August 2017

Whitehall Township Pollution Reduction Plan

Prepared By: Center for Watershed Protection, Inc.

Table of Contents

List of Figures

List of Tables

Introduction

Whitehall Township lies in Lehigh County, Pennsylvania directly north of the City of Allentown. The entire Township is essentially covered in the 2010 Allentown, PA urbanized area (UA). According to the Pennsylvania Department of Environmental Protection's (PADEP's) document entitled, "Statewide MS4 Land Cover Estimates", Whitehall Township contains 8,156.3 acres of 2010 urbanized area (UA) with an average of 32% impervious and 68% pervious cover.

Whitehall Township has been identified in PADEP's MS4 Requirements Table for discharges necessitating an Appendix E within the 2018 MS4 PAG-13 General Permit. Therefore, the Township has created the following Pollution Reduction Plan (PRP) for submittal with the Notice of Intent to renew general permit coverage. The following document is organized and formatted precisely as required by the PADEP PRP Instructions.

Section A – Public Participation

Whitehall Township shall complete the following public participation measures listed below, and report in the PRP that each was completed. Whitehall Township will:

- make a complete copy of the PRP available for public review.
- publish, in a newspaper of general circulation in the area, a public notice containing a statement describing the plan, where it may be reviewed by the public, and the length of time the permittee will provide for the receipt of comments. The public notice must be published at least 45 days prior to the deadline for submission of the PRP to DEP. Attach a copy of the public notice to the PRP.
- accept written comments for a minimum of 30 days from the date of public notice. Attach a copy of all written comments received from the public to the PRP.
- accept comments from any interested member of the public at a public meeting or hearing, which may include a regularly scheduled meeting of the governing body of the municipality or municipal authority that is the permittee.
- consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment. Attach a copy of the permittee's record of consideration of all timely comment received in the public comment period to the PRP.

Section B – Map

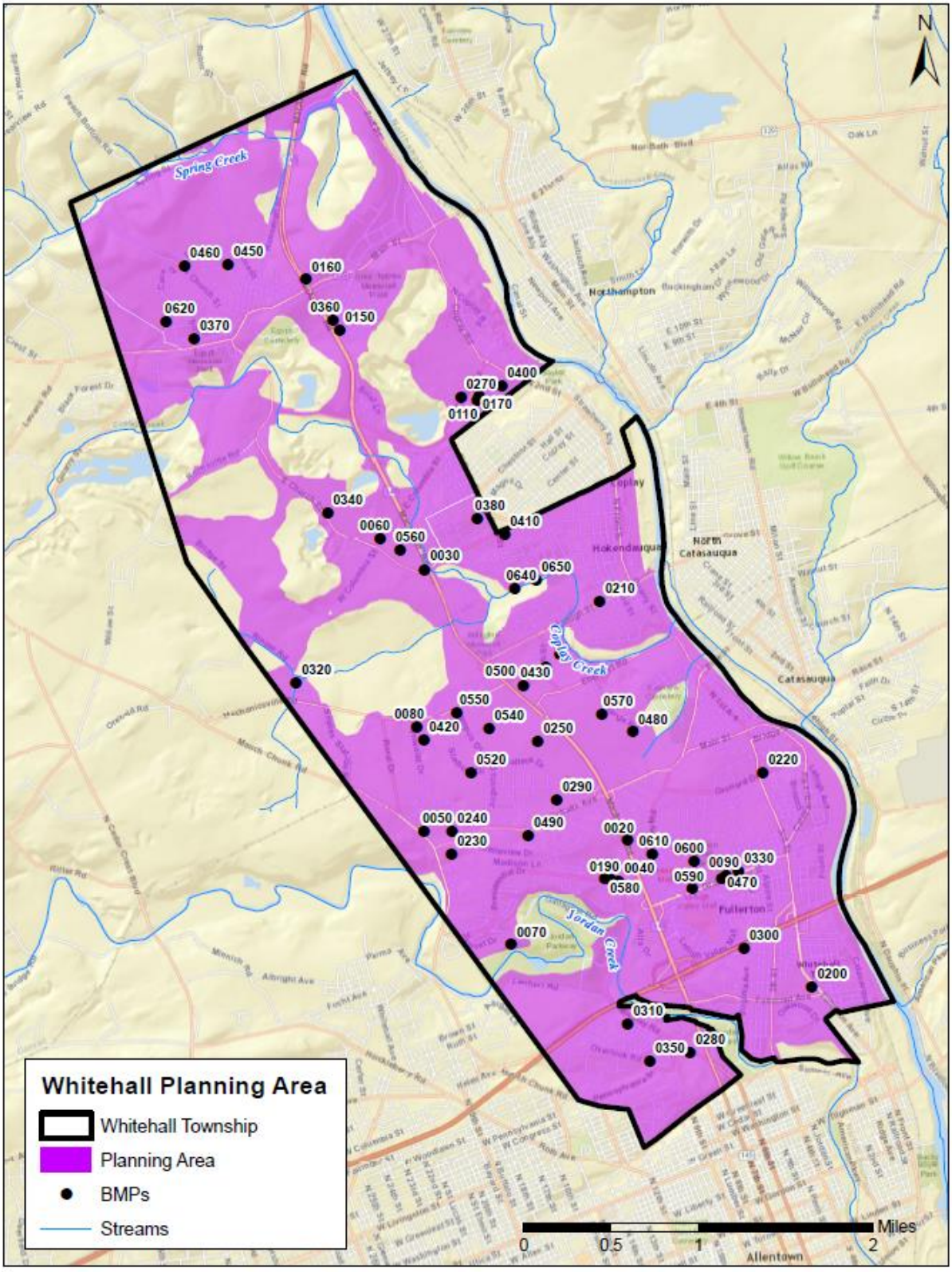

Figure 1 – Whitehall Township Planning Area with BMP Locations

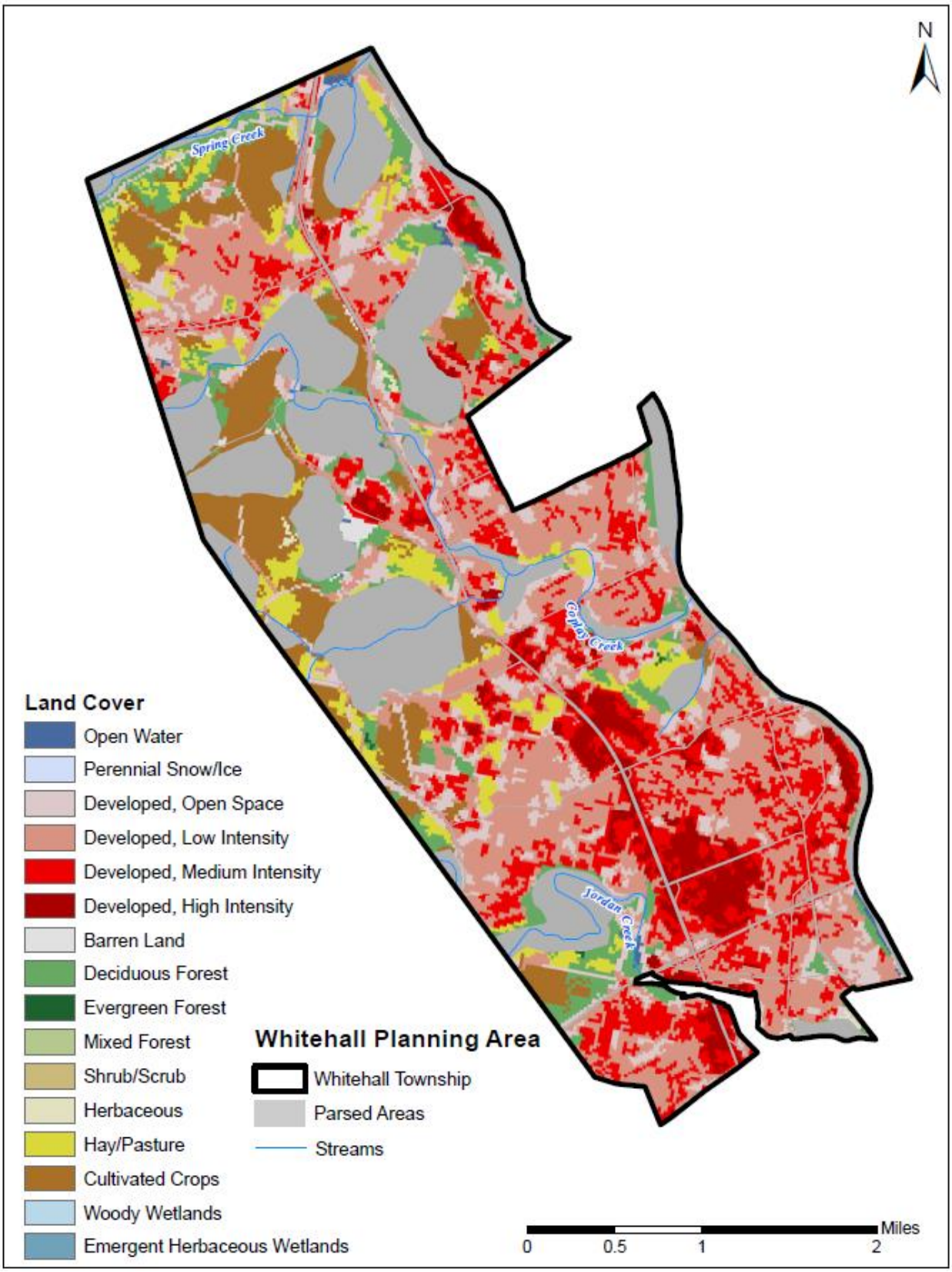

Figure 2 – Whitehall Township Planning Area with 2011 NLCD Land Uses

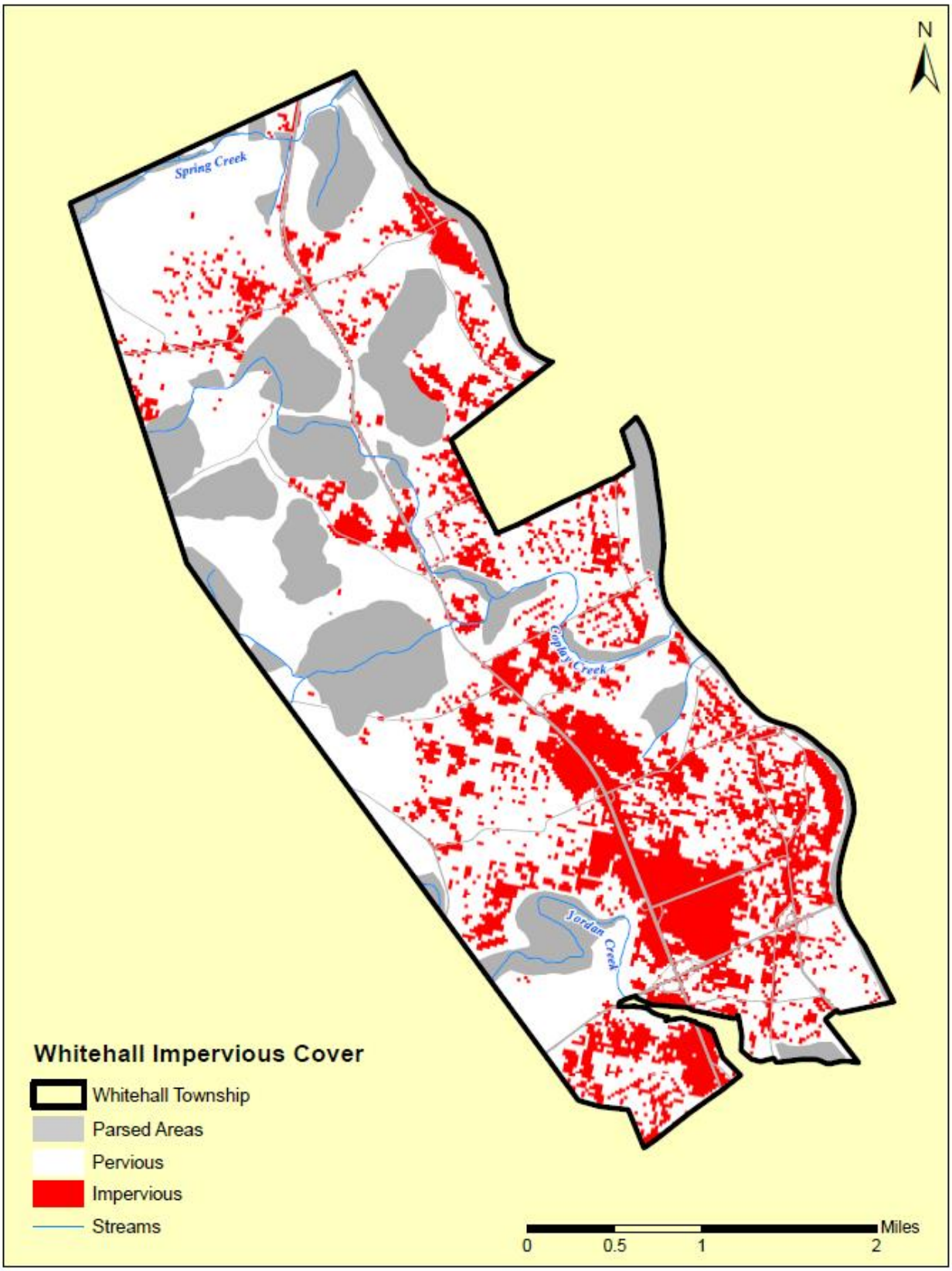

Figure 3 – Whitehall Planning Area with Impervious and Pervious Cover

Section C – Pollutants of Concern

The PADEP MS4 Requirements Table, on page 108, lists four impaired downstream waters applicable to Whitehall Township (NPDES Permit ID PAG132214). The impaired downstream waters are: Coplay Creek, Little Lehigh Creek, Jordan Creek, and Lehigh River (Figure 4). All four are listed as requiring the PA MS4 General Permit Appendix E for sediment, however the Lehigh River is listed as requiring Appendix E for both sediment and nutrients (organic enrichment/low D.O).

NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
PAG132214	No		Coplay Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)
			Little Lehigh Creek	Appendix E-Siltation (5)
			Jordan Creek	Appendix E-Siltation (5)
			Lehigh River	Appendix A-Metals (5), Appendix E-Organic Enrichment/Low D.O., Siltation, Suspended Solids (5)

Figure 4 – MS4 Requirements Table listing for Whitehall Township

The PADEP document entitled, "Pollutant Aggregation Suggestions for MS4 Requirements Table Instructions" states that the:

> DEP Pollutant Reduction Plan (PRP) Instructions and TMDL Instructions allow flexibility in the location of BMPs for the upcoming permit term; load reductions need not necessarily be accomplished in each stream and tributary listed in the MS4 Requirements Table. Instead, the instructions promote planning on a larger scale. The MS4 is required to calculate the required pollutant load reduction for its entire Planning Area, but load reductions in some impaired surface waters can be more than what is required, and less than what is required in others, so long as the total reduction is at least the required percentage of the total (pg.1).

Further the PADEP PRP Instructions, in Section II.E on page 8, provides the following:

> Opportunities for BMP installation vary across a municipality, and for that reason MS4s with multiple PRP obligations need not propose BMPs to address each impairment listed in the Table during the permit term. The existing loading must be calculated for the entire PRP Planning Area which drains to impaired waters, but pollutant controls to be installed during the subsequent permit term may be located such that they reduce the load in one sub-watershed by less than 10% and by more than 10% in another (as long as the overall amount of lbs reduced constitutes 10% of the existing loading for the entire PRP Planning Area)

Section I.B of the PADEP PRP Instructions guidance document states that, "PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction" (pg. 1).

Therefore, in order to most cost-effectively calculate the reduction requirements, and cost-effectively implement BMP projects due to increased flexibility, Whitehall Township will consider one Planning

Area throughout this analysis. The singular Planning Area will be composed of all four of the individual Appendix E planning areas combined into one. An overall 10% sediment reduction target will be pursued from the entire Planning Area under the presumptive approach provided by PADEP. The derivation of the entire Planning Area is described in the next section, “Determining the Planning Area – Methodology”.

Section D – Determine Existing Loading for Pollutants of Concern

Determining the Planning Area – Methodology

The Planning Area for Whitehall Township was determined by utilizing the 2010 U.S. Census UA layer, PennDOT road maps, topographic data with 5-foot contour intervals, stormsewer data, and aerial imagery. Attachment A "Parsing Guidelines for MS4s in Pollutant Reduction Plans" on page 10 of the PADEP PRP Instruction document provides four examples of areas that may be removed from the Planning Area for a PRP. The following two examples were utilized in the determination of the Planning Area for Whitehall Township:

- Land areas in which stormwater runoff does not enter the MS4. If an accurate storm sewershed map is developed, these lands may be parsed or excluded as part of that process. Potential examples include homeowner's associations and schools which do not contain municipal roads or other municipal infrastructure
- Land area associated with PennDOT roadways…….(roads and right of ways)

The Township is almost completely covered by the 2010 UA, except for two small parcels of land along the western Township border with South Whitehall Township (Figure 5). The northern parcel (circled in black in Figure 5), drains into the municipal conveyances of Mechanicsville Road and Seiples Station Road, becoming part of the Planning Area. However, the southern parcel (circled in black in Figure 5), directly drains into a stream without encountering a conveyance and is therefore excluded from the Planning Area.

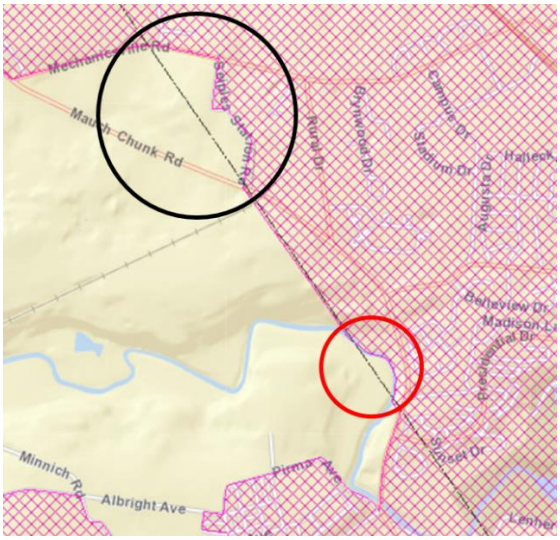

Figure 5 – Picture from PADEP's eMapPA Depicting Two Small Parcels in Whitehall Township Not Covered by the 2010 UA (the Parcel Included in the Planning Area Circled in Black and the Parcel Excluded from the Planning Area is Circled in Red)

Aerial analysis indicated that there are several quarries in the northern portion of the Township (Figure 6). As the areas draining into the quarries do not enter a regulated MS4 conveyance, they were removed from the Planning Area.

Figure 6 – Aerial Indicating Concentration of Quarries West of Coplay Borough, in the Northern Portion of Whitehall Township (Circled in Red)

PennDOT road maps, stormsewer system data obtained from Whitehall Township, 5-foot contour topographic data, and aerial analysis were utilized to locate and remove all tracts of land that directly discharge to streams without passing through a regulated MS4 conveyance. For example, there is a large section of pervious cover that was removed from an area surrounding Jordan Creek in the southwest corner of the Township (Figure 7). The PennDOT road map indicated the location of Township roads that are to be included as MS4 conveyances and the location of private roads which may be excluded. Stormsewer data indicated that although Sunset Drive was a private road, it did receive discharge from the "upstream" MS4 regulated conveyances to the north thereby necessitating the private road to be included as an MS4 conveyance and kept in the Planning Area. The 5-foot contour topographic data, and aerial analysis were then employed to determine the red hatched area in Figure 7 which discharges directly to Jordan Creek without passing through a regulated MS4 conveyance, and is therefore allowed to be removed from the Planning Area.

Finally, all state and federal road areas were removed from the Whitehall Township Planning Area. A state/federal road centerline GIS layer was obtained from PennDOT that contains the road and divisor widths as part of the attribute data. A buffer was created around the road centerlines based on the road and divisor widths to approximate the total roadway area. The resulting impervious roadway area of 155.16 acres was removed from the overall Whitehall Township Planning Area (Table 1). Although Attachment A of the PADEP PRP Instruction document allows for both the roads and right of ways to be parsed, only the road width was removed from the Planning Area to be conservative. Whitehall

Township may seek to refine the Planning Area, including the removal of state and federal road right of ways, during the upcoming permit term.

Figure 7 – Excerpt from the Whitehall Township PennDOT Road Map Indicating Public Roads (with Solid Black Lines and Decimal Mileage Below) and a Private Road (Sunset Drive with Shaded Grey Line and no Decimal Mileage Below) on the Left. On the Right is the Aerial with Roads (in Green), Stormsewer Data (with Red Pipes, Blue Inlets, Red Circle Manholes, and Green Square Outfalls) and Area Determined to Direct Discharge into the Jordan Creek (in Red Hatched Lines)

Determining the Existing Loading without BMPs

Planning Area Land Use/Land Cover Analysis

With all applicable areas parsed per Attachment A of the PADEP PRP Instructions document, the 2011 National Land Cover Database (NLCD) was utilized to determine the land cover at the scale of the entire Planning Area. Please note that the 2011 NLCD land use data did include 101 acres of Open Water which was removed from the analysis as it does not contain either impervious or pervious acres.

Next, the NLCD was converted from a raster to a vector layer so that the developed land cover categories could be extracted as polygons. After these categories were exported to a new layer, they were intersected with the municipal boundary and the PRP planning area delineation. The 2011 NLCD Developed Impervious dataset and Spatial Analyst Tools were used to summarize the acres of impervious cover within the PRP planning area. The land use/land cover analysis is presented in

Table 1.

Table 1 – Whitehall Land Use/Land Cover Data with Resulting Impervious and Pervious Acres

NLCD Land Use	Total Acres in Land Use	Impervious Acres	Pervious Acres
Developed, Open Space	884	120	763
Developed, Low Intensity	2,133	811	1,323
Developed, Medium Intensity	1,279	791	488
Developed, High Intensity	424	369	55
Barren Land	25	0	25
Deciduous Forest	490	0	490
Evergreen Forest	3	0	3
Mixed Forest	14	0	14
Shrub/Scrub	4	0	4
Grassland/Herbaceous	14	0	14
Pasture/Hay	457	0	457
Cultivated Crops	758	0	758
Woody Wetlands	13	0	13
Subtotal	6,499	2,090	4,409
Minus State and Federal Roadways	-155	-155	0
Final Land Use Values	**6,344**	**1,935**	**4,409**

Determining the Sediment Load Reduction Requirement

The "simplified method", provided by the PADEP, was utilized to calculate the pollutant load discharging from the Planning Area.

Attachment B on page 12 of the PADEP PRP Instructions documents states under Note 2 that:

> For MS4s located outside of the Chesapeake Bay watershed, the land loading rates for "All Other Counties" may be used to develop PRPs under Appendix E.

The land use loading rates provided by PADEP for "All Other Counties" are:

- 1,839 lb/acre/yr of sediment for impervious land uses
- 264.96 lb/acre/yr of sediment for pervious land uses

The sediment pollutant load calculation results for the Whitehall Township Planning Area without accounting for existing BMPs is provided in Table 2.

Table 2 - Sediment Load Calculation without Accounting for Existing BMPs

Land Use	Acres	Sediment Loading Rate (lb/acre/yr)	Sediment Load (lb/yr)
Impervious	1,935	1,839	3,558,465
Pervious	4,409	264.96	1,168,209
Total	6,344		4,726,674
10% Sediment Target			**472,667**

Determining the Final Existing Loading by Accounting for Existing BMPs

Existing BMP Reductions

The PRP Instructions document on page 7 states that the existing sediment load may be reduced by accounting for the function of existing BMPs. Field reconnaissance of all existing BMPs within Whitehall Township was performed, and their potential for retrofit evaluated. Stormwater basin retrofits comprise the majority of the proposed BMP projects to meet the mandatory sediment reduction. The retrofit calculation requires that the existing sediment reduction value is deducted from the proposed sediment reduction value to obtain a net retrofit sediment reduction value. All existing BMP performance, and retrofit BMP calculations, with a description of the practice are available in Appendix A. Only one BMP, Site ID 0480, is utilized to achieve an existing load reduction without proposal for retrofit.

BMP Drainage Area Delineation

To determine the existing and proposed BMP reduction values, the 2013 1-meter resolution land cover dataset for the Commonwealth of Pennsylvania developed by the University of Vermont Spatial Analysis Laboratory was obtained from PASDA. The dataset includes twelve land cover categories: background, water, emergent wetlands, tree canopy, scrub/shrub, low vegetation, barren, structures, other impervious surfaces, roads, tree canopy over structures, tree canopy over other impervious surfaces, and tree canopy over roads. The 1-meter dataset was utilized over the 2011 NLCD for BMP analysis due to the finer resolution at the smaller scales of BMP drainage areas compared to the much larger scale of the entire Whitehall Township Planning Area.

The Spatial Analyst Zonal Histogram Tool in ArcGIS Desktop 10.5 was used to calculate the area of each of the land cover categories within the drainage area to each BMP. The amount of impervious surface within the BMP drainage areas was calculated as the sum of the structures, other impervious surfaces, roads, tree canopy over structures, tree canopy over other impervious surfaces, and tree canopy over roads land cover categories. All other land cover categories were assumed pervious.

Land draining to each BMP was delineated through a process that incorporated Arc Hydro version 10.5 and visual evaluation of topographic and hydrologic data. Data used in the Arc Hydro data model included a Lehigh County 1-meter LIDAR-derived DEM from the DCNR PAMAP Program, and NHD Flowlines obtained from Pennsylvania Spatial Data Access (PASDA). The Arc Hydro terrain preprocessing steps were followed to allow for DEM-based watershed delineation and network generation.

In some cases, the delineations provided by Arc Hydro were inaccurate due to the inconsistencies in the stormdrain network, large variations in topography, or recent development not captured with the DEM. These drainage areas were corrected by manual delineation based on visual inspection of the DEM, aerial photography, NHD flowlines, and knowledge of the sites from field investigation.

Final Existing Load Accounting for Existing BMPs

The sediment reduction performance values for all existing and proposed BMP projects were calculated using the Retrofit Curve and Performance Standard methodologies from the respective Expert Panel Reports. The exception is for proposed stream restoration projects which were calculated using the default Chesapeake Bay Program-Approved Rate of 44.88 lb/ft of stream restoration from the "Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects". Pictures, calculations, and a brief narrative are provided for each of the existing and proposed projects in "Appendix A - BMP Summary Sheets". A summary of the existing BMPs and their associated reductions is provided in Table 3.

Table 3 – Summary of BMPs with Existing Load Reductions

Project	Project ID	BMP Type	Sediment Load to the BMP (lb/yr)	Percent Reduction (%)	Existing Load Reduction (lb/yr)
Aldi	0010	Infiltration practice	1,937	20.1%	390
Egyptian Hills	0180	Detention basin w/ wetland pockets	35,378	0.1%	30
MacArthur Town Centre	0290	Detention basin w/ wetland pockets	183,737	0.4%	773
Walmart	0480	Water quality basin	28,564	78.4%	22,389
Total					**23,582**

The total sediment load reduction from existing BMPs within Whitehall Township is 23,582 lb/yr, and used to determine the final adjusted 10% sediment target in Table 4.

Table 4 – Determination of the Final Adjusted 10% Sediment Target

Sediment Load w/o Accounting for Existing BMPs (lb/yr)	Sediment Load Reduced by Existing BMPs (lb/yr)	Final Adjusted Sediment Load (lb/yr)	Final Adjusted 10% Sediment Target (lb/yr)
4,726,674	23,582	4,703,092	470,309

Section E – Select BMPs To Achieve the Minimum Required Reductions in Pollutant Loading

As described above, the sediment reduction performance values for all existing and proposed BMP projects were calculated using Chesapeake Bay Program expert panel reports. Specifically, the:

- Recommendations of the Expert Panel to Define Removal Rates for Urban Stormwater Retrofit Projects
- Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards
- Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects

All proposed stream restoration projects were calculated using the default Chesapeake Bay Program-Approved Rate of 44.88 lb/ft from the expert panel report. Pictures, calculations, and a brief narrative are provided for each the existing and proposed projects in "Appendix A - BMP Summary Sheets". A summary of the proposed BMPs and their associated reductions is provided in Table 5.

There are a total of 57 stormwater basin retrofits and two streambank restoration BMPs proposed to meet Whitehall Township's mandatory sediment reduction. Basin retrofits were chosen as the primary BMP type due to the significant cost-effectiveness of increasing the performance of sites that are already devoted to stormwater management. Streambank restoration was chosen because of the effectiveness of the practice in reducing sediment.

Table 5 – Summary of Proposed BMPs

Project	Project ID	BMP Type	Sediment Load to the BMP (lb/yr)	Percent Reduction (%)	Proposed Load Reduction (lb/yr)
Aldi	0010	Infiltration	1,937	36.2%	312
American St. Jughandle	0020	Water Quality Basin	5,433	60.1%	3,267
Auto Zone	0030	Water Quality Swale	1,461	80.7%	1,180
Bank of America	0040	Water Quality Basin	4,552	72.6%	3,303
Bible Fellowship	0050	Infiltration Basin	22,263	80.9%	18,005
Bon-Ton	0060	Infiltration Basin	39,901	51.8%	20,677
Brooke Apartments	0070	Infiltration Basin	59,875	34.6%	20,734
Brynwood #2	0080	Infiltration Basin	31,630	42.0%	13,279
Chili's	0090	Water Quality Basin	3,934	22.9%	901
Computer Design	0110	Infiltration Basin	7,094	83.0%	5,889
DVS-B	0140	Water Quality Basin	4,908	57.6%	2,828
Eagle Point Estates	0150	Infiltration Basin	16,869	38.7%	6,521
Eagle Point Plaza	0160	Sand Filter	4,468	15.8%	705
EAMCO	0170	Water Quality Basin	2,630	77.4%	2,035
Egyptian Hills	0180	Water Quality Basin	35,378	20.0%	7,059
Forman Mills	0190	Water Quality Basin	49,454	18.9%	9,322

Project	Project ID	BMP Type	Sediment Load to the BMP (lb/yr)	Percent Reduction (%)	Proposed Load Reduction (lb/yr)
Garden of Peace	0200	Infiltration Basin	379	84.9%	322
Grace Baptist Church	0210	Water Quality Basin	4,229	15.4%	652
Hess (Speedway)	0220	Water Quality Basin	499	21.7%	108
Islamic Center	0230	Infiltration Basin	4,379	75.2%	3,293
Korean Church	0240	Infiltration Basin	1,704	63.1%	1,074
Lowes	0250	Water Quality Basin	13,550	58.5%	7,926
LV Ice Arena	0260	Water Quality Swale	132,095	13.3%	17,623
M&M Landscape	0270	Water Quality Basin	694	75.6%	525
Mac Road Self Storage	0280	Sand filter, Filtrexx® SiltSoxx™	5,009	36.0%	1,803
MacArthur Town Centre	0290	Wetland	183,737	61.5%	112,224
Maryland Court (Jehova's Witnesses)	0300	Infiltration Basin	9,845	18.0%	1,769
Nob Hill	0310	Infiltration Basin	4,039	21.5%	870
Northfield	0320	Infiltration Basin	933	84.9%	792
Northfield OPT	0325	Water Quality Swale, Rain Garden	5,017	45.5%	2,283
Olive Garden	0330	Water Quality Basin	3,406	29.0%	986
Overhead Door	0340	Infiltration Basin	28,374	36.9%	10,467
Overlook Basin and Woodlawn Channel	0350	Infiltration Basin	99,973	51.5%	51,530
Pennsylvania Street	0360	Infiltration Basin or Wet Pond	3,623	22.5%	816
Rolling Hills SUB	0370	Infiltration Basin	21,671	25.6%	5,538
Rolling Hills SURFACE	0375	Infiltration Basin	1,704	84.3%	1,436
Ruffles	0380	Infiltration Basin	2,482	60.9%	1,512
Sidleck	0400	Water Quality Basin	3,301	50.4%	1,663
St. John's #1	0410	Infiltration Basin	1,208	84.9%	1,025
St. Stephens	0420	Infiltration Basin	12,666	55.5%	7,031
STI (Shaw)	0430	Water Quality Swale	8,263	32.4%	2,674
Township 1	0450	Infiltration Basin	11,285	33.9%	3,824
Township 2	0460	Infiltration Basin	4,175	39.0%	1,627
Toys-R-Us	0470	Wet Pond	8,184	25.7%	2,100
Walnut Gardens	0490	None	7,867	13.5%	1,060
Wawa	0500	Infiltration Basin	4,656	73.8%	3,434
WCSD far south	0520	Infiltration Basin	19,841	82.2%	16,303
WCSD south	0540	Water Quality Swale, Rain Garden	12,955	40.1%	5,198
WCSD west	0550	Water Quality Swale	45,631	17.9%	8,189

Project	Project ID	BMP Type	Sediment Load to the BMP (lb/yr)	Percent Reduction (%)	Proposed Load Reduction (lb/yr)
WCSD west (half option)	0555	Water Quality Swale	34,999	12.2%	4,287
Weis	0560	Water Quality Basin	13,522	45.2%	6,109
Whitehall Shopping Center	0570	Infiltration Basin	14,589	49.2%	7,174
Whitehall Square	0580	Water Quality Basin	14,080	44.6%	6,281
Whitehall Mall East	0590	Water Quality Swale	4,333	8.6%	373
Whitehall Mall North	0600	Water Quality Basin	15,467	10.8%	1,671
Whitehall Mall West	0610	Water Quality Basin	5,483	52.6%	2,886
Windsor Court	0620	Infiltration Basin	1,189	58.6%	697
Ruch St Stream Rest	0640	Stream Restoration	600 ft at 44.88 lb/ft		26,928
Clear Stream Dr St R	0650	Stream Restoration	700 ft at 44.88 lb/ft		31,416
Total					**481,517**

The total sediment reduction achieved by implementing the proposed BMPs in Table 5 totals 481,517 lb/yr, thereby exceeding the 10% reduction target of 470,309 lb/yr (Table 6). Greater reductions than the minimum requirements mandate are proposed due to the following important considerations:

- The BMPs and their associated sediment reduction values are estimated from planning level analysis and will be refined throughout the permit term
- Certain projects may achieve more or less sediment reductions than conceptually calculated
- Unforeseen projects may be added to the PRP as new opportunities arise
- Certain projects may prove to be entirely unfeasible due to utilities, land acquisition, permitting obstacles, or any number of unanticipated constraints

Overall, the implementation of the PRP will be dynamic in nature, and as such Whitehall Township sought to be conservative by putting forward a wealth of potential projects. However, Whitehall Township is not obligated to achieve any greater sediment reduction than the minimum 10% requirement established by the PADEP.

Table 6 – Sediment Load Reduced by Proposed BMPs to Meet the Sediment Reduction Target

Final Adjusted 10% Sediment Target (lb/yr)	Sediment Load Reduced by Proposed BMPs (lb/yr)
470,309	481,517

Section F – Identify Funding Mechanisms

The PRP Instructions on page 8 states the following:

> Prior to approving coverage DEP will evaluate the feasibility of implementation of an applicant's PRP. Part of this analysis includes a review of the applicant's proposed method(s) by which BMPs will be funded. Applicants must identify all project sponsors and partners and probable funding sources for each BMP.

As described above, the implementation of the PRP over the 2018 to 2023 permit term will be dynamic in nature, and unforeseen changes or opportunities may occur. As of the time of PRP submission, Whitehall Township anticipates that the source of revenue for implementation of all the BMPs in this PRP will be the general fund, except those that are supplemented by grants.

Section G – Identify Responsible Parties for Operation and Maintenance of BMPs

The PRP Instructions on page 8 in Section II.G state that "once implemented the BMPs must be maintained in order to continue producing the expected pollutant reductions" and requires that PRPs identify the following for each selected BMP:

- The party(ies) responsible for ongoing operation and maintenance (O and M);
- The activities involved with O and M for each BMP; and
- The frequency at which O and M activities will occur

As of the time of submission of this document, Whitehall Township or contractors operating on behalf of Whitehall Township, are anticipated to perform the O and M on all of the BMPs in this PRP. However, once again, the implementation and maintenance of BMPs in this PRP will be dynamic and unanticipated opportunities may arise from which O and M of certain, or all, practices may be performed by another party. Such changes will be documented in MS4 Annual Reports.

As each BMP is selected for implementation and a specific design is created, the O and M requirements (including the frequency of the activities) will be specifically tailored to that BMP and clearly defined, along with the responsible party. The design specific O and M activities and verification that such activities have been performed will be provided in the Annual MS4 Status Reports submitted under the permit.

The two main BMPs that are utilized to achieve the mandatory sediment pollution reductions are stormwater basin retrofits and stream restoration. The following basic O and M requirements for these practices are provided below and will be used as the starting point for defining the design specific O and M requirements throughout the permit term.

Stormwater Basin Retrofits

Considerations for effective inspection, operation, and maintenance of are provided below.

- A site-specific O&M plan that includes the following considerations should be prepared by the designer prior to putting the bioretention practice into operation:
    - Operating instructions for outlet component
    - Vegetation maintenance schedule
    - Inspection checklists
    - Routine maintenance checklists
- Adequate access to all facilities for inspection, maintenance and landscaping upkeep.
- The surface of the basin area may become clogged with fine sediment over time. Core aeration or cultivating of non-vegetated areas may be required to ensure adequate filtration.
- Basin areas should not be used as dedicated snow storage areas:
    - Areas designed for infiltration should be protected from excessive snow storage where sand and salt is applied.
- In areas of high salt use in the winter the basin area should be planted with salt tolerant and non-woody plant species.
    - Basin areas should be periodically inspected for sediment build-up on the surface.

Recommended Maintenance Activities

- During establishment
    - Water plants as needed unless rainfall is adequate.
    - Replace dead plant material.
- As needed
    - Prune and weed to maintain appearance and plant survival
    - Replace mulch as needed
    - Remove trash and debris
    - Replace vegetation whenever percent cover of acceptable vegetation falls below acceptable levels
- Semi-annually
    - Inspect inflow and overflow points for clogging; remove any sediment and debris
    - Inspect for erosion or gullying as necessary
    - Evaluate the health of plant material and replanted as appropriate to meet project goals
    - Remove any dead or severely diseased vegetation
    - Cut back and remove previous year's plant material and remove accumulated leaves if needed (or controlled burn where appropriate).

Stream Restoration

Stream restoration in the broadest sense is a set of activities that aim to restore the natural state and functioning of the stream system to support, biodiversity, recreation, flood management and landscape development. Stream restoration typically involves the application of fluvial geomorphology to create stable channels that maintain a state of dynamic equilibrium among water, sediment, and vegetation such that the channel does not aggrade or degrade over time. Stream restoration projects may or may not include substantial floodplain connection. While there are a variety of approaches the stream restoration some common considerations for effective inspection, operation, and maintenance considerations for stream restoration are provided below.

Recommended Maintenance Activities

- During establishment
    - Replace dead plant material.
    - Remove litter and debris
- As needed
    - Prune and weed to maintain appearance and plant survival
- Semi Annual
    - Regular inspections should be undertaken after significant storm
        - Inspect structural elements (weirs, rock veins, etc.)

Conclusion

The PADEP's MS4 Requirements Table lists Whitehall Township as responsible to create and implement a Pollution Reduction Plan per Appendix E within the 2018 MS4 PAG-13 General Permit. Appendix E requires that the Township reduce sediment pollution by 10% from the land areas with stormwater discharge to surface waters considered impaired for sediment or nutrients. The Township has created this Pollution Reduction Plan for submittal with the Notice of Intent to renew general permit coverage.

Analysis has determined that the 10% sediment reduction for Whitehall Township is 470,309 lb/yr. In order to accomplish this reduction, Whitehall Township has proposed two primary BMP types: stormwater basin retrofits and streambank restoration. Basin retrofits were chosen due to the cost effectiveness of increasing pollution reduction on lands that are already devoted to stormwater management. Streambank restoration was chosen due to the significant sediment reductions that can be achieved by this practice. In total, 57 basin retrofits and two stream restoration projects are proposed.

By implementing all of the proposed stormwater projects in this Pollution Reduction Plan, conceptual level calculations show that Whitehall Township will reduce their sediment discharge by 481,517 lb/yr, thereby exceeding the minimum sediment reduction target of 470,309 lb/yr. Throughout the 2018 to 2023 MS4 permit term the implementation of the PRP will be dynamic in nature, as actual designs are created and BMPs installed, there may prove to be more or less sediment reduction accomplished than was conceptually calculated. Additionally, there may be unforeseen BMP opportunities that present themselves, and unanticipated obstacles inhibiting the installation of certain BMPs. Therefore, Whitehall Township sought to be conservative by putting forward more projects than the minimum required. However, Whitehall Township is not obligated to achieve any greater sediment reduction than the minimum 10% requirement established by the PADEP.

Appendix A – BMP Summary Sheets

Aldi (0010)

Table 1. Background Information

BMP Type	Latitude	Longitude
Infiltration	40.621659	-75.479670

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.05	1,839	1,930
Pervious	0.03	264.96	7
Total	1.08		1,937

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.011	0.13	20.1%	390.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.023	0.26	36.2%	702.2	312.2

BMP Summary

This very small basin captures the runoff from a portion of the roof of the adjacent building. The yard inlet within it is set about six inches above the basin floor, causing the basin to act as an infiltration basin. It appears there is a small underground vault beneath the basin.

As is, it provides some treatment as outlined above. However, it could also be retrofit for greater treatment, making it a filtration practice, or simply increasing the potential ponding depth. Some native plants would also provide benefit. The potential benefit is quite small, likely meaning it is not worth the mobilization and modification cost.

American St. Jughandle (0020)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.637846	-75.488272

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.76	1,839	5,072
Pervious	1.36	264.96	360
Total	4.12		5,433

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.152	0.66	60.1%	3,267.2	3,267.2

BMP Summary

Currently this location acts simply as conveyance, but could easily be upgraded to provide some treatment. If the median area is excavated to create some basin area, and either a berm or outlet structure is added to the southwest pipe (outlet), temporary storage and treatment, and even some infiltration, is possible. Due to its location, the staging for any proposed construction activities would be quite constrained. Likely utility conflicts were not apparent, though there are several lights and other improvements nearby, so extra care during excavation is advised. Also, to maintain sight lines in the busy traffic intersection, any vegetation should be very low height and low maintenance.

Auto Zone (0030)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.660771	-75.509624

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.64	1,839	1,173
Pervious	1.09	264.96	288
Total	1.73		1,461

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.075	1.41	80.7%	1,179.6	1,179.6

BMP Summary

Currently the Auto Zone site runoff follows two general paths. One includes the building roof which, along with a portion of the runoff from S Church St., flows around the parking lot, crosses under the driveway entrance along MacArthur Rd., and continues north alongside MacArthur Rd. The other includes most of parking lot and driveway entrances, and drains off-site to the north, into the conveyance ditch alongside MacArthur. The conveyance channel in front of Auto Zone could be retrofit with either a rain garden or water quality swale (likely a dry swale given soil type). The eventual drainage destination on the adjacent property to the north is currently unused, but presumably has some commercial use or purpose for eventual development.

Bank of America (0040)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.634527	-75.489321

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.37	1,839	4,354
Pervious	0.75	264.96	198
Total	3.11		4,552

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.230	1.16	72.6%	3,303.2	3,303.2

BMP Summary

The primary detention basin, which has a gabion wall, outlets to an open basin. Both of these areas have potential for retrofit. Calculations are based on a basin floor area of 10,000 square feet, which is comprised of two 5,000 sf basins. Either or both of these could be retrofited. If only retrofitting one, use half the volume for pollutant load reduction calculations.

Adding a riser structure to the outlet pipe, or even more simply, adding a berm around it, will detain some water. We recommend a ponding depth of 12 inches. Though the soils are compacted urban soils, there does appear to be some infiltration potential here. To ensure drawdown times are fast enough, a small upturned perforated standpipe from behind the berm (downstream) into the primary basin (upstream) will allow a slow drawdown creating an extended detention basin, which combined with some added native vegetation will provide an effective water quality treatment practice.

A similar retrofit for the lower basin is possible, though there is greater potential for a rain garden at the lower basin. Due to potential freeboard concerns, the ponding area of the lower basin should be outfitted with a robust overflow weir to the outlet pipe.

The outlet of the upper basin leads to the lower basin, and the outlet of the lower basin leads to Forman Mills (0190) basin.

Bible Fellowship (0050)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.639022	-75.510416

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	10.05	1,839	18,479
Pervious	14.28	264.96	3,784
Total	24.33		22,263

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
1.194	1.43	80.9%	18,004.7	18,004.7

BMP Summary

This large basin has several standpipes installed in the basin floor for unknown purpose. The purpose for these installations may guide the potential retrofit.

If the soils infiltrate well, this basin has the potential to be a significant benefit by way of infiltration. If site conditions allow, the entire basin could have an average ponding depth of 12 inches and function as an infiltration basin; berms could be built from in-situ soils, requiring only minimal excavation, and no haul and spoil. If the soils do not infiltrate well, depending on the available head relative to the outbound storm drain system, there may be a large filtration potential. The primary inlet pipe is a couple feet above the low-elevation outlet, and therefore a surface sand filter located at the inlet, contained by a berm built from in-situ soils, is one option for retrofit using much less than the total footprint of the basin.

Bon-Ton (0060)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.663361	-75.514358

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	19.64	1,839	36,123
Pervious	14.26	264.96	3,778
Total	33.90		39,901

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.717	0.44	51.8%	20,676.6	20,676.6

BMP Summary

This large basin with a very large commercial/industrial contributing drainage area offers a lot of opportunity. The simplest retrofit would be raising the low-elevation orifice to create some ponding, fostering infiltration. A more holistic approach would be to use some of the available in-situ soils to build berms to create pocket ponds, wetland cells, and increase the flow path from the southwest inlet. Provided the underlying soils would allow a wetland system to be constructed, this would offer significant ecosystem services advantages over the infiltration basin approach. However, it may add cost and potential challenges to neighboring properties and roadways with the increased wildlife presence. An infiltration basin could also invite some additional wildlife presence, even if just temporarily.

Brooke Apartments (0070)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.629445	-75.501216

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	27.83	1,839	51,172
Pervious	32.85	264.96	8,703
Total	60.67		59,875

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.574	0.25	34.6%	20,734.3	20,734.3

BMP Summary

One of the inlets is very close to the outlet, short-circuiting the potential flow path in the long, narrow basin. Installing a blocking plate with multiple orifices over the existing lower orifice of the outlet structure – a 42”x16” rectangular opening – will offer some extended detention and/or infiltration function to the basin. A series of small berms constructed from in-situ soil can provide some pocket pools for ponding, allowing more infiltration and pollutant removal.

While the outfall was not found, location strongly suggests that the outfall is directly into, or immediately uphill from, Jordan Creek. Extended detention at this basin is highly recommended to protect against channel and bank erosion of Jordan Creek, especially given the large drainage area of the basin.

Care should be taken to ensure that whatever retrofit is implemented does not adversely affect the adjacent town homes.

Brynwood #2 (0080)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.647735	-75.510882

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	10.08	1,839	18,542
Pervious	49.39	264.96	13,087
Total	59.48		31,630

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.269	0.32	42.0%	13,279.5	13,279.5

BMP Summary

The site constraints and residential location make retrofit options limited, but due to the large drainage area, and available basin floor area, a retrofit here likely provides good benefit-to-cost ratio. Minor earthwork using in-situ soils to lower the basin floor slightly, while building short berms to create some ponding, will allow for some infiltration and sediment settling. Modifications to the outlet structure could include blocking the lower portion of the trapezoidal opening in the lower structure, and adding an upturned, perforated standpipe to the low-elevation orifice to create some extended detention. This could be done in concert with, or exclusive of, the earthwork. The outlet structure configuration, with two outlet structures and a robust overflow weir, appears to allow a little flexibility in design pool elevations despite the proximity to the roadway.

Chili's (0090)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.634700	-75.477621

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.11	1,839	3,872
Pervious	0.23	264.96	62
Total	2.34		3,934

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.029	0.16	22.9%	900.5	900.5

BMP Summary

Adding small check dams along the sloped channel from the inlets will allow some sediment settling and increase storage time. Adding a perforated standpipe to the low-elevation orifice with perforations starting 12 inches above the basin floor will create some ponding for sediment settling, and also some extended detention for volumes beyond that first foot of detention.

The potential water quality benefit is rather small, thus calling into question the cost effectiveness of mobilizing to retrofit this particular basin.

Computer Design (0110)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.675067	-75.503220

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.02	1,839	5,558
Pervious	5.80	264.96	1,537
Total	8.82		7,094

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.436	1.73	83.0%	5,889	5,889

BMP Summary

If soil conditions allow, a very simple retrofit option for this open basin is to simply block the bottom 12 inches of the tapered orifice in the outlet structure. This would provide significant infiltration potential. USDA/NRCS Soil Survey suggests B soils, there is ample staged outflow potential in the existing outlet structure which is in good condition, and the overflow weir is large and robust.

DVS – B (0140)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.673822	-75.504223

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.52	1,839	4,630
Pervious	1.05	264.96	278
Total	3.57		4,908

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.126	0.60	57.6%	2,828.1	2,828.1

BMP Summary

This basin captures runoff from most of the Scheuerman Excavating property. There is no practical option for modification to the basin itself, but raising the low-elevation outlet or adding an upturned perforated standpipe to it can create some retention or extended detention, or both, to provide water quality treatment. The dense brush in the basin will aid the treatment capability of the basin, but adding retentive capacity to the basin may make maintenance more difficult, given the steep side slopes of the basin walls.

Eagle Point Estates (0150)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.680731	-75.518224

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	7.72	1,839	14,190
Pervious	10.11	264.96	2,678
Total	17.82		16,869

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.184	0.29	38.7%	6,520.6	6,520.6

BMP Summary

One of two inlet pipes short-circuits the basin to the outlet, and the basin floor is roughly one foot above the outlet invert. Minor earthwork moving some soil from the basin floor to build a berm around the outlet structure would create some retention ponding, allow infiltration and sediment settling, and have minimal or no effect on rate control of the basin. Alternatively, modifying the outlet structure by raising the invert of the low-elevation orifice, partially blocking it, and/or adding a perforated standpipe, will lead to some retention ponding and potentially some extended detention.

Eagle Point Plaza (0160)

Table 1. Background Information

BMP Type	Latitude	Longitude
Underground vault	40.685051	-75.521737

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.22	1,839	4,076
Pervious	1.48	264.96	392
Total	3.70		4,468

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.020	0.11	15.8%	705	705

BMP Summary

The current stormwater management at this location appears to be a small underground vault, much of which is in a state of disrepair with rusted and broken screens or grates. The site is very constrained by the adjacent parking lot and MacArthur Road. However, a surface sand filter is likely a viable option. One possible retrofit option includes placing a stilling pool at the north end of the practice where the swale enters the proposed BMP area, installing overflow structures in place of the existing yard inlets, and connecting an underdrain system for the sand filter to the existing storm drain system.

The potential benefit at this location is quite small, and therefore likely not worth the mobilization cost. However, if and when the current infrastructure needs to be replaced for its own sake, it may make sense to replace it with something providing some water quality treatment, even though it would be relatively little.

Due to the location, any construction staging would be fairly tight. Also, utility conflicts are of particular concern if doing any significant excavating. Utility and sign poles are immediately adjacent to the BMP location.

EAMCO (0170)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.674688	-75.503460

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.19	1,839	2,197
Pervious	1.63	264.96	433
Total	2.83		2,630

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.172	1.73	77.4%	2,034.6	2,034.6

BMP Summary

Two simple retrofit options for this detention basin are either doing a little earthwork moving some soil from the basin floor to build a short (12-inch) berm around the outlet structure to create some ponding for sediment settling and possibly some infiltration, or adding an upturned, perforated standpipe to the existing low-elevation orifice, ideally with perforations starting at least six inches above the basin floor, ideally 12 inches, for some retention and some extended detention treatment.

Egyptian Hills (0180)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.683038	-75.536538

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	12.52	1,839	23,022
Pervious	46.63	264.96	12,356
Total	59.15		35,378

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.006	0.01	0.1%	30.4

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.147	0.14	20.0%	7,089.7	7,059.3

BMP Summary

This basin currently has a little bit of wetland vegetation that has established itself along the flow path between the inlet and the outlet structure. The low-elevation orifice is a 24-inch diameter hole which does little to nothing for rate control in heavy storms. A recommended low-cost retrofit option is to block the bottom half of this orifice to create 12 inches of long-term detention, or retention if the soils infiltrate. Likely, based on observed conditions, this would simply expand the wetland area to the rest of the basin floor, and treat significantly more volume.

This basin may receive effluent from Township 2 (Site ID: 0460). If retrofitting Township 2 and Egyptian Hills, the pollutant removal accounting may have to factor in series treatment for accurate pollutant concentrations.

Forman Mills (0190)

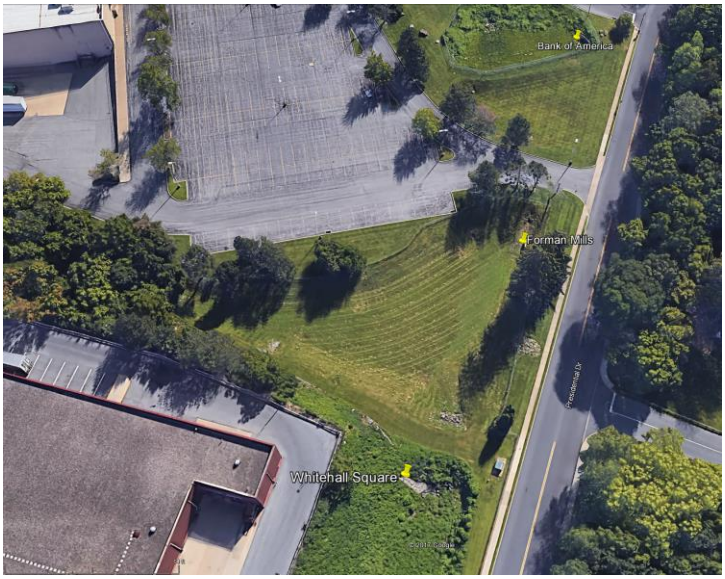

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.634607	-75.490133

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	26.15	1,839	48,096
Pervious	5.13	264.96	1,358
Total	31.28		49,454

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.287	0.13	18.9%	9,322.4	9,322.4

BMP Summary

Several inlets feed this basin. The drainage area used for calculations for this basin is the area that feeds this basin exclusively, though inlets do enter this basin from the adjacent stormwater basins' outlets – both Whitehall Square (Site ID: 0580) and Bank of America (Site ID: 0040) drain through this basin. Thus, any hydraulic, freeboard, and similar safety-oriented calculations should account for the extra potential volume. There are retrofit opportunities that would create ponding and treatment for the Forman Mills drainage area exclusively, allowing the effluent from 0580 and 0040 to bypass the treatment practice.

A retrofit option which would treat exclusively the Forman Mills drainage area is to build a berm just north of the line between the Whitehall Square outlet and the Bank of America outlet, thus separating those flow paths and the outlet structure from a newly-formed detention basin for Forman Mills. This is a low-cost option, achieved simply by a little earthmoving within the basin, and perhaps stabilizing a dedicated overflow weir with some riprap.

A retrofit option that would provide some treatment for all of the water coming through the Forman Mills basin is to either replace the outlet structure with one which provides some extended or long-term detention, to build a small berm around just the outlet structure, or to modify the current outlet structure in such a way as to block the orifice and raise a new one, or possibly to utilize a perforated standpipe. It is worth noting that the existing outlet structure is simply a 21-inch concrete pipe in/through a headwall, behind which there is some slump and erosion occurring. Replacing this outlet structure may soon be necessary, regardless of retrofit plans.

Garden of Peace (0200)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.625298	-75.468600

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.00	1,839	0
Pervious	1.43	264.96	378
Total	1.43		379

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.046	2.5	84.9%	321.5	321.5

BMP Summary

Though there is a basin at this location, the area of the basin itself is somewhat poorly defined. The area seems to be suffering from lack of maintenance. Given the small drainage area and lack of impervious cover, this is not a significant issue, but it is a consideration for retrofit. If the basin was retrofit to treat runoff from the contributing drainage area under current conditions, the benefit would be minimal, and therefore likely not worth the time and money.

The outlet structure is a 24-inch high grate on a concrete box with a 12-inch diameter hole as the low-elevation orifice. It does not appear that freeboard would be an issue, though no detailed site survey was performed. The nearby berms and roadway appear to be 5-6 feet higher than the basin floor, leaving 3-4 feet above the overflow grate in the outlet structure.

Grace Baptist Church (0210)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.657691	-75.490660

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.95	1,839	3,578
Pervious	2.46	264.96	651
Total	4.40		4,229

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.017	0.11	15.4%	652.5	652.5

BMP Summary

This basin offers very limited retrofit options and opportunity, although one of the retrofit options is very simple. Adding an upturned, perforated standpipe with perforations starting approximately 12-18" above the current low-flow orifice invert would offer some detention, sediment settling, and possible even a little infiltration. A more involved retrofit option would be to create a small surface sand filter, but this option likely does not offer a good benefit:cost ratio since the potential benefit is quite small, and mobilization for anything other than a small plumbing project (adding a standpipe) is probably more expensive than it is worth.

Hess (Speedway) (0220)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.643190	-75.473344

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.27	1,839	494
Pervious	0.02	264.96	5
Total	0.29		499

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.003	0.15	21.7%	108.3	108.3

BMP Summary

This basin is so small, and treats such a small drainage area, that it is almost certainly not worth retrofitting. With that caveat, it is possible to modify the outlet structure by adding a perforated standpipe to create some detention. Modifying the outlet structure is the only apparent option.

Islamic Center (0230)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.637125	-75.507463

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.23	1,839	4,098
Pervious	1.06	264.96	281
Total	3.29		4,379

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.188	1.01	75.2%	3,292.6	3,292.6

BMP Summary

This detention basin offers a very simple and low-cost retrofit opportunity like many others; simply adding an upturned, perforated standpipe with perforations beginning 12 inches above the existing invert will create some ponding for retention and infiltration. There is a little erosion at the north surface inlet next to the garden and shed which should probably be addressed so that it does not worsen.

Korean Church (0240)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.638954	-75.507354

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.88	1,839	1,611
Pervious	0.35	264.96	93
Total	1.23		1,704

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.046	0.63	63.1%	1,074.5	1,074.5

BMP Summary

This basin is very small, not well suited for expansion, and somewhat unconventional in its construction. Currently, there is simply a V-notch weir at the low point of a depression. In order to get significant retention in this basin, a berm would have to be built. This could likely be done using in-situ soils. With an earthen berm and weir, a 2,000 square foot rain garden could be constructed, providing treatment for over a half inch per acre of impervious cover. This would provide a rather small amount of water quality benefit, so cost:benefit ratio may be a deciding factor in whether or not to retrofit this BMP.

Lowe's (0250)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.646297	-75.497768

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.88	1,839	12,649
Pervious	3.40	264.96	901
Total	10.28		13,550

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.356	0.62	58.5%	7,925.7	7,925.7

BMP Summary

This basin is quite long and narrow, and the outlet is a 48-inch pipe with a trash rack over it. A simple retrofit option for this basin is to block the bottom 18 inches of the outlet pipe to cause ponding behind it. Due to the length and gradual slope of the basin, to take advantage of the entire footprint of the basin floor, it is recommended to add 18-inch check dams along the flow path at each 12-inch rise in elevation of the basin floor, along the flow path from the inlets to the outlet pipe. This would result in approximately 12 inches of ponding throughout the basin.

LV Ice Arena (0260)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.653372	-75.494007

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	61.11	1,839	112,381
Pervious	74.41	264.96	19,714
Total	135.52		132,095

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.433	0.09	13.3%	17,622.6	17,622.6

BMP Summary

This conveyance channel appears to receive runoff from a very large drainage area, including that from some other BMPs such as WCSD far south (Site ID: 0520). The drainage area and volume calculations are based on the LV Ice Arena drainage area excluding any other BMP drainage areas which are within it. Pollutant load and removal accounting may have to factor in series treatment if multiple BMPs treat the same runoff before final outfall.

The conveyance channel currently appears to have a robust geotextile lining, but it is seriously exposed in many places, and erosion is progressing despite its presence. The following retrofit recommendation would not only provide water quality treatment, but stabilize and strengthen the channel and reduce the chances of repeated erosion and vegetation damage.

Excavating a two-foot-deep basin right at the top of the channel just after the culvert pipe outfall with a confining berm and overflow weir to the channel below, would provide significant storage and sediment settling for pretreatment. The channel itself would need some light grading to ensure slope are even and transitions are smooth. Vegetation should be reestablished, ideally with deep-rooted and strong, pollutant- and salt-resistant grasses and sedges. Check dams 18 inches tall, placed at every 12-18 inches of elevation drop, will help slow the flow rate, dissipate some erosive energy, and offer more ponding and sediment settling. Some infiltration will also likely occur based on the soils likely present according to the NRCS Soil Survey.

M&M Landscape (0270)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.675006	-75.505199

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.34	1,839	631
Pervious	0.24	264.96	63
Total	0.58		694

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.041	1.45	75.6%	524.8	524.8

BMP Summary

This small basin captures some runoff from the back parking and utility lot and a portion of the building, at M&M Landscape. The pipe inlet at the low end completely short-circuits the basin. This basin is quite small, as is the drainage area it treats, making the potential pollutant reduction quite small as well. If a retrofit is performed, a simple series of berms and check dams to temporarily pond the runoff is probably the most sensible and cost effective option. A berm around the outlet structure to pond the water coming from the inlet pipe and a check dam or berm each 12-18 inches higher up in the basin floor will provide some extended detention, possibly some infiltration, and modest water quality treatment.

Mac Road Self Storage (0280)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.620090	-75.482077

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.42	1,839	4,448
Pervious	2.12	264.96	560
Total	4.53		5,009

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.057	0.28	36.0%	1,803	1,803

BMP Summary

This basin has some unusual constraints regarding retrofitting. First, any extended detention or retention could present a risk for the north/northeast slope downhill from the practice. There is a retaining wall of sorts that appears to already be suffering some structural issues. Second, while there is plenty of available head from the basin floor to the eventual outfall along Mickley Road, excavating would be both difficult due to the site layout, and problematic due to the gabion basket structure of the walls containing the basin.

Our most confident and conservative recommendation for a retrofit would be to add one or two rows of a product like **Filtrexx® SiltSoxx™** to trap the sediment, but allow fast flow-through so as not to wet, soften, and threaten the adjacent slopes. Another option would be to create shallow surface sand filters at each of the inlets into the basin, excavating a small amount if/as necessary. If a more conventional retrofit is desired, such as installing a perforated standpipe for extended detention or excavating to allow for a deeper filter practice like a whole-basin sand filter or even a bioretention, we strongly recommend having a geotechnical analysis performed to ensure that this approach will not cause problems or safety issues.

MacArthur Town Centre (0290)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.641412	-75.495875

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	83.50	1,839	153,55
Pervious	113.91	264.96	30,182
Total	197.41		183,737

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.055	0.01	0.4%	772.5

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
4.827	0.69	61.5%	112,996.4	112,223.9

BMP Summary

This is an extremely large basin at nearly 5 acres, with a nearly 200-acre drainage area. Currently, there are some small, established patches of wetland vegetation mostly near the inlets, covering approximately one eighth of the basin floor area. Overall, the basin appears to stay rather dry. Most of the basin floor is 1.5 to 2.0 feet above the elevation of the invert of the low-elevation orifice of the outlet structure.

This appears to be an ideal site for a bona fide wetland. Provided the soils and water balance calculations will accommodate a wetland, there is enough room around this basin that wildlife will not be threatened by or interfere with traffic. If portions of the basin area are conducive to establishing wetland habitat, and others are not, this basin is large enough to accommodate both wetland and infiltration practices, increasing the potential for water quality treatment. Geotechnical investigations are recommended.

Volume calculations and pollutant removal projections are based on an average 12-inch treatment depth over the basin floor. Planned properly, we believe that no borrow or spoil will be needed; the in-situ soils should be able to be moved around within the basin to create pools, shelves, berms, and other water management structures. Due to its size, earthwork here should be fairly easy to stage logistically.

The drainage area for this BMP appears to include the drainage area for Walnut Gardens (Site ID: 0490). Thus, if implementing water quality retrofits at both locations, it may be necessary to account for the series treatment of the runoff originating within the Walnut Gardens contributing drainage area. If a retrofit is only implemented at the MacArthur Town Centre and not Walnut Gardens, the pollutant removal would be approximately 3,000 pounds greater for sediment removal.

Maryland Court (Jehovah's Witnesses) (0300)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.628653	-75.475907

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.75	1,839	8,728
Pervious	4.22	264.96	1,117
Total	8.96		9,845

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.046	0.12	18.0%	1,769.4	1,769.4

BMP Summary

This basin, though listed as "Maryland Ct.," was actually at the edge of the parking lot of the Kingdom Hall of Jehovah's Witnesses at 502 7th St. This is a small depression basin with only a pipe as an outlet structure. Runoff enters through pipes from roof gutters under the parking lot, and at the surface from two gentle conveyance swales at the north and south sides of the parking lot, most entering along the south side of the parking lot after flowing down Vermont Street.

The downstream side of the depression is a very low berm separating the church property from the apartment complex to the west of it, at the end of Maryland Court. A representative of the church who was on site at the time of the site visit, Jim Gattone (phone number: 484-273-5259), explained that the church would like to be able to build up the berm to help prevent water from overtopping it and flooding the adjacent Maryland Ct. apartments, and that the church would likely be amenable to retrofitting with a larger, more effective practice, such as a rain garden or other infiltration practice.

Nob Hill (0310)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.622613	-75.488773

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.95	1,839	3,582
Pervious	1.73	264.96	457
Total	3.67		4,039

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.023	0.14	21.5%	870.4	870.4

BMP Summary

This is a small basin with steep, riprap-lined sides. Access is not easy, even on foot. Retrofitting is possible, though not easy, and would likely come with an unattractive benefit:cost ratio.

There is sufficient head from the inlet pipes to the outlet invert to install a surface sand filter. Alternatively, since the soils are probably type B, reconfiguring the outlet to create some ponding would probably foster some infiltration. Adding a perforated standpipe to the existing low-elevation orifice, with perforations starting 12 inches above the current invert, would be the simplest outlet structure modification to change the basin's function.

Northfield (0320, 0325)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.651610	-75.523936

Table 2. Sediment Load to the BMP (for just the existing basin)

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.43	1,839	791
Pervious	0.54	264.96	142
Total	0.97		933

Table 3. Existing Condition Calculations (for just the existing basin)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations (for just the existing basin)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.09	2.5	84.9%	792.1	792.1

BMP Summary

Though retrofitting the basin at Northfield is an option, it offers little benefit. A larger drainage area and alternative BMP location are options. Retrofitting the existing basin with a raised outlet and perhaps different vegetation would capture runoff from portions of a couple residential parcels and about half of Stecasso Court and cul-de--sac.

Adding a water quality swale and rain garden along Ringer Road between Stecasso Court and the border of the farm parcel directly to the north would capture both the runoff from the aforementioned drainage area that flows through the existing basin, runoff from an additional 4-6 residential parcels, along with the other half of Stecasso Ct. This would provide approximately three times the sediment removal benefit. The loading and sediment removal numbers shown in the tables on the previous page are based on retrofitting just the existing basin. The tables below show the loading and removal if electing this latter retrofit option, dubbed "Northfield OPT" (Site ID: 0325).

The total sediment load reduction reported for all BMPs includes the 0320 option, retrofitting only the existing basin.

Table 2b. Sediment Load to the BMP (for swale and rain garden along Ringer Rd.)

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.92	1,839	3,531
Pervious	5.61	264.96	1,486
Total	7.53		5,017

Table 3b. Existing Condition Calculations (for swale and rain garden along Ringer Rd.)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4b. Proposed Condition Calculations (for swale and rain garden along Ringer Rd.)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.06	0.36	45.5%	2,283.3	2,283.3

Olive Garden (0330)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.635086	-75.476271

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.81	1,839	3,325
Pervious	0.30	264.96	81
Total	2.11		3,406

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.033	0.22	29.0%	986.3	986.3

BMP Summary

Adding a small check dam along the sloped channel from the inlets would allow some sediment settling and storage time. Adding a perforated standpipe to the low-elevation orifice with perforations starting 12 inches above the basin floor would create some ponding for sediment settling and also some extended detention for volumes beyond that first foot of detention. A secondary orifice should be added if the low-elevation orifice is converted for some extended detention.

There is an irrigation control valve in the swale portion of the basin. Other utility conflicts were not identified, and the extent of this installation is unknown.

Overhead Door (0340)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.665660	-75.520032

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	12.31	1,839	22,640
Pervious	21.64	264.96	5,734
Total	33.95		28,374

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.275	0.27	36.9%	10,467.3	10,467.3

BMP Summary

The BMP locations identified for Aloia, Gardner, and Overhead Door are all part of the same drainage system, which leads to only one suitable retrofit opportunity at the downstream end (at Overhead Door). Aloia has an underground detention vault, and Gardner has what appears to be nothing more than a yard inlet in a possible drainage path. Both of these flow to and through a conveyance channel network, under Commerce Drive through a culvert, and into the dry detention basin at Overhead Door. Most or all of the commercial and industrial park on Commerce Drive also drains to this basin through a storm drain network and a series of yard and curb inlets, with the only obvious exception being Choice Precision Machine at the top of the hill, which has its own detention basin to treat runoff from that parcel.

The NRCS Soil Survey suggests B soils, which is consistent with observed conditions. The simplest retrofit option for this basin which would create an infiltration basin would be to block the low-elevation orifice on the outlet structure. The low orifice is an arch-top, 8.5” x 8.5” orifice. The next set of orifices have inverts at 18” above the low-elevation invert. To add 12 inches of retention to this basin, add a steel blocking plate over, or concrete plug in, the low orifice, and drill/bore a new low-flow orifice perhaps 2-3 inches in diameter with the invert at 12 inches above the current one. Alternatively, an upturned, perforated standpipe, with perforations starting 12 inches above the current invert, installed through the current low-elevation orifice and sealed with concrete and caulk, would achieve the same goal. The orifices above the low-elevation orifice appear sufficient to prevent any flooding issues. An employee of Overhead Door who was present during the site visit explained that she has worked at Overhead Door for 20 years, and she has not seen any water accumulate or remain in the basin, except for a vague possibility of extreme storm events.

Overlook Basin and Woodlawn Channel / 0350

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.619474	-75.486438

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	44.38	1,839	81,620
Pervious	69.26	264.96	18,352
Total	113.65		99,973

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
1.607	0.43	51.5%	51,530.1	51,530.1

BMP Summary

With almost 114 acres of contributing drainage area within Whitehall, the Overlook Basin and Woodlawn Channel (which leads into the Overlook Basin) is an excellent retrofit opportunity. With a series of check dams and berms, this BMP has the ability to take advantage of approximately 70,000 square feet of usable swale and basin floor area. Along the Woodlawn Channel, a series of stone check dams will temporarily detain runoff, allowing it to pass, but slowing it down and allowing some sediment settling. This will act as the pretreatment for the practice as a whole. No excavation or other modifications should be required, and this will likely have no discernable impact on the adjacent homeowners. The Overlook Basin itself would also benefit from either a series of berms to create some ponding and allow infiltration and sediment settling, or perhaps a more natural system of pools and shelves which might evolve into a small wetland and wet pond system over time. The simplest and least expensive retrofit is to simply move in-situ soils to build 12- to 18-inch-tall berms to retain ponded water, and effect a meandering flow path for any water actively moving through the system.

Pennsylvania Street (0360)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.681573	-75.518933

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.58	1,839	2,899
Pervious	2.73	264.96	724
Total	4.31		3,623

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.020	0.15	22.5%	815.9	815.9

BMP Summary

This basin is a small, gabion-walled detention basin that, according to visual indicators and a conversation with the current resident, does not noticeably detain any water, even in heavier storms. The GIS drainage area delineation and inlet pipe size suggest the drainage area is large enough to warrant a retrofit, but the cost:benefit ratio is likely the deciding factor. The resident said they were amenable to conversion to wet pond or possibly some infiltration practice like a rain garden. Currently, the BMP is something of an eyesore, and a retrofit offers the possibility of aesthetic upgrade.

Possible retrofits include a small wet pond or a rain garden. A wet pond could be constructed simply by adding an impermeable liner to the current basin floor and gabion basket walls and blocking the low-elevation orifice in the outlet structure. A rain garden would simply involve some soil amendment, mulch top layer, and some native, hydrophilic plants, with the potential also block the low-elevation orifice of the outlet structure to create some ponding potential. Pollutant removal calculations above assume 12 inches of retention and a runoff reduction condition, as would be expected with a rain garden with 9-12 inches of ponding.

Rolling Hills / (0370, 0375)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.680344	-75.534094

Table 2. Sediment Load to the BMP (for surface drainage only)

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.77	1952.17	1,409
Pervious	1.11	309.90	295
Total	1.88		1,704

Table 3. Existing Condition Calculations (for surface drainage only)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations (for surface drainage only)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.142	2.23	84.3%	1,436.0	1,436.0

BMP Summary

Rolling Hills has an odd storm drain connection in that a 20-acre drainage area flows through a storm drain system which flows beneath the basin. The storm drain pipes drain into and through the outlet structure, all below the surface of the detention basin. Tables 2, 3, and 4 show the drainage area, loading, and potential pollutant removal based on only capturing and retaining the surface runoff which enters the basin from the southeast corner of the basin along Fairview Street (Rolling Hills SURFACE, Site ID: 0375). Tables 2b, 3b, and 4b below show the drainage area, sediment loading, and potential pollutant removal including both the subsurface drainage and the surface runoff. In order to take advantage of the larger drainage area, some method for moving the runoff from the underground pipe network to the surface of the basin would be required. There are multiple ways to approach this, but the easiest and least invasive method would be to install a sump pump system, and perhaps an additional vault space to allow a smaller pump to work through larger storm events.

Retrofitting this basin would involve blocking the large yard inlet at the basin floor surface, in front of the raised outlet structure, and perhaps adding another orifice in the standing outlet structure. This would create some ponding for infiltration and sediment settling. To increase the benefit provided by this retrofit, install a sump pump in the structure just upstream of the main outlet structure, connected either to the power supply at an adjacent street light, or possibly a battery pack and solar charger. This sump pump would either need to be a very high flow rate pump, or a vault would need to be added so the runoff does not quickly bypass the pump as it travels through the storm drain system. The tables below show the potential benefit under this hybrid system (Rolling Hills SUB, Site ID: 0370).

The total sediment reduction reported includes the 0375, surface-only retrofit option.

Table 2b. Sediment Load to the BMP (for subsurface and surface drainage)

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	9.96	1952.17	18,316
Pervious	12.66	309.90	3,354
Total	22.62		21,671

Table 3b. Existing Condition Calculations (for subsurface and surface drainage)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4b. Proposed Condition Calculations (for subsurface and surface drainage)

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.142	0.17	25.6%	5,537.9	5,537.9

Ruffles (0380)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.664919	-75.503769

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.94	1,839	1,729
Pervious	2.84	264.96	753
Total	3.78		2,482

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.046	0.59	60.9%	1,512.5	1,512.5

BMP Summary

This small basin is part of a resident's back yard. While there is a retrofit opportunity here, based on a conversation with the homeowner and the neighbor, we suspect the homeowner to be hesitant to allow a retrofit here unless some incentive is offered. We were told that once every three years, the homeowner is charged $50 for inspection, and could be charged more if the inspector finds something that requires attention. This is a nuisance to the homeowner, and any practice that will raise the likelihood or frequency of maintenance or repair is probably going to be met with resistance. With that qualifier, it is possible to simply block and raise the outlet orifice to create some ponding. Retention and infiltration are most likely viable given how short a time the flow path stays wet during storms, according to the homeowner.

Sidleck (0400)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.675818	-75.500703

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.61	1,839	2,970
Pervious	1.25	264.96	331
Total	2.86		3,301

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.063	0.47	50.4%	1,662.9	1,662.9

BMP Summary

This narrow basin has a 3+ percent slope from end to end. In order to create some ponding and detention for the runoff that enters at the top end via a grass swale, check dams or shallow berms would be needed. A shallow berm around the outlet structure, or a perforated standpipe, would add some detention at the bottom end of the basin where the inlet pipe that enters the basin has a negligible flow path to the outlet. Recommended retrofit is a combination of these: perforated standpipe in the low-elevation orifice of the outlet structure with perforations beginning 12-18 inches above the current invert, and check dams across the basin floor at each 12-18 inches of elevation gain moving up (west) in the basin.

St. John's #1 (0410)

Table 1. Background Information

BMP Type	Latitude	Longitude
None	40.663463	-75.500815

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.24	1,839	433
Pervious	2.92	264.96	775
Total	3.16		1,208

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.149	2.5	84.9%	1,025.2	1,025.2

BMP Summary

The identified location for an existing BMP or piece of infrastructure at St. Johns Cemetery appears to be a culvert pipe at the low point of a natural drainage regime which leads under residential parcels, and receives runoff almost exclusively from within the municipal boundaries of Coplay, and not Whitehall. There is no basin at this location, nor any practical method for installing one. The assessment and recommendations below relate only to the cemetery site and ability to install a BMP on that site, capturing runoff from that site.

There is very little impervious area within this site and drainage area. As such, the ability to retain and infiltrate a significant amount of water is somewhat lost in the benefit:cost analysis. With that said, there is available space on the slope downhill from the driveway through the cemetery, and a shallow grass swale already guides water from the upper portion of this parcel past a reasonable area to install a rain garden or infiltration basin, or even a bioretention with an underdrain that outfalls near the large culvert pipe mentioned above. It is unknown whether the cemetery has plan to eventually use this space for additional grave sites. The impervious area is unlikely to increase significantly, so the cost:benefit ratio is likely to stay unattractive or impractical.

St. Stephens (0420)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.646583	-75.510170

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.43	1,839	11,833
Pervious	3.14	264.96	833
Total	9.58		12,666

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.264	0.49	55.5%	7,031.3	7,031.3

BMP Summary

The NRCS Soil Survey suggests B soils, and visual inspection of site conditions reinforces this. The outlet structure already has a decent extended detention orifice configuration. If the basin filled to 27 inches, which is where the first high-rate orifice becomes accessible, the drain time would be approximately 23 hours. This is a very functional rate control configuration, but provides little to no water quality treatment. To increase sediment removal, it is recommended to add shallow (18-inch) berms or check dams along the basin floor from the outlet structure to the eastern end every 12 inches of elevation rise. This will allow pools to infiltrate, while preserving the extended detention function of the basin. In-situ soils can most likely be used for the base of these berms or check dams.

A geotechnical investigation is recommended if retrofitting this basin to ensure no threat to the adjacent parking lot entrance and driveway, which abut the southern edge slope of the detention basin. It would also be advisable to confirm infiltration capacity of the basin in 2-3 locations using something as simple as a hand or powered auger and falling head infiltration test.

STI (Shaw) (0430)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.653434	-75.495084

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.12	1,839	7,577
Pervious	2.59	264.96	686
Total	6.71		8,263

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.078	0.23	32.4%	2,674	2,674

BMP Summary

This is a gravel/riprap channel or flume. Retrofit options are limited. One option is to remove the stone, and establish a well-stabilized, vegetated swale or potentially a bioswale (also called a dry swale) for runoff reduction, with check dams to attenuate flow velocity and energy. Another option is potentially installing a flow splitter and creating an offline water quality basin along the northeast edge of the parking lot along the southeast side of the channel. There is currently some thick vegetation there, though it appears that only a small number of trees with trunk diameters exceeding 4-6 inches are present.

Township 1 (0450)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.686475	-75.530209

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	5.03	1,839	9,258
Pervious	7.65	264.96	2,027
Total	12.69		11,285

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.101	0.24	33.9%	3,823.8	3,823.8

BMP Summary

This is a very residential area, so factors such as mosquito potential and aesthetics should be considered. Retrofitting this basin should be fairly simple; a little earthmoving inside the basin, using in-situ soils to create shallow berms and check dams between inlets and the outlet structure, will offer some retention and according to probable soil type (B) based on NRCS Soil Survey, infiltration and runoff reduction. Extended detention for rate control can also be added by reducing the size of the low-elevation orifice in the outlet structure, once proper safety calculations are performed.

Township 2 (0460)

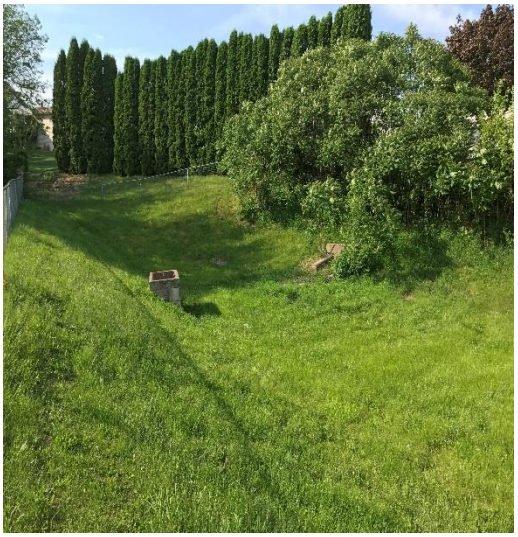

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.686404	-75.534922

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	1.91	1,839	3,510
Pervious	2.51	264.96	665
Total	4.42		4,175

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.046	0.29	39.0%	1,626.7	1,626.7

BMP Summary

This small basin has sufficient head to the outfall that a practice as deep as a bioretention could be constructed, though there is some rock present which may indicate underground conditions. Also, the cost:benefit may not warrant such a practice. A simple retrofit would be to reduce the size of the low-elevation orifice, add a perforated standpipe for extended detention, and to move some of the in-situ soils to create a berm or check dam to pond and retain some water coming from the pipe inlet, which currently short-circuits the basin along a short flow path.

Toys-R-Us (0470)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.634540	-75.478121

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	4.43	1,839	8,141
Pervious	0.16	264.96	43
Total	4.59		8,184

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.069	0.19	25.7%	2,100	2,100

BMP Summary

This detention basin is constrained by concrete walls, the Toys-R-Us parking lot, Grape Street, and Jordan Boulevard. The only obvious retrofit opportunity is to add a blocking plate or half of a standing pipe section to raise the threshold for water to overtop in order to reach the existing outlet pipe. A 12- to 15-inch-tall half-round section of pipe, anchored and sealed against the concrete wall through which the outlet pipe runs, will create some ponding, allowing residence time to settle sediment out. Without reducing the actual outlet pipe size or blocking it, once additional water enters the basin, it will overtop the standpipe (functioning as a check dam or berm, in limited space) and exit the basin at the same rate it does currently. It is important to verify that backing up an additional 12 inches of water will not create upstream problems in the storm drains that lead to the basin, though the elevation of the inlets suggests this is not an issue.

Walmart (0480)

Table 1. Background Information

BMP Type	Latitude	Longitude
Modern detention basin	40.646696	-75.486953

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	14.50	1,839	26,670
Pervious	7.15	264.96	1,895
Total	21.65		28,564

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
2.659	2.2	78.4%	22,389.0

BMP Summary

This basin is a recent addition, and up to modern standards. It appears to include a basin for extended detention and release into the primary treatment area, and perhaps even a reuse component. Overall it is in very good condition. The treatment area of the basin is arranged in such a way that it maintains a long flow path for runoff coming from the inlets to the outlet structure. A large portion of the influent is temporarily stored in the pretreatment basin or forebay, and released at the most upstream end of that elongated flow path. Calculations above are based on the assumption that the basin captures and treats the 2-year storm of 3.27 inches of rain, and given the drainage area parameters, 2.2 acre-inches.

Walnut Gardens (0490)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.638428	-75.499093

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	3.20	1,839	5,893
Pervious	7.45	264.96	1,974
Total	10.65		7,867

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.023	0.09	13.5%	1,059.9	1,059.9

BMP Summary

This is perhaps one of the oddest stormwater BMPs our assessor has seen. The best description is “a stone ramp down to a large, perforated, corrugated metal standpipe.” There is no basin, per se. There is a little storage provided by the depression, but most of what could be described as a basin is filled with the stone and gravel comprising the ramp. The perforations in the standpipe are also large enough and numerous enough to not provide significant extended detention. There is also a section of concrete culvert pipe sitting on the ground at the top of the ramp. Overall, this would best be qualified as an eyesore.

At minimum, the concrete culvert pipe section should be removed. In order to provide some actual detention for rate control, the stone ramp should be removed, and the standpipe should either be replaced or lined with a smaller perforated standpipe with fewer, smaller perforations. Beyond that, creating some retention for runoff reduction is possible, but the stone ramp of course must still be removed from the basin, the soils beneath it (now compacted, most likely) loosened and amended, native vegetation planted, and an outlet structure to pond and detain the water for at least 48 hours should be added.

This appears to be within the drainage area for the MacArthur Town Centre basin. If implementing water quality practices at both locations, pollutant removal accounting may need to be adjusted for this series treatment. We recommend retrofitting MacArthur Town Centre for water quality, and simply removing the unnecessary and waste materials from this site, restoring a natural conveyance system, and adding a standpipe for rate control only.

Wawa (0500)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.650975	-75.499152

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.51	1,839	4,611
Pervious	0.17	264.96	45
Total	2.68		4,656

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.198	0.95	73.8%	3,434.2	3,434.2

BMP Summary

The outlet structure for this basin already has a sufficiently small low-flow orifice, resulting in approximately a 48-hour drawdown time for the water quality storm (1-inch precipitation depth). To better allow some of the finer sediment to settle out, a gravel berm approximately 20-24 inches high would force a longer flow path from two of the three inlets (which currently short-circuit the basin to the outlet), and increase residence time for the runoff coming through those pipes. It would not affect the larger storm events, but would raise the effectiveness of treatment for the water quality storm. See picture below showing a 120-foot long berm in a configuration matching the purpose described above.

WCSD far south (0520)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.643791	-75.505131

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	9.63	1,839	17,705
Pervious	8.06	264.96	2,136
Total	17.69		19,841

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
1.274	1.59	82.2%	16,302.8	16,302.8

BMP Summary

This large, shallow basin offers simple retrofit opportunity in the form of earthmoving within the basin to use in-situ soils, and/or perhaps gravel, to create berms and check dams between the inlets and the outlet structure to retain the runoff that enters the basin, give it time to infiltrate, and thereby reduce the sediment load leaving the basin. Each of the inlets appears to be at least 2-3 feet higher than the outlet invert. Berms or check dams 12-18 inches high, placed at each 12-inch elevation drop from the inlets (or 12-inch elevation gain from the outlet), would offer an average of 12 inches ponding and retention over the basin floor area.

WCSD south (0540)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.647629	-75.502349

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	6.25	1,839	11,500
Pervious	5.49	264.96	1,455
Total	11.74		12,955

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.172	0.33	40.1%	5,197.5	5,197.5

BMP Summary

There is no basin to retrofit at this location, but the conveyance path has several locations where a retrofit could be added, such as a rain garden or perhaps some kind of filtration practice (such as a bioretention or sand filter) if there is sufficient head to the existing storm drain system to install an underdrain. The picture below shows two possible locations for a practice at a size to deliver the pollutant reductions indicated above in Table 4. The soils are potentially type B allowing for infiltration, but may be more compacted urban soils, so any practice which requires infiltration for proper function should follow a geotechnical investigation.

A rain garden in one of the locations shown below will provide both water quality treatment and exposure for educational impact. A water quality swale in the conveyance channel is another option – either a vegetated swale without an underdrain, or a dry swale with an underdrain if the storm drain system is low enough to accommodate an underdrain.

The conveyance channel to the west of these locations, while physically suitable for a water quality swale, is not recommended for retrofitting due to the heavy use by vehicles. At the time of the site visit, there was an event in progress at the school and many vehicles were parked next to or even in the conveyance channel. This compacts the soils, and suggests that unless a barrier is installed, a BMP at this location might suffer physical damage.

WCSD west (0550)

Table 1. Background Information

BMP Type	Latitude	Longitude
Conveyance channel	40.648862	-75.506514

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	19.61	1,839	36,058
Pervious	36.13	264.96	9,573
Total	55.74		45,631

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.189	0.12	17.9%	8,189.4	8,189.4

BMP Summary

This BMP location is part of a conveyance system with no basin, per se. Two options for drainage area and treatment area are available; the larger is presented here and is tallied in the report. There is a slight berm separating the conveyance channel between the exit drive of St. Stephens Church, and Campus Dr. at the Whitehall-Coplay School District (WCSD). Removing this berm and connecting the two halves of this ditch allows for greater treatment area and pollutant removal. Recommended retrofit is to block the bottom 12 inches of the 36-inch outlet pipe, and to add 18-inch tall earthen and/or stone check dams each 12 inches of elevation rise headed in either direction in the conveyance ditch. At the east end of this conveyance ditch, there is also a surface inlet which conveys water from a pipe at the northeast corner of the tennis courts at WCSD along the east side of the baseball field through a shallow ditch into the east end of the ditch along Mechanicsville Road. We recommend adding check dams along this ditch as well, though reducing them to 12 inches tall unless widening the ditch.

Culverts and pedestrian crossings are recommended at various points along this proposed retrofit for continued access to sports fields, and protection of the stormwater retrofit.

If electing to only retrofit the portion of the ditch on the east side of the separating berm, the following tables summarize the drainage area and pollutant removal. This option is called “WCSD west (half option)” and bears the Site ID 0555.

Table 2b. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	15.88	1,839	29,198
Pervious	21.89	264.96	5,800
Total	37.77		34,999

Table 3b. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4b. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.103	0.08	12.2%	4,286.7	4,286.7

Weis (0560)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.662453	-75.512218

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	7.00	1,839	12,876
Pervious	2.44	264.96	647
Total	9.44		13,522

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.230	0.39	45.2%	6,109.1	6,109.1

BMP Summary

Aerial imagery taken between April 2014 and July 2017 seems to indicate that clogging happened somewhere between 2014 and 2016, and the condition as of May 2017 included significant outlet clogging resulting in a submerged outlet, partially submerged inlets, and standing water.

Retrofitting should include maintenance operations of removing the clogging and maintaining vegetation as necessary. The water quality retrofit recommended is a stone check dam/berm around the outlet, as tall as the outlet pipe itself (approximately 24-30 inches). This will temporarily detain water, allowing sediment settling, and also allowing the runoff to slowly pass through the stone. Any storm events that more than fill the bottom 12 inches of the basin will simply overtop the gravel berm and exit the basin as originally intended. This will be functionally between a sediment trap and extended detention basin.

The steep slopes of the basin are the only apparent access constraint.

Whitehall Mall East (0590)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.633694	-75.481356

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.35	1,839	4,313
Pervious	0.08	264.96	20
Total	2.42		4,333

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.012	0.06	8.6%	372.6	372.6

BMP Summary

There is very little potential for modification within this basin. There is also very little pollutant removal potential, and thus the cost:benefit ratio is likely unattractive and impractical.

Any practice that would significantly raise the water surface elevation during a storm event is likely not an option given the proximity to Grape St. and the potential risk associated with roadway flooding. That said, currently there is a steeply sloped concrete flume from the inlet pipe to the outlet pipe with very little chance for any detention except during such intense storm events that drivers are highly unlikely to be on the road.

Our recommendation – if retrofitting – is to remove the concrete flume, stabilize the flow path with geotextile, and install shallow (12-inch) gravel check dams to at least slightly attenuate flow rates and allow some sediment settling.

Whitehall Mall North (0600)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.636037	-75.481068

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	8.37	1,839	15,384
Pervious	0.31	264.96	83
Total	8.68		15,467

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.051	0.07	10.8%	1,670.9	1,670.9

BMP Summary

The inlet pipe is immediately adjacent to the outlet pipe and therefore short-circuits the already-small basin. Recommended retrofit is using some in-situ soils to build a 2-foot tall earthen berm and weir around the outlet pipe creating some ponding space. This is a relatively small basin and potential pollutant removal benefit, but it is a relatively simple and inexpensive retrofit. An alternative is to add an outlet structure or control device to create some ponding by some other method, and yet still convey the design storms.

Whitehall Mall West (0610)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.636685	-75.485600

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	2.72	1,839	5,003
Pervious	1.81	264.96	480
Total	4.53		5,483

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.115	0.51	52.6%	2,886.1	2,886.1

BMP Summary

The basin currently has concrete flumes between the inlets and the outlet pipe. There is a robust outlet structure and overflow weir in this basin. Recommended retrofit is to remove the concrete flumes, and when regrading, use in-situ soils to build 18-inch tall berms or check dams across the basin floor, each 12 inches of elevation rise, to create an average of 12 inches ponding in the basin. While there is likely not much infiltration potential, some may occur, and the increased residence time for runoff from small storms will allow sediment settling.

Whitehall Shopping Center (0570)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.648356	-75.490696

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	7.52	1,839	13,821
Pervious	2.90	264.96	768
Total	10.41		14,589

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.253	0.40	49.2%	7,174.1	7,174.1

BMP Summary

Currently the basin is completely bypassed by any throughflow since there is a riprap flume from the inlet pipe directly to the outlet pipe. It is possible that during intense storm events some runoff does back up into the basin. A simple retrofit would be to remove the stone lining, excavate slightly within the basin to cause low-flow conditions to flow into the basin, and add a simple outlet structure such as a standpipe at the current outlet pipe. The site inspector was not able to identify the location or elevation of the eventual outfall. It is possible that with sufficient available elevation drop, a surface sand filter or other practice could be installed. The calculations above are based on the assumption that the practice becomes a shallow infiltration basin with 12 inches of ponding, which is the simple retrofit described above. Some non-turfgrass native vegetation would be a good enhancement if the property management is amenable to maintenance other than grass mowing and occasional sediment removal.

Whitehall Square (0580)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.634780	-75.490868

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	7.14	1,839	13,127
Pervious	3.60	264.96	953
Total	10.73		14,080

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.230	0.39	44.6%	6,280.9	6,280.9

BMP Summary

This basin could be retrofit quite simply by adding check dams or berms to retain (or detain) water as it flows downhill through the basin from west to east. Since one large inlet pipe completely short-circuits the basin, feeding in right next to the outlet pipes, a berm or other standing structure separating the outlet pipes from the adjacent inlet pipe is recommended as well. The soils are listed by NRCS/USDA as combination B and urban soils. Some infiltration is expected, but the pollutant removal calculations are based on the ST (stormwater treatment) performance curves.

The outlet pipes lead directly into the adjacent basin, Forman Mills (Site ID: 0190), as does the outlet from Bank of America (Site ID: 0040). See the Forman Mills summary for options and pollutant accounting considerations.

There is a utility junction box at the east end of the basin, though no utility lines are expected to be running within the basin footprint.

Windsor Court (0620)

Table 1. Background Information

BMP Type	Latitude	Longitude
Dry detention basin	40.681851	-75.537105

Table 2. Sediment Load to the BMP

	Drainage Area (ac)	Land Use Loading Rate (lb/acre/yr)	Sediment Loading to BMP (lb/yr)
Impervious	0.56	1,839	1,025
Pervious	0.62	264.96	164
Total	1.18		1,189

Table 3. Existing Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)
0.000	0.00	0.0%	0.0

Table 4. Proposed Condition Calculations

Volume Treated (ac-ft)	Inches per Impervious Acre	Percent Reduction	Sediment Load Reduced by BMP (lb/yr)	Retrofit Final Sediment Load Reduced [Proposed Load – Existing Load Reduced (lb/yr) (**Retrofits Only**)]
0.025	0.54	58.6%	697.3	697.3

BMP Summary

This tiny basin appears to span two adjacent residential parcels, and a portion of the basin floor is currently being used as garden space. There is very little pollutant removal potential at this location, even if both homeowners are amenable to retrofit implementation.

The soils are listed as likely B type soils, and therefore a small infiltration basin is possible. Modifying the outlet structure to block the low-elevation orifice and pond 12 inches of water behind it will offer a low-cost option. It might be necessary to do some minor grading within the basin, moving some soil from the basin floor to the embankment/berm around the sides.

Ruch Street Stream Restoration (0640)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Restoration	40.659072	-75.499829

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
600	44.88	26,928

BMP Summary

The section of stream near Ruch Street, and west of the Ironton Rail Trail, contains bank cutting on both sides and sediment deposition throughout. Possible recommendations include removing the sediment deposition, and providing bank treatments such as live stakes, rip-rap, root wad plantings, rock or log vanes, or rock deflectors. Some potential for floodplain reconnection exists. Creating a buffer with riparian plantings is highly recommended.

Clear Stream Drive Stream Restoration (0650)

Table 1. Background Information

BMP Type	Latitude	Longitude
Stream Restoration	40.659615	-75.497517

Table 2. Stream Restoration Proposed Condition Calculation

Length of Restoration (ft)	Sediment Reduction Applied (lb/ft/yr)	Sediment Load Reduced by BMP (lb/yr)
700	44.88	31,416

BMP Summary

The section of stream east of the Ironton Rail Trail and south of Clear Stream Drive, also contains bank cutting on both sides and sediment deposition throughout. Possible restoration practices include narrowing the stream channel by cribbing the north bank into the central sediment deposit, and potentially employing grade control structures such as cross vanes to mitigate further downstream bank erosion. There is the strong potential for floodplain enhancement on the south bank. Bank treatments could possibly include live stakes, rip-rap, root wad plantings, rock or log vanes, rock deflectors, and some riparian plantings. Enhancing the riparian buffer is highly recommended.