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Introduction

Borough of Kennett Square is required to develop a TMDL Plan as part of the 2018 National Pollutant Discharge Elimination System (NPDES) Individual Permit Application to the Pennsylvania Department of Environmental Protection (PADEP). This plan has been prepared and organized following the guidelines outlined in PADEP’s TMDL Plan Instructions published in March of 2017.

Borough of Kennett Square is located within Chester County, PA. There are two (2) main streams running through the borough. The East Branch of Red Clay Creek and an Unnamed Tributary run from northeast to southeast through the eastern border of the Borough of Kennett Square. The West Branch of Red Clay Creek and its tributaries run northwest to southwest along the western border of the Borough of Kennett Square. The Unnamed Tributary to the East Branch of Red Clay Creek is listed as impaired for sediment and nutrients, East Branch of Red Clay Creek is listed as impaired for sediment, and the West Branch of Red Clay Creek and its tributaries are listed as impaired for sediment. See Figure 1, printed from PADEP’s web-based GIS application published April 2017, for a map of the Borough of Kennett Square.

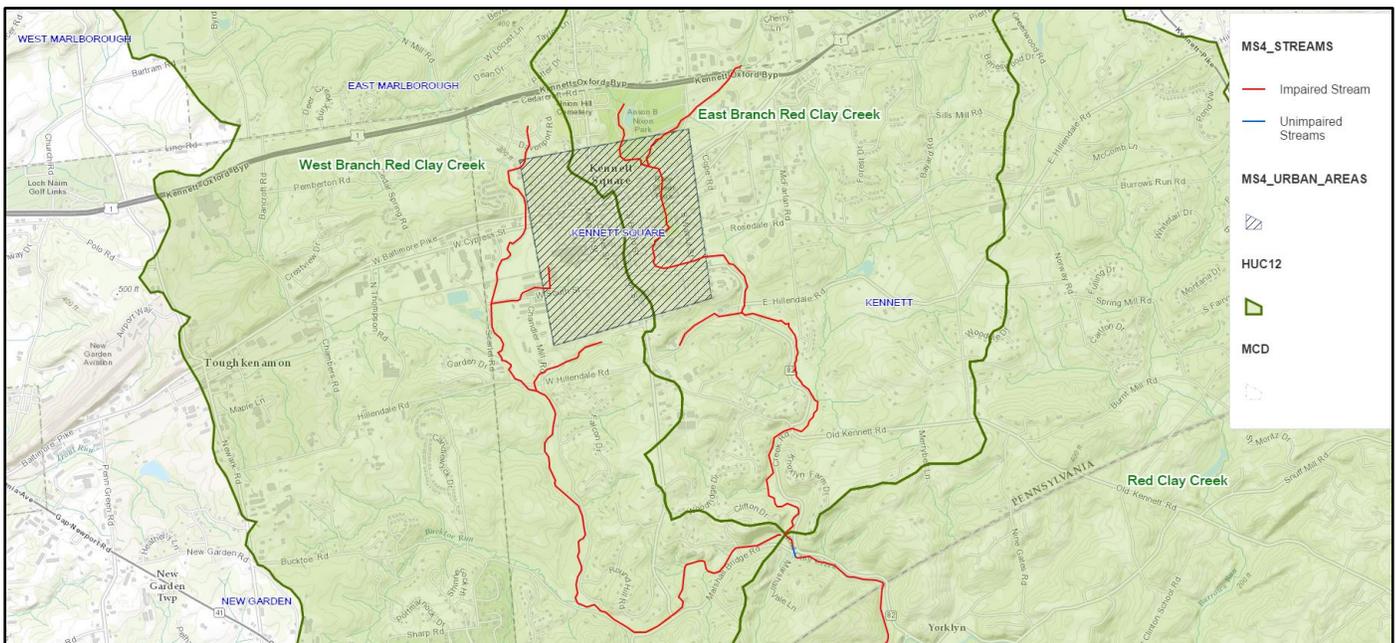


Figure 1: Borough of Kennett Square Impaired Streams

Per the published MS4 requirements table on PA DEP’s website (Table 1), the Borough of Kennett Square is responsible for developing a TMDL Plan addressing sediment and nutrients per the Christina Basin TMDL Reports. The goal of this TMDL Plan is to identify placement and types of stormwater best management practices (BMPs) that achieve a 10% sediment reduction for the March 2018 to March 2023 permit cycle.

Table 1: Borough of Kennett Square MS4 Requirements Table

KENNETT SQUARE BORO	PAG130037	Yes	TMDL Plan	West Branch Red Clay Creek	Appendix C-PCB (4a)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Red Clay Creek	Appendix C-PCB (4a)	

Definitions

Adjusted TMDL Allocations: MS4 Baseline Loads, MS4 Allocations (Wasteload Allocations), or Load Reductions that have been recalculated to more accurately represent the pollutant loads received and discharged by the regulated MS4, and covered by the MS4 permit, as recommended in the TMDL Reports.

Best Management Practices (BMPs): means schedules of activities, prohibitions of practices, maintenance procedures and other management practices to prevent or reduce pollutant loading to surface waters of this Commonwealth. The term includes treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. The term includes activities, facilities, measures, planning or procedures used to minimize accelerated erosion and sedimentation and manage stormwater to protect, maintain, reclaim and restore the quality of waters and the existing and designated uses of waters within this Commonwealth before, during and after earth disturbance activities. (25 Pa. Code § 92a.2)

Impaired Waters: means surface water that fail to attain one or more of its designated uses under 25 Pa. Code Chapter 93 and as listed in Categories 4 and 5 of Pennsylvania’s Integrated Water Quality Monitoring and Assessment Report.

Load Reduction: means the required pollutant load reduction; difference between the TMDL MS4 Baseline Load and the MS4 Allocation (Wasteload Allocation).

MS4 Allocation: Used herein to refer to EPA’s “MS4 Allocation, EPA’s “MS4 Load Allocations”, as used in the TMDL Reports, and which appear to be used by EPA as synonyms for “Waste Load Allocation”.

Municipal Separate Storm Sewer System (MS4): means all separate storm sewers that are defined as “large” or “medium” or “small” municipal separate storm sewer systems pursuant to 40 CFR §§ 122.26(b)(4), (b)(7), and (b) (16), respectively, or designated under 40 CFR § 122.26(a)(1)(v). (25 Pa. Code § 92a.32(a) and 40 CFR § 122.26(b) (18))

National Pollutant Discharge Elimination System (NPDES): refers to a Federal permitting system that regulates the discharge or potential discharge of pollutants from a point source to surface waters.

Outfall: means a point source as defined by 40 CFR § 122.2 at the point where a municipal separate storm sewer discharges to surface waters and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other surface waters and are used to convey surface waters. (25 Pa. Code § 92a.32(a) and 40 CFR §122.26(b)(9))

Owner or Operator: means the owner or operator of any “facility” or “activity” subject to regulation under the NPDES program. (25 Pa. Code § 92a.3(b)(1) and 40 CFR § 122.2)

Planning Area: means the storm sewersheds that an MS4 must consider in the determination of existing loads and required load reductions.

Pollutant: means any contaminant or other alteration of the physical, chemical, biological, or radiological integrity of surface water which causes or has the potential to cause pollution as defined in section 1 of the Pennsylvania Clean Streams Law, 35 P.S. § 691.1. (25 Pa. Code § 92a.2)

Storm Sewershed: means the land area that drains to an individual MS4 outfall from within the jurisdiction of the MS4 permittee. The term “combined storm sewershed” means the drainage areas of all MS4 outfalls that discharge to a specific surface water or the waters within the Chesapeake Bay watershed.

Stormwater: means runoff from precipitation, snow melt runoff and surface runoff and drainage. “Stormwater” has the same meaning as “storm water.” (25 Pa. Code § 92a.2)

Total Maximum Daily Load (TMDL): means the sum of individual waste load allocations for point sources, load allocations for nonpoint sources and natural quality and a margin of safety expressed in terms of mass per time, toxicity or other appropriate measures. (25 Pa. Code § 96.1)

Urbanized Area (UA): means land area comprising one or more places (central place(s)) and the adjacent densely settled surrounding area (urban fringe) that together have a residential population of at least 50,000 and an overall population density of at least 1,000 people per square mile, as defined by the United States Bureau of the Census and as determined by the latest available decennial census. The UA outlines the extent of automatically regulated areas.

Wasteload Allocation (WLA): means the portion of a surface water’s loading capacity that is allocated to existing and future point source discharges. (25 Pa. Code § 96.1)

A. Public Participation

The Borough of Kennett Square made the amended version of the approved TMDL Plan available for public’s review for thirty (30) days from _____. The public was made aware of the opportunity to review the Plan by a notice placed in the Daily Local News indicating the description of the plan, where it could be reviewed, and the length of time for receiving comments, see attached. Also, the TMDL Plan was presented at the Borough Council Meeting _____. Comments received from the public that reviewed the Plan and attended the aforesaid meeting are attached in Appendix A with responses and actions taken.

B. Map

GIS data was obtained from various sources (PASDA, Chester County, PADEP, PennDOT) to map municipal boundaries, contours, roadways, landuse and hydrology. Outfalls were categorized as regulated MS4 outfalls or as non-MS4 outfalls based on ownership of both the outfall and land draining to the outfall. In areas where the outfall location was inaccessible or uncertain, observation point locations were designated. Storm sewersheds were delineated to each outfall and planning areas were identified based on municipal boundaries and urban areas.

Refer to Appendix B for a map displaying the Borough of Kennett Square’s MS4 system This includes roads, stormwater facilities, drainage pipes and swales, inlets, manholes and regulated outfalls. In addition, 2010 urban areas, impervious and pervious cover, surface waters, storm sewersheds for each outfall, planning area and proposed BMP locations are provided on the map. In addition, a complete list of outfalls with descriptions and storm sewershed acreage is provided on the map.

C. Pollutants of Concern

The Borough of Kennett Square is required to develop a TMDL plan addressing Total Suspended Solids (TSS or sediment), Total Nitrogen (TN), and Total Phosphorus (TP) per the TMDL Reports listed below:

- a. *Total Maximum Daily Loads for Bacteria and Sediment in the Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as Bacteria/Sediment TMDL Report). This TMDL Report presents TMDLs for sediment and bacteria.
- b. *Revisions to Total Maximum Daily Loads for Nutrient and Low Dissolved Oxygen Under High-Flow Conditions, Christina River Basin, Pennsylvania, Delaware, and Maryland.* September 2006. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as the Nutrient/Low DO TMDL Report). This TMDL Report presents TMDLs for Total Nitrogen and Total Phosphorus.
- c. *Total Maximum Daily Loads, Polychlorinated Biphenyls (PCBs) and Chlordane, West Branch Brandywine Creek, Chester County, Pennsylvania.* March 9, 2001. Pennsylvania Department of Environmental Protection, Harrisburg, PA (herein referred to as the Brandywine Creek PCB/Chlordane TMDL Report). This TMDL Report presents a TMDL only for PCB.
- d. *Total Maximum Daily Load for the Red Clay Creek Basin Chester County, Pennsylvania.* April 7, 2007. U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as the Red Clay Creek PCB TMDL Report). This TMDL Report presents TMDLs for PCB.

There are no Municipal WLAs listed in the Brandywine Creek PCB/Chlordane or the Red Clay Creek PCB TMDL Report. The Brandywine Creek PCB/Chlordane TMDL applies only to 5.6 miles of the West Branch Brandywine Creek in East Fallowfield, West Bradford, and Newlin Townships, the City of Coatesville, and Modena Borough. As quoted in the Brandywine Creek PCB/Chlordane TMDL Report: "Pennsylvania found no permitted point sources contributing to the load of either chlordane or PCBs to the West Branch Brandywine Creek" and "...the WLA was assigned a value of 0". The Red Clay Creek PCB TMDL applies only to the NVF Tributary. As quoted in the Red Clay Creek PCB TMDL Report: "According to Pennsylvania Department of Environmental Protection, there are no known point sources of PCB to Red Clay" and "...the WLA was assigned a value of 0". Therefore, implementation of the Brandywine Creek PCB/Chlordane TMDL and the Red Clay Creek PCB TMDL are not addressed in this the Borough of Kennett Square MS4 TMDL Strategy.

D. Existing Loads for Pollutants of Concern

The Borough of Kennett Square has baseline loads reported in the published Christina Basin TMDL Reports for pollutants of concern. Table C.1 in Appendix C lists the reported pollutants and WLAs present in the Bacteria/Sediment TMDL Report and the Nutrient/Low DO TMDL Report for the Borough of Kennett Square and for all other municipalities listed in the TMDL Report(s). However, baseline loads were adjusted using the Christina Basin Land Use Loading Rates Calculator Tool (years 1995 and 2012) for the Red Clay Creek Watershed, refer to Appendix C.

Furthermore, baseline loads for the Borough of Kennett Square (686 acres) were reduced to loads for the Borough of Kennett Square planning area (469 acres) by following the weighted land use approach described in the Attachment A of the TMDL Plan Instructions titled "Parsing Guidelines for MS4s in TMDL Plans". Loading rates (lbs/acre/year) were developed for each land use through the Christina Basin MapShed model and prepared by Chester County Water Resources Authority (CCWRA) to be consistent with PADEP's 2017 TMDL instructions for MS4s. Refer to Appendix C Attachments C.1 and C.2 for the loading rates developed by the MapShed model for 1995 and 2012 land use within the Red Clay Creek Watershed.

Original TMDL baseline loads for the entire Borough of Kennett Square and adjusted 1995 and 2012 existing loads for the Borough of Kennett Square's planning area are provided in the table below. For more detailed calculations of sediment and nutrient loads, refer to Tables C.2 and C.3 in Appendix C.

Table 2: TMDL Baseline Loads

Pollutant	TMDL Baseline Load (lbs)	1995 Planning Area Load (lbs)	2012 Planning Area Load (lbs)
Sediment	1,680,200	457,846	555,665
Nitrogen	10,670	1,405	1,651
Phosphorus	364	209	244

E. Wasteload Allocations (WLAs)

The TMDL Report(s) presented WLAs as "MS4 Load Allocation" (for Total Suspended Solids (TSS) or sediment), and "MS4 Allocation" (for total nitrogen (TN), and total phosphorus (TP)). These allocations are reported in Table D.1 in Appendix C. Adjusted wasteload allocations that apply to the Borough of Kennett Square planning area were developed by applying the same percent reductions reported in the TMDL reports (51.74% Sediment, 50.00% Nitrogen, and 66.59% Phosphorus) to the adjusted baseline loads developed in Section D. These values are reported in Table 4 below. More detailed calculations are provided in Appendix C.

Table 3: TMDL Load Reductions

Pollutant	% Reduction	TMDL MS4 Load Reduction (lbs)	1995 Planning Area MS4 Load Reduction (lbs)	2012 Planning Area MS4 Load Reduction (lbs)
Sediment	51.74	419,518	236,890	334,708
Nitrogen	50.00	2,668	702	948
Phosphorus	66.59	81	139	174

Table 4: TMDL Wasteload Allocations

Pollutant	TMDL WLA (lbs)	1995 Planning Area WLA (lbs)	2012 Planning Area WLA (lbs)
Sediment	391,302	220,957	220,957
Nitrogen	2,668	702	702
Phosphorus	41	70	70

F. Analysis of TMDL Objectives

a. Long-Term Reduction

Long Term loading reductions are dictated by the published TMDL Reports (See Table C.1 in Appendix C). Percent reductions for sediment, nitrogen and phosphorus were applied to the adjusted existing loads to determine the reduction in pounds required by the Borough of Kennett Square, refer to prior Table 3.

b. Short-Term Reduction

Over the short-term five (5) year permit term, the Borough of Kennett Square is not able to achieve the entire load reduction dictated by the TMDL report. However, the sediment load reduction will be greater than the current 10% minimum required.

G. Short-Term Reductions for the Permit Term

a. Short-Term Reductions for the Permit Term

Short term reductions will be achieved over the five (5) year permit term by implementing stormwater BMPs strategically placed throughout the Borough to achieve a 20.57% reduction in sediment loading, 11.56% reduction of nitrogen loading, and 70.88% reduction of phosphorous loading. East Branch Red Clay Creek and West Branch Red Clay Creek are both impaired streams. East Branch Red Clay Creek is listed as impaired by siltation and organic enrichment/low D.O. per PA DEP’s GIS web application. The Tributary to West Branch Red Clay Creek is listed as impaired by siltation, organic enrichment/low D.O., and PCB per PA DEP’s GIS web application. The Tributary to East Branch Red Clay Creek is listed as impaired by siltation, nutrients, and organic enrichment/low D.O. The TMDL load for the Borough of Kennett Square is within the West Branch Red Clay Creek Watershed and the East Branch Red Clay Creek Watershed, which aligns well with the impaired status of the two streams. The BMP selected within the Borough of Kennett Square planning area discharges to the East Branch Red Clay Creek watershed. The BMP was selected considering its greater pollution reduction to the Borough impaired streams overall.

East Branch Red Clay Creek BMP

The stream restoration project proposed for the East Branch of Red Clay Creek will address significant bank erosion and unstable conditions. The Borough will team with the Brandywine Red Clay Alliance and Kennett Township to do the stabilizing restoration of the stream

A detailed BMP map, calculation and narrative are provided in Appendix D.

Table 5: Proposed BMPs

BMP	Description	Proposed BMP	Sediment Reduction (lbs)	Nitrogen Reduction (lbs)	Phosphorus Reduction (lbs)
1	Anson Nixon Park Basin	Stream Restoration	114,310	190.8	172.96
		Sub Total	114,310	191	173
		Kennett Square Baseline Load	555,665	1,651	244
		% Reduction Achieved	20.57%	11.56%	70.88%

b. Long-Term Reductions to meet the WLA(s)

The majority of impairment within the Borough of Kennett Square lies within the drainage area to the East Branch Red Clay Creek. This area of the Borough is densely populated and highly urbanized. Therefore, there is little opportunity to install stormwater facilities and the number of facilities required to meet the full TMDL reduction percentages would be great.

Four (4) options are currently being considered to meet the mandated long-term reductions:

1. Perform stream restoration along Tributary of East Branch Red Clay Creek –

The Brandywine Red Clay Alliance and Kennett Township want to continue their partnership with the Borough of Kennett Square to address additional stream restoration along the Tributary of East Branch Red Clay Creek. There are two (2) potential constraints to this plan. There may be property owner push-back since the stream crosses multiple properties. To achieve a well-designed stream restoration all property owners would need to grant approval for the improvements to be made on their property. There are also space limitations along parts of East Branch Red Clay Creek due to close proximity to residential properties and businesses.

2. Water Quality Inlet Inserts –

The Borough of Kennett Square has a large municipal storm sewer system. Water quality inserts could be placed in high density areas where other BMPs are not feasible due to location constraints. There is one significant constraint to this plan: water quality inlets require a substantial amount of maintenance.

3. Green Alleys –

The Borough of Kennett Square has a lot of alleys that could be converted into green alleys. Green alleys are alleys that contain permeable pavements that allow stormwater to filter through the pavement and drain into the ground, instead of draining to the outfalls. The permeable pavement can be used on the full width of the alley or simply in the center. There is one significant constraint to this plan: maintenance. Permeable pavement requires maintenance to keep it unclogged to function properly and salting and sanding should be prohibited.

4. Curb Bump-Outs –

There are multiple areas within the Borough to install curb bump-outs. Curb bump-outs would address load reductions required in the TMDL plan and reduce vehicular speeds, which is a concern within the Borough. There are two (2) potential constraints with this plan. The implementation of curb bump-outs will reduce the amount of parking within the Borough. Limited available parking is a major concern within the Borough. Additionally, curb bump-outs provide minimal reduction potential and cannot be the only strategy implemented in the future.

5. Race Street Infiltration Basin –

The Borough of Kennett Square has a lot tentatively planned for parking that would incorporate a subsurface infiltration bed.

H. Identify Funding Mechanism(s)

The Borough of Kennett Square will utilize General Funds and pursue grants to fund the implementation of the currently proposed BMP. However, the Borough Council and Administration understand that there may be a need for alternative means of funding to reach the ultimate goal of bringing impaired streams to a non-impaired status. Therefore, discussions are on-going regarding ways to fund tasks and means associated with reducing the pollutant levels to acceptable levels. The estimated costs for implementing the currently proposed BMP is as indicated in the following table.

Table 2: BMP Estimated Costs

BMP	Estimated Design Cost ¹	Estimated Construction Cost	Total Estimated Cost
1	KAPA ²	\$14,400 ³	\$14,400
TOTAL:	-	\$14,400	\$14,400

1. Design cost includes survey, engineering design, permitting, bid document preparation, and construction observation and administration
2. Kennett Area Park Authority and Brandywine Red Clay Alliance have coordinated the design and will oversee implementation.
3. Construction cost is 40% of the required municipal contribution.

I. Responsible Parties for Operation and Maintenance (O&M) of BMP

The following lists the proposed BMP with the property ownership on which they are located, responsible party for O&M and the O&M tasks proposed.

Table 3: BMP Operation and Maintenance

BMP	Property Owner	Responsible Party for O&M	O&M Tasks
#1	Kennett Area Park Authority	Kennett Area Park Authority	<p>The stabilized stream should require little to no long-term maintenance. Inspect biannually and after significant storm events.</p> <ul style="list-style-type: none"> • Repair any erosion and remove any debris • Remove weeds and invasive species • Mow at a high height twice each growing season

Appendix A – Public Participation

Appendix B – Mapping *

Figure B.1 – MS4 Mapping

Figure B.2 – 1995 Land Use

Figure B.3 – 2012 Land Use

* Note: Full Scale Map of Figure B.1 is attached separately to this report

Appendix C – Load Calculations

Attachment C.1 – 1995 Christina Basin MapShed Loading Rates Calculation Tool, Red Clay Watershed

Attachment C.2 – 2012 Christina Basin MapShed Loading Rates Calculation Tool, Red Clay Watershed

Table C.1 – Brandywine-Christina Watershed EPA TMDL MS4 Baseline Pollutant Loadings, MS4 Allocations, and Reductions

Table C.2 – Borough of Kennett Square Revised 1995 Baseline Pollutant Loadings, MS4 Allocations, and Reductions

Table C.3 – Borough of Kennett Square Revised 2012 Baseline Pollutant Loadings, MS4 Allocations, and Reductions

Table C.4 – 1995 Landuse Category Areas

Table C.5 – 2012 Landuse Category Areas

Table C.6 – 2012 Revised Baseline Loading and Landuse by Planning Area within each Stormsewershed

Appendix D – BMP Calculations