIBUTARY J WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary J is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary J originates from a privately-owned stormwater outfall. Unnamed Tributary J flows for approximately 3,900 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate varies from gravel to silt and clay material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary J Watershed is 520 acres. Major land use types within the watershed include: recreation (24%), residential: single family detached (16%) and commercial (13%). Most of Poquessing Creek Unnamed Tributary J is surrounded by wooded land on both sides. The wooded buffer ranges from about 300 feet to about 1,000 feet wide.

Figure 3-61: Poquessing Creek Unnamed Tributary J Watershed Land Use



3.1.13.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary J Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary J Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.13.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of Poquessing Creek Unnamed Tributary J Watershed are classified as urban soils. Soils classified as urban soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-85: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary J Watershed

Group	Area (acres)	Percent of Total Area
B	56.8	11%
C	42.2	8%
C/D	16.5	3%
D	29.7	6%
Urban	375.4	72%
Total Area	520.5	100%

3.1.13.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for three reaches in Poquessing Creek, Unnamed Tributary J Watershed (Table 3-86). All three reaches were found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for all reaches in the Poquessing Creek, Unnamed Tributary J Watershed was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-87). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-62: Geology of Poquessing Creek, Unnamed Tributary J Watershed

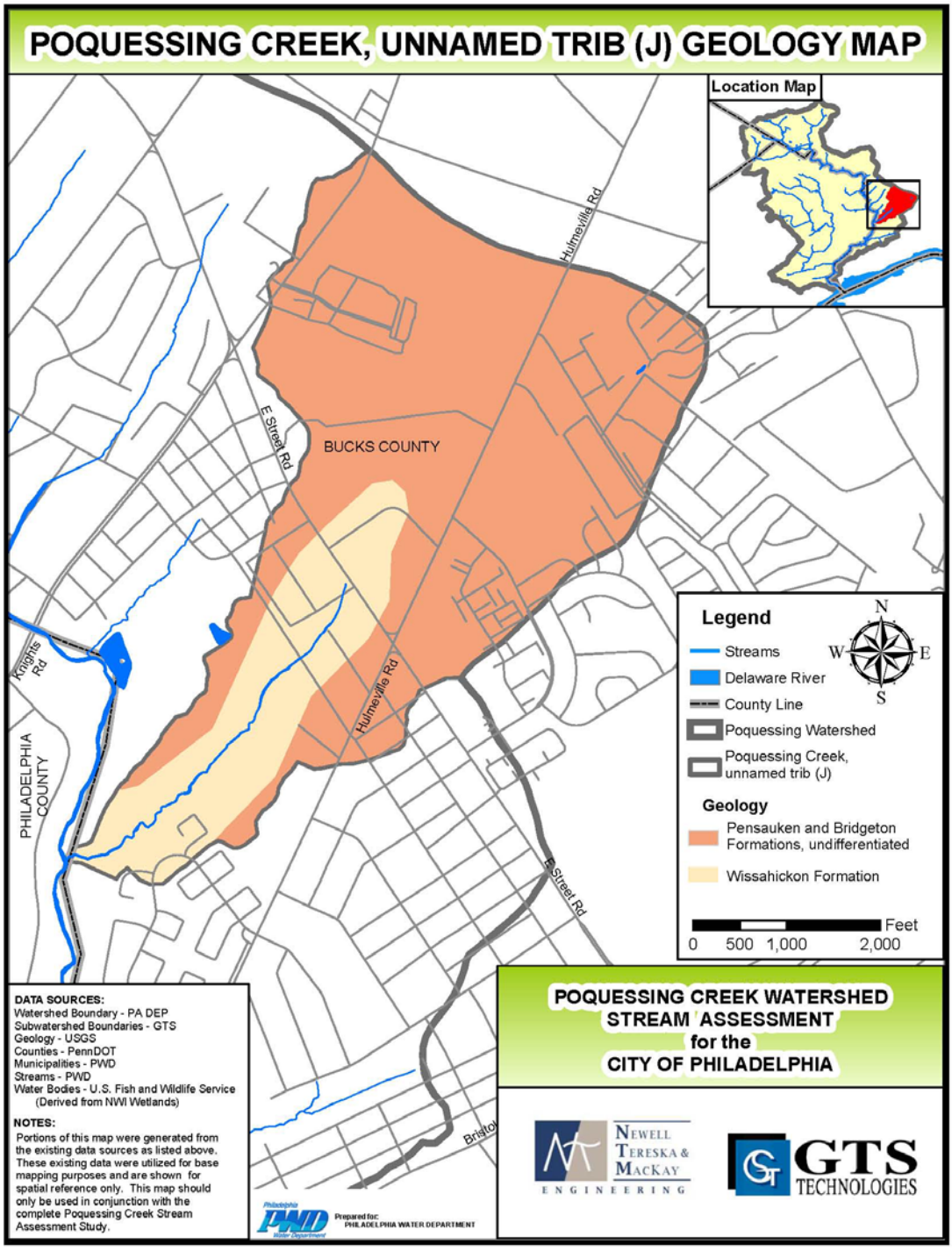


Figure 3-63: Distribution of NRCS Soil Types in Poquessing Creek, Unnamed Tributary J Watershed

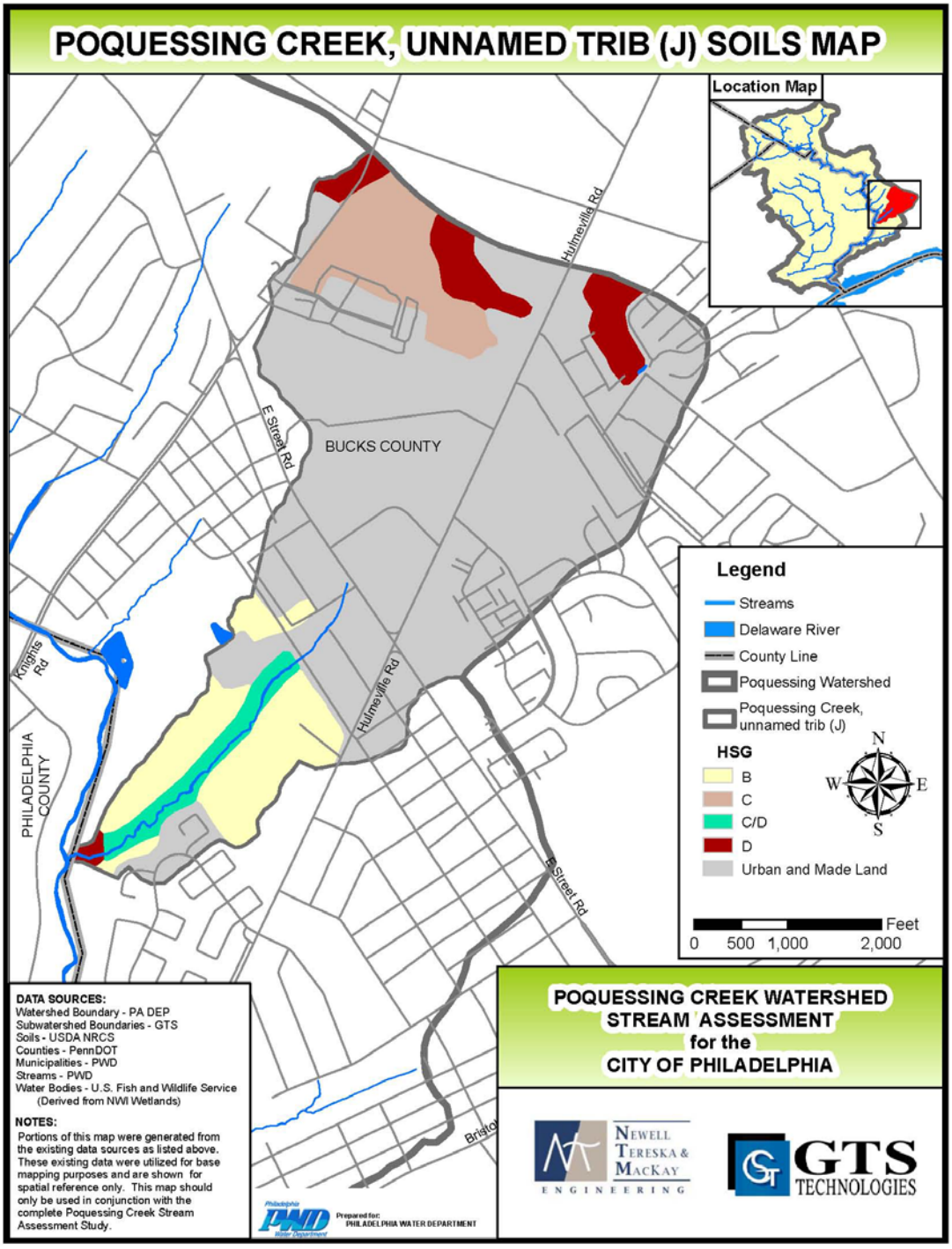


Table 3-86: Erosion Rates for Poquessing Creek Unnamed Tributary J Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSJ02	0.416	-0.160	-1.039	-0.129	-0.026	E
PQMSJ04	0.432	0.205	-2.826	-0.097	-0.019	E
PQMSJ06	-0.703	0.408	-7.213	-0.310	-0.062	E
PQMSJ08	-0.500	-0.253	-0.928	-0.264	-0.053	E
Average	-0.089	0.050	-3.002	-0.200	-0.040	E

Table 3-87: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.13.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary J is a tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary J occur as stormwater drainage from surrounding dense residential and commercial development. The majority of infrastructure was located consistently along the upstream portion of Poquessing Creek Unnamed Tributary J. There is no infrastructure located in the downstream portion of the reach from the confluence to approximately 1,100 feet upstream of the confluence. The reach flows through the Bensalem Township Country Club and most of the infrastructure along this reach is on the golf club property or just upstream at the Brown Avenue crossing. All infrastructure is indicated as being in good or fair condition. Four outfalls exist along the reach just upstream of the country club. The outfalls range in size from 1 foot to 1.5 feet in diameter and drain stormwater from the surrounding residential and commercial development. Culvert PQcul091 is a 48-foot long by 5-foot high by 6-foot wide concrete box culvert which conveys flow under Brown Avenue before flowing through the country club property. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the locations of infrastructure can be found in Appendix C.

Table 3-88: Summary of Poquessing Creek Unnamed Tributary J Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSJ02	1	1	3	2	0	0	0	0	7
PQMSJ04	3	2	1	0	1	0	2	0	9
PQMSJ06	1	0	0	0	1	0	0	0	2
TOTAL	5	3	4	2	2	0	2	0	18

3.1.13.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary J stream channel is a first-order, single thread channel. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-64: Results for Poquessing Creek, Unnamed Tributary J Watershed USAM Components

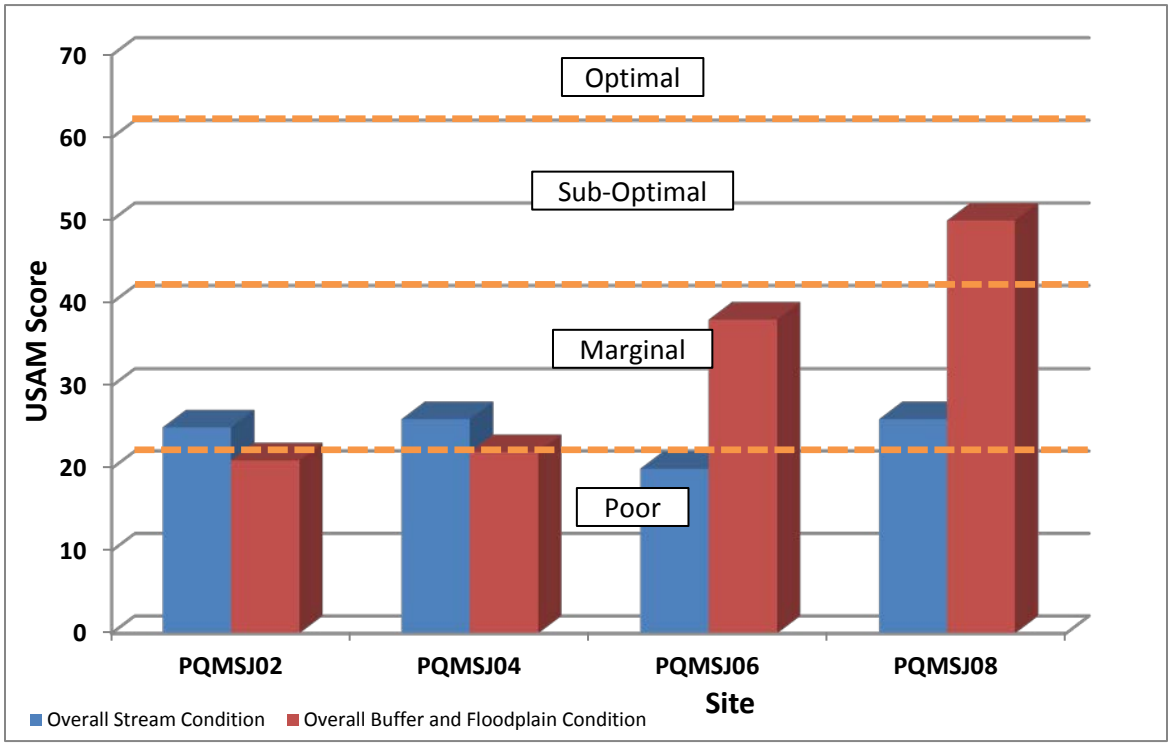
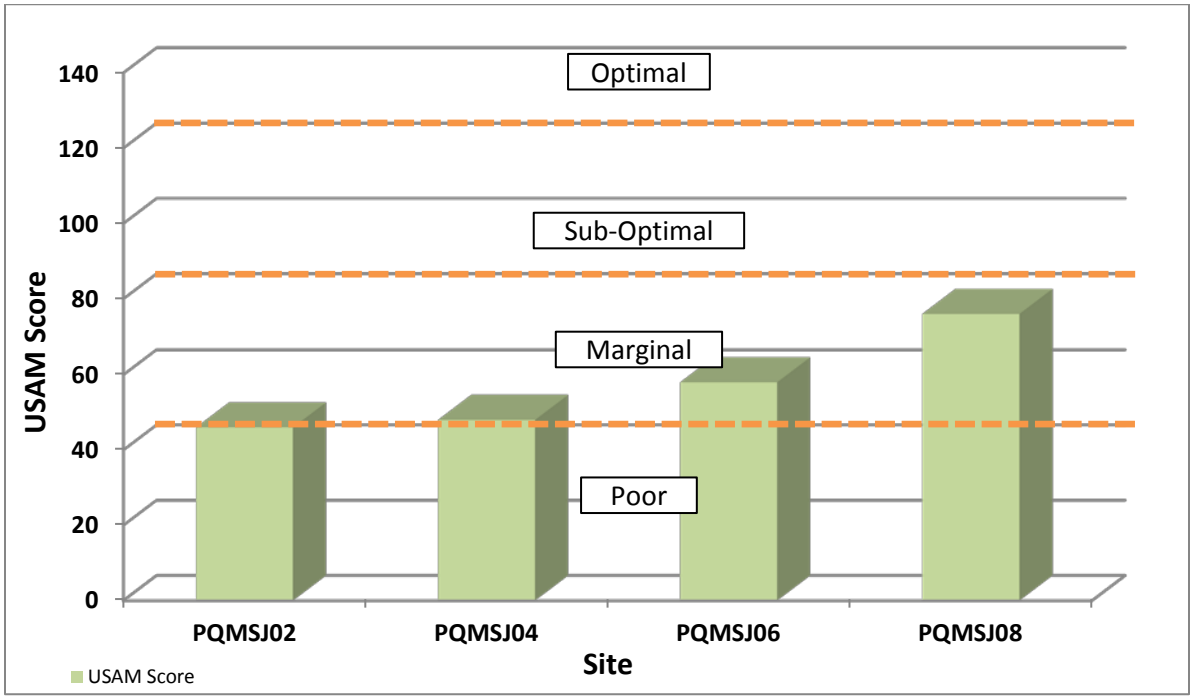


Figure 3-65: Poquessing Creek, Unnamed Tributary J Watershed USAM Results



3.1.13.5.1 PQMSJ02

Reach PQMSJ02 is the first reach of Poquessing Creek, Unnamed Tributary J. The headwaters of this tributary begin at a stormwater outfall near East Street Road. This reach then travels through a commercial and residential area before in enters the Bensalem Township Country Club. Reach PQMSJ02 is characterized by a shallow slope (0.9%), low width to depth ratio (10.7), a moderately entrenched channel (ER = 1.9), low sinuosity (1.05), and silt/clay substrate. The reach was classified as a B6c type stream. The composite USAM score for reach PQMSJ02 was marginal (46/160).

3.1.13.5.2 PQMSJ04

Reach PQMSJ04 begins approximately 600 feet upstream of cross section PQMSJ04. This reach runs entirely through the Bensalem Township Country Club. Reach PQMSJ04 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (15.1), a moderately entrenched channel (ER = 1.7), low sinuosity (1.07), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSJ04 was marginal (48/160).

3.1.13.5.3 PQMSJ06

Reach PQMSJ06 begins approximately 600 feet upstream of cross section PQMSJ06. The upper portion of this reach runs through the Bensalem Township Country Club and the lower portion runs through a wooded corridor between the Country Club and a residential area. Reach PQMSJ06 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (19.6), a highly entrenched channel (ER = 1.3), low sinuosity (1.07), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSJ06 was marginal (58/160).

3.1.13.5.4 PQMSJ08

Reach PQMSJ08 begins approximately 500 feet upstream of cross section PQMSJ08. The upper portion runs through a wooded corridor between the Country Club and a residential area and the lower half through a wooded floodplain prior to entering the mainstream of Poquessing Creek. Reach PQMSJ08 is characterized by a shallow slope (0.6%), moderate to high width to depth ratio (15.0), a highly entrenched channel (ER = 1.3), moderate sinuosity (1.2), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQMSJ08 was suboptimal (76/160).

3.1.13.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

A total of four reaches were analyzed for the Poquessing Creek, Unnamed Tributary J Watershed. The mean scores for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM score were classified as marginal (Table 3-89). The watershed averages for the Overall Stream Condition components as well Overall Buffer and Floodplain and composite USAM were lower than the respective All Reaches averages. The scores for individual parameters ranged from

poor to suboptimal, with most being in the marginal range. Graphs of each USAM category rating are in Appendix D.

Table 3-89: USAM Results for Poquessing Creek, Unnamed Tributary J Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSJ02	PQ, Unnamed Tributary J	25	21	46
PQMSJ04	PQ, Unnamed Tributary J	26	22	48
PQMSJ06	PQ, Unnamed Tributary J	20	38	58
PQMSJ08	PQ, Unnamed Tributary J	26	50	76
PQMSJ Mean		24.3	32.8	57.0
All Reaches Average		37.1	37.4	74.4

3.1.13.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY J WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were generally poor to marginal. The mean watershed score (24.3/80.0) was rated as marginal and was somewhat lower than the All Reaches average score (37.1/80.0) which was also considered marginal.

This stream runs through a residential area and the Bensalem Township Country Club Golf Course which has significant impact on the condition of the riparian and floodplain areas.

Table 3-90: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary J Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQMSJ02	PQ, Unnamed Tributary J	5	3	3	2	3	9	25
PQMSJ04	PQ, Unnamed Tributary J	5	4	4	3	3	7	26
PQMSJ06	PQ, Unnamed Tributary J	6	3	4	1	3	3	20
PQMSJ08	PQ, Unnamed Tributary J	7	2	5	2	7	3	26
PQMSJ Mean		5.8	3.0	4.0	2.0	4.0	5.5	24.3
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.13.6.1.1 INSTREAM HABITAT

Of the four reaches analyzed for the Poquessing Creek, Unnamed Tributary J Watershed, two reaches (PQMSJ02 and PQMSJ04) were rated as poor and two reaches (PQMSJ06 and PQMSJ08) were rated as marginal. The watershed mean (5.8/20.0) was lower than the All Reaches average (8.2/20.0). A poor rated habitat is characterized by unstable or lacking substrate and less than 20% stable habitat while a marginal characterization indicates a 20-40% mix of stable habitat but with less than desirable habitat availability. Habitat was significantly impacted by sedimentation in the reaches of the watershed.

3.1.13.6.1.2 VEGETATIVE PROTECTION

Both banks of three of the reaches analyzed (PQMSJ02, PQMSJ04 and PQMSJ06) for the Poquessing Creek, Unnamed Tributary J Watershed had marginal vegetative protection. One reach (PQMSJ08) had a poor rating for the left bank and a marginal rating for the right bank. A poor characterization indicates less than 50% of the streambanks covered by vegetation and the area very disturbed while a marginal rating reflects 50-70% vegetative coverage with some areas of obvious disruption. The All Reaches averages for both banks were about the same when compared to the Poquessing Creek, Unnamed Tributary J Watershed, all rated as marginal. The marginal scores for this parameter are attributed to disturbance of streambank vegetation by erosion.

3.1.13.6.1.3 BANK EROSION

The four reaches analyzed for Poquessing Creek, Unnamed Tributary J Watershed had varying scores. Reaches PQMSJ02 and PQMSJ06 had poor ratings for the left banks and marginal ratings for the right banks. Reach PQMSJ04 had marginal ratings for both the left and right banks. Reach PQMSJ08 had a poor rating for the left bank and a suboptimal rating for the right bank. Reaches PQMSJ06 and PSMSJ08 had extremely high, eroded banks on the downstream left which are contributing significant sediment to the stream channel. A poor rating indicates active downcutting with tall banks and a fast erosion rate with significant sediment contribution to the stream. A rating of marginal indicates active stream widening and erosion at a moderate rate while a suboptimal rating reflects stable grade and width with only isolated areas of erosion. The mean watershed scores for the left bank were rated as poor (2.0/10.0) while the All Reaches average achieved a marginal rating (3.9/10.0). The watershed mean and All Reaches average for the right bank were both rated as marginal (4.0/10.0).

3.1.13.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary J Watershed was poor or marginal. Reach PQMSJ02 and PQMSJ04 were both characterized as marginal and reaches PQMSJ06 and PQMSJ08 were both characterized as poor. A poor rating indicates that this reach was deeply entrenched and high flows were not making it into the floodplain while a marginal rating is similar, just to a lesser degree. The mean for the Poquessing Creek, Unnamed Tributary J Watershed was much lower than for the All Reaches average with a score of 5.5/20.0 as compared to 13.0/20.0, giving this watershed an overall poor rating while the All Reaches average was rated suboptimal.

3.1.13.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY J WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to suboptimal. The mean component score for the Poquessing Creek, Unnamed Tributary J Watershed (32.8/80.0) was slightly less than the All Reaches average (37.4/80.0), although both were considered marginal. The reduced function of the floodplains in this watershed can be attributed to development and golf course in the buffer and floodplain areas.

Table 3-91: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary J Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSJ02	PQ, Unnamed Tributary J	2	4	6	3	6	21
PQMSJ04	PQ, Unnamed Tributary J	4	3	4	3	8	22
PQMSJ06	PQ, Unnamed Tributary J	4	8	11	8	7	38
PQMSJ08	PQ, Unnamed Tributary J	8	7	12	10	13	50
PQMSJ Mean		4.5	5.5	8.3	6.0	8.5	32.8
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.13.6.2.1 VEGETATED BUFFER WIDTH

Vegetated buffer widths for the four reaches analyzed for the Poquessing Creek, Unnamed Tributary J Watershed ranged from poor to suboptimal. Reach PQMSJ02 had a poor rating for the left bank and a marginal rating for the right bank. Reach PQMSJ04 had marginal ratings for both the left and right banks. Reach PQMSJ06 had a marginal rating for the left bank and a suboptimal rating for the right bank while reach PQMSJ08 had suboptimal scores for both the left and right banks. A poor rating indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities while a marginal rating reflects a buffer width of 10-25 feet with a great deal of human disturbance. A suboptimal rating reflects a buffer width of 25-50 feet with only minimal disturbance. The mean watershed score of 4.5/10.0 for the left bank was less than 5.3/10.0 for the all reaches average, both considered marginal. The mean watershed score for the right bank was 5.5/10.0, considered marginal, while the All Reaches average was considered suboptimal with a rating of 6.0/10.0.

3.1.13.6.2.2 FLOODPLAIN VEGETATION

Reach PQMSJ02 had a marginal rating, indicating a dominant vegetation type of shrub. Reach PQMSJ04 was characterized as poor, indicating a dominant vegetation type of turf. Reaches PQMSJ06 and PQMSJ08 were rated as suboptimal, indicating a dominant vegetation type of young forest within the floodplain. The mean Poquessing Creek, Unnamed Tributary J Watershed score (8.3/20.0) was rated as marginal, as was the All Reaches average (9.7/20.0).

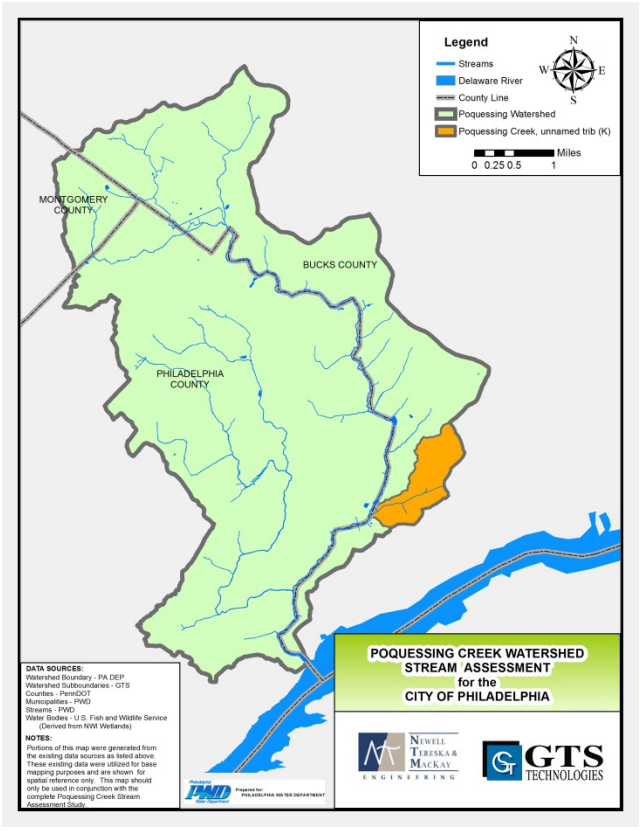
3.1.13.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was somewhat limited throughout the Poquessing Creek, Unnamed Tributary J Watershed, with ratings of either poor or marginal. One of the primary causes of habitat limitation was development and the golf course in the riparian and floodplain areas. Reaches PQMSJ02 and PQMSJ04 had poor ratings, reflecting either all wetland or non-wetland habitat with no evidence of ponding or standing water. Reaches PQMSJ06 and PQMSJ08 were characterized as marginal, reflecting all wetland or non-wetland habitat, with evidence of ponding or standing water. The mean watershed score for this parameter (6.0/20.0) was rated as marginal, as was the All Reaches average score (8.3/20).

3.1.13.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter were mostly marginal for the Poquessing Creek, Unnamed Tributary J Watershed. One reach (PQMSJ08) was characterized as suboptimal. A suboptimal rating reflects minor floodplain encroachment without affecting floodplain function while a marginal rating reflects moderate floodplain encroachment with some effect on floodplain function. The mean score for the watershed was (8.5/20.0) which was slightly higher than the All Reaches average score of (8.2/20.0), both scores considered marginal.

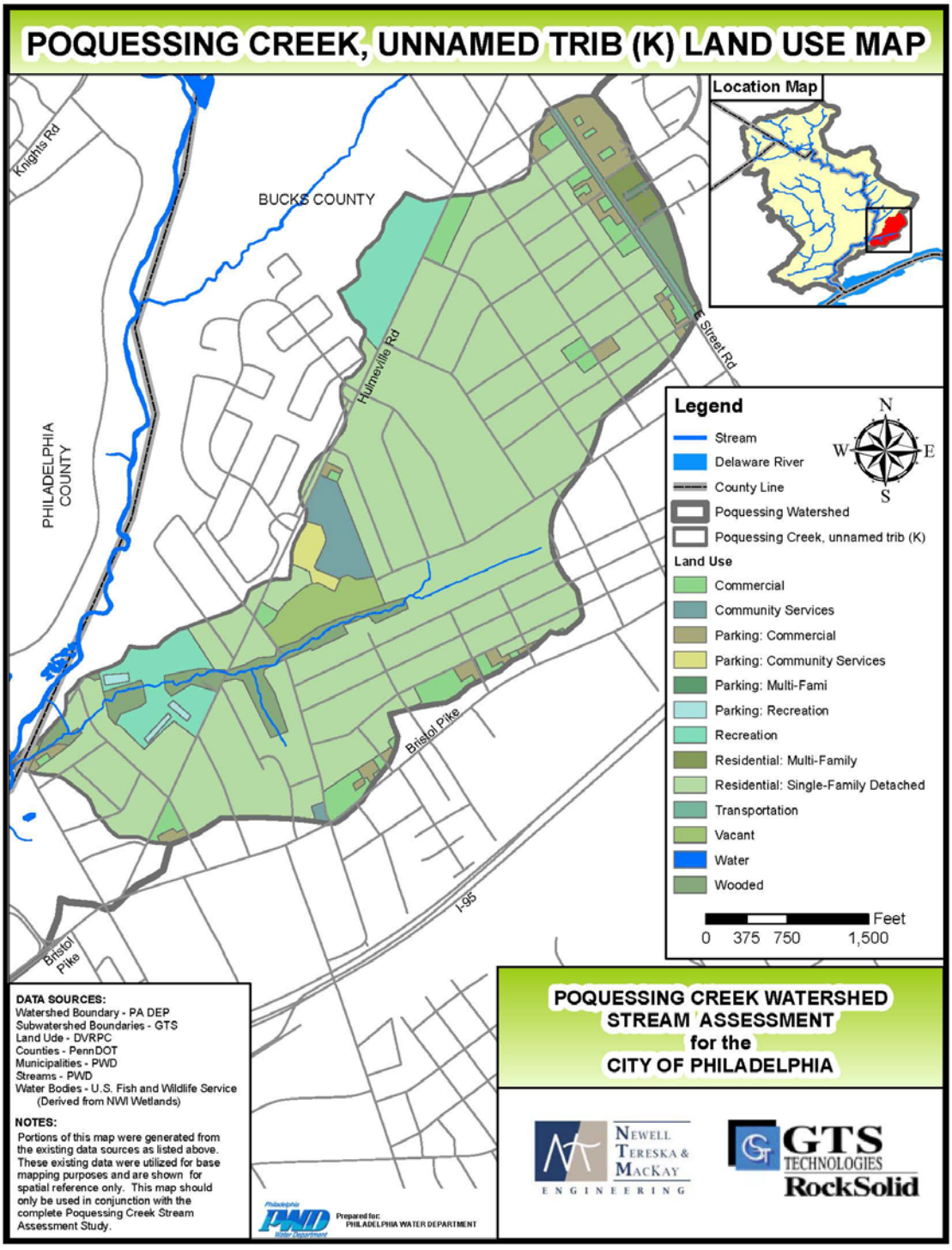
3.1.14 POQUESSING CREEK UNNAMED TRIBUTARY K WATERSHED AND REACH CHARACTERISTICS



Poquessing Creek Unnamed Tributary K is a tributary to the mainstem of the Poquessing Creek. Poquessing Creek Unnamed Tributary K originates from a number of outfalls draining stormwater from surrounding residential development. Poquessing Creek Unnamed Tributary K is a second-order tributary for approximately 4,700 feet before meeting the confluence with the Poquessing mainstem. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Unnamed Tributary K Watershed is 404 acres. Major land use types within the watershed include: residential: single family detached (74%) and recreation (7%). Poquessing Creek Unnamed Tributary K is surrounded by wooded land on both sides along most of the reach. The wooded buffer ranges from about 50 feet to about 400 feet wide.

Figure 3-66: Poquessing Creek, Unnamed Tributary K Watershed Land Use



3.1.14.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary K Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary K Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.1.14.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of Poquessing Creek Unnamed Tributary K Watershed are classified as urban soils. Soils classified as urban soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-92: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary K Watershed

Group	Area (acres)	Percent of Total Area
B	23.6	6%
C	23.4	6%
D	20.5	5%
Urban	336.8	83%
Total Area	404.3	100%

3.1.14.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for five reaches in Poquessing Creek, Unnamed Tributary K Watershed (Table 3-93). Four reaches were found to be eroding based on the total wetted perimeter calculation, while one was aggrading. The average total erosion rate for all reaches in the Poquessing Creek, Unnamed Tributary K Watershed was less than the average for all Poquessing Creek subwatersheds (Table 3-94). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-67: Geology of Poquessing Creek Unnamed Tributary K Watershed

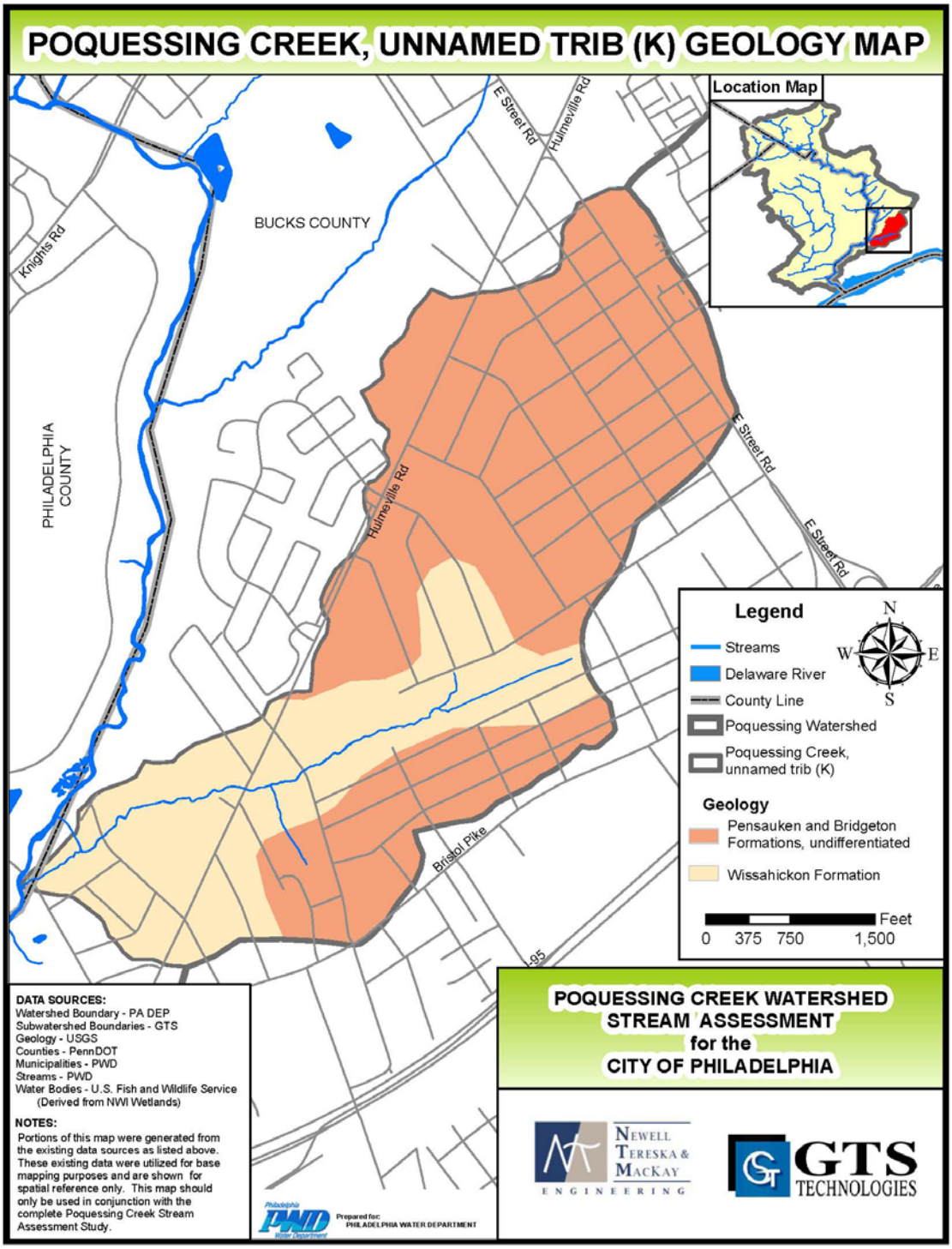


Figure 3-68: Distribution of NRCS Soil Types in Poquessing Creek Unnamed Tributary K Watershed

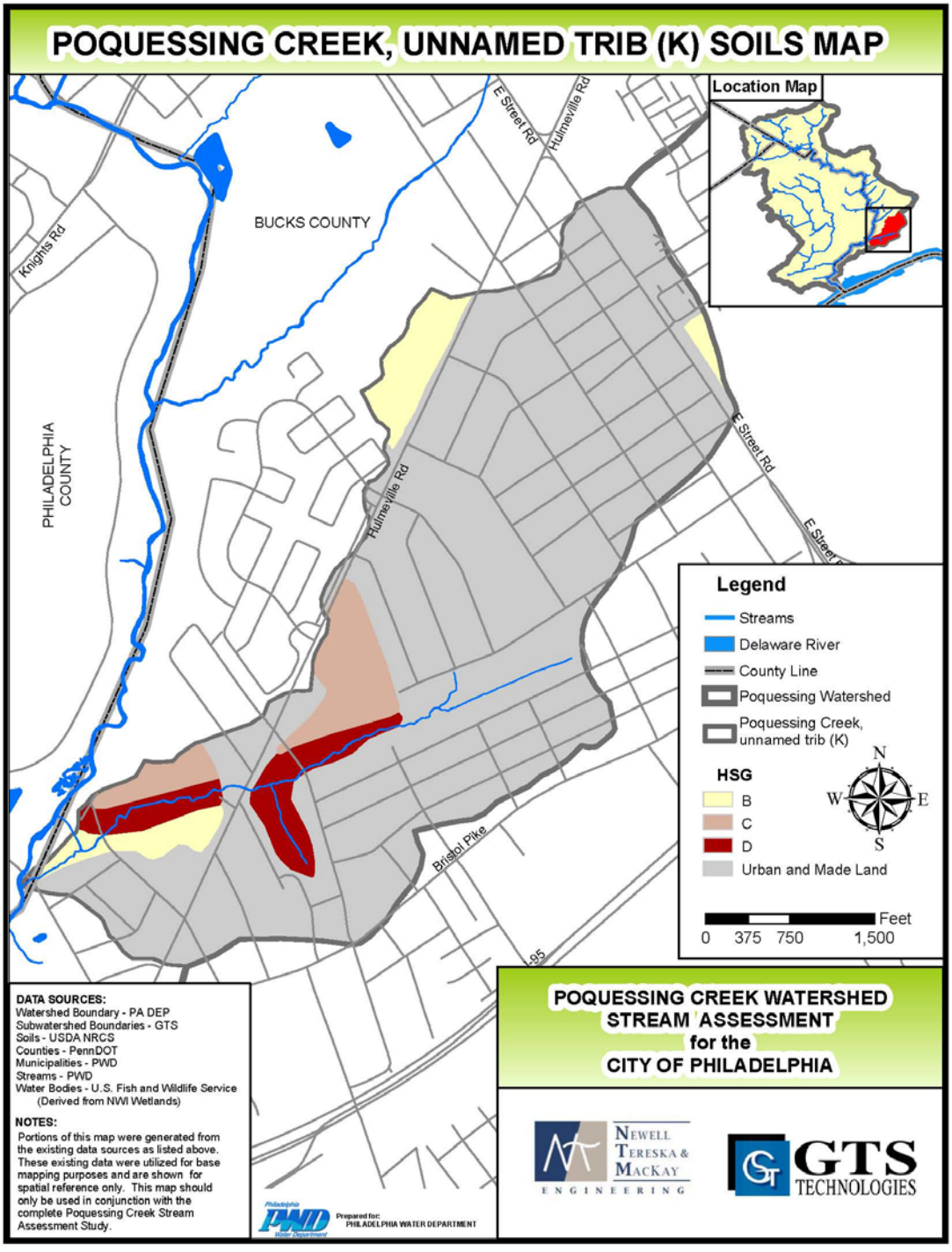


Table 3-93: Erosion Rates for Poquessing Creek Unnamed Tributary K Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMSK02	0.343	-0.075	-0.016	-0.006	-0.001	E
PQMSK04	0.095	0.005	0.319	0.032	0.006	A
PQMSK06	-0.042	-0.241	-0.430	-0.151	-0.030	E
PQMSK08	-0.515	-0.120	-0.080	-0.112	-0.022	E
PQMSK10	0.104	-0.192	-1.100	-0.236	-0.047	E
Average	-0.003	-0.125	-0.261	-0.095	-0.019	E

Table 3-94: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.1.14.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Poquessing Creek Unnamed Tributary K is a tributary to the Poquessing Creek located within Bucks County. The headwaters of Poquessing Creek Unnamed Tributary K lie in a dense residential area. At the downstream end and closer to the confluence, the residential development is less dense with some recreational land use and wooded land mixed in before reaching the confluence with Poquessing Creek.

The majority of infrastructure was located upstream at cross section PQMSK02 mainly in the form of constructed channels and stormwater outfalls. This cross section is in the area of Bensalem Avenue. Five outfalls exist at this section which drains stormwater from surrounding residential property into Poquessing Creek Unnamed Tributary K. All culverts and outfalls along Poquessing Creek Unnamed Tributary K are described as being in good or fair condition. Culvert PQcul102 is a 51-foot long by 5-fot high by 5-foot wide concrete box culvert, is in good condition and conveys flow under Hulmeville Road.

The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 1.0 to 4.0 feet in diameter. The number of headwater outfalls (Table 3-95) on this stream indicates that it is heavily influenced by stormwater discharges along the reach. Four of the constructed channels along the reach are identified as being in poor condition. Channels PQchan151, PQchan152, PQchan159 and PQchan161 each occur within an area of wooded buffer surrounded by residential development and are found in the upstream portion of the watershed. Poor condition channels range in length from 12 feet to 50 feet and are constructed of a variety of materials (iron, concrete and other). Two bridges along the reach are identified as poor condition infrastructure. PQbri062 is a wooden footbridge located upstream at PQMSK02 and is 5-feet long and 8-feet wide. Bridge PQbri065 is another wooden footbridge also located at PQMSK02 and is 5-feet long and 5-feet wide. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-95: Summary of Poquessing Creek Unnamed Tributary K Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSK02	5	8	5	12	2	0	0	4	36
PQMSK04	1	0	3	0	1	0	0	0	5
PQMSK06	1	0	1	1	2	0	0	0	5
PQMSK08	1	0	3	0	0	0	0	0	4
PQMSK10	1	0	1	0	0	0	0	0	2
TOTAL	9	8	13	13	5	0	0	4	52

3.1.14.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Poquessing Creek, Unnamed Tributary K stream channel is a second-order, single thread channel with two small unnamed tributaries. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-69: Results for Poquessing Creek, Unnamed Tributary K Watershed USAM Components

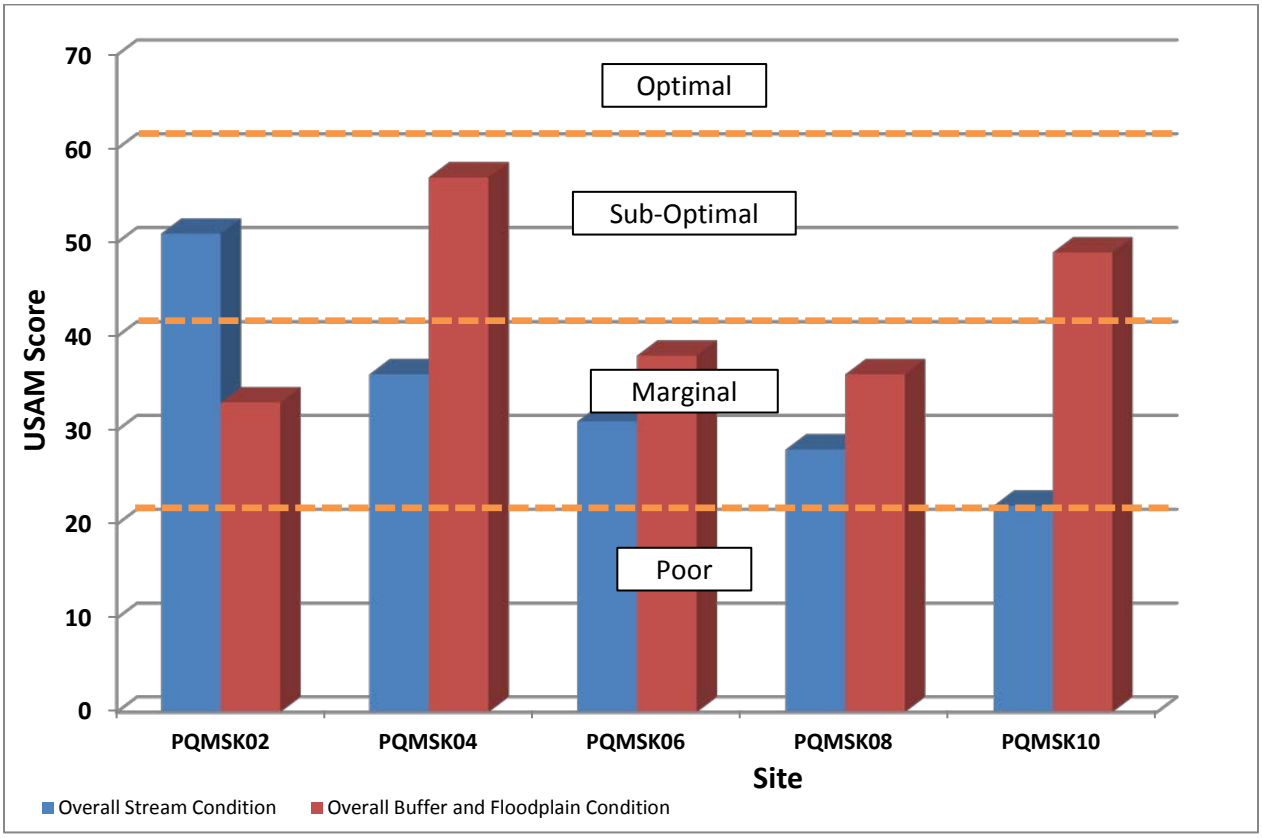
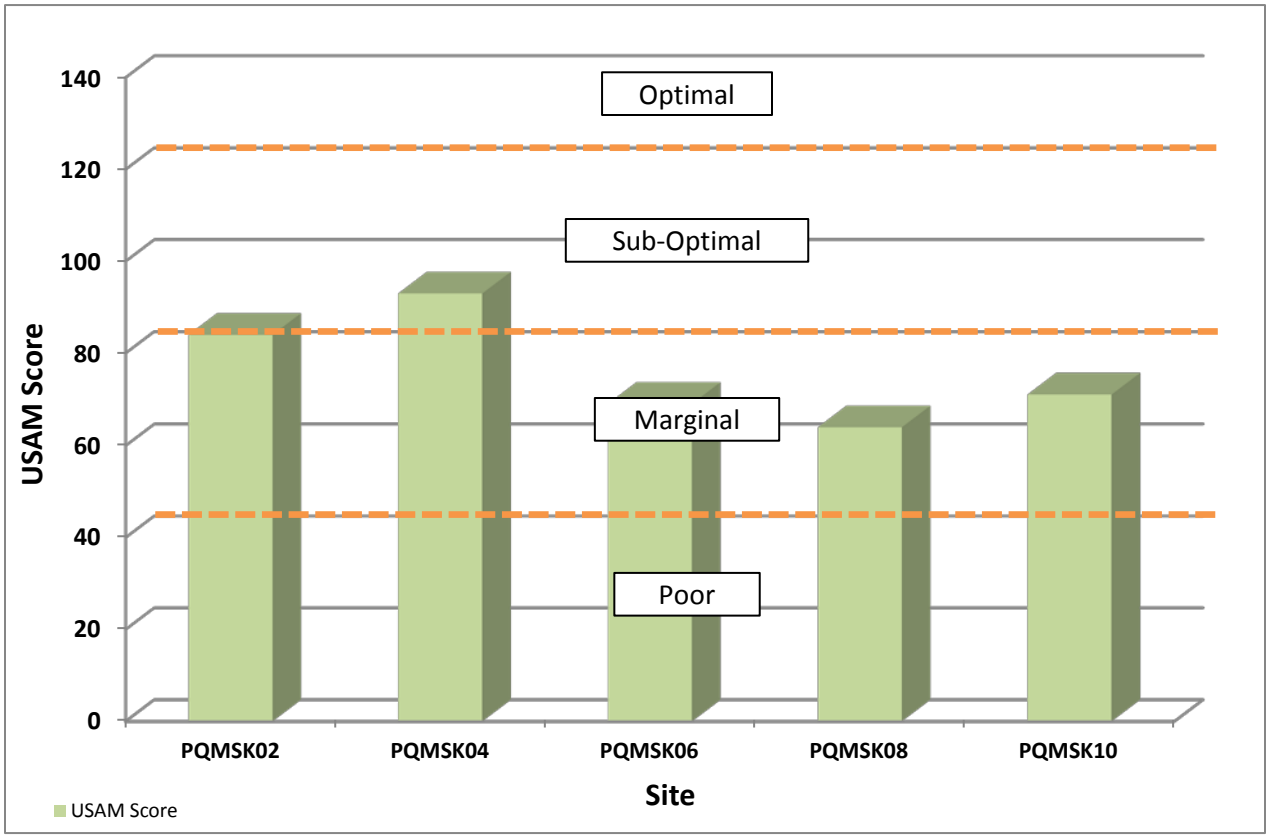


Figure 3-70: Poquessing Creek, Unnamed Tributary K Watershed USAM Results



3.1.14.5.1 PQMSK02

Reach PQMSK02 is the first reach of Poquessing Creek, Unnamed Tributary K. The headwaters of this tributary begin at a stormwater outfall in a residential area. Reach PQMSK02 is characterized by a shallow slope (0.6%), low width to depth ratio (11.6), a slightly entrenched channel (ER = 21.1), low sinuosity (1.01), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMSK02 was suboptimal (84/160).

3.1.14.5.2 PQMSK04

Reach PQMSK04 begins approximately 800 feet upstream of cross section PQMSK04. This reach runs through a commercial and residential area. Reach PQMSJ04 is characterized by a shallow slope (0.5%), low width to depth ratio (9.9), a moderately entrenched channel (ER = 2.0), low sinuosity (1.05), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSK04 was suboptimal (93/160).

3.1.14.5.3 PQMSK06

Reach PQMSK06 begins approximately 600 feet upstream of cross section PQMSK06. The upper portion of this reach runs through a residential area and the lower portion runs through a ballfield park area after passing under Hulmeville Road. An Unnamed Tributary joins from the south in the upper portion of this reach. Reach PQMSK06 is characterized by a shallow slope (0.5%), moderate to high width to depth ratio (15.3), a highly entrenched channel (ER = 1.4), low sinuosity (1.10), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSK06 was marginal (69/160).

3.1.14.5.4 PQMSK08

Reach PQMSK08 begins approximately 400 feet upstream of cross section PQMSK08. This reach continues through a partially wooded corridor adjacent to the ballfield park area. Reach PQMSK08 is characterized by a shallow slope (0.4%), moderate width to depth ratio (13.2), a moderately entrenched channel (ER = 1.5), low sinuosity (1.08), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMSK08 was marginal (64/160).

3.1.14.5.5 PQMSK10

Reach PQMSK10 begins approximately 400 feet upstream of cross section PQMSK10. This reach runs between a wooded floodplain area and a residential area prior to entering the mainstream of Poquessing Creek. Reach PQMSK10 is characterized by a shallow slope (0.4%), low width to depth ratio (8.8), a highly entrenched channel (ER = 1.4), moderate sinuosity (1.36), and gravel substrate. The reach was classified as a G4c type stream. The composite USAM score for reach PQMSK10 was marginal (71/160).

3.1.14.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Five reaches were analyzed for the Poquessing Creek, Unnamed Tributary K Watershed. The mean scores for both the Overall Stream Condition components as well as the composite USAM score were classified as marginal (Table 3-96). Average conditions within the Poquessing Creek, Unnamed Tributary K Watershed's stream channels were worse than conditions observed within the buffers and floodplains, where the Overall Buffer and Floodplain Condition mean was rated as suboptimal. The watershed averages for the Overall Stream Condition component was slightly lower than the All Reaches average. The means for Overall Buffer and Floodplain Condition and USAM Score were slightly higher than their All Reaches Average counterparts. The scores for individual parameters ranged from poor to optimal, with most scoring in the marginal range. Graphs of each USAM category rating are in Appendix D.

Table 3-96: USAM Results for Poquessing Creek, Unnamed Tributary K Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMSK02	PQ, Unnamed Tributary K	51	33	84
PQMSK04	PQ, Unnamed Tributary K	36	57	93
PQMSK06	PQ, Unnamed Tributary K	31	38	69
PQMSK08	PQ, Unnamed Tributary K	28	36	64
PQMSK10	PQ, Unnamed Tributary K	22	49	71
PQMSK Mean		33.6	42.6	76.2
All Reaches Average		37.1	37.4	74.4

3.1.14.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY K WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were mostly in the marginal range with a few reaches scoring in the poor or suboptimal range.

Table 3-97: USAM Overall Stream Condition Scoring for Poquessing Creek, Unnamed Tributary K Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQMSK02	PQ, Unnamed Tributary K	4	6	6	7	8	20	51
PQMSK04	PQ, Unnamed Tributary K	7	4	5	4	6	10	36
PQMSK06	PQ, Unnamed Tributary K	10	4	5	4	4	4	31
PQMSK08	PQ, Unnamed Tributary K	6	4	5	4	4	5	28
PQMSK10	PQ, Unnamed Tributary K	6	3	3	4	2	4	22
PQMSK Mean		6.6	4.2	4.8	4.6	4.8	8.6	33.6
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.1.14.6.1.1 INSTREAM HABITAT

Of the five reaches analyzed for Poquessing Creek, Unnamed Tributary K, all scored in the marginal range except for Reach PQMSK02, which had a poor rating primarily due to low baseflow quantity and a lack of pool/riffle complex. A marginal rating reflects 20-40% stable habitat with less than desirable availability and a disturbed substrate. A poor rating reflects less than 20% stable habitat and a substrate that is unstable or lacking. The watershed mean was lower than the All Reaches average (6.6/20.0 vs. 8.2/20.0).

3.1.14.6.1.2 VEGETATIVE PROTECTION

Of the five reaches analyzed for Poquessing Creek, Unnamed Tributary K Watershed, four reaches (PQMSK04, PQMSK06, PQMSK08 and PQMSK10) were rated as marginal for both banks. One reach (PQMSK02) was rated as suboptimal, for both the left and right banks. A rating of marginal reflects 50-70% of the banks covered by vegetation with disruption obvious such as bare soil patches and cut vegetation. A suboptimal rating indicates 70-90% of the streambank is covered with native vegetation with one class of plants notably absent and some signs of disruption, but not enough to affect plant colonization. The All Reaches averages for both banks were slightly lower than the Poquessing Creek, Unnamed Tributary K Watershed (4.0/10.0 vs. 4.2/10.0, LB and 3.9/10.0 vs. 4.8/10.0, RB), although both the All Reaches averages and the watershed mean were both considered marginal for both the left and right banks. The mostly marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks due to channel erosion.

3.1.14.6.1.3 BANK EROSION

Of the five reaches analyzed for Poquessing Creek, Unnamed Tributary K Watershed, one reach (PQMSK02) had a rating of suboptimal for both the left and right banks. A suboptimal rating indicates stable grade and width with some isolated areas of bank failure and/or erosion. Two reaches (PQMSK06 and PQMSK08) had marginal ratings for both banks, reflecting past downcutting events and active stream widening with erosion occurring at a moderate rate. Reach PQMSK04 had a marginal rating for the left bank and a suboptimal rating for the right banks. Reach PQMSK10 had a rating of marginal for the left bank and a poor rating for the right bank. A poor rating indicates active downcutting, a fast rate of erosion, and significant sediment contribution to the stream. The mean watershed scores for the left and right banks were both (4.6/10.0 and 4.8/10.0) rated as marginal and scored higher than the respective All Reaches averages of 3.9/10.0 and 4.0/10.0, also characterized as marginal.

3.1.14.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Poquessing Creek, Unnamed Tributary K Watershed was varied. Reaches PQMSK06, PQMSK08, and PQMSK10 had very low Floodplain Connection Scores within the poor range, indicating that this reach was deeply entrenched and high flows were not making it into the floodplain. Reach PQMSK04 had a marginal rating of 10.0/20.0 indicating high flows not able to enter the floodplain and deep entrenchment, just to a lesser degree than a poor rated stream. Reach PQMSK02

was rated as optimal, with a score of 20.0/20.0. The mean for the Poquessing Creek, Unnamed Tributary K Watershed was lower than for All Reaches with a score of 8.6 as compared to 13.0, giving this watershed an overall marginal rating.

3.1.14.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK, UNNAMED TRIBUTARY K WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to optimal. The mean component score for the Poquessing Creek, Unnamed Tributary K Watershed (42.6/80.0) was greater than the All Reaches average (37.4/80.0). The improved function of the floodplains in this watershed can be attributed to the wooded buffer that exists along much of the channel.

Table 3-98: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek, Unnamed Tributary K Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMSK02	PQ, Unnamed Tributary K	2	2	5	11	13	33
PQMSK04	PQ, Unnamed Tributary K	6	9	16	14	12	57
PQMSK06	PQ, Unnamed Tributary K	9	3	9	8	9	38
PQMSK08	PQ, Unnamed Tributary K	9	3	8	9	7	36
PQMSK10	PQ, Unnamed Tributary K	8	3	14	11	13	49
PQMSK Mean		6.8	4	10.4	10.6	10.8	42.6
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.1.14.6.2.1 VEGETATED BUFFER WIDTH

The left bank of the Poquessing Creek, Unnamed Tributary K Watershed scored better than the right banks. Two reaches (PQMSK06 and PQMSK08) had optimal scores for the left bank. Reach PQMSK04 and PQMSK10 had suboptimal left bank. Reach PQMSK02 scored as poor for both the left and right banks. Reaches PQMSK06, PQMSK08, and PQMSK10 had marginal right banks. Reach PQMSK04 had an optimal right bank score. A score of optimal reflects a buffer zone of greater than 50 feet and little human activity. A poor rating indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. Suboptimal and marginal reflect degrees in between. The mean watershed score of 6.8/10.0 for the left bank was greater than 5.3/10.0 for the all reaches average. The mean watershed score for the right banks (4.0/10.0) was lower than the all reaches average for right banks (6.0/10.0).

3.1.14.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation types within the Poquessing Creek, Unnamed Tributary K Watershed ranged from grass to mature riparian forest. Reach PQMSK04 had an optimal rating, indicating that the predominant vegetation type was mature floodplain forest. Reach PQMSK10 had a suboptimal score reflecting young forest. Reaches PQMSK06 and PQMSK08 were both rated as marginal or predominantly scrub/shrub vegetation type. Reach PQMSK02 had a poor rating, indicating the presence of turf. The mean Poquessing Creek, Unnamed Tributary K Watershed score (10.4/20.0) was rated as marginal, which was slightly higher than the All Reaches average (9.7/20.0) which was also considered marginal.

3.1.14.6.2.3 FLOODPLAIN HABITAT

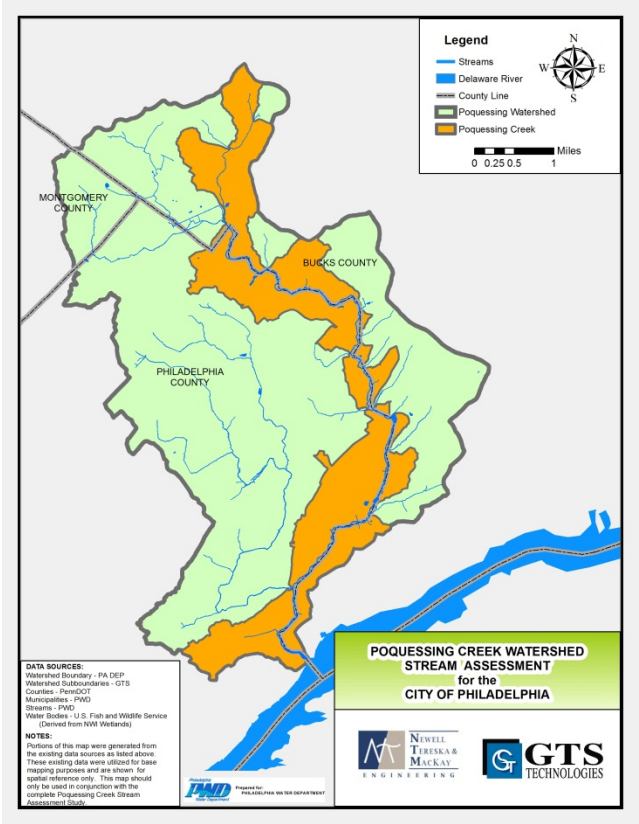
Floodplain habitat was varied throughout the Poquessing Creek, Unnamed Tributary K Watershed. Three reaches (PQMSK02, PQMSK04, and PQMSK10) of the five analyzed were rated as suboptimal, indicating an even mix of wetland and non-wetland habitats and no evidence of standing or ponded water. The remaining two reaches (PQMSK06 and PQMSK08) were both considered marginal, reflecting all wetland or non-wetland habitat with evidence of standing water. The mean watershed score for this parameter (10.6/2.0) was rated as marginal and was slightly higher than the All Reaches average score (8.3/20.0) which was also considered marginal.

3.1.14.6.2.4 FLOODPLAIN ENCROACHMENT

Of the five reaches analyzed for Poquessing Creek, Unnamed Tributary K Watershed, three reaches (PQMSK02, PQMSK04, and PQMSK10) were considered suboptimal, reflecting minor floodplain encroachment without affecting floodplain function. Two reaches (PQMSK06 and PQMSK08) were considered marginal, indicating moderate floodplain encroachment with some effect on floodplain function. The mean score for the watershed was (10.8/20.0) which was slightly higher than the All Reaches average score of (8.2/20.0), giving the Poquessing Creek, Unnamed Tributary K Watershed an overall rating of marginal.

3.2 POQUESSING CREEK MAINSTEM WATERSHED

Poquessing Creek mainstem is defined as the area directly to Poquessing Creek. The watershed characteristics of the mainstem is described in the following section.

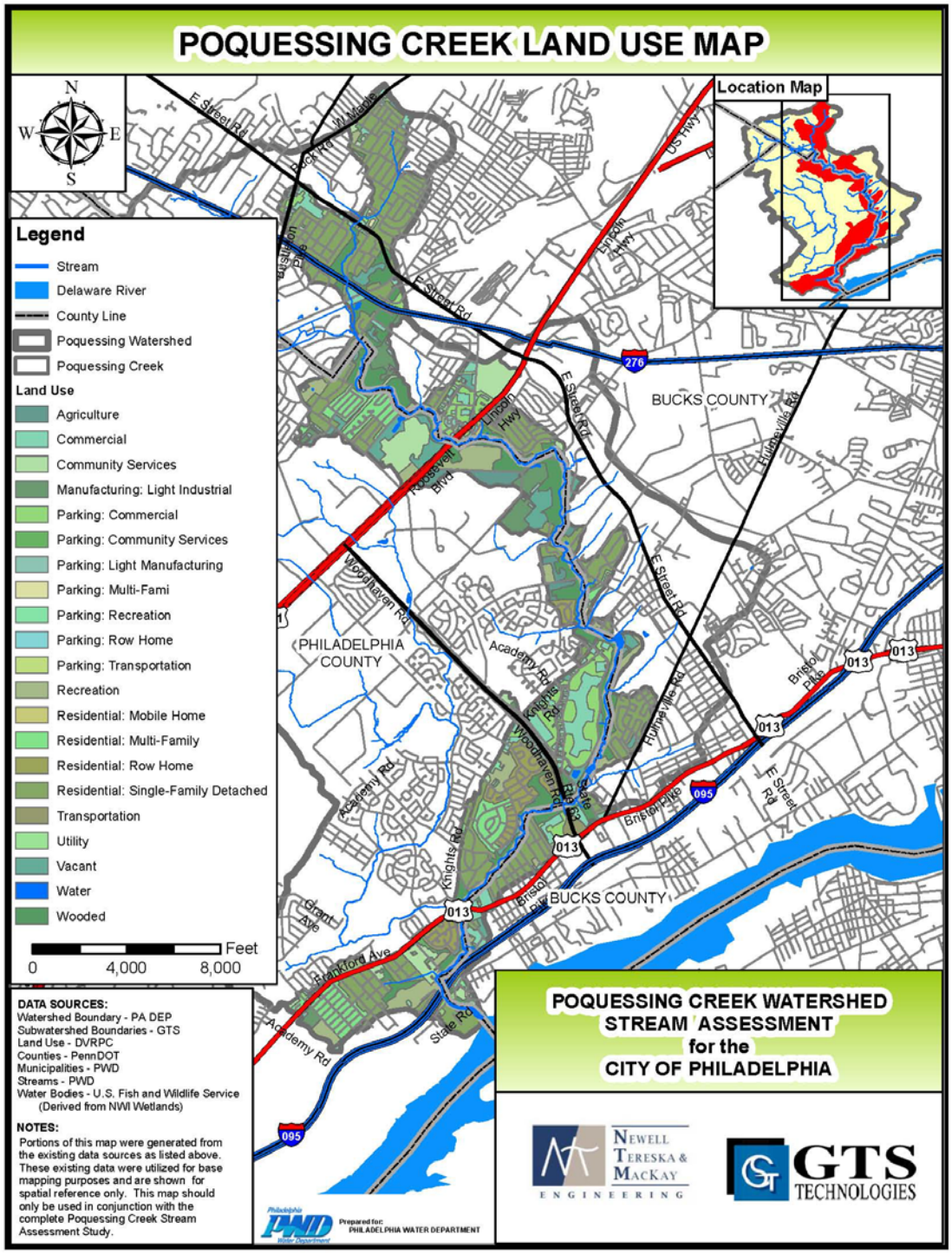


3.2.1 POQUESSING CREEK WATERSHED AND REACH CHARACTERISTICS

Poquessing Creek originates from a stormwater outfall in Bucks County and flows for approximately 57,000 feet before meeting the confluence with the Delaware River. The dominant substrate varies from gravel to cobble material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Poquessing Creek Watershed is 13,670 acres. Major land use types within the watershed include: residential single-family detached (30%), manufacturing: light wooded (18%), commercial (8%), residential: multi-family (7%), recreation (6%), and parking commercial (6%). Portions of the Poquessing Creek are surrounded by wooded land on both sides. The wooded buffer ranges from about 20 feet to about 2,000 feet wide.

Figure 3-71: Poquessing Creek Mainstem Watershed Land Use



3.2.1.1 GEOLOGY

The majority of the Poquessing Creek Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

Other geologic formations within the Poquessing Creek Watershed are the Chickies Formation, Felsic Gneiss, Mafic Gneiss Pennsauken and Bridgeton Formations and Trenton Gravel. The Chickies Formation is composed of quartzite and quartz schist. The Felsic Gneiss consists of metamorphic rock units that yield small quantities of water due to the smallness of the cracks, joints, and other openings within the rock. This fine - grained granitic gneiss is resistant to weathering but shows good surface drainage. Mafic Gneiss consists of medium to fine grained, dark colored calcic plagioclase, hyperthene, augite, and quartz. The Pennsauken Formation consists of quartz and sand. And Trenton Gravel which contains gray or pale reddish-brown, very gravelly sand interstratified with crossbedded sand and clay-silt beds. Trenton Gravel also includes areas of Holocene alluvium and swamp deposits.

3.2.1.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority Poquessing Creek Watershed are classified as urban. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-99: Distribution of NRCS Soil Types in Poquessing Mainstem Watershed

Group	Area (acres)	Percent of Total Area
A/D	14.7	0.4%
B	601.2	16%
C	31.7	0.8%
D	370.2	10%
Urban	2730.0	73%
Water	7.1	0.2%
Total Area	3755.0	100%

3.2.1.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for fifty reaches in Poquessing Creek (Table 3-100). Thirty seven reaches were found to be eroding based on the total wetted perimeter calculation, while thirteen were aggrading. The average total erosion rate for all reaches in Poquessing Creek was less than the average for all Poquessing Creek subwatersheds (Table 3-101). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-72: Geology of Poquessing Creek Mainstem Watershed

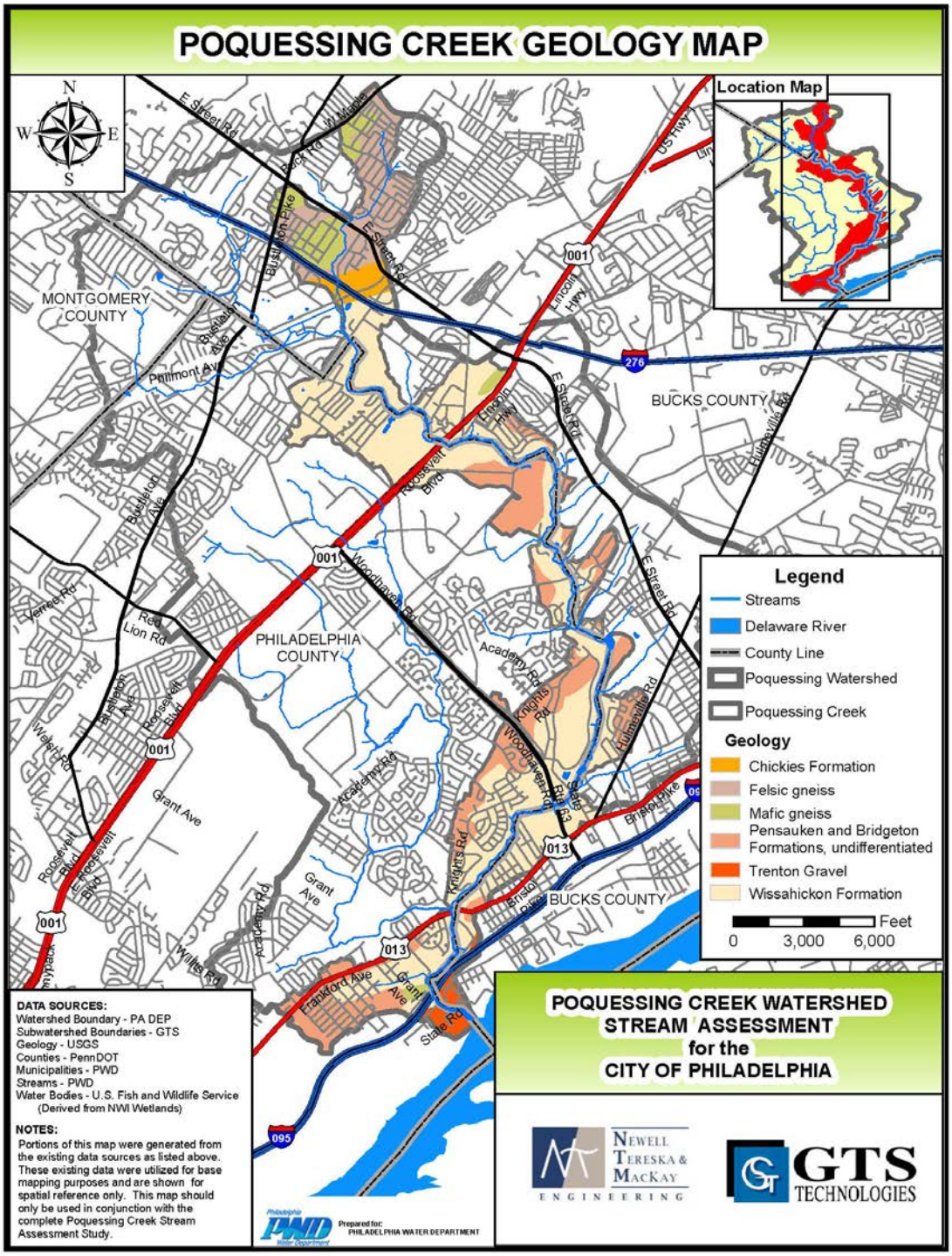


Figure 3-73: Distribution of NRCS Soil Types in Poquessing Creek Mainstem Watershed

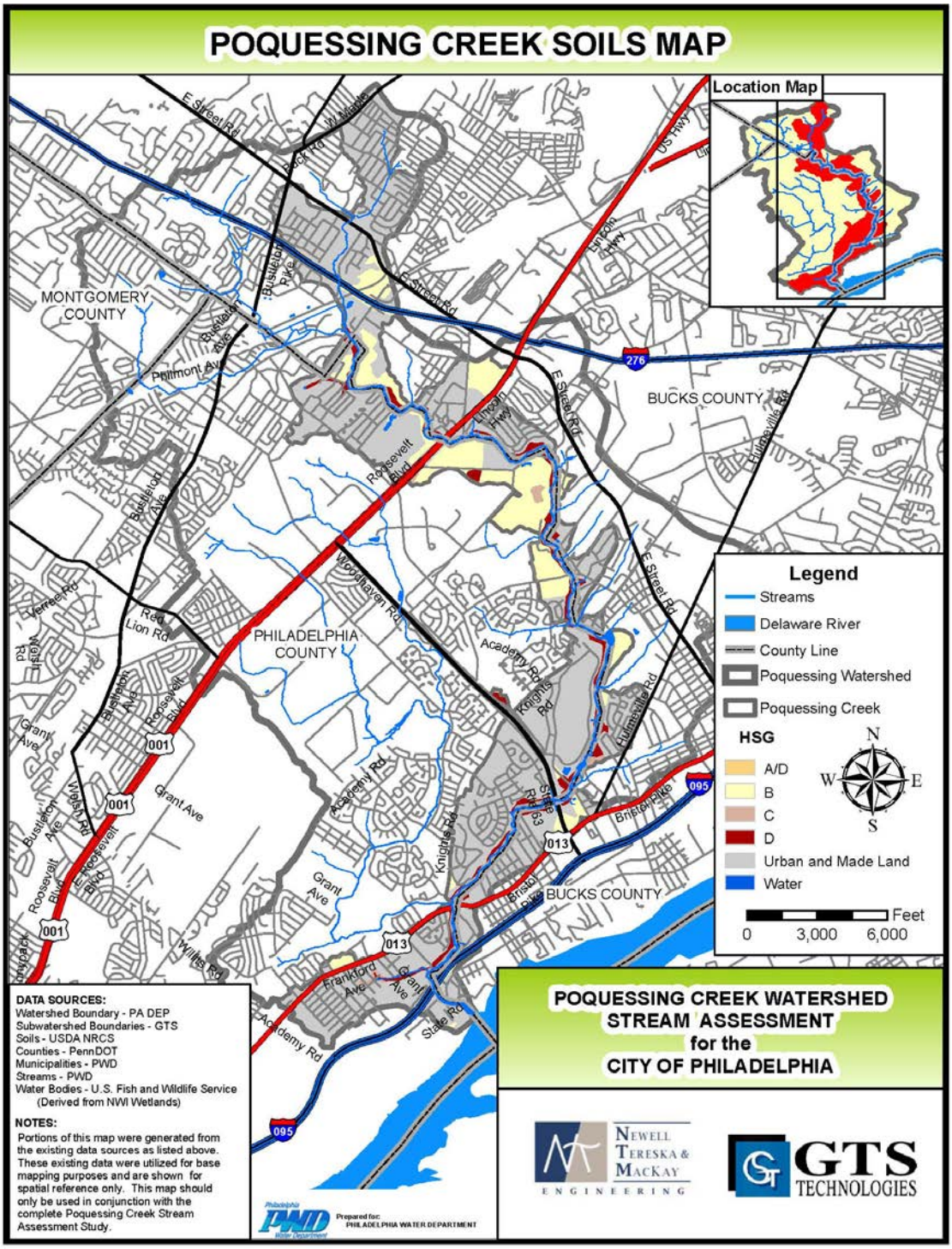


Table 3-100: Erosion Rates for Poquessing Creek Mainstem Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQMS02	0.638	0.345	-0.419	0.111	0.022	A
PQMS04	-0.008	0.000	0.123	0.007	0.001	A
PQMS06	0.947	0.105	-0.313	0.130	0.026	A
PQMS08	-1.934	0.057	-0.538	-0.138	-0.028	E
PQMS10	-0.117	-0.098	-0.979	-0.156	-0.031	E
PQMS12	0.144	-0.097	0.941	-0.040	-0.008	E
PQMS14	-1.853	-0.471	-4.459	-0.764	-0.153	E
PQMS16	0.393	0.201	-3.725	-0.086	-0.017	E
PQMS18	-0.578	0.010	0.455	-0.008	-0.002	E
PQMS20	-0.816	-0.182	0.279	-0.111	-0.022	E
PQMS22	-1.634	-0.015	0.570	-0.087	-0.017	E
PQMS24	1.797	-0.037	-2.510	-0.049	-0.010	E
PQMS26	-3.851	-0.240	0.422	-0.332	-0.066	E
PQMS28	0.187	-0.196	-0.895	-0.213	-0.043	E
PQMS30	3.190	-0.179	-0.144	0.123	0.025	A
PQMS32	-1.706	-0.396	-3.256	-0.549	-0.110	E
PQMS34	2.720	0.162	-4.922	-0.106	-0.021	E
PQMS36	-1.215	-0.667	-1.374	-0.702	-0.140	E
PQMS38	-0.112	0.067	-0.835	-0.017	-0.003	E
PQMS40	-1.020	0.154	-0.004	-0.016	-0.003	E
PQMS42	-2.233	-0.142	-0.820	-0.258	-0.052	E
PQMS44	-1.601	0.061	-2.536	-0.244	-0.049	E
PQMS46	-2.986	-0.153	0.308	-0.265	-0.053	E
PQMS48	0.585	0.017	-1.576	-0.081	-0.016	E
PQMS50	-1.317	0.183	1.178	0.127	0.025	A
PQMS52	-3.706	-0.202	2.139	-0.090	-0.018	E
PQMS54	-1.159	-0.165	0.029	-0.191	-0.038	E
PQMS56	-0.585	0.181	-2.101	-0.151	-0.030	E
PQMS58	-0.835	-0.292	-0.374	-0.259	-0.052	E
PQMS60	2.363	-0.270	-1.070	0.007	0.001	A
PQMS62	-2.012	-0.101	-0.197	-0.195	-0.039	E
PQMS64	-0.351	0.441	0.313	0.224	0.045	A
PQMS66	-0.038	-0.481	-1.248	-0.342	-0.068	E
PQMS68	3.731	-0.077	-5.263	-0.134	-0.027	E
PQMS70	-0.542	-0.222	-0.300	-0.138	-0.028	E
PQMS72	-1.981	-0.870	0.091	-0.516	-0.103	E
PQMS74	-2.517	0.121	-0.232	-0.104	-0.021	E
PQMS76	-1.017	-0.362	0.030	-0.279	-0.056	E
PQMS78	1.971	-0.031	-0.067	0.053	0.011	A
PQMS80	0.996	-0.031	3.106	0.211	0.042	A
PQMS82	-0.490	0.052	-0.084	-0.012	-0.002	E
PQMS84	-0.603	-0.210	-0.006	-0.057	-0.011	E
PQMS86	1.207	-0.141	-0.517	-0.009	-0.002	E
PQMS88	-0.829	-0.091	-0.445	-0.126	-0.025	E
PQMS90	-3.680	-0.047	12.123	0.344	0.069	A
PQMS92	-6.222	0.537	9.514	0.245	0.049	A
PQMS94	1.500	0.233	-1.005	0.191	0.038	A

PQMS96	1.185	-0.151	-1.535	-0.117	-0.023	E
PQMS98	-0.908	-0.192	-0.627	-0.211	-0.042	E
PQMS100	3.098	1.495	1.776	1.216	0.243	A
Average	-0.476	-0.048	-0.220	-0.083	-0.017	E

Table 3-101: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.2.1.4 INFRASTRUCTURE TRACKDOWN SUMMARY

The Poquessing Creek Watershed is a subwatershed of the Delaware River Watershed in Bucks and Philadelphia Counties. The headwaters of the Poquessing Creek mainstem lie in an area of dense residential development. Along the reach, the predominant land use patterns vary between residential,

commercial, light manufacturing industrial, recreation and wooded. At the downstream end and closer to the confluence, the land use patterns become mainly residential mixed with wooded, industrial and commercial and flow under Interstate 95, before reaching the confluence with the Delaware River. Much of Poquessing Creek exhibits some of the impairments associated with urban streams given its location and proximity to high density residential, industrial and commercial development and a number of major transportation routes that surround and cross the stream channel.

The majority of infrastructure was located at upstream cross section PQMS02 and downstream PQMS100. Cross section PQMS02 is the headwaters of the reach and infrastructure is found here mainly in the form of constructed channels. PQMS02 is an area of dense residential development therefore infrastructure is needed in the forms of constructed channels, culverts, bridges, outfalls, manholes and sewer grates to navigate the Poquessing Creek around the existing development. All infrastructure located at PQMS02 is in good or fair condition. Cross Section PQMS100 is located at the downstream most section of the Poquessing. This cross section includes the crossing at Interstate 95, a major transportation corridor in this area, which is supported by the existing infrastructure. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.5 to 5.0 feet in diameter. The number of outfalls (Table 3-102) on this stream indicates that it is heavily influenced by stormwater discharges along the Poquessing Creek.

A number of major transportation routes cross over the reach along the entirety of the Poquessing Creek and are as follows in order from upstream to downstream: Street Road (PQcul010), Interstate 276 (PQcul011), Philmont Avenue (PQcul013), Trevose Road (PQbri038), Roosevelt Boulevard (PQbri041), Dunks Ferry Road (PQbri047), Knights Road (PQbri052), Woodhaven Road (PQbri067 and PQbri068), Frankford Avenue (PQbri103), Interstate 95 (PQbri107, PQbri108 and PQbri109) and State Road (PQbri112). Each of these crossings is described as being in good or fair condition.

Along the Poquessing Creek, the majority of infrastructure elements were considered in good or fair condition. Out of the 272 infrastructure elements found in the Poquessing Creek Watershed, 13 were found to be in poor condition. The majority of poor condition infrastructure found in the Poquessing Creek Watershed is in the form of constructed channels. Channels PQchan118, PQchan121, PQchan122, PQchan125, PQchan166, PQchan167 and PQchan168 were described as poor condition. The channels range in dimension from a height of 2 feet to 12 feet and a length of 12 feet to 338 feet and are constructed with stone or concrete. Four outfalls were described as poor condition. Outfalls PQout021, PQout168, PQout471 and PQout485 range in size from 0.7 feet to 4 feet. Culvert PQcul072 is a poor condition culvert located on wooded land and is 9 feet in length. Lastly, a manhole (PQman024) is located near Old Lincoln Highway and in poor condition. The manhole is not exposed and sits away from the road and industrial development in a wooded area. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-102: Summary of Poquessing Creek Mainstem Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMS02	4	5	3	15	1	0	0	2	30
PQMS04	2	1	1	6	0	0	1	4	15
PQMS06	1	0	2	4	0	0	0	2	9
PQMS08	0	0	3	0	0	0	0	0	3
PQMS10	0	4	0	0	0	0	0	0	4
PQMS12	1	0	3	8	0	0	1	0	13
PQMS14	3	2	2	1	1	0	0	0	9
PQMS16	0	1	2	0	1	0	0	0	4
PQMS18	0	0	0	0	0	0	0	0	0
PQMS20	0	0	1	0	1	0	0	1	3
PQMS22	0	1	1	1	0	0	0	0	3
PQMS24	0	0	3	2	1	0	1	0	7
PQMS26	0	0	2	0	0	0	0	0	2
PQMS28	0	0	4	0	0	0	0	3	7
PQMS30	0	0	4	0	1	0	1	1	7
PQMS32	0	1	4	4	0	0	0	0	9
PQMS34	2	0	5	0	3	0	0	0	10
PQMS36	0	0	2	0	1	0	1	0	4
PQMS38	1	0	1	1	1	0	0	0	4
PQMS40	0	1	1	4	1	0	0	0	7
PQMS42	0	1	1	0	2	0	0	0	4
PQMS44	0	0	0	0	0	0	0	0	0
PQMS46	0	0	0	1	0	0	0	0	1
PQMS48	0	0	1	1	0	0	0	0	2
PQMS52	0	0	2	0	0	0	0	0	2
PQMS54	0	1	4	0	0	0	0	0	5
PQMS56	0	0	4	2	0	0	0	0	6
PQMS58	0	1	2	0	0	0	0	0	3
PQMS60	0	0	0	1	0	0	0	0	1
PQMS62	0	0	2	0	0	0	0	0	2
PQMS64	0	0	1	0	1	0	0	0	2
PQMS66	0	0	0	0	0	0	0	0	0
PQMS70	0	0	0	0	0	0	0	0	0
PQMS72	0	0	0	0	0	0	0	0	0

PQMS74	0	0	5	2	2	0	0	0	9
PQMS76	1	0	2	7	3	1	0	1	15
PQMS80	0	0	3	0	2	0	0	0	5
PQMS82	0	0	3	3	1	0	0	2	9
PQMS84	0	0	3	0	0	0	0	0	3
PQMS86	0	0	1	0	0	0	1	0	2
PQMS88	0	1	0	1	0	0	0	0	2
PQMS90	0	1	0	0	0	0	1	0	2
PQMS94	0	2	0	0	0	0	0	0	2
PQMS96	0	0	1	0	0	0	0	0	1
PQMS98	0	0	1	0	0	0	0	0	1
PQMS100	2	7	14	7	4	0	3	6	43
TOTAL	17	30	94	71	27	1	10	22	272

3.2.1.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream section of the Poquessing Creek stream channel is a fourth-order, single thread channel with fifteen direct tributaries. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-74A: Results for Poquessing Creek Mainstem Watershed USAM Components

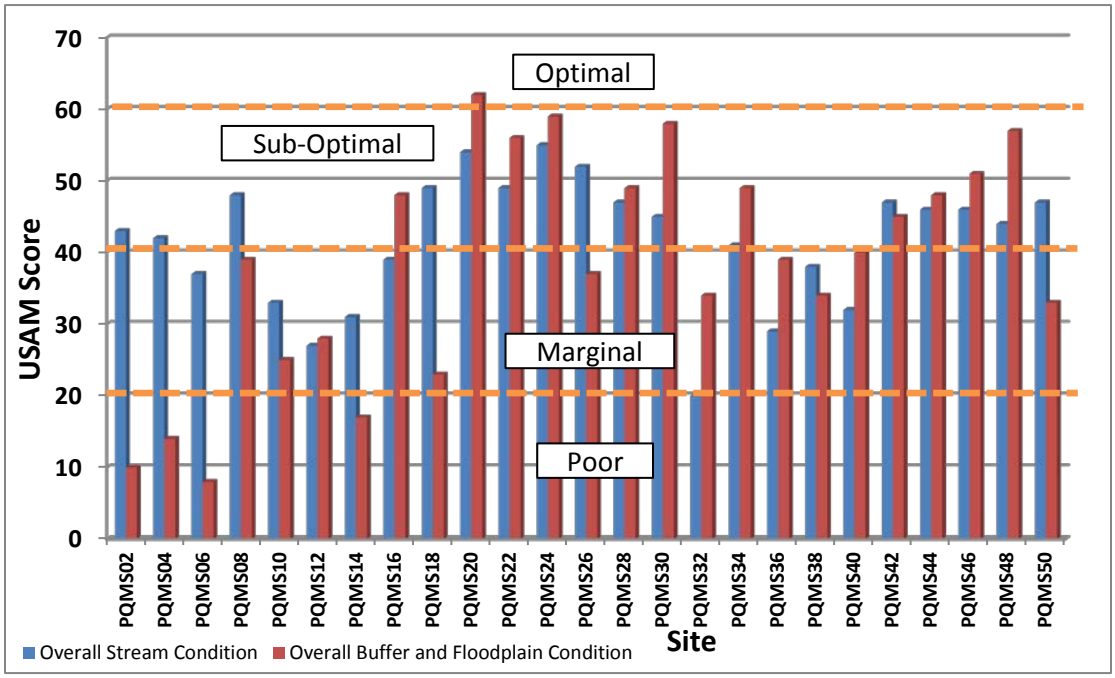


Figure 3-74B: Results for Poquessing Creek Mainstem Watershed USAM Components

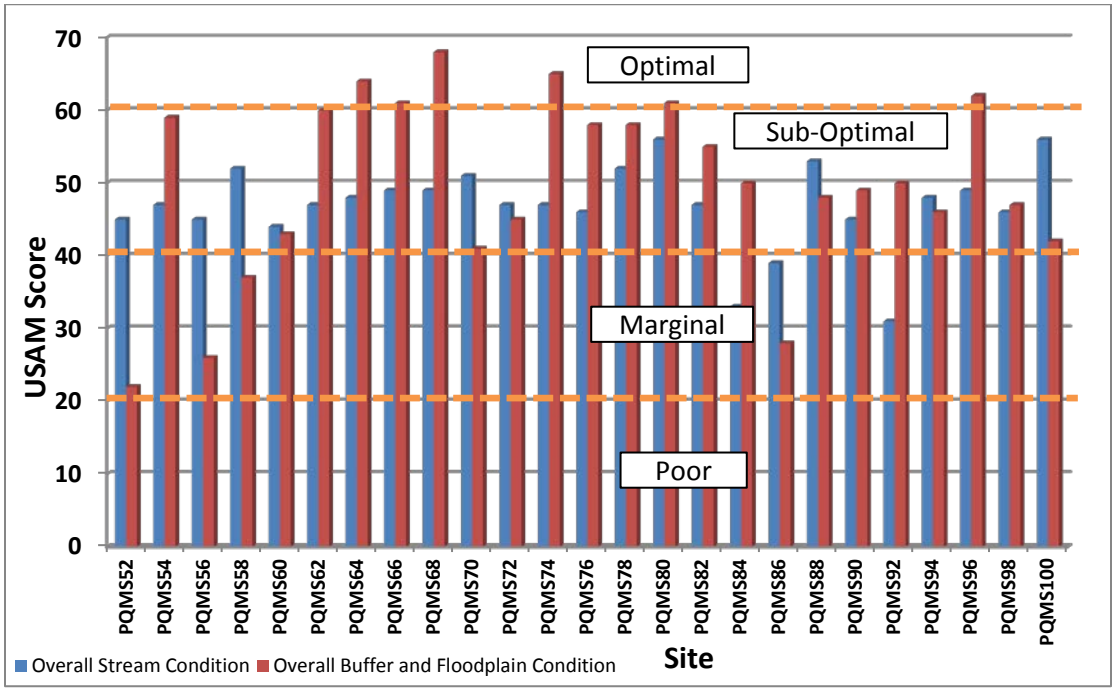


Figure 3-75A: Poquessing Creek Mainstem Watershed USAM Results

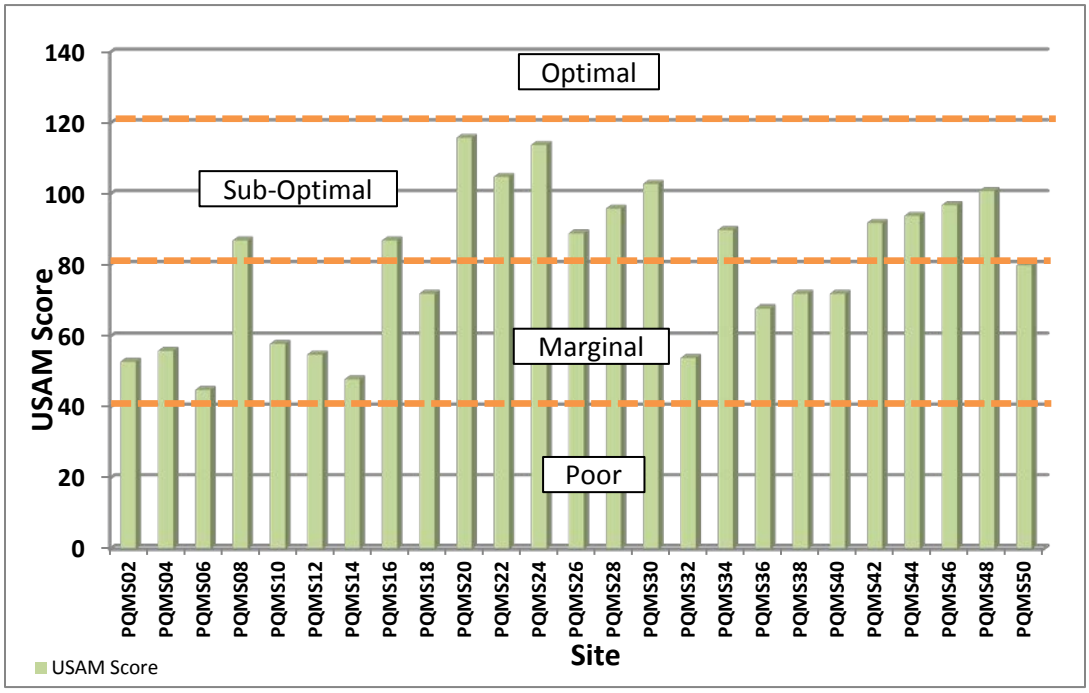
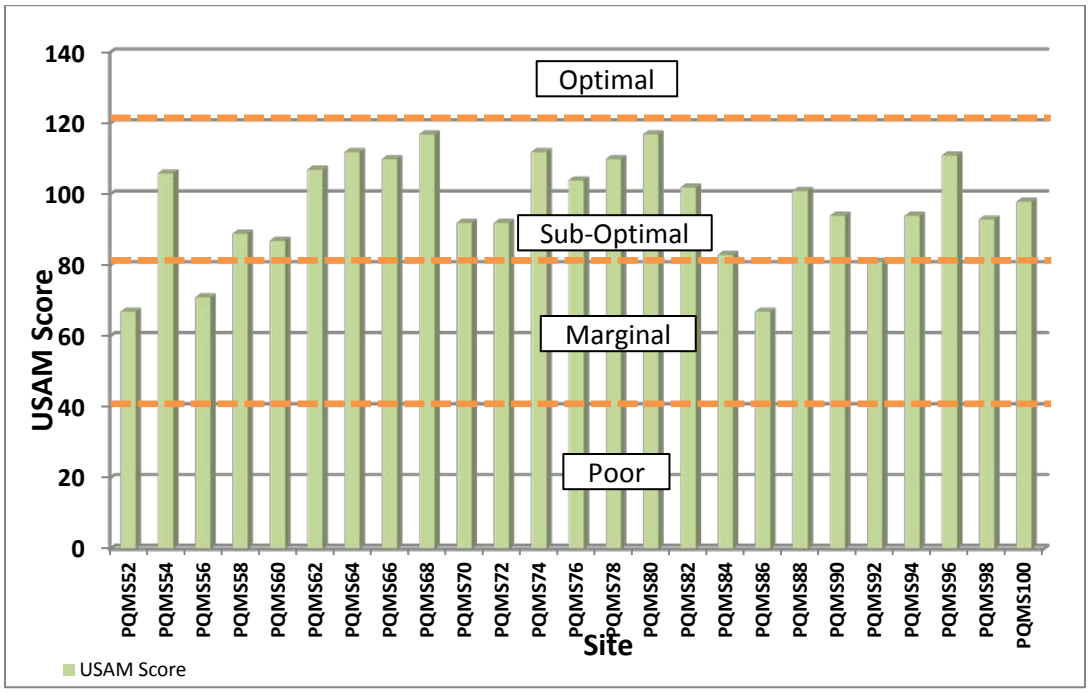


Figure 3-75B: Poquessing Creek Mainstem Watershed USAM Results



3.2.1.5.1 PQMS02

Reach PQMS02 is the first reach of the mainstem of Poquessing Creek. The headwaters of this tributary begin at a stormwater outfall in a dense residential area. Reach PQMS02 is characterized by a shallow slope (1.1%), low width to depth ratio (9.3), a slightly entrenched channel (ER = 3.6), low sinuosity (1.12), and cobble substrate. The reach was classified as an E6 type stream. The composite USAM score for reach PQMS02 was marginal (53/160).

3.2.1.5.2 PQMS04

Reach PQMS04 begins approximately 900 feet upstream of cross section PQMS04. This reach runs through a residential area. Reach PQMS04 is characterized by a shallow slope (0.8%), moderate to high width to depth ratio (14.3), a slightly entrenched channel (ER = 3.0), low sinuosity (1.01), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS04 was marginal (56/160).

3.2.1.5.3 PQMS06

Reach PQMS06 begins approximately 800 feet upstream of cross section PQMS06. The upper portion of this reach runs through a residential area and the lower portion runs through a commercial area and passes under East Street Road. Reach PQMS06 is characterized by a shallow slope (0.6%), low width to depth ratio (10.4), a slightly entrenched channel (ER = 4.4), low sinuosity (1.12), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS06 was marginal (45/160).

3.2.1.5.4 PQMS08

Reach PQMS08 begins approximately 500 feet upstream of cross section PQMS08. This reach begins in a commercial area adjacent to East Street Road but the majority of the reach runs through a residential area with a wooded buffer. Reach PQMS08 is characterized by a shallow slope (0.5%), moderate to high width to depth ratio (16.3), a slightly entrenched channel (ER = 3.2), moderate sinuosity (1.35), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS08 was suboptimal (87/160).

3.2.1.5.5 PQMS10

Reach PQMS10 begins approximately 600 feet upstream of cross section PQMS10. This reach continues through a partially wooded corridor adjacent to a residential area. Reach PQMS10 is characterized by a shallow slope (0.4%), moderate width to depth ratio (13.3), a moderately entrenched channel (ER = 1.7), moderate sinuosity (1.2), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS10 was marginal (58/160).

3.2.1.5.6 PQMS12

Reach PQMS12 begins approximately 500 feet upstream of cross section PQMS12. This reach continues through a partially wooded corridor adjacent to a residential area. The end of this reach passes through a culvert under the Pennsylvania Turnpike (I-276) Reach PQMS12 is characterized by a shallow slope (0.8%), moderate to high width to depth ratio (19.6), a moderately entrenched channel (ER = 1.6), low sinuosity (1.13), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS12 was marginal (55/160).

3.2.1.5.7 PQMS14

Reach PQMS14 begins approximately 600 feet upstream of cross section PQMS14. The upper portion of this reach passes through a residential area. The reach is bisected by Philmont Avenue and the lower portion of the reach passes through a dense commercial area and then a wooded area. There is significant erosion upstream of Philmont Avenue culvert, which is threatening adjacent commercial properties. Reach PQMS14 is characterized by a shallow slope (0.8%), moderate width to depth ratio (14.3), a moderately entrenched channel (ER = 1.7), low sinuosity (1.05), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS14 was marginal (48/160).

3.2.1.5.8 PQMS16

Reach PQMS16 begins approximately 800 feet upstream of cross section PQMS16. This reach continues through a wooded corridor adjacent to residential and industrial areas. This reach gains significant flow from the additions of Unnamed Tributaries C and D prior to passing under Trevose Road. Reach PQMS16 is characterized by a shallow slope (0.5%), very high width to depth ratio (65.7), a slightly entrenched channel (ER = 4.0), low sinuosity (1.07), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS16 was suboptimal (87/160).

3.2.1.5.9 PQMS18

Reach PQMS18 begins approximately 300 feet upstream of cross section PQMS18. This reach continues through a partially wooded corridor with a new development being constructed on the downstream left side and a single residence on the downstream right. This reach enters Poquessing Valley Park. Reach PQMS18 is characterized by a shallow slope (0.3%), low width to depth ratio (11.2), a slightly entrenched channel (ER = 5.9), moderate sinuosity (1.22), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS18 was marginal (72/160).

3.2.1.5.10 PQMS20

Reach PQMS20 begins approximately 700 feet upstream of cross section PQMS20. This reach has a significant wooded buffer as it travels through Poquessing Valley Park. Reach PQMS20 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (19.1), a slightly

entrenched channel (ER = 4.8), low sinuosity (1.13), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS20 was suboptimal (116/160).

3.2.1.5.11 PQMS22

Reach PQMS22 begins approximately 600 feet upstream of cross section PQMS22. This reach continues through Poquessing Valley Park and has large wooded buffer on the downstream left. The end of this reach passes under a rail line and leaves Poquessing Valley Park. Reach PQMS22 is characterized by a shallow slope (0.3%), moderate width to depth ratio (13.9), a slightly entrenched channel (ER = 5.9), low sinuosity (1.09), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS22 was suboptimal (105/160).

3.2.1.5.12 PQMS24

Reach PQMS24 begins approximately 700 feet upstream of cross section PQMS24. This reach travels through a wooded corridor adjacent to a dense residential area on the downstream right and a large wooded area on the downstream left. Reach PQMS24 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (19.0), a slightly entrenched channel (ER = 4.2), low sinuosity (1.17), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS24 was suboptimal (114/160).

3.2.1.5.13 PQMS26

Reach PQMS26 begins approximately 500 feet upstream of cross section PQMS26. This reach runs through a partially wooded corridor with a park on the downstream left and residential area on the right. Reach PQMS26 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (19.5), slightly entrenched channel (ER = 14.2), low sinuosity (1.08), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS26 was suboptimal (89/160).

3.2.1.5.14 PQMS28

Reach PQMS28 begins approximately 600 feet upstream of cross section PQMS28. This reach travels through a wooded corridor between residential and commercial areas. Reach PQMS28 is characterized by a shallow slope (0.3%), low to moderate width to depth ratio (11.0), a slightly entrenched channel (ER = 7.5), low sinuosity (1.07), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS28 was suboptimal (96/160).

3.2.1.5.15 PQMS30

Reach PQMS30 begins approximately 800 feet upstream of cross section PQMS30. This reach travels through a wooded corridor between residential and commercial areas. Reach PQMS30 is characterized by a shallow slope (0.3%), low width to depth ratio (10.1), a slightly entrenched channel (ER = 8.3),

high sinuosity (1.84), and gravel substrate. The reach was classified as an E4 type stream. The composite USAM score for reach PQMS30 was suboptimal (103/160).

3.2.1.5.16 PQMS32

Reach PQMS32 begins approximately 500 feet upstream of cross section PQMS32. This reach goes through the Roosevelt Blvd (US Rt. 1) bridge and continues through a partially wooded corridor. This reach runs between a commercial area on the downstream left and Benjamin Rush State Park on the downstream right. Significant floodplain filling and channelization exists throughout this reach. Reach PQMS32 is characterized by a shallow slope (0.3%), low to moderate width to depth ratio (11.1), a highly entrenched channel (ER = 1.3), low sinuosity (1.16), and cobble substrate. The reach was classified as an A6 type stream. The composite USAM score for reach PQMS32 was marginal (54/160).

3.2.1.5.17 PQMS34

Reach PQMS34 begins approximately 500 feet upstream of cross section PQMS34. This reach continues through a wooded corridor on Benjamin Rush State Park land. A large wooded zone exists on the downstream right while a commercial/residential area is adjacent to the upper portion of the downstream left. Reach PQMS34 is characterized by a shallow slope (0.3%), moderate width to depth ratio (12.8), a slightly entrenched channel (ER = 3.5), moderate sinuosity (1.37), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS34 was suboptimal (90/160).

3.2.1.5.18 PQMS36

Reach PQMS36 begins approximately 800 feet upstream of cross section PQMS36. This reach continues through a partially wooded corridor on Benjamin Rush State Park land. A large wooded zone exists on the downstream right while a commercial/residential area is adjacent to the lower portion of the downstream left. Reach PQMS36 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (18.1), a moderately entrenched channel (ER = 2.0), low sinuosity (1.10), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS36 was marginal (68/160).

3.2.1.5.19 PQMS38

Reach PQMS38 begins approximately 400 feet upstream of cross section PQMS38. This reach continues through a partially wooded corridor on Benjamin Rush State Park land. A large wooded zone exists on the downstream right while a ball field, park area is adjacent to the middle portion of the downstream left. Reach PQMS38 is characterized by a shallow slope (0.4%), moderate width to depth ratio (14.6), a slightly entrenched channel (ER = 4.2), low sinuosity (1.14), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS38 was marginal (72/160).

3.2.1.5.20 PQMS40

Reach PQMS40 begins approximately 600 feet upstream of cross section PQMS40. The upper portion of this reach travels through a wooded corridor on Benjamin Rush State Park land and then travels between residential area and wooded parkland (Poquessing Valley Park). Reach PQMS40 is characterized by a shallow slope (0.4%), high width to depth ratio (72.2), a moderately entrenched channel (ER = 2.1), low sinuosity (1.05), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS40 was marginal (72/160).

3.2.1.5.21 PQMS42

Reach PQMS42 begins approximately 700 feet upstream of cross section PQMS42. This reach continues through a mostly wooded corridor with wooded parkland on the downstream right and residential/commercial area on the downstream left. Reach PQMS42 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (17.0), a slightly entrenched channel (ER = 3.2), low sinuosity (1.11), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS42 was suboptimal (92/160).

3.2.1.5.22 PQMS44

Reach PQMS44 begins approximately 600 feet upstream of cross section PQMS44. This reach continues through a wooded corridor with wooded parkland on the downstream right and commercial area on the lower portion of the downstream left. Reach PQMS44 is characterized by a shallow slope (0.4%), moderate to high width to depth ratio (15.1), a slightly entrenched channel (ER = 5.5), low sinuosity (1.13), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS44 was suboptimal (94/160).

3.2.1.5.23 PQMS46

Reach PQMS46 begins approximately 300 feet upstream of cross section PQMS46. This reach continues through a wooded corridor with wooded parkland on the downstream right and commercial area on the lower portion of the downstream left. Reach PQMS46 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (17.6), a slightly entrenched channel (ER = 3.9), low sinuosity (1.04), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS46 was suboptimal (97/160).

3.2.1.5.24 PQMS48

Reach PQMS48 begins approximately 400 feet upstream of cross section PQMS48. This reach continues through a wooded parkland corridor with some residential properties on the floodplain fringe. Reach PQMS48 is characterized by a shallow slope (0.3%), low to moderate width to depth ratio (12.0), a slightly entrenched channel (ER = 9.8), moderate sinuosity (1.2), and gravel substrate. The reach was

classified as a C4 type stream. The composite USAM score for reach PQMS48 was suboptimal (101/160).

3.2.1.5.25 PQMS50

Reach PQMS50 begins approximately 900 feet upstream of cross section PQMS50. This reach runs through a partially wooded corridor between residential areas. Reach PQMS50 is characterized by a shallow slope (0.3%), low width to depth ratio (11.5), a slightly entrenched channel (ER = 5.0), high sinuosity (1.52), and gravel substrate. The reach was classified as an E4 type stream. The composite USAM score for reach PQMS50 was marginal (80/160).

3.2.1.5.26 PQMS52

Reach PQMS52 begins approximately 700 feet upstream of cross section PQMS52. This reach runs through a mostly wooded corridor except a housing complex and related parking area is very close to the lower portion of the reach on the downstream left side. Reach PQMS52 is characterized by a shallow slope (0.3%), high width to depth ratio (52.2), a slightly entrenched channel (ER = 3.2), moderate sinuosity (1.23), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS52 was marginal (67/160).

3.2.1.5.27 PQMS54

Reach PQMS54 begins approximately 500 feet upstream of cross section PQMS54. The upper portion of the reach travels immediately adjacent to a housing complex until it travels under Dunks Ferry Road. The remaining portion of the reach travels through a densely wooded corridor. Reach PQMS54 is characterized by a shallow slope (0.2%), moderate width to depth ratio (13.3), a slightly entrenched channel (ER = 8.8), low sinuosity (1.16), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS54 was suboptimal (106/160).

3.2.1.5.28 PQMS56

Reach PQMS56 begins approximately 1100 feet upstream of cross section PQMS56. This reach runs through a partially wooded corridor between urban and residential areas. Reach PQMS56 is characterized by a shallow slope (0.2%), moderate width to depth ratio (13.7), a slightly entrenched channel (ER = 5.5), low sinuosity (1.16), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS56 was marginal (71/160).

3.2.1.5.29 PQMS58

Reach PQMS58 begins approximately 800 feet upstream of cross section PQMS58. This reach is closely paralleled by a residential area on the downstream left and has significant parkland, wooded buffer (Poquessing Valley Park) on the downstream right. Reach PQMS58 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (20.6), a slightly entrenched channel (ER = 4.9), low

sinuosity (1.07), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS58 was suboptimal (89/160).

3.2.1.5.30 PQMS60

Reach PQMS60 begins approximately 400 feet upstream of cross section PQMS60. This reach begins after the Poquessing passes under Knights Road. This reach travels through a wooded corridor with the Franklin Mills Mall above the stream valley on the downstream right. A pond on the downstream left at the midpoint of the reach is very close to the creek due to channel erosion. The land on left side above the stream corridor is part of the Bensalem Country Club. Reach PQMS60 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (25.3), a slightly entrenched channel (ER = 4.4), high sinuosity (1.81), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS60 was suboptimal (87/160).

3.2.1.5.31 PQMS62

Reach PQMS62 begins approximately 500 feet upstream of cross section PQMS62. This reach continues through a wooded corridor between the Franklin Mills Mall and Bensalem Country Club. Reach PQMS62 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (18.0), a slightly entrenched channel (ER = 2.8), low sinuosity (1.06), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS62 was suboptimal (107/160).

3.2.1.5.32 PQMS64

Reach PQMS64 begins approximately 800 feet upstream of cross section PQMS64. This reach continues through a wooded corridor between the Franklin Mills Mall and Bensalem Country Club. Reach PQMS64 is characterized by a shallow slope (0.2%), moderate width to depth ratio (14.0), a slightly entrenched channel (ER = 13.3), moderate sinuosity (1.33), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS64 was suboptimal (112/160).

3.2.1.5.33 PQMS66

Reach PQMS66 begins approximately 300 feet upstream of cross section PQMS66. This reach continues through a wooded corridor between the Franklin Mills Mall and a residential area. Reach PQMS66 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (17.0), a slightly entrenched channel (ER = 6.7), low sinuosity (1.10), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS66 was suboptimal (110/160).

3.2.1.5.34 PQMS68

Reach PQMS68 begins approximately 600 feet upstream of cross section PQMS68. This reach continues through a wooded corridor between the Franklin Mills Mall and a residential area. Reach PQMS68 is

characterized by a shallow slope (0.2%), moderate to high width to depth ratio (15.1), a slightly entrenched channel (ER = 8.9), high sinuosity (1.6), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS68 was suboptimal (117/160).

3.2.1.5.35 PQMS70

Reach PQMS70 begins approximately 500 feet upstream of cross section PQMS70. This reach continues through a wooded corridor between the Franklin Mills Mall and a residential area. Reach PQMS70 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (20.10), a slightly entrenched channel (ER = 5.1), moderate sinuosity (1.21), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS70 was suboptimal (92/160).

3.2.1.5.36 PQMS72

Reach PQMS72 begins approximately 500 feet upstream of cross section PQMS72. This reach continues through a wooded corridor between the Franklin Mills Mall and a ballfield park area. Reach PQMS72 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (16.0), a slightly entrenched channel (ER = 6.9), moderate sinuosity (1.23), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS72 was suboptimal (92/160).

3.2.1.5.37 PQMS74

Reach PQMS74 begins approximately 500 feet upstream of cross section PQMS74. This reach continues through a wooded corridor between the Franklin Mills Mall detention basin and a residential area. Reach PQMS74 is characterized by a shallow slope (0.3%), moderate width to depth ratio (14.6), a slightly entrenched channel (ER = 11.1), low sinuosity (1.04), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS74 was suboptimal (112/160).

3.2.1.5.38 PQMS76

Reach PQMS76 begins approximately 600 feet upstream of cross section PQMS76. This reach continues through a wooded corridor between industrial and residential areas. Reach PQMS76 is characterized by a shallow slope (0.2%), moderate width to depth ratio (12.1), a slightly entrenched channel (ER = 5.0), moderate sinuosity (1.20), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS76 was suboptimal (104/160).

3.2.1.5.39 PQMS78

Reach PQMS78 begins approximately 400 feet upstream of cross section PQMS78. This reach travels under Woodhaven Road and then enters a wooded portion of Poquessing Valley Park. A residential development closely parallels the downstream left bank while the right bank has a wide forested buffer. Reach PQMS78 is characterized by a shallow slope (0.2%), high width to depth ratio (74.8), a slightly entrenched channel (ER = 3.8), moderate sinuosity (1.24), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS78 was suboptimal (110/160).

3.2.1.5.40 PQMS80

Reach PQMS80 begins approximately 600 feet upstream of cross section PQMS80. This reach runs through a mostly wooded corridor between urban and residential developments. Reach PQMS80 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (24.9), a slightly entrenched channel (ER = 8.7), low sinuosity (1.10), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS80 was suboptimal (117/160).

3.2.1.5.41 PQMS82

Reach PQMS82 begins approximately 700 feet upstream of cross section PQMS82. This reach continues through a partially wooded corridor between urban and residential areas. Reach PQMS82 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (15.0), a slightly entrenched channel (ER = 6.6), moderate sinuosity (1.26), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS82 was suboptimal (102/160).

3.2.1.5.42 PQMS84

Reach PQMS84 begins approximately 700 feet upstream of cross section PQMS84. This reach continues through a partially wooded corridor between urban and residential areas. The residential development is close the stream channel on the downstream left side. Reach PQMS84 is characterized by a shallow slope (0.2%), high width to depth ratio (69.6), a moderately entrenched channel (ER = 1.9), low sinuosity (1.07), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS84 was suboptimal (83/160).

3.2.1.5.43 PQMS86

Reach PQMS86 begins approximately 500 feet upstream of cross section PQMS86. This reach travels between two residential areas. Reach PQMS86 is characterized by a shallow slope (0.2%), high width to depth ratio (64.1), a moderately entrenched channel (ER = 1.8), high sinuosity (1.71), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS86 was marginal (67/160).

3.2.1.5.44 PQMS88

Reach PQMS88 begins approximately 700 feet upstream of cross section PQMS88. This reach travels through a partially wooded corridor between residential and industrial areas. Reach PQMS88 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (15.0), a slightly entrenched channel (ER = 4.1), low sinuosity (1.08), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS88 was suboptimal (101/160).

3.2.1.5.45 PQMS90

Reach PQMS90 begins approximately 700 feet upstream of cross section PQMS90. This reach goes under Bristol Pike/Frankford Avenue and the upper portion of the reach run between commercial areas. The lower portion of the reach enters a wooded park area between urban and residential properties. Reach PQMS90 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (28.9), a slightly entrenched channel (ER = 2.4), low sinuosity (1.03), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS90 was suboptimal (94/160).

3.2.1.5.46 PQMS92

Reach PQMS92 begins approximately 200 feet upstream of cross section PQMS92. This reach continues through a wooded park corridor between urban, residential, and commercial areas. Reach PQMS92 is characterized by a shallow slope (0.3%), high width to depth ratio (51.0), a moderately entrenched channel (ER = 1.4), low sinuosity (1.07), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQMS92 was suboptimal (81/160).

3.2.1.5.47 PQMS94

Reach PQMS94 begins approximately 200 feet upstream of cross section PQMS94. This reach continues through a wooded park corridor between urban, residential, and commercial areas. Reach PQMS94 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (17.5), a slightly entrenched channel (ER = 3.6), low sinuosity (1.06), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQMS94 was suboptimal (94/160).

3.2.1.5.48 PQMS96

Reach PQMS96 begins approximately 400 feet upstream of cross section PQMS96. This reach continues through a wooded park corridor between an urban area and Mill Road, which parallels Interstate 95. Reach PQMS96 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (17.5), a slightly entrenched channel (ER = 3.3), low sinuosity (1.12), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMS96 was suboptimal (111/160).

3.2.1.5.49 PQMS98

Reach PQMS98 begins approximately 400 feet upstream of cross section PQMS98. This reach continues through a wooded park corridor between Nazareth Academy High School and Mill Road, which parallels I-95. Reach PQMS98 is characterized by a shallow slope (0.3%), moderate width to depth ratio (13.5), a slightly entrenched channel (ER = 2.5), low sinuosity (1.02), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMS98 was suboptimal (93/160).

3.2.1.5.50 PQMS100

Reach PQMS100 begins approximately 400 feet upstream of cross section PQMS100. This tidally influenced portion of Poquessing Creek runs under I-95 through and residential, commercial, and industrial areas prior to entering the Delaware River. An unnamed tributary enters from the west in the upper portion of this reach. Reach PQMS100 is characterized by a shallow slope (0.3%), low width to depth ratio (10.3), a slightly entrenched channel (ER = 7.2), moderate sinuosity (1.22), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQMS100 was suboptimal (98/160).

3.2.1.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

A total of fifty reaches were analyzed for the Poquessing Creek mainstem watershed. The mean scores for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM score were all classified as suboptimal (Table 3-110). Average conditions within the Poquessing Creek Watershed's stream channels were similar to conditions observed within the buffers and floodplains in terms of quality. The watershed averages for the Overall Stream Condition and Overall Buffer and Floodplain components as well as the composite USAM were higher than the respective All Reaches averages. The scores for individual parameters ranged from poor to optimal, with many of the lower scoring parameters occurring within the upper reaches (PQMS02-PQMS20). Graphs of each USAM category rating are in Appendix D.

3.2.1.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE POQUESSING CREEK 1 WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal, with most occurring in the marginal range. The Instream Habitat and Floodplain Connection had most of the suboptimal and optimal scores, particularly Floodplain Connection which had 39 reaches out of 50 score within the optimal range. The mean watershed score (44.3/80.0) was rated as suboptimal and was higher than the All Reaches average score (37.1/80.0) which was classified as marginal.

Table 3-103: USAM Results for Poquessing Creek mainstem Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQMS02	Poquessing Creek	43	10	53
PQMS04	Poquessing Creek	42	14	56
PQMS06	Poquessing Creek	37	8	45
PQMS08	Poquessing Creek	48	39	87
PQMS10	Poquessing Creek	33	25	58
PQMS12	Poquessing Creek	27	28	55
PQMS14	Poquessing Creek	31	17	48
PQMS16	Poquessing Creek	39	48	87
PQMS18	Poquessing Creek	49	23	72
PQMS20	Poquessing Creek	54	62	116
PQMS22	Poquessing Creek	49	56	105
PQMS24	Poquessing Creek	55	59	114
PQMS26	Poquessing Creek	52	37	89
PQMS28	Poquessing Creek	47	49	96
PQMS30	Poquessing Creek	45	58	103
PQMS32	Poquessing Creek	20	34	54
PQMS34	Poquessing Creek	41	49	90
PQMS36	Poquessing Creek	29	39	68
PQMS38	Poquessing Creek	38	34	72
PQMS40	Poquessing Creek	32	40	72
PQMS42	Poquessing Creek	47	45	92
PQMS44	Poquessing Creek	46	48	94
PQMS46	Poquessing Creek	46	51	97
PQMS48	Poquessing Creek	44	57	101
PQMS50	Poquessing Creek	47	33	80
PQMS52	Poquessing Creek	45	22	67
PQMS54	Poquessing Creek	47	59	106
PQMS56	Poquessing Creek	45	26	71
PQMS58	Poquessing Creek	52	37	89
PQMS60	Poquessing Creek	44	43	87
PQMS62	Poquessing Creek	47	60	107
PQMS64	Poquessing Creek	48	64	112
PQMS66	Poquessing Creek	49	61	110
PQMS68	Poquessing Creek	49	68	117
PQMS70	Poquessing Creek	51	41	92
PQMS72	Poquessing Creek	47	45	92
PQMS74	Poquessing Creek	47	65	112
PQMS76	Poquessing Creek	46	58	104
PQMS78	Poquessing Creek	52	58	110
PQMS80	Poquessing Creek	56	61	117
PQMS82	Poquessing Creek	47	55	102
PQMS84	Poquessing Creek	33	50	83
PQMS86	Poquessing Creek	39	28	67
PQMS88	Poquessing Creek	53	48	101
PQMS90	Poquessing Creek	45	49	94
PQMS92	Poquessing Creek	31	50	81
PQMS94	Poquessing Creek	48	46	94
PQMS96	Poquessing Creek	49	62	111

PQMS98	Poquessing Creek	46	47	93
PQMS100	Poquessing Creek	56	42	98
PQMS Mean		44.3	44.2	88.4
All Reaches Average		37.1	37.4	74.4

Table 3-104: USAM Overall Stream Condition Scoring for Poquessing Creek Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQMS02	Poquessing Creek	5	1	1	8	8	20	43
PQMS04	Poquessing Creek	8	5	1	6	2	20	42
PQMS06	Poquessing Creek	8	1	2	2	4	20	37
PQMS08	Poquessing Creek	13	5	4	2	4	20	48
PQMS10	Poquessing Creek	12	3	5	2	4	7	33
PQMS12	Poquessing Creek	11	3	4	1	2	6	27
PQMS14	Poquessing Creek	13	4	2	4	1	7	31
PQMS16	Poquessing Creek	7	3	3	3	3	20	39
PQMS18	Poquessing Creek	9	6	4	5	5	20	49
PQMS20	Poquessing Creek	11	7	6	6	4	20	54
PQMS22	Poquessing Creek	11	5	6	3	4	20	49
PQMS24	Poquessing Creek	13	6	6	5	5	20	55
PQMS26	Poquessing Creek	13	4	7	4	4	20	52
PQMS28	Poquessing Creek	11	5	5	3	3	20	47
PQMS30	Poquessing Creek	10	5	4	4	2	20	45
PQMS32	Poquessing Creek	7	3	2	4	1	3	20
PQMS34	Poquessing Creek	12	3	2	3	1	20	41
PQMS36	Poquessing Creek	12	2	1	2	2	10	29
PQMS38	Poquessing Creek	8	2	2	3	3	20	38
PQMS40	Poquessing Creek	11	1	4	1	4	11	32
PQMS42	Poquessing Creek	11	3	5	3	5	20	47
PQMS44	Poquessing Creek	10	7	3	2	4	20	46
PQMS46	Poquessing Creek	11	3	6	2	4	20	46
PQMS48	Poquessing Creek	10	4	4	3	3	20	44
PQMS50	Poquessing Creek	13	3	5	1	5	20	47
PQMS52	Poquessing Creek	12	4	4	1	4	20	45
PQMS54	Poquessing Creek	9	4	4	5	5	20	47
PQMS56	Poquessing Creek	12	3	3	4	3	20	45
PQMS58	Poquessing Creek	13	5	5	5	4	20	52
PQMS60	Poquessing Creek	11	4	4	2	3	20	44
PQMS62	Poquessing Creek	13	5	5	2	4	18	47
PQMS64	Poquessing Creek	13	5	5	2	3	20	48
PQMS66	Poquessing Creek	11	5	6	4	3	20	49
PQMS68	Poquessing Creek	11	4	5	4	5	20	49
PQMS70	Poquessing Creek	14	4	5	2	6	20	51
PQMS72	Poquessing Creek	10	5	3	5	4	20	47
PQMS74	Poquessing Creek	7	4	6	4	6	20	47
PQMS76	Poquessing Creek	7	5	5	5	4	20	46
PQMS78	Poquessing Creek	10	6	6	5	5	20	52
PQMS80	Poquessing Creek	14	5	6	5	6	20	56
PQMS82	Poquessing Creek	12	4	3	4	4	20	47
PQMS84	Poquessing Creek	7	4	4	4	5	9	33

PQMS86	Poquessing Creek	8	5	7	5	6	8	39
PQMS88	Poquessing Creek	14	6	5	6	2	20	53
PQMS90	Poquessing Creek	10	5	6	4	6	14	45
PQMS92	Poquessing Creek	9	4	4	5	5	4	31
PQMS94	Poquessing Creek	9	5	4	5	5	20	48
PQMS96	Poquessing Creek	12	5	4	4	4	20	49
PQMS98	Poquessing Creek	12	6	5	3	5	15	46
PQMS100	Poquessing Creek	14	6	7	5	4	20	56
PQMS Mean		10.7	4.2	4.3	3.6	4.0	17.4	44.3
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.2.1.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter were mostly within the marginal and suboptimal range, with one score of poor for Reach PQMS02. A poor rating reflects less than 20% stable habitat and unstable or lacking substrate. Nineteen reaches were rated marginal, or with a 20-40% mix of stable habitat with less than desirable availability and a disturbed or removed substrate. Thirty reaches displayed a suboptimal scoring, which indicates a 40-70% mix of stable habitat, well suited for colonization and adequate for maintenance of populations. The watershed mean was slightly higher than the All Reaches average 10.7/20.0 vs. 8.2/10.0) though both were rated as marginal. Sedimentation was the primary contributor to impaired habitat in mainstem channel.

3.2.1.6.1.2 VEGETATIVE PROTECTION

Scores for vegetative protection for the fifty reaches analyzed for the Poquessing mainstem watershed ranged from poor to suboptimal, with most reaches scoring within the marginal range. The poorer scoring reaches were limited to the upper reaches of the Poquessing mainstem. A poor score indicates streambanks with less than 50% coverage by vegetation and a high degree of disturbance of vegetation. Factors contributing to these poorer scores within the upper reaches include the encroachment of development on the stream channel and bank erosion. The lower reaches generally had a wider forested buffer although vegetation was impacted by erosion throughout the length of the mainstem. The All Reaches averages for both banks were slightly lower than the Poquessing Creek mainstem watershed mean (4.0/10.0 vs. 4.2/10.0, LB and 3.9/10.0 vs. 4.3/10.0, RB), although both the watershed mean and All Reaches average were characterized as marginal.

3.2.1.6.1.3 BANK EROSION

Bank erosion within the fifty reaches analyzed for the Poquessing Creek mainstem watershed ranged from poor to suboptimal and like vegetative protection, most of the poorer scoring reaches were limited to the upper reaches. A poor score reflects active downcutting, tall banks with fast erosion rates and significant sediment contribution to the stream. The majority of reaches analyzed scored within the marginal range, indicating past downcutting events, active stream widening and a moderate erosion rate. The mean watershed scores for the left and right banks were both (3.6/10.0 and 4.0/10.0) rated as marginal, as were the All Reaches averages for the left and right banks (3.9/10.0 and 4.0/10.0).

3.2.1.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection scores for the Poquessing Creek mainstem watershed were very high. Of the fifty reaches analyzed, thirty-nine reaches had optimal ratings, reflecting high flows easily able to enter the floodplain and no deep stream entrenchment. Three reaches were suboptimal, similar to optimal conditions, but to a lesser degree. Six reaches were rated as marginal, indicating high flows not able to enter the floodplain with deep stream entrenchment. Two reaches were characterized as poor, also reflecting high flows not able to enter the floodplain and stream entrenchment, but to a greater degree than the marginal rating. The mean for the Poquessing Creek mainstem watershed was higher than for all reaches with a score of 17.4/20.0 (optimal) as compared to 13.0/20.0 (suboptimal).

Floodplain connection scores are based on the ratio of flood prone width to bankfull width. This is also known as entrenchment ratio. The relatively high bankfull flow predictions in the watershed result in a prediction of a wide flood prone width in many cases. Therefore, it is predicted that relatively frequent flood events will exceed the channel capacity and reach adjacent floodplains.

Table 3-105: USAM Buffer and Floodplain Condition Scoring for Poquessing Creek Mainstem Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQMS02	Poquessing Creek	1	1	2	2	4	10
PQMS04	Poquessing Creek	3	1	3	2	5	14
PQMS06	Poquessing Creek	0	2	1	2	3	8
PQMS08	Poquessing Creek	8	4	10	12	5	39
PQMS10	Poquessing Creek	3	5	7	5	5	25
PQMS12	Poquessing Creek	2	7	7	6	6	28
PQMS14	Poquessing Creek	4	3	6	2	2	17
PQMS16	Poquessing Creek	7	8	11	9	13	48
PQMS18	Poquessing Creek	6	3	5	3	6	23
PQMS20	Poquessing Creek	10	9	17	10	16	62
PQMS22	Poquessing Creek	10	7	11	16	12	56
PQMS24	Poquessing Creek	10	7	14	14	14	59
PQMS26	Poquessing Creek	4	7	8	7	11	37
PQMS28	Poquessing Creek	6	9	13	9	12	49
PQMS30	Poquessing Creek	9	8	16	12	13	58
PQMS32	Poquessing Creek	4	8	11	8	3	34
PQMS34	Poquessing Creek	8	10	16	6	9	49
PQMS36	Poquessing Creek	6	9	12	1	11	39
PQMS38	Poquessing Creek	3	9	10	2	10	34
PQMS40	Poquessing Creek	3	9	11	6	11	40
PQMS42	Poquessing Creek	7	9	13	7	9	45
PQMS44	Poquessing Creek	5	10	14	10	9	48
PQMS46	Poquessing Creek	5	10	14	13	9	51
PQMS48	Poquessing Creek	8	10	16	8	15	57
PQMS50	Poquessing Creek	2	7	5	11	8	33
PQMS52	Poquessing Creek	1	9	4	5	3	22

PQMS54	Poquessing Creek	10	10	17	9	13	59
PQMS56	Poquessing Creek	2	5	6	11	2	26
PQMS58	Poquessing Creek	3	9	7	13	5	37
PQMS60	Poquessing Creek	6	8	11	12	6	43
PQMS62	Poquessing Creek	9	8	14	16	13	60
PQMS64	Poquessing Creek	9	8	15	17	15	64
PQMS66	Poquessing Creek	9	7	14	17	14	61
PQMS68	Poquessing Creek	9	9	19	13	18	68
PQMS70	Poquessing Creek	3	9	15	9	5	41
PQMS72	Poquessing Creek	2	9	11	9	14	45
PQMS74	Poquessing Creek	9	8	17	13	18	65
PQMS76	Poquessing Creek	8	9	17	11	13	58
PQMS78	Poquessing Creek	8	9	18	14	9	58
PQMS80	Poquessing Creek	6	9	17	14	15	61
PQMS82	Poquessing Creek	6	7	16	12	14	55
PQMS84	Poquessing Creek	2	9	12	12	15	50
PQMS86	Poquessing Creek	3	2	7	6	10	28
PQMS88	Poquessing Creek	5	7	16	11	9	48
PQMS90	Poquessing Creek	5	9	12	13	10	49
PQMS92	Poquessing Creek	6	6	13	13	12	50
PQMS94	Poquessing Creek	6	7	13	8	12	46
PQMS96	Poquessing Creek	8	8	17	14	15	62
PQMS98	Poquessing Creek	5	8	15	12	7	47
PQMS100	Poquessing Creek	9	2	13	13	5	42
PQMS Mean		5.7	7.3	11.8	9.6	9.9	44.2
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.2.1.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE POQUESSING CREEK MAINSTEM WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were mostly in the marginal (14 reaches) and suboptimal (25 reaches) ranges. Four reaches were rated as poor and were confined to the upper portion of the Poquessing Creek. Seven reaches were rated as optimal and were mostly confined to the lower portion. The mean component score for the Poquessing Creek mainstem watershed (44.2/80.0) was higher than the All Reaches average (37.4/80.0), giving the Poquessing Creek mainstem watershed an overall buffer and floodplain rating of suboptimal. The All Reaches average was classified as marginal. The improved function of the floodplains in this watershed can be attributed to the existence of forested buffers along much of the mid and lower portions of the mainstem stream channel. Much of this land is protected parkland although some private, forested parcels exist.

3.2.1.6.2.1 VEGETATED BUFFER WIDTH

The fifty reaches analyzed for the Poquessing Creek mainstem watershed had vegetated buffer width scores ranging from poor to optimal. The left banks scores were lower than the scores for the right banks. Left bank vegetated buffer widths tended to mostly be in the marginal and suboptimal range with a few

optimal and poor scoring reaches. The right banks vegetated width scores were heavily represented in the suboptimal and optimal range, with few reaches scoring within the poor and marginal range. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity and no impact while suboptimal indicates a buffer width of 25-50 feet and minimal human impact. Marginal and poor scoring reaches have narrower buffer zones still and much greater impact from human activities. Factors contributing to the overall better quality of the right banks of the Poquessing Creek mainstem watershed include the protection of this side of the stream in parkland. The mean watershed score of 5.7/10.0 for the left bank was slightly higher than 5.3/10.0 for the All Reaches average, although both are considered marginal. The mean watershed score for the right bank was also higher than the All Reaches average (7.3/10.0 vs. 6.0/10.00), both having a rating of suboptimal.

3.2.1.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type within the Poquessing Creek mainstem watershed was young forest (suboptimal), with twenty-two reaches scoring in that range. Mature forest was the dominant vegetation type in thirteen reaches (optimal). Shrub vegetation was dominant in nine reaches (marginal) and turf was dominant in six reaches (poor). Poor and marginal vegetation was mostly represented in association with the upper reaches of the Poquessing Creek mainstem watershed while the lower reaches reflected more of the forested portions of the watershed. This was due to the forested floodplain that existed in many of the middle and lower reaches while the upper reaches traveled through residential and commercial areas. The mean Poquessing Creek Watershed score (11.8/20.0) was rated as suboptimal, which was higher than the All Reaches average (9.7/20.0) which was rated as marginal.

3.2.1.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat within the Poquessing Creek mainstem watershed ranged from poor to optimal, with most reaches scoring within the marginal to suboptimal range. Nine reaches were characterized as poor and were located within the upper reaches of the watershed. A poor rating reflects either all wetland or non-wetland habitat and no evidence of standing or ponded water. Sixteen reaches were characterized as marginal or having all wetland or non-wetland habitat but with evidence of standing/ponded water. Twenty-one reaches received suboptimal scoring, indicating an even mix of wetland and non-wetland habitat but without evidence of standing/ponded water. Four reaches were rated as optimal, reflecting an even mix of habitat with evidence of standing/ponded water. Most of the suboptimal and optimal rated reaches were located in the lower portion of the watershed. This was due to the forested floodplain that existed in many of the middle and lower reaches. The mean watershed score for this parameter (9.6/20.0) was rated as marginal and was slightly higher than the All Reaches average score (8.3/20.0), also considered marginal.

3.2.1.6.2.4 FLOODPLAIN ENCROACHMENT

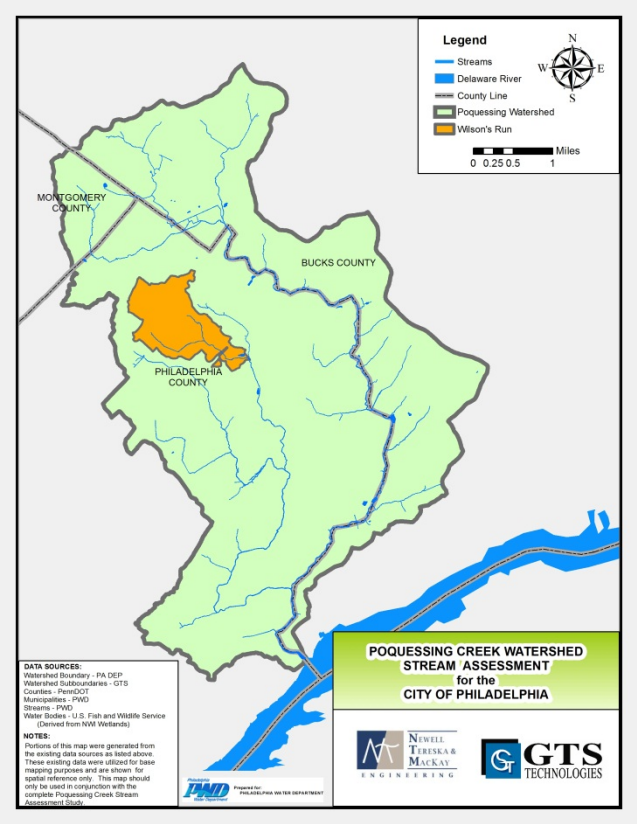
Scores for the Floodplain Encroachment parameter ranged from poor to optimal throughout the Poquessing Creek mainstem watershed. As with other components, the poorer scores tended to be associated with the

upper reaches of the watershed, while the higher scoring components were most likely found within the lower portion of the watershed. Twelve reaches were rated as poor or with significant floodplain encroachment and significant effect on floodplain function. Fourteen reaches were characterized as marginal, reflecting moderate encroachment with some effect on floodplain function. Twenty reaches were classified as suboptimal, having minor encroachment with no effect on floodplain function. Optimal ratings were given to four reaches that exhibited no evidence of floodplain encroachment. The mean score for the watershed was (9.9/20.0) which was slightly higher than the All Reaches average score of (8.2/20.0), both scores being within the marginal range.

3.3 BYBERRY CREEK TRIBUTARY WATERSHEDS

Byberry Creek Tributaries are defined as direct tributaries to the mainstem of Byberry Creek. The watershed characteristics of each direct tributary are described in the following section. Small Tributaries to the Byberry Creek were defined as those having only one cross section and representative reach. In the subsequent section, "Small Tributary Average" refers to the average USAM score of the respective metric.

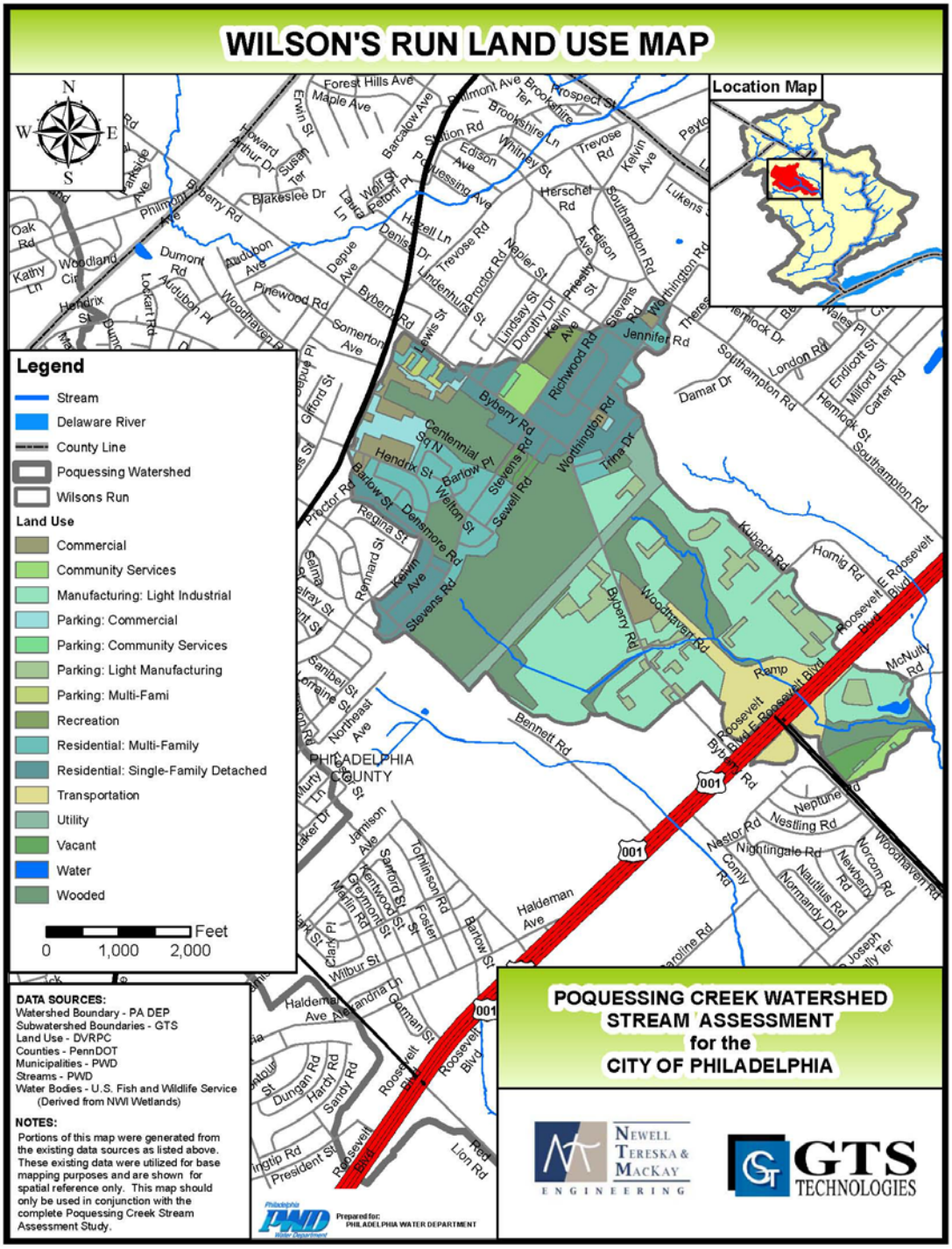
3.3.1 WILSON'S RUN WATERSHED AND REACH CHARACTERISTICS



Wilson's Run is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Wilson's Run originates from stormwater drainage and flow from Wilson's Run Unnamed Tributary A. Wilson's Run flows for approximately 2,000 feet until a 3,500 feet tributary enters Wilson's Run approximately 1,900 feet from the confluence with the Byberry Creek mainstem. The dominant substrate varies from sand to cobble material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Wilson's Run Watershed is 603 acres. Major land use types within the watershed include: manufacturing: light industrial (26%) and wooded (26%). Wilson's Run and Wilson's Run Unnamed Tributary A is surrounded by wooded land on both sides for the majority of the reach. The wooded buffer ranges from about 50 feet to about 400 feet wide.

Figure 3-76: Wilson's Run Watershed Land Use



3.3.1.1 GEOLOGY

The majority of the Wilson's Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

There is one small section within the Wilson's Run Watershed that is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consists of quartz and sand.

3.3.1.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the majority of soils for the entire Wilson's Run Watershed are classified as urban soils (74%). This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely. A mixture of soils from hydrologic groups B, C, and D are also found in the Wilson's Run Watershed.

Table 3-106: Distribution of NRCS Soil Types in Wilson's Run Watershed

Group	Area (acres)	Percent of Total Area
B	100.4	17%
C	22.7	4%
D	36.0	6%
Urban	443.7	74%
Total Area	602.9	100%

3.3.1.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for seven reaches in the Wilson's Run Watershed (Table 3-107). Six reaches were found to be eroding based on the total wetted perimeter calculation, while one was aggrading. The average total erosion rate for all reaches in the Wilson's Run Watershed was near the average for all Poquessing Creek subwatersheds (Table 3-108). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-77: Geology of Wilson's Run Watershed

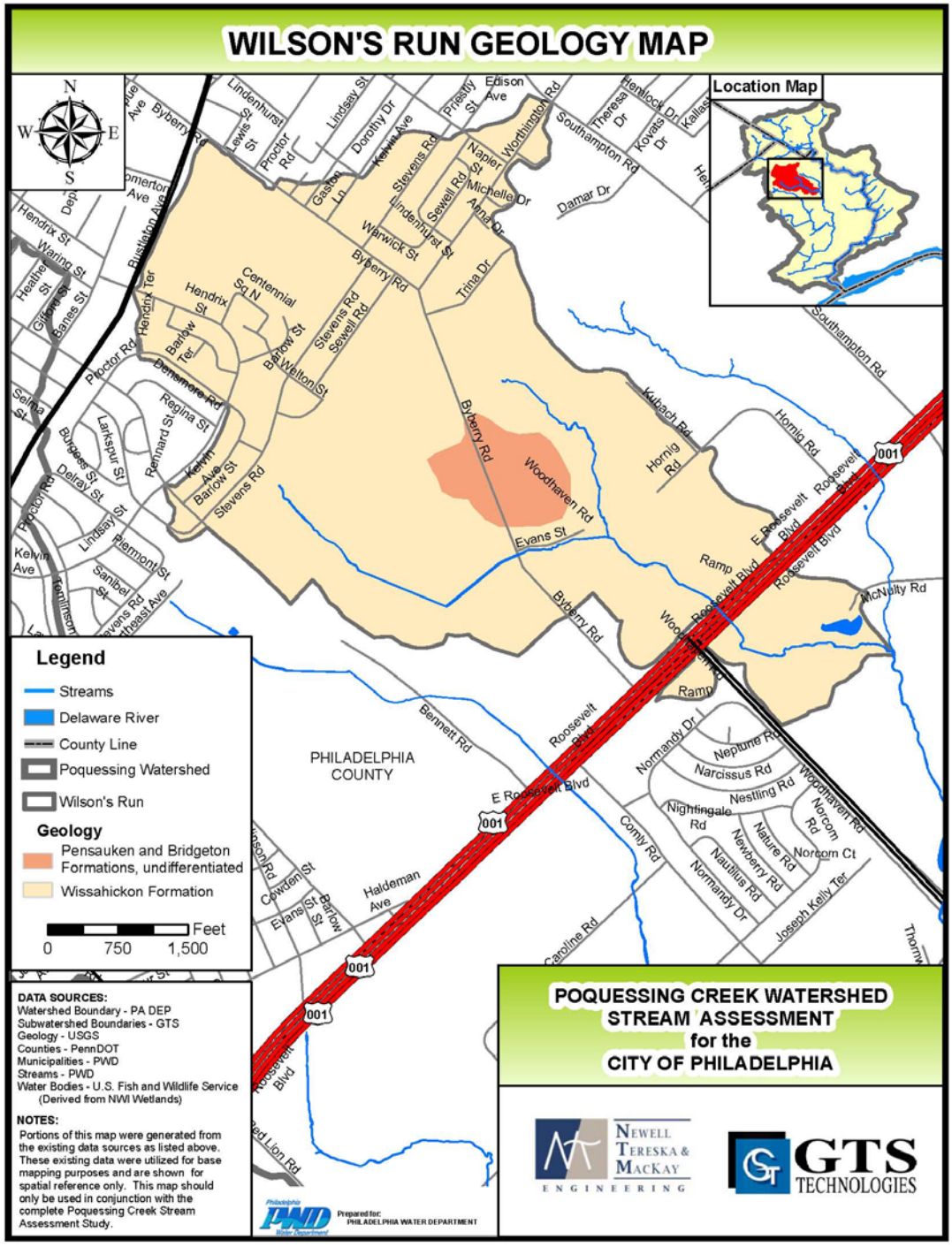


Figure 3-78: Distribution of NRCS Soil Types in Wilson's Run Watershed

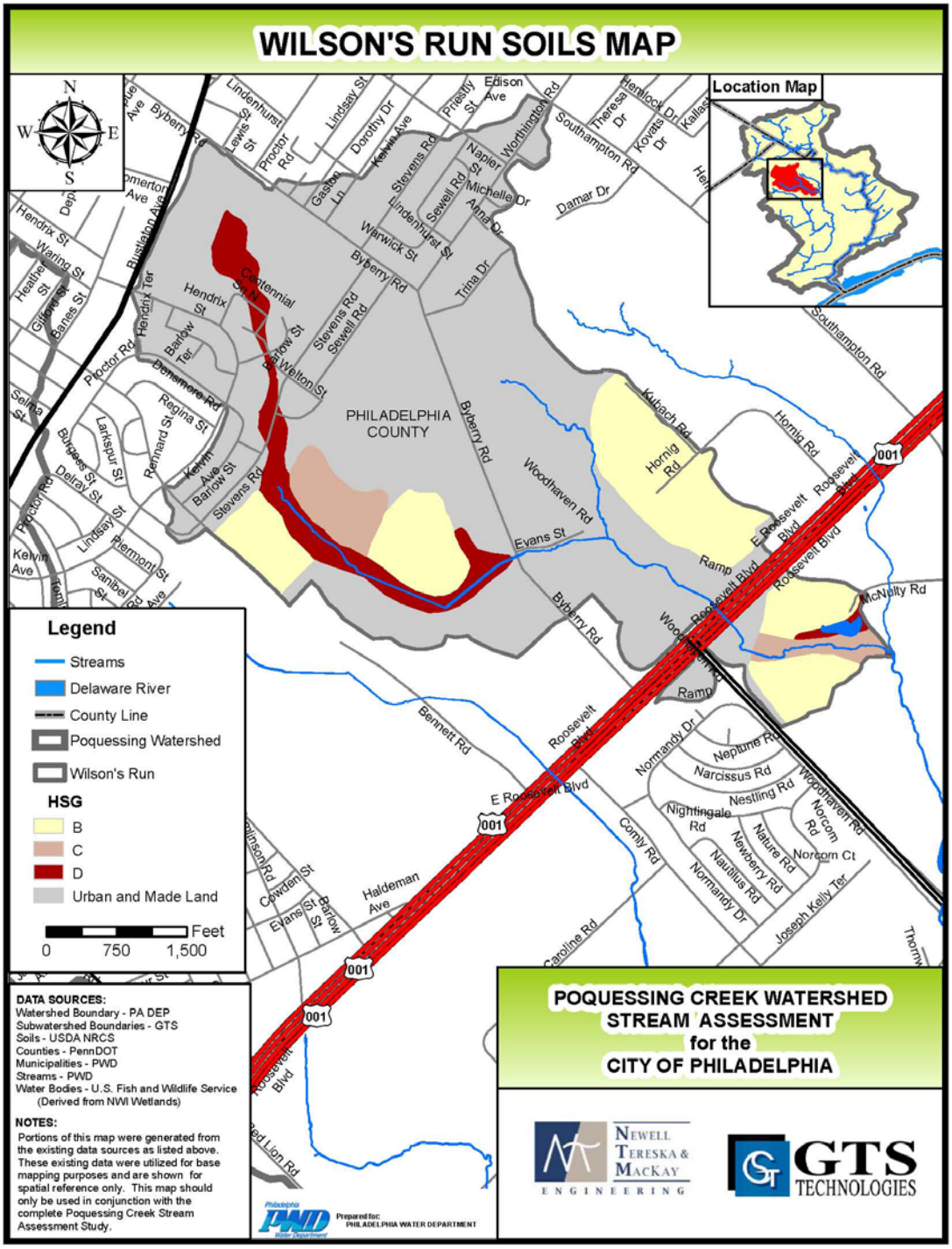


Table 3-107: Erosion Rates for Wilson's Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQWI02	0.000	-0.181	-4.187	-0.281	-0.056	E
PQWI04	-1.519	-0.125	0.520	-0.108	-0.022	E
PQWI06	-0.714	-0.283	-1.599	-0.310	-0.062	E
PQWI08	2.770	-0.185	-4.913	-0.170	-0.034	E
PQWIA02	0.333	-0.183	-15.105	-0.328	-0.066	E
PQWIA04	0.104	0.043	-0.208	0.008	0.002	A
PQWIA06	-0.242	-0.102	-1.234	-0.194	-0.039	E
Average	0.105	-0.145	-3.818	-0.198	-0.040	E

Table: 3-108: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.1.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Wilson's Run is a small tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Wilson's Run lies in a mainly wooded area with commercial development close by. At the downstream end and closer to the confluence, the land use patterns become mainly commercial and light manufacturing development before reaching the confluence with Byberry Creek. The majority of infrastructure was located at cross section PQWI06 mainly in the form of outfalls. This cross section is in the area of Woodhaven Road. There were 15 outfalls located along Wilson's Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 1.3 to 5.0 feet in diameter. The number of outfalls (Table 3-109) on this stream indicates that it is heavily influenced by stormwater discharges in the downstream-most segments of PQWI06 and PQWI08.

There were ten culverts along Wilson's Run that conveyed the stream under transportation corridors. Culvert PQcul111 is a 226-foot long by 5-foot high by 8-foot wide concrete box culvert that conveys flow under Woodhaven Road. This culvert is described as being in good condition. PQcul114 is a 370-foot long by 8-foothigh by 8-foot wide concrete box culvert, in good condition, that conveys flow under Roosevelt Boulevard, another major transportation corridor in this area.

Along Wilson's Run, most infrastructure elements were considered in fair or good condition. Outfall PQoout257 is described as being in poor condition. This outfall has a 2-foot diameter opening and is constructed of a clay/terra cotta material and is located approximately 800 feet upstream of the confluence of Wilson's Run Unnamed Tributary A and Wilson's Run. No other infrastructure is considered to be in poor condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-109: Summary of Wilson's Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQWI02	1	0	0	0	0	0	0	0	1
PQWI04	0	0	1	0	0	0	0	0	1
PQWI06	1	0	6	5	0	0	1	0	13
PQWI08	2	0	6	0	3	0	1	0	12
PQWIA02	0	1	0	0	0	0	0	0	1
PQWIA04	4	0	0	0	0	0	0	0	4
PQWIA06	2	0	2	2	2	0	0	4	12
TOTAL	10	1	15	7	5	0	2	4	44

3.3.1.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream reach of the Wilson's Run stream channel is a second-order, single thread channel with one small, unnamed tributary. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-79: Results for Wilson's Run Watershed USAM Components

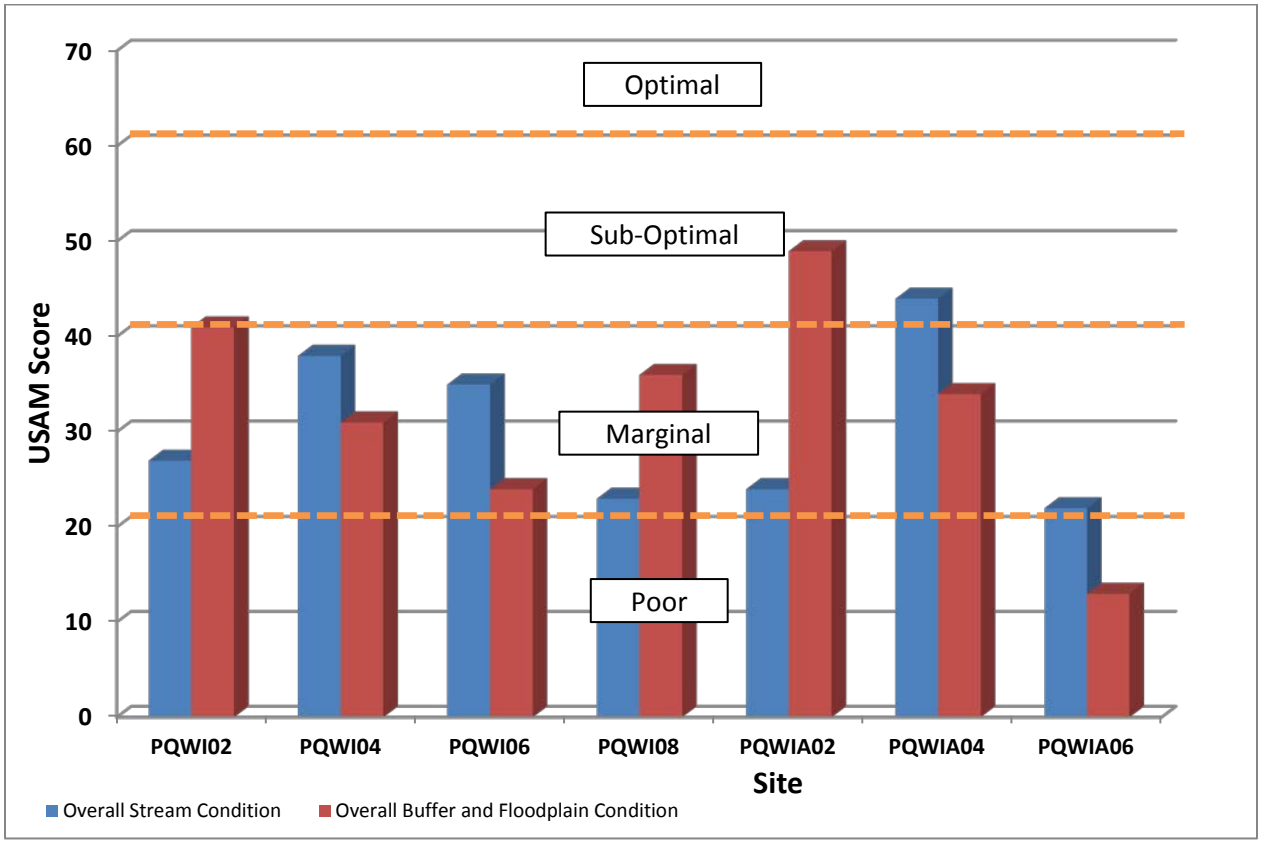
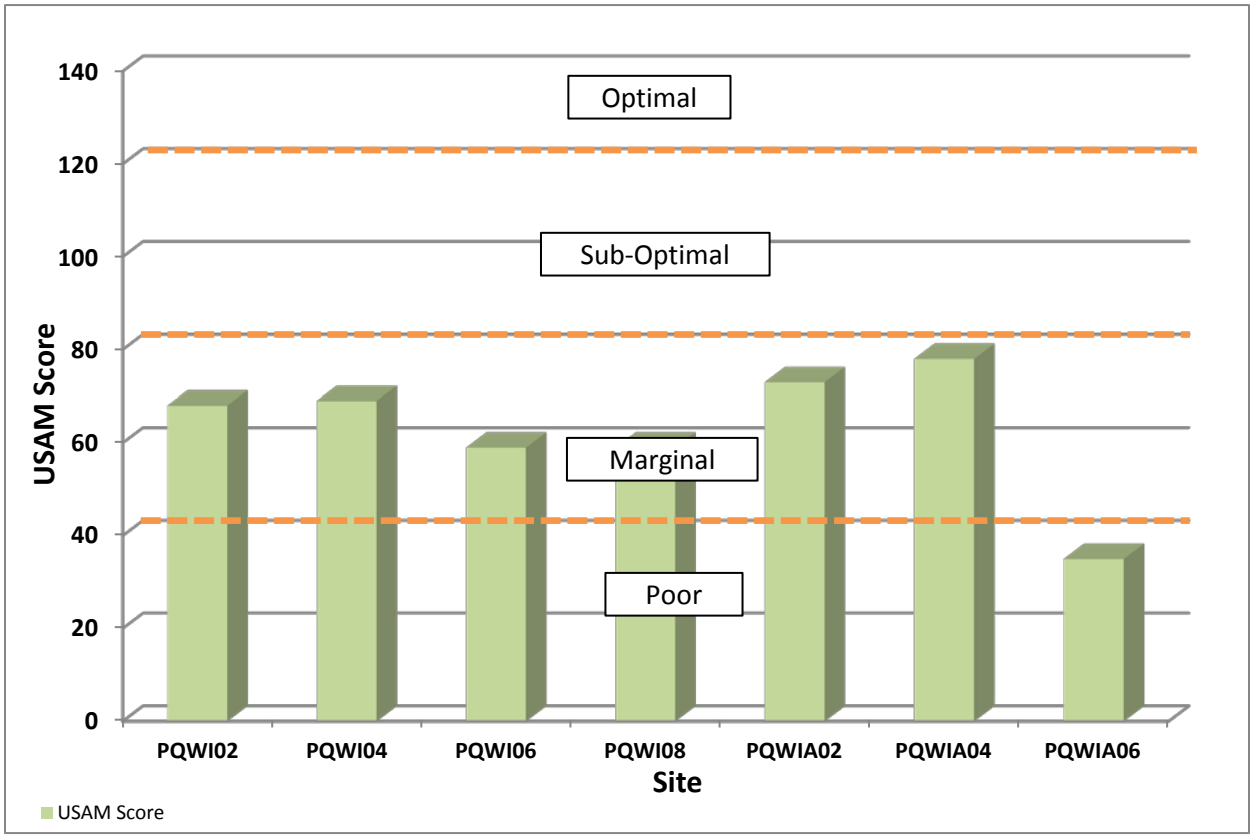


Figure 3-80: Wilson's Run Watershed USAM Results



3.3.1.5.1 PQWI02

Reach PQWI02 is the first reach of Wilson's Run. The headwaters of this tributary begin at a stormwater outfall near Byberry Road. This reach is closely paralleled on the right side by an industrial area. The downstream left side has a significant wooded buffer. Reach PQWI02 is characterized by a shallow slope (1.0%), moderate to high width to depth ratio (30.2), a highly entrenched channel (ER = 1.2), low sinuosity (1.19), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQWI02 was marginal (68/160).

3.3.1.5.2 PQWI04

Reach PQWI04 begins approximately 300 feet upstream of cross section PQWI04. This reach runs through a mostly wooded area with surrounding industrial area. Reach PQWI04 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (12.4), a moderately entrenched channel (ER = 2.0), low sinuosity (1.05), and cobble substrate. The reach was classified as a B6c type stream. The composite USAM score for reach PQWI04 was marginal (69/160).

3.3.1.5.3 PQWI06

Reach PQWI06 begins approximately 600 feet upstream of cross section PQWI06. This reach runs through a wooded area surrounded by industrial and residential development before entering into PQWIA08. Reach PQWI06 is characterized by a shallow slope (0.7%), low width to depth ratio (11.8), a moderately entrenched channel (ER = 1.7), low sinuosity (1.08), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQWI06 was marginal (59/160).

3.3.1.5.4 PQWI08

Reach PQWI08 begins approximately 800 feet upstream of cross section PQWI08. This reach runs under Roosevelt Boulevard through a culvert into an area of mixed wooded, industrial and residential development before reaching the mainstem of Poquessing Creek. Reach PQWI06 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (23.6), a highly entrenched channel (ER = 1.2), moderate sinuosity (1.21), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQWI06 was marginal (59/160).

3.3.1.5.5 PQWIA02

Reach PQWIA02 is the first reach of Wilson's Run Unnamed Tributary A. The entire portion of this reach runs through a wooded area before entering PQWIA04. Reach PQWIA02 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (33.4), a highly entrenched channel (ER = 1.2), low sinuosity (1.04), and sand substrate. The reach was classified as a F5 type stream. The composite USAM score for reach PQWIA02 was marginal (73/160).

3.3.1.5.6 PQWIA04

Reach PQWIA04 begins approximately 200 feet upstream of cross section PQWIA04. The upper portion of this reach runs through a wooded area and the lower half through large culvert and channelized reach in an area of industrial development. Reach PQWIA04 is characterized by a shallow slope (0.6%), low width to depth ratio (8.6), a slightly entrenched channel (ER = 3.0), low sinuosity (1.02), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQWIA04 was marginal (78/160).

3.3.1.5.7 PQWIA06

Reach PQWIA06 begins approximately 600 feet upstream of cross section PQWIA06. The upper portion of this reach runs through a small wooded buffer surrounded by industrial development before reaching the mainstem of Wilson's Run. Reach PQWIA06 is characterized by a shallow slope (0.6%), low width to depth ratio (10.0), a moderately entrenched channel (ER = 1.5), low sinuosity (1.06), and gravel substrate. The reach was classified as a A4 type stream. The composite USAM score for reach PQWIA06 was poor (35/160).

3.3.1.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Seven reaches were analyzed for the Wilson's Run Watershed. The mean scores for the Overall Stream Condition components, the Overall Buffer and Floodplain components as well as the composite USAM score were classified as marginal (Table 3-110). Overall Stream Condition components scores were mostly within the marginal range, except for Reach PQWIA04, which warranted a rating of suboptimal. Overall Buffer and Floodplain components showed a little more variability with four reaches classified as marginal (PQWI04, PQWI06, PQWI08 and PQWIA04), two reaches (PQWI02 and PQWIA02) classified as suboptimal and one reach (PQWIA06) classified as poor. USAM scores for the individual reaches were almost entirely within the marginal range except for Reach PQWIA06, which was classified as poor. The watershed averages for the Overall Stream Condition components, Overall Buffer and Floodplain Components as well as the composite USAM were all slightly lower than the respective All Reaches averages. Graphs of each USAM category rating are in Appendix D.

Table 3-110: USAM Results for Wilson's Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQWI02	Wilson's Run	27	41	68
PQWI04	Wilson's Run	38	31	69
PQWI06	Wilson's Run	35	24	59
PQWI08	Wilson's Run	23	36	59
PQWIA02	Wilson's Run	24	49	73
PQWIA04	Wilson's Run	44	34	78
PQWIA06	Wilson's Run	22	13	35
PQWI Mean		30.4	32.6	63.0
All Reaches Average		37.1	37.4	74.4

3.3.1.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE WILSON'S RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis showed little variation and were mostly within the marginal range with only a few components characterized as poor. No components were rated in the suboptimal or optimal range.

Table 3-111: USAM Overall Stream Condition Scoring for Wilson's Run Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQWI02	Wilson's Run	7	5	5	4	4	2	27
PQWI04	Wilson's Run	8	5	5	5	5	10	38
PQWI06	Wilson's Run	9	5	5	4	5	7	35
PQWI08	Wilson's Run	9	4	2	4	2	2	23
PQWIA02	Wilson's Run	2	5	5	5	5	2	24
PQWIA04	Wilson's Run	4	5	5	5	5	20	44
PQWIA06	Wilson's Run	8	2	3	2	2	5	22
PQWI Mean		6.7	4.4	4.3	4.1	4.0	6.8	30.4
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.3.1.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter for most reaches analyzed were entirely within the marginal range except for reaches PQWIA02 and PQWIA04 which were both classified as poor. A poor rating indicates unstable or lacking substrate and less than 20% stable habitat. A marginal rating indicates a 20-40% mix of stable habitat. The watershed mean was smaller than the All Reaches average (6.7/20 vs. 8.2/20). There was a lack of pool/riffle complexes and significant sedimentation in the channel which accounted for the lower habitat scores.

3.3.1.6.1.2 VEGETATIVE PROTECTION

Both banks of the seven reaches analyzed for the Wilson's Run Watershed scored mostly within the marginal range with the exception of the right bank of reach PQWI08 and the left bank of reach PQWIA06. A marginal rating reflects 50-70% of the streambank covered with vegetation with some disturbance apparent in the form of bare soil or close cropped vegetation. A poor rating indicates less than 50% vegetation with a higher rate of disturbance. The All Reaches averages for both banks were slightly lower than the Wilson's Run Watershed (4.0 vs. 4.4, LB and 3.9 vs. 4.3, RB).

3.3.1.6.1.3 BANK EROSION

Most reaches analyzed for the Wilson's Run Watershed scored within the marginal range with the exception of the right bank of reach PQWI08 and the left and right bank of reach PQWIA06, which were classified as poor. A rating of marginal indicates active stream widening and erosion at a moderate rate while a poor rating reflects active downcutting at a fast rate and significant sediment contribution to the stream. The mean watershed scores for the left bank scored slightly higher than the All Reaches Average (4.1 vs. 3.9), both being considered marginal. The mean watershed score and the All Reaches Average for the right bank were both the same with a score of 4.0 or marginal.

3.3.1.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection scores for the Wilson's Run Watershed were the only Overall stream Condition component that showed some variation, ranging from poor to optimal. Of the seven reaches analyzed, four reaches (PQWI02, PQWI08, PQWIA02, and PQWIA06) were classified as poor, indicating that these reaches were deeply entrenched and high flows were not making it into the floodplain. Two reaches (PQWI04 and PQWI06) were classified as marginal. A marginal rating also reflects high flows and deep entrenchment with floodwaters not able to enter the floodplain, just to a lesser degree. Reach PQWIA04 achieved an optimal classification indicating very little entrenchment and floodwaters easily entering the floodplain. The mean for the Wilson's Run Watershed was much lower than for all reaches with a score of 6.3 as compared to 13, giving this watershed an overall suboptimal rating.

3.3.1.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE WILSON'S RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis showed greater variation than those in the Overall Stream Condition category. The mean component score for the Wilson's Run Watershed (32.6/80.0) was less than the All Reaches average (37.4/80.0). The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being development and its associated infrastructure.

Table 3-112: USAM Buffer and Floodplain Condition Scoring for Wilson's Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQWI02	Wilson's Run	7	8	12	8	6	41
PQWI04	Wilson's Run	3	9	9	5	5	31
PQWI06	Wilson's Run	4	5	7	6	2	24
PQWI08	Wilson's Run	7	9	9	7	4	36
PQWIA02	Wilson's Run	6	6	17	12	8	49
PQWIA04	Wilson's Run	4	5	11	13	1	34
PQWIA06	Wilson's Run	1	3	4	4	1	13
PQWI Mean		4.6	6.4	9.8	7.8	3.8	32.5
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.3.1.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank vegetated buffer for the seven reaches analyzed ranged from poor to suboptimal while the widths of the right bank ranged from poor to optimal. Reaches PQWI02 and PQWIA02 had both banks rated as suboptimal. Reaches PQWI06 and PQWIA04 had both banks rated as marginal. Reach PQWI04 had a marginal left bank and an optimal right bank. Reach PQWI08 had a suboptimal left bank and an optimal right bank. Reach PQWIA06 had a poor left bank and a marginal right bank. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity while a poor rating indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities. Suboptimal and marginal reflect varying degrees in between. The mean watershed score of 4.6/10.0 for the left bank was slightly less than 5.3/10.0 for the all reaches average. The mean watershed score for the right bank was slightly higher than the all reaches average (6.4/10.0 vs. 6.0/10.0).

3.3.1.6.2.2 FLOODPLAIN VEGETATION

The floodplain vegetation ratings for the seven reaches analyzed within the Wilson's Run Watershed also ranged from poor to optimal. Reach PQWIA06 was rated as poor or a predominant floodplain vegetation type of turf or crop. Three reaches (PQWI04, PQWI06, and PQWI08) had marginal ratings reflecting a vegetation type of shrub. Reaches PQWI02 and PQWIA04 had suboptimal ratings indicating the presence of young forest. Only one reach (PQWIA02) had an optimal rating, reflecting mature floodplain forest. The mean Wilson's Run Watershed score (9.8/20.0) was rated as marginal, which was slightly higher than the All Reaches average (9.7/20), also considered marginal.

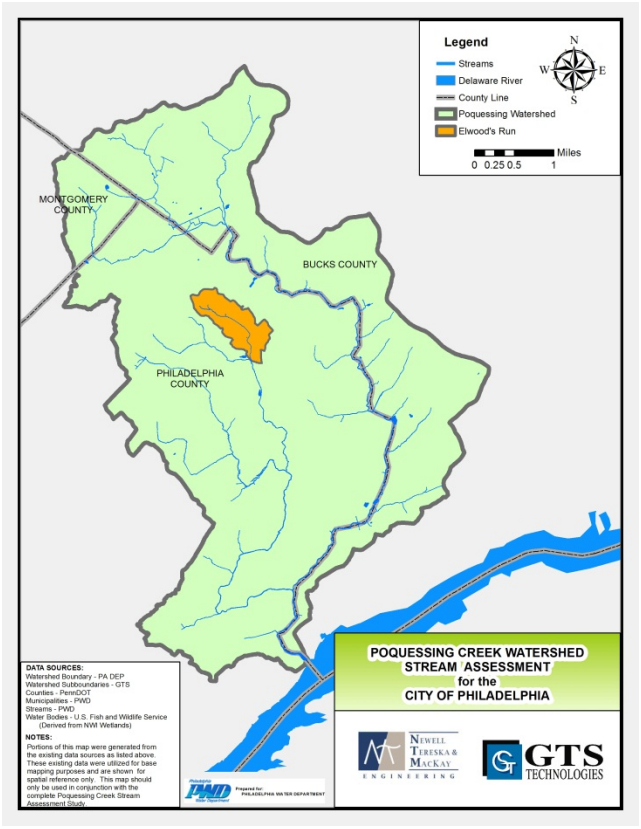
3.3.1.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was varied throughout the Wilson's Run Watershed with scores for the seven reaches analyzed ranging from poor to suboptimal. Three reaches (PQWI02, PQWI06, and PQWI08) were classified as marginal or characterized by all wetland or non-wetland habitat, with evidence of ponding or standing water. Reaches PQWIA02 and PQWIA04 had ratings of suboptimal, characterized by an even mix of both wetland and non-wetland habitat and no standing water observed. Two reaches (PQWI04 and PQWIA06) were classified as poor, or all wetland or non-wetland habitat with no evidence of ponding/standing water. The mean watershed score for this parameter (7.8/20.0) was rated as marginal and was slightly lower than the All Reaches average score (8.3/20) which was also considered marginal.

3.3.1.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter were either poor or marginal for the seven reaches analyzed throughout the Wilson's Run Watershed because of adjacent floodplain development. Poorly rated reaches included reach PQWI04, PQWI06, PQWI08, PQWIA04 and PQWIA06, indicating significant floodplain encroachment and resulting significant effect on floodplain function. Marginal rated reaches were PQWI02 and PQWIA02, reflecting moderate floodplain encroachment with some effect on floodplain function. The mean score for the watershed was (3.8/20) which was much lower than the All Reaches average score of (8.2/20), giving the Wilson's Run Watershed an overall rating of poor.

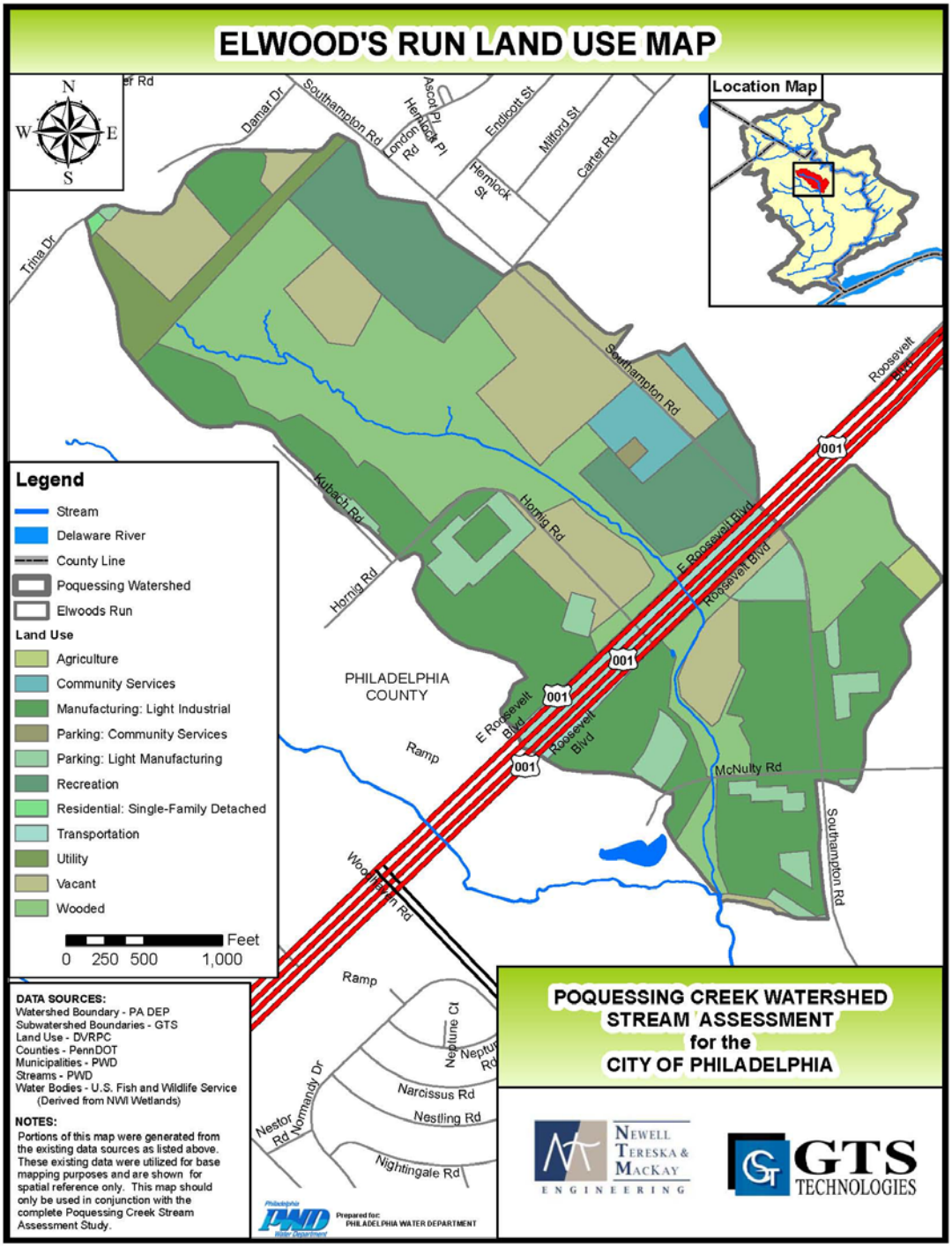
3.3.2 ELWOOD'S RUN WATERSHED AND REACH CHARACTERISTICS



Elwood's Run is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Elwood's Run originates from drainage from the surrounding area. Elwood's Run flows for approximately 5,700 feet from the confluence with Byberry Creek. The dominant substrate varies from gravel to silt and clay material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Elwood's Run Watershed is 271 acres. Major land use types within the watershed include: manufacturing: light industrial (26%), wooded (26%) and residential: single-family detached (15%). Elwood's Run is surrounded by wooded land on both sides. The wooded buffer ranges from about 100 feet to about 1,000 feet wide.

Figure 3-81: Elwood's Run Watershed Land Use



3.3.2.1 GEOLOGY

The majority of the Elwood's Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

There is one small section within the Elwood's Run Watershed that is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

3.3.2.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of Elwood's Run Watershed are classified as hydrologic group B and urban soils. Soils in hydrologic group B have a moderate rate of infiltration when saturated. Water movement through these soils is moderately rapid. The depth to any restrictive layer is greater than 50 cm (20 inches) and to a permanent water table is deeper than 60 cm (2 feet). Soils categorized as urban have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely. Hydrologic groups C and D are also present in the Elwood's Run Watershed.

Table 3-113: Distribution of NRCS Soil Types in Elwood's Run Watershed

Group	Area (acres)	Percent of Total Area
B	111.9	41%
C	31.5	12%
D	15.4	6%
Urban	112.2	41%
Total Area	271.1	100%

3.3.2.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for four reaches in Elwood's Run (Table 3-114). Three reaches were found to be eroding based on the total wetted perimeter calculation, while one was aggrading. The average total erosion rate for all reaches in Elwood's Run was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-115). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-82: Geology of Elwood's Run Watershed

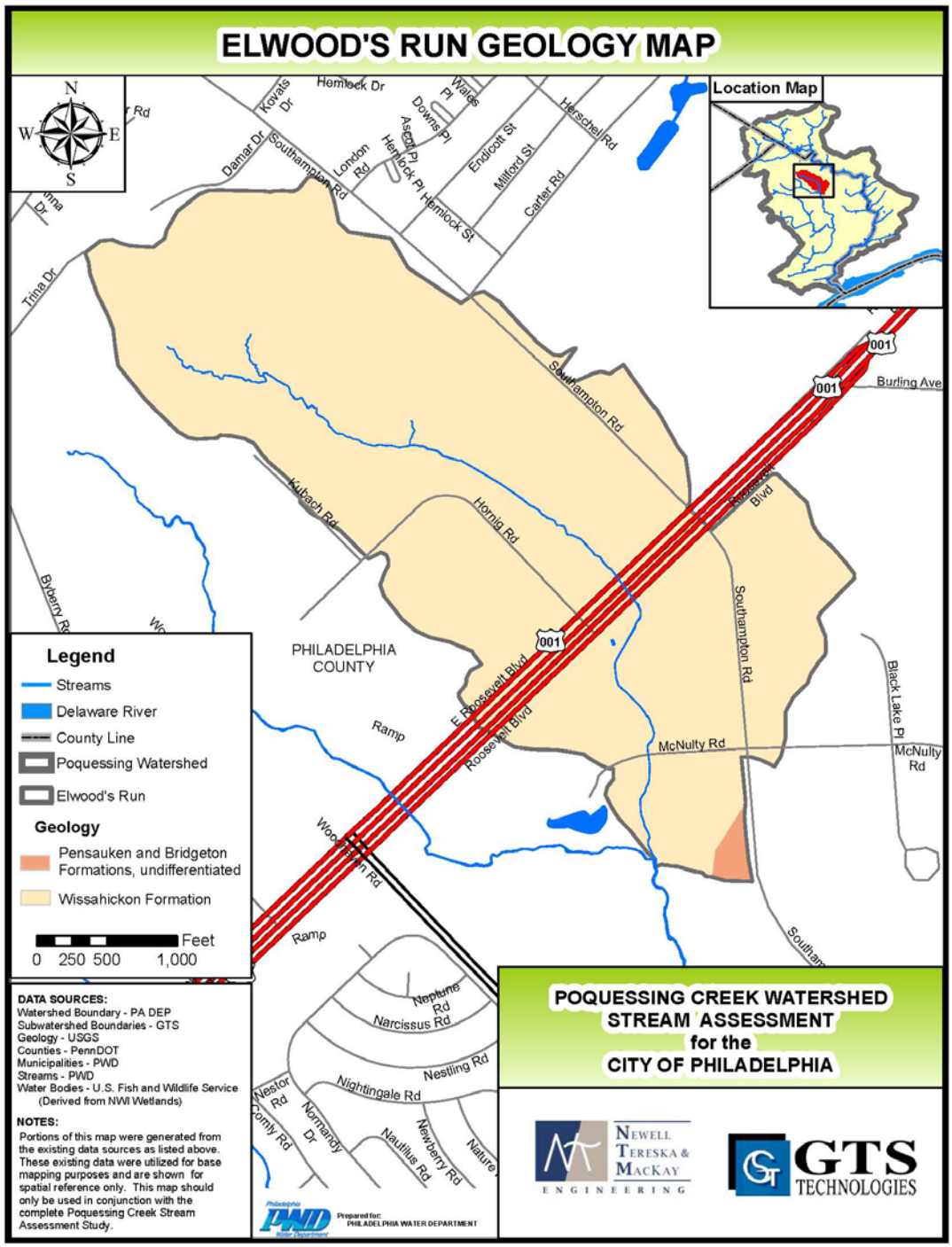


Figure 3-83: Distribution of NRCS Soil Types in Elwood's Run Watershed

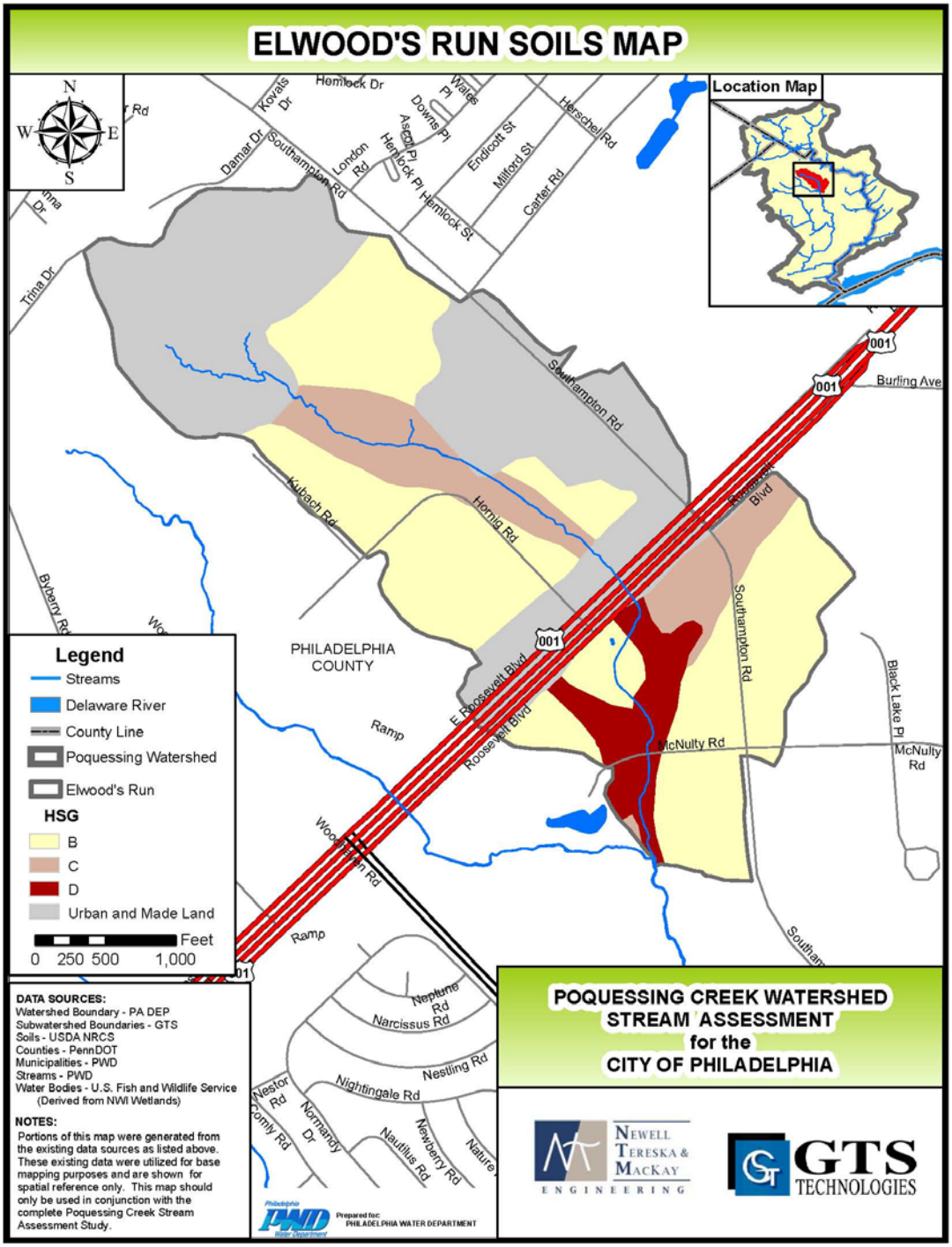


Table 3-114: Erosion Rates for Elwood's Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQER02	-0.517	-0.046	0.203	-0.057	-0.011	E
PQER04	-2.513	-0.400	-3.683	-0.551	-0.110	E
PQER06	0.338	-0.117	-1.049	-0.145	-0.029	E
PQER08	0.259	0.010	-0.158	0.012	0.002	A
PQER10	0.290	-0.037	-1.555	-0.145	-0.029	E
Average	-0.428	-0.118	-1.248	-0.177	-0.035	E

Table 3-115: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.2.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Elwood's Run is a small tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Elwood's Run lies in a mainly wooded area with light industrial manufacturing development close by. At the downstream end and closer to the confluence, the land use patterns remain the same and flow under Roosevelt Boulevard, U.S. Route 1, before reaching the confluence with Byberry Creek. The downstream portion of Elwood's Run exhibits some of the impairments associated with urban streams given its location and proximity to light manufacturing development and a major transportation route that surrounds the stream channel. The majority of infrastructure was located at cross section PQER08 mainly in the form of outfalls. This cross section is in the area of Roosevelt Boulevard. There were 16 outfalls located along Elwood's Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.8 to 3.0 feet in diameter. The number of outfalls (Table 3-116) on this stream indicates that it is heavily influenced by stormwater discharges in the downstream segments of PQER08.

There were five culverts along Elwood's Run that conveyed the stream under transportation corridors: PQcul117, PQcul118, PQcul119, PQcul120 and PQcul121. Culvert PQcul120 is a 285 feet long 560 concrete box culvert that conveys flow under Roosevelt Boulevard. Along Elwood's Run, all infrastructure elements were considered in good condition or better. A 2-foot high by 20-foot wide dam exists upstream of Roosevelt Boulevard at PQER06 and is considered in good condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-116: Summary of Elwood's Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQER02	1	0	1	0	0	0	0	0	2
PQER04	0	0	0	0	0	0	0	0	0
PQER06	2	0	1	0	0	0	1	0	4
PQER08	1	0	12	0	0	0	0	0	13
PQER10	1	0	2	0	0	0	0	0	3
TOTAL	5	0	16	0	0	0	1	0	22

3.3.2.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream section of the Elwood's Run stream channel is a second-order, single thread channel with two, short unnamed tributaries. Elwood's Run is a tributary to Byberry Creek which is a tributary to the mainstem of Poquessing. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of

the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-84: Results for Elwood's Run Watershed USAM Components

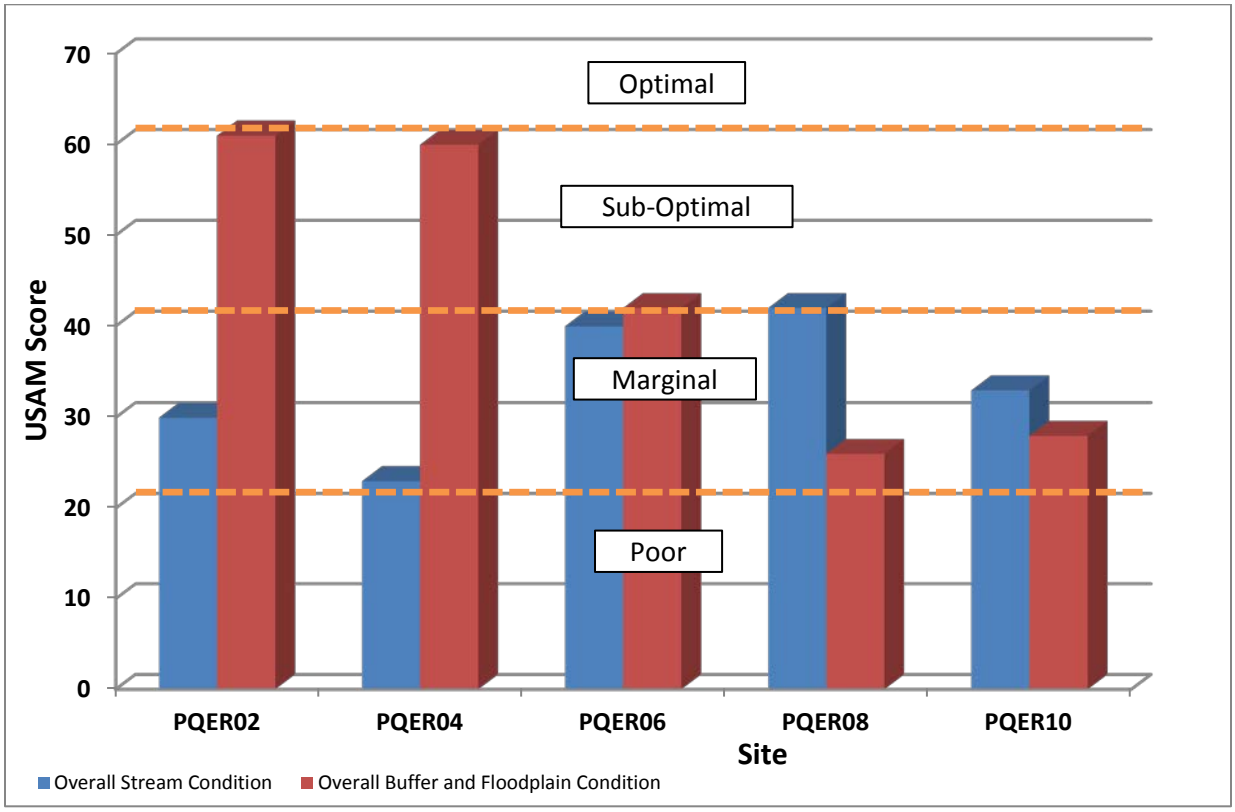
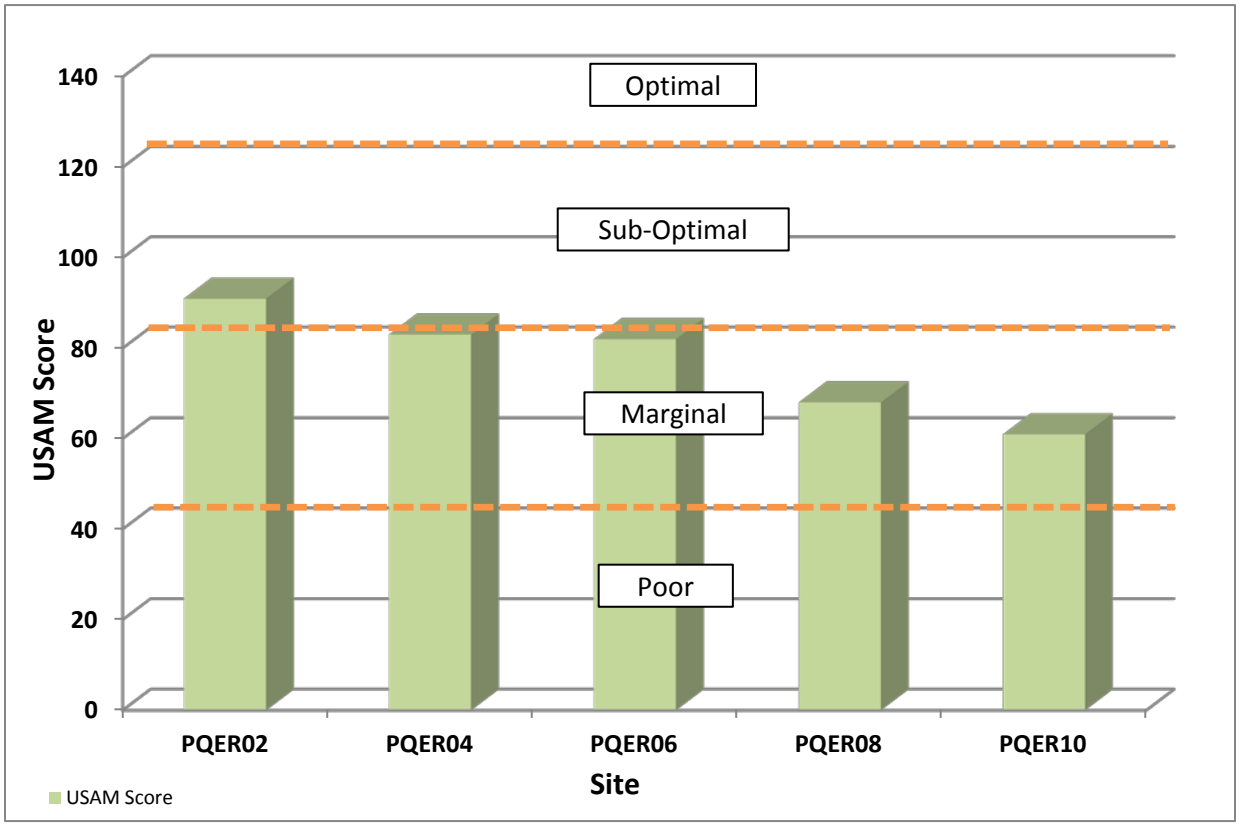


Figure 3-85: Elwood's Run Watershed USAM Results



3.3.2.5.1 PQER02

Reach PQER02 is the first reach of Wilson's Run. The headwaters of this tributary begin in a significant wooded area between industrial and commercial properties. Reach PQER02 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (20.0), a highly entrenched channel (ER = 1.2), low sinuosity (1.07), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQER02 was suboptimal (91/160).

3.3.2.5.2 PQER04

Reach PQER04 begins approximately 500 feet upstream of cross section PQER04. This reach runs through a significant wooded area between industrial and commercial properties. Reach PQER04 is characterized by a shallow slope (1.0%), moderate to high width to depth ratio (12.0), a highly entrenched channel (ER = 1.4), low sinuosity (1.01), and silt/clay substrate. The reach was classified as a B6c type stream. The composite USAM score for reach PQER04 was suboptimal (83/160).

3.3.2.5.3 PQER06

Reach PQER06 begins approximately 600 feet upstream of cross section PQER06. This reach flows through a small wooded corridor between recreational fields. Reach PQER06 is characterized by a shallow slope (0.8%), moderate width to depth ratio (13.8), a slightly entrenched channel (ER = 6.5), low sinuosity (1.00), and sand substrate. The reach was classified as a C5 type stream. The composite USAM score for reach PQER06 was suboptimal (82/160).

3.3.2.5.4 PQER08

Reach PQER08 begins approximately 700 feet upstream of cross section PQER08. The upper portion of this reach flows under Roosevelt Blvd (US Rt. 1) and then flows through a small wooded corridor between industrial and commercial properties. Reach PQER08 is characterized by a shallow slope (0.8%), moderate width to depth ratio (12.9), a slightly entrenched channel (ER = 43.6), low sinuosity (1.19), and sand substrate. The reach was classified as a C5 type stream. The composite USAM score for reach PQER08 was marginal (68/160).

3.3.2.5.5 PQER10

Reach PQER10 begins approximately 500 feet upstream of cross section PQER10. This reach travels through a wooded corridor between commercial and industrial properties before joining Wilson's Run to form the mainstem of Byberry Creek. Reach PQER10 is characterized by a shallow slope (1.0%), low width to depth ratio (9.1), a moderately entrenched channel (ER = 2.0), low sinuosity (1.10), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQER10 was marginal (61/160).

3.3.2.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean scores for the Overall Stream Condition components as well as the composite USAM score were both classified as marginal (Table 3-117). The mean score for the Overall Buffer and Floodplain Condition was classified as suboptimal. Average conditions within the Elwood's Run Watershed's buffers and floodplains were considerably better than conditions observed within the stream channels. The watershed average for the Overall Stream Condition component was lower than the respective All Reaches averages; however the Overall Buffer and Floodplain component and the Overall USAM Score were both higher than their respective All Reaches averages. The scores for individual parameters ranged from poor to optimal, with some reaches in obviously better condition than others. Graphs of each USAM category rating are in Appendix D.

Table 3-117: USAM Results for Elwood's Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQER02	Elwood's Run	30	61	91
PQER04	Elwood's Run	23	60	83
PQER06	Elwood's Run	40	42	82
PQER08	Elwood's Run	42	26	68
PQER10	Elwood's Run	33	28	61
PQER Mean		33.6	43.4	77.0
All Reaches Average		37.1	37.4	74.4

3.3.2.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE ELWOOD'S RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were generally marginal with little variation. The mean watershed score (33.6/80.0) was rated as marginal and was slightly lower than the All Reaches average score (37.1/80) which was also considered marginal.

Table 3-118: USAM Overall Stream Condition Scoring for Elwood's Run Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQER02	Elwood's Run	7	5	6	5	5	2	30
PQER04	Elwood's Run	3	3	3	5	5	4	23
PQER06	Elwood's Run	3	4	3	5	5	20	40
PQER08	Elwood's Run	6	4	4	4	4	20	42
PQER10	Elwood's Run	8	4	4	3	4	10	33
PQER Mean		5.4	4.0	4.0	4.4	4.6	11.2	33.6
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.3.2.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to marginal for the five reaches analyzed in the Elwood's Run Watershed. The watershed mean was lower than the All Reaches average (5.4 compared to 8.2). Two of the reaches within the Elwood's Run Watershed (PQER04 and PQER06) were characterized by unstable or lacking substrate and less than 20% stable habitat. The three remaining reaches (PQER02, PQER08, and PQER10) fared slightly better, showing marginal stable habitat (20-40%). There was a lack of pool/riffle complexes and significant sedimentation in the channel which accounted for the lower habitat scores.

3.3.2.6.1.2 VEGETATIVE PROTECTION

Of the five reaches analyzed for the Elwood's Run Watershed, all were rated as marginal except for the right bank of PQER02. A marginal rating is characterized by 50-70% of the streambank covered with vegetation and obvious signs of disturbance. The All Reaches averages for the left bank was the same as the watershed All Reaches average. Both were 4.0/10 or marginal. The watershed average for the right bank was slightly higher than that for the All Reaches average (4.0/10.0 vs. 3.9/10.0) but was also considered marginal. The marginal scores for this parameter are attributed to the patchy distribution of vegetation along the stream banks due to erosion. Furthermore, the presence of invasive vegetation was observed along the stream channel.

3.3.2.6.1.3 BANK EROSION

All five reaches analyzed for Elwood's Run Watershed scored marginal for both left and right banks. The mean watershed scores for the left and right banks scored higher than the All Reaches average (4.4 vs. 3.9, LB and 4.6 vs. 4.0, RB) but were still considered marginal. A rating of marginal indicates active stream widening and erosion at a moderate rate.

3.3.2.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection scores for the five reaches analyzed for the Elwood's Run Watershed were widely varied. Reaches PQER02 and PQER04 had very low Floodplain Connection Score of 2.0/20.0 and 4.0/20.0, respectively, indicating that this reach was deeply entrenched and high flows were not making it into the floodplain. Reaches PQER06 and PQER08 had optimal ratings of 20/20 indicating very little entrenchment and floodwaters easily entering the floodplain. Reach PQER10 was marginal, with a score of 10.0/20.0, reflecting high flows not able to enter the floodplain and deep stream entrenchment. The mean for the Elwood's Run Watershed was just slightly lower than for all reaches with a score of 11.2 as compared to 13.0, giving this watershed an overall suboptimal rating.

3.3.2.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE ELWOOD'S RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were mostly marginal to optimal except for the Floodplain Encroachment parameter, where reaches PQER08 and PQER10 both classified as poor. The mean component score for the Elwood's Run Watershed (43.4/80.0) was greater than the All Reaches average (37.4/80.0). The increased function of the floodplains in this watershed can be attributed to a number of factors including a small wooded buffer along much of the stream channel.

Table 3-119: USAM Buffer and Floodplain Condition Scoring for Elwood's Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQER02	Elwood's Run	9	9	17	11	15	61
PQER04	Elwood's Run	9	9	16	11	15	60
PQER06	Elwood's Run	6	6	9	11	10	42
PQER08	Elwood's Run	4	5	8	7	2	26
PQER10	Elwood's Run	3	5	7	11	2	28
PQER Mean		6.2	6.8	11.4	10.2	8.8	43.4
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.3.2.6.2.1 VEGETATED BUFFER WIDTH

Of the five reaches analyzed for Elwood's Run Watershed, two had ratings of optimal (PQER02 and PQER04), two had ratings of marginal (PQER08 and PQER10) and one reach was rated as suboptimal (PQER06). Bank conditions for this watershed matched on both banks unlike other watersheds which exhibit great variability between the left and right banks. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity. A suboptimal rating indicates a buffer zone of 25-50 feet with minimal human activity, while a marginal rating describes a buffer of 10-25 feet with significant human impact. The mean watershed score of 6.2/10.0 for the left bank was greater than 5.3/10.0 for the All Reaches average. The mean watershed score for the right bank was also greater than the All Reaches average (6.9 vs. 6.0). Because of slightly different actual score numbers, the left bank had an overall marginal rating while the right bank just made it into the suboptimal category.

3.3.2.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation types for the five reaches analyzed for Elwood's Run Watershed were mature floodplain forest and young forest. Two reaches (PQER02 and PQER04) had ratings of optimal, indicating the predominance of mature floodplain forest. The remaining three reaches achieved ratings of marginal reflecting young floodplain forest. The mean Elwood's Run Watershed score (11.4/20.0) was rated as suboptimal, which was slightly higher than the All Reaches average (9.7/20) which was rated as marginal.

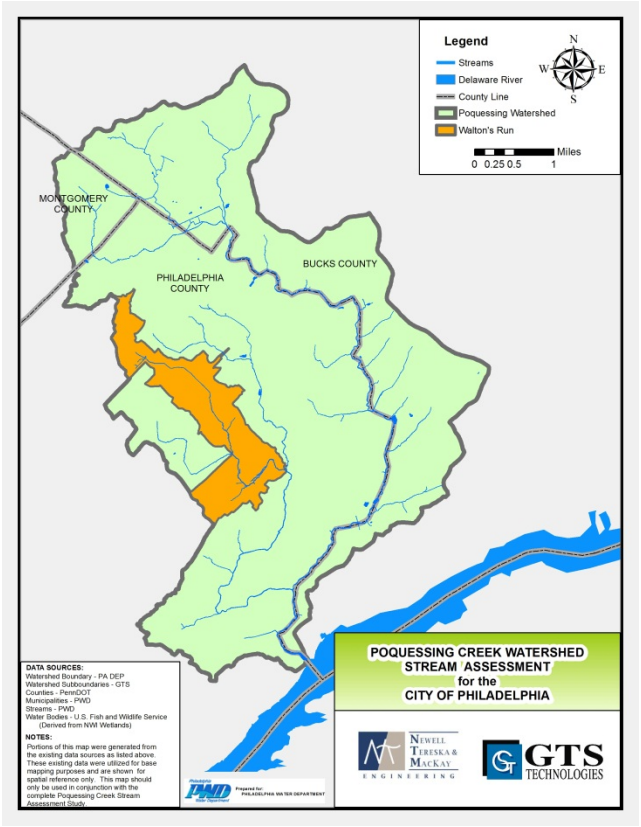
3.3.2.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat throughout the Elwood's Run Watershed was better than in several other subwatersheds. Of the five reaches analyzed, four reaches were rated as suboptimal (PQER02, PQER04, PQER06 and PQER10). A suboptimal rating is characterized by an even mix of both wetland and non-wetland habitat and no standing water observed. Reach PQER08 was rated marginal with all wetland or non-wetland habitat and evidence of ponding or standing water. The mean watershed score for this parameter (10.2/20.0) was rated as marginal and was slightly higher than the All Reaches average score (8.3/20) which was also considered marginal.

3.3.2.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter ranged from poor to suboptimal within the Elwood's Run Watershed. Reaches PQER02 and PQER04 were both rated as suboptimal, reflecting minor floodplain encroachment without affecting floodplain function. Reach PQER06 had a rating of marginal reflecting moderate floodplain encroachment with some effect on floodplain function. Reaches PQER08 and PQER10 both scored in the poor range, indicating significant floodplain encroachment and resulting significant effect on floodplain function. The mean score for the watershed was (8.8/20.0) which was slightly higher than the All Reaches average score of (8.2/20.0), giving the Elwood's Run Watershed an overall rating of marginal.

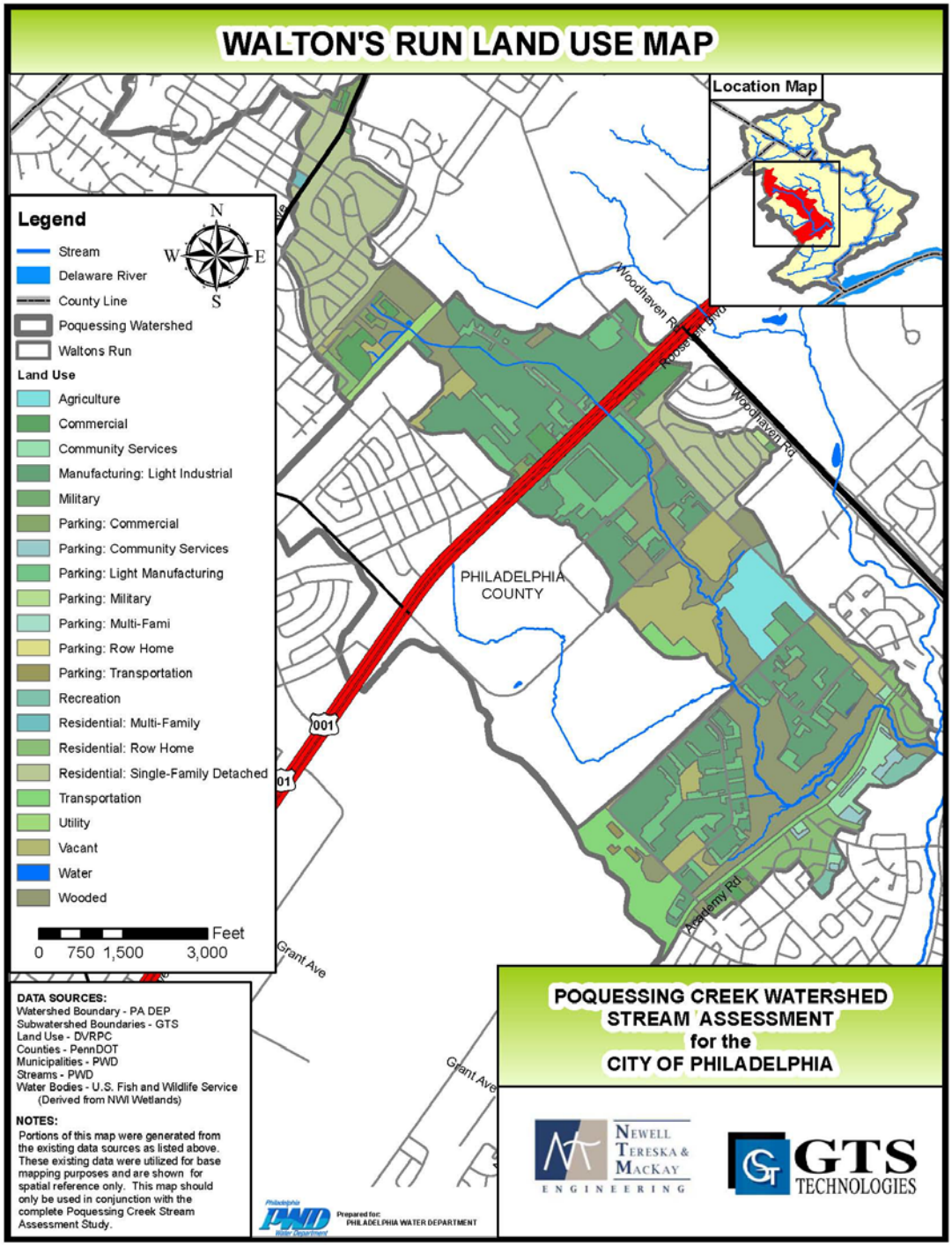
3.3.3 WALTON'S RUN WATERSHED AND REACH CHARACTERISTICS



Walton's Run is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Walton's Run originates from stormwater outfalls draining surrounding residential and parking areas. Walton's Run flows for approximately 17,000 feet before meeting the confluence with the Byberry mainstem. The dominant substrate varies from sand to cobble material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Walton's Run Watershed is 1715 acres. Major land use types within the watershed include: manufacturing: light industrial (29%) and wooded (17%). Walton's Run is surrounded by wooded land on both sides. The wooded buffer ranges from about 50 feet to about 800 feet wide.

Figure 3-86: Walton's Run Watershed Land Use



3.3.3.1 GEOLOGY

The majority of the Walton's Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

A portion of the Walton's Run Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

3.3.3.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of the Walton's Run Watershed are classified as urban soils (89%). This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-120: Distribution of NRCS Soil Types in Walton's Run Watershed

Group	Area (acres)	Percent of Total Area
B	39.8	3%
C	6.4	1%
D	81.7	7%
Urban	1017.6	89%
Total Area	1145.6	100%

3.3.3.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for fourteen reaches in the Walton's Run Watershed (Table 3-121). Ten reaches were found to be eroding based on the total wetted perimeter calculation, while four were aggrading. The average total erosion rate for all reaches in the Walton's Run Watershed was less than the average for all Poquessing Creek subwatersheds (Table 3-122). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-87: Geology of Walton's Run Watershed

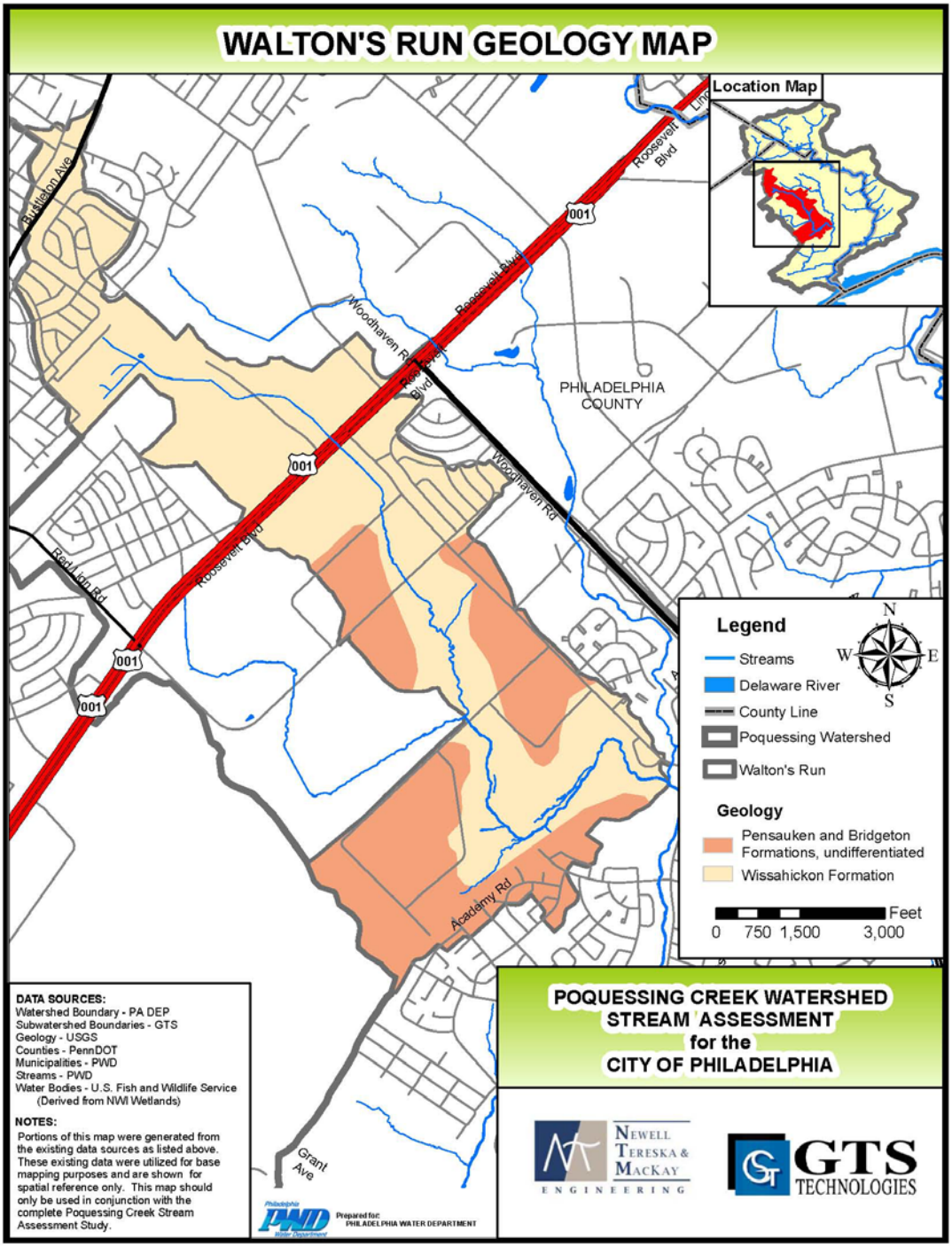


Figure 3-88: Distribution of NRCS Soil Types in Walton's Run Watershed

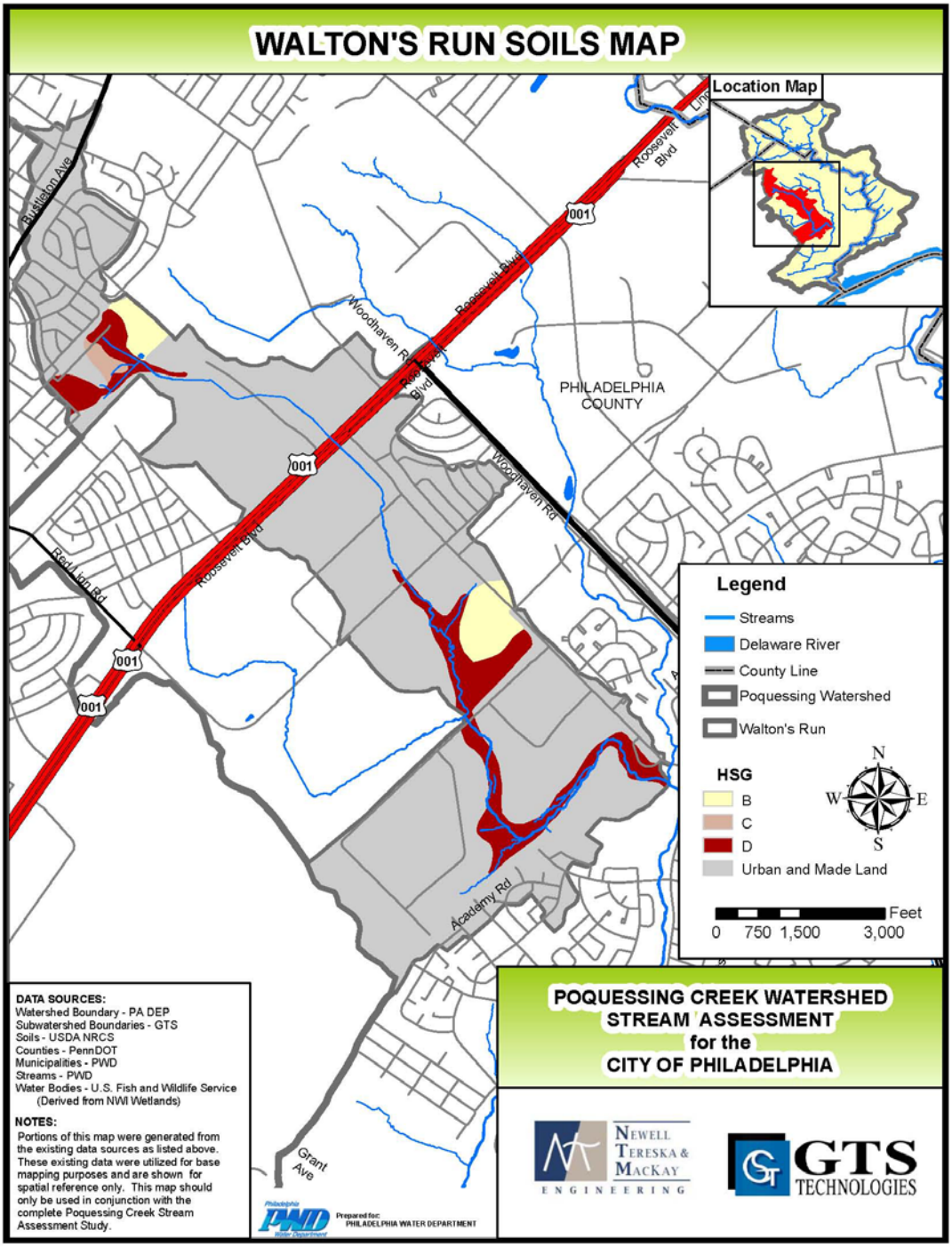


Table 3-121: Erosion Rates for Walton's Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQWA06	0.092	0.542	-0.952	0.206	0.041	A
PQWA08	-0.104	-0.122	-1.250	-0.164	-0.033	E
PQWA10	-0.055	0.255	-0.339	0.106	0.021	A
PQWA12	-1.365	0.016	-1.359	-0.147	-0.029	E
PQWA14	-0.029	-0.079	-1.563	-0.141	-0.028	E
PQWA16	-1.532	-0.092	0.668	-0.113	-0.023	E
PQWA18	-1.902	0.029	-0.264	-0.147	-0.029	E
PQWA20	-0.964	0.169	-0.352	0.091	0.018	A
PQWA22	-0.485	0.193	-6.983	-0.377	-0.075	E
PQWA24	3.531	-0.129	-2.497	-0.007	-0.001	E
PQWA26	-3.648	-0.253	-2.984	-0.632	-0.126	E
PQWA28	-0.111	-0.089	1.905	0.129	0.026	A
PQWAA02	-0.577	-0.374	-3.490	-0.660	-0.132	E
PQWAB04	-1.338	-0.196	-0.750	-0.183	-0.037	E
Average	-0.606	-0.009	-1.443	-0.146	-0.029	E

Table 3-122: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.3.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Walton's Run is a medium sized tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Walton's Run lies in a mainly wooded area with commercial development close by. At the downstream end and closer to the confluence, the land use patterns become mainly commercial development and the stream flows under Academy before reaching the confluence with Byberry Creek. The downstream portion of Walton's Run exhibits some of the impairments associated with urban streams given its location and proximity to commercial and residential development that surrounds the stream channel. The majority of infrastructure was located in reach PQWA06 mainly in the form of outfalls. This reach is in the area of dense industrial development. There were 54 outfalls located along Walton's Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 0.7 to 5.0 feet in diameter. The number of headwater outfalls (Table 3-123) on this stream indicates that it is heavily influenced by stormwater discharges in the upstream-most section of PQWA06.

The majority of infrastructure elements along Walton's Run is identified as being in good or fair condition. Seven infrastructure elements have been identified as being in poor condition. Four channels (PQchan207, PQchan208, PQchan209, and PQchan210) have a height of 6 feet each and range in length from 53 feet to 790 feet. All are constructed of concrete. Bridge PQbri078 is a poor condition, 8-foot long bridge by 8-foot high by 10-foot wide opening and is located in the upstream portion of Walton's Run. Manhole PQman074 is a 2-foot high, exposed manhole and is also identified to be in poor condition. It is located at the downstream end of Walton's Run, approximately 2,500 feet upstream of the confluence with Byberry Creek. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-123: Summary of Walton's Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQWA06	4	2	15	8	2	0	0	1	32
PQWA08	1	0	19	1	2	0	0	0	23
PQWA10	0	0	4	2	2	0	0	0	8
PQWA12	1	0	2	0	0	0	0	2	5
PQWA14	1	0	4	1	0	0	0	0	6
PQWA16	0	0	0	0	0	1	0	0	1
PQWA18	0	0	0	0	0	0	0	0	0
PQWA20	2	0	6	0	0	0	0	0	8
PQWA22	0	0	1	0	0	0	0	0	1
PQWA24	0	0	1	0	2	0	0	0	3
PQWA26	0	0	1	0	0	0	0	0	1
PQWAB04	1	0	1	0	1	0	0	0	3
TOTAL	10	2	54	12	9	1	0	3	91

3.3.3.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream reach of the Walton's Run stream channel is a second-order, single thread channel with six tributaries. These tributaries include Colbert's Run and five small, unnamed tributaries. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-89: Results for Walton's Run Watershed USAM Components

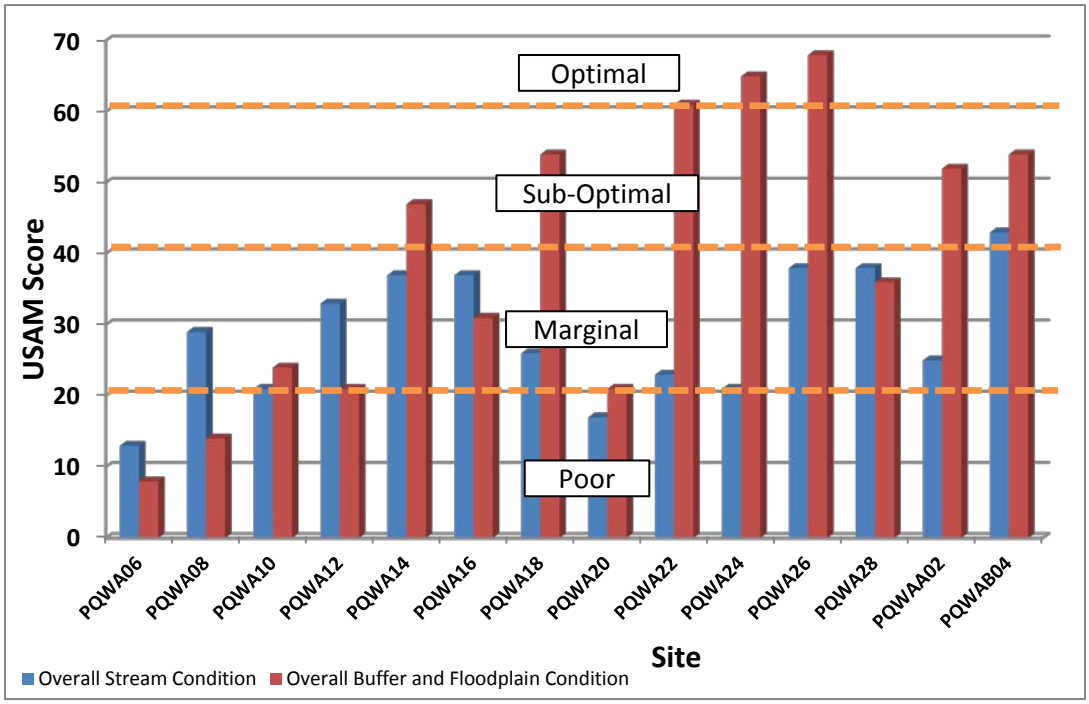
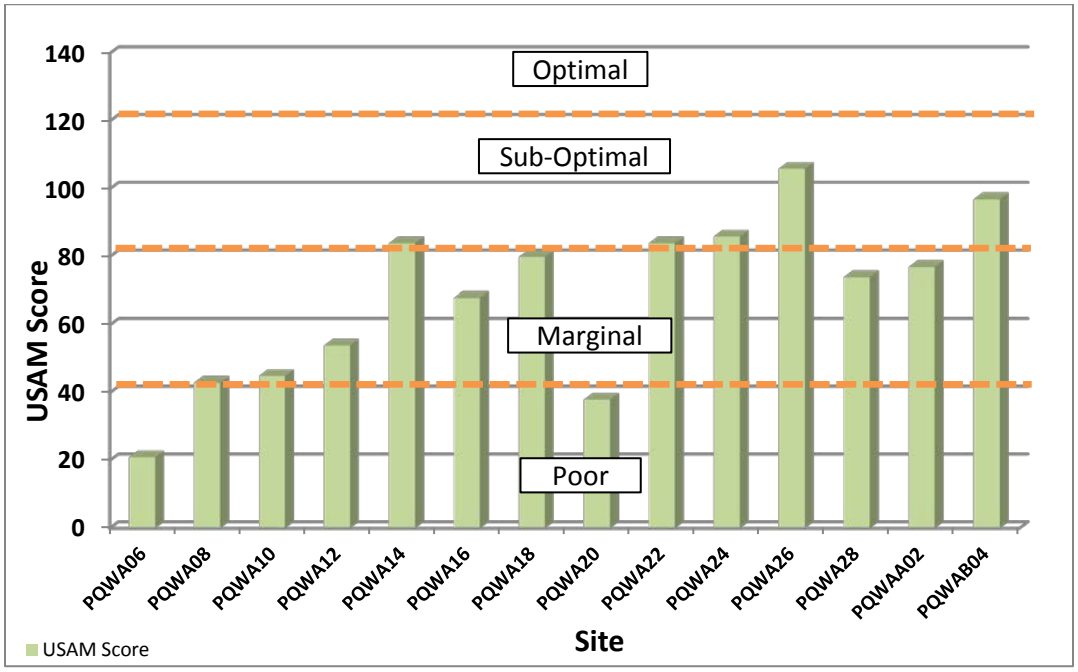


Figure 3-90: Walton's Run Watershed USAM Results



3.3.3.5.1 PQWA06

Reach PQWA06 is the first reach of Walton's Run. The headwaters of this tributary begin at a stormwater outfall and travels through a heavy industrial area. Much of this reach is culverted and/or channelized throughout its length. Reach PQWA06 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (16.9), a highly entrenched channel (ER = 1.4), low sinuosity (1.07), and sand substrate. The reach was classified as a B5c type stream. The composite USAM score for reach PQWA06 was poor (21/160).

3.3.3.5.2 PQWA08

Reach PQWA08 begins approximately 900 feet upstream of cross section PQWA08. This reach continues through a small wooded corridor between industrial properties. The lower end of this reach passes under Roosevelt Blvd (US Rt. 1). Reach PQWA08 is characterized by a shallow slope (0.9%), low to moderate width to depth ratio (12.0), a highly entrenched channel (ER = 1.4), low sinuosity (1.03), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQWA08 was marginal (43/160).

3.3.3.5.3 PQWA10

Reach PQWA10 begins approximately 700 feet upstream of cross section PQWA10. This reach travels through a wooded corridor between industrial properties. Reach PQWA10 is characterized by a shallow slope (1.0%), moderate width to depth ratio (14.3), a highly entrenched channel (ER = 1.2), low sinuosity (1.13), and cobble substrate. The reach was classified as a F6 type stream. The composite USAM score for reach PQWA10 was marginal (45/160).

3.3.3.5.4 PQWA12

Reach PQWA12 begins approximately 400 feet upstream of cross section PQWA12. The upper portion of this reach flows under Roosevelt Blvd (US Rt. 1) and then flows through a small wooded corridor between industrial and commercial properties. Reach PQWA12 is characterized by a shallow slope (0.9%), moderate to high width to depth ratio (23.6), a slightly entrenched channel (ER = 2.6), low sinuosity (1.03), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQWA12 was marginal (54/160).

3.3.3.5.5 PQWA14

Reach PQWA14 begins approximately 700 feet upstream of cross section PQWA14. This reach is crossed by Norcom Road. and travels through a wooded corridor between an industrial property and Northeast Philadelphia Airport land. Reach PQWA14 is characterized by a shallow slope (0.8%), moderate width to depth ratio (17.1), a slightly entrenched channel (ER = 2.6), moderate sinuosity (1.29), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQWA14 was suboptimal (84/160).

3.3.3.5.6 PQWA16

Reach PQWA16 begins approximately 700 feet upstream of cross section PQWA16. This reach travels through a partially wooded corridor on Northeast Philadelphia Airport land. Reach PQWA16 is characterized by a shallow slope (0.8%), low width to depth ratio (11.7), a slightly entrenched channel (ER = 6.9), moderate sinuosity (1.35), and cobble substrate. The reach was classified as a E6 type stream. The composite USAM score for reach PQWA16 was marginal (68/160).

3.3.3.5.7 PQWA18

Reach PQWA18 begins approximately 500 feet upstream of cross section PQWA18. This reach travels through a wooded corridor on Northeast Philadelphia Airport land. Reach PQWA18 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (16.8), a highly entrenched channel (ER = 1.3), low sinuosity (1.07), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQWA18 was marginal (80/160).

3.3.3.5.8 PQWA20

Reach PQWA20 begins approximately 500 feet upstream of cross section PQWA20. This reach flows under Decatur Road and travels through a partially wooded zone (Walton's Run Park) between industrial properties. The industrial property on the downstream left encroaches on the channel. Reach PQWA20 is characterized by a shallow slope (0.5%), moderate to high width to depth ratio (25.9), a highly entrenched channel (ER = 1.1), low sinuosity (1.19), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQWA20 was poor (38/160).

3.3.3.5.9 PQWA22

Reach PQWA22 begins approximately 700 feet upstream of cross section PQWA22. This reach travels through a wide wooded zone (Walton's Run Park) between industrial properties. Reach PQWA22 is characterized by a shallow slope (0.3%), moderate to high width to depth ratio (22.8), a moderately entrenched channel (ER = 1.5), low sinuosity (1.19), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQWA22 was suboptimal (84/160).

3.3.3.5.10 PQWA24

Reach PQWA24 begins approximately 600 feet upstream of cross section PQWA24. This reach travels through a wide wooded zone (Walton's Run Park) between industrial properties. Reach PQWA24 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (25.5), a highly entrenched channel (ER = 1.2), low sinuosity (1.11), and sand substrate. The reach was classified as a F5 type stream. The composite USAM score for reach PQWA24 was suboptimal (86/160).

3.3.3.5.11 PQWA26

Reach PQWA26 begins approximately 400 feet upstream of cross section PQWA26. This reach travels through a wide wooded zone (Walton's Run Park) between industrial properties and Academy Road. Reach PQWA26 is characterized by a shallow slope (0.3%), low to moderate width to depth ratio (12.0), a slightly entrenched channel (ER = 7.2), low sinuosity (1.04), and sand substrate. The reach was classified as a C5 type stream. The composite USAM score for reach PQWA26 was suboptimal (106/160).

3.3.3.5.12 PQWA28

Reach PQWA28 begins approximately 800 feet upstream of cross section PQWA28. This reach passes under Academy Road and travels through a wooded corridor between an urban area and St. Martha's School before joining the mainstem of Byberry Creek. Reach PQWA28 is characterized by a shallow slope (0.3%), low width to depth ratio (10.0), a slightly entrenched channel (ER = 5.6), moderate sinuosity (1.49), and gravel substrate. The reach was classified as a E4 type stream. The composite USAM score for reach PQWA28 was marginal (74/160).

3.1.1.5.13 PQWAA02

Reach PQWAA02 is the entire length of Walton's Run, Unnamed Tributary A. The headwaters of this tributary begin at a stormwater outfall near Comly Road. The remainder of the reach travels through a small wooded corridor near the Northeast Philadelphia Airport before joining Walton's Run. Reach PQWAA02 is characterized by a shallow slope (1.3%), low width to depth ratio (7.9), a moderately entrenched channel (ER = 1.6), low sinuosity (1.03), and gravel substrate. The reach was classified as an A4 type stream. The composite USAM score for reach PQWAA02 was marginal (77/160).

3.1.1.5.14 PQWAB04

Reach PQWAB04 is the entire length of Walton's Run, Unnamed Tributary B. The headwaters of this tributary begin at a stormwater outfall between an industrial area and Academy Road. The remainder of this reach travels through a wooded corridor (Walton's Run Park) between industrial areas and Academy Road before reaching Walton's Run. Reach PQWAB04 is characterized by a shallow slope (1.1%), low width to depth ratio (21.6), a moderately entrenched channel (ER = 3.9), low sinuosity (1.06), and sand substrate. The reach was classified as a C5 type stream. The composite USAM score for reach PQWAB04 was suboptimal (97/160).

3.3.3.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Fourteen reaches were analyzed for the Walton's Run Watershed. The mean scores for the Overall Stream Condition and Overall Buffer and Floodplain Condition components as well as the composite USAM score were all classified as marginal. Average conditions within the Walton's Run Watershed's stream

channels were slightly worse than conditions observed within the buffers and floodplains. The watershed averages for the Overall Stream Condition component as well as the composite USAM were lower than the respective All Reaches averages, however the Overall Buffer and Floodplain component was slightly higher than the All Reaches average. The scores for individual parameters ranged from poor to optimal, displaying levels of variability between reaches. Graphs of each USAM category rating are in Appendix D.

Table 3-124: USAM Results for Walton's Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQWA06	Walton's Run	13	8	21
PQWA08	Walton's Run	29	14	43
PQWA10	Walton's Run	21	24	45
PQWA12	Walton's Run	33	21	54
PQWA14	Walton's Run	37	47	84
PQWA16	Walton's Run	37	31	68
PQWA18	Walton's Run	26	54	80
PQWA20	Walton's Run	17	21	38
PQWA22	Walton's Run	23	61	84
PQWA24	Walton's Run	21	65	86
PQWA26	Walton's Run	38	68	106
PQWA28	Walton's Run	38	36	74
PQWAA02	Walton's Run	25	52	77
PQWAB04	Walton's Run	43	54	97
PQWA Mean		28.6	39.7	68.3
All Reaches Average		37.1	37.4	74.4

3.3.3.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THEWALTON'S RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal, though most scored in the marginal range. The only optimal ratings were found within the floodplain connection component. The mean watershed score (28.6/80.0) was rated as marginal and was lower than the All Reaches average score (37.1/80.0), although both received a marginal classification.

Table 3-125: USAM Overall Stream Condition Scoring for Walton's Run Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQWA06	Walton's Run	0	2	1	3	3	4	13
PQWA08	Walton's Run	6	5	5	5	4	4	29
PQWA10	Walton's Run	4	4	4	4	3	2	21
PQWA12	Walton's Run	6	2	3	2	4	16	33
PQWA14	Walton's Run	8	3	2	5	3	16	37
PQWA16	Walton's Run	7	2	2	3	3	20	37
PQWA18	Walton's Run	9	2	2	5	5	3	26
PQWA20	Walton's Run	7	3	2	1	3	1	17
PQWA22	Walton's Run	7	3	2	3	3	5	23
PQWA24	Walton's Run	7	4	1	4	3	2	21
PQWA26	Walton's Run	6	4	1	4	3	20	38
PQWA28	Walton's Run	6	4	4	2	2	20	38
PQWAA02	Walton's Run	5	3	3	4	4	6	25
PQWAB04	Walton's Run	1	5	5	6	6	20	43
PQBL Mean		5.6	3.3	2.6	3.6	3.5	9.9	28.6
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.3.3.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to marginal for the fourteen reaches analyzed in the Walton's Run Watershed. Most reaches scored in the marginal range. Four reaches (PQWA06, PQWA10, PQWAA02, and PQWAB04) scored within the poor range. A poor rating is characterized by unstable or lacking substrate and less than 20% stable habitat. A marginal rating reflects a 20-40% mix of stable habitat with a disturbed or removed substrate. The watershed mean was lower than the All Reaches average (5.6/20.0 vs. 8.2/20.0), giving the watershed an overall rating of poor and the All Reaches average a rating of marginal. Excessive channel erosion and has resulted in excess sediments in the stream channel. The overwidened channel also has typically shallow flows with little variation in habitat type. Water quality issues also exist throughout the subwatershed as evidenced by discolored water in certain locations.

3.3.3.6.1.2 VEGETATIVE PROTECTION

Both banks of all fourteen reaches analyzed for the Walton's Run Watershed ranged from poor to marginal. Five reaches (PQWA08, PQWA10, PQWA28, PQWAA02, and PQWAB04) had left and right banks that were both rated marginal. Three reaches (PQWA06, PQWA16, and PQWA18) had both banks rated as poor. The remaining reaches had a mix of marginal and poor ratings for both banks. A poor rating reflects less than 50% of the streambanks covered by vegetation and the area appearing very disturbed while a marginal rating reflects 50-70% coverage with lesser degrees of disturbance. The All Reaches averages for the left banks were slightly higher than the watershed mean (4.0 vs. 3.3) although both were considered marginal. The All Reaches average for the right banks was also rated as marginal (3.9/10.0) while the

watershed mean scored within the poor range (2.6/10.0). The poor to marginal scores for this parameter are attributed to the highly eroded banks which have prevented heavy vegetation from developing.

3.3.3.6.1.3 BANK EROSION

Ten reaches analyzed for the Walton's Run Watershed had both banks scoring within the marginal range. A characterization of marginal reflects past downcutting and active stream widening with moderate erosion. Two reaches (PQWA12 and PQWA20) had left banks that scored within the poor range and right banks that were marginal. A rating of poor reflects active downcutting, tall banks, fast erosion rates, and significant sediment contribution to the stream. One reach (PQWA28) had both banks score within the poor range. Reach PQWAB04 had both banks score within the suboptimal range, the highest scoring reach for the watershed. A rating of suboptimal reflects a stable width and grade and isolated areas of erosion. The mean watershed scores for the left and right banks were both rated as marginal (3.6/10.0 and 3.5/10.0). The All Reaches average for both left and right banks also were rated as marginal (3.9/10.0 and 4.0/10.0).

3.3.3.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection scores for the Walton's Run Watershed were widely varied with most scores in either the poor or optimal range. Seven reaches (PQWA06, PQWA08, PQWA10, PQWA18-24) had poor ratings indicating that these reaches were deeply entrenched and high flows were not making it into the floodplain. Six reaches (PQWA12, PQWA14, PQWA16, PQWA26, PQWA28, and PQWAB04) had optimal ratings, indicating high flows able to enter the floodplain and no deep entrenchment. Reach PQWAA02 was characterized as marginal, indicating high flows not able to enter the floodplain and deep entrenchment, but to a lesser degree than a score of poor. The mean for the Walton's Run Watershed was just slightly lower than for all reaches with a score of 9.9/20.0 (marginal) as compared to 13.0/20.0 (suboptimal). The highly entrenched reaches were typically impacted by adjacent development and floodplain filling. The reaches that were better connected to the floodplain typically had significant riparian buffers and were protected by parkland.

3.3.3.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE WALTON'S RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis were widely varied, ranging from poor to optimal with wide variations within each component and even among reaches. The mean component score for the Walton's Run Watershed (39.7/80) was slightly higher than the All Reaches average (37.4/80). The improved function of the floodplains in this watershed can be attributed to the presence of some areas with significant riparian buffers and floodplains. The higher rated reaches are typically protected by parkland.

Table 3-126: USAM Buffer and Floodplain Condition Scoring for Walton's Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQWA06	Walton's Run	2	2	2	1	1	8
PQWA08	Walton's Run	3	3	4	3	1	14
PQWA10	Walton's Run	4	2	10	6	2	24
PQWA12	Walton's Run	1	9	6	4	1	21
PQWA14	Walton's Run	8	9	10	6	14	47
PQWA16	Walton's Run	4	3	5	11	8	31
PQWA18	Walton's Run	9	9	10	12	14	54
PQWA20	Walton's Run	4	9	0	6	2	21
PQWA22	Walton's Run	9	9	15	13	15	61
PQWA24	Walton's Run	10	9	17	13	16	65
PQWA26	Walton's Run	10	10	17	13	18	68
PQWA28	Walton's Run	5	5	8	11	7	36
PQWAA02	Walton's Run	8	8	10	11	15	52
PQWAB04	Walton's Run	9	9	13	15	8	54
PQWA Mean		6.1	6.8	9.1	8.9	8.7	39.7
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.3.3.6.2.1 VEGETATED BUFFER WIDTH

The widths of the vegetated buffers for the fourteen reaches analyzed within the Walton's Run Watershed varied widely. One reach (PQWA06 had poor ratings for both the left and right banks. A rating of poor indicates a vegetated buffer less than 10 feet in width and no riparian vegetation due to human activities Three reaches (PQWA08, PQWA16, and PQWA28) had both banks scored as marginal. A marginal score indicates a buffer width of 10-25 feet with a great deal of human impact. Five reaches (PQWA18, PQWA22-26, and PQWAB04) had both banks score within the optimal range. An optimal rating reflects a buffer zone of greater than 50 feet and little human activity. The mean watershed score of 6.1/10.0 (suboptimal) for the left bank was greater than 5.3/10.0 (marginal) for the all reaches average. The mean watershed score for the right bank was also higher than all reaches average for right banks (6.8/10.0 vs. 6.0/10.0), both considered suboptimal.

3.3.3.6.2.2 FLOODPLAIN VEGETATION

The vegetation types within the Walton's Run Watershed also varied widely. Four reaches were characterized by a dominant vegetation type of turf. Six reaches had a dominant vegetation type of shrub. Two reaches had dominant vegetation types of young forest and two reaches had a dominant vegetation type of mature forest. The mean Walton's Run Watershed score (9.1/20.0) was rated as marginal, which was slightly higher than the All Reaches average (9.7/20.0), also considered marginal.

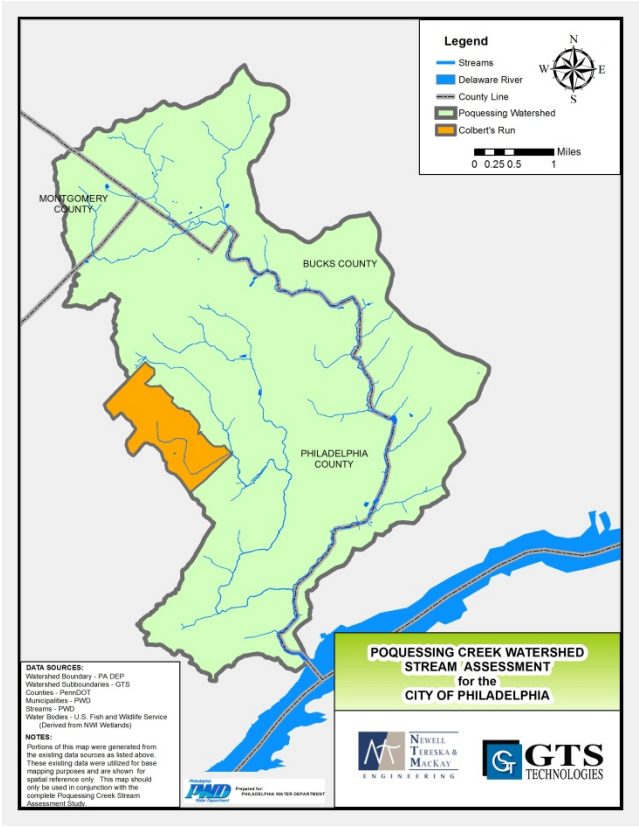
3.3.3.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat was somewhat varied throughout the Walton's Run Watershed. Three reaches (PQWA06, PQWA08, and PQWA12) had ratings of poor, reflecting either all wetland or non-wetland habitat and no evidence of standing or ponded water. Three reaches were characterized as marginal: PQWA10, PQWA14, and PQWA20. A marginal rating is similar to a poor rating, but with evidence of ponded or standing water. The remaining reaches were all rated as suboptimal, reflecting an even mix of wetland and non-wetland habitat and no evidence or ponded or standing water. The mean watershed score for this parameter (8.9/20.0) was rated as marginal and was slightly higher than the All Reaches average score (8.3/20.0) which was also considered marginal.

3.3.3.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter were wide ranging throughout the Walton's Run Watershed. Five reaches were characterized as poor: PQWA06-12 and PQWA20. A poor rating reflects significant floodplain encroachment with resulting significant effect on floodplain function. Three reaches (PQWA16, PQWA28, and PQWAB04) were rated as marginal, indicating moderate floodplain encroachment with some effect on floodplain function. The remaining four reaches were characterized as suboptimal: PQWA14, PQWA18, PQWA22, and PQWAA02. A suboptimal rating indicates minor floodplain encroachment without affecting floodplain function. The mean score for the watershed was (8.7/20.0) which was slightly higher than the All Reaches average score of (8.2/20.0), both having an overall rating of marginal.

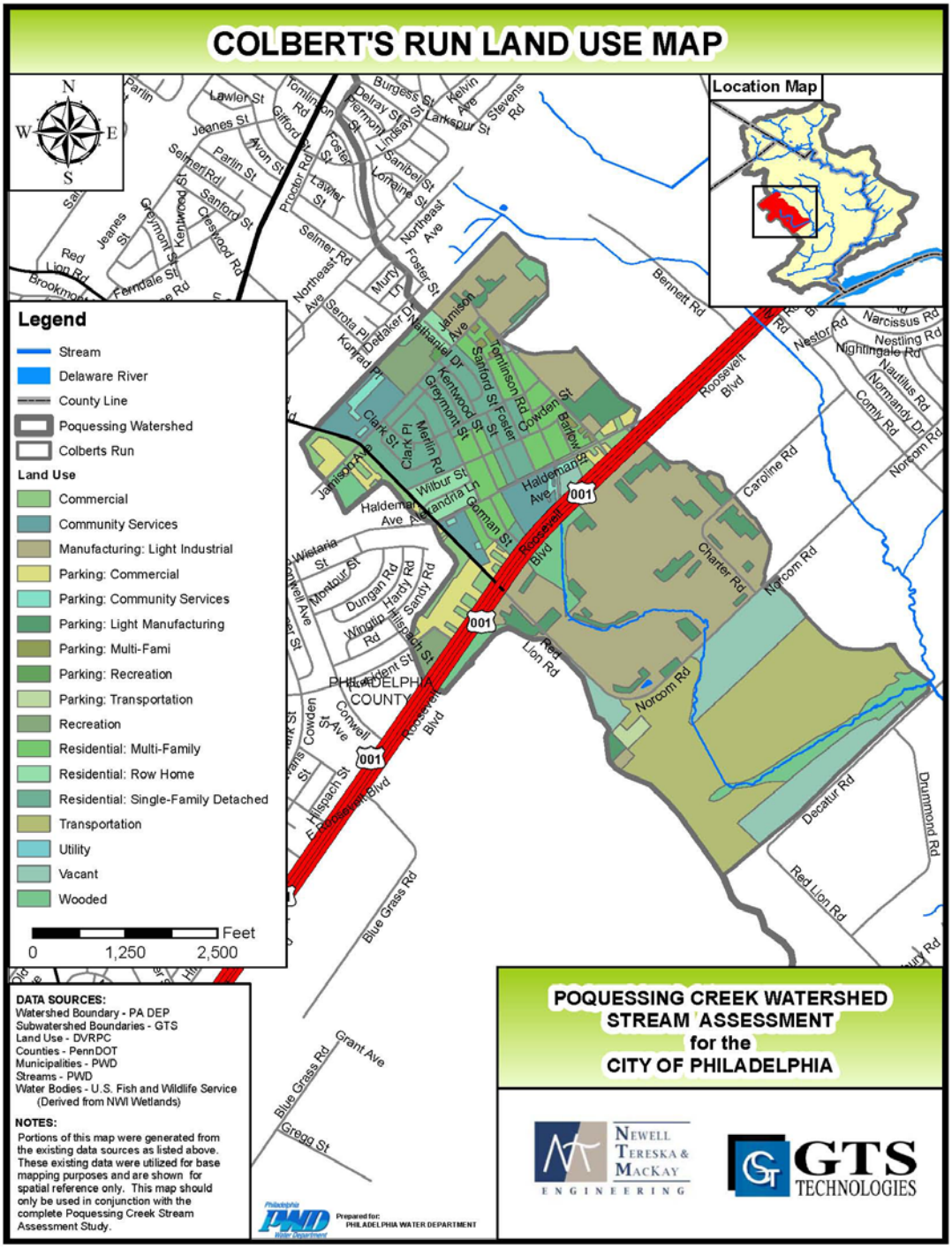
3.3.4 COLBERT'S RUN WATERSHED AND REACH CHARACTERISTICS



Colbert's Run is a tributary to Walton's Run which is a tributary to the mainstem of the Byberry Creek. Colbert's Run originates from a privately-owned stormwater outfall in the area of Roosevelt Boulevard and Red Lion Road. Colbert's Run is a first-order tributary for approximately 8,000 feet before meeting the confluence with Walton's Run. The dominant substrate varies from sand to cobble material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Colbert's Run Watershed is 655 acres. Major land use types within the watershed include: manufacturing: light industrial (27%), transportation (23%) and vacant (9%). Colbert's Run is surrounded by wooded land on both sides. The wooded buffer ranges from about 50 feet to about 400 feet wide.

Figure 3-91: Colbert's Run Watershed Land Use



3.3.4.1 GEOLOGY

The majority of the Colbert's Run Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

There is one small section within the Colbert's Run Watershed that is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

3.3.4.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of Colbert's Run Watershed are classified as urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-127: Distribution of NRCS Soil Types in Colbert's Run Watershed

Group	Area (acres)	Percent of Total Area
B	71.9	11%
D	25.4	4%
Urban	557.8	85%
Total Area	655.1	100%

3.3.4.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for six reaches in Colbert's Run (Table 3-128). Three reaches were found to be eroding based on the total wetted perimeter calculation, while three were aggrading. The average total erosion rate for the reaches in Colbert's Run was positive (aggrading), which is significantly different than the negative (eroding) average for all Poquessing Creek subwatersheds (Table 3-129). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-92: Geology of Colbert's Run Watershed

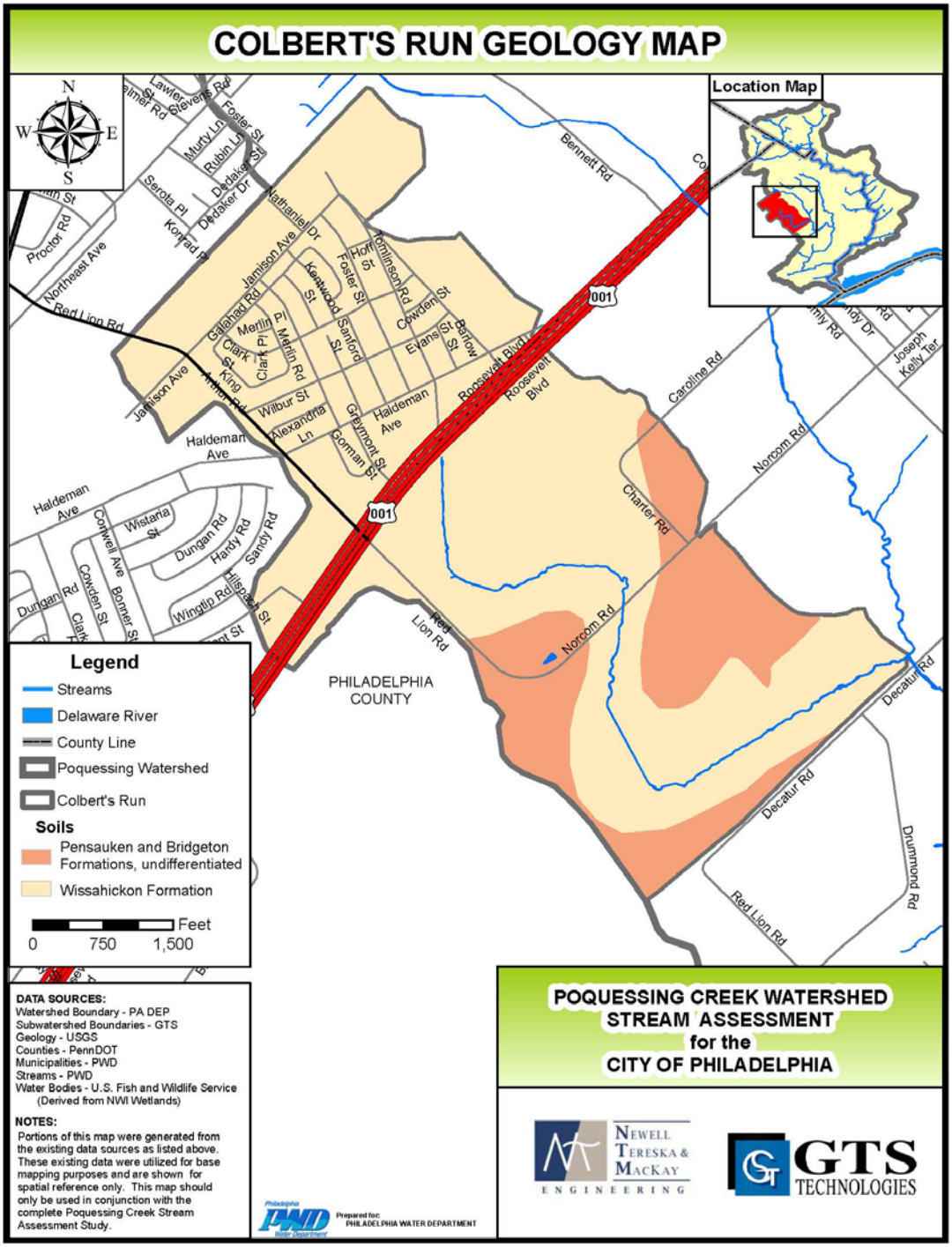


Figure 3-93: Distribution of NRCS Soil Types in Colbert's Run

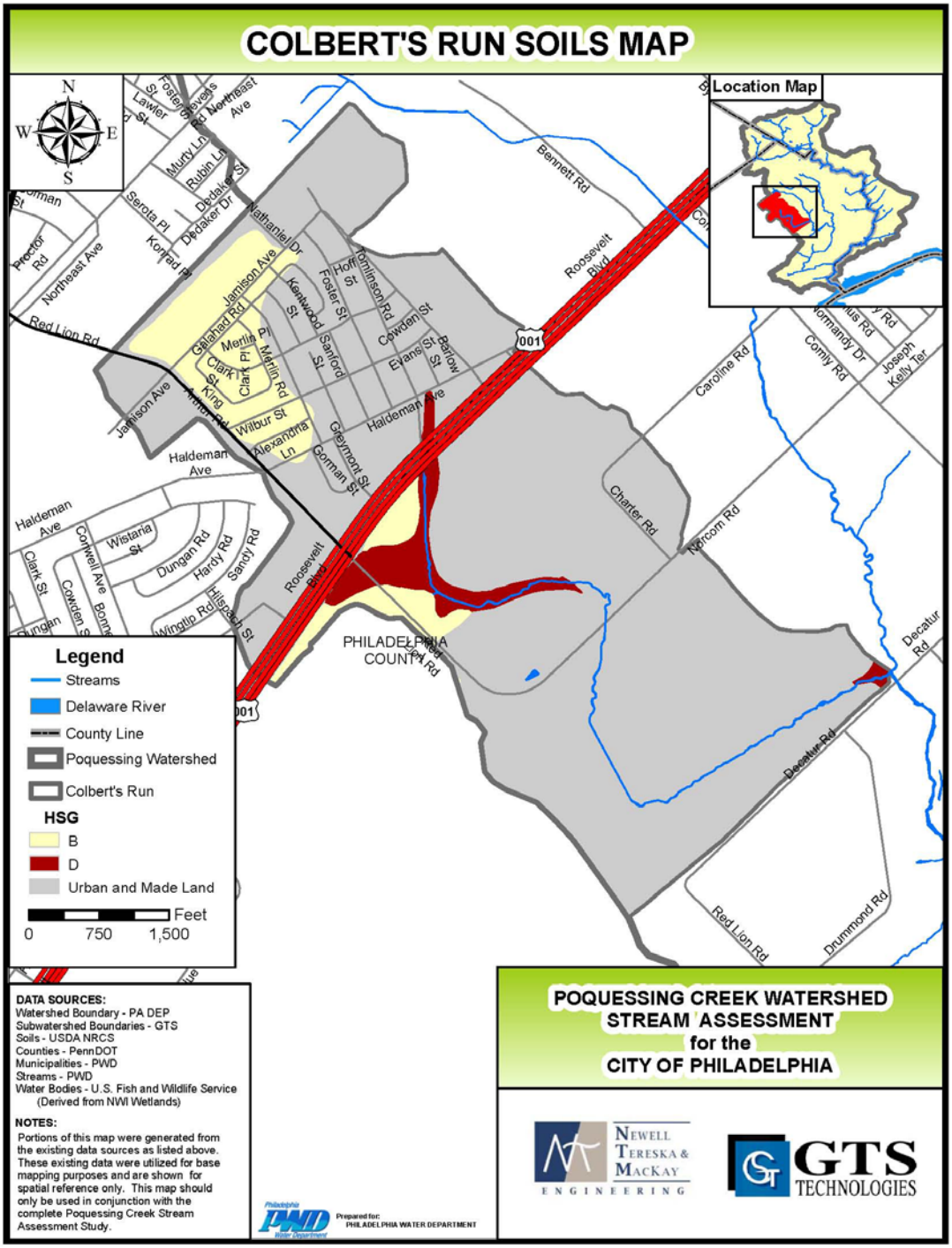


Table 3-128: Erosion Rates for Colbert's Run Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQCR02	-0.207	-0.164	-1.900	-0.242	-0.048	E
PQCR04	0.836	0.362	0.479	0.295	0.059	A
PQCR06	0.783	0.017	-2.230	-0.132	-0.026	E
PQCR08	1.690	-0.079	0.348	0.121	0.024	A
PQCR12	-0.514	-0.192	0.555	-0.063	-0.013	E
PQCR14	0.000	0.253	-0.295	0.115	0.023	A
Average	0.431	0.033	-0.507	0.016	0.003	A

Table 3-129: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.4.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Colbert's Run is a small tributary to Walton's Run which is a tributary to the Byberry Creek located within Philadelphia County. The headwaters of Colbert's Run lies in a mainly wooded area with light industrial manufacturing development close by. At the downstream end and closer to the confluence, the land use patterns remain the same before reaching the confluence with Walton's Run. The downstream portion of Colbert's Run exhibits some of the impairments associated with urban streams given its location and proximity to commercial development, the Northeast Philadelphia Airport, and a Roosevelt Avenue that surrounds the stream channel. The majority of infrastructure was located at reach PQCR06 mainly in the form of outfalls. This reach is in the area of Norcom Road. There were 15 outfalls located along Colbert's Run. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in dimension from 1.0 to 6.0 feet in diameter. The number of outfalls (Table 3-130) on this stream indicates that it is heavily influenced by stormwater discharges along the reach.

The presence of Philadelphia Northeast Airport has heavy impacts on Colbert's Run. A 926-foot long by 6-foot wide by 8-foot wide box culvert conveys the flow under a large portion of the airport. Along Colbert's Run, most infrastructure elements were considered in good or fair condition. At the downstream section of Colbert's Run a bridge has been identified as being in poor condition and is located approximately 700 feet upstream of the confluence with Walton's Run in a wooded corridor. Bridge PQbri079 is a 5-foot long by 8-foot high by 10-foot wide bridge. No other poor condition infrastructure elements have been identified along Colbert's Run. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure locations can be found in Appendix C.

Table 3-130: Summary of Colbert's Run Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQCR02	2	0	3	0	0	0	0	0	5
PQCR04	2	2	0	0	0	0	0	0	4
PQCR06	1	0	7	1	0	0	0	0	9
PQCR08	1	0	4	2	0	0	0	0	7
PQCR12	0	0	1	1	0	0	0	0	2
PQCR14	0	1	0	0	1	0	0	0	2
TOTAL	6	3	15	4	1	0	0	0	29

3.3.4.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Colbert's Run stream channel is a first-order, single thread channel with no tributaries. Colbert's Run is a tributary to Walton's Run which is a tributary to the mainstem of Byberry Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-94: Results for Colbert's Run Watershed USAM Components

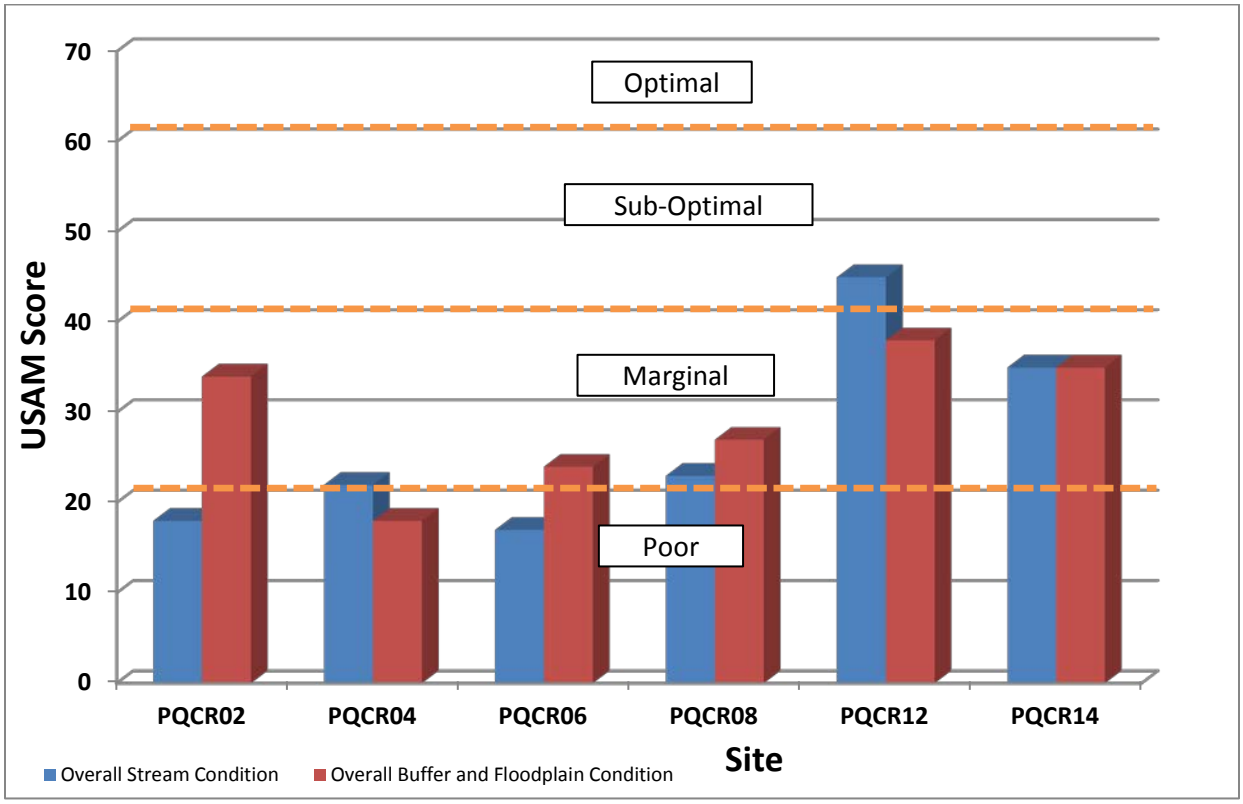
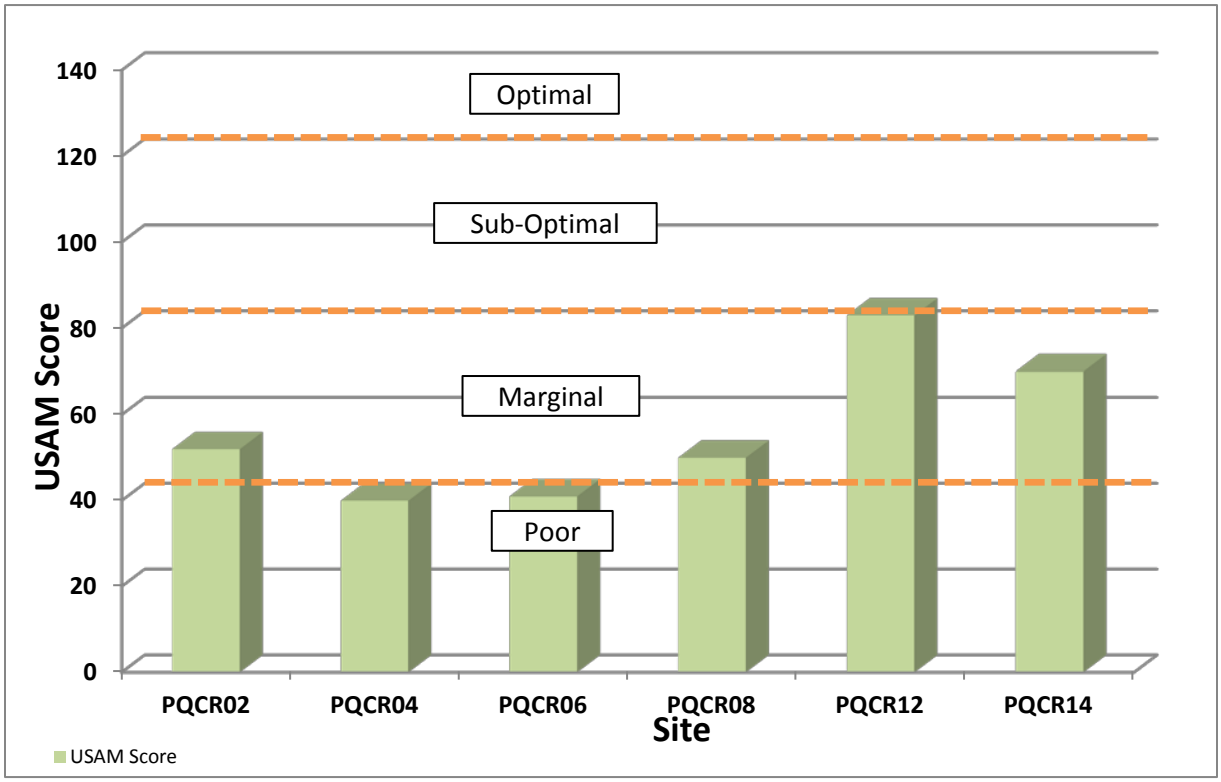


Figure 3-95: Colbert's Run Watershed USAM Results



3.3.4.5.1 PQCR02

Reach PQCR02 is the first reach of Colbert's Run. The headwaters of this tributary begin at a stormwater outfall near Roosevelt Blvd. and the reach travels in a small wooded corridor through an industrial area. Reach PQCR02 is characterized by a shallow slope (0.7%), moderate to high width to depth ratio (17.2), a highly entrenched channel (ER = 1.2), low sinuosity (1.02), and sand substrate. The reach was classified as a F5 type stream. The composite USAM score for reach PQCR02 was marginal (52/160).

3.3.4.5.2 PQCR04

Reach PQCR04 begins approximately 500 feet upstream of cross section PQCR04. This reach continues through a small wooded corridor between industrial properties. Reach PQCR04 is characterized by a shallow slope (0.7%), low to moderate width to depth ratio (11.7), a highly entrenched channel (ER = 1.3), low sinuosity (1.18), and cobble substrate. The reach was classified as an A6 type stream. The composite USAM score for reach PQCR04 was poor (40/160).

3.3.4.5.3 PQCR06

Reach PQCR06 begins approximately 700 feet upstream of cross section PQCR06. This reach continues through a partially wooded corridor between industrial properties. Reach PQWA10 is characterized by a shallow slope (0.7%), moderate width to depth ratio (12.2), a highly entrenched channel (ER = 1.4), high sinuosity (2.23), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQCR06 was marginal (41/160).

3.3.4.5.4 PQCR08

Reach PQCR08 begins approximately 700 feet upstream of cross section PQCR08. This reach continues through a partially wooded corridor on Northeast Philadelphia Airport property. The lower portion of this reach is culverted under the airport runways. Reach PQCR08 is characterized by a shallow slope (0.6%), moderate to high width to depth ratio (15.6), a moderately entrenched channel (ER = 1.5), low sinuosity (1.06), and gravel; substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQCR08 was marginal (50/160).

3.3.4.5.5 PQCR12

Reach PQCR12 begins approximately 1100 feet upstream of cross section PQCR12. The upper portion of this reach is culverted under the Northeast Philadelphia Airport runways. The lower portion of this reach travels through a partially wooded corridor on Northeast Philadelphia Airport property. Reach PQCR12 is characterized by a shallow slope (0.5%), low width to depth ratio (9.7), a slightly entrenched channel (ER = 3.1), moderate sinuosity (1.31), and gravel substrate. The reach was classified as a E4 type stream. The composite USAM score for reach PQCR12 was suboptimal (83/160).

3.3.4.5.12 PQCR14

Reach PQCR14 begins approximately 600 feet upstream of cross section PQCR14. This reach continues through a partially wooded corridor on Northeast Philadelphia Airport property before joining Walton's Run. Reach PQCR14 is characterized by a shallow slope (0.4%), low width to depth ratio (10.0), a slightly entrenched channel (ER = 2.7), low sinuosity (1.05), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQCR14 was marginal (70/160).

3.3.4.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Six reaches were analyzed for the Colbert's Run Watershed. The mean scores for the Overall Stream Condition components and the USAM scores ranged from poor to sub-optimal (Table 3-131). Scores for the Overall Buffer and Floodplain components were lower, ranging from poor to marginal. The watershed averages for the Overall Stream Condition and Overall Buffer/Floodplain Condition components as well as the composite USAM were lower than their respective All Reaches averages, although all were rated as marginal. Graphs of each USAM category rating are in Appendix D.

Table 3-131: USAM Results for Colbert's Run Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQCR02	Colbert's Run	18	34	52
PQCR04	Colbert's Run	22	18	40
PQCR06	Colbert's Run	17	24	41
PQCR08	Colbert's Run	23	27	50
PQCR12	Colbert's Run	45	38	83
PQCR14	Colbert's Run	35	35	70
PQCR Mean		26.7	29.3	56.0
All Reaches Average		37.1	37.4	74.4

3.3.4.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE COLBERT'S RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis were mostly poor to marginal with the exception of two reaches that achieved optimal scores in the Floodplain Connection component. The mean watershed score (26.7/80.0) was rated as marginal and was lower than the All Reaches average score (37.1/80.0) which also was a marginal score.

Table 3-132: USAM Overall Stream Condition Scoring for Colbert's Run Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQCR02	Colbert's Run	5	2	2	3	4	2	18
PQCR04	Colbert's Run	6	4	4	2	3	3	22
PQCR06	Colbert's Run	4	2	1	3	3	4	17
PQCR08	Colbert's Run	4	4	4	4	2	5	23
PQCR12	Colbert's Run	8	5	4	4	4	20	45
PQCR14	Colbert's Run	8	2	2	3	3	17	35
PQCR Mean		5.8	3.2	2.8	3.2	3.2	8.5	26.7
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.3.4.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from poor to marginal for the six reaches analyzed in the Colbert's Run Watershed. The watershed mean (5.8/20.0) was lower than the All Reaches average (8.2/20.0). Three of the reaches within the Colbert's Run Watershed (PQCR02, PQCR06, and PQCR08) were characterized by unstable or lacking substrate and less than 20% stable habitat. The three remaining reaches (PQCR04, PQCR12, and PQCR14) fared slightly better, showing marginal stable habitat (20-40%) with the substrate either disturbed or removed. Excessive channel erosion has

resulted in excess sediments in the stream channel. The overwidened channel also has typically shallow flows with little variation in habitat type. Water quality issues also exist throughout the subwatershed as evidenced by discolored water observed in numerous locations during this assessment.

3.3.4.6.1.2 VEGETATIVE PROTECTION

The banks of the six reaches studied for Colbert's Run varied from poor to marginal. Both banks of reaches PQCR02, PQCR06, and PQCR14 were rated poor, meaning these areas had less than 50% of the streambanks vegetated and a high degree of disturbance. PQCR04, PQCR08, and PQCR12 fared slightly better with a rating of marginal, meaning 50-70% of the streambank was vegetated and a lesser level of disturbance. The All Reaches averages for both banks were higher than for the Colbert's Run Watershed (4.0/10.0 vs. 3.2/10.0, LB and 3.9/10.0 vs. 2.8/10.0, RB). Most were scored as marginal with the exception of the watershed mean for the right bank, which was rated as poor. The poor to marginal scores for this parameter are attributed to the highly eroded banks which have prevented heavy vegetation from developing.

3.3.4.6.1.3 BANK EROSION

The six reaches analyzed for Colbert's Run Watershed scored between poor and marginal for both left and the right banks. Reaches PQCR02, PQCR06, PQCR12 and PQCR14 had ratings for both banks in the marginal range. Reach PQCR04 had a poor rating for the left bank and a marginal rating for the right bank, while Reach PQCR08 had a marginal rating for the left bank and a poor rating for the right bank. A rating of marginal indicates active stream widening and erosion at a moderate rate, with no threat to property or infrastructure. A poor rating reflects active downcutting and a fast erosion rate with significant sediment contribution to the stream. The mean watershed scores for the left and right banks were both (3.2/10.0) rated as marginal. The All Reaches average also scored in the marginal range with 3.9/10.0 for the left bank and 4.0/10.0 for the right bank.

3.3.4.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection scores for the Colbert's Run Watershed were varied. Of the six reaches analyzed, four were rated poor (PQCR02, PQCR04, PQCR06 and PQCR08). A poor rating reflects floodwaters not able to enter the floodplain and deep entrenchment. The remaining two reaches (PQCR12 and PQCR14) scored much higher, within the optimal range, indicating minimal entrenchment and floodwaters easily able to enter the floodplain. The mean for the Colbert's Run Watershed was lower than for all reaches with a score of 8.5 as compared to 13.0, giving this watershed an overall marginal rating while the All Reaches average scored in the suboptimal range.

3.3.4.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE COLBERT'S RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to optimal. The mean component score for the Colbert's Run Watershed (29.3/80.0) was less than the All Reaches average (37.4/80.0).

Table 3-133: USAM Buffer and Floodplain Condition Scoring for Colbert's Run Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQCR02	Colbert's Run	5	9	9	6	5	34
PQCR04	Colbert's Run	2	4	7	4	1	18
PQCR06	Colbert's Run	2	6	9	4	3	24
PQCR08	Colbert's Run	7	3	8	5	4	27
PQCR12	Colbert's Run	5	7	9	11	6	38
PQCR14	Colbert's Run	5	7	7	11	5	35
PQCR Mean		4.3	6.0	8.2	6.8	4.0	29.3
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.3.4.6.2.1 VEGETATED BUFFER WIDTH

The widths of the vegetated buffer observed ranged from poor to optimal. None of the reaches analyzed had banks with buffer width that were equal. Reach PQCR02 had a left bank that was marginal and a right bank that was optimal. Reach PQCR04 had a poor left bank and marginal right bank. Reach PQCR06 also had a poor left bank but had a suboptimal right bank. Reach PQCR08 had a suboptimal left bank with a marginal right bank, while Reaches PQCR12 and PQCR14 had marginal left banks and suboptimal right banks. A poor rating indicates a vegetated buffer width of less than ten feet, with little or no riparian vegetation due to disturbance. A rating of marginal indicates a buffer width of 10-25 feet, but still greatly disturbed. Suboptimal vegetated buffers are 25-50 feet with minimal human impact, while optimal ratings reflect a buffer greater than 50 feet and no human impact. The mean score for the left bank was 4.3/10.0, compared to 5.3/10.0 for the All Reaches average, both considered marginal. The mean and All Reaches score for the right bank matched at 6.0/10.0, considered suboptimal.

3.3.4.6.2.2 FLOODPLAIN VEGETATION

All six reaches analyzed for the Colbert's Run Watershed had floodplain vegetation ratings of marginal, indicating that the predominant vegetation type is shrub. The mean Colbert's Run Watershed score (8.2/20.0) was rated as marginal, which was slightly lower than the All Reaches average (9.7/20.0), also considered marginal.

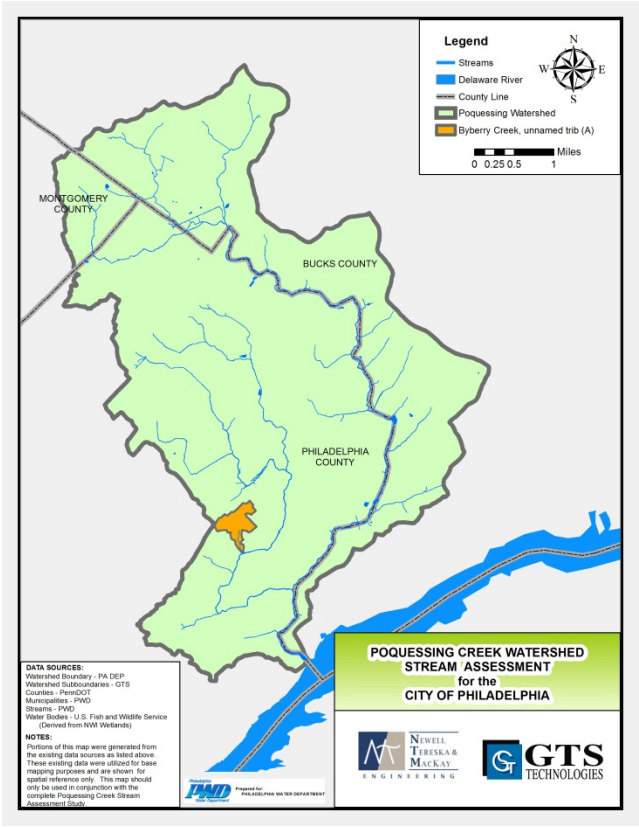
3.3.4.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat ranged from poor to suboptimal throughout the Colbert's Run Watershed. The primary cause was adjacent development, particularly through the Northeast Philadelphia Airport. Reach PQCR02 was rated marginal, indicating either all wetland or no wetland habitat and the presence of standing water. Reaches PQCR04, PQCR06, and PQCR08 all rated as poor, indicating either all wetland or no wetland habitat and no evidence of standing water. Reaches PQCR12 and PQCR14 were characterized as suboptimal, indicating an even mix of wetland and non-wetland habitat with no evidence of ponding or standing water. The mean watershed score for this parameter (6.8/20.0) was rated as marginal and was slightly lower than the All Reaches average score (8.3/20.0) which was also considered marginal.

3.3.4.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter were either poor or marginal for the six reaches observed within the Colbert's Run Watershed. Scores were limited by the extent of development, landscaping, and infrastructure which were all very pervasive throughout the watershed. Reaches PQCR02, PQCR04, PQCR06, PQCR08 and PQCR14 all rated as poor. Only one reach, PQCR12 rated as marginal. A rating of poor indicates significant floodplain encroachment and resulting significant effect on floodplain function. A marginal rating indicated moderate floodplain encroachment with some effect on the floodplain. The mean score for the watershed was (4.0/20.0) which was lower than the All Reaches average score of (8.2/20), giving the Colbert's Run Watershed an overall rating of poor.

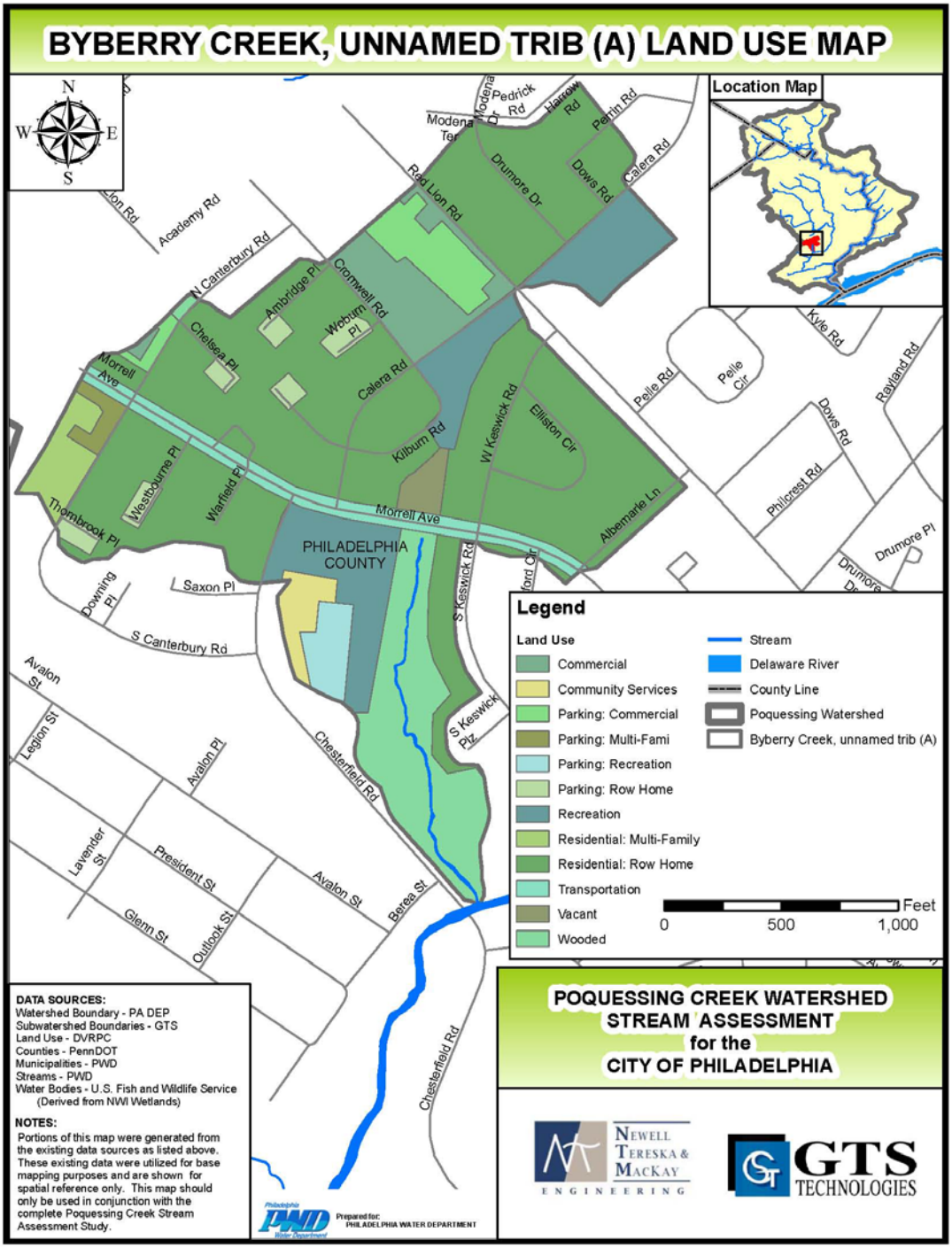
3.3.5 BYBERRY CREEK UNNAMED TRIBUTARY A WATERSHED AND REACH CHARACTERISTICS



Byberry Creek Unnamed Tributary A is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Byberry Creek Unnamed Tributary A originates from a stormwater outfall at Morrell Avenue. Byberry Creek Unnamed Tributary A is a first-order tributary for approximately 1,300 feet before flowing into the confluence with Byberry Creek. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Byberry Creek Unnamed Tributary A Watershed is 94 acres. Major land use types within the watershed include: residential: row home (56%), recreation (12%) and wooded (10%). Byberry Creek Unnamed Tributary A is surrounded by wooded land on both sides. The wooded buffer ranges from about 150 feet to about 400 feet wide.

Figure 3-96: Byberry Creek, Unnamed Tributary A Watershed Land Use



3.3.5.1 GEOLOGY

The majority of the Poquessing Creek Unnamed Tributary A Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

A significant portion of the Poquessing Creek Unnamed Tributary A Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

3.3.5.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the majority of Byberry Creek Unnamed Tributary A Watershed are classified as urban soils (99%). This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-134: Distribution of NRCS Soil Types in Byberry Creek Unnamed Tributary A Watershed

Group	Area (acres)	Percent of Total Area
D	1.2	1%
Urban	93.2	99%
Total Area	94.4	100%

3.3.5.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Byberry Creek, Unnamed Tributary A (Table 3-135). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Byberry Creek, Unnamed Tributary A was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-136). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-97: Geology of Byberry Creek, Unnamed Tributary A Watershed

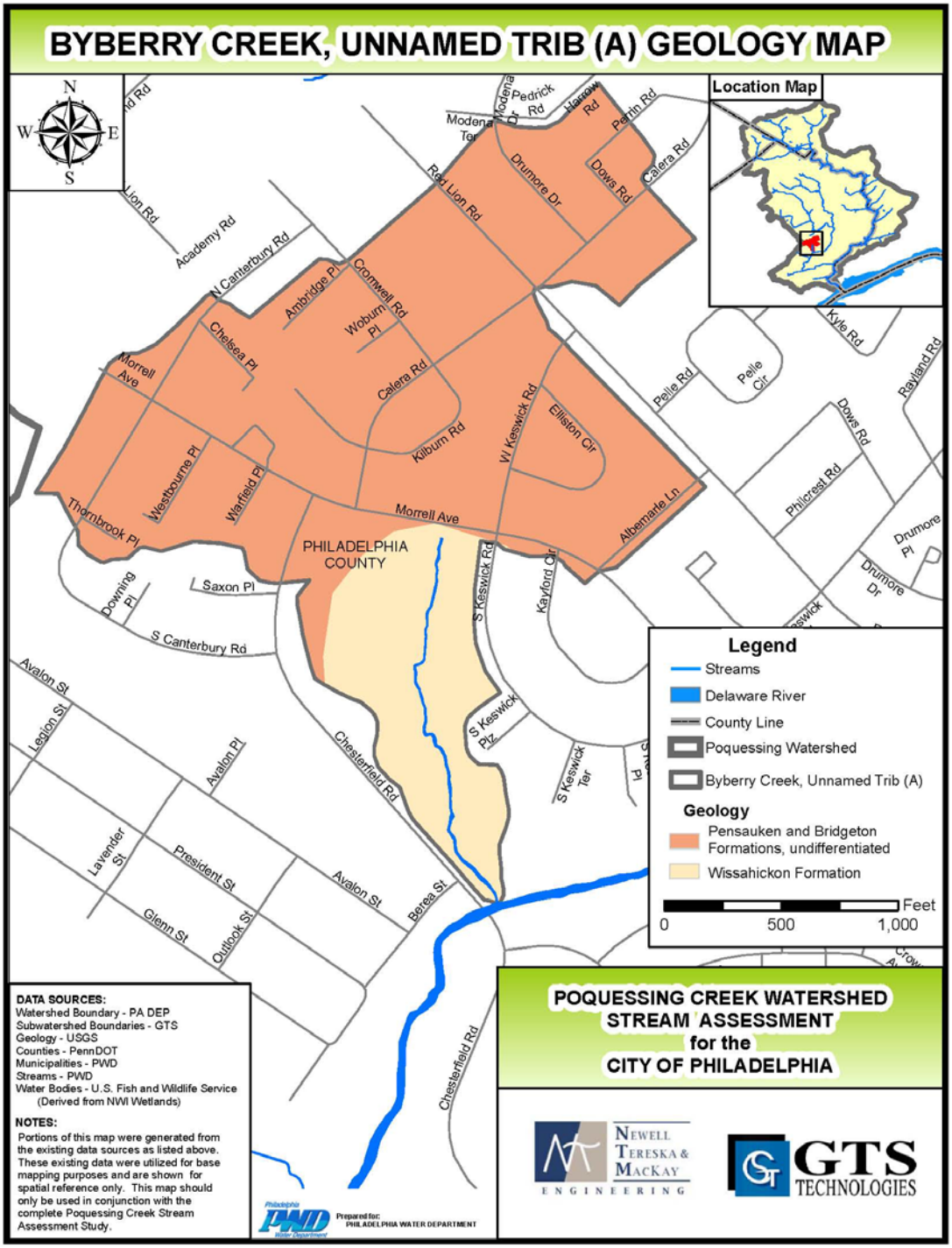


Figure 3-98 Distribution of NRCS Soil Types in Byberry Creek, Unnamed Tributary A Watershed

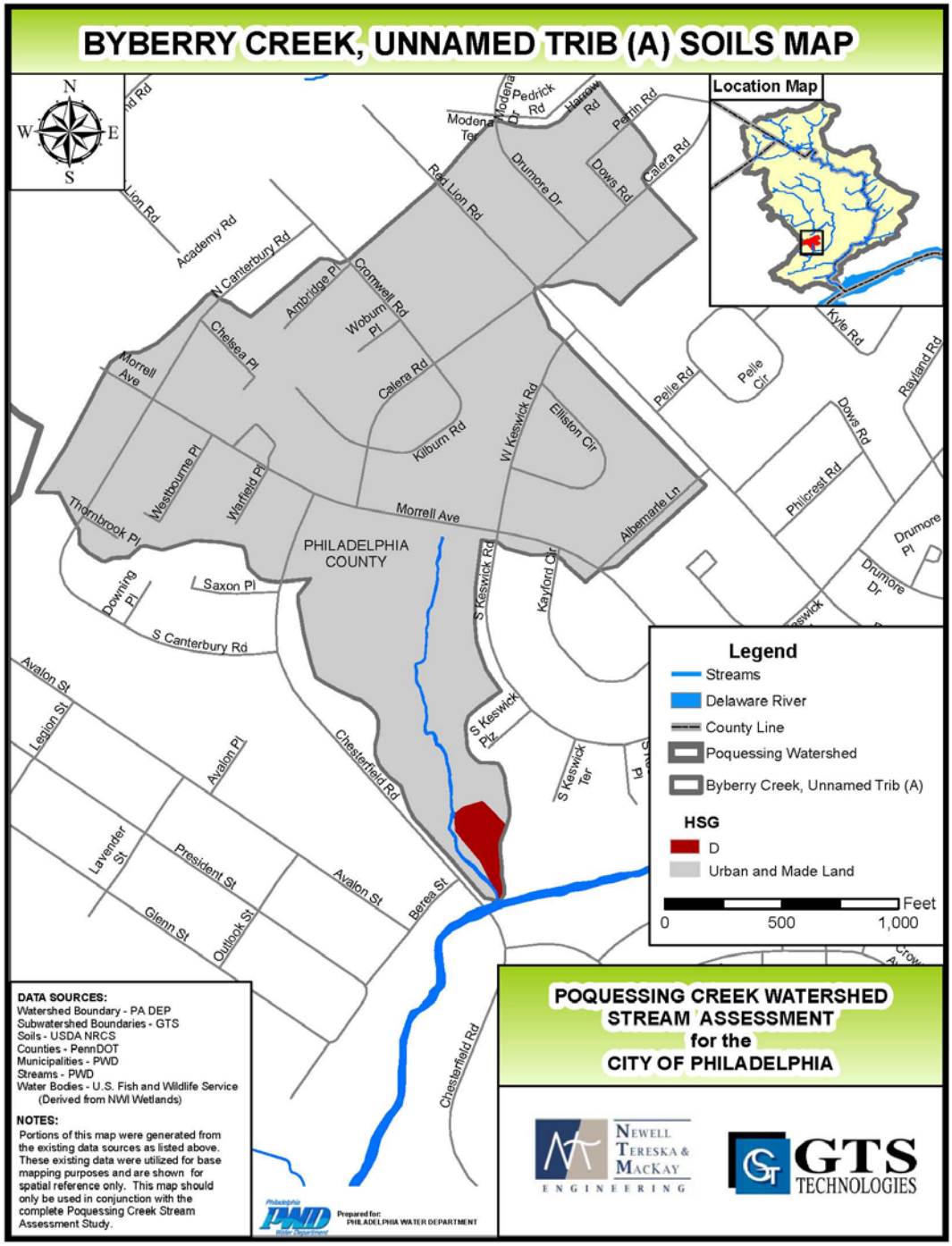


Table 3-135: Erosion Rates for Byberry Creek Unnamed Tributary A Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBYA02	-1.673	-0.126	-0.382	-0.171	-0.034	E

Table 3-136: Erosion Rates for Byberry Creek Unnamed Tributary A Tributaries

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.5.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Byberry Creek Unnamed Tributary A is a small tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Byberry Creek Unnamed Tributary A lies in a mainly wooded area with residential development close by. This is a small tributary with only one cross section area along the reach. The most predominant infrastructure elements in the watershed were constructed channels ranging in height from 2.0 to 4.0 feet in height. Each of the three channels were indicated as being in fair condition. A stormwater outfall exists at the upstream end of the

reach and is considered in good condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-137: Summary of Byberry Creek Unnamed Tributary A Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBYA02	0	0	1	3	0	0	0	0	4

3.3.5.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Byberry Creek, Unnamed Tributary A stream channel is a first-order, single thread channel with no tributaries. Byberry Creek, Unnamed Tributary A is a direct tributary to the mainstem of Byberry Creek, which is a tributary to Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-99: Results for Byberry Creek, Unnamed Tributary A Watershed USAM Components

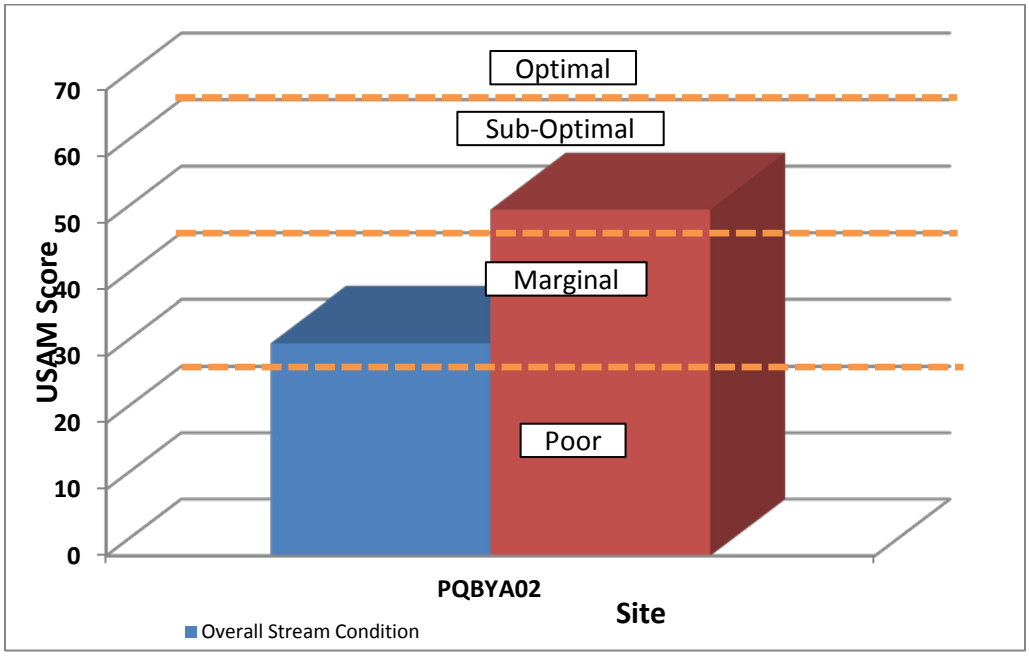
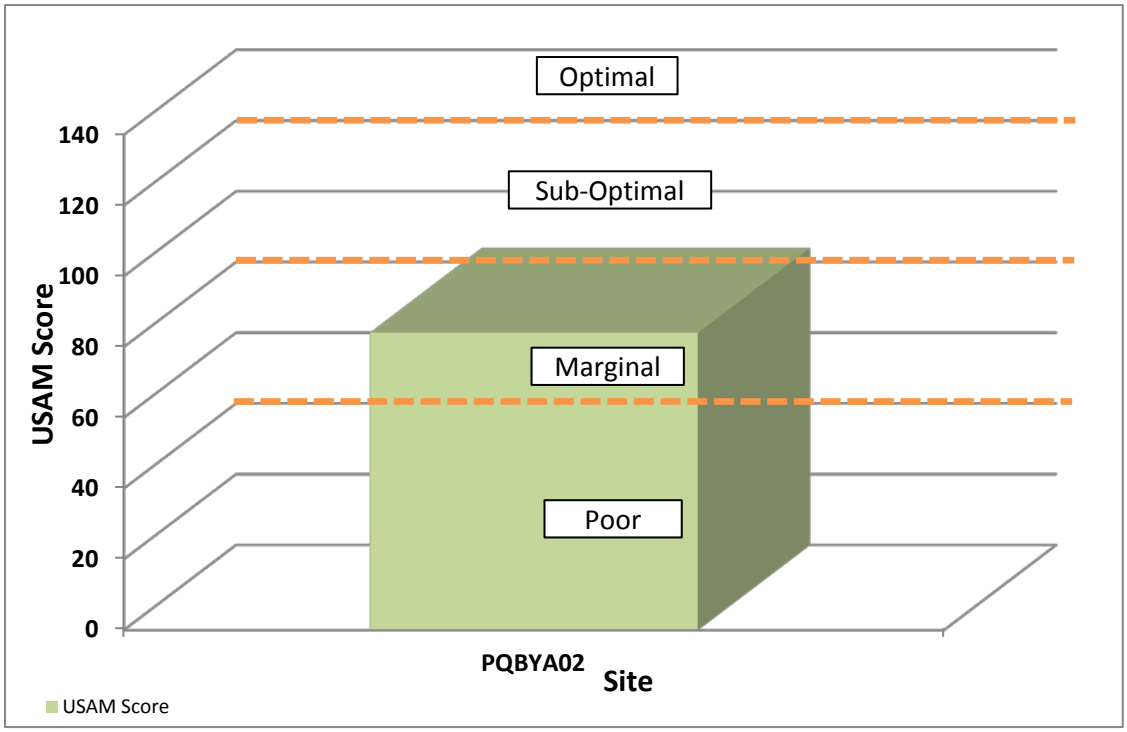


Figure 3-100: Byberry Creek, Unnamed Tributary A USAM Results



3.3.5.5.1 PQBYA02

Reach PQBYA02 is the entire length of Byberry Creek, Unnamed Tributary A. This reach flows through a small forested buffer in a residential area. Reach PQBYA02 is characterized by a moderate slope (2.1%), moderate to high width to depth ratio (18.8), a highly entrenched channel (ER = 1.3), low sinuosity (1.13), and gravel substrate. The reach was classified as a F4b type stream. The composite USAM score for reach PQBYA02 was marginal (84/160).

3.3.5.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach, PQBYA02, was analyzed for Byberry Creek, Unnamed Tributary A. The mean scores for both the Overall Stream Condition components as well as the composite USAM score were classified as marginal (Table 3-138). The mean score for the Overall Buffer and Floodplain Condition was classified as suboptimal. The Overall Stream Condition score was slightly higher than that for the Small Tributary Average while the scores for the Overall Buffer and Floodplain and the USAM were much higher than the Small Tributary Average. The scores for individual parameters ranged from poor to suboptimal. Graphs of each USAM category rating are in Appendix D.

Table 3-138: USAM Results for Byberry Creek, Unnamed Tributary A Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBYA02	Byberry Creek, Unnamed Tributary A	32	52	84
Small Tributary Average		30.6	33.1	63.8

3.3.5.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE BYBERRY CREEK UNNAMED TRIBUTARY A WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to moderate. The Overall Stream Condition score (32/80) was slightly higher than that for the Small Tributary Average (30.6/80), both rating in the marginal range.

Table 3-139: USAM Overall Stream Condition Scoring for Byberry Creek, Unnamed Tributary A Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQBYA02	Byberry Creek, Unnamed Tributary A	11	4	4	5	5	3	32
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.3.5.6.1.1 INSTREAM HABITAT

The score for Instream Habitat for Byberry Creek, Unnamed Tributary A was 11/20, a suboptimal rating indicating a 40-70% mix of stable habitat, well suited for full colonization potential and adequate habitat for maintenance of populations of macroinvertebrates and fish. The Small Tributary average for Instream Habitat was much lower (5.6/20), earning a rating of poor. A poor rating indicates instream conditions providing less than 20% stable habitat and a substrate that is unstable or lacking. Some coarse woody debris and macrophytes were observed instream. However, the eroded banks resulting in excess sediments prevented this reach from attaining an "optimal" rating.

3.3.5.6.1.2 VEGETATIVE PROTECTION

Both banks of Reach PQBYA02 scored a 4.0 on Vegetative Protection out of an overall possible score of 10. This gives Byberry Creek Unnamed Tributary A a rating of marginal. This indicates that 50-70% of the streambank is covered with vegetation but with areas of disruption present and patches of bare soil visible. The Small Tributary Average was also 4.0/10.0.

3.3.5.6.1.3 BANK EROSION

The right and left bank of Byberry Creek Unnamed Tributary A both scored 5.0/10, resulting in a rating of marginal. A marginal rating indicates active stream widening and erosion at a moderate rate. Significant erosion was observed on both banks. The Small Tributary Average for the left bank was 4.3 and 4.0 for the left bank, out of a possible score of 10, slightly lower than the rating for Unnamed Tributary A, but also deserving of a marginal rating.

3.3.5.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Byberry Creek, Unnamed Tributary A scored 3 out of 20, getting a rating of poor and indicating that this reach was deeply entrenched and high flows were not making it into the floodplain. This reach is highly entrenched for the small upstream drainage area. The Small Tributary Average was 8.8 out of 20, rating a marginal rating, higher than that for the Unnamed Tributary A. A rating of marginal also reflects high flows unable to enter the floodplain with a deeply entrenched stream, but to a lesser degree than that of a poor rating.

3.3.5.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BYBERRY CREEK, UNNAMED TRIBUTARY A RUN WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from marginal to optimal. The mean component score for the Byberry Creek Unnamed Tributary A (52.0/80) was much higher than the Small Tributary Average of 33.1/80. The enhanced function of this small Unnamed Tributary can be attributed to the vegetated buffer on both sides of the stream.

Table 3-140: USAM Buffer and Floodplain Condition Scoring for Byberry Creek, Unnamed Tributary A Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBYA02	BY, Unnamed Tributary A	7	6	17	10	12	52
All Reaches Average		4.3	4.5	9.1	6.5	8.8	33.1

3.3.5.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank and right bank vegetated buffer for Byberry Creek Unnamed Tributary A were rated as suboptimal, reflecting a buffer zone of 25-50 feet and little human activity. The Small Tributary Average score of 4.3/10.0 for the left bank and 4.5/10 for the right bank both warranted a marginal rating,

lower than that for the Unnamed Tributary. A marginal rating indicates a buffer zone approximately 25-50 feet wide but with significant human impact.

3.3.5.6.2.2 FLOODPLAIN VEGETATION

Floodplain vegetation related to Byberry Creek Unnamed Tributary A was rated as optimal (17/20). Optimal floodplain vegetation is made up of mature forest. Byberry Creek Unnamed Tributary A scored much higher than the Small Tributary Average (9.1/20), which only rated as marginal. A marginal floodplain vegetation rating indicates the predominate presence of young forest.

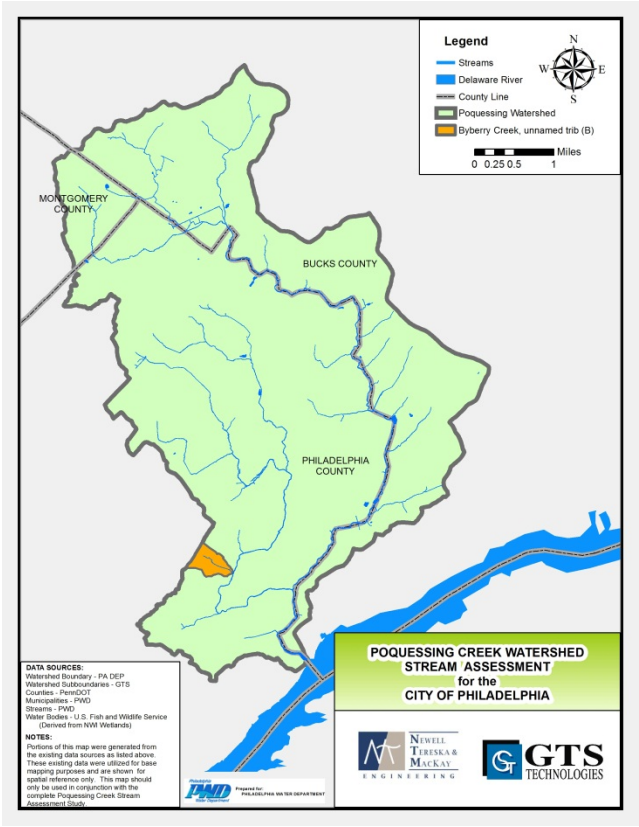
3.3.5.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat associated with Byberry Creek Unnamed Tributary A was rated as marginal (10/20). This floodplain was characterized by all wetland or non-wetland habitat, with some evidence of ponding or standing water. The Small Tributary Average scored slightly lower (6.5/20), also earning a marginal rating.

3.3.5.6.2.4 FLOODPLAIN ENCROACHMENT

Floodplain Encroachment within the Byberry Creek Unnamed Tributary A was rated as suboptimal (12/20), reflecting minor floodplain encroachment in the form of fill, land development or structures, but without affecting floodplain function. The Small Tributary Average was rate marginal (8.8/20), reflecting moderate floodplain encroachment with some effect on floodplain function.

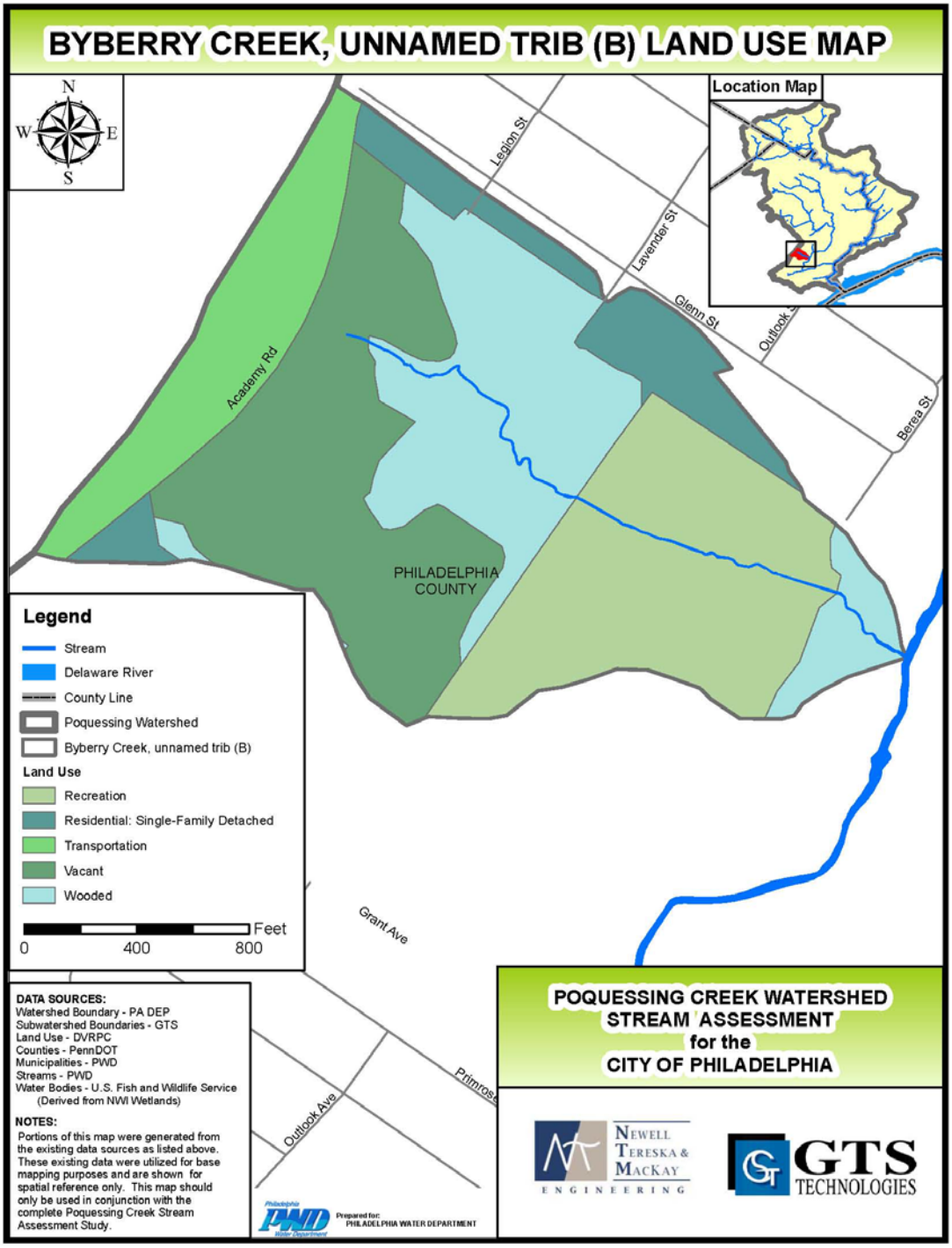
3.3.6 BYBERRY CREEK UNNAMED TRIBUTARY B WATERSHED AND REACH CHARACTERISTICS



Byberry Creek Unnamed Tributary B is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Byberry Creek Unnamed Tributary B originates from overland flow in a wooded area. Byberry Creek Unnamed Tributary B is a first-order tributary for approximately 1,800 feet until meeting the confluence with the Byberry Creek mainstem. The dominant substrate is identified as a mixture of silt and clay. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Byberry Creek Unnamed Tributary B Watershed is 84 acres. Major land use types within the watershed include: vacant (28%), wooded (25%) and recreation (25%). Byberry Creek Unnamed Tributary B is surrounded by wooded or recreational land on both sides. The wooded buffer ranges from about 700 feet to about 1,200 feet wide.

Figure 3-101: Byberry Creek, Unnamed Tributary B Watershed Land Use



3.3.6.1 GEOLOGY

The majority of the Byberry Creek Unnamed Tributary B Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

There is a small section within the Byberry Creek Unnamed Tributary B Watershed that is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

3.3.6.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Byberry Creek Unnamed Tributary B Watershed are classified as urban soils (98%). This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-141: Distribution of NRCS Soil Types in Byberry Creek Unnamed Tributary B Watershed

Group	Area (acres)	Percent of Total Area
D	1.7	2%
Urban	82.6	98%
Total Area	84.3	100%

3.3.6.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for one reach in Byberry Creek, Unnamed Tributary B (Table 3-142). This reach was found to be eroding based on the total wetted perimeter calculation. The average total erosion rate for the reach in Byberry Creek, Unnamed Tributary B was greater than twice the average for all Poquessing Creek subwatersheds (Table 3-143). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Figure 3-102: Geology of Byberry Creek, Unnamed Tributary B Watershed

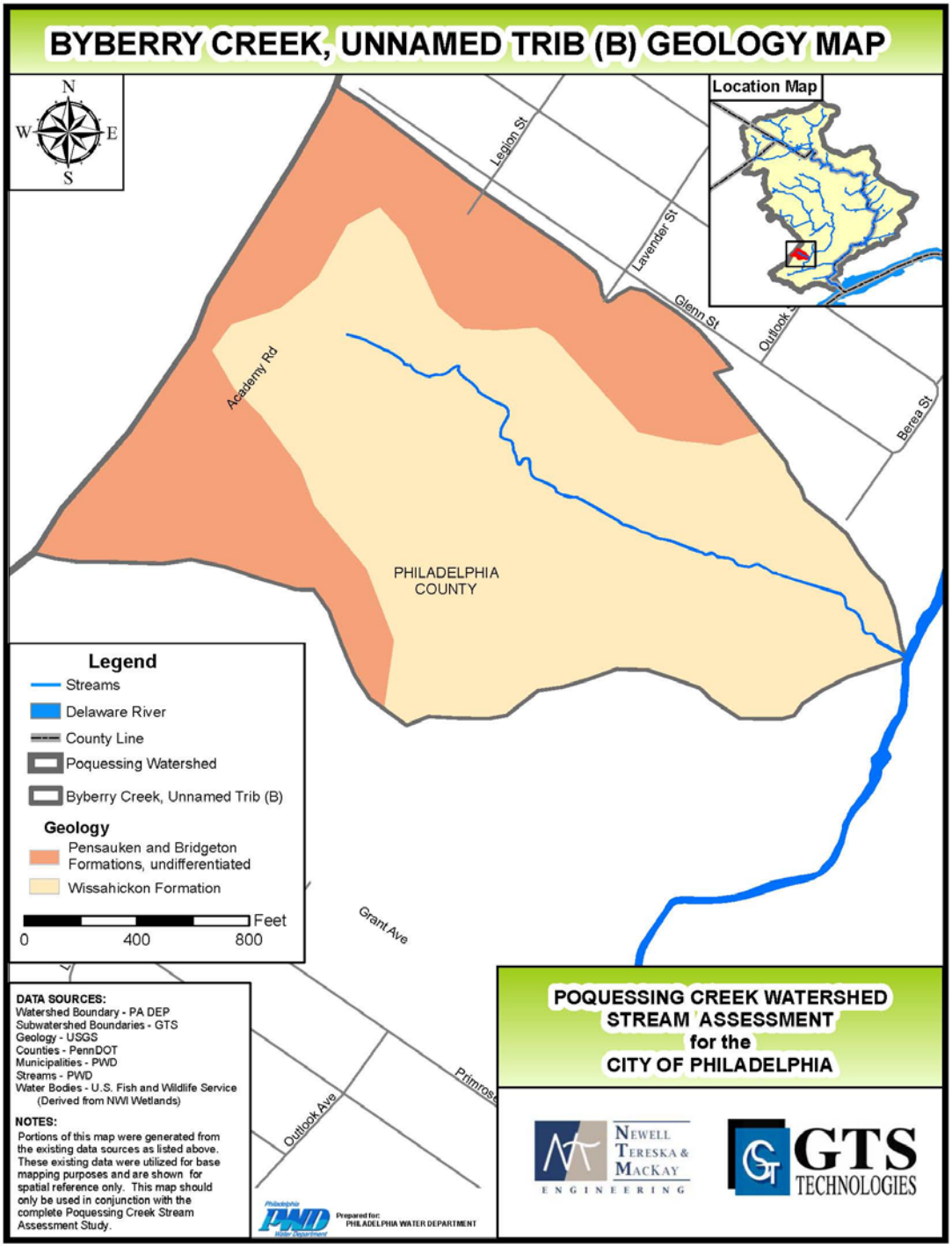


Figure 3-103: Distribution of NRCS Soil Types in Byberry Creek, Unnamed Tributary B Watershed

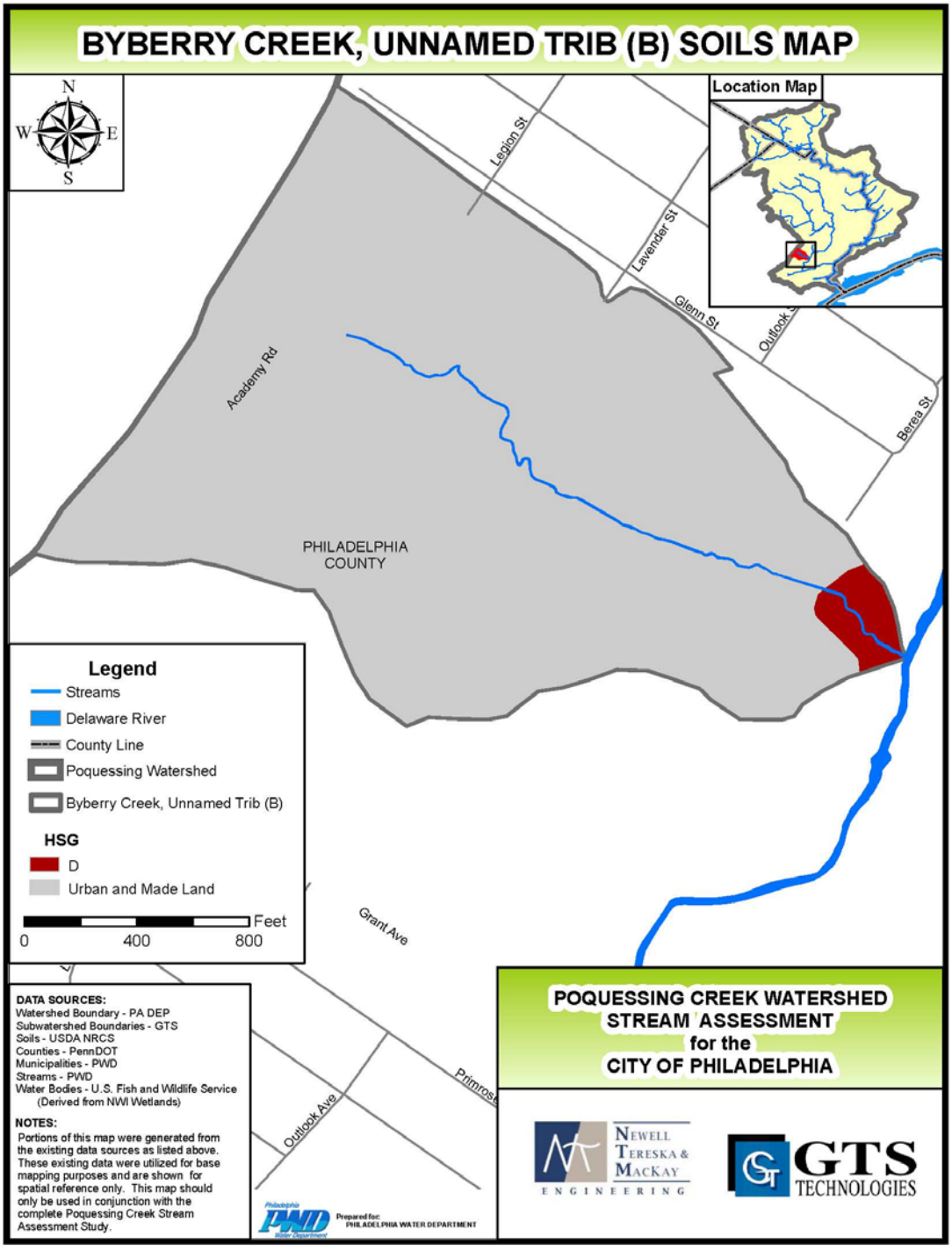


Table 3-142: Erosion Rates for Byberry Creek Unnamed Tributary B Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBYB04	0.400	-0.570	0.263	-0.474	-0.095	E

Table 3-143: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.6.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Byberry Creek Unnamed Tributary B is a small tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The majority of infrastructure was located approximately 300 to 1,200 feet upstream of the confluence with Byberry Creek mainly in the form of culverts. None of these culvert crossings go under major transportation routes. This reach is in the area of the Torresdale-Frankford Country Club and all inventoried infrastructure is on the country club property and in good condition. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-144: Summary of Byberry Creek Unnamed Tributary B Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBYB04	5	3	1	0	0	0	0	0	9

3.3.6.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Byberry Creek, Unnamed Tributary B stream channel is a first-order, single thread channel with no tributaries. Byberry Creek, Unnamed Tributary B is a direct tributary to the mainstem of Byberry Creek, which is a tributary to Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-104: Results for Byberry Creek, Unnamed Tributary B Watershed USAM Components

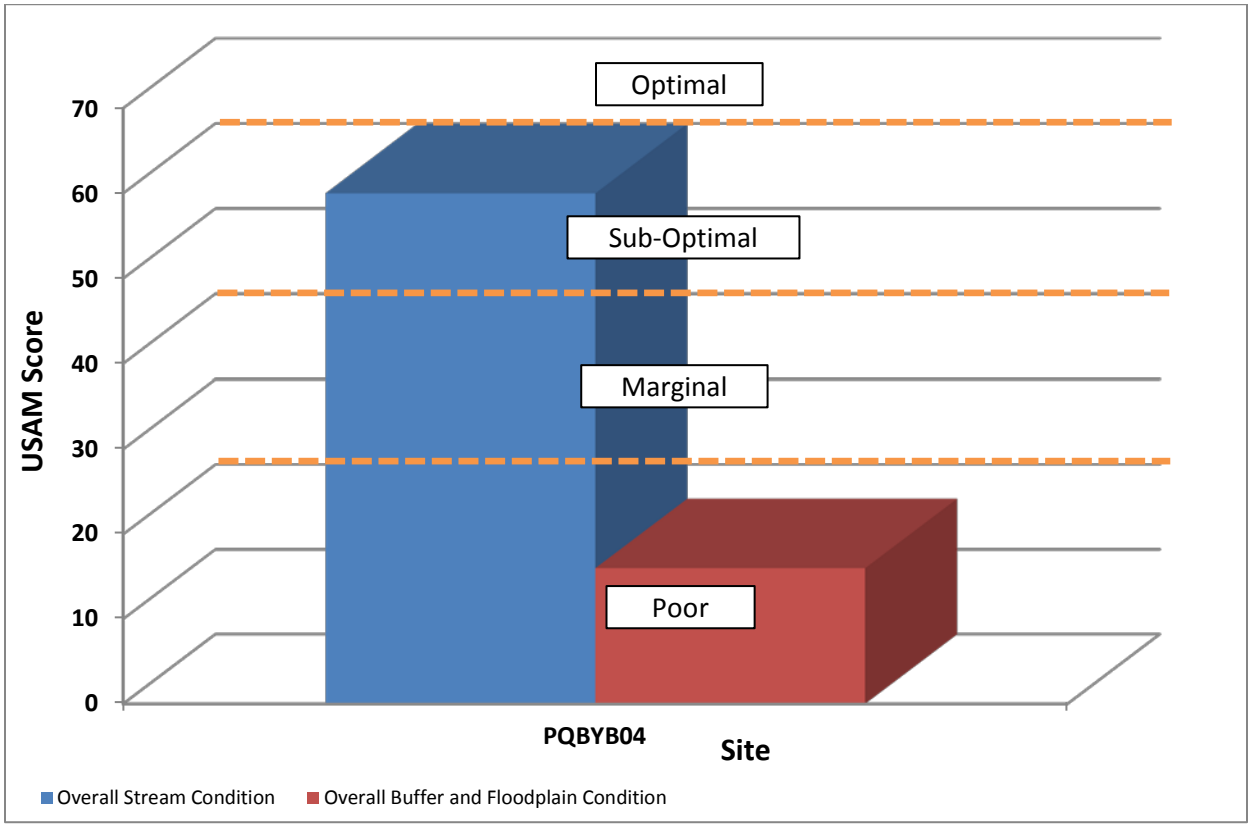
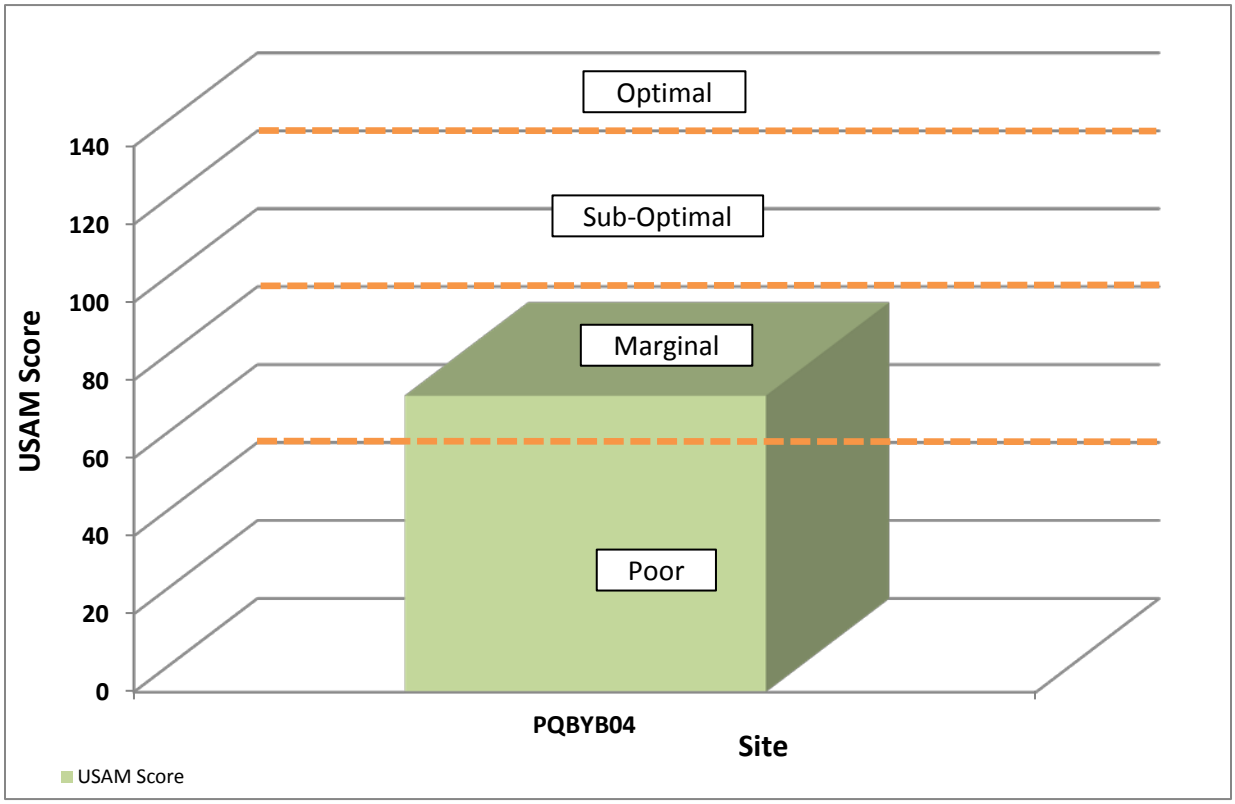


Figure 3-105: Byberry Creek, Unnamed Tributary B Watershed USAM Results



3.3.6.5.1 PQBYB04

Reach PQBYB04 is the entire length of Byberry Creek, Unnamed Tributary B. This reach starts in a wooded area and then travels through a golf course. Reach PQBYB04 is characterized by a shallow slope (1.5%), moderate to high width to depth ratio (11.8), a slightly entrenched channel (ER = 9.2), low sinuosity (1.12), and silt/clay substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQBYB04 was marginal (76/160).

3.3.6.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Only one reach, PQBYB04, was analyzed for Byberry Creek, Unnamed Tributary B. The mean score for the Overall Stream Condition components was classified as suboptimal (Table 3-145). The mean score for the Overall Buffer and Floodplain Condition was classified as poor and the USAM score was marginal. The Overall Stream Condition score was double that of the Small Tributary Average and the USAM score was slightly higher than the Small Tributary Average. The Overall Buffer and Floodplain score was much lower than that for the Small tributary Average. The scores for individual parameters ranged from poor to optimal. Graphs of each USAM category rating are in Appendix D.

Table 3-145: USAM Results for Byberry Creek, Unnamed Tributary B Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBYB04	Byberry Creek, Unnamed Tributary B	60	16	76
Small Tributary Average		30.6	33.1	63.8

3.3.6.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE BYBERRY CREEK UNNAMED TRIBUTARY B WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal. The Overall Stream Condition score (60.0/80) with a rating of suboptimal, was much higher than that for the Small Tributary Average (30.6/80), which rated as marginal.

Table 3-146: USAM Overall Stream Condition Scoring for Byberry Creek, Unnamed Tributary B Watershed

OVERALL STREAM CONDITION								
Reach ID	Sub-watershed	Instream Habitat	Vegetative Protection		Bank Erosion		Floodplain Connection	Overall Stream Condition
			Left	Right	Left	Right		
PQBYB04	Byberry Creek, Unnamed Tributary B	6	8	8	9	9	20	60
Small Tributary Average		5.6	4.0	4.0	4.0	4.3	8.8	30.6

3.3.6.6.1.1 INSTREAM HABITAT

The score for Instream Habitat for Byberry Creek, Unnamed Tributary B was 6/20, a marginal rating indicating a 20-40% mix of stable habitat, indicating less than desirable habitat availability and a substrate that has been either disturbed or removed. The Small Tributary average for Instream Habitat was slightly lower (5.6/20), earning a rating of poor. A poor rating indicates instream conditions providing less than 20% stable habitat and a substrate that is unstable or lacking. There was a lack of coarse woody debris and channel was choked with excess sediments.

3.3.6.6.1.2 VEGETATIVE PROTECTION

Both banks of Reach PQBYB04 scored an 8.0 on Vegetative Protection out of an overall possible score of 10. This gives Byberry Creek Unnamed Tributary B a rating of suboptimal. This indicates that 70-90% of the streambank is covered with vegetation (with one class of plants not represented) and disruption evident but with little effect. The Small Tributary Average was also 4.0/10.0.

3.3.6.6.1.3 BANK EROSION

The right and left bank of Byberry Creek Unnamed Tributary B both scored 9.0/10, resulting in a rating of optimal. An optimal rating indicates stable banks with little or no evidence of erosion and minimal potential for future problems. The Small Tributary Average for the left bank was 4.3 and 4.0 for the right bank, out of a possible score of 10, much lower than the rating for Unnamed Tributary B.

3.3.6.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Byberry Creek, Unnamed Tributary B scored 20 out of 20, an optimal rating reflecting high flows able to enter the floodplain and no deep stream entrenchment. The Small Tributary Average was 8.8 out of 20, a marginal rating, much lower than that for Unnamed Tributary B. A rating of marginal also reflects high flows unable to enter the floodplain with a deeply entrenched stream.

3.3.6.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BYBERRY CREEK, UNNAMED TRIBUTRARY B WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to marginal. The mean component score for the Byberry Creek Unnamed Tributary B (16.0/80) was much lower than the Small Tributary Average of 33.1/80. This reach lacked a riparian buffer and had no adjacent wetland and no stream shading.

Table 3-147: USAM Buffer and Floodplain Condition Scoring for Byberry Creek, Unnamed Tributary B Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBYB04	Byberry Creek, Unnamed Tributary B	1	1	2	2	10	16
Small Tributary Average		4.3	4.5	9.1	6.5	8.8	33.1

3.3.6.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank and right bank vegetated buffer for Byberry Creek Unnamed Tributary B were rated as poor (1/10), reflecting a buffer zone of less than 10 feet and little to no vegetation as a result of human activity. The Small Tributary Average score of 4.3/10.0 for the left bank and 4.5/10 for the right bank both warranted a marginal rating, higher than that for the unnamed tributary. A marginal rating indicates a buffer zone approximately 25-50 feet wide but with significant human impact.

3.3.6.6.2.2 FLOODPLAIN VEGETATION

Floodplain vegetation related to Byberry Creek Unnamed Tributary B was rated as poor (2/20), indicating that the predominant floodplain vegetation type is turf or cropland. Byberry Creek Unnamed Tributary B scored much lower than that for the Small Tributary Average (9.1/20), which rated as marginal. A marginal floodplain vegetation rating indicates the predominate presence of young forest.

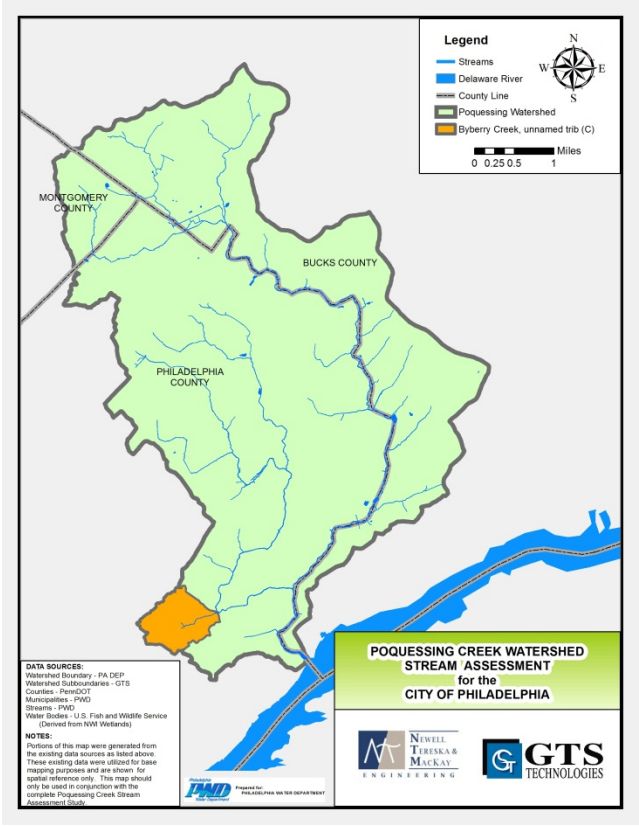
3.3.6.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat associated with Byberry Creek Unnamed Tributary B was rated as marginal (2/20). This floodplain was characterized by all wetland or non-wetland habitat and no evidence of ponding or standing water. The Small Tributary Average scored higher (6.5/20), earning a marginal rating.

3.3.6.6.2.4 FLOODPLAIN ENCROACHMENT

Floodplain Encroachment within the Byberry Creek Unnamed Tributary B was rated as marginal (10/20), reflecting moderate floodplain encroachment in the form of fill, land development or structures and some effect on floodplain function. The Small Tributary Average was also rated marginal (8.8/20).

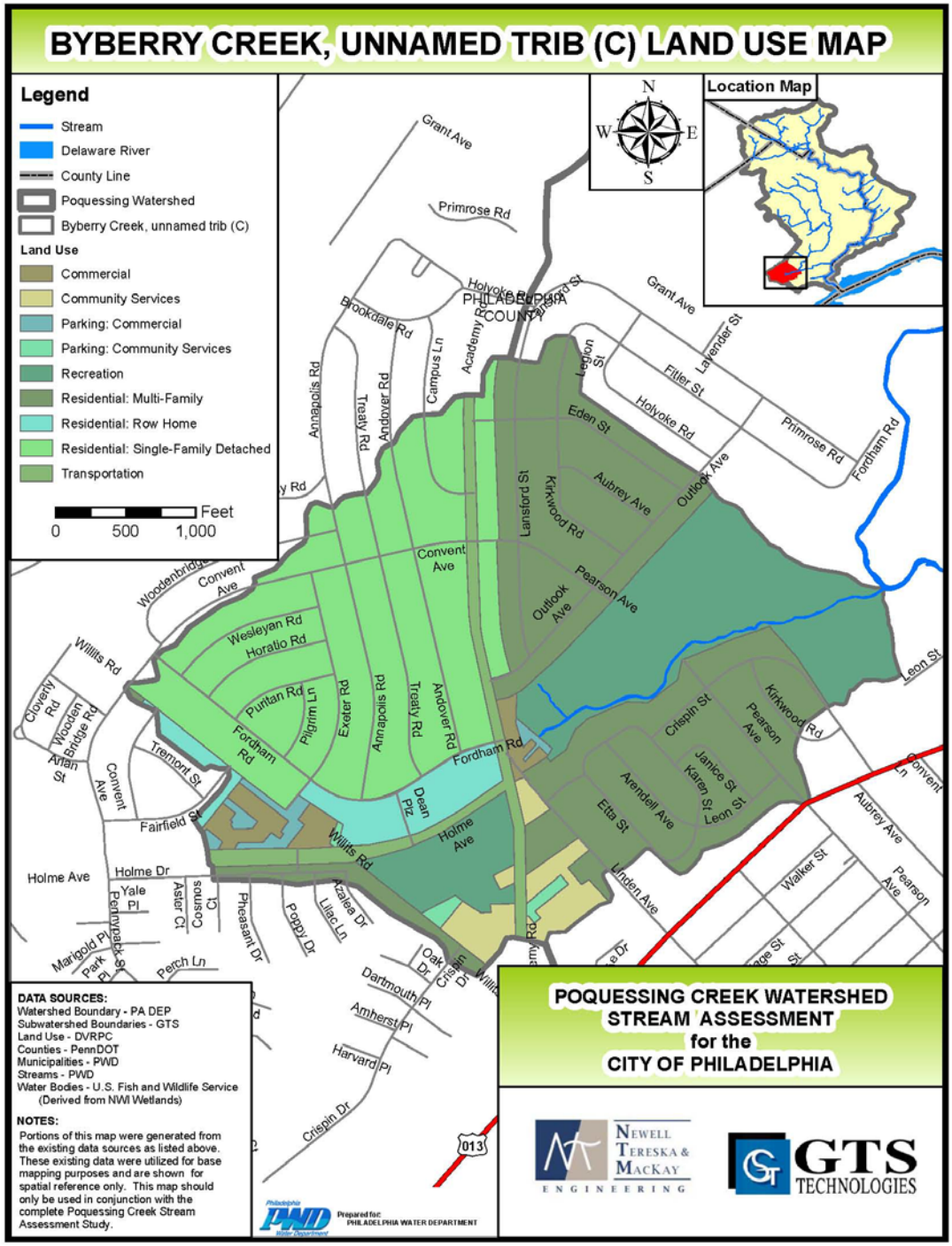
3.3.7 BYBERRY CREEK UNNAMED TRIBUTARY C WATERSHED AND REACH CHARACTERISTICS



Byberry Creek Unnamed Tributary C is a tributary to the Byberry Creek which is a tributary to the mainstem of the Poquessing Creek. Byberry Creek Unnamed Tributary C originates from stormwater drainage from surrounding residential development. Byberry Creek Unnamed Tributary C is a second-order tributary that flows for approximately 2,300 feet before meeting the confluence with Byberry Creek. The dominant substrate is identified as gravel material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Byberry Creek Unnamed Tributary C Watershed is 314 acres. Major land use types within the watershed include: residential: multi-family (35%), residential: single family detached (32%) and recreation (19%). Byberry Creek Unnamed Tributary C is surrounded by some wooded land and recreational land on both sides. The wooded buffer ranges from about 100 feet to about 300 feet wide.

Figure 3-106: Byberry Creek, Unnamed Tributary C Watershed Land Use



3.3.7.1 GEOLOGY

The majority of the Byberry Creek Unnamed Tributary C Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

Sections within the Byberry Creek Unnamed Tributary C Watershed are underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formations consist of quartz and sand.

3.3.7.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the soils for the entire Byberry Creek Unnamed Tributary C Watershed vary and are classified as follows: hydrologic group B (3%), hydrologic group D (4%) and Urban (94%). The majority are urban soils. This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-148: Distribution of NRCS Soil Types in Byberry Creek, Unnamed Tributary C Watershed

Group	Area (acres)	Percent of Total Area
B	8.3	3%
D	12.0	4%
Urban	293.8	94%
Total Area	314.2	100%

Figure 3-107: Geology of Byberry Creek, Unnamed Tributary C Watershed

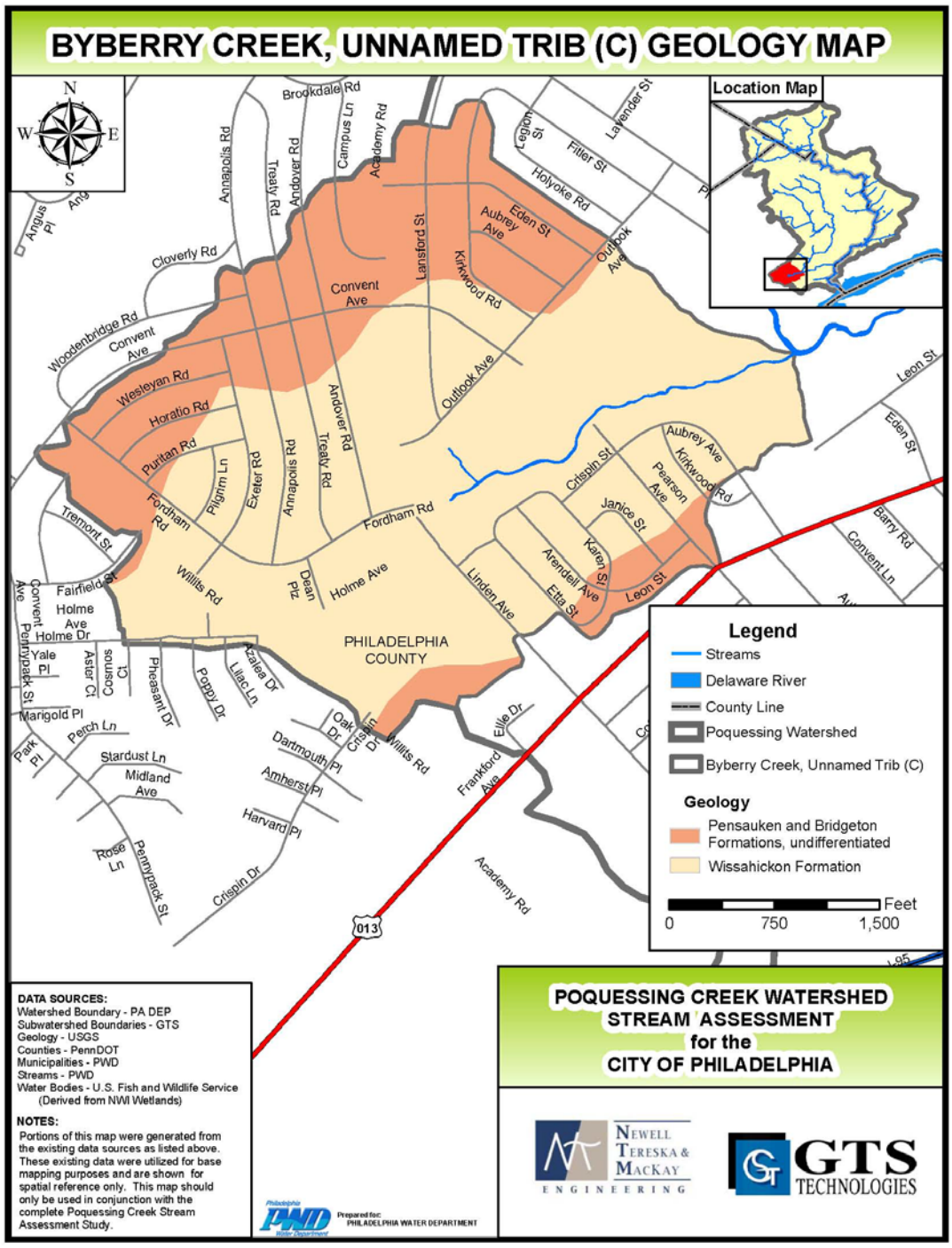
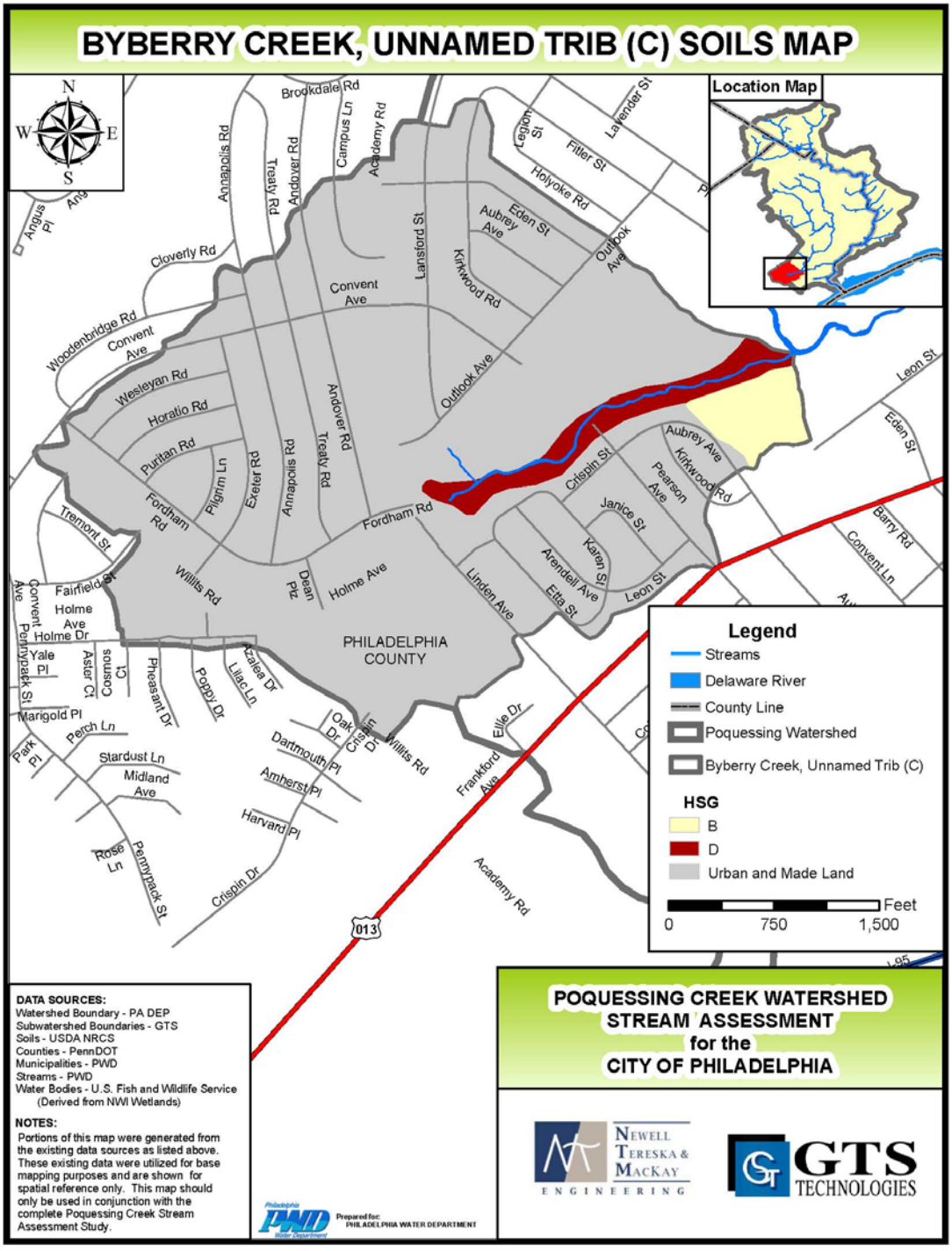


Figure 3-108: Distribution of NRCS Soil Types in Byberry Creek, Unnamed Tributary C Watershed



3.3.7.3 BANK EROSION

The erosion rate for the left bank, stream bed, right bank, and total wetted perimeter were calculated for two reaches in Byberry Creek, Unnamed Tributary C (Table 3-149). One reach was found to be eroding and one was found to be aggrading based on the total wetted perimeter calculation. The average total erosion rate for the reach in Byberry Creek, Unnamed Tributary C was near the average for all Poquessing Creek subwatersheds (Table 3-150). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-149: Erosion Rates for Byberry Creek Unnamed Tributary C Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBYC02	-0.937	0.238	0.376	0.187	0.037	A
PQBYC04	-5.083	-0.213	-0.155	-0.589	-0.118	E
Average	-3.010	0.013	0.111	-0.201	-0.040	E

Table 3-150: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.3.7.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Byberry Creek Unnamed Tributary C is a small tributary to Byberry Creek which is a tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Byberry Creek Unnamed Tributary C occur as stormwater drainage from surrounding dense residential development. Infrastructure was located consistently along the Byberry Creek Unnamed Tributary C. The reach flows through the John F. Byrne Golf Club and most of the infrastructure is on the golf club property. All infrastructure is indicated as being in good condition. According to infrastructure assessments (Refer to Appendix B) and field reconnaissance, the existing culverts are in good condition but seem to have considerable debris blockage. Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-151: Summary of Byberry Creek, Unnamed Tributary C Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBYC02	2	0	3	0	0	0	0	0	5
PQBYC04	2	2	0	0	0	0	0	0	4
TOTAL	4	2	3	0	0	0	0	0	9

3.3.7.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The Byberry Creek, Unnamed Tributary C stream channel is a second-order, single thread channel with one short unnamed tributary. Byberry Creek, Unnamed Tributary C is a direct tributary to the mainstem of Byberry Creek, which is a tributary to Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-109: Results for Byberry Creek, Unnamed Tributary C Watershed

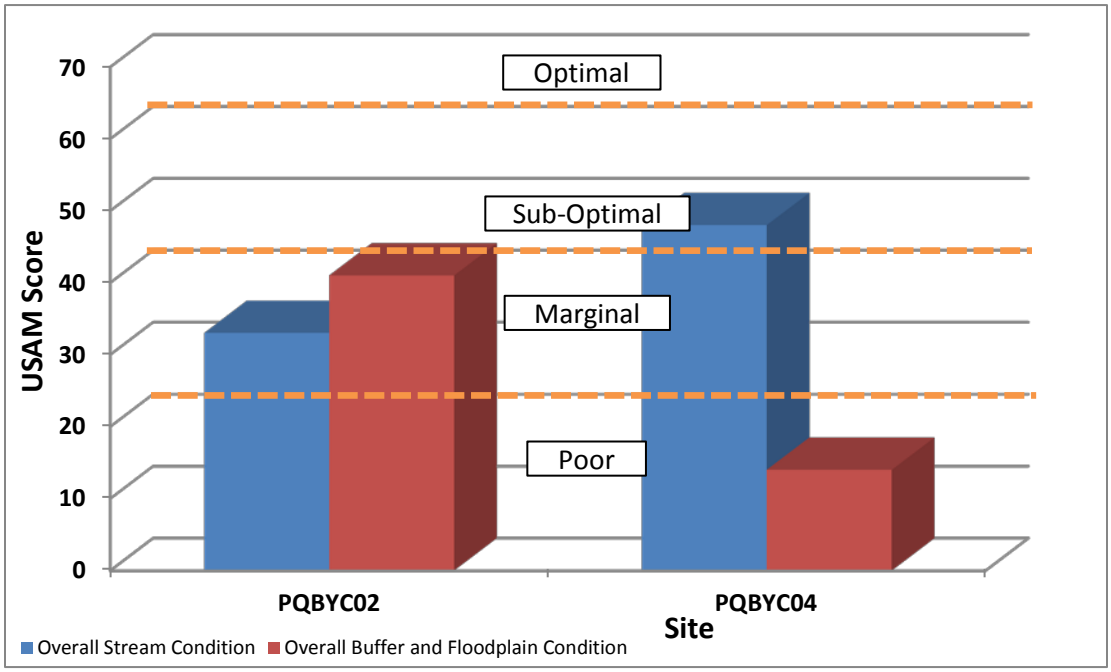
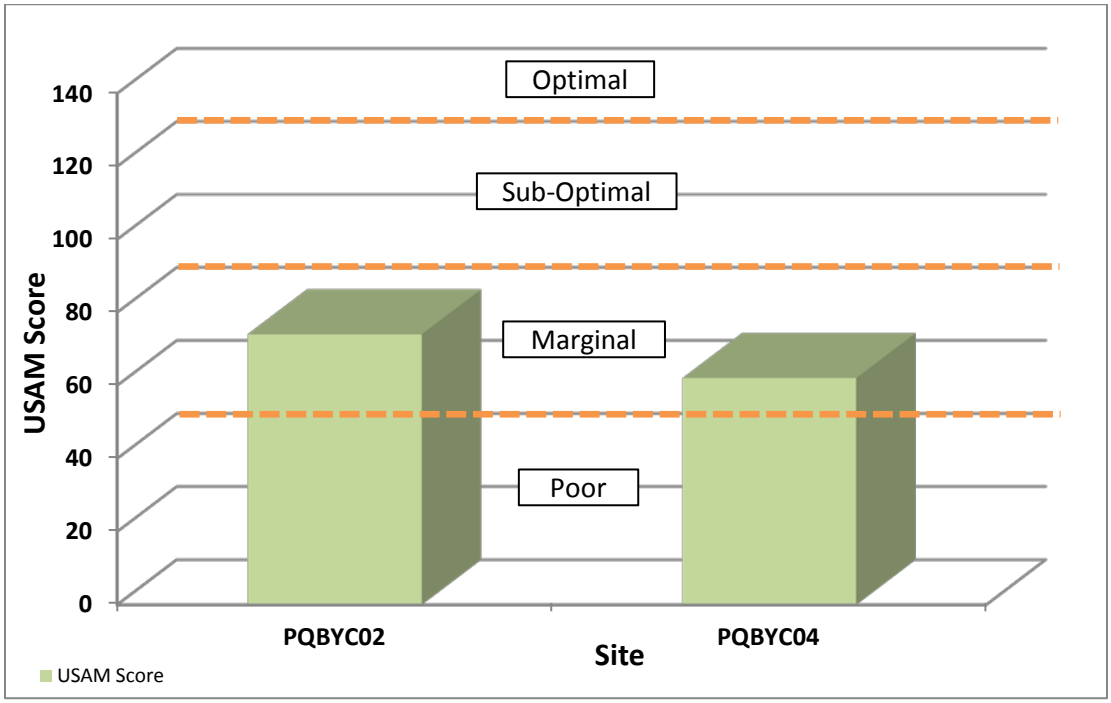


Figure 3-110: Byberry Creek, Unnamed Tributary C Watershed USAM Results



3.3.7.5.1 PQBYC02

Reach PQBYC02 is the first reach of Byberry Creek, Unnamed Tributary C. This reach flows through a small forested buffer between a golf course and a residential area. Reach PQBYC02 is characterized by a shallow slope (0.5%), moderate to high width to depth ratio (22.5), a moderately entrenched channel (ER = 1.6), low sinuosity (1.08), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBYC02 was marginal (74/160).

3.3.7.5.2 PQBYC04

Reach PQBYC04 begins approximately 500 feet upstream of cross section PQBYC02. This reach flows through a golf course and has a predominantly turf floodplain vegetation. Reach PQBYC04 is characterized by a shallow slope (0.6%), low width to depth ratio (9.2), a slightly entrenched channel (ER = 2.4), low sinuosity (1.02), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBYC04 was marginal (62/160).

3.3.7.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

Two reaches were analyzed for Byberry Creek Unnamed Tributary C: reach PQBYC02 and PQBYC04. The mean score for the Overall Stream Condition was classified as suboptimal. The mean scores for both the Overall Buffer and Floodplain Condition component as well as the composite USAM score were classified as marginal (Table 3-152). Average conditions within the Byberry Creek, Unnamed Tributary C Watershed's stream channels were slightly better than conditions observed within the buffers and floodplains. The watershed average for the Overall Stream Condition component was slightly higher than the All Reaches average; however the Overall Buffer and Floodplain component and the USAM score were slightly lower compared to the All Reaches average. The scores for individual parameters ranged from poor to suboptimal. Graphs of each USAM category rating are in Appendix D.

Table 3-152: USAM Results for Byberry Creek, Unnamed Tributary C Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBYC02	Byberry Creek, Unnamed Tributary C	33	41	74
PQBYC04	Byberry Creek, Unnamed Tributary C	48	14	62
PQBYC Mean		40.5	27.5	68
All Reaches Average		37.1	37.4	74.4

3.3.7.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THEBYBERRY CREEK UNNAMED TRIBUTARY C WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from marginal to suboptimal, with most scoring slightly higher than their respective All Reaches average scores.

Table 3-153: USAM Overall Stream Condition Scoring for Byberry Creek, Unnamed Tributary C Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQBYC02	Byberry Creek, Unnamed Tributary C	8	4	5	4	6	6	33
PQBYC04	Byberry Creek, Unnamed Tributary C	10	5	7	5	7	14	48
PQBYC Mean		9.0	4.5	6.0	4.5	6.5	10.0	40.5
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.3.7.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter were marginal for the two reaches analyzed in the Byberry Creek, Unnamed Tributary C Watershed. Reach PQBYC02 scored 8.0/20 and reach PQBYC04 scored 10/20. The watershed mean was slightly higher than the All Reaches average (9.0/20 vs. 8.2/20), but this also was designated a marginal rating. A marginal rating indicates a 20-40% mix of stable habitat with less than desirable habitat availability, being frequently disturbed or removed. There was a lack of coarse woody debris and the channel was choked with excess sediments.

3.3.7.6.1.2 VEGETATIVE PROTECTION

The left bank of both reach PQBYC02 and PQBYC04 were rated as marginal, 4.0/10 and 5.0/10, respectively, as was the right bank of reach PQBYC02. A marginal rating indicates that 50-70% of the streambank surface is covered by vegetation with some evidence of disruption, such as bare soil patches or closely cropped vegetation. The right bank of reach PQBYC04 was rated as suboptimal. A suboptimal rating reflects streambank coverage of 70-90% native vegetation with one class of plants unaccounted for and evidence of some disruption but not enough to inhibit plant growth. The mean for the left bank of Byberry Creek Unnamed Tributary C was 4.5/10 or marginal, slightly higher than the All Reaches average for the left bank (4.0/10), also given a rating of marginal. The mean for the right bank of the unnamed tributary was slightly higher (6.0/10) with a rating of suboptimal, greater than the All Reaches average for the right bank (3.9/10), with a rating of marginal.

3.3.7.6.1.3 BANK EROSION

The left bank of both reach PQBYC02 and PQBYC04 were rated as marginal (4.0/10 and 5.0/10, respectively), while both right banks of the reaches rated as suboptimal (6.0/10 and 7.0/10, respectively). A rating of marginal indicates active stream widening and erosion at a moderate rate while a suboptimal rating reflects a stable grade and width with only isolated areas of erosion. The PQBYC Mean for the left bank was 4.5/10 or marginal, slightly higher than the left bank All Reaches average of 3.9/10, which also rates as marginal. The PQBYC mean for the right bank was 6.5/10, or suboptimal, higher than the right bank All Reaches average of 4.0/10 which is considered marginal.

3.3.7.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Byberry Creek, Unnamed Tributary C Watershed ranged from marginal to suboptimal. Reach PQBYC02 had a marginal Floodplain Connection Score of 6/20, indicating that this reach was deeply entrenched and high flows were not making it into the floodplain. Reach PQBYC04 had an suboptimal rating of 14/20 indicating very little entrenchment and floodwaters easily entering the floodplain. The mean for the Byberry Creek, Unnamed Tributary C Watershed was just slightly lower than for all reaches with a score of 10.0 as compared to 13, giving this watershed an overall marginal rating.

3.3.7.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BYBERRY CREEK, UNNAMED TRIBUTARY C WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis ranged from poor to suboptimal. The mean component score for the Byberry Creek Unnamed Tributary C Watershed (27.5/80) was less than the All Reaches average (37.4/80). This reach lacked riparian vegetation and had minimal stream shading.

Table 3-154: USAM Buffer and Floodplain Condition Scoring for Byberry Creek, Unnamed Tributary C Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBYC02	Byberry Creek, Unnamed Tributary C	2	6	8	12	13	41
PQBYC04	Byberry Creek, Unnamed Tributary C	1	1	2	2	8	14
PQBYC Mean		1.5	3.5	5	7	10.5	27.5
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.3.7.6.2.1 VEGETATED BUFFER WIDTH

The widths of the left bank vegetated buffer for both reaches analyzed were rated as poor, reflecting a buffer zone of less than 10 feet and no riparian vegetation due to human activities. The width of the vegetated buffer zone of the right banks of reach PQBYC04 was also rated as poor. The right bank of Reach PQBYC02 however, was rated as suboptimal, indicating a vegetated buffer zone 25-50 feet in width with only minimal impact from human activities. The mean watershed score of 1.5/10.0 (poor) for the left bank was lower than 5.3/10.0 (marginal) for the All Reaches average. The mean watershed score for the right bank was 3.5/10.0 (marginal) was also lower than the All Reaches average of 6.0/10.0 (suboptimal).

3.3.7.6.2.2 FLOODPLAIN VEGETATION

The dominant vegetation type in Reach PQBYC02 was shrub, with a marginal score (8/20). Reach PQBYC04 scored poor (1/20). This reflects a predominant floodplain vegetation type of grass or cropland. The mean Byberry Creek, Unnamed Tributary C Watershed score was rated as poor (5.0/20), which was lower than the All Reaches average which was rated as marginal (9.7/20).

3.3.7.6.2.3 FLOODPLAIN HABITAT

Reach PQBYC02 was suboptimal, with a score of 12/20. This reach was characterized by an even mix of wetland and non-wetland habitat, with no evidence of ponding or standing water. Reach PQBYC04 had a rating of poor (2/20), characterized by either all wetland or non-wetland habitat and no standing water observed. The mean watershed score for this parameter was rated as marginal (7/20) and was slightly lower than the All Reaches average score (8.3/20) which was also considered marginal.

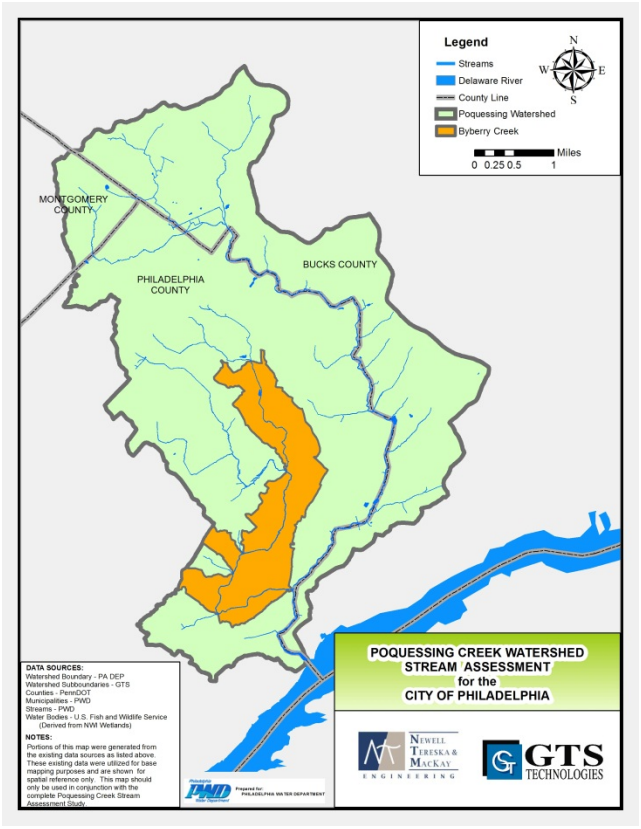
3.3.7.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter in the Byberry Creek, Unnamed Tributary C Watershed ranged from marginal to suboptimal. Reach PQBYC02 was rated suboptimal, with a score of 13.0/20, indicating minor floodplain encroachment and with little effect on floodplain function. Reach PQBYC04 had a score of marginal (8/20), indicating moderate evidence of floodplain encroachment in the form of fill material or human intervention with some effect on floodplain function. The mean score for the watershed was 10.5/20 which was slightly higher than the All Reaches average score of 8.2/20, giving the Byberry Creek, Unnamed Tributary C Watershed an overall rating of sub-optimal.

3.4 BYBERRY CREEK MAINSTEM WATERSHED

Byberry Creek mainstem is defined as the area directly to Buberry Creek. The watershed characteristics of the mainstem is described in the following section.

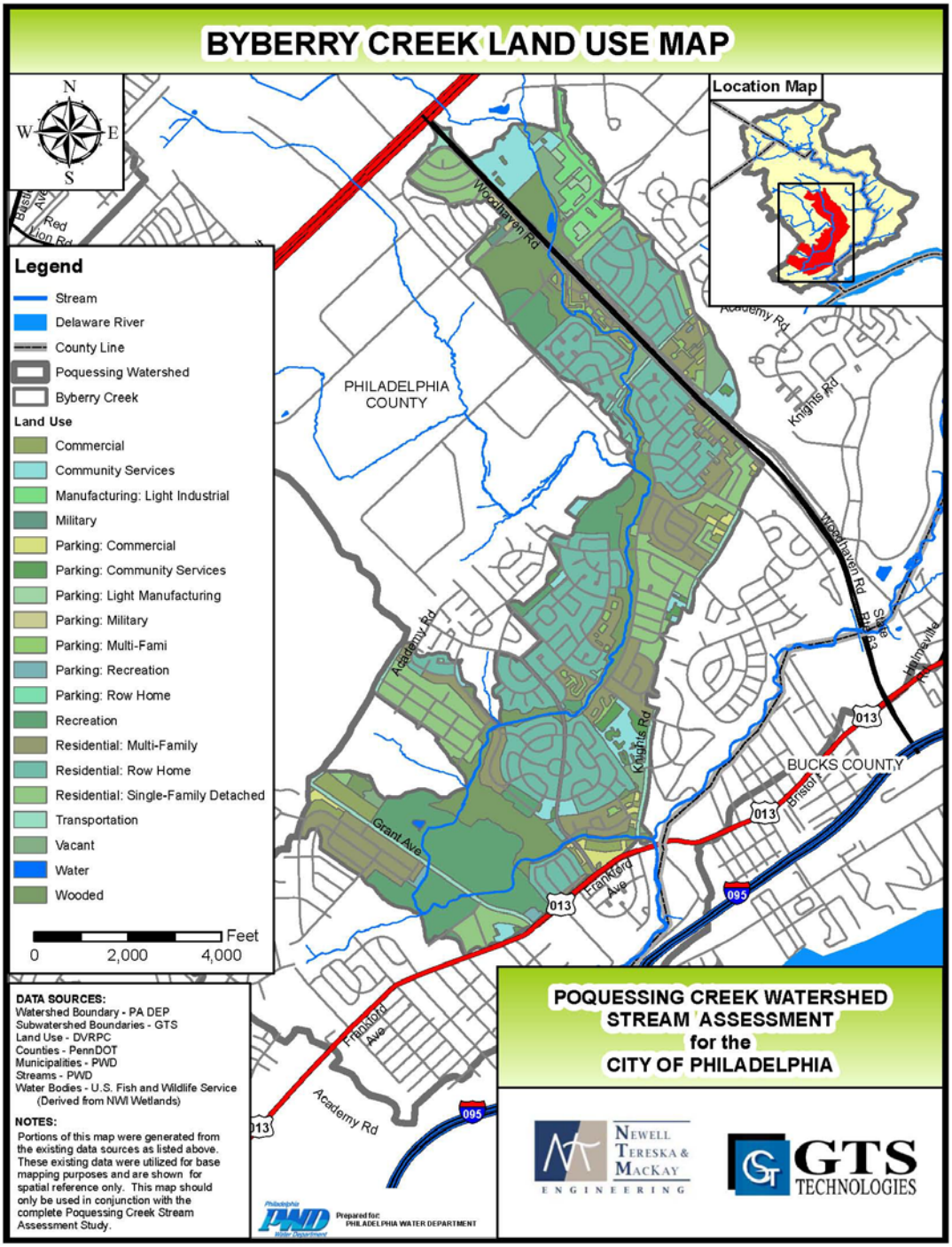
3.4.1 BYBERRY CREEK WATERSHED AND REACH CHARACTERISTICS



Byberry Creek is a tributary to the mainstem of the Poquessing Creek. Byberry Creek originates from the confluence of Wilson's Run and Elwood's Run. Byberry Creek flows for approximately 5 miles until meeting the confluence with the Poquessing mainstem. The dominant substrate varies from gravel to cobble material. Both the valley floor and channel have been substantially impacted by past and current land use.

The entire Byberry Creek Watershed is 4,570 acres. Major land use types within the watershed include: residential: row home (28%) residential: multifamily (14%) and wooded (11%). Byberry Creek is surrounded by wooded land on both sides. The wooded buffer ranges from about 20 feet to about 2,000 feet wide.

Figure 3-111: Byberry Creek Watershed Land Use



3.4.1.1 GEOLOGY

The majority of the Byberry Creek Watershed is underlain by the Wissahickon Formation. The Wissahickon Formation consists of mica schist, gneiss and quartzite. The exposed schist near the surface is highly weathered. The Wissahickon Formation is also comprised of metamorphosed sedimentary rocks.

A large portion of the Byberry Creek Watershed is underlain by the Pennsauken and Bridgeton Formations. The Pennsauken and Bridgeton Formation consist of quartz and sand.

3.4.1.2 SOILS

According to the National Resource and Conservation Service Soil Survey, the majority of soils for the entire Byberry Creek Watershed are classified as for Urban Soils (85%). This generally means that soils have been sufficiently disturbed from their natural state as to preclude classification. Furthermore, due to this disturbance, urban soil infiltration characteristics may vary widely.

Table 3-155: Distribution of NRCS Soil Types in Byberry Creek Mainstem Watershed

Group	Area (acres)	Percent of Total Area
A	7.4	0.5%
B	118.4	7%
C	1.0	0.1%
D	108.7	7%
Urban	1351.1	85%
Total Area	1586.6	100%

Figure 3-112: Geology of Byberry Creek Watershed

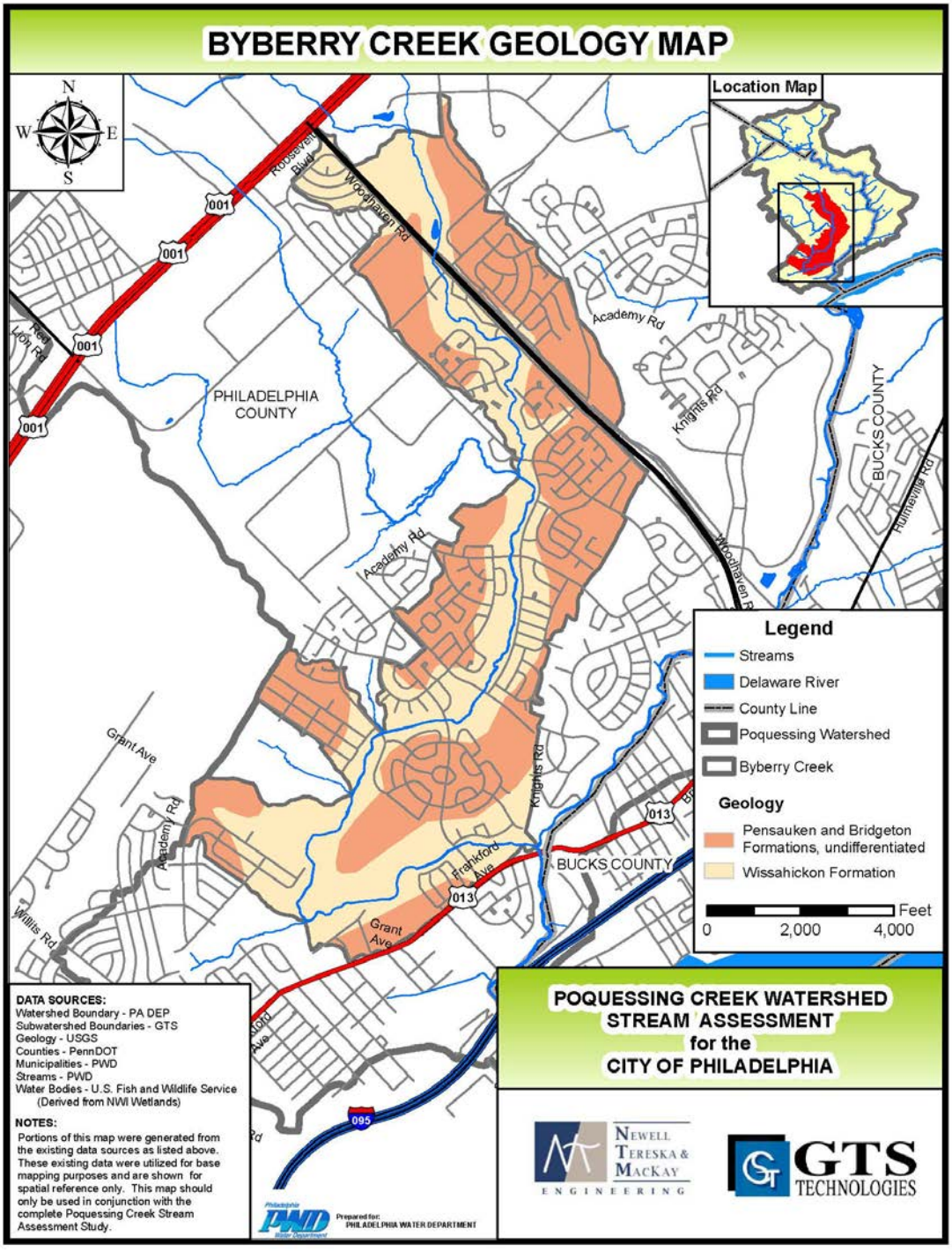
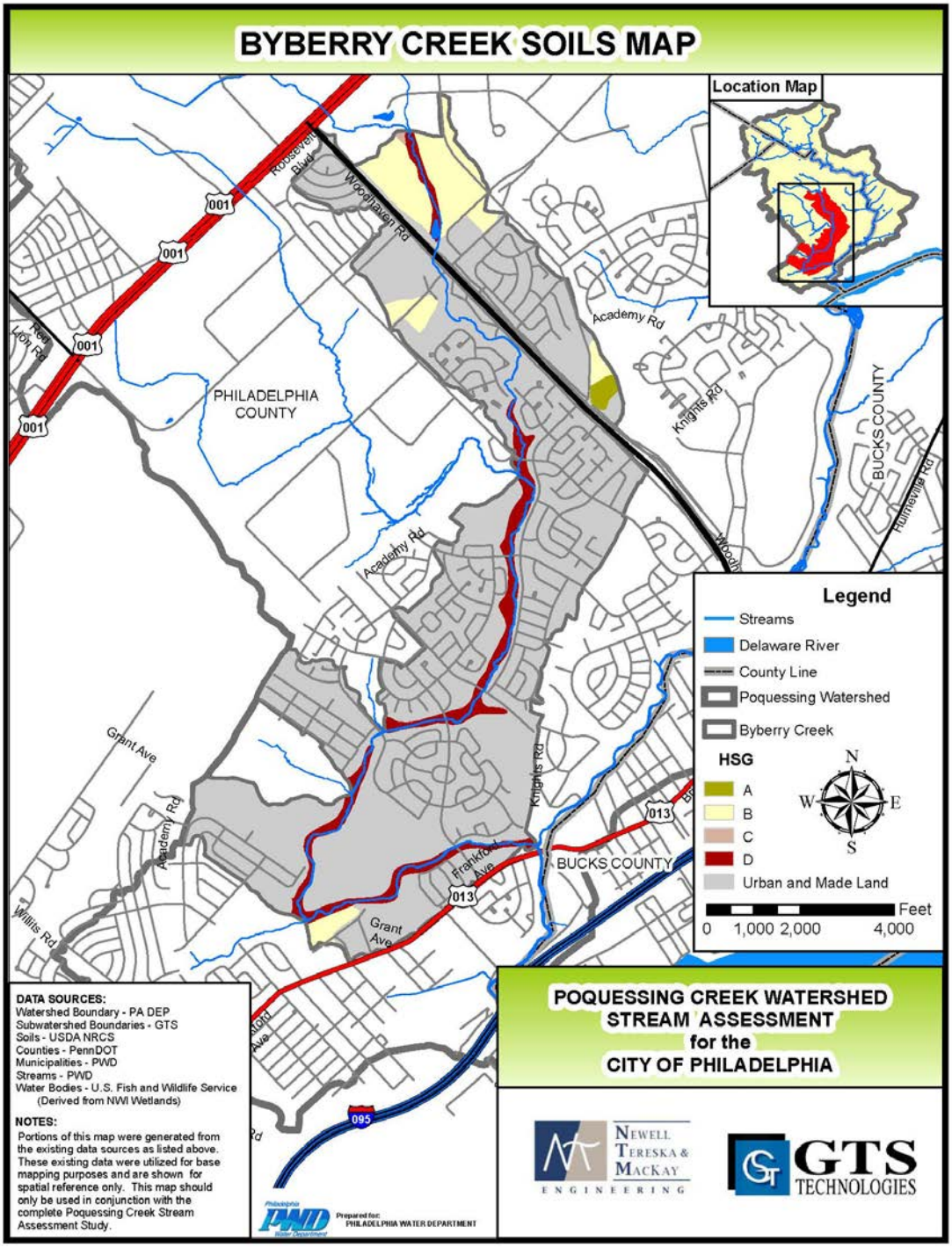


Figure 3-113: Distribution of NRCS Soil Types in Byberry Creek Watershed



3.4.1.3 BANK EROSION

Erosion rates for the left bank, stream bed, right bank, and total wetted perimeter were calculated for twenty reaches in Byberry Creek (Table 3-156). Fifteen reaches were found to be eroding based on the total wetted perimeter calculation, while 5 reaches were aggrading. The average total erosion rate for all reaches in Byberry Creek was slightly less than the average for all Poquessing Creek subwatersheds (Table 3-157). Comparison cross sections and associated erosion rates for each reach are included in Appendix A.

Table 3-156: Erosion Rates for Byberry Creek Mainstem Tributaries

Reach	Erosion (ft.) from 2007 to 2012				Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
	Left Bank	Stream Bed	Right Bank	Total		
PQBY02	-1.735	0.018	0.420	-0.086	-0.017	E
PQBY04	-0.426	-0.090	-2.251	-0.302	-0.060	E
PQBY06	0.473	0.050	-1.300	-0.059	-0.012	E
PQBY08	-0.300	0.297	-0.392	0.152	0.030	A
PQBY10	0.239	0.061	0.584	0.105	0.021	A
PQBY12	-1.221	-0.734	-10.068	-0.920	-0.184	E
PQBY14	0.149	-0.061	0.328	0.008	0.002	A
PQBY16	0.381	-0.109	0.288	-0.015	-0.003	E
PQBY18	-0.434	0.354	-0.909	0.005	0.001	A
PQBY20	-4.717	-0.358	-0.335	-0.641	-0.128	E
PQBY22	0.138	0.163	-14.927	-0.733	-0.147	E
PQBY24	0.665	0.005	-1.775	-0.067	-0.013	E
PQBY26	-1.516	0.157	-1.567	-0.143	-0.029	E
PQBY28	-0.406	0.125	-0.093	0.019	0.004	A
PQBY32	0.131	0.006	-2.000	-0.142	-0.028	E
PQBY34	-1.322	0.080	-0.040	-0.044	-0.009	E
PQBY36	0.458	-0.132	-0.526	-0.051	-0.010	E
PQBY38	-0.590	-0.381	-1.199	-0.295	-0.059	E
PQBY40	-0.004	-0.047	-0.083	-0.034	-0.007	E
PQBY42	1.183	0.110	0.217	0.206	0.041	A
PQBY44	-0.676	0.197	-0.832	-0.051	-0.010	E
Average	**-0.454**	**-0.014**	**-1.736**	**-0.147**	**-0.029**	**E**

Table 3-157: Erosion Rate Comparison for all Subwatersheds

Subwatershed	Average Total Erosion Rate (ft./yr.)	Eroding (-) or Aggrading (+)
Black Lake Run	-0.027	E
Bloody Run	-0.081	E
Byberry Creek	-0.029	E
Byberry Creek, Unnamed Tributary A	-0.034	E
Byberry Creek, Unnamed Tributary B	-0.095	E
Byberry Creek, Unnamed Tributary C	-0.040	E
Colbert's Run	0.003	A
Elwood's Run	-0.035	E
Gilbert's Run	-0.060	E
Poquessing Creek	-0.017	E
Poquessing Creek, Unnamed Tributary A	-0.018	E
Poquessing Creek, Unnamed Tributary B	-0.085	E
Poquessing Creek, Unnamed Tributary C	-0.031	E
Poquessing Creek, Unnamed Tributary D	-0.030	E
Poquessing Creek, Unnamed Tributary E	-0.019	E
Poquessing Creek, Unnamed Tributary F	-0.336	E
Poquessing Creek, Unnamed Tributary G	0.005	A
Poquessing Creek, Unnamed Tributary H	0.072	A
Poquessing Creek, Unnamed Tributary I	-0.086	E
Poquessing Creek, Unnamed Tributary J	-0.040	E
Poquessing Creek, Unnamed Tributary K	-0.019	E
Walton's Run	-0.029	E
Wilson's Run	-0.040	E
Subwatershed Average	**-0.046**	**E**

3.4.1.4 INFRASTRUCTURE TRACKDOWN SUMMARY

Byberry Creek is a large tributary to the Poquessing Creek located within Philadelphia County. The headwaters of Byberry Creek are made up of the upstream Wilson's Run and Elwood's Run. Both tributaries meet and form the Byberry Creek after crossing through a culvert (PQcul116) that goes under an unnamed business road. The headwaters lie in a mainly wooded area with commercial development close by. At the downstream end and closer to the confluence, the land use patterns become mainly residential development before reaching the confluence with Poquessing Creek. The downstream portion of Byberry Creek exhibits some of the impairments associated with urban streams given its location and proximity to commercial development and several major transportation routes that surround the stream channel.

The majority of infrastructure was located at cross section PQBY40 mainly in the form of outfalls. This cross section is in the area of Grant Avenue, a major transportation corridor in the northeast region of Philadelphia and the John F. Byrne Golf Club. There were 94 outfalls located along Byberry Creek. The most predominant infrastructure elements in the watershed were stormwater outfalls ranging in

dimension from 0.5 to 4.0 feet in diameter. The number of outfalls (Table 3-158) on this stream indicates that it is heavily influenced by stormwater discharges along the majority of the reach.

Along Byberry Creek, the majority of infrastructure elements were considered in fair or good condition. Seven individual infrastructure elements were found to be in poor condition. Six outfalls (PQout412, PQout416, PQout427, PQout433, PQout466, and PQout467) ranging in size from 1.5 to 3 feet and constructed of either concrete or corrugated metal were found to be in poor condition. One bridge (PQbri102) located upstream of Morrell Avenue is no longer in use and described as being in poor condition. A number of bridges and culverts (33) convey flow along Byberry Creek in which thirty-two of these structures are considered in fair or good condition. Major crossings include Woodhaven Road (PQcul122), Thornton Road (PQcul123), Academy Road (PQcul124), Fairdale Road (PQcul125), Chalfont Drive (PQcul139), Red Lion Road (PQbri081), Morrell Avenue (PQcul140 and PQcul152), Chesterfield road (PQbri082), Grant Avenue (PQcul146 and PQcul151), and Knights Road (PQcul153). Photographs and characteristics of each infrastructure point can be found in Appendix B. Maps with the location of infrastructure can be found in Appendix C.

Table 3-158: Summary of Byberry Creek Infrastructure Points

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBY02	1	1	0	1	0	0	1	0	4
PQBY04	0	2	1	7	0	0	0	0	10
PQBY06	2	0	8	3	0	0	0	0	13
PQBY08	0	2	5	2	0	0	0	0	9
PQBY10	0	1	3	6	0	0	0	0	10
PQBY12	0	0	4	0	0	0	0	0	4
PQBY14	1	0	6	0	1	0	0	0	8
PQBY16	1	0	4	3	1	0	0	0	9
PQBY18	0	0	1	0	0	0	0	0	1
PQBY20	1	0	4	1	0	0	0	0	6
PQBY22	0	0	4	1	0	0	0	0	5
PQBY24	0	0	4	0	0	0	0	0	4
PQBY26	0	1	5	0	1	0	0	0	7
PQBY28	1	0	5	4	1	0	0	0	11
PQBY30	0	0	6	0	1	0	0	0	7
PQBY32	0	0	2	0	3	0	0	0	5
PQBY34	0	2	0	3	1	0	0	0	6
PQBY36	1	4	10	2	3	0	0	0	20
PQBY38	1	3	3	3	1	1	0	0	12
PQBY40	0	5	7	6	0	0	0	0	18
PQBY42	1	1	6	1	0	0	0	0	9
PQBY44	1	0	6	2	1	0	0	0	10
TOTAL	**11**	**22**	**94**	**45**	**14**	**1**	**1**	**0**	**188**

3.4.1.5 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The most downstream section of the Byberry Creek stream channel is a fourth-order, single thread channel with six direct tributaries. Byberry Creek is a direct tributary to the mainstem of Poquessing Creek. The Center for Watershed Protection's (CWP) Unified Stream Assessment Methodology (USAM) was used to score and rate the instream, riparian buffer and floodplain conditions of the stream corridor to allow for comparison to other reaches and subwatersheds within the Poquessing Creek Basin. Geomorphic information and photographs for each reach are included in Appendix A.

Figure 3-114: Results for Byberry Creek Mainstem Watershed USAM Components

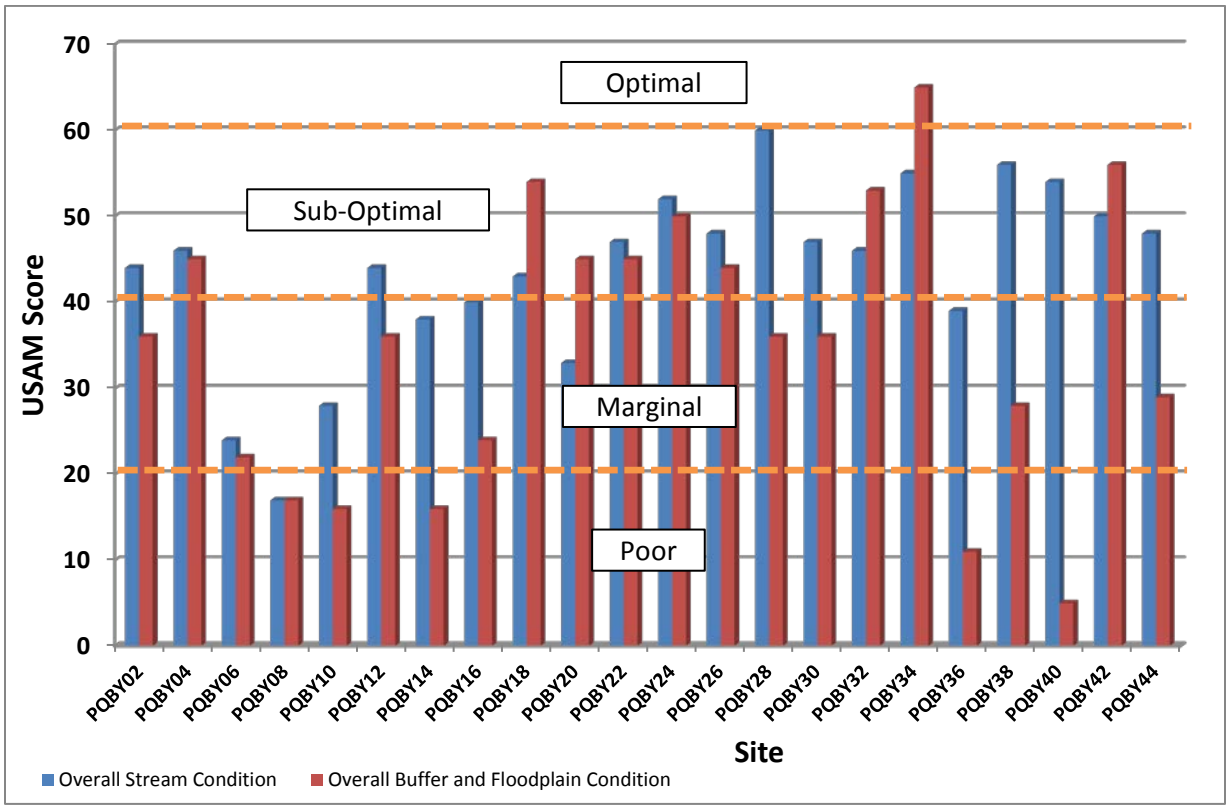
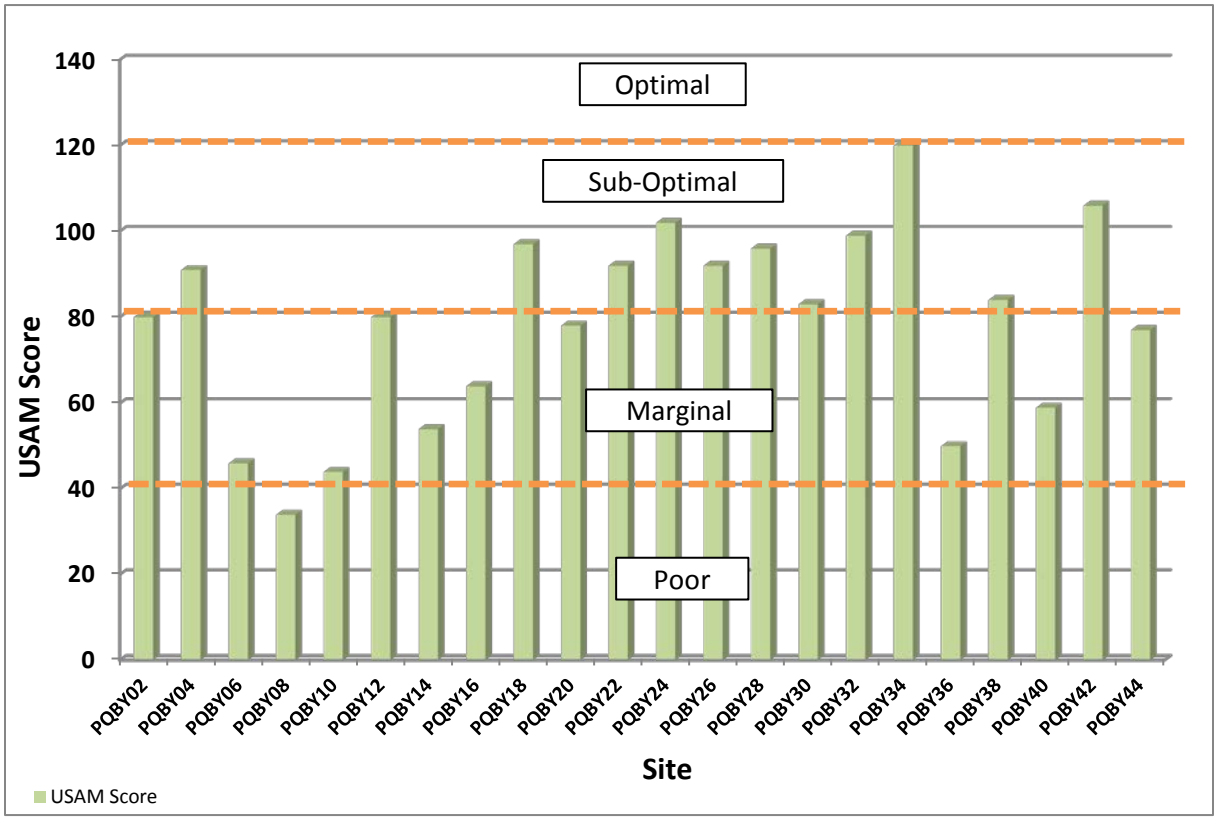


Figure 3-115: Byberry Creek Mainstem Watershed USAM Results



3.4.1.5.1 PQBY02

Reach PQBY02 is the first reach of the mainstem of Byberry Creek. The mainstem forms at the confluence of Elwood's Run and Wilson's Run. This reach flows through a small forested buffer in a commercial area. Reach PQBY02 is characterized by a shallow slope (0.7%), low width to depth ratio (10.8), a slightly entrenched channel (ER = 2.7), low sinuosity (1.09), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY02 was marginal (80/160).

3.4.1.5.2 PQBY04

Reach PQBY04 begins approximately 700 feet upstream of cross section PQBY04. This reach runs between a large forested tract on the downstream right and a commercial area on the downstream left. Reach PQBY04 is characterized by a shallow slope (0.6%), low width to depth ratio (10.7), a slightly entrenched channel (ER = 5.2), low sinuosity (1.02), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY04 was suboptimal (91/160).

3.4.1.5.3 PQBY06

Reach PQBY06 begins approximately 700 feet upstream of cross section PQBY06. This reach travels under Woodhaven Road. and Thornton Road. The upper portion of the reach travels through a wooded corridor and the lower portion of the reach travels between housing complexes. Reach PQBY06 is characterized by a shallow slope (0.6%), low width to depth ratio (10.9), a highly entrenched channel (ER = 1.3), low sinuosity (1.12), and gravel substrate. The reach was classified as an A4 type stream. The composite USAM score for reach PQBY06 was marginal (46/160).

3.4.1.5.4 PQBY08

Reach PQBY08 begins approximately 600 feet upstream of cross section PQBY08. This reach closely parallels a housing complex on the downstream left. Reach PQBY08 is characterized by a shallow slope (0.6%), moderate to high width to depth ratio (15.3), a highly entrenched channel (ER = 1.4), moderate sinuosity (1.38), and gravel substrate. The reach was classified as a F4 type stream. The composite USAM score for reach PQBY08 was poor (34/160).

3.4.1.5.5 PQBY10

Reach PQBY10 begins approximately 600 feet upstream of cross section PQBY10. This reach runs through a lightly wooded corridor between a housing complex and an urban area. Reach PQBY10 is characterized by a shallow slope (0.6%), moderate width to depth ratio (12.8), a moderately entrenched channel (ER = 1.7), low sinuosity (1.11), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBY10 was marginal (44/160).

3.4.1.5.6 PQBY12

Reach PQBY12 begins approximately 500 feet upstream of cross section PQBY12. This reach continues through a partially wooded corridor between residential and urban areas. Reach PQBY12 is characterized by a shallow slope (0.5%), moderate width to depth ratio (13.9), a slightly entrenched channel (ER = 3.3), low sinuosity (1.19), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY12 was marginal (80/160).

3.4.1.5.7 PQBY14

Reach PQBY14 begins approximately 600 feet upstream of cross section PQBY14. The upper portion of this reach passes under Academy Road. The reach then travels through a partially wooded corridor between urban areas. Reach PQBY14 is characterized by a shallow slope (0.3%), low width to depth ratio (8.7), a slightly entrenched channel (ER = 2.6), low sinuosity (1.17), and gravel substrate. The reach was classified as a E4 type stream. The composite USAM score for reach PQBY14 was marginal (54/160).

3.4.1.5.8 PQBY16

Reach PQBY16 begins approximately 500 feet upstream of cross section PQBY16. This reach travels through a partially wooded corridor between urban areas. Reach PQBY16 is characterized by a shallow slope (0.5%), very high width to depth ratio (65.7), a slightly entrenched channel (ER = 4.0), low sinuosity (1.07), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY16 was marginal (64/160).

3.4.1.5.9 PQBY18

Reach PQBY18 begins approximately 500 feet upstream of cross section PQBY18. This reach travels through a wooded corridor between the Archbishop Ryan High School fields and Waldemire Drive. This reach enters Poquessing Valley Park. Reach PQBY18 is characterized by a shallow slope (0.3%), low width to depth ratio (10.5), a slightly entrenched channel (ER = 5.4), moderate sinuosity (1.25), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY18 was suboptimal (97/160).

3.4.1.5.10 PQBY20

Reach PQBY20 begins approximately 700 feet upstream of cross section PQBY20. This reach travels through a wooded corridor between the Archbishop Ryan High School fields and Waldemire Drive. Reach PQBY20 is characterized by a shallow slope (0.2%), moderate width to depth ratio (13.7), a moderately entrenched channel (ER = 1.7), low sinuosity (1.08), and gravel substrate. The reach was classified as a B4c type stream. The composite USAM score for reach PQBY20 was marginal (78/160).

3.4.1.5.11 PQBY22

Reach PQBY22 begins approximately 500 feet upstream of cross section PQBY22. This reach travels through a wooded corridor between an urban area and Waldemire Drive. Reach PQBY22 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (18.8), a slightly entrenched channel (ER = 3.0), low sinuosity (1.05), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY22 was suboptimal (92/160).

3.4.1.5.12 PQBY24

Reach PQBY24 begins approximately 600 feet upstream of cross section PQBY24. This reach travels through a wooded corridor between an urban area and Waldemire Drive. Reach PQBY24 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (16.4), a slightly entrenched channel (ER = 3.9), low sinuosity (1.02), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY24 was suboptimal (102/160).

3.4.1.5.13 PQBY26

Reach PQBY26 begins approximately 400 feet upstream of cross section PQBY26. This reach travels through a wooded corridor between an urban area and Waldemire Drive. The lower end of the reach passes under Red Lion Road. Reach PQBY26 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (13.2), slightly entrenched channel (ER = 2.8), low sinuosity (1.13), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY26 was suboptimal (92/160).

3.4.1.5.14 PQBY28

Reach PQBY28 begins approximately 600 feet upstream of cross section PQBY28. This reach travels through a lightly wooded corridor between residential and urban areas. The lower end of the reach passes under Morrell Avenue. Reach PQBY28 is characterized by a shallow slope (0.3%), low to moderate width to depth ratio (11.0), a slightly entrenched channel (ER = 3.9), low sinuosity (1.17), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY28 was suboptimal (96/160).

3.4.1.5.15 PQBY30

Reach PQBY30 begins approximately 700 feet upstream of cross section PQBY30. This reach travels through a partially wooded corridor between residential and urban areas. The lower end of the reach passes under Chesterfield Road. Reach PQBY30 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (16.3), a slightly entrenched channel (ER = 3.9), high sinuosity (1.01), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY30 was suboptimal (83/160).

3.4.1.5.16 PQBY32

Reach PQBY32 begins approximately 700 feet upstream of cross section PQBY32. This reach travels through a wooded corridor between residential and urban areas Reach PQBY32 is characterized by a shallow slope (0.1%), moderate to high width to depth ratio (15.3), a slightly entrenched channel (ER = 3.2), low sinuosity (1.08), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY32 was suboptimal (99/160).

3.4.1.5.17 PQBY34

Reach PQBY34 begins approximately 600 feet upstream of cross section PQBY34. A significant wooded buffer exists on the upstream portion of this reach. The lower portion of the reach travels through the Torresdale-Frankford Country Club golf course. Reach PQBY34 is characterized by a shallow slope (0.2%), moderate width to depth ratio (14.0), a slightly entrenched channel (ER = 5.3), low sinuosity (1.11), and gravel substrate. The reach was classified as a C4 type stream. The composite USAM score for reach PQBY34 was suboptimal (120/160).

3.4.1.5.18 PQBY36

Reach PQBY36 begins approximately 700 feet upstream of cross section PQBY36. This reach continues to travel through the Torresdale-Frankford Country Club golf course. This reach is also bisected by Grant Avenue and then travels through the John F. Byrne Golf Club. Reach PQBY36 is characterized by a shallow slope (0.2%), high width to depth ratio (150.5), a moderately entrenched channel (ER = 1.8), low sinuosity (1.17), and cobble substrate. The reach was classified as a B6c type stream. The composite USAM score for reach PQBY36 was marginal (50/160).

3.4.1.5.19 PQBY38

Reach PQBY38 begins approximately 1300 feet upstream of cross section PQBY38. This reach continues to travel through the John F. Byrne Golf Club. This reach also travels under Grant Avenue. Reach PQBY38 is characterized by a shallow slope (0.2%), moderate to high width to depth ratio (26.0), a slightly entrenched channel (ER = 2.9), low sinuosity (1.16), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQBY38 was suboptimal (84/160).

3.4.1.5.20 PQBY40

Reach PQBY40 begins approximately 500 feet upstream of cross section PQBY40. This reach travels through the Torresdal-Frankford Country Club golf course. The majority of this reach has been channelized. Reach PQBY40 is characterized by a shallow slope (0.2%), low width to depth ratio (6.1), a slightly entrenched channel (ER = 8.6), low sinuosity (1.22), and cobble substrate. The reach was classified as an E6 type stream. The composite USAM score for reach PQBY40 was marginal (59/160).

3.4.1.5.21 PQBY42

Reach PQBY42 begins approximately 700 feet upstream of cross section PQBY42. This reach travels through a wooded corridor with a significant wooded buffer on the downstream left and an urban area on the downstream right. The bottom end of this reach passes under Morrell Avenue. Reach PQBY42 is characterized by a shallow slope (0.2%), low width to depth ratio (10.7), a slightly entrenched channel (ER = 5.5), low sinuosity (1.07), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQBY42 was suboptimal (106/160).

3.4.1.5.22 PQBY44

Reach PQBY44 begins approximately 600 feet upstream of cross section PQBY44. The last reach of Byberry Creek runs between an urban area and a shopping plaza prior to entering the mainstem of Poquessing Creek. Reach PQBY44 is characterized by a shallow slope (0.3%), low width to depth ratio (8.5), a slightly entrenched channel (ER = 2.4), low sinuosity (1.02), and cobble substrate. The reach was classified as a C6 type stream. The composite USAM score for reach PQBY44 was marginal (77/160).

3.4.1.6 SUMMARY OF UNIFIED STREAM ASSESSMENT RESULTS

The mean score for the Overall Stream Condition components were classified as suboptimal (Table 3-159), while the mean scores for both the Overall Buffer and Floodplain Condition and USAM both resulted in marginal classifications. Average conditions within the Byberry Creek Watershed's stream channels were better than conditions observed within the buffers and floodplains. The watershed averages for the Overall Stream Condition component as well as the composite USAM were slightly higher than the respective All Reaches averages. However, the Overall Buffer and Floodplain component was slightly lower than the All Reaches average. The scores for individual parameters ranged from poor to optimal, displaying similar levels of variability between reaches. Graphs of each USAM category rating are in Appendix D.

Table 3-159: USAM Results for Byberry Creek Watershed

Reach ID	Sub-watershed	Overall Stream Condition	Overall Buffer/Floodplain Condition	USAM Score
PQBY02	Byberry Creek	44	36	80
PQBY04	Byberry Creek	46	45	91
PQBY06	Byberry Creek	24	22	46
PQBY08	Byberry Creek	17	17	34
PQBY10	Byberry Creek	28	16	44
PQBY12	Byberry Creek	44	36	80
PQBY14	Byberry Creek	38	16	54
PQBY16	Byberry Creek	40	24	64
PQBY18	Byberry Creek	43	54	97
PQBY20	Byberry Creek	33	45	78
PQBY22	Byberry Creek	47	45	92
PQBY24	Byberry Creek	52	50	102
PQBY26	Byberry Creek	48	44	92
PQBY28	Byberry Creek	60	36	96
PQBY30	Byberry Creek	47	36	83
PQBY32	Byberry Creek	46	53	99
PQBY34	Byberry Creek	55	65	120
PQBY36	Byberry Creek	39	11	50
PQBY38	Byberry Creek	56	28	84
PQBY40	Byberry Creek	54	5	59
PQBY42	Byberry Creek	50	56	106
PQBY44	Byberry Creek	48	29	77
PQBY Mean		43.6	35.0	78.5
All Reaches Average		37.1	37.4	74.4

3.4.1.6.1 SUMMARY OF OVERALL STREAM CONDITION SCORES IN THE HILLCREST RUN WATERSHED

The scores for the individual parameters of the Overall Stream Condition component of the USAM analysis ranged from poor to optimal, with the majority scoring in the marginal range. The mean watershed score (43.6/80) was rated as suboptimal and was slightly higher than the All Reaches average score (37.1/80) which was classified as marginal.

Two parameters had importance with respect to raising average overall stream condition scores for Byberry Creek relative to the overall watershed average. These conditions were instream habitat and floodplain connection.

Table 3-160: USAM Overall Stream Condition Scoring for Byberry Creek Watershed

OVERALL STREAM CONDITION								
Reach ID	**Sub-watershed**	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**Overall Stream Condition**
			Left	**Right**	**Left**	**Right**		
PQBY02	Byberry Creek	11	3	3	5	5	17	44
PQBY04	Byberry Creek	12	3	3	4	4	20	46
PQBY06	Byberry Creek	11	3	3	2	2	3	24
PQBY08	Byberry Creek	8	1	2	1	1	4	17
PQBY10	Byberry Creek	8	3	4	3	3	7	28
PQBY12	Byberry Creek	7	4	5	4	4	20	44
PQBY14	Byberry Creek	6	4	4	4	4	16	38
PQBY16	Byberry Creek	9	4	3	5	2	17	40
PQBY18	Byberry Creek	9	2	2	5	5	20	43
PQBY20	Byberry Creek	9	4	4	5	4	7	33
PQBY22	Byberry Creek	8	5	5	4	5	20	47
PQBY24	Byberry Creek	12	5	6	4	5	20	52
PQBY26	Byberry Creek	13	4	5	4	4	18	48
PQBY28	Byberry Creek	15	6	5	8	6	20	60
PQBY30	Byberry Creek	7	6	4	6	4	20	47
PQBY32	Byberry Creek	8	6	4	4	4	20	46
PQBY34	Byberry Creek	12	5	7	5	6	20	55
PQBY36	Byberry Creek	7	7	1	6	10	8	39
PQBY38	Byberry Creek	14	6	6	4	6	20	56
PQBY40	Byberry Creek	12	1	1	10	10	20	54
PQBY42	Byberry Creek	12	5	4	5	4	20	50
PQBY44	Byberry Creek	13	5	5	7	4	14	48
PQBY Mean		10.1	4.2	3.9	4.8	4.6	16.0	43.6
All Reaches Average		8.2	4.0	3.9	3.9	4.0	13.0	37.1

3.4.1.6.1.1 INSTREAM HABITAT

Scores for the Instream Habitat parameter varied from marginal to suboptimal with most in the marginal range for the 22 reaches analyzed in the Byberry Creek Watershed. The watershed mean was greater than the All Reaches average (10.1/20 vs. 8.2/20). Although sedimentation and erosion existed throughout the reaches, usable habitat in the form of pool riffle complexes made of gravels and cobbles were present.

3.4.1.6.1.2 VEGETATIVE PROTECTION

Vegetative protection of both banks of Byberry Creek ranged from poor to suboptimal with most banks scoring in the marginal range. The lowest scoring banks were those of reaches PQBY08, PQBY18, PQBY40, and the right bank of PQBY36. This was due to the flashy hydrologic regime which is causing bank erosion and scouring of vegetation. The highest scoring vegetative protection occurred on the left bank of reach PQBY34 and the right bank of reach PQBY36. These areas exhibited more than 90% native vegetation coverage of the streambank and immediate riparian zones. The All Reaches averages for both banks were about the same when compared to the Byberry Creek Watershed (4.0 vs. 4.2, left bank and 3.9 vs. 3.9, right bank). Generally, Byberry Creek streambanks exhibited 50-70% coverage of streambanks with a mix of native and non-native vegetation with areas of bare soil and signs of disruption by humans.

3.4.1.6.1.3 BANK EROSION

Scores for the 22 reaches analyzed for Byberry Creek Watershed varied between poor and optimal for both left and right banks, with most scoring in the marginal range, indicating active stream widening and erosion at a moderate rate. The lowest scoring reaches were the right and left banks of reaches PQBY06 and PQBY08 and the right bank of PQBY16. These areas were characterized by active downcutting, undercut banks, and significant sediment contribution to Byberry Creek. The highest rated reaches were the right bank of PQBY36 and the right and left banks of PQBY40. These areas were characterized by stable banks, little evidence of erosion and minimal potential for future problems. The mean watershed scores for the left and right banks of Byberry Creek were higher than those for the All Reaches average (4.8 vs. 3.9, left bank and 4.6 vs. 4.0, right bank), although both resulted in a rating of marginal. It is evident that active erosion is occurring throughout the Byberry Creek channel although there are examples of more rapid erosion throughout the Poquessing Watershed.

3.4.1.6.1.4 FLOODPLAIN CONNECTION

Floodplain connection for the Byberry Creek Watershed reaches scored predominantly in the optimal range for the 22 reaches analyzed. Two scored poorly (PQBY06 and PQBY08), three scored marginal (PQBY10, PQBY20, and PQBY36), and one reach scored as suboptimal (PQBY44). The remaining 16 reaches were rated as optimal. This indicates that the Byberry Creek Watershed has high flows able to enter the watershed via a stream channel that is not deeply entrenched. The mean for the Byberry Creek Watershed was slightly higher than for all reaches with a score of 16/20 as compared to 13/20, giving this watershed an overall optimal rating.

Floodplain connection scores are based on the ratio of flood prone width to bankfull width. This is also known as entrenchment ratio. The relatively high bankfull flow predictions in the watershed result in a prediction of a wide flood prone width in many cases. Therefore, it is predicted that relatively frequent flood events will exceed the channel capacity and reach adjacent floodplains.

3.4.1.6.2 SUMMARY OF OVERALL BUFFER AND FLOODPLAIN CONDITION SCORES IN THE BYBERRY CREEK WATERSHED

The scores for the individual parameters of the Overall Buffer and Floodplain Condition component of the USAM analysis all scored within the marginal range. The mean component score for the Byberry Creek Watershed (35/80) was slightly less than the All Reaches average (37.4/80). The reduced function of the floodplains in this watershed can be attributed to a number of factors, with the most influential being development and its associated infrastructure.

Table 3-161: USAM Buffer and Floodplain Condition Scoring for Byberry Creek Watershed

OVERALL BUFFER AND FLOODPLAIN CONDITION							
Reach ID	**Sub-watershed**	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**Overall Buffer/Floodplain Condition**
		Left	**Right**				
PQBY02	Byberry Creek	6	6	7	11	6	36
PQBY04	Byberry Creek	7	9	7	13	9	45
PQBY06	Byberry Creek	2	8	6	4	2	22
PQBY08	Byberry Creek	1	8	3	3	2	17
PQBY10	Byberry Creek	1	6	3	4	2	16
PQBY12	Byberry Creek	7	6	6	12	5	36
PQBY14	Byberry Creek	4	2	5	3	2	16
PQBY16	Byberry Creek	7	2	5	4	6	24
PQBY18	Byberry Creek	9	9	10	12	14	54
PQBY20	Byberry Creek	5	7	17	7	9	45
PQBY22	Byberry Creek	6	6	14	12	7	45
PQBY24	Byberry Creek	6	8	17	11	8	50
PQBY26	Byberry Creek	7	6	14	11	6	44
PQBY28	Byberry	7	5	10	8	6	36

	Creek						
PQBY30	Byberry Creek	5	7	13	7	4	36
PQBY32	Byberry Creek	6	7	17	11	12	53
PQBY34	Byberry Creek	9	9	19	13	15	65
PQBY36	Byberry Creek	2	2	3	2	2	11
PQBY38	Byberry Creek	5	4	9	7	3	28
PQBY40	Byberry Creek	1	1	1	1	1	5
PQBY42	Byberry Creek	9	5	16	14	12	56
PQBY44	Byberry Creek	4	6	11	5	3	29
PQBY Mean		5.3	5.9	9.7	8.0	6.2	35.0
All Reaches Average		5.3	6.0	9.7	8.3	8.2	37.4

3.4.1.6.2.1 VEGETATED BUFFER WIDTH

The quality of the vegetated buffer width for the left and right banks of Byberry Creek varied widely, from poor to suboptimal, with the majority scoring in the marginal range. The lowest scoring reaches, with a scoring of poor were the following: the left banks of PQBY06, PQBY08, and PQBY10, the right banks of PQBY14, and PQBY16, and both banks of PQBY36 and PQBY40. These reaches were characterized by a vegetated buffer zone of less than 10 feet in width and little or no riparian vegetation. The reaches scoring in the highest or suboptimal range were those of reaches PQBY04, PQBY18, and PQBY34, the right banks of PQBY06, PQBY08, PQBY20, PQBY24, PQBY30 and PQBY32, and the left banks of PQBY12, PQBY16, PQBY26, PQBY28, and PQBY42. These suboptimal banks were characterized by a vegetated buffer width of between 25 and 50 feet with only minimal human disturbance. The mean watershed score of 5.3/10.0 for the left bank was the same as for the All Reaches average. The mean watershed score for the right bank was slightly lower (5.9/10.0) than the All Reaches average of 6.0/10.0.

3.4.1.6.2.2 FLOODPLAIN VEGETATION

Floodplain vegetation scores for the Byberry Creek Watershed varied widely with scores ranging from poor to optimal, with six reaches scoring in the poor range, eight reaches in the marginal range, three reaches in the suboptimal range and five as optimal. The mean Byberry Creek Watershed score 9.7/20, was rated as marginal and was the same as that for the All Reaches average (9.7/20). The area was characterized by a dominant vegetation type of shrub instead of a healthier young or mature forest.

3.4.1.6.2.3 FLOODPLAIN HABITAT

Floodplain habitat scores for the Byberry Creek Watershed ranged from poor to suboptimal. Reaches PQBY06, PQBY08, PQBY10, PQBY14, PQBY16, PQBY36, PQBY40, and PQBY44 scored in the poor range, characterized by either all wetland or non-wetland habitat and no evidence of standing or ponded water. Reaches scoring in the marginal range were PQBY02, PQBY20, PQBY24, PQBY26, PQBY28, PQBY30, PQBY32, and PQBY38. These areas exhibited either all wetland or non-wetland habitat with some evidence of standing or ponded water. Reaches PQBY04, PQBY12, PQBY14, PQBY22, PQBY34, and PQBY42 scored in the suboptimal range, indicating that there was a mix of wetland and non-wetland habitat but with no evidence of standing/ponded water. The mean watershed score for this parameter was rated as marginal (8.0/20) and was slightly lower than the All Reaches average score 8.3/20 which was also considered marginal.

3.4.1.6.2.4 FLOODPLAIN ENCROACHMENT

Scores for the Floodplain Encroachment parameter for the Byberry Creek Watershed varied from poor to suboptimal. Reaches PQBY06, PQBY08, PQBY10, PQBY12, PQBY14, PQBY30, PQBY36, PQBY38, PQBY40 and PQBY44 all scored within the poor range. This indicates significant floodplain encroachment and the resulting significant impact on the floodplain. Reaches PQBY02, PQBY04, PQBY16, and PQBY20-28 scored in the marginal range, indicating moderate floodplain encroachment with some effect on floodplain function. Four reaches scored in the suboptimal range: PQBY18, PQBY32, PQBY34, and PQBY42. These reaches were characterized by minor encroachment with no floodplain function effect. The mean score for the watershed was 6.2/20 which was lower than that for the All Reaches average score of 8.2/20, both having an overall rating of marginal.

3.5 SUMMARY

Over time, the Poquessing Creek Watershed has experienced continual and extensive urban land development. More than forty percent of the Poquessing Creek Watershed is covered by residential development with single family residential and row home residential making up the bulk of that development. Portions of the riparian corridor of the Poquessing Creek and its tributaries has remained covered as wooded land, mostly protected through long-term preservation efforts.

Geology and soils play a role in the hydrology, water quality, and ecology of a watershed. The northern portion of the Poquessing Creek Watershed is located within the Piedmont Upland Section of the Piedmont Physiographic Province, which is underlain primarily by metamorphic rocks called schists. The southern portion of the watershed is within the Lowland and Intermediate Upland Section of the Atlantic Coastal Plain Physiographic Province, which is underlain by unconsolidated to poorly consolidated sand and gravel deposits which rest on various metamorphic rocks (Pennsylvania Department of Conservation and Natural Resources, 2000).

The geology of the upper watershed is mostly underlain by Felsic gneiss and Mafic gneiss. The geology of the lower Poquessing Watershed is mostly underlain by the Wissahickon Formation and the Pennsauken and Bridgeton Formations. Soils beneath the Poquessing watershed are mainly classified as urban land; although, pockets of hydrologic soil group C and D soils exist.

Bank and bed erosion and deposition was calculated by comparing the cross section survey data from 2007 and 2012. This comparison allows for the calculation of erosion and/or deposition rates (ft./yr.) for the left bank, right bank, streambed, and the entire cross section. The average subwatershed erosion rate was calculated to be -0.046 ft./yr. or greater than one half inch per year over the entire cross section. This calculated erosion rate suggests that the Poquessing Creek Watershed is eroding sediment annually as a result of the flashy flow regime.

3.5.1 POQUESSING CREEK WATERSHED TRIBUTARIES

3.5.1.1 INFRASTRUCTURE

The following tables are a summary of the data presented in previous sections. The purpose of these tables is to allow comparisons between individual reaches such that the relative impacts of point and linear infrastructure elements within each respective reach can be clearly distinguished.

In Table 3-163, select infrastructure metrics have been presented in order to identify the reaches in tributaries to the mainstem of Poquessing Creek in which are most impacted by certain types of infrastructure.

Table 3-162: Poquessing Creek Watershed Tributary Infrastructure Point Summary

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMSA02	1	0	2	2	0	0	0	3	8
PQMSB02	0	0	6	1	1	2	0	0	10
PQMSB04	1	0	8	1	0	0	0	0	10
PQMSC02	3	0	2	0	1	0	0	0	6
PQMSC04	1	2	1	5	0	0	0	0	9
PQMSC06	5	0	7	1	0	0	1	1	15
PQMSC08	2	5	5	2	1	0	0	0	15
PQMSC10	3	0	4	1	0	0	0	0	8
PQMSC12	1	0	1	1	0	0	0	0	3
PQMSC16	1	0	1	0	0	0	0	0	2
PQMSCA02	3	0	5	3	1	0	0	0	12
PQMSCA04	1	0	0	0	0	0	0	0	1
PQMSCB02	9	3	8	10	0	0	1	1	32
PQMSCC02	2	0	0	1	0	0	0	0	3
PQMSCC04	6	3	4	8	1	0	4	6	32
PQMSCAA02	0	0	0	0	0	0	0	0	0
PQMSD02	0	0	3	7	0	0	1	0	11
PQMSD04	1	1	6	1	0	0	0	0	9
PQMSD06	0	0	2	2	2	2	0	0	8
PQMSD08	2	0	1	7	0	0	3	0	13
PQMSD12	2	2	6	8	2	0	0	0	20
PQMSD14	1	2	3	5	3	0	0	0	14
PQMSD16	3	2	12	0	1	0	0	0	18
PQMSD18	2	0	10	0	0	0	0	0	12
PQMSD20	1	1	8	5	0	0	0	0	15
PQMSD22	0	1	4	3	1	0	0	0	9
PQMSD23	3	0	2	1	0	0	0	0	6
PQMSD24	2	3	2	5	0	0	0	0	12
PQMSD26	0	0	1	2	0	0	0	0	3
PQBR02	2	0	1	0	0	0	0	0	3
PQBR04	1	1	2	0	0	0	0	0	4
PQMSE08	2	0	8	0	5	0	0	2	17
PQBL02	0	0	1	0	0	0	0	2	3
PQBL04	2	0	0	1	2	0	0	2	7
PQBL06	1	0	1	2	0	0	1	0	5
PQMSF04	2	1	3	0	0	0	0	0	6
PQMSG04	2	1	0	2	0	0	0	0	5
PQMSH06	2	3	3	0	0	1	0	0	9
PQGR02	1	0	5	1	1	0	0	4	12
PQGR04	1	0	4	0	0	0	0	0	5
PQGR06	1	0	1	0	2	0	0	1	5
PQGRA02	0	0	1	0	1	0	0	0	2
PQMSI02	3	3	2	0	0	0	0	1	9
PQMSJ02	1	1	3	2	0	0	0	0	7
PQMSJ04	3	2	1	0	1	0	2	0	9
PQMSJ06	1	0	0	0	1	0	0	0	2
PQMSK02	5	8	5	12	2	0	0	4	36

PQMSK04	1	0	3	0	1	0	0	0	5
PQMSK06	1	0	1	1	2	0	0	0	5
PQMSK08	1	0	3	0	0	0	0	0	4
PQMSK10	1	0	1	0	0	0	0	0	2
TOTAL	90	45	163	103	32	5	13	27	478

Table 3-163: Summary of Poquessing Creek Tributary Infrastructure by Reach

Parameter	Poquessing Creek Tributaries	
	Max	**Mean**
Total Infrastructure	PQMSK02 (36)	9.4
Culverts	PQMSCB02 (9)	1.8
Bridges	PQMSK02 (8)	0.9
Outfalls	PQMSD16 (12)	3.2
Channels	PQMSK02 (12)	2
Manholes	PQMSE02 (12)	0.6
Pipe Sewer	PQMSB02 (20) PQMSD02 (20)	0.1
Dam	PQMSCC04 (4)	0.3
Other	PQMSCC04 (6)	0.5

3.5.1.2 UNIFIED STREAM ASSESSMENT

The following table has been presented as a means of quickly assessing the performance of individual reaches within the Poquessing Creek Tributary USAM assessment. The reaches presented correspond to the extreme values among the dataset; however by comparing these values to the mean Poquessing Creek Watershed Tributary value for each respective metric, it is possible to quickly gauge the variability of conditions within the tributaries of the Poquessing Creek watershed. The USAM scores for each Tributary watershed are included in Appendix D.

Table 3-164: Summary of Poquessing Creek Tributary USAM Results by Reach

Overall Stream Condition							
Parameter	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**OSC Score**
		Left	**Right**	**Left**	**Right**		
MIN	PQMSCA02 PQMSC12 (0)	PQMSC12 PQMSC14 (1)	PQMSC12 (0)	PQMSB04 PQMSD02 PQMSF04 PQMSJ06 (1)	PQMSB04 (1)	PQGR04 PQGRA02 (1)	PQGR04 PQMSCA02 (12)
MAX	PQBR02 PQBR04 (14)	PQBR04 (8)	PQBR02 (7)	PQMSM02	PQMSK02 (8)	PQMSC06 PQMSC10 PQMSC12 PQMSC16 PQMSCA04 PQMSCAA02 PQMSB02 PQMSD08 PQMSD20 PQMSD22 PQMSD24 PQMSD26 PQMSK02 PQBL04 PQBR02 (20)	PQMSCA04 (58)
MEAN	6.5	3.7	3.7	3.8	3.9	10.2	31.7

Overall Buffer Floodplain Condition						
Parameter	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**OBF Score**
	Left	**Right**				
MIN	PQMSC12 PQMSC14 PQMSD02 (1)	PQMSC08 PQMSC12 PQMSC14 (1)	PQMSC12 PQMSC14 (1)	PQMSC12 PQMSC14 (1)	PQMSB04 PQMSC12 PQMSC14 PQMSD16 (1)	PQMSC12 PQMSC14 (5)
MAX	PQMSC16 PQMSK06 PQMSK08 PQBL02 PQBL04 PQBL06 PQGRA02 (9)	PQMSCA02 PQMSCA04 PQMSK04 PQGRA02 (9)	PQMSCA02 PQMSK04 (16)	PQMSCA04 (17)	PQBL04 (18)	PQMSCA04 (64)
MEAN	5	4.6	8	7.2	8	32.8

3.5.2 POQUESSING CREEK MAINSTEM

3.5.2.1 INFRASTRUCTURE

The following tables are a summary of the data presented in previous sections. The purpose of these tables is to allow comparisons between individual reaches such that the relative impacts of point and linear infrastructure elements within each respective reach can be clearly distinguished.

In Table 3-166, select infrastructure metrics have been presented in order to identify the reaches in the Poquessing Creek Mainstem Watershed infrastructure assessment most impacted by certain types of infrastructure.

Table 3-165: Poquessing Creek Mainstem Watershed Infrastructure Point Summary

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQMS02	4	5	3	15	1	0	0	2	30
PQMS04	2	1	1	6	0	0	1	4	15
PQMS06	1	0	2	4	0	0	0	2	9
PQMS08	0	0	3	0	0	0	0	0	3
PQMS10	0	4	0	0	0	0	0	0	4
PQMS12	1	0	3	8	0	0	1	0	13
PQMS14	3	2	2	1	1	0	0	0	9
PQMS16	0	1	2	0	1	0	0	0	4
PQMS18	0	0	0	0	0	0	0	0	0
PQMS20	0	0	1	0	1	0	0	1	3
PQMS22	0	1	1	1	0	0	0	0	3
PQMS24	0	0	3	2	1	0	1	0	7
PQMS26	0	0	2	0	0	0	0	0	2
PQMS28	0	0	4	0	0	0	0	3	7
PQMS30	0	0	4	0	1	0	1	1	7
PQMS32	0	1	4	4	0	0	0	0	9
PQMS34	2	0	5	0	3	0	0	0	10
PQMS36	0	0	2	0	1	0	1	0	4
PQMS38	1	0	1	1	1	0	0	0	4
PQMS40	0	1	1	4	1	0	0	0	7
PQMS42	0	1	1	0	2	0	0	0	4
PQMS44	0	0	0	0	0	0	0	0	0
PQMS46	0	0	0	1	0	0	0	0	1
PQMS48	0	0	1	1	0	0	0	0	2
PQMS52	0	0	2	0	0	0	0	0	2
PQMS54	0	1	4	0	0	0	0	0	5
PQMS56	0	0	4	2	0	0	0	0	6
PQMS58	0	1	2	0	0	0	0	0	3
PQMS60	0	0	0	1	0	0	0	0	1
PQMS62	0	0	2	0	0	0	0	0	2

PQMS64	0	0	1	0	1	0	0	0	2
PQMS66	0	0	0	0	0	0	0	0	0
PQMS70	0	0	0	0	0	0	0	0	0
PQMS72	0	0	0	0	0	0	0	0	0
PQMS74	0	0	5	2	2	0	0	0	9
PQMS76	1	0	2	7	3	1	0	1	15
PQMS80	0	0	3	0	2	0	0	0	5
PQMS82	0	0	3	3	1	0	0	2	9
PQMS84	0	0	3	0	0	0	0	0	3
PQMS86	0	0	1	0	0	0	1	0	2
PQMS88	0	1	0	1	0	0	0	0	2
PQMS90	0	1	0	0	0	0	1	0	2
PQMS94	0	2	0	0	0	0	0	0	2
PQMS96	0	0	1	0	0	0	0	0	1
PQMS98	0	0	1	0	0	0	0	0	1
PQMS100	2	7	14	7	4	0	3	6	43
TOTAL	17	30	94	71	27	1	10	22	272

Table 3-166: Summary of Poquessing Creek Mainstem Infrastructure by Reach

Parameter	Poquessing Creek Mainstem	
	Max	Mean
Total Infrastructure	PQMS100 (43)	5.9
Culverts	PQMS02 (4)	0.4
Bridges	PQMS100 (7)	0.7
Outfalls	PQMS100 (14)	2.0
Channels	PQMS02 (15)	1.5
Manholes	PQMS100 (4)	0.6
Pipe Sewer	PQMS76 (1)	0.0
Dam	PQMS100 (3)	0.2
Other	PQMS100 (6)	0.5

3.5.2.2 UNIFIED STREAM ASSESSMENT

The following table has been presented as a means of quickly assessing the performance of individual reaches within the Poquessing Creek mainstem USAM assessment. The reaches presented correspond to the extreme values among the dataset; however by comparing these values to the mean Poquessing Creek Watershed mainstem value for each respective metric, it is possible to quickly gauge the variability of conditions within the Poquessing Creek watershed. The USAM scores for the Poquessing Creek watershed are included in Appendix D.

Table 3-167: Summary of Poquessing Creek Mainstem USAM Results by Reach

Overall Stream Condition							
Parameter	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**OSC Score**
		Left	**Right**	**Left**	**Right**		
MIN	PQMS02 (5)	PQMS02 PQMS06 PQMS40 (1)	PQMS02 PQMS04 PQMS36 (1)	PQMS12 PQMS40 PQMS50 PQMS52 (1)	PQMS14 PQMS32 PQMS34 (1)	PQMS32 (3)	PQMS32 (20)
MAX	PQMS80 PQMS88 (14)	PQMS20 PQMS44 (7)	PQMS26 PQMS86 PQMS100 (7)	PQMS02 (8)	PQMS02 (8)	PQMS02 PQMS04 PQMS06 PQMS08 PQMS16 PQMS18 PQMS20 PQMS22 PQMS24 PQMS26 PQMS28 PQMS30 PQMS34 PQMS38 PQMS42 PQMS44 PQMS46 PQMS48 PQMS50 PQMS52 PQMS54 PQMS56 PQMS58 PQMS60 PQMS64 PQMS66 PQMS68 PQMS70 PQMS72 PQMS74 PQMS76 PQMS78 PQMS80 PQMS82 PQMS88 PQMS94 PQMS96 PQMS100 (20)	PQMS80 PQMS100 (56)
MEAN	10.7	4.2	4.3	3.6	4	17.4	44.3

Overall Buffer Floodplain Condition						
Parameter	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**OBF Score**
	Left	**Right**				
MIN	PQMS06 (0)	PQMS02 PQMS04 (1)	PQMS06 (1)	PQMS36 (1)	PQMS14 PQMS56 (2)	PQMS06 (8)
MAX	PQMS20 PQMS22 PQMS24 PQMS54 (10)	PQMS34 PQMS44 PQMS46 PQMS48 PQMS54 (10)	PQMS68 (19)	PQMS64 PQMS66 (17)	PQMS68 PQMS74 (18)	PQMS68 (68)
MEAN	5.7	7.3	11.8	9.6	9.9	32.8

3.5.3 BYBERRY CREEK WATERSHED TRIBUTARIES

3.5.3.1 INFRASTRUCTURE

The following tables are a summary of the data presented in previous sections. The purpose of these tables is to allow comparisons between individual reaches such that the relative impacts of point and linear infrastructure elements within each respective reach can be clearly distinguished.

In Table 3-169, select infrastructure metrics have been presented in order to identify the reaches in the Byberry Creek Watershed Tributary infrastructure assessment most impacted by certain types of infrastructure.

Table 3-168: Byberry Creek Watershed Tributary Infrastructure Point Summary

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQWI02	1	0	0	0	0	0	0	0	1
PQWI04	0	0	1	0	0	0	0	0	1
PQWI06	1	0	6	5	0	0	1	0	13
PQWI08	2	0	6	0	3	0	1	0	12
PQWIA02	0	1	0	0	0	0	0	0	1
PQWIA04	4	0	0	0	0	0	0	0	4
PQWIA06	2	0	2	2	2	0	0	4	12
PQER02	1	0	1	0	0	0	0	0	2
PQER04	0	0	0	0	0	0	0	0	0
PQER06	2	0	1	0	0	0	1	0	4
PQER08	1	0	12	0	0	0	0	0	13
PQER10	1	0	2	0	0	0	0	0	3
PQWA06	4	2	15	8	2	0	0	1	32
PQWA08	1	0	19	1	2	0	0	0	23
PQWA10	0	0	4	2	2	0	0	0	8
PQWA12	1	0	2	0	0	0	0	2	5
PQWA14	1	0	4	1	0	0	0	0	6
PQWA16	0	0	0	0	0	1	0	0	1
PQWA18	0	0	0	0	0	0	0	0	0
PQWA20	2	0	6	0	0	0	0	0	8
PQWA22	0	0	1	0	0	0	0	0	1
PQWA24	0	0	1	0	2	0	0	0	3

PQWA26	0	0	1	0	0	0	0	0	1
PQWAB04	1	0	1	0	1	0	0	0	3
PQCR02	2	0	3	0	0	0	0	0	5
PQCR04	2	2	0	0	0	0	0	0	4
PQCR06	1	0	7	1	0	0	0	0	9
PQCR08	1	0	4	2	0	0	0	0	7
PQCR12	0	0	1	1	0	0	0	0	2
PQCR14	0	1	0	0	1	0	0	0	2
PQBYA02	0	0	1	3	0	0	0	0	4
PQBYB04	5	3	1	0	0	0	0	0	9
PQBYC02	2	0	3	0	0	0	0	0	5
PQBYC04	2	2	0	0	0	0	0	0	4
TOTAL	40	11	105	26	15	1	3	7	208

Table 3-169: Summary of Byberry Creek Tributary Infrastructure by Reach

Parameter	Byberry Creek Tributaries	
	Max	**Mean**
Total Infrastructure	PQWA06 (32)	6.1
Culverts	PQBYB04 (5)	1.2
Bridges	PQBYB04 (3)	0.3
Outfalls	PQWA08 (19)	3.1
Channels	PQWA06 (8)	0.8
Manholes	PQWI08 (3)	0.4
Pipe Sewer	PQWA16 (1)	0.0
Dam	PQWI06 (1) PQWI08 (1) PQER08 (1)	0.1
Other	PQWIA06 (4)	0.2

3.5.3.2 UNIFIED STREAM ASSESSMENT

The following table has been presented as a means of quickly assessing the performance of individual reaches within the Byberry Creek Tributary USAM assessment. The reaches presented correspond to the extreme values among the dataset; however by comparing these values to the mean Byberry Creek Watershed Tributary value for each

respective metric, it is possible to quickly gauge the variability of conditions within the tributaries of the Byberry Creek watershed. The USAM scores for each Tributary watershed are included in Appendix D.

Table 3-170: Summary of Byberry Creek Tributary USAM Results by Reach

Overall Stream Condition							
Parameter	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**OSC Score**
		Left	**Right**	**Left**	**Right**		
MIN	PQWA06 (0)	PQWA06 PQCR06 PQCR02 PQWA12 PQWA16P QCR14 (2)	PQCR06 PQWA06 PQWA24 PQWA26 (1)	PQWA20 (1)	PQWA28 PQWIA06 PQCR08 PQWI08 (2)	PQWA20 (1)	PQWA06 (13)
MAX	PQBYB02 (11)	PQBYB04 (8)	PQBYB0 4 (8)	PQBYB04 (9)	PQBYB04 (9)	PQWA28 PQWA16 PQWA26 PQCR12 PQER08 PQER06 PQWIA04 PQWAB04 PQBYB04 (20)	PQBYB04 (60)
MEAN	6	3.7	3.3	3.9	3.8	9.8	30.5
Overall Buffer Floodplain Condition							
Parameter	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**		**Floodplain Encroachment**	**OBF Score**
	Left	**Right**					
MIN	PQWIA06 PQWA12 PQBYC04 PQBYB04 (1)	PQBYC04 PQBYB04 (1)	PQBYC04 PQBYB04 PQWA06 (2)	PQWA06 (1)		PQWA06 PQWA08 PQWIA06 PQWA12 PQCR04 PQWIA04 (1)	PQWA06 (8)
MAX	PQWA24 PQWA26 (10)	PQWA26 (10)	PQWIA02 PQBYA02 PQER02 PQWA24 PQWA26 (17)	PQWAB04 (15)		PQWA26 (18)	PQWA26 (68)
MEAN	5.7	6.6	9.9	8.9		7.2	38

3.5.4 BYBERRY CREEK MAINSTEM

3.5.4.1 INFRASTRUCTURE

The following tables are a summary of the data presented in previous sections. The purpose of these tables is to allow comparisons between individual reaches such that the relative impacts of point and linear infrastructure elements within each respective reach can be clearly distinguished.

In Table 3-172, select infrastructure metrics have been presented in order to identify the reaches in the Byberry Creek Watershed infrastructure assessment most impacted by certain types of infrastructure.

Table 3-171: Byberry Creek Mainstem Watershed Infrastructure Point Summary

Section ID	Culvert Count	Bridge Count	Outfall Count	Channel Count	Manhole Count	Pipe Sewer Count	Dam Count	Other Count	Infra Point Count
PQBY02	1	1	0	1	0	0	1	0	4
PQBY04	0	2	1	7	0	0	0	0	10
PQBY06	2	0	8	3	0	0	0	0	13
PQBY08	0	2	5	2	0	0	0	0	9
PQBY10	0	1	3	6	0	0	0	0	10
PQBY12	0	0	4	0	0	0	0	0	4
PQBY14	1	0	6	0	1	0	0	0	8
PQBY16	1	0	4	3	1	0	0	0	9
PQBY18	0	0	1	0	0	0	0	0	1
PQBY20	1	0	4	1	0	0	0	0	6
PQBY22	0	0	4	1	0	0	0	0	5
PQBY24	0	0	4	0	0	0	0	0	4
PQBY26	0	1	5	0	1	0	0	0	7
PQBY28	1	0	5	4	1	0	0	0	11
PQBY30	0	0	6	0	1	0	0	0	7
PQBY32	0	0	2	0	3	0	0	0	5
PQBY34	0	2	0	3	1	0	0	0	6
PQBY36	1	4	10	2	3	0	0	0	20
PQBY38	1	3	3	3	1	1	0	0	12
PQBY40	0	5	7	6	0	0	0	0	18
PQBY42	1	1	6	1	0	0	0	0	9
PQBY44	1	0	6	2	1	0	0	0	10
TOTAL	11	22	94	45	14	1	1	0	188

Table 3-172: Summary of Byberry Creek Infrastructure by Reach

Parameter	Byberry Creek Mainstem	
	Max	**Mean**
Total Infrastructure	PQBY36 (20)	8.5
Culverts	PQBY06 (2)	0.5
Bridges	PQBY40 (5)	1.0
Outfalls	PQBY36 (10)	4.3
Channels	PQBY04 (7)	2.0
Manholes	PQBY32 (3) PQBY36 (3)	0.6
Pipe Sewer	PQBY38 (1)	0.0
Dam	PQBY02 (1)	0.0

3.5.4.2 UNIFIED STREAM ASSESSMENT

The following table has been presented as a means of quickly assessing the performance of individual reaches within the Byberry Creek Mainstem USAM assessment. The reaches presented correspond to the extreme values among the dataset; however by comparing these values to the mean Byberry Creek Watershed value for each respective metric, it is possible to quickly gauge the variability of conditions within the Byberry Creek watershed. The USAM scores for the Byberry Creek watershed are included in Appendix D.

Table 3-173: Summary of Byberry Creek Mainstem USAM Results by Reach

Overall Stream Condition							
Parameter	**Instream Habitat**	**Vegetative Protection**		**Bank Erosion**		**Floodplain Connection**	**OSC Score**
		Left	**Right**	**Left**	**Right**		
MIN	PQBY14 (6)	PQBY08 PQBY40 (1)	PQBY40 PQBY36 (1)	PQBY08 (1)	PQBY08 (1)	PQBY06 (3)	PQBY08 (17)
MAX	PQBY28 (15)	PQBY36 (7)	PQBY34 (7)	PQBY40 (10)	PQBY36 PQBY40 (10)	PQBY04 PQBY12 PQBY32 PQBY42 PQBY30 PQBY22 PQBY24 PQBY18 PQBY38 PQBY34 PQBY28 PQBY40 (20)	PQBY28 (60)
MEAN	10.1	4.2	3.9	4.8	4.6	16	43.6

Overall Buffer Floodplain Condition						
Parameter	**Vegetated Buffer Width**		**Floodplain Vegetation**	**Floodplain Habitat**	**Floodplain Encroachment**	**OBF Score**
	Left	**Right**				
MIN	PQBY08 PQBY10 PQBY40 (1)	PQBY40 (1)	PQBY40 (1)	PQBY40 (1)	PQBY40 (1)	PQBY40 (5)
MAX	PQBY18 PQBY42 PQBY34 (9)	PQBY04 PQBY18 PQBY34 (9)	PQBY34 (19)	PQBY42 (14)	PQBY34 (15)	PQBY34 (65)
MEAN	5.3	5.9	9.7	8	6.2	35

3.6 RECOMMENDATIONS

3.6.1 REACH PRIORITIZATION

Reaches in the Poquessing Creek Watershed were prioritized for restoration efforts. The goals of this effort were to determine which reaches were most in need of restoration due to stream condition, floodplain condition, and erosion as well as the ability to complete a restoration in a particular reach by considering accessibility and presence of public land. The five components of the prioritization are described below.

The USAM Overall Stream Condition was 30 percent of the prioritization score. This category consists of ratings for instream habitat, vegetative protection, bank erosion, and floodplain connection. The inverse of the USAM rating was used to determine the prioritization score within this category. Therefore, the reaches with the lowest USAM rating were prioritized the highest. The score was them modified to represent 30 percent of the total prioritization value. This category was weighted the highest of all categories because it represents characteristics that could be significantly improved by stream restoration efforts while not requiring significant tracts of floodplain property.

The USAM Overall Buffer and Floodplain Condition was 15 percent of the prioritization score. This category consists of ratings for vegetated buffer width, floodplain vegetation, floodplain habitat, and floodplain encroachment. The inverse of the USAM rating was used to determine the prioritization score within this category. Therefore, the reaches with the lowest USAM rating were prioritized the highest. The score was them modified to represent 15 percent of the total prioritization value. This category was weighted lower than Stream Condition value because it represents characteristics that have less potential for restoration efforts due to the presence of private property and infrastructure along many of the Poquessing Creek Watershed reaches.

The USAM rating for Reach Accessibility was 15 percent of the prioritization score. This category considers public ownership, stockpile areas, and heavy equipment access to stream channel (Figure 3-116). The field assessed value was used to determine the prioritization score within this category. The score was modified to represent 15 percent of the total prioritization value. This category was weighted as 15% of the prioritization score since access to the channel can make restoration projects more achievable, but are not the highest weighted factor.

Figure 3-116: Reach Accessibility Categories (Source: Center for Watershed Protection, 2004)

REACH ACCESSIBILITY				
Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.		**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.		**Difficult**. Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3	2	1

The calculated erosion or aggradation rate for the reach was 20 percent of the prioritization score. This category was developed from the entire cross section, erosion and deposition rates for each reach. This value was developed by comparing the cross section survey data from 2007 and 2012. Channel erosion was shown as a negative value and aggradation was shown as a positive value in the original calculation. To calculate a prioritization value, the absolute value of the erosion rate was calculated and aggradation values were reduced by 50 percent. In this calculation, erosion is weighted higher than aggradation because it is theorized that erosion has a more detrimental effect than aggradation in the Poquessing Creek Watershed. The score was then modified to represent 20 percent of the total prioritization value. This category was weighted as 20 percent of the prioritization score since channel erosion from urban runoff was found to be a significant cause of impairment in the watershed.

Public land access was 20 percent of the prioritization score. This category consists of ratings for the presence of public land adjacent to each side of the stream. Reaches with no adjacent public land were assigned a value of zero. Reaches with public land adjacent to one side of the stream were assigned a value of one, and reaches with public land adjacent to both sides of the stream were assigned a value of two. The score was then modified to represent 20 percent of the total prioritization value. This category was weighted as 20 percent of the prioritization score since the presence of public land typically makes the implementation and funding of a restoration project more achievable.

These prioritization scores were combined and the percentile of each reach compared to all others in the watershed was calculated. These percentile values were broken into five categories (Table 3-174). These categories were assigned a color symbol for display in tables and figures.

Table 3-174: Reach Prioritization Categories and Values

Prioritization Category	Percentile of Prioritization Score	Color Symbol
Low	0-20	
Moderately Low	20-40	
Moderate	40-60	
Moderately High	60-80	
High	80-100	

The reach prioritization values, percentiles, and prioritization categories were tabulated by Poquessing Creek Tributaries (Table 3-175), Poquessing Creek Mainstem (Table 3-176), Byberry Creek Tributaries (Table 3-177), and Byberry Creek Mainstem (Table 3-178).

Table 3-175: Poquessing Creek Tributaries - Reach Prioritization

Reach ID	Sub-watershed	Pts. For Overall Stream Condition (Max of 3)	Pts. For Overall Buffer Condition (Max of 1.5)	Pts. For Reach Accessibility (Max of 1.5)	Pts. For Public Land Access (Max of 2)	Pts for Erosion Rate (max of 2)	Restoration Priority Score (max of 10)	Restoration Priority Percentile	Restoration Priority
PQBL02	Black Lake Run	2.062	0.938	0.9	1	1.424	6.324	84	High
PQBL04	Black Lake Run	1.350	0.338	1.2	1	1.312	5.199	59	Moderate
PQBL06	Black Lake Run	1.612	0.488	0.9	0	0.000	3.000	5	Low
PQBR02	Bloody Run	0.862	0.488	0.9	0	1.986	4.236	27	Mod. Low
PQBR04	Bloody Run	1.162	0.769	1.5	0	1.474	4.905	48	Moderate
PQGR02	Gilbert's Run	2.475	1.050	1.2	2	1.774	8.499	99	High
PQGR04	Gilbert's Run	2.550	0.825	1.2	2	0.636	7.211	93	High
PQGR06	Gilbert's Run	2.475	0.769	1.5	2	1.850	8.594	100	High
PQGRA02	Gilbert's Run	2.362	0.431	1.2	2	0.400	6.394	86	High
PQMSA02	PQ, unnamed trib (A)	2.062	1.200	0.9	0	0.724	4.886	46	Moderate
PQMSB02	PQ, unnamed trib (B)	2.250	1.144	0.6	0	1.812	5.806	71	Mod. High
PQMSB04	PQ, unnamed trib (B)	2.212	1.331	0.9	0	1.662	6.106	76	Mod. High
PQMSC02	PQ, unnamed trib (C)	2.137	1.275	0.6	2	1.586	7.598	97	High
PQMSC04	PQ, unnamed trib (C)	2.025	1.256	0.9	0	0.274	4.455	33	Mod. Low
PQMSC06	PQ, unnamed trib (C)	1.275	0.638	0.9	0	1.636	4.448	32	Mod. Low
PQMSC08	PQ, unnamed trib (C)	1.875	1.331	1.2	0	0.586	4.992	52	Moderate
PQMSC10	PQ, unnamed trib (C)	1.275	0.975	1.2	0	1.712	5.162	57	Moderate
PQMSC12	PQ, unnamed trib (C)	1.837	1.406	0.6	0	0.800	4.644	39	Mod. Low
PQMSC14	PQ, unnamed trib (C)	2.137	1.406	0.6	0	0.624	4.768	44	Moderate
PQMSC16	PQ, unnamed trib (C)	1.275	0.825	0.6	0	0.662	3.362	9	Low
PQMSCA02	PQ, unnamed trib (C)	2.550	0.413	0.6	0	1.024	4.586	35	Mod. Low
PQMSCA04	PQ, unnamed trib (C)	0.825	0.300	0.6	0	1.024	2.749	3	Low
PQMSCAA02	PQ, unnamed trib (C)	1.125	0.638	0.9	0	1.962	4.624	38	Mod. Low
PQMSCB02	PQ, unnamed trib (C)	1.200	1.125	0.6	0	1.324	4.249	28	Mod. Low
PQMSCC02	PQ, unnamed trib (C)	1.725	0.844	0.9	0	1.736	5.205	60	Moderate
PQMSCC04	PQ, unnamed trib (C)	1.687	0.863	0.9	2	0.236	5.686	70	Mod. High
PQMSD02	PQ, unnamed trib (D)	2.250	1.200	0.9	2	0.674	7.024	91	High
PQMSD04	PQ, unnamed trib (D)	2.025	0.544	0.9	2	1.786	7.255	93	High
PQMSD06	PQ, unnamed trib (D)	1.800	0.769	1.2	0	1.574	5.343	61	Mod. High
PQMSD08	PQ, unnamed trib (D)	1.462	1.050	1.2	0	0.950	4.662	41	Moderate
PQMSD12	PQ, unnamed trib (D)	1.500	1.294	1.2	0	0.600	4.594	36	Mod. Low
PQMSD14	PQ, unnamed trib (D)	1.537	1.069	1.2	0	1.050	4.856	46	Moderate
PQMSD16	PQ, unnamed trib (D)	2.025	1.313	0.9	0	1.262	5.499	65	Mod. High
PQMSD18	PQ, unnamed trib (D)	2.212	1.238	1.2	0	1.536	6.186	80	Mod. High
PQMSD20	PQ, unnamed trib (D)	1.575	1.088	0.9	0	1.212	4.774	45	Moderate
PQMSD22	PQ, unnamed trib (D)	1.312	0.769	0.9	0	1.236	4.217	26	Mod. Low
PQMSD23	PQ, unnamed trib (D)	2.100	0.750	1.2	0	0.150	4.200	25	Mod. Low
PQMSD24	PQ, unnamed trib (D)	1.125	1.031	1.2	0	0.250	3.606	14	Low
PQMSD26	PQ, unnamed trib (D)	1.387	0.544	0.9	0	0.574	3.405	10	Low
PQMSE08	PQ, unnamed trib (E)	2.025	0.656	0.9	2	0.762	6.343	85	High
PQMSF04	PQ, unnamed trib (F)	2.287	0.750	0.9	0	2.000	5.937	75	Mod. High
PQMSG04	PQ, unnamed trib (G)	1.650	0.600	0.9	0	0.174	3.324	8	Low
PQMSH06	PQ, unnamed trib (H)	2.137	0.994	0.9	0	1.336	5.367	62	Mod. High
PQMSI02	PQ, unnamed trib (I)	2.100	1.106	1.2	2	1.750	8.156	98	High
PQMSJ02	PQ, unnamed trib (J)	2.062	1.106	0.9	2	0.986	7.055	91	High
PQMSJ04	PQ, unnamed trib (J)	2.025	1.088	1.2	2	0.786	7.098	92	High
PQMSJ06	PQ, unnamed trib (J)	2.250	0.788	0.9	2	1.624	7.561	96	High
PQMSJ08	PQ, unnamed trib (J)	2.025	0.563	0.6	0	1.512	4.699	41	Moderate
PQMSK02	PQ, unnamed trib (K)	1.087	0.881	0.9	0	0.086	2.955	3	Low
PQMSK04	PQ, unnamed trib (K)	1.650	0.431	1.2	0	0.212	3.493	11	Low
PQMSK06	PQ, unnamed trib (K)	1.837	0.788	1.2	0	1.186	5.011	53	Moderate
PQMSK08	PQ, unnamed trib (K)	1.950	0.825	1.2	0	0.912	4.887	47	Moderate
PQMSK10	PQ, unnamed trib (K)	2.175	0.581	0.9	0	1.436	5.092	55	Moderate

Table 3-176: Poquessing Creek Mainstem - Reach Prioritization

Reach ID	Sub-watershed	Pts. For Overall Stream Condition (Max of 3)	Pts. For Overall Buffer Condition (Max of 1.5)	Pts. For Reach Accessibility (Max of 1.5)	Pts. For Public Land Access (Max of 2)	Pts for Erosion Rate (Max of 2)	Restoration Priority Score (Max of 10)	Restoration Priority Percentile	Restoration Priority
PQMS02	Poquessing Creek	1.387	1.313	0.9	0	0.412	4.012	21	Mod. Low
PQMS04	Poquessing Creek	1.425	1.238	0.9	0	0.024	3.586	13	Low
PQMS06	Poquessing Creek	1.612	1.350	1.2	0	0.550	4.712	42	Moderate
PQMS08	Poquessing Creek	1.200	0.769	0.9	0	1.074	3.943	20	Low
PQMS10	Poquessing Creek	1.762	1.031	0.9	0	1.224	4.918	50	Moderate
PQMS12	Poquessing Creek	1.987	0.975	0.9	0	0.300	4.162	24	Mod. Low
PQMS14	Poquessing Creek	1.837	1.181	1.2	0	1.950	6.169	80	Mod. High
PQMS16	Poquessing Creek	1.537	0.600	0.9	0	0.700	3.737	16	Low
PQMS18	Poquessing Creek	1.162	1.069	1.2	1	0.112	4.543	33	Mod. Low
PQMS20	Poquessing Creek	0.975	0.338	0.6	1	0.886	3.798	18	Low
PQMS22	Poquessing Creek	1.162	0.450	0.9	1	0.712	4.224	26	Mod. Low
PQMS24	Poquessing Creek	0.937	0.394	0.9	0	0.336	2.567	1	Low
PQMS26	Poquessing Creek	1.050	0.806	1.5	1	1.686	6.042	76	Mod. High
PQMS28	Poquessing Creek	1.237	0.581	1.2	1	1.412	5.431	64	Mod. High
PQMS30	Poquessing Creek	1.312	0.413	0.9	1	0.500	4.125	22	Mod. Low
PQMS32	Poquessing Creek	2.250	0.863	1.2	2	1.824	8.136	98	High
PQMS34	Poquessing Creek	1.462	0.581	1.2	2	0.862	6.106	77	Mod. High
PQMS36	Poquessing Creek	1.912	0.769	0.9	2	1.924	7.505	96	High
PQMS38	Poquessing Creek	1.575	0.863	1.5	2	0.224	6.161	79	Mod. High
PQMS40	Poquessing Creek	1.800	0.750	0.9	1	0.200	4.650	40	Mod. Low
PQMS42	Poquessing Creek	1.237	0.656	1.2	1	1.486	5.580	69	Mod. High
PQMS44	Poquessing Creek	1.275	0.600	0.6	1	1.462	4.937	50	Moderate
PQMS46	Poquessing Creek	1.275	0.544	0.6	1	1.524	4.943	51	Moderate
PQMS48	Poquessing Creek	1.350	0.431	0.6	1	0.650	4.031	21	Mod. Low
PQMS50	Poquessing Creek	1.237	0.881	0.9	0	0.524	3.543	13	Low
PQMS52	Poquessing Creek	1.312	1.088	0.9	1	0.736	5.036	53	Moderate
PQMS54	Poquessing Creek	1.237	0.394	0.6	1	1.362	4.593	36	Mod. Low
PQMS56	Poquessing Creek	1.312	1.013	0.6	0	1.200	4.125	23	Mod. Low
PQMS58	Poquessing Creek	1.050	0.806	0.9	2	1.500	6.256	83	High
PQMS60	Poquessing Creek	1.350	0.694	0.6	1	0.036	3.680	15	Low
PQMS62	Poquessing Creek	1.237	0.375	1.2	1	1.386	5.198	58	Moderate
PQMS64	Poquessing Creek	1.200	0.300	0.9	1	0.900	4.300	29	Mod. Low
PQMS66	Poquessing Creek	1.162	0.356	0.6	0	1.700	3.819	18	Low
PQMS68	Poquessing Creek	1.162	0.225	0.6	0	1.012	2.999	4	Low
PQMS70	Poquessing Creek	1.087	0.731	0.9	0	1.062	3.781	17	Low
PQMS72	Poquessing Creek	1.237	0.656	1.2	0	1.800	4.894	48	Moderate
PQMS74	Poquessing Creek	1.237	0.281	0.9	0	0.836	3.255	7	Low
PQMS76	Poquessing Creek	1.275	0.413	0.9	0	1.550	4.137	23	Mod. Low
PQMS78	Poquessing Creek	1.050	0.413	0.9	0	0.262	2.624	2	Low
PQMS80	Poquessing Creek	0.900	0.356	0.9	1	0.850	4.006	20	Low
PQMS82	Poquessing Creek	1.237	0.469	0.6	0	0.162	2.468	0	Low
PQMS84	Poquessing Creek	1.762	0.563	0.9	1	0.436	4.661	40	Mod. Low
PQMS86	Poquessing Creek	1.537	0.975	0.9	0	0.124	3.536	12	Low
PQMS88	Poquessing Creek	1.012	0.600	1.2	1	0.974	4.786	45	Moderate
PQMS90	Poquessing Creek	1.312	0.581	0.9	1	1.300	5.094	56	Moderate
PQMS92	Poquessing Creek	1.837	0.563	0.6	1	0.962	4.962	51	Moderate
PQMS94	Poquessing Creek	1.200	0.638	0.6	1	0.774	4.211	25	Mod. Low
PQMS96	Poquessing Creek	1.162	0.338	0.9	1	0.936	4.336	30	Mod. Low
PQMS98	Poquessing Creek	1.275	0.619	0.9	1	1.400	5.194	58	Moderate
PQMS100	Poquessing Creek	0.900	0.713	0.9	1	1.874	5.386	63	Mod. High

Table 3-177: Byberry Creek Tributaries – Reach Prioritization

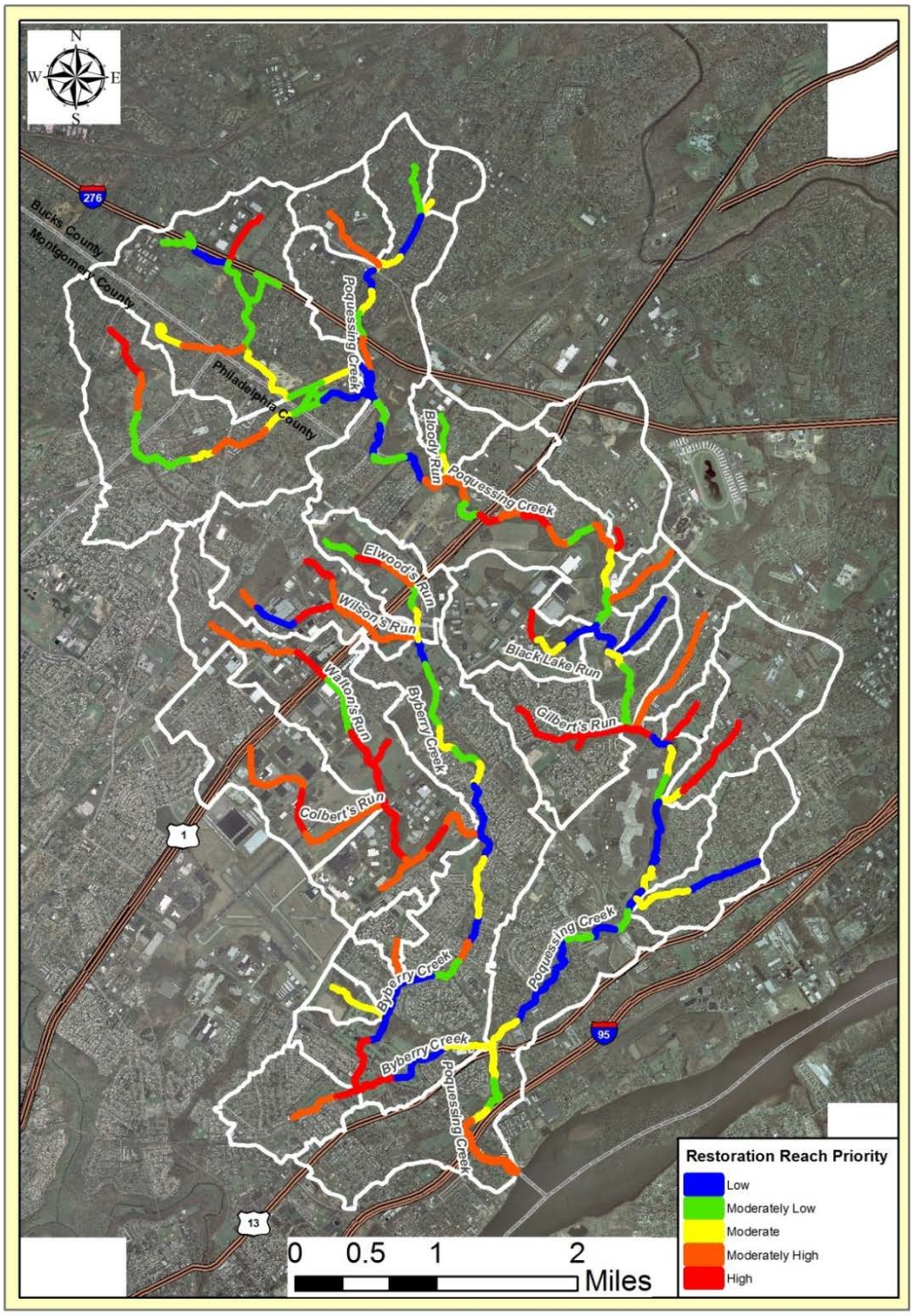
Reach ID	Sub-watershed	Pts. For Overall Stream Condition (Max of 3)	Pts. For Overall Buffer Condition (Max of 1.5)	Pts. For Reach Accessibility (Max of 1.5)	Pts. For Public Land Access (Max of 2)	Pts for Erosion Rate (Max of 2)	Restoration Priority Score (Max of 10)	Restoration Priority Percentile	Restoration Priority
PQBYA02	BY, unnamed trib (A)	1.800	0.525	0.9	1	1.286	5.511	66	Mod. High
PQBYB04	BY, unnamed trib (B)	0.750	1.200	1.2	0	1.762	4.912	49	Moderate
PQBYC02	BY, unnamed trib (C)	1.762	0.731	0.9	2	0.750	6.144	78	Mod. High
PQBYC04	BY, unnamed trib (C)	1.200	1.238	1.2	2	1.862	7.499	95	High
PQCR02	Colbert's Run	2.325	0.863	0.9	0	1.450	5.537	67	Mod. High
PQCR04	Colbert's Run	2.175	1.163	0.9	0	1.174	5.411	63	Mod. High
PQCR06	Colbert's Run	2.362	1.050	1.2	0	1.000	5.612	70	Mod. High
PQCR08	Colbert's Run	2.137	0.994	0.6	2	0.474	6.205	81	High
PQCR12	Colbert's Run	1.312	0.788	0.9	2	0.512	5.512	66	Mod. High
PQCR14	Colbert's Run	1.687	0.844	0.9	2	0.450	5.881	73	Mod. High
PQER02	Elwood's Run	1.875	0.356	0.9	1	0.424	4.555	35	Mod. Low
PQER04	Elwood's Run	2.137	0.375	0.9	1	1.836	6.248	82	High
PQER06	Elwood's Run	1.500	0.713	1.2	1	1.136	5.548	68	Mod. High
PQER08	Elwood's Run	1.425	1.013	0.9	1	0.074	4.411	30	Mod. Low
PQER10	Elwood's Run	1.762	0.975	0.9	0	1.124	4.761	43	Moderate
PQWA06	Walton's Run	2.512	1.350	1.2	0	0.812	5.874	73	Mod. High
PQWA08	Walton's Run	1.912	1.238	0.9	2	1.250	7.300	94	High
PQWA10	Walton's Run	2.212	1.050	0.9	0	0.386	4.548	34	Mod. Low
PQWA12	Walton's Run	1.762	1.106	0.6	0	1.162	4.631	38	Mod. Low
PQWA14	Walton's Run	1.612	0.619	0.9	2	1.086	6.217	81	High
PQWA16	Walton's Run	1.612	0.919	1.2	2	0.924	6.655	89	High
PQWA18	Walton's Run	2.025	0.488	0.9	2	1.150	6.562	88	High
PQWA20	Walton's Run	2.362	1.106	0.6	2	0.324	6.393	86	High
PQWA22	Walton's Run	2.137	0.356	0.6	2	1.724	6.818	90	High
PQWA24	Walton's Run	2.212	0.281	0.9	2	0.100	5.494	65	Mod. High
PQWA26	Walton's Run	1.575	0.225	0.6	2	1.886	6.286	83	High
PQWA28	Walton's Run	1.575	0.825	0.9	2	0.536	5.836	72	Mod. High
PQWAA02	Walton's Run	2.062	0.525	0.9	2	1.912	7.399	95	High
PQWAB04	Walton's Run	1.387	0.488	0.6	2	1.350	5.825	71	Mod. High
PQWI02	Wilson's Run	1.987	0.731	1.2	1	1.562	6.481	88	High
PQWI04	Wilson's Run	1.575	0.919	1.2	1	0.874	5.568	68	Mod. High
PQWI06	Wilson's Run	1.687	1.050	0.6	1	1.650	5.987	75	Mod. High
PQWI08	Wilson's Run	2.137	0.825	0.9	1	1.274	6.136	78	Mod. High
PQWIA02	Wilson's Run	2.100	0.581	0.9	0	1.674	5.255	61	Mod. High
PQWIA04	Wilson's Run	1.350	0.863	0.9	0	0.062	3.174	6	Low
PQWIA06	Wilson's Run	2.175	1.256	0.6	1	1.374	6.405	87	High

Table 3-178: Byberry Creek Mainstem - Reach Prioritization

Reach ID	Sub-watershed	Pts. For Overall Stream Condition (Max of 3)	Pts. For Overall Buffer Condition (Max of 1.5)	Pts. For Reach Accessibility (Max of 1.5)	Pts. For Public Land Access (Max of 2)	Pts for Erosion Rate (Max of 2)	Restoration Priority Score (Max of 10)	Restoration Priority Percentile	Restoration Priority
PQBY02	Byberry Creek	1.350	0.825	0.9	0	0.686	3.761	16	Low
PQBY04	Byberry Creek	1.275	0.656	0.9	0	1.612	4.443	31	Mod. Low
PQBY06	Byberry Creek	2.100	1.088	0.6	0	0.462	4.249	28	Mod. Low
PQBY08	Byberry Creek	2.362	1.181	0.9	0	0.612	5.056	55	Moderate
PQBY10	Byberry Creek	1.950	1.200	0.9	0	0.374	4.424	31	Mod. Low
PQBY12	Byberry Creek	1.350	0.825	0.9	0	1.974	5.049	54	Moderate
PQBY14	Byberry Creek	1.575	1.200	0.6	0	0.050	3.425	10	Low
PQBY16	Byberry Creek	1.500	1.050	0.9	0	0.186	3.636	15	Low
PQBY18	Byberry Creek	1.387	0.488	0.6	0	0.012	2.487	1	Low
PQBY20	Byberry Creek	1.762	0.656	0.9	0	1.900	5.219	60	Moderate
PQBY22	Byberry Creek	1.237	0.656	0.9	0	1.936	4.730	43	Moderate
PQBY24	Byberry Creek	1.050	0.563	0.9	0	0.562	3.074	5	Low
PQBY26	Byberry Creek	1.200	0.675	0.9	2	1.112	5.887	74	Mod. High
PQBY28	Byberry Creek	0.750	0.825	0.9	2	0.136	4.611	37	Mod. Low
PQBY30	Byberry Creek	1.237	0.825	0.6	0	0.486	3.148	6	Low
PQBY32	Byberry Creek	1.275	0.506	0.6	0	1.100	3.481	11	Low
PQBY34	Byberry Creek	0.937	0.281	0.9	0	0.312	2.431	0	Low
PQBY36	Byberry Creek	1.537	1.294	1.2	2	0.350	6.381	85	High
PQBY38	Byberry Creek	0.900	0.975	1.2	2	1.600	6.675	90	High
PQBY40	Byberry Creek	0.975	1.406	1.2	0	0.286	3.867	19	Low
PQBY42	Byberry Creek	1.125	0.450	0.9	0	0.824	3.299	8	Low
PQBY44	Byberry Creek	1.200	0.956	0.6	2	0.362	5.118	56	Moderate

Prioritized reaches were also mapped for a visual representation throughout the Poquessing Creek Watershed (Figure 3-117). Sections of continuous reaches with high prioritization values were investigation further and are described in the next section.

Figure 3-117: Reach Prioritization for the Poquessing Creek Watershed



3.6.1.1 POQUESSING MAINSTEM

The longest contiguous length (0.85 miles) of high and moderately high priority reaches on the Poquessing mainstem are located adjacent to the Benjamin Rush State Park. This priority location consists of reaches PQMS32, PQMS34, PQMS36, and PQMS38 (See Appendix E for Priority Restoration Reach Maps). These reaches have highly eroded banks which is impacting vegetation on the streambanks. Sedimentation and stream over-widening is also impacting in-stream habitat.

The presence of public land within Philadelphia County could improve the potential for successful restoration partnerships. Burling Ave provides access to the State Park and much of the lower portion of the high priority reaches. Construction access off of Burlington Road could be developed through the State Park. A trail is proposed along the Poquessing Creek as part of the Benjamin Rush State Park Master Plan that could potentially be used for access to portions of the restoration reach.

Shortly downstream of the State Park, reaches PQMS42, PQMS44, and PQMS46 travel between Poquessing Valley Park (Fairmount Park Commission) and a commercial area. These reaches are considered moderately high or moderate priority but would present an excellent opportunity for restoration work due to the presence of impaired stream segments and public land.

Figure 3- 118: Left- downstream view of PQMS34; Right-downstream right bank on PQMS36

3.6.1.2 GILBERT'S RUN

The entire 0.9 miles of Gilbert's Run and 0.1 miles of the Unnamed Tributary to Gilbert Run are classified as high priority reaches. These reaches are located in the Poquessing Valley Park (Fairmount Park Commission) in Philadelphia County. This priority location consists of reaches PQGR02, PQGR04, PQGR06, and PQGRA02 (See Appendix E for Priority Restoration Reach Maps). This location had the highest priority reaches in the entire Poquessing Creek Watershed. These reaches are extremely entrenched and over-widened. Streambanks are actively eroding and streambank vegetation is impacted. Over-widening, sedimentation, and minimal baseflow has severely impacted instream habitat. Invasive vegetation exists throughout the priority location.

The presence of Fairmount Park Commission land on both sides of much of the stream channel will improve the potential for successful restoration partnerships. A walking trail adjacent to Gilbert's Run could provide construction access for restoration activities.

Figure 3- 119: Left- downstream view of PQGR02, Right- downstream view of PQGR06

3.6.1.3 POQUESSING CREEK, UNNAMED TRIBUTARIES I & J

The entire 0.4 miles of Poquessing Creek Unnamed Tributary I is classified as a high priority reach. The upper 0.7 miles of Poquessing Creek Unnamed Tributary J are classified as high priority. These reaches are located on the Bensalem Township Country Club Golf Course property in Bucks County. This priority location consists of reaches PQMSI02, PQMSJ02, PQMSJ04, and PQMSJ06 (See Appendix E for Priority Restoration Reach Maps). These reaches have extremely eroded banks and little riparian vegetation throughout the golf course. Although good access to the channel exists throughout these reaches, there may be difficulties coordinating construction activities on an active golf course. Also, a highly eroded bank adjacent to a golf course pond exists on Poquessing Creek (Reaches PQMS 60 & PQMS 62) near Unnamed Tributary I. This bank should be stabilized to prevent the connection of Poquessing Creek with this pond. This would result in a significant sediment discharge to Poquessing Creek.

Figure 3- 120: Left- upstream view of PQMSI02; Right- downstream left bank of PQMSJ06


3.6.1.4 BYBERRY MAINSTEM

A total of 0.7 miles of Byberry Creek and 0.2 miles on Byberry Creek, unnamed tributary C are classified as high priority reaches. These reaches lie entirely within Philadelphia County. These reaches pass through the privately owned Torresdale-Frankford Country Club at the upstream and downstream ends. The middle of this priority section passes through the publicly owned (Fairmount Park) John F. Byrne Golf Club. This priority location consists of reaches PQBY36, PQBY38, and PQBYC04 (See Appendix E for Priority Restoration Reach Maps). These reaches have extremely eroded banks and little riparian vegetation throughout the golf courses. Also, the stream channels are over-widened and little useable habitat exists. Also, the Creek is channelized in gabion walls through the Torresdale-Frankford Country Club and significant coordination and approvals would be required with the private landowner to complete a more naturalized restoration. Also, the expansion of a riparian buffer throughout the reach would be very beneficial to the Creek in this location. However, this may not be compatible with the current golf course layouts. Although good access to the channel exists throughout these reaches, there may be difficulties coordinating construction activities on active golf courses.

Figure 3- 121: Left- upstream view of PQBY36; Right- upstream View of PQBY38


3.6.1.5 WALTON'S RUN

The most downstream 1.9 miles of Walton's Run is classified as high or moderately high priority reaches. These reaches lie entirely within Philadelphia County. The upper portion of these prioritized reaches flow adjacent to Northeast Philadelphia Airport property. The lower portion of these reaches run through the Walton's Run Fairmount Park Parcel. This priority location consists of reaches PQWA14, PQWA16, PQWA18, PQWA20, PQWA22, PQWA24, PQWA26, and PQWA28 (See Appendix E for Priority Restoration Reach Maps). This location had the longest length of high priority reaches in the entire Poquessing Creek Watershed. These reaches are generally entrenched and over-widened. Streambanks are actively eroding and streambank vegetation is impacted. Over-widening, sedimentation, and minimal baseflow has severely impacted instream habitat. Invasive vegetation exists throughout the priority location. However, significant forested buffers and floodplain wetlands exist throughout these reaches.

The presence of Fairmount Park property on both sides of much of the lower portion of the stream channel will improve the potential for successful restoration partnerships. It is likely that construction access roads will be needed to restore these reaches. This is considered a very high priority reach with high potential for successful restoration partnerships.

Figure 3- 122: Left: Upstream view of PQWA14; Downstream view of PQWA18


Figure 3- 123: Left- downstream view of PQWA22; Right- downstream View of PQWA24


3.6.1.7 WILSON'S RUN

The entire 1.2 miles of Wilson's Run is classified as high or moderately high priority reaches. These reaches are primarily located between transportation right-of-way and industrial properties in Philadelphia County. This priority location consists of reaches PQWI02, PQWI04, PQWI06, and PQWI08 (See Appendix E for Priority Restoration Reach Maps). These reaches are extremely entrenched and over-widened. Streambanks are actively eroding and streambank vegetation is impacted. Over-widening, sedimentation, and the flashy flow regime has severely impacted instream habitat. Invasive vegetation exists throughout the priority location.

The presence of private industrial properties and active transportation corridors throughout the reaches may pose some difficulties for successful restoration partnerships. Construction access would need to be obtained through private properties or transportation right-of-ways.

Figure 3- 124: Left- downstream view of PQWI02; Right- upstream view of PQWI08

3.6.2 RESTORATION STRATEGIES

Stream restoration is a general term that may be used to describe a broad spectrum of activities undertaken to correct problems affecting streams or improve stream habitat, structure and function. However, stream restoration and streambank reinforcement activities that do not take into account the stream's current morphological state and the tendency of streams to adjust to new hydrologic conditions may not be successful, and in some cases may be counterproductive. In order to be successful, stream restoration activities should:

1.) Work with the stream's tendency to establish a dynamic equilibrium between land and water

2.) Take into account new hydrologic conditions that accompany changes in land use, and

3.) Seek establishment of a natural stream dimension, pattern, and profile.

Stream corridors represent a micro-ecosystem within a watershed, consisting not only of the channel, but also of the adjacent floodplain and a transitional area where the floodplain ends and merges into an upland area. Stream restoration, therefore is the restoration of multiple micro-habitats that are a part of a larger watershed.

A comprehensive approach to watershed management and restoration is essential and should be planned and prioritized according to representative watershed indicators and identified issues. All information should be organized, maintained and be made easily accessible to residents. Components of an ideal watershed master plan should include information organized on a watershed basis for existing channel condition, impervious cover, sewer and storm drain infrastructure, drainage network, stormwater outfalls, stormwater problem locations, industrial sites, open space, and natural areas. The assessment of the Poquessing Creek Watershed has provided some of these essential elements that can be used independently or built upon to identify and prioritize watershed indicators and issues. All strategies should complement existing regulations, management strategies, and community efforts.

Restoration strategies that would alleviate or minimize identified direct and future cumulative impacts to the Poquessing Creek Watershed are discussed in the following section. These strategies have been divided into three categories:

Restoration Strategy Category I:	Channel Stability & Infrastructure
Restoration Strategy Category II:	Habitat
Restoration Strategy Category III:	Land management.

3.6.2.1 RESTORATION STRATEGY CATEGORY I: CHANNEL STABILITY & INFRASTRUCTURE

3.6.2.1. BANK STABILIZATION

Many parameters that were evaluated throughout the Poquessing Creek watershed may be applied as metrics to gauge the applicability of bank stabilization techniques for a given reach. Bank stabilization measures can vary, based on the severity of the erosion and whether it is localized or continues for some distance along a bank, from small plantings to the installation of boulder walls. Bank stabilization measures may consist of boulder bank and/or boulder "toe of slope" reinforcement in areas where the greatest erosive potential exists. Boulder structures may also be used in smaller channels when the stream is eroding and over-widening to the point where property is, or is expected, to be lost. Other more natural bank stabilization methods such as bioengineering, root wads, plantings and log and woody structures should be used in areas where the bankfull channel has not been severely overwidened and significant additional channel changes are not expected. These methods are best suited to small, local areas of bank erosion scattered throughout the smaller tributaries where discharges are the lowest. Bank stabilization can reduce erosion, sediment supply, tree fall, channel widening and migration.

3.6.2.1.2 BED STABILIZATION

Bed stabilization is recommended for those reaches that are currently degrading through incising or downcutting. Bed stabilization measures such as rock/log vanes with grade control, rock/log cross vanes, and using naturally occurring boulders and bedrock are examples of methods that could be used to stabilize channel beds. Rock/log vanes differ from cross vanes because they do not extend the entire width of the channel. However, both structures provide grade control while diverting flow away from the channel banks. Bed stabilization should be used to eliminate headcuts or knickpoints. Advantages of bed stabilization consist of bank protection through diverting flow and elimination of migrating bed scour through providing grade control. Bed stabilization techniques can also aid in re-establishing natural pool-riffle-run sequences that are often lacking in degraded reaches.

In general, bank and bed stabilization restoration potential should be evaluated together such that the maximum amount of stream improvement value may be obtained for the funds allotted for a particular project. This is also important because of the implicit relationship that one has with the other. For example, spacing and alignment of bed stabilization structures must also be coordinated with bank

stabilization features so that the restoration design features complement one another and work with the stream's natural meander pattern rather than against it. It is also often necessary to secure stream- crossing structures such as rock and log vanes by trenching them into the streambanks.

3.6.2.1.3 REALIGNMENT & RELOCATION

Stream channel realignment and relocation are the most severe restoration measures involving the greatest amount of channel changes. These methods should be employed when it is more advantageous to realign the channel than it is to stabilize degrading, out-of-pattern sections. Channel realignment and relocation are commonly implemented for shorter portions of a channel rather than for extensive lengths of channel due to construction and maintenance costs, and the amount of disturbance that occurs to existing natural habitat. Stream channel realignment and relocation is best suited to consecutive severely degraded reaches where existing land uses are threatened.

3.6.2.1.4 INFRASTRUCTURE IMPACTS

Large structures or facilities within stream channels can interrupt natural flow patterns and alter the hydrology and hydraulics of the creek in which they are present. Anthropogenic alterations to the natural balance or progression towards the natural balance between land and water generally have adverse impacts on the channel. For example, some features, such as dams, can disrupt the natural movement of sediment and block upstream migration of stream biota. Other infrastructure features, such as stormwater outfalls or culverts, can create local erosion by causing stormwater shear forces to be directed at a small area or creating high velocity scour at constrictions. These local disturbances often serve as "knickpoints", from which additional destabilizing erosion, scour, and sediment transport problems may propagate.

3.6.2.1.5 STORMWATER OUTFALLS

Over 450 stormwater outfalls were found in the Poquessing Creek watershed. Due to the density within the watershed and the degree to which they may cause local erosion, stormwater outfalls are considered one of the most important considerations in assessing stream reach stability. Outfalls often drain large areas of impervious surfaces and efficiently deliver large volumes of water to small streams. Streambank erosion and bed erosion (scour pools) were often observed at these outfalls, and in some cases, this local erosion served as a knickpoint, causing headcutting in an upstream direction. Because outfalls may be positioned to direct flow at banks from a disadvantageous angle, it may be necessary to armor the opposite bank or install energy dissipating structures where the outfall meets the stream. The presence of a large outfall or outfalls may also constrain the final pattern and profile of a stream restoration design.

3.6.2.1.6 CULVERTS

Culverts may have many of the same destabilizing influences as dams and stormwater outfalls and must also be considered in stream restoration design. In some cases, a large culvert may serve as a stable starting or end point for a stream restoration project, with the remainder of the restoration designed to mitigate the destabilization and sediment transport issues at the site.

3.6.2.1.7 DAM AND POND IMPACTS

There were 27 dams present within the Poquessing Creek Watershed that provide little or no positive value to the hydraulic regime of the stream. Observations made during the various field investigations and infrastructure assessment suggested that most dams accrued large amounts of fine sediments upstream, and that reaches downstream of these structures are likely to have undergone a greater amount of channel degradation than those channels not influenced by dams. There are also a small number of ponds located in Poquessing watershed most of which are associated with golf courses, large estates and developments. Ponds often develop serious management problems, and are associated with algal blooms, overheating of impounded water and an overabundance of resident Canadian geese.

Despite these facts, their installation may also have created some beneficial habitat. Additional consideration must be given to the fact that any beneficial habitat may now rely on the existence of these dams, in which case removing dams to create a more natural channel may outweigh the benefits that resulted from its installation. Overall, dam and pond removal have been presented as possible channel stability restoration measures. It should be noted that careful evaluation of all environmental costs and benefits, specifically habitat and any potential historical significance associated with each structure must be taken into consideration.

3.6.2.1.8 REMEDIATION OF INFRASTRUCTURE IN POOR CONDITION

Products of the infrastructure assessment conducted during this study were observations and locations of infrastructure in poor condition. This classification was attributed to those dams, bridges and outfalls that exhibited the characteristics of being broken, exposed, or the potential of such issues based upon their proximity to the stream and ongoing bank erosion. It is recommended that repair or replacement of adjacent infrastructure in poor condition is included with any stream restoration efforts.

3.6.2.2 RESTORATION STRATEGY CATEGORY II: HABITAT

3.6.2.2.1 RIPARIAN BUFFER EXPANSION/IMPROVEMENT

Riparian buffer expansion and improvement can act as strategies which can significantly improve the habitat characteristics of the associated stream reaches. Several parameters were qualitatively and quantitatively evaluated along each reach which can be utilized in the prioritization of stream sections with respect to this strategy. Although priority reforestation areas consist of floodplains, steep slopes, and wetlands, smaller areas such as public right-of-ways, parks, schools, and neighborhoods also provide reforestation opportunities. Benefits of reforestation are numerous. Cooler temperatures, stream shading, rainfall interception, reduced runoff, reduced sediment load, reduced discharge velocities, increased groundwater recharge, increased species diversity and habitat, and improved air quality and aesthetics are all positive effects associated with a healthy riparian buffer.

3.6.2.2.2 INVASIVE SPECIES MANAGEMENT

Maintaining a healthy riparian plant community within the Poquessing Creek Watershed will retain biodiversity and support a healthy stream ecosystem. Invasive species provide little value to native animals that depend on native species for habitat and/or food. Because of this threat to the biodiversity of native communities, an invasive species management plan would assist natural succession within the riparian buffer through decreasing possible further impacts of invasive species. An invasive species management plan will require, at a minimum, a three-year commitment to ensure success. Planting plans for all restoration efforts should complement the invasive species management plan by recommending appropriate native planting to supplement areas where invasive species have been eliminated. Although invasive species management priority areas are considered those that contain 80% or greater invasive species, invasive species management should also be implemented for all preliminary recommended channel restoration sites.

3.6.2.2.3 WETLAND CREATION

Land currently available for reforestation located adjacent to the channel is also ideal for wetland creation. Wetland creation adjacent to the channel is best suited to those areas where stream relocation and realignment are suitable. Because stream relocation and realignment typically involve large quantities of grading, replanting the disturbed areas can be customized to create specific habitats. Wetlands, a rich habitat that relies on saturated soils and vegetation adapted to these conditions could be created concurrently with channel relocation and realignment. Therefore, the best opportunities for wetland creation may be adjacent to those channels that are also suitable relocation /realignment sites.

Further investigation of all potential restoration and realignment sites should include the following: rainfall data collection and evaluation, runoff calculations, soils investigation, water budget, native species investigation, and groundwater monitoring. Ideally, groundwater levels for all potential wetland creation sites should be monitored to determine their suitability prior to design. Advantages of wetland creation are groundwater recharge, increased habitat, increased plant and animal species diversity, and improved water quality.

3.6.2.2.4 PRESERVATION OF EXISTING FORESTED AREAS

Existing forests are valuable habitat and should be protected. All of these areas throughout the watershed should be protected and managed, if necessary, to preserve the forested riparian buffer present surrounding all creeks within the watershed. Educational/informational signage, creating small parks or designated green space, and installing fences or prohibiting access in areas where the riparian area has been disturbed are additional strategies to help preserve existing forests.

3.6.2.3 RESTORATION STRATEGY CATEGORY III: LAND MANAGEMENT

3.6.2.3.1 REDUCE DIRECTLY CONNECTED IMPERVIOUS SURFACES

Stream channels within each watershed have responded to high density development and increased runoff through downcutting and over-widening in an attempt to accommodate higher flows. In addition to preserving land available for reforestation or to protect from becoming developed, the amount of existing impervious surfaces should be reduced. Examples of strategies to reduce the amount of existing impervious surfaces and/or decrease the severity of runoff include:

Stormwater management basins – both wet/dry ponds have the ability to collect storm flow, hold water temporarily and release water to a stream at a constant rate. Disadvantages of basins are finding the available land to build them and the associated maintenance over many years. In areas where additional development is still possible, or re-development may occur, stormwater management ponds are a suitable method to reduce runoff. Planned species selection for vegetating the pond perimeter, banks, and edges may also help reduce nutrients delivered to streams. Similarly, in areas where adequate space is not available, grass swales can be used to increase infiltration while decreasing the velocity of runoff prior to delivering it to the creeks.

Bioretention – bioretention facilities are similar to stormwater management ponds in their function, but differ since they are much better suited for small areas. Bioretention facilities can be installed next to parking lots, curbs, major roads, etc. to immediately catch runoff, filter sediment and allow rainwater to infiltrate back into the groundwater table.

Parking Lot Island Installation and Plantings – parking lot islands can be installed and planted within large paved areas to create less contiguous impervious surfaces. Islands can be depressed to catch stormwater and planted to provide water quality benefits, shade and aesthetic value. Often, planted parking lot islands can serve dual purposes and provide water quality benefits if they are also bioretention facilities. At a minimum, efforts should aim to steady the existing percent impervious surfaces associated with parking lots. When and if the opportunity arises, unnecessarily paved and oversized parking lots could be converted to have smaller spaces and contain islands to create less contiguous paved surfaces. Parking lots and other paved right-of-ways should also be evaluated when adding or relocating utilities. To fully utilize existing paved surfaces instead of creating new impervious surfaces utilities could be located underneath existing pavement.

3.6.2.3.2 APPROPRIATE ROAD AND CULVERT MAINTENANCE

Often inappropriately sized culverts or poorly stabilized roads will impact a channel through eroding the bed and banks. Bed scour may cause a headcut or knickpoint that is capable of migrating upstream. A headcut or knickpoint will continue to scour the bed and deepen the channel as it moves upstream until it is inhibited by a natural bed formation or man-made structure resistant to erosion. Although the headcut or knickpoint may have stopped migrating, it is still present in the channel and if channel conditions change may begin to migrate again.

3.6.2.3.3 PUBLIC EDUCATION

Because watersheds are so diverse in their land use and ownership, a public educated in the ways and means of being a good steward to their watershed is perhaps one the best ways of addressing its restoration. Disturbances such as footbridges, landscaping, and mowing adjacent to the channel will continue so long as public education and awareness are not increased. Public education provides opportunities to relate the importance of stream habitat and stability and to influence and/or change the behavior of residents.

Public education begins with public involvement. One principal avenue for educating residents is through forming local watershed groups. Local watershed groups are most effective when strong, mutually beneficial relationships are established early between the volunteers and local government agencies. Planning agencies and volunteers could then communicate and work together to educate neighbors through activities such as stream clean-ups, re-vegetating stream banks, long-term monitoring, and publishing articles in the local newspaper(s), among many others. Additional opportunities for the community to participate in all aspects of the planning/development phase increases not only public education, but also recreation and habitat enhancement opportunities.

In 2005, the Poquessing Creek Watershed Partnership was formed, consisting of a consortium of proactive environmental groups, community groups, government agencies, businesses, residents and other watershed stakeholders interested in improving their watershed. The goals of the partnership initiative are to protect, enhance, and restore the beneficial uses of the waterways and riparian areas. The partnership seeks to achieve greater levels of environmental improvement by sharing information and resources. This partnership has assisted with Rivers Conservation Planning, Act 167 Planning, and small scale restoration projects. Some key stakeholders involved with the Partnership include the Philadelphia Water Department, Friends of the Poquessing Watershed, Philadelphia Parks and Recreation, Pennsylvania Environmental Council, Bensalem Township, Lower Moreland Township, Lower Southhampton Township, Bucks County, Montgomery County, and the Pennsylvania Department of Conservation and Natural Resources.

More information about the Poquessing Watershed Partnership can be found on the Philadelphia Water Department's website (http://www.phillyriverinfo.org/).

3.7 COMPLETED AND PROPOSED PROJECTS

3.7.1 MAINSTEM POQUESSING CREEK

A few small scale projects are proposed along the mainstem of Poquessing Creek including riparian planting at the confluence of Poquessing Creek and the Delaware River as well as some trail development projects.

3.7.1.1 PROPOSED GLEN FOERD PROJECT

Friends of Poquessing Watershed (FOPW) and their partners, the Pennsylvania Environmental Council (PEC), the Glen Foerd Conservation Corporation, and Philadelphia Parks and Recreation, are seeking PECO Green Region Program Grant for the first phase of restoring the stream banks at the confluence of the Poquessing Creek and the Delaware River on the grounds of Glen Foerd, part of Philadelphia's Fairmount Park system.

Figure 3-125: The confluence of the Poquessing Creek and the Delaware River (viewed from the base of the stream bank; presently inaccessible to the public due to safety concerns)

In the proposed Phase 1 of this project, for which they are currently requesting funds, invasive vegetation along the southern bank of the Poquessing Creek will be removed and native trees, shrubs and herbaceous species of the Atlantic coastal plain will be planted. The new landscape will reduce erosion of the steep slopes of this tidal waterway, provide habitat for birds, insect pollinators, and other wildlife, reduce

stormwater runoff (including non-point-source pollutants) and allow a clear view of the creek and river confluence which is currently obscured by bamboo stands.

The confluence is just north of the Baxter Water Treatment Plant, which provides water for nearly 60% of Philadelphia's population and for parts of Lower Bucks County, making this site an ideal location to educate the public about the importance of the Poquessing Creek and the ecological significance of healthy riparian buffers.

The historic plan for the stream bank had little to do with sustainability, and has contributed to its current degraded state. The stakeholders plan to engage a landscape architecture firm. The firm would conduct a site inventory and analysis to determine the plant community and extent of disturbance, and develop a proposed landscape regeneration plan for the site. This plan would include bank stabilization and soil regeneration strategy as well as a plant species list and stewardship plan. A brief written narrative discussing the process and a general graphic plan would be included. The plan would specify plant material for the ground cover and shrub layers with heights that, at maturity, will not impede the view of the creek or its mouth.

The consultant would cooperate with staff from Fairmount Park/Philadelphia Parks and Recreation (PP&R). PP&R would provide the labor on the steep banks where volunteer labor would be inappropriate. The volunteer recruiting and organizing would be a joint effort of Glen Foerd, PEC, and FOPW with the support of PP&R, which would also provide a volunteer coordinator and help supervise volunteers in accessible areas.

PP&R is currently submitting a grant proposal to DCNR's TreeVitalize program for funding to purchase native trees and shrubs; these monies would provide the matching funds required by the PECO Green Region grant. Funding for Phase 2 (restoration of the western bank of the Delaware River at Glen Foerd) and Phase 3 (creation of a trail to safely access the Poquessing above its mouth) will be included in future grant applications.

Each stage of the restoration process will be carefully documented for use as a teaching tool for visitors to the museum and its grounds and local students whom we plan to engage in environmental education programs.

3.7.1.2 OTHER PROPOSED PROJECTS

Currently, planning efforts are underway to make improvements to the Benjamin Rush State Park grounds. Proposed improvements include a trail along the Poquessing Creek (See Figure 3-125). The Fairmount Park Commission is also planning a 1.5 mile trail project that will connect the Parkwood neighborhood to the Poquessing Creek Park (Fairmount Park Commission) and the Benjamin Rush State Park (See Figure 3-126).

Figure 3-126: Benjamin Rush State Park Development Plan

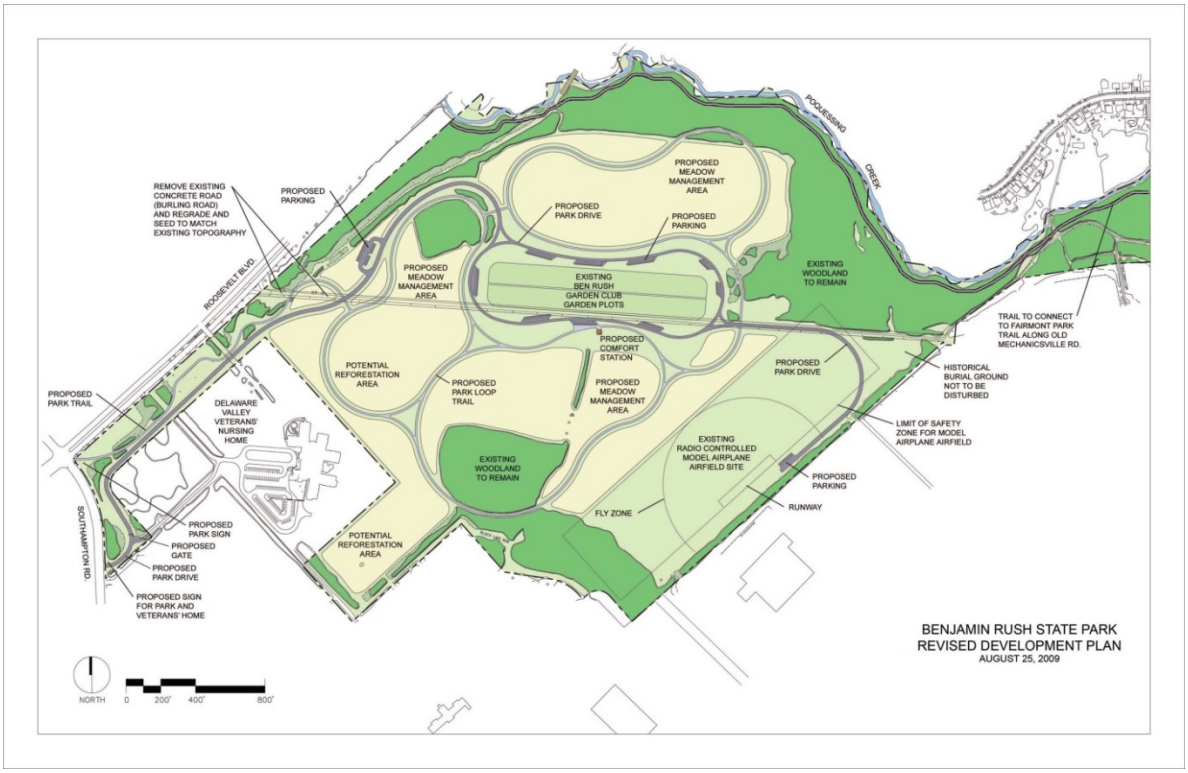
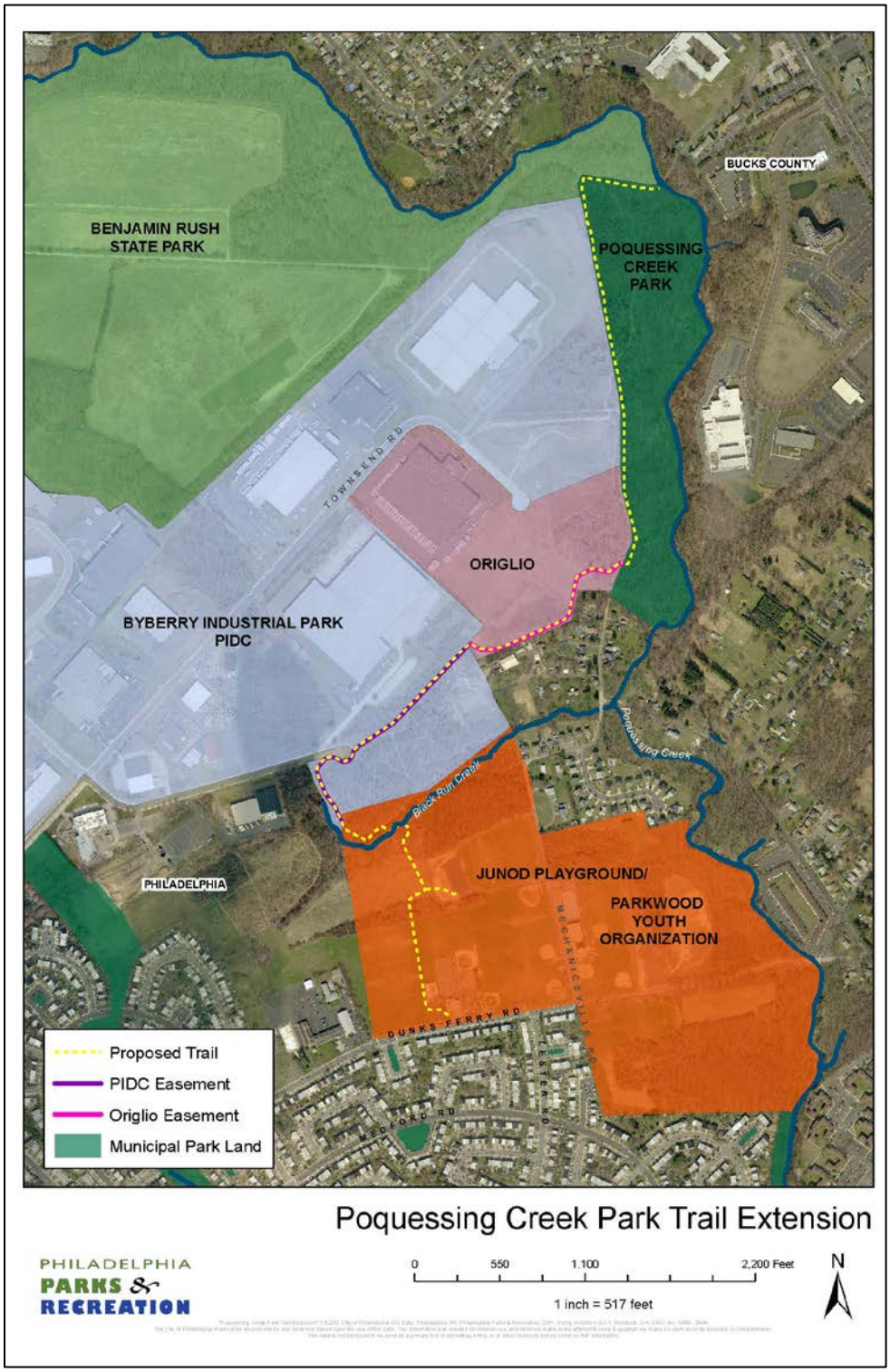


Figure 3-126: Proposed Poquessing Creek Trail Extension



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