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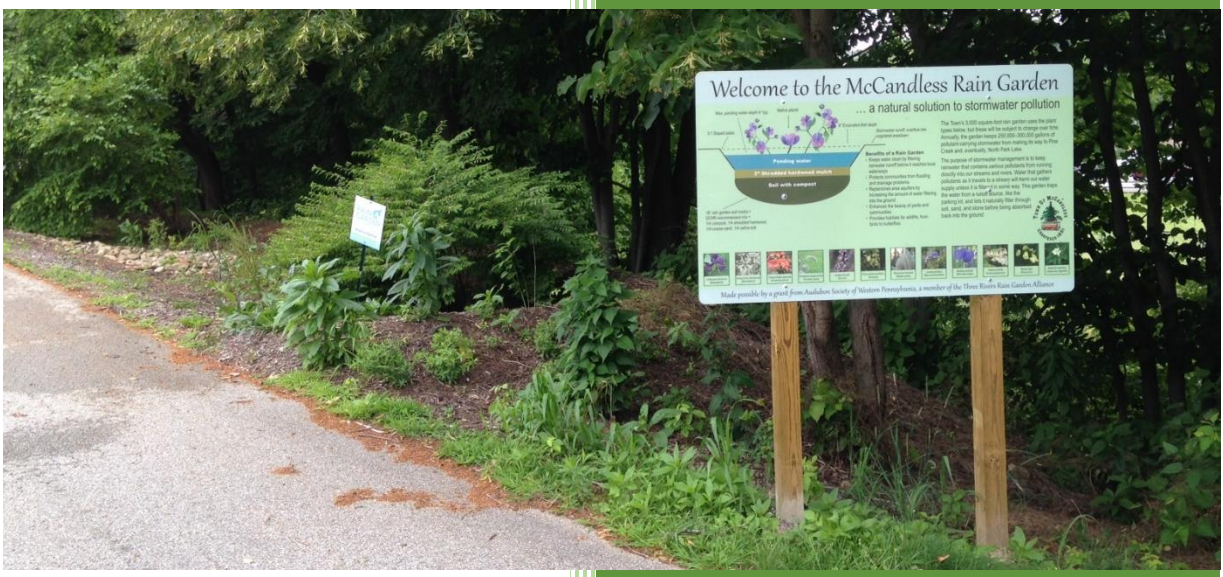
The Town of McCandless

Pollutant Reduction Plan
Lowries Run HUC-12 Watershed



Municipal Separate Storm Sewer System

Kelley R. Harrington, E.I.T.
Project Manager
Ashley A. Neptune, P.E.
Adam J. Isenberg, GIS Technician
Daniel S. Deiseroth, P.E.
Town Engineer

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ACRONYMS

BMP	Best Management Practice
HUC	Hydraulic Unit Code
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer
NPDES	National Pollutant Discharge Elimination System
PADEP	Pennsylvania Department of Environmental Protection
PRP	Pollutant Reduction Plan
TP	Total Phosphorus

GLOSSARY OF TERMS

Impaired Waters - surface waters 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.

Integrated Water Quality Monitoring and Assessment Report - the report published every other year by PADEP to report on the conditions of Pennsylvania's surface waters to satisfy sections 305(b) and 303(d) of the CWA.

Nutrients – refers to total nitrogen and total phosphorus

Outfall - 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))

Outfall Sewershed - the land area that drains to an individual MS4 outfall, observation point, or discharge point from within the jurisdiction of the MS4 permittee.

Parsing - a process in which land area is removed from a Planning Area in order to calculate the actual or target pollutant loads that are applicable to an MS4. Land area which can be parsed includes areas that do not drain to the MS4's system or land that is already covered by an NPDES permit for control of stormwater.

Planning Area – the area used to calculate existing loads and plan load reductions for.

Sediment – refers to siltation and suspended solids; all of which are inorganic solids.

Structural Best Management Practices - means stormwater storage and management practices including, but not limited to, wet ponds and extended detention outlet structures; filtration practices such as grassed swales, sand filters and filter strips; infiltration practices such as infiltration basins and infiltration trenches; and other BMPs as referenced in Chapter 6 of the Pennsylvania Stormwater BMP Manual (363-0300-002).

Surface Waters - perennial and intermittent streams, rivers, lakes, reservoirs, ponds, wetlands, springs, natural seeps and estuaries, excluding water at facilities approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds and constructed wetlands used as part of a wastewater treatment process. (25 Pa. Code § 92a.2)

Urbanized Area - 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 urbanized area outlines the extent of automatically regulated areas.

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 Town of McCandless was issued a Municipal Separate Storm Sewer System (MS4) Permit through the Pennsylvania Department of Environmental Protection (PADEP) and the Environmental Protection Agency. The Town is regulated under PADEP's General NPDES Permit (PAG-136140). 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 Lowries Run Watershed Background

Lowries Run 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. Lowries Run is tributary to the Ohio River.

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. Lowries Run Watershed is impacted by organic enrichment, low dissolved oxygen and siltation from urban runoff and storms sewers.

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 (2020), aerial (2021), and stream layers in ESRI ArcMap. By following these layers and the storm sewer network, all outfalls were assigned a sewershed. 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 Town of McCandless 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 does not drain to the MS4's system or 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 Town of McCandless parsed out all state and county owned roads and sheet flow on private property. Appendix A illustrates the final planning area for the MS4 by displaying the HUC-12 watershed boundaries and the planning area.

Chapter 3. Existing Loading without BMPs

The 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, WikiWatershed Model My Watershed (MMW) was chosen as the most appropriate method. The loads generated within this PRP were calculated in August 2022.

3.1 WikiWatershed Modeling Overview

WikiWatershed MMW is a free and publicly available software developed by the Stroud Water Research Center. Within MMW there are two options for modeling water quality and quantity; Site Storm Model and Watershed Multi-Year Model. For the purposes of the PRP, the Watershed Multi-Year Model was used. This program "simulates 30-years of daily water, nutrient, and sediment fluxes using the Generalized Watershed Loading Function Enhanced (GWLF-E) model that was developed for the MapShed desktop modeling application by Barry M. Evans, Ph.D., and his group at Penn State University." The GWLF-E model takes into account hydrology, land cover, soils, weather, topography and other environmental data to calculate sediment and nutrient loads. The model utilizes well known soil and hydrologic equations to model surface runoff and soil erosion.

For modeling surface runoff and streamflow, the GWLF-E model 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. Additional information on the layers and methods used in WikiWatershed MMW can be found at https://wikiwatershed.org/documentation/mmw-tech/.

3.2 WikiWatershed Modeling Methodology

In order for WikiWatershed MMW to perform these hydrologic calculations, an area of interest is needed. The area of interest for this PRP includes the boundaries of the HUC-12 watershed. Once the sediment and phosphorus loads are calculated in the Multi-Year Model, the MMW Spreadsheet Tool developed by Barry Evans, Anthony Aufdenkampe, and Mike Hickman is utilized for estimating the pollutant loads in the planning areas. The land cover and sediment and phosphorus loads previously obtained from WikiWatershed MMW are entered into the spreadsheet in order to generate loading rates as pounds per year per acre. The planning area is imported into WikiWatershed MMW as the area of interest to obtain the land cover distribution data. This data is entered into the spreadsheet where it calculates the sediment and phosphorus loads from each type of land cover within the planning area.

3.3 WikiWatershed Modeling Results

The results from WikiWatershed MMW and the MMW Spreadsheet Tool can be found in Appendix B.

3.3.1 Lowries Run HUC-12 Watershed Results

The PRP comprised in this report is focused on load reductions on a HUC-12 watershed basis. Lowries Run watershed is about 10,857 acres in size, with only 1,844 of those total acres located within the Town of McCandless. However, after parsing, the total planning area within the MS4 boundary is 943 acres. Table 3-1 shows the amount of sediment and phosphorus pollution from developed land cover and undeveloped land cover.

Table 3-1: HUC-12 Existing Pollutant Load Results without BMPs

SOURCE	SEDIMENT (lbs/yr)	PHOSPHORUS (lbs/yr)
Developed Land Cover	309,719.48	137.85
Undeveloped Land Cover	23,286.99	9.38
Total	**333,006.47**	**147.23**

3.4 Final Existing Loading and Required Reductions

The final existing loading and required reduction is illustrated in Table 3-2. 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 3-2 Final Existing Loads and Required Reductions

POLLUTANT	FINAL EXISTING LOAD (lbs/yr)	REQUIRED REDUCTION (lbs/yr)
Sediment	333,006.47	**33,300.65**
Phosphorus	147.23	**N/A***

**In accordance with PADEP guidance, the Town plans to take a presumption approach that a 10% reduction of sediment will also accomplish a 5% phosphorus reduction.*

Chapter 4. Achieving Load Reductions

Based on the PRP requirements, the final existing load calculated in Chapter 3 needs to be reduced by implementing proposed structural and non-structural BMPs. At the time of this submission, the Town of McCandless is proposing structural BMPs that include existing BMP retrofits, tree planting and stream restoration throughout the PRP planning area. Appendix C 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 Town of McCandless is planning to propose load reductions with existing BMP retrofits through its stormwater BMP Maintenance Program. The Town of McCandless will investigate ways to achieve the required sediment reduction through its Stormwater BMP Maintenance Program. The program was initiated to sustain the performance of stormwater detention facilities within the Town. Although the program focuses on enhancing performance in facilities designed for flood control, McCandless intends to integrate sediment and phosphorus removal as well into its maintenance program.

There are three types of retrofits that can be performed: enhancement, restoration, or conversion. The type of retrofit being done to the BMP determines if a full or an incremental percent removal is utilized. BMP enhancement utilizes the original stormwater treatment mechanism but improves removal by increasing storage volume or hydraulic residence time. Enhanced BMPs will utilize an incremental removal rate. BMP conversions involve retrofit of older existing stormwater ponds, such as converting a dry pond into a constructed wetland or a wet pond. Restoration of a BMP applies to major maintenance upgrades to BMPs which have either failed or lost their original stormwater treatment capacity. Typical major maintenance items include dredging ponds, replanting all vegetation, replacing contaminated soil, or complete rehabilitation. For restoration of existing BMPs, the full percent removal can be credited for the PRP. 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 Town of McCandless plans to calculate the efficiency of the existing BMP retrofits through the PADEP'S BMP Effectiveness Values Table.

The Town of McCandless also has a tree planting program. The tree planting initiative encourages residential and commercial property owners to report the planting of trees on their property. This will serve as an outreach and educational mechanism as well. The program would expand the tree canopy throughout the Town and therefore reduce stormwater runoff. Trees are beneficial for reducing stormwater pollution by taking up nutrients and various pollutants through their root systems. Though tree planting is not a requirement to residents and businesses, the Town will tabulate the number of trees planted within this 5-year cycle and add the result to the amount of sediment removed, which will be determined based on guidance from PADEP.

The Town also intends to ask the Environmental Advisory Committee to incorporate a tree canopy investigation as part of its green space inventory.

Though stream restoration projects are classified as structural BMPs, the method used to calculate their reduction efficiency is slightly different then 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.

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. McCandless plans to calculate the efficiency of the structural stormwater BMPs through the PADEP BMP Effectiveness Values Table.

For calculating the pollutant loads generated within the BMP's drainage area, the MMW Spreadsheet Tool was used. The MMW Spreadsheet Tool developed by Barry Evans, Anthony Aufdenkampe, and Mike Hickman is utilized for estimating the pollutant loads in the planning areas. The land cover and sediment and phosphorus loads previously obtained from WikiWatershed are entered into the spreadsheet in order to generate loading rates as pounds per year per acre. These loading rates for the HUC-12 watershed were already calculated and depicted in Appendix B. The drainage area to each BMP is then imported into WikiWatershed as the area of interest to obtain the land cover distribution data. This data is entered into the spreadsheet where it calculates the sediment and phosphorus loads from each type of land cover within the drainage area. The spreadsheet for each analyzed BMP drainage area is located in Appendix D. Appendix E is an overall table detailing the existing loads, the percent removals, and the load reductions of each existing BMP.

OPERATION AND MAINTENANCE OF POTENTIAL BMPS

Each situation for which a potential BMP is considered will be evaluated based on merits (listed in no particular order) such as documented areas of historical flooding, portions of watersheds in floodplains, estimated degradation of a stream greater than or equal to 10% of sediment in the stream where the BMP is proposed, areas of general streambank erosion, the type of BMP/retrofit proposed, and portions of watersheds without stormwater management BMPs. The Town may assume maintenance responsibility for BMPs that detain or retain stormwater with the approval of Town Council. All other situations will remain the responsibility of the private property owner. Operation and maintenance for all BMPs on Town property are the responsibility of the Town.

FUNDING OF POTENTIAL BMPS

Potential BMPs have been identified for permitting purposes in Section 4.1 Potential Structural BMPs. The approval of and funding for each BMP is subject to the Town's budgeting process. Grant opportunities (public and private) will be researched and pursued to buttress local funding.

4.1 Structural BMPs

Trolley Court Detention Basin Retrofit (P01)

- *Location*: N40° 34' 14.16", W80° 03' 1.37"
- *Description*: The Town restored and converted the Trolley Court Detention Basin into a dry extended detention basin. The treated drainage area is approximately 6 acres and includes primarily medium density developed area.
- *Estimated Reductions:* The project will reduce 1,716.19 lbs/year of sediment from Lowries Run.
- *Operation & Maintenance*: Operation and maintenance of the stormwater facility will be performed by the Town in accordance with the PA Stormwater BMP Manual for the applicable type of BMP.
- *Funding*: Town's Capital Budget, grant opportunities, and other watershed-based funding opportunities.

Highland Road Valley Stream Restoration (P02)

- *Location*: Start: N40° 34' 05.41", W80° 02' 58.08"
  End: N40° 34' 13.68", W80° 02' 56.11"
- *Description*: Approximately 880 LF of Lowries Run was rehabilitated near Highland Road.
- *Estimated Reductions:* The project reduced 101,200 lbs/year of sediment from Lowries Run.
- *Operation & Maintenance*: Operation and maintenance of the restored stream will be performed by the Town of McCandless.
- *Funding*: Town's Capital Budget, grant opportunities, and other watershed-based funding opportunities.

4.2 Summary of Proposed BMPs

Table 4-1 illustrates the existing load, required reduction, and achieved reduction. The MS4 has achieved its load reduction requirement for the HUC-12 watershed through the implementation of the proposed BMPs.

Table 4-1: Expected Load Reductions from Proposed BMPs

POLLUTANT	FINAL EXISTING LOAD (lbs/yr)	REQUIRED REDUCTION (lbs/yr)	ACHIEVED REDUCTION (lbs/yr)
Sediment	333,006.47	33,300.65	102,916.19
Phosphorus	147.23	N/A*	N/A*

**In accordance with PADEP guidance, the Town plans to take a presumption approach that a 10% reduction of sediment will also accomplish a 5% phosphorus reduction.*

Appendix A – Planning Area Map

File Path: G:\Projects\85000 Upper St Clair\85274 MS4 & TMDL\ 2017 MS4\GIS\Planning_Area_Maps\Brush_Run_Planning_Area_Map.mxd

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100 McMorris Road Pittsburgh, PA 15205
Phone: 412-921-4030 - Fax 412-921-9960
-Butler, PA 724- 287-1055 -Washington, PA 724- 229-3362
http://www.gatewayengineers.com

Job No: C-35419-K024
Date August 30, 2022

Scale
0 250 500 1,000
Feet

Township of McCandless

Lowries Run Planning Area Map

- 🟩 2022-08-04 Lowries Run Planning Area
- ✚ Storm Network Structures
- ● Storm Sewer Manholes
- ■ Storm Sewer Inlets
- ▲ Storm Sewer Discharge Point
- ✚ Storm Clean Outs
- — Storm Sewer Lines
- 🟦 Storm Detention Area
- — Streams and Rivers
- — Road Centerlines
- ⬜ Municipal Boundaries
- ⬜ Tax Parcels
- ▨ HUC12 Watersehds

Date: August 30, 2022

Appendix B – Existing Loads without BMPs

Look-Up Table for MMW Land Use Loading Rates

Watershed: Lowries Run
Year: 2022

Section 3: MMW Model Output

This page is where the output data from a mult-year MMW model run is to be copied and pasted into this workbook and is the source data for calculations throughout the workbook.

1. Source File Name - User-specified filename for the output file from MMW (optional).
2. Watershed Name - User-specified name of a watershed for which land use loading rates are being calculated (optional).
3. Source file - The annual pollutant data, in English Units, is copied directly from the MMW output file to the table below.
4. Year - the year modeled (optional).

Data Entered By:	*KML*
Date Data Entered:	*8/18/2022*
Source File Name:	*User Specified*
Watershed:	*Lowries Run*
Year:	*2022*

Model My Watershed OUTPUT DATA

Source	Area	Sediment	Tot N	Tot P
Units	*acres*	*tons/year*	*lbs/year*	*lbs/year*
Hay/Past	44.44	7.82	49.83	29.00
Cropland	-	0.10	1.74	0.49
Forest	4,002.47	7.85	235.78	33.14
Wetland	2.47	0.00	0.64	0.04
Disturbed	-	-	-	-
Turfgrass	-	-	-	-
Open_Land	49.38	4.80	47.36	14.33
Bare_Rock	4.94	0.00	1.74	0.07
Sandy_Areas	-	-	-	-
Unpaved Road	-	-	-	-
Ld_Mixed	5,385.19	14.60	815.14	85.66
Md_Mixed	1,133.33	41.23	1,605.81	163.48
Hd_Mixed	234.57	8.51	331.48	33.74
Ld Residential	-	-	-	-
Md_Residential	-	-	-	-
Hd Residential	-	-	-	-
Farm Animals		-	294.92	78.92
Tile Drainage		-	-	-
Stream Bank		1,767.96	2,030.81	1,274.49
Groundwater		-	7,761.42	323.94
Point Source		-	-	-
Septic Systems		-	3,602.75	-
Totals	*10,856.79*	*1,852.87*	*16,779.43*	*2,037.29*

STREAM LENGTHS*	**KM***	**FEET**	Sed lb/ft	TN lb/ft	TP lb/ft
Total Length	47.72	156561.7	22.6	0.01	0.01
Ag Streams	0.18	590.6			
Non-Ag Streams	47.54	155971.1			

* These values can be obtained from the "Stream" tab in the "Analyze" section of a Model My Watershed run

FARM ANIMAL DATA

TYPE*	NUMBER*	AVG WT KG	TOTAL KG	TOTAL AEU	KG N/AEU/DAY	KG P/AEU/DAY	TOTAL N/DAY	TOTAL P/DAY
Chickens, Broilers	8	0.9	7.2	0.0072	1.07	0.3	0.007704	0.00216
Chickens, Layers	95	1.8	171	0.171	0.85	0.29	0.14535	0.04959
Cows, Beef	0	360	0	0	0.31	0.09	0	0
Cows, Dairy	0	640	0	0	0.44	0.07	0	0
Horses	31	500	15500	15.5	0.28	0.06	4.34	0.93
Pigs/Hogs/Swine	4	61	244	0.244	0.48	0.15	0.11712	0.0366
Sheep	31	50	1550	1.55	0.37	0.1	0.5735	0.155
Turkeys	0	6.8	0	0	0.59	0.2	0	0
					Daily Totals		5.18	1.17
					Poultry Totals		0.15	0.05
					Livestock Totals		5.03	1.12
					Poultry Fraction		0.03042	0.04614
					Livestock Fraction		0.97047	0.95590

* These values can be obtained from the "Animal" tab in the "Analyze" section of a Model My Watershed run

MMW NLCD Land Cover Categories for Watershed (from "Analyze" csv file)

TYPE	AREA (km^2)	AREA (acres)
Open Water	0	-
Perennial Ice/Snow	0	-
Developed, Open Space	11.36	2,804.94
Developed, Low Intensity	10.45	2,580.25
Developed, Medium Intensity	4.59	1,133.33
Developed, High Intensity	0.95	234.57
Barren Land (Rock/Sand/Clay)	0.02	4.94
Deciduous Forest	15.55	3,839.51
Evergreen Forest	0	-
Mixed Forest	0.6	148.15
Shrub/Scrub	0.06	14.81
Grassland/Herbaceous	0.2	49.38
Pasture/Hay	0.18	44.44
Cultivated Crops	0	-
Woody Wetlands	0	-
Emergent Herbaceous Wetlands	0.01	2.47
Totals	*43.97*	*10,856.79*

Pollutant Load Conversion from Metric to Standard Units (from "Model" csv file)

SOURCE	SEDIMENT (kg)	TOTAL N (kg)	TOTAL P (kg)	SEDIMENT (tons)	TOTAL N (lbs)	TOTAL P (lbs)
Hay/Pasture	7,094.45	22.60	13.15	7.821631125	49.833	28.99575
Cropland	88.19	0.79	0.22	0.097229475	1.74195	0.4851
Wooded Areas	7,124.06	106.93	15.03	7.85427615	235.78065	33.14115
Wetlands	2.56	0.29	0.02	0.0028224	0.63945	0.0441
Open Land	4,350.58	21.48	6.50	4.79651445	47.3634	14.3325
Barren Areas	2.81	0.79	0.03	0.003098025	1.74195	0.06615
Low-Density Mixed	13,239.02	369.68	38.85	14.59601955	815.1444	85.66425
Medium-Density Mixed	37,393.02	728.26	74.14	41.22580455	1605.8133	163.4787
High-Density Mixed	7,718.86	150.33	15.30	8.51004315	331.47765	33.7365
Other Upland Areas	14,394.14	401.93	42.23	15.86953935	886.25565	93.11715
Farm Animals	0.00	133.75	35.79	0	294.91875	78.91695
Stream Bank Erosion	1,603,594.00	921.00	578.00	1767.962385	2030.805	1274.49
Subsurface Flow	0.00	3,519.92	146.91	0	7761.4236	323.93655
Point Sources	0.00	0.00	0.00	0	0	0
Septic Systems	0.00	1,633.90	0.00	0	3602.7495	0
Totals	*1,695,001.69*	*8,011.65*	*966.17*	*1,868.74*	*17,665.69*	*2,130.40*

Note: The information below is only used for allocation of "urban" loads within a larger watershed boundary

MMW NLCD Land Cover Categories for Urban Area (from second, smaller "Analyze" csv file)

TYPE	AREA (km^2)	AREA (acres)	TN (lb/yr)	TP (lb/yr)	Sediment (lb/yr)
Open Water	0	-			
Perennial Ice/Snow	0	-			
Developed, Open Space	1.13	279.01	86.49	39.06	92,771.09
Developed, Low Intensity	1.91	471.60	146.20	66.02	156,807.77
Developed, Medium Intensity	0.39	96.30	173.33	31.78	58,172.38
Developed, High Intensity	0.01	2.47	4.94	0.99	1,968.23
Barren Land (Rock/Sand/Clay)	0	-	0.00	0.00	0.00
Deciduous Forest	0.35	86.42	17.28	8.64	21,448.54
Evergreen Forest	0	-	0.00	0.00	0.00
Mixed Forest	0.03	7.41	1.48	0.74	1,838.45
Shrub/Scrub	0	-	0.00	0.00	0.00
Grassland/Herbaceous	0	-	0.00	0.00	0.00
Pasture/Hay	0	-	0.00	0.00	0.00
Cultivated Crops	0	-	0.00	0.00	0.00
Woody Wetlands	0	-	0.00	0.00	0.00
Emergent Herbaceous Wetlands	0	-	0.00	0.00	0.00
Totals	*3.82*	*943.21*	*429.73*	*147.23*	*333,006.47*

(Note: The values below only pertain to the smaller target area)

STREAM LENGTH	**KM***	**FEET**
Total Length	1.42	4658.8
Ag Streams	0	0.0
Non-Ag Streams	1.42	4658.8

* These values can be obtained from the "Stream" tab in the "Analyze" section of a Model My Watershed run

TYPE	AREA (m^2)*	AREA (acres)			
Open Water	0	0.00			
Perennial Ice/Snow	0	0.00			
Developed, Open Space	0	0.00	0.00	0.00	0.00
Developed, Low Intensity	0	0.00	0.00	0.00	0.00
Developed, Medium Intensity	0	0.00	0.00	0.00	0.00
Developed, High Intensity	0	0.00	0.00	0.00	0.00
Barren Land (Rock/Sand/Clay)	0	0.00	0.00	0.00	0.00
Deciduous Forest	0	0.00	0.00	0.00	0.00
Evergreen Forest	0	0.00	0.00	0.00	0.00
Mixed Forest	0	0.00	0.00	0.00	0.00
Shrub/Scrub	0	0.00	0.00	0.00	0.00
Grassland/Herbaceous	0	0.00	0.00	0.00	0.00
Pasture/Hay	0	0.00	0.00	0.00	0.00
Cultivated Crops	0	0.00	0.00	0.00	0.00
Woody Wetlands	0	0.00	0.00	0.00	0.00
Emergent Herbaceous Wetlands	0	0.00	0.00	0.00	0.00
Totals	*0*	*0.00*	-	-	-

*Only use this input block if land cover distribution is given in square meters (m^2).
This occurs when AOI is less than about 2 square kilometer2.

TOTAL LOADS	**429.73**	**147.23**	**333,006.47**
			33,300.65

Look-Up Table for MMW Loading Rates
Watershed: Lowries Run
Year: 2022
Source File: User Specified

Section 2: Landcover Loading Rates Look-Up Table

TOTAL WATERSHED ANNUAL LOADS

ANNUAL LAND USE LOADING RATES (lbs/acre)

MapShed Land Use Categories

Source	Area	Sediment	Total Nitrogen	Total Phosphorus		SEDIMENT: From Land Use	SEDIMENT: From Stream Banks ①	SEDIMENT: TOTAL SEDIMENT LOADING RATE		NITROGEN: From Land Use	NITROGEN: From Stream Banks ①	NITROGEN: From Farm Animals ②	NITROGEN: TOTAL NITROGEN LOADING RATE		PHOSPHORUS: From Land Use	PHOSPHORUS: From Stream Banks ①	PHOSPHORUS: From Farm Animals ②	PHOSPHORUS: TOTAL PHOSPHORUS LOADING RATE	
Units	*Acres*	*Tons*	*Pounds*	*Pounds*		lbs/acre	lbs/acre	lbs/acre		lbs/acre	lbs/acre	lbs/acre	lbs/acre		lbs/acre	lbs/acre	lbs/acre	lbs/acre	
Source	*area_ac*	*sediment_tons*	*TN_lbs*	*TP_lbs*	*Colum*	*TSS_LoadRateLa*	*TSS_LoadRateBa*	*TSS_LoadRate_lbPerAc*	*Colum*	*TN_LoadRateLa*	*TN_LoadRateBa*	*TN_LoadRateAi*	*TN_LoadRate_lbPerAcP*	*Column6*	*TP_LoadRateLand*	*TP_LoadRateBanks*	*TP_LoadRateAnimal*	*TP_LoadRate_lbPerAcA*	
Hay/Past	44.44	7.82	49.83	29.00		351.97	244.27	**596.24**		1.12	0.14	6.64	**7.90**		0.65	0.09	1.78	**2.52**	Hay/Past
Cropland	0.00	0.10	1.74	0.49		0.00	0.00	**0.00**		0.00	0.00	0.00	**0.00**		0.00	0.00	0.00	**0.00**	Cropland
Forest	4,002.47	7.85	235.78	33.14		3.92	244.27	**248.19**		0.06	0.14	n/a	**0.20**		0.01	0.09	n/a	**0.10**	Forest
Wetland	2.47	0.00	0.64	0.04		2.29	244.27	**246.55**		0.26	0.14	n/a	**0.40**		0.02	0.09	n/a	**0.11**	Wetland
Disturbed	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Disturbed
Turfgrass	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Turfgrass
Open_Land	49.38	4.80	47.36	14.33		194.26	244.27	**438.52**		0.96	0.14	n/a	**1.10**		0.29	0.09	n/a	**0.38**	Open_Land
Bare_Rock	4.94	0.00	1.74	0.07		1.25	244.27	**245.52**		0.35	0.14	n/a	**0.49**		0.01	0.09	n/a	**0.10**	Bare_Rock
Sandy_Areas	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Sandy_Areas
Unpaved_Road	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Unpaved_Road
Ld_Mixed	5,385.19	14.60	815.14	85.66		5.42	327.08	**332.50**		0.15	0.16	n/a	**0.31**		0.02	0.12	n/a	**0.14**	Ld_Mixed
Md_Mixed	1,133.33	41.23	1,605.81	163.48		72.75	531.35	**604.10**		1.42	0.38	n/a	**1.80**		0.14	0.19	n/a	**0.33**	Md_Mixed
Hd_Mixed	234.57	8.51	331.48	33.74		72.56	724.57	**797.13**		1.41	0.59	n/a	**2.00**		0.14	0.26	n/a	**0.40**	Hd_Mixed
Ld_Residential	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Ld_Residential
Md_Residential	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Md_Residential
Hd_Residential	0.00	0.00	0.00	0.00		0.00	0.00	**0.00**		0.00	0.00	n/a	**0.00**		0.00	0.00	n/a	**0.00**	Hd_Residential
						Tons * 2000 lbs/ton acres of a land use		Sum of previous two sources		Tons * 2000 lbs/ton acres of a land use			Sum of previous three sources		Tons * 2000 lbs/ton acres of a land use			Sum of previous three sources	

Addt'l Sources

Source	Sediment	Total Nitrogen	Total Phosphorus
Units	*Tons*	*Pounds*	*Pounds*
Farm Animals	0.00	294.92	78.92
Tile Drainage	0.00	0.00	0.00
Stream Bank ①	1,767.96	2,030.81	1,274.49
Groundwater	0.00	7,761.42	323.94
Point Source	0.00	0.00	0.00
Septic Systems	0.00	3,602.75	0.00

Notes:

① - Separate worksheets are used to calculate and apportion the loading rates from the Stream Bank source loads (for sediment, total nitrogen, and total phosphorus) from the MMW Output file into each land use category, using methodology provided by Dr. Barry Evans (Pennsylvania State University), the author of MapShed, and with concurrence from Mr. Bill Brown (PADEP).

② - A separate worksheet is used to calculate and apportion the "Total Nitrogen" and "Total Phosphorus" loading rates from the Farm Animals source load from the MMW Output file into the two agricultural land uses, Hay/Pasture and Cropland, based on area weighting. The methodology was provided by Dr. Barry Evans (Pennsylvania State University), the author of MapShed, and with concurrence from Mr. Bill Brown (PADEP). Additionally, since the Farm Animals source loads do not apply to other land use catergories, the values in those cells are "n/a".

Groundwater	0.0	7,761.4	323.9
Point Source	0.0	0.0	0.0
Septic Systems	0.0	3,602.7	0.0

Appendix C – Proposed Structural BMPs Maps

Township of McCandless
Lowries Run Watershed

Proposed Stream Restoration and Proposed BMP Locations

Project Number: C-35419-K024

Date: 10/13/2022
Scale: 1" = 200'

N
W E
S

Trolley Court Detention Basin Retrofit P01

Highland Road Valley Stream Restoration P02

TROLLEY CT
HARMONY DRIVE
VICTORY ROAD
WILLOUGHBY ROAD
RYLAND DRIVE
PINE LINE DR
PINE HEIGHTS PL
CALAIS DR
SLOOP ROAD
WITTMER ROAD
HIGHLAND ROAD
SQUIRE PLACE
TROUTWOOD DRIVE
MOHICAN AVENUE
HURON AVENUE
SEMINOLE AVENUE
CHICHASAW AVE
ONEIDA AVENUE
PONTIAC AVENUE

- Lowries Run Stream Restoration
- Trolley Court Basin
- Storm Network Structures
- Storm Sewer Manholes
- Storm Sewer Inlets
- Storm Sewer Discharge Point
- Storm Clean Outs
- Storm Sewer Lines
- Storm Detention Area
- Tax Parcels
- Municipal Boundaries
- Road Centerlines
- Streams and Rivers

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

GATEWAY
On Call. On Time. On Target.

Path: G:\Projects\850000 Upper St Clair\85374 MS4 & TMDL\2017 MS4\PRP\GIS\Potential BMP Mapbook\Brush_Run_BMP_Mapbook_11x17.mxd

Appendix D – Proposed BMPs Load Calculations

Look-Up Table for MMW Land Use Loading Rates

Watershed: Lowries Run
Year: 2022

Section 3: MMW Model Output

This page is where the output data from a mult-year MMW model run is to be copied and pasted into this workbook and is the source data for calculations throughout the workbook.

1. Source File Name - User-specified filename for the output file from MMW (optional).
2. Watershed Name - User-specified name of a watershed for which land use loading rates are being calculated (optional).
3. Source file - The annual pollutant data, in English Units, is copied directly from the MMW output file to the table below.
4. Year - the year modeled (optional).

Data Entered By: *KML*
Date Data Entered: *8/18/2022*
Source File Name: *Trolley Court Detention Basin*
Watershed: *Lowries Run*
Year: *2022*

Model My Watershed OUTPUT DATA

Source	Area	Sediment	Tot N	Tot P
Units	*acres*	*tons/year*	*lbs/year*	*lbs/year*
Hay/Past	44.44	7.82	49.83	29.00
Cropland	-	0.10	1.74	0.49
Forest	4,002.47	7.85	235.78	33.14
Wetland	2.47	0.00	0.64	0.04
Disturbed	-	-	-	-
Turfgrass	-	-	-	-
Open_Land	49.38	4.80	47.36	14.33
Bare_Rock	4.94	0.00	1.74	0.07
Sandy_Areas	-	-	-	-
Unpaved Road	-	-	-	-
Ld_Mixed	5,385.19	14.60	815.14	85.66
Md_Mixed	1,133.33	41.23	1,605.81	163.48
Hd_Mixed	234.57	8.51	331.48	33.74
Ld Residential	-	-	-	-
Md_Residential	-	-	-	-
Hd Residential	-	-	-	-
Farm Animals		-	294.92	78.92
Tile Drainage		-	-	-
Stream Bank		1,767.96	2,030.81	1,274.49
Groundwater		-	7,761.42	323.94
Point Source		-	-	-
Septic Systems		-	3,602.75	-
Totals	*10,856.79*	*1,852.87*	*16,779.43*	*2,037.29*

STREAM LENGTHS* **KM*** **FEET**

			Sed lb/ft	TN lb/ft	TP lb/ft
Total Length	47.72	156561.7	22.6	0.01	0.01
Ag Streams	0.18	590.6			
Non-Ag Streams	47.54	155971.1			

* These values can be obtained from the "Stream" tab in the "Analyze" section of a Model My Watershed run

FARM ANIMAL DATA

TYPE*	NUMBER*	AVG WT KG	TOTAL KG	TOTAL AEU	KG N/AEU/DAY	KG P/AEU/DAY	TOTAL N/DAY	TOTAL P/DAY
Chickens, Broilers	8	0.9	7.2	0.0072	1.07	0.3	0.007704	0.00216
Chickens, Layers	95	1.8	171	0.171	0.85	0.29	0.14535	0.04959
Cows, Beef	0	360	0	0	0.31	0.09	0	0
Cows, Dairy	0	640	0	0	0.44	0.07	0	0
Horses	31	500	15500	15.5	0.28	0.06	4.34	0.93
Pigs/Hogs/Swine	4	61	244	0.244	0.48	0.15	0.11712	0.0366
Sheep	31	50	1550	1.55	0.37	0.1	0.5735	0.155
Turkeys	0	6.8	0	0	0.59	0.2	0	0

Daily Totals	5.18	1.17
Poultry Totals	0.15	0.05
Livestock Totals	5.03	1.12
Poultry Fraction	0.03042	0.04614
Livestock Fraction	0.97047	0.95590

* These values can be obtained from the "Animal" tab in the "Analyze" section of a Model My Watershed run

MMW NLCD Land Cover Categories for Watershed (from "Analyze" csv file)

TYPE	AREA (km^2)	AREA (acres)
Open Water	0	-
Perennial Ice/Snow	0	-
Developed, Open Space	11.36	2,804.94
Developed, Low Intensity	10.45	2,580.25
Developed, Medium Intensity	4.59	1,133.33
Developed, High Intensity	0.95	234.57
Barren Land (Rock/Sand/Clay)	0.02	4.94
Deciduous Forest	15.55	3,839.51
Evergreen Forest	0	-
Mixed Forest	0.6	148.15
Shrub/Scrub	0.06	14.81
Grassland/Herbaceous	0.2	49.38
Pasture/Hay	0.18	44.44
Cultivated Crops	0	-
Woody Wetlands	0	-
Emergent Herbaceous Wetlands	0.01	2.47
Totals	*43.97*	*10,856.79*

Pollutant Load Conversion from Metric to Standard Units (from "Model" csv file)

SOURCE	SEDIMENT (kg)	TOTAL N (kg)	TOTAL P (kg)	SEDIMENT (tons)	TOTAL N (lbs)	TOTAL P (lbs)
Hay/Pasture	7,094.45	22.60	13.15	7.821631125	49.833	28.99575
Cropland	88.19	0.79	0.22	0.097229475	1.74195	0.4851
Wooded Areas	7,124.06	106.93	15.03	7.85427615	235.78065	33.14115
Wetlands	2.56	0.29	0.02	0.0028224	0.63945	0.0441
Open Land	4,350.58	21.48	6.50	4.79651445	47.3634	14.3325
Barren Areas	2.81	0.79	0.03	0.003098025	1.74195	0.06615
Low-Density Mixed	13,239.02	369.68	38.85	14.59601955	815.1444	85.66425
Medium-Density Mixed	37,393.02	728.26	74.14	41.22580455	1605.8133	163.4787
High-Density Mixed	7,718.86	150.33	15.30	8.51004315	331.47765	33.7365
Other Upland Areas	14,394.14	401.93	42.23	15.86953935	886.25565	93.11715
Farm Animals	0.00	133.75	35.79	0	294.91875	78.91695
Stream Bank Erosion	1,603,594.00	921.00	578.00	1767.962385	2030.805	1274.49
Subsurface Flow	0.00	3,519.92	146.91	0	7761.4236	323.93655
Point Sources	0.00	0.00	0.00	0	0	0
Septic Systems	0.00	1,633.90	0.00	0	3602.7495	0
Totals	*1,695,001.69*	*8,011.65*	*966.17*	*1,868.74*	*17,665.69*	*2,130.40*

Note: The information below is only used for allocation of "urban" loads within a larger watershed boundary

MMW NLCD Land Cover Categories for Urban Area (from second, smaller "Analyze" csv file)

TYPE	AREA (km^2)	AREA (acres)	TN (lb/yr)	TP (lb/yr)	Sediment (lb/yr)
Open Water		-			
Perennial Ice/Snow		-			
Developed, Open Space		-	0.00	0.00	0.00
Developed, Low Intensity		-	0.00	0.00	0.00
Developed, Medium Intensity		-	0.00	0.00	0.00
Developed, High Intensity		-	0.00	0.00	0.00
Barren Land (Rock/Sand/Clay)		-	0.00	0.00	0.00
Deciduous Forest		-	0.00	0.00	0.00
Evergreen Forest		-	0.00	0.00	0.00
Mixed Forest		-	0.00	0.00	0.00
Shrub/Scrub		-	0.00	0.00	0.00
Grassland/Herbaceous		-	0.00	0.00	0.00
Pasture/Hay		-	0.00	0.00	0.00
Cultivated Crops		-	0.00	0.00	0.00
Woody Wetlands		-	0.00	0.00	0.00
Emergent Herbaceous Wetlands		-	0.00	0.00	0.00
Totals	-	-	-	-	-

(Note: The values below only pertain to the smaller target area)

STREAM LENGTH **KM*** **FEET**

Total Length		0.0
Ag Streams		0.0
Non-Ag Streams		0.0

* These values can be obtained from the "Stream" tab in the "Analyze" section of a Model My Watershed run

TYPE	AREA (m^2)*	AREA (acres)			
Open Water	0	0.00			
Perennial Ice/Snow	0	0.00			
Developed, Open Space	897.17	0.22	0.07	0.03	73.66
Developed, Low Intensity	8971.7	2.22	0.69	0.31	736.56
Developed, Medium Intensity	12560.38	3.10	5.58	1.02	1,873.51
Developed, High Intensity	897.17	0.22	0.44	0.09	176.58
Barren Land (Rock/Sand/Clay)	0	0.00	0.00	0.00	0.00
Deciduous Forest	0	0.00	0.00	0.00	0.00
Evergreen Forest	0	0.00	0.00	0.00	0.00
Mixed Forest	0	0.00	0.00	0.00	0.00
Shrub/Scrub	0	0.00	0.00	0.00	0.00
Grassland/Herbaceous	0	0.00	0.00	0.00	0.00
Pasture/Hay	0	0.00	0.00	0.00	0.00
Cultivated Crops	0	0.00	0.00	0.00	0.00
Woody Wetlands	0	0.00	0.00	0.00	0.00
Emergent Herbaceous Wetlands	0	0.00	0.00	0.00	0.00
Totals	*23326.42*	*5.76*	*6.78*	*1.45*	*2,860.31*

*Only use this input block if land cover distribution is given in square meters (m^2).
This occurs when AOI is less than about 2 square kilometer2.

TOTAL LOADS **6.78** **1.45** **2,860.31**

Appendix E – Proposed BMPs Load Reduction Table

Lowries Run 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)
P01	Trolley Court Detention Basin Retrofit - Dry ED	BMP Effectiveness Values	2,860.31	1.45	60%	20%	1,716.19	0.29
P02	Highland Valley Streambank Restoration	BMP Effectiveness Values	101,200.00	4.10	100%	100%	101,200.00	4.10
Total							**102,916.19**	**4.39**