



GATEWAY

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The Township of Upper St. Clair

Pollutant Reduction Plan Middle Chartiers Creek HUC-12 Watershed



*Municipal Separate
Storm Sewer System*

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Chapter 1. Introduction

1.1 Purpose

Municipalities throughout the country are under a federal mandate requiring a stormwater management program for reducing pollution impacts from stormwater runoff. In 2003, the Township of Upper St. Clair was issued a Municipal Separate Storm Sewer System (MS4) Permit through the Pennsylvania Department of Environmental Protection (PADEP) and the Environmental Protection Agency. The Township is regulated under PADEP's General NPDES Permit (PAG-136270). Implemented through the Clean Water Act, the permit's numerous requirements are through six Minimum Control Measures (MCMs). In addition, PADEP is requiring MS4s that discharge to an impaired stream prepare a Pollutant Reduction Plan (PRP) for sediment, nitrogen, and/or phosphorus. The goal of the PRP is to reduce pollution caused by sediment and/or nutrients in impaired streams.

1.2 Middle Chartiers Creek Watershed Background

The Middle Chartiers Creek Watershed is considered the Hydrologic Unit Code (HUC) 12 watershed. Within the Southwestern region of Pennsylvania, these HUC-12 watersheds are tributaries to either the Ohio, Monongahela, Allegheny, or Youghiogheny Rivers. For the Middle Chartiers Creek Watershed its tributary is the Ohio River. On a smaller scale, there are numerous smaller watersheds that are tributaries to Middle Chartiers Creek. These small watersheds include Chartiers Creek 7380 and Chartiers Creek 7149.

Once every two years, PADEP publishes a report entitled "Pennsylvania Integrated Water Quality Monitoring and Assessment Report" that summarizes the various water quality management programs including water quality standards. The PRP was assigned for each MS4 based on the 2014 report. If a stream was assigned as impaired from siltation, organic enrichment, low dissolved oxygen, or nutrients then a PRP is required. The Middle Chartiers Creek Watershed is impacted by metals, chlordane, nutrients, organic enrichment/low dissolved oxygen, siltation, and turbidity. Within the Middle Chartiers Creek Watershed, there are several impaired streams that include Chartiers Creek, Graesers Run, McLaughlin Run, Painters Run, and Brush Run.

Chapter 2. Outfall Sewersheds & Planning Areas

Before beginning the calculations of the pollutant loads, the outfall sewersheds are delineated and the PRP planning area is identified.

2.1 Delineation Procedures

As part of the PRP process, outfall sewersheds are required to be delineated. An outfall sewershed is an area of land in which stormwater flows into a storm sewer system and is discharged into a stream, lake, or waterway. Accurate outfall sewersheds were drawn based on topography (2006), aerial (2013), and stream layers in ESRI ArcMap. By following these layers and the storm sewer network, all outfalls were assigned a sewershed. The map which will be submitted with the Notice of Intent illustrates the outfall sewersheds. Aside from being a requirement of the PRP, delineation of the outfall sewersheds is useful if any parsing is implemented.

2.2 Planning Area

The planning area is defined as the area used to calculate existing loads and plan load reductions. PADEP offered several options for how to define the planning area for each impaired water. The options vary from using a combination of the storm sewersheds to using watershed boundaries. The Township of Upper St. Clair plans to utilize the HUC-12 watershed boundary as its planning area with some additional parsing that is described in the next section.

2.3 Parsing

Once the preliminary planning area was defined; additional parsing within the area was performed to remove area that either do not drain to the MS4's system, or are land that is already covered by an NPDES permit for the control of stormwater. Parsing reduces the MS4's area of responsibility and therefore the pollutant loads. The Township of Upper St. Clair parsed out PennDOT owned roads that are within in the Township. Appendix A illustrates the final planning area for the MS4 by displaying the HUC-12 and small watershed boundaries, as well as the parsed-out areas.

Chapter 3. Existing Loading without BMPs

PADEP provides several suggested methods that are scientifically-supported for estimating the existing loads. The approved methods for calculating the loads include PADEP Simplified Method land use loading rates, MapShed, or other watershed models that reflect both overland flow and in-stream erosion components. For the purpose of this PRP, MapShed was chosen as the most appropriate method. The loads generated within this PRP were calculated in July 2017.

3.1 MapShed Modeling Overview

MapShed is a free and publicly available software developed by Pennsylvania State University that derives the loading rates from mathematical simulation of pollutant generation and hydrologic processes. The software takes into account hydrology, land cover, soils, weather, topography and other environmental data to calculate sediment and nutrient loads. MapShed utilizes well known soil and hydrologic equations to model surface runoff and soil erosion.

For modeling surface runoff and streamflow, MapShed uses the National Resources Conservation Service Curve Number (NRCS-CN) combined with daily precipitation and temperature data. Evapotranspiration is calculated using the daily weather data and a land cover dependent factor. To model monthly erosion and sediment loss, the Universal Soil Loss Equation is applied. Nitrogen, phosphorus, and total suspended solids are modeled for each type of land cover using export coefficients for both the dissolved and solid phases. Overall, the software uses geographic data, land use runoff coefficients, daily weather, and the universal soil loss equations to calculate pollutant loads in terms of mass and concentration.

3.2 MapShed Modeling Methodology

In order for MapShed to perform these hydrologic calculations, initial data is needed beforehand. There are six required input sources and up to eleven optional sources in MapShed. The required data includes basins, weather stations, streams, soils, land use/cover, and surface elevation. The optional layers, which were included as part of this PRP, consist of urban areas, soil-phosphorus, physiographic provinces, and counties. Each data source is described below in more detail.

3.2.1 Basin Layer

The Basins layer in MapShed serves as the area modeled for the pollutant loads. The small watershed boundaries were used for this layer. The small watershed boundaries were obtained from Pennsylvania Spatial Data Access (PASDA) and are defined as catchment areas for named and unnamed streams. Utilizing the small watershed boundaries as the basin layer adequately accounts for downstream channel impacts.

3.2.2 Urban Area Layer

The Urban Area layer is considered optional in MapShed; however, it is required for the PRP to properly allocate the loads in which the MS4 is responsible. MapShed's urban area data that is available is considered the 2010 Urbanized Areas boundaries which are based on the U.S. Census Bureau's database. The Urban Area layer simulated loads that are area weighted for each based upon their land use/cover percent distribution within the basin. The urbanized area boundary was altered slightly depending on the amount of parsing incorporated into the PRP planning area.

3.2.3 Weather Stations Layer

With MapShed, weather data for the Generalized Watershed Loading Functions-Enhanced (GWLFE) input file is automatically prepared using daily climate data contained in "csv-formatted" Excel files. These Excel files are connected to a weather station shapefile through the use of a unique station ID number. A statewide weather database contains temperature and precipitation from 78 weather stations around the state between 1975 and 1998.

3.2.4 Streams Layer

In order to better estimate erosion, a streams layer is required within the model. The stream segments are derived from the National Hydrography Datasets at a 1:24,000 scale or better. The length of a stream within a basin affects many things such as streambank erosion.

3.2.5 Soils Layer

The soils layer holds information pertaining to various soil properties such as the available water-holding capacity, soil erodibility factor and the dominant hydrologic soil group. These properties are crucial when calculating the loads generated within a basin. Within the Middle Chartiers Creek Watershed, the Township of Upper St. Clair has soils mostly comprised of Group D.

3.2.6 Land Use Layer

The Land Use layer is one of the most critical layers used by MapShed since pollutant loads generated within a watershed are largely influenced by land surface conditions. These surface conditions are correlated to runoff, surface erosion, and infiltration, which are directly associated with vegetative cover. MapShed's land use data is obtained from the 2011 National Land Cover Database. There are 16 land use classes that each generate different loading rates.

3.2.7 Surface Elevation Layer

This particular grid layer is used to calculate land slope-related data for use within the model. The 30-meter digital elevation model used is considered a higher resolution grid cell data.

3.2.8 County Boundaries Layer

Having the boundary for each Pennsylvania county loaded into MapShed will geographically represent estimates of the cropping management and erosion control practice factors for hay/pasture, row crops, and wooded land covers.

3.2.9 Physiographic Province Layer

The physiographic province layer covers geographically and seasonally based estimates for the groundwater recession rate and erosivity coefficient values. The Township of Upper St. Clair is located within the Appalachian Plateaus Province, which has a groundwater recession rate of 0.1, a cool rain factor of 0.08, and a warm rain factor of 0.26.

3.2.10 Soil Phosphorus Layer

The soil phosphorus layer is used to estimate the phosphorus concentrations in sediment transported to nearby streams. For the purpose of the PRP, the layer is depicted as Soil Test P. The Soil Test P is an estimate of available soil phosphorus that was measured by standard lab tests.

3.3 MapShed Modeling Results

Each small watershed was analyzed separately in MapShed and the results can be found in Appendix B. The results from MapShed for the existing loads without BMPs are captured as screenshots of the Urban Area Viewer.

3.3.1 Chartiers Creek 7380 Small Watershed Results

The Chartiers Creek 7380 Watershed is about 5973 acres in size, with only 1675.3 of those total acres being located within the Township of Upper St. Clair. However, after parsing, the total watershed area within the MS4 boundary is 1641 acres. Table 3-1 identifies the amount of sediment and phosphorus pollution from land cover and stream bank erosion. The Chartiers Creek 7380 Watershed is mostly comprised of medium density residential, contributing a total of 28,707.10 lbs of sediment, and 66.10 lbs of phosphorus.

Table 3-1: Existing Pollutant Load Results without BMPs

SOURCE	SEDIMENT (lbs/yr)	PHOSPHORUS (lbs/yr)
Land Cover	192,755.61	126.9
Stream Bank	486,018.29	26.5
Total	678,773.90	153.4

3.3.2 Chartiers Creek 7149 Small Watershed Results

The Chartiers Creek 7149 Watershed is about 3744 acres in size, with only 18.2 of those total acres being located within the Township of Upper St. Clair. However, after parsing, the total watershed area within the MS4 boundary is 14 acres. Table 3-2 shows the amount of sediment and phosphorus pollution from land cover and stream bank erosion. The Chartiers Creek 7149 Watershed is mostly comprised of open land contributing a total of 1,827 lbs of sediment, and 0.50 lbs of phosphorus.

Table 3-2: Existing Pollutant Load Results without BMPs

SOURCE	SEDIMENT (lbs/yr)	PHOSPHORUS (lbs/yr)
Land Cover	1,954.25	0.9
Stream Bank	3,419.15	0.2
Total	5,373.40	1.1

3.3.3 Middle Chartiers Creek HUC-12 Watershed Results

The PRP comprised in this report is focused on load reductions on a HUC-12 watershed basis. The small watersheds analyzed are part of the HUC-12 watershed and are thus collectively summed together to obtain the existing load within the Township of Upper St. Clair. Table 3-3 shows the amount of sediment and phosphorus pollution from land cover and stream bank erosion.

Table 3-3: HUC-12 Existing Pollutant Load Results without BMPs

SOURCE	SEDIMENT (lbs/yr)	PHOSPHORUS (lbs/yr)
Land Cover	194,709.86	127.8
Stream Bank	489,437.44	26.7
Total	684,147.30	154.5

Chapter 4. Existing Structural BMPs

The existing loads calculated in Chapter 3 do not account for any reductions of existing stormwater BMPs. PADEP is allowing communities to reduce their existing load by taking credit for only Chapter 102 permitted stormwater BMPs. The locations of the existing permitted BMPs are located on the Planning Area Map in Appendix A.

4.1 BMP Performance Calculation Overview

PADEP provides several suggested methods that are scientifically-supported for estimating the pollution reduction potential of BMPs. These methods include the Expert Panel New Development Performance Standards Report and DEP's BMP Effectiveness Values Table. The method chosen for this report is the DEP's BMP Effectiveness Values Table.

For calculating the pollutant loads generated within the BMP's drainage area, the more detailed approach of analyzing the existing BMPs individually in MapShed was used. The approach is taken by using MapShed to analyze the land cover within a BMP's drainage area using its Land Cover Distribution Tool. If the BMP's drainage area overlaps with a parsed area, before the land cover is analyzed in MapShed, these parsed areas within each drainage area are clipped out in order to prevent load analysis on the parsed areas. Once the amount of land cover in the drainage area is computed, the values will be entered into the applicable spreadsheet depending on which small watershed the BMP is located in. Each small watershed produces its own specific loading rate (lbs/acre) for each land cover for sediment and phosphorus. These loading rates are applied to the BMP's drainage area land cover and the existing load for each is calculated. The streambank component of MapShed does not produce a loading rate as it is primarily generated based on the amount of developed land in the watershed. Since this is the case, a simplified approach of calculating the amount of streambank erosion in a BMP's drainage area is taken. This simplified approach involves determining the fraction of the drainage area's developed land (i.e. residential and mixed) within the watershed. This percentage is then applied to the watershed's total streambank erosion load for sediment and phosphorus through multiplication. The spreadsheet that determines the amount of existing load for each BMP's drainage area is located in Appendix C. Appendix D is an overall table detailing the existing loads, the percent removals, and the load reductions of each existing BMP.

4.2 Existing Loadings from Stormwater BMPs

For the Middle Chartiers Creek Watershed, 6 existing permitted BMPs were utilized to reduce the existing load. All permitted BMPs that were used as credit to reduce the existing loading estimates continue to function as they were originally designed. The BMPs will be frequently inspected by the Township's Engineer or the property owner to ensure appropriate operation and maintenance is being implemented. Each BMP has its own operation and maintenance plan that closely follows the applicable structural BMP located in the PADEP Stormwater BMP Manual. Information on the type of BMP, permit number, geographic location, and the installation date can be found in Appendix D-2.

4.3 Final Existing Loading and Required Reductions

After incorporating all the permitted existing BMPs, the final existing load for sediment and phosphorus within the PRP planning area was determined and is illustrated in Table 4-1. The required reduction is based on a 10% reduction for sediment and 5% for phosphorus. The MS4 plans to take a presumption approach that a 10% reduction of sediment will also accomplish a 5% phosphorus reduction.

Table 4-1 Final Existing Loads and Required Reductions

POLLUTANT	FINAL EXISTING LOAD (lbs/yr)	REQUIRED REDUCTION (lbs/yr)
Sediment	618,859.91	61,886
Phosphorus	145.35	7.27

Chapter 5. Achieving Load Reductions

Based on the PRP requirements, the final existing load calculated in Chapter 4 needs to be reduced by implementing proposed structural and non-structural BMPs. PADEP is leaving it up to the MS4 on how they will plan to reduce the required pollution reduction. However, their proposed structural BMPs must be developed to the point that they can be located on a map and estimate their specific load reductions. The MS4 may briefly describe other BMPs that cannot yet be located as a possibility, but may not count them as planned load reductions. As a result, these BMPs are only proposed at a planning level. Once additional analysis based on engineering design and cost feasibility is performed, the BMPs may be altered or eliminated. PADEP is allowing MS4's to update their PRPs between March 2018 and March 2023 to account for these changes in proposed BMPs.

One such opportunity that the Township of Upper St. Clair cannot account for in this September 2017 submission is taking credit for its stricter stormwater management ordinance. The Township of Upper St. Clair's stormwater ordinance goes above and beyond the Chapter 102 NPDES permit requirements for stormwater associated with construction activities. As a result, the MS4 can take credit for those pollution reductions that will occur from exceeding PADEP regulatory requirements.

The Township of Upper St. Clair may also update this plan in the future based on opportunities with various conservation and environmental groups. These types of organizations are dedicated to reducing pollution through outreach and small BMP installation to accomplish their goals. The Township recognizes these opportunities and will continue to promote outreach to such organizations.

The Township of Upper St. Clair encompasses two HUC-12 watershed boundaries; Lower Chartiers Creek and Middle Chartiers Creek that share the same impairments. The Township intends to coordinate with PADEP on combining the two watersheds into one PRP planning area. Combining the two separate PRPs will allow for flexibility in choosing the best project locations to reduce the amount of sediment and phosphorus pollution in Chartiers Creek.

At the time of this submission, the Township of Upper St. Clair is proposing structural BMPs that include new retrofit BMPs throughout the PRP planning area. Appendix E entails maps of the proposed BMP locations and associated drainage areas. There are various methods used to determine the removal rates of each type of BMP. These approved methods are discussed in further detail below.

The Township of Upper St. Clair is planning to propose load reductions through new retrofit BMPs. These types of BMPs are still considered retrofits because the drainage area in which the new BMP will be installed is not being developed or changed. PADEP provides several methods that are scientifically-supported for estimating the pollution reduction potential of new retrofit

BMPs. These approved methods for calculating the reductions are the PADEP BMP Effectiveness Values Table and the Expert Panel Removal Rates for Urban Stormwater Retrofit Projects. The Township of Upper St. Clair plans to calculate the efficiency of the new retrofit BMPs through the PADEP'S BMP Effectiveness Values Table.

For calculating the pollutant loads generated within the BMP's drainage area, the same method that was used in Chapter 4 of the report was utilized. The spreadsheet that determines the amount of existing load for each proposed new retrofit BMP's drainage area is located in Appendix F. Appendix G is an overall table detailing the existing loads, the percent removals, and the load reductions of each proposed BMP.

Though stream restoration projects are classified as structural BMPs, the method used to calculate their reduction efficiency is slightly different than the previously discussed methods. For simplicity purposes, a default effectiveness rate of 115 lb/ft/yr for sediment load will be used for each proposed stream restoration project. To obtain the phosphorus loading rate, a default value of 1.05 pounds of phosphorus per ton of sediment is used.

5.1 Structural BMPs

Boyce Road Wet Pond

- *Location:* N40° 18' 55.0303", W80° 06' 25.5849"
- *Description:* The Township owned land will be used to construct a wet pond and prevent flooding during large storm events. The treated drainage area is 17.85 acres and includes primarily medium density residential.
- *Estimated Reductions:* The potential project can reduce 4,463.08 lbs/year of sediment and 0.65 lbs/year of phosphorus from Chartiers Creek 7380.
- *Operation & Maintenance:* Operation and maintenance of the stormwater facility will be performed by the Township of Upper St. Clair in accordance with the PA Stormwater BMP Manual for the applicable type of BMP.
- *Funding:* Township's Capital Budget, grant opportunities, and other watershed based funding opportunities.

Old Boyce Road Wet Pond

- *Location:* N40° 19' 04.6012", W80° 06' 30.2569"
- *Description:* The Township owned land will be used to construct a wet pond and prevent flooding downstream during large storm events. The treated drainage area is 27.85 acres and includes primarily forest.
- *Estimated Reductions:* The potential project can reduce 2,558.07 lbs/year of sediment and 0.48 lbs/year of phosphorus from Chartiers Creek 7380.

- *Operation & Maintenance:* Operation and maintenance of the stormwater facility will be performed by the Township of Upper St. Clair in accordance with the PA Stormwater BMP Manual for the applicable type of BMP.
- *Funding:* Township’s Capital Budget, grant opportunities, and other watershed based funding opportunities.

Chartiers Creek Stream Restoration

- *Location:* Start: N 40° 19' 39.3689", W 80° 05' 56.0421"
End: N 40° 19' 41.7065", W 80° 06' 01.6761"
- *Description:* Approximately 500 LF of Tributary 36867 to Chartiers Creek may be rehabilitated. The actual start and end of the stream segment may be changed depending on the condition of the stream banks during field analysis. Streams that have highly eroded banks will be given priority for streambank restoration.
- *Estimated Reductions:* The potential project can reduce 57,500 lbs/year of sediment and 30.19 lbs/year of phosphorus.
- *Operation & Maintenance:* Operation and maintenance of the restored stream may be performed by the Township of Upper St. Clair in accordance with the approved permit.
- *Funding:* Township’s Capital Budget, grant opportunities, and other watershed based funding opportunities.

5.2 Summary of Proposed BMPs

After incorporating all the proposed BMPs, the existing and final pollutant loads for sediment and phosphorus within the PRP planning area were determined and are illustrated in Table 5-1. The MS4 has achieved its load reduction requirement for the HUC-12 watershed through the implementation of proposed BMPs.

Table 5-1: Expected Load Reductions from Proposed BMPs

POLLUTANT	EXISTING LOAD (lbs/yr)	REQUIRED REDUCTION (lbs/yr)	PROPOSED REDUCTION (lbs/yr)	FINAL LOAD w/ BMPS (lbs/yr)
Sediment	618,859.91	61,886	64,521.15	554,338.76
Phosphorus	145.35	7.27	31.32	114.03

Chapter 6. PRP 5 Year Plan

The Township of Upper St. Clair proposes the following plan to comply with the proposed NPDES permit to be issued by the DEP for the MS4 program.

6.1 Year 1 Plan Overview

- Develop specific BMP technology concepts for each delineated Proposed BMP drainage area
- Determine segments of stream restoration based on property ownership, ease of access, damage mitigation, exposed pipeline locations, stream banks conditions, etc.

6.2 Year 2 Plan Overview

- Feasibility study for each of the proposed BMPs based on property ownership, ease of access, slope, soils, utilities, permitting, cost, etc.
- Engineering analysis and preliminary design development for stream restoration projects

6.3 Year 3 Plan Overview

- If feasible, begin engineering analysis and preliminary design development of the proposed BMP concepts.
- Begin permitting and design of stream restoration projects

6.4 Year 4 Plan Overview

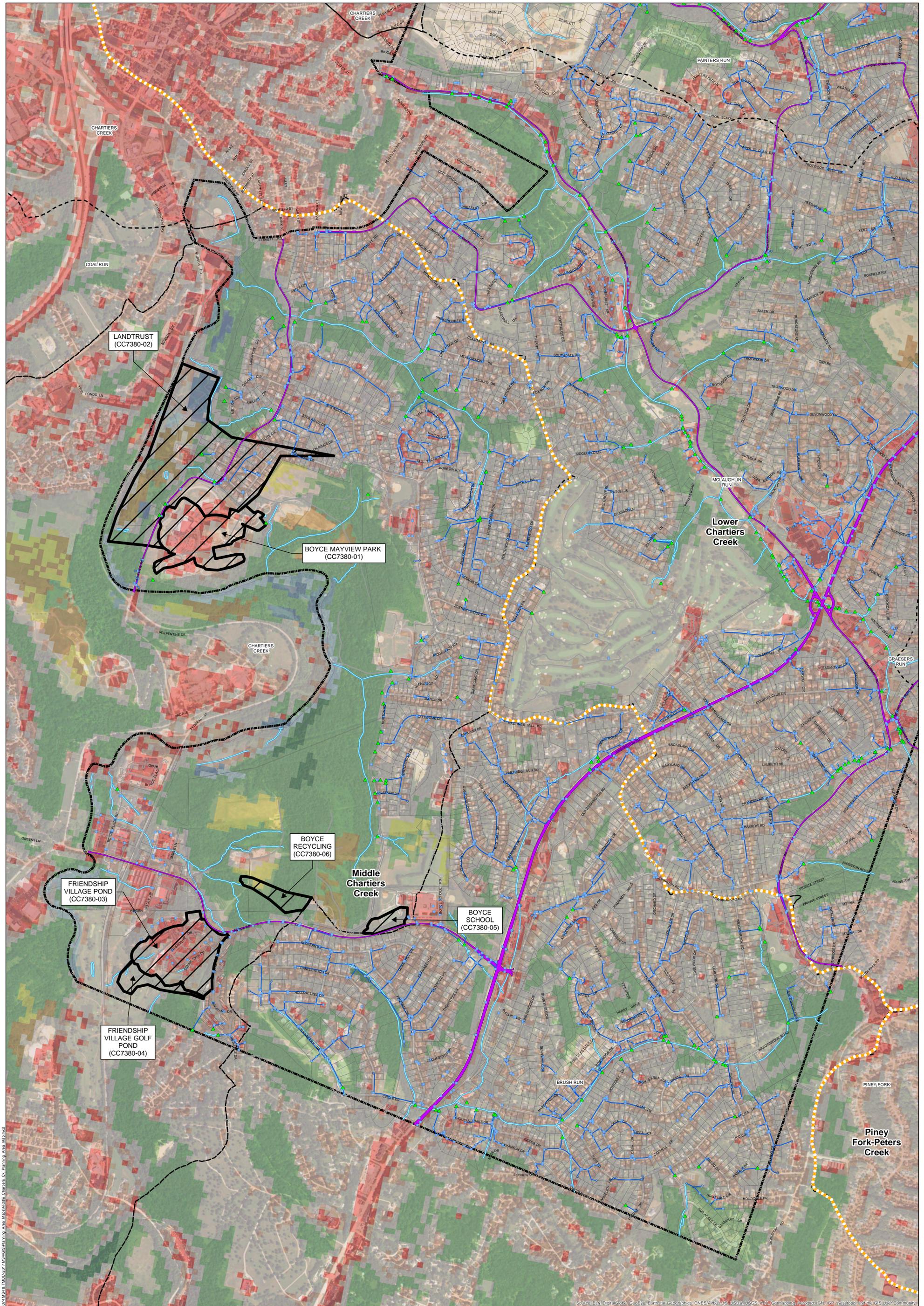
- Develop final design and bid documents for implementation of design BMP projects
- Complete permitting and design and bid stream restoration projects

6.5 Year 5 Plan Overview

- Construction oversight and completion of proposed BMPs.
- Construction, oversight and completion of stream restoration projects.

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Appendix A – Planning Area Map



Appendix B – Existing Loads without BMPs

CHARTIERS CREEK 7380 SMALL WATERSHED

GWLF-E Urban Area Viewer - Version 1.1.3

Select input data file: C:\MapShed\Runfiles\ChartiersCreek7380_USC\Output\ParsedWatershed-24173696.5241_ua.csv

Watershed Totals **Municipality Loads** Regulated Loads Unregulated Loads

View loads for municipality: Upperstclair (00001)

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	27	3642.30	134.90	12.70	0.47	1.60	0.06
Cropland	40	96996.00	2424.90	255.60	6.39	23.60	0.59
Forest	479	8430.40	17.60	38.30	0.08	4.80	0.01
Wetland	22	211.20	9.60	4.20	0.19	0.20	0.01
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	292	46749.20	160.10	221.90	0.76	11.70	0.04
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	74	703.00	9.50	18.50	0.25	2.20	0.03
MD Mixed	69	3594.90	52.10	72.50	1.05	8.30	0.12
HD Mixed	47	2444.00	52.00	49.40	1.05	5.60	0.12
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	551	28707.10	52.10	578.60	1.05	66.10	0.12
HD Residential	25	1277.50	51.10	26.00	1.04	2.80	0.11
Water	15						
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		486018.29		243.1		26.5	0.321
Groundwater				1669.4		38.9	0.292
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	1641	678773.9		3190.2		192.3	

Source Weighting

CHARTIERS CREEK 7149 SMALL WATERSHED

GWLF-E Urban Area Viewer - Version 1.1.3

Select input data file: C:\MapShed\Runfiles\USC\ChartiersCreek7149_USC\Output\ParsedWatershed-15151999.3735_ua.csv

Watershed Totals **Municipality Loads** Regulated Loads Unregulated Loads

View loads for municipality: Upperstclair (00001)

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	0	0.00	0.00	0.00	0.00	0.00	0.00
Cropland	0	0.00	0.00	0.00	0.00	0.00	0.00
Forest	0	0.00	0.00	0.00	0.00	0.00	0.00
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	10	1827.00	182.70	8.10	0.81	0.50	0.05
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	2	18.20	9.10	0.50	0.25	0.10	0.03
MD Mixed	2	109.00	54.50	2.90	1.47	0.30	0.16
HD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		3419.15		1.7		0.2	0.001
Groundwater				7.4		0.2	0.002
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	14	5373.4		20.6		1.3	

Source Weighting

Appendix C – Existing BMPs Load Calculations

Land Trust Wetland

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	Percent Difference
Hay/Pasture	0	153	0.00	
Cropland	5	116	12.36	
Forest	4.6	1858	11.37	
Wetland	0.5	69	1.24	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	12.3	1169	30.39	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	11	1114	27.18	
HD Residential	0	25	0.00	
LD Mixed	1.1	247	2.72	
MD Mixed	5	472	12.36	
HD Mixed	4.9	334	12.11	
Total	44.40	5947.00	109.71	
Stream Bank	22	2582	54.36	2.11%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	29960.24573	7.2895975
Forest	17.6	0.01	200.056208	0.1136683
Wetland	9.6	0.01	11.86104	0.01235525
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	4866.065792	1.2157566
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	25.8224725	0.08154465
MD Mixed	52.1	0.12	643.708525	1.48263
HD Mixed	52	0.12	629.62354	1.4529774
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	1416.158755	3.261786
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	37,753.54	14.91

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	2.11%	34,896.16	1.90

Total Existing Loads

Sediment	72,649.70 lbs/yr
Phosphorus	16.81 lbs/yr

Boyce Mayview Park

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	
Hay/Pasture	0	153	0.00	
Cropland	0	116	0.00	
Forest	0	1858	0.00	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	5.9	1169	14.58	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0	1114	0.00	
HD Residential	0	25	0.00	
LD Mixed	1.8	247	4.45	
MD Mixed	4.1	472	10.13	
HD Mixed	1.8	334	4.45	
Total	13.60	5947.00	33.61	
				Percent Difference
Stream Bank	7.7	2582	19.03	0.74%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	0	0
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	2334.12912	0.5831678
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	42.254955	0.1334367
MD Mixed	52.1	0.12	527.8409905	1.2157566
HD Mixed	52	0.12	231.29028	0.5337468
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	0	0
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	3,135.52	2.47

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.74%	12,213.66	0.67

Total Existing Loads

Sediment	15,349.17 lbs/yr
Phosphorus	3.13 lbs/yr

Friendship Village Pond

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	
Hay/Pasture	0	153	0.00	
Cropland	0	116	0.00	
Forest	0	1858	0.00	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	4	1169	9.88	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0.4	1114	0.99	
HD Residential	7.7	25	19.03	
LD Mixed	0.9	247	2.22	
MD Mixed	0.2	472	0.49	
HD Mixed	0	334	0.00	
Total	13.20	5947.00	32.62	
				Percent Difference
Stream Bank	9.2	2582	22.73	0.88%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	0	0
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	1582.46042	0.395368
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	21.1274775	0.06671835
MD Mixed	52.1	0.12	25.748341	0.0593052
HD Mixed	52	0.12	0	0
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	51.496682	0.1186104
HD Residential	51.1	0.11	972.2840435	2.09297935
Total	2,973.30	1.24	2,653.12	2.73

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.88%	14,592.94	0.80

Total Existing Loads

Sediment	17,246.06 lbs/yr
Phosphorus	3.53 lbs/yr

Friendship Village Golf Pond

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	
Hay/Pasture	0	153	0.00	
Cropland	0	116	0.00	
Forest	0.3	1858	0.74	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	2.6	1169	6.42	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0.1	1114	0.25	
HD Residential	0	25	0.00	
LD Mixed	0	247	0.00	
MD Mixed	0	472	0.00	
HD Mixed	0	334	0.00	
Total	3.00	5947.00	7.41	
				Percent Difference
Stream Bank	0.1	2582	0.25	0.01%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	13.047144	0.00741315
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	1028.599273	0.2569892
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	0	0
MD Mixed	52.1	0.12	0	0
HD Mixed	52	0.12	0	0
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	12.8741705	0.0296526
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	1,054.52	0.29

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.01%	158.62	0.01

Total Existing Loads

Sediment **1,213.14 lbs/yr**
 Phosphorus **0.30 lbs/yr**

Boyce Recycling

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	Percent Difference
Hay/Pasture	0.3	153	0.74	
Cropland	0	116	0.00	
Forest	2.4	1858	5.93	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	0	1169	0.00	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0	1114	0.00	
HD Residential	0	25	0.00	
LD Mixed	0	247	0.00	
MD Mixed	0	472	0.00	
HD Mixed	0.2	334	0.49	
Total	2.90	5947.00	7.17	
Stream Bank	0.2	2582	0.49	0.02%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	100.0033935	0.0444789
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	104.377152	0.0593052
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	0	0
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	0	0
MD Mixed	52.1	0.12	0	0
HD Mixed	52	0.12	25.69892	0.0593052
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	0	0
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	230.08	0.16

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.02%	317.24	0.02

Total Existing Loads

Sediment **547.32 lbs/yr**
 Phosphorus **0.18 lbs/yr**

Boyce School

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	
Hay/Pasture	0	153	0.00	
Cropland	0	116	0.00	
Forest	0	1858	0.00	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	1.1	1169	2.72	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0	1114	0.00	
HD Residential	0	25	0.00	
LD Mixed	0	247	0.00	
MD Mixed	0	472	0.00	
HD Mixed	0.8	334	1.98	
Total	1.90	5947.00	4.69	
				Percent Difference
Stream Bank	0.8	2582	1.98	0.08%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	0	0
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	435.1766155	0.1087262
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	0	0
MD Mixed	52.1	0.12	0	0
HD Mixed	52	0.12	102.79568	0.2372208
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	0	0
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	537.97	0.35

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.08%	1,268.95	0.07

Total Existing Loads

Sediment	1,806.92 lbs/yr
Phosphorus	0.42 lbs/yr

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Appendix D – Existing BMPs Load Reduction Table

Middle Chartiers Creek Existing BMPs Load Reduction Table

BMP ID	BMP Type	Removal Efficiency Determination Method	Existing Sediment Load (lb/yr)	Existing TP Load (lb/yr)	Sediment Removal Efficiency	TP Removal Efficiency	Sediment Load Reduction (lb/yr)	TP Load Reduction (lb/yr)
CC7308-01	Land Trust - Wetland	BMP Effectiveness Values	72,649.70	16.81	60%	45%	43,589.82	7.56
CC7308-02	Boyce Mayview Park -Dry ED	BMP Effectiveness Values	15,349.17	3.13	60%	20%	9,209.50	0.63
CC7308-03	Friendship Village Pond -Dry ED	BMP Effectiveness Values	17,246.06	3.53	60%	20%	10,347.64	0.71
CC7308-04	Friendship Village Golf Pond - Wet Pond	BMP Effectiveness Values	1,213.14	0.30	60%	45%	727.88	0.14
CC7308-05	Boyce Recycling	BMP Effectiveness Values	547.32	0.18	60%	20%	328.39	0.04
CC7308-06	Boyce School	BMP Effectiveness Values	1,806.92	0.42	60%	20%	1,084.15	0.08
Total							65,287.39	9.15

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Appendix D-2 – Existing BMPs Table

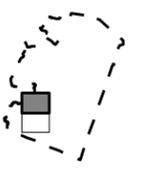
Middle Chartiers Creek Existing BMPs Table

BMP ID	BMP Type	Latitude	Longitude	Permit Number	Installation Year
CC7380-01	Boyce Mayview Park- Dry ED	N 40° 20' 05.59472222"	W 80° 06' 32.22276906"	PAG2000205048	2008
CC7380-02	Land Trust-Wetland	N 40° 20' 13.54108002"	W 80° 06' 33.88445190"	PAG2000207088	2008
CC7380-03	Friendship Village Pond- Dry ED	N 40° 18' 50.23468674"	W 80° 06' 35.29049368"	N/A	Under Review
CC7380-04	Friendship Village Golf Pond- Wet Pond	N 40° 18' 45.79718857"	W 80° 06' 44.35491750"	N/A	Under Review
CC7380-05	Boyce School	N 40° 18' 57.57275361"	W 80° 05' 47.98286099"	PAG2000209024	2010
CC7380-06	Boyce Recycling	N 40° 19' 01.45444729"	W 80° 06' 14.30827945"	PAG2000204119	2003

Appendix E– Proposed Structural BMPs Maps

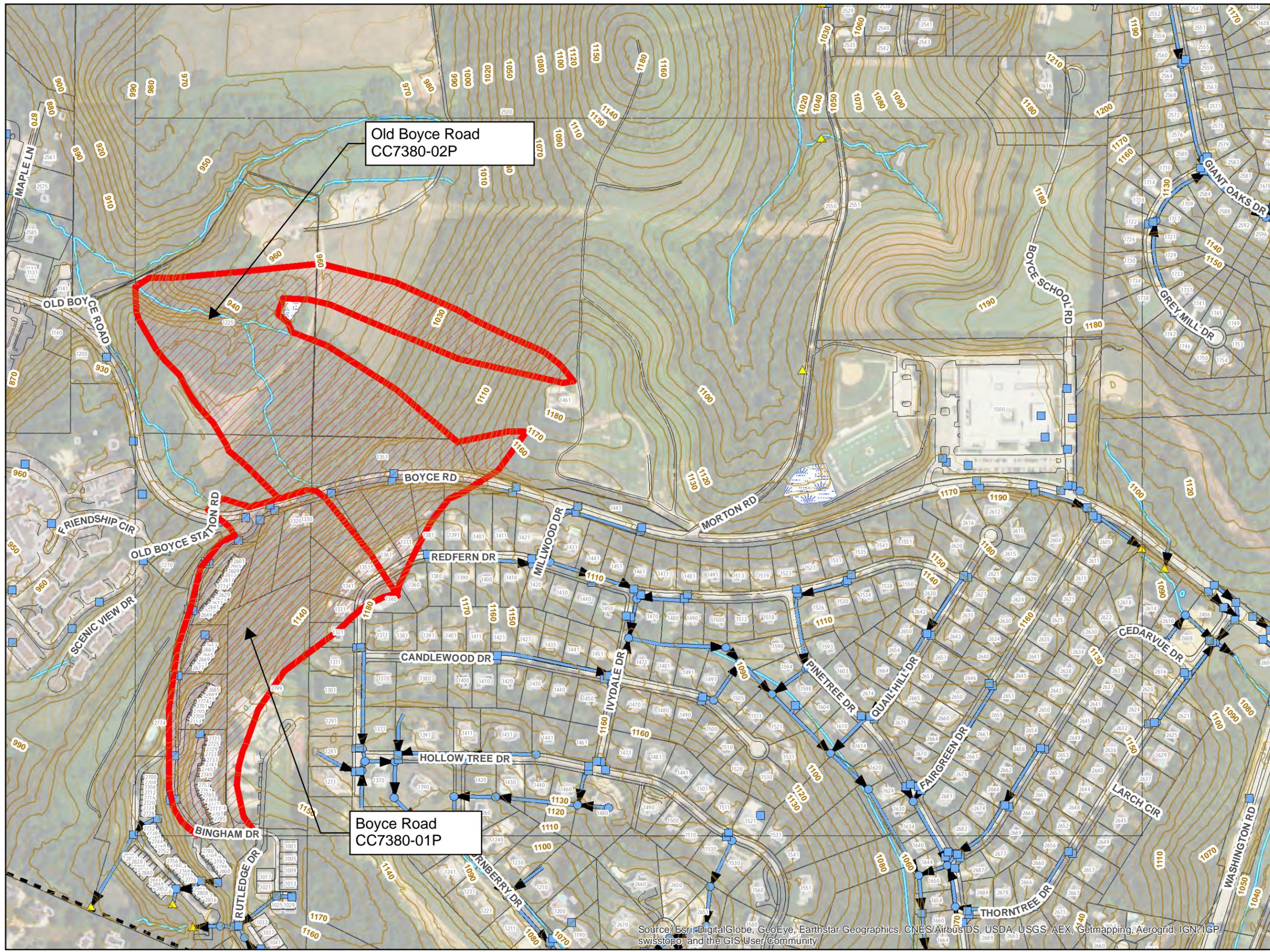


Date: 7/24/2017
Scale: 1" = 400'



Township of Upper St. Clair Middle Chartiers Creek Watershed Potential Structural BMP Drainage Area Locations

Project Number: C-85374-2017



- Proposed BMP Drainage Area
- USC Middle Stream Restoration
- Storm Discharge Point
- Storm Sewer Inlet
- Storm Sewer Manhole
- Storm Sewer Structure
- Storm Sewer Clean Out
- Storm Sewer Pipes
- Existing BMPs
- Streams
- Building Footprints
- Parcels
- Boundary

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100 McMorris Road
Pittsburgh, PA 15205
Phone: 412-921-4030
Fax 412-921-9960

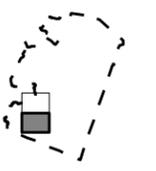


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Path: G:\Projects\85000 Upper St. Clair\85374 MS4 & TMDL\2017 MS4\PRPGIS\Potential BMP Mapbook\Middle Chartiers_CK_BMP_Mapbook_11x17.mxd



Date: 7/24/2017
Scale: 1" = 400'



Township of Upper St. Clair
Middle Chartiers Creek Watershed
Potential Structural BMP
Drainage Area Locations
 Project Number: C-85374-2017

- Proposed BMP Drainage Area
- USC Middle Stream Restoration
- Storm Discharge Point
- Storm Sewer Inlet
- Storm Sewer Manhole
- Storm Sewer Structure
- Storm Sewer Clean Out
- Storm Sewer Pipes
- Existing BMPs
- Streams
- Building Footprints
- Parcels
- Boundary

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100 McMorris Road
 Pittsburgh, PA 15205
 Phone: 412-921-4030
 Fax 412-921-9960



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Path: G:\Projects\85000 Upper St. Clair\85374 MS4 & TMDL\2017 MS4\PRPGIS\Potential BMP Map\Map00MM_Chartiers_CK_BMP_Mapbook_11x17.mxd

Appendix F – Proposed New Retrofit BMPs Load Calculations

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Boyce Road

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	Percent Difference
Hay/Pasture	0	153	0.00	
Cropland	0	116	0.00	
Forest	2.2	1858	5.44	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	0.7	1169	1.73	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	2.9	1114	7.17	
HD Residential	0	25	0.00	
LD Mixed	1.3	247	3.21	
MD Mixed	0	472	0.00	
HD Mixed	0	334	0.00	
Total	7.10	5947.00	17.54	
Stream Bank	4.2	2582	10.38	0.40%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	0	0
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	95.679056	0.0543631
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	276.9305735	0.0691894
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	30.5174675	0.09637095
MD Mixed	52.1	0.12	0	0
HD Mixed	52	0.12	0	0
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	373.3509445	0.8599254
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	776.48	1.08

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.40%	6,661.99	0.36

Total Existing Loads

Sediment	7,438.47 lbs/yr
Phosphorus	1.44 lbs/yr

Old Boyce Road

Land Cover	BMP Drainage Area (Hectares)	Watershed Area (acres)	BMP Drainage Area (acres)	
Hay/Pasture	0.8	153	1.98	
Cropland	0	116	0.00	
Forest	7.4	1858	18.29	
Wetland	0	69	0.00	
Disturbed	0	0	0.00	
Turfgrass	0	0	0.00	
Open Land	0.7	1169	1.73	
Bare Rock	0	0	0.00	
Sandy Areas	0	0	0.00	
Unpaved Roads	0	0	0.00	
LD Residential	0	390	0.00	
MD Residential	0.6	1114	1.48	
HD Residential	0	25	0.00	
LD Mixed	0.3	247	0.74	
MD Mixed	0	472	0.00	
HD Mixed	1.1	334	2.72	
Total	10.90	5947.00	26.93	
				Percent Difference
Stream Bank	2	2582	4.94	0.19%

MapShed Modeling

Land Cover	Watershed Sediment Loading Rate (lbs/acre)	Watershed TP Loading Rate (lbs/acre)	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Hay/Pasture	134.9	0.06	266.675716	0.1186104
Cropland	2424.9	0.59	0	0
Forest	17.6	0.01	321.829552	0.1828577
Wetland	9.6	0.01	0	0
Disturbed	0	0	0	0
Turfgrass	0	0	0	0
Open Land	160.1	0.04	276.9305735	0.0691894
Bare Rock	0	0	0	0
Sandy Areas	0	0	0	0
Unpaved Roads	0	0	0	0
LD Mixed	9.5	0.03	7.0424925	0.02223945
MD Mixed	52.1	0.12	0	0
HD Mixed	52	0.12	141.34406	0.3261786
LD Residential	9.4	0.03	0	0
MD Residential	52.1	0.12	77.245023	0.1779156
HD Residential	51.1	0.11	0	0
Total	2,973.30	1.24	1,091.07	0.90

Source	Watershed Sediment (lbs)	Watershed TP (lbs)	BMP DA Percent	BMP DA Sediment (lbs)	BMP DA TP (lbs)
Stream Bank	1,657,408.80	90.4	0.19%	3,172.38	0.17

Total Existing Loads

Sediment	4,263.45 lbs/yr
Phosphorus	1.07 lbs/yr

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Appendix G – Proposed BMPs Load Reduction Table

Middle Chartiers Creek Proposed BMPs Load Reduction Table

BMP ID	BMP Type	Removal Efficiency Determination Method	Existing Sediment Load (lb/yr)	Existing TP Load (lb/yr)	Sediment Removal Efficiency	TP Removal Efficiency	Sediment Load Reduction (lb/yr)	TP Load Reduction (lb/yr)
CC7380-01P	Boyce Road - Wet Pond	BMP Effectiveness Method	7,438.47	1.44	60%	45%	4,463.08	0.65
CC7380-02P	Old Boyce Road - Wet Pond	BMP Effectiveness Method	4,263.45	1.07	60%	45%	2,558.07	0.48
CC7380-03P	Stream Restoration	BMP Effectiveness Method	57,500.00	30.19	100%	100%	57,500.00	30.19
Total							64,521.15	31.32