TMDL Plan
West Chester Borough Goose Creek MS4

MS4 TMDL Strategy

Submitted By: **West Chester Borough**

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Prepared By:

Gilmore & Associates, Inc.
Engineers ♦ Land Surveyors ♦ Planners ♦ GIS Consultants
184 West Main Street, Suite 300
Trappe, PA 19426
(610) 489-4949

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West Chester Borough, Chester County is submitting this TMDL Strategy in accordance with the requirements of the *National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4)*; specifically, in accordance with the *MS4 Requirements Table (Municipal) Anticipated Obligations for Subsequent NPDES Permit Term (Revised 3/05/2018)*. West Chester Borough must create a TMDL due to discharges from their MS4 to Chester Creek, which has been listed as having a Requirement of TMDL Plan Nutrients, for Goose Creek TMDL (see Appendix G).

The intent of this MS4 TMDL is to establish the existing loading of pollutants discharged from the MS4 to Goose (Chester) Creek, and to present a plan to reduce these pollutants. This MS4 TMDL is organized to follow the 3800-PM-BCW0200d Rev. 3/2017 *National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s) TMDL Plan Instructions* included as part of the *MS4 Individual Permit* package. This TMDL may be evaluated and updated by West Chester Borough on an as-needed basis, based on its effectiveness in reducing pollutant loads in discharges from the regulated small MS4. If this occurs, West Chester Borough will work with the Department of Environmental Protection (DEP) for review and approval of any revisions or updates.

Each MS4 TMDL must include the following Required TMDL Elements:

Section A: Public Participation
Section B: Map
Section C: Pollutants of Concern
Section D: Existing Load for Pollutant(s) of Concern
Section E: Wasteload Allocation(s) (WLA(s))
Section F: Analysis of TMDL Objectives
Section G: Select BMPs to Achieve the Minimum Required Reductions in Pollutant Load
Section H: Identify Funding Mechanisms
Section I: Identify Responsible Parties for Operation and Maintenance (O&M) of BMPs

This TMDL is organized to follow the above outline of required elements as shown on the following pages. Relevant verbiage from the TMDL Instructions is reiterated herein for each of the above required TMDL Elements.

I. General Information

A. **Terms**: The term "nutrients" refers to "Total Phosphorus" (TP) unless specifically stated otherwise in DEP's latest Integrated Report. The terms "sediment," "siltation," and "suspended solids" all refer to inorganic solids and are hereinafter referred to as "sediment."

The term "storm sewershed" is defined in the PAG-13 General Permit as the land area that drains to the municipal separate storm sewer from within the jurisdiction of the MS4 permittee. This term is used in these instructions as well as the term, "TMDL Planning Area" (or "Planning Area") which refers to all the storm sewersheds for which an MS4 must calculate existing loads and plan load reductions.

The term "baseline load" is used in these instructions to refer to the pollutant load discharged by an MS4 as reported in a TMDL. A baseline load can be revised by 1) conducting a new modeling effort that utilizes the land use/land cover information from the original TMDL and 2) by considering the reductions achieved through structural BMPs installed prior to approval of a TMDL that were not considered during development of the TMDL.

The term "existing load" refers to the pollutant load that the MS4 estimates is draining to impaired waters from the Planning Area at the time of TMDL Plan submission. The existing load will be the same as the baseline load (regardless of whether or not the baseline load is revised) unless the MS4 accounts for reductions from structural BMPs installed between the date of TMDL approval and TMDL Plan submission.

B. **Pollutant(s) of Concern**: The pollutant(s) of concern for TMDL Plans will be based on the following:

- If a WLA has been established in a TMDL for sediment, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment.

- If WLAs have been established in a TMDL for sediment and nutrients, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment and TP, unless the MS4 chooses to utilize a presumptive approach for TP. DEP will allow MS4s to calculate loads and pollutant reductions based on sediment, under the assumption that the achievement of TMDL Plan objectives for sediment will also achieve the objectives for TP. MS4s must identify use of the presumptive approach in its TMDL Plan if chosen.

- If a WLA has been established in a TMDL for nutrients alone (or surrogates for nutrients such as "excessive algal growth" and "organic enrichment/low D.O."), the MS4 is expected to develop the TMDL Plan based on the reduction of TP, unless the presumptive approach is chosen, as described above.

C. **TMDL Plan Objectives**: There are two objectives for a TMDL Plan:

1. **Long-Term Reduction** – Plan for the reduction of pollutant load(s) to achieve the WLA(s) in the TMDL.

   The TMDL Plan must describe a general plan as to how WLA(s) will ultimately be achieved.

2. **Short-Term Reduction** – Plan for the short-term reduction of pollutant load(s) that will be achieved within the subsequent NPDES permit term (i.e., the 5-year permit term resulting from DEP's issuance of a permit in response to the receipt of the MS4's next submission of an individual permit application).

   MS4s must achieve at least one of the following objectives within the 5-year permit term: 1) the WLA(s) in the TMDL, or 2) if the WLA(s) cannot be achieved, a load reduction of at least 10% for sediment and/or 5% for TP, compared to the existing load for these pollutants at the time of TMDL Plan submission. A load reduction of at least 10% for sediment may be used as the objective in lieu of a 5% reduction in TP under the presumptive approach.

NOTE – The presumptive approach cannot be used to assume that meeting TMDL Plan objectives for nutrients will result in meeting objectives for sediment.

NOTE – The minimum required reduction to be to be accomplished during the permit term is based on the existing pollutant load at the time of TMDL Plan submission, not at the time of the original TMDL approval. If an MS4 can demonstrate to DEP's satisfaction in its TMDL Plan that it has already achieved the WLA(s) of the applicable TMDL(s), the MS4 will not be required to implement further pollutant load reductions during the subsequent permit term.

D. **Existing Pollutant Load(s)**: The estimation or determination of existing loads for TMDL Plans is different than the estimation of existing loads for PRPs. MS4s have two options in establishing the existing pollutant load(s) for pollutant(s) of concern for TMDL Plans:

1. MS4s may report the existing load(s) specified in the TMDL (i.e., the TMDL "baseline load"). The baseline load(s) may be represented in the TMDL as either:

    - Load(s) that are specific to the MS4 (i.e., the load is listed in a table within the TMDL with the name of the MS4 identified); or
    - Load(s) that are not specific to the MS4 (i.e., are represented in the TMDL as bulk/aggregate load(s) for all MS4s in the TMDL watershed), in which the MS4 will need to distribute its individual load(s) UNLESS a collaborative TMDL Plan is developed with all other MS4s identified in the TMDL.

2. MS4s may choose to calculate existing load(s) for a TMDL Plan through a new modeling effort using the MapShed model developed by the Pennsylvania State University (www.mapshed.psu.edu) or a comparable, or more robust, continuous simulation model. Any new modeling effort must focus on the TMDL Planning Area and account for overland flow as well as downstream channel and bank erosion; therefore, modeling must be done at a scale that allows for the

quantification of both impacts. New modeling must utilize the same land use/land cover information that was used to develop the TMDL or other quality assured land use/land cover data from the time of TMDL approval. DEP recommends that prior to and/or during any new modeling effort that MS4s contact DEP's Bureau of Clean Water, Water Quality Division, TMDL Section at (717) 787-5017 for guidance.

If a combined PRP and TMDL Plan is developed (see Section I.F), in which the PRP and TMDL Planning Areas are combined into one Planning Area, the existing loads for the Planning Area may only be derived using a new modeling effort (Option 2 above).

NOTE – If an MS4 is aware of the date(s) of data collection in support of TMDL development, land use/land cover information from this date rather than the TMDL approval date may be used.

NOTE – MapShed, or any other watershed model where channel erosion is explicitly modeled, should be run on a minimum of ~10 mi2 area to properly account for downstream impacts and include impaired waters identified in the MS4 Requirements Table. Aggregation of these waters up to approximately the 12-digit HUC scale for modeling purposes is acceptable. Modeling may not be done at the individual storm sewershed or municipal scale where the extent of downstream impact is not included in load calculation.

NOTE – Baseline loads in older TMDLs typically did not account for load reductions from urban stormwater BMPs existing at the time of TMDL preparation. In such cases, MS4s may consider structural BMPs installed **prior to** the TMDL approval date in estimating existing loads. MS4s may also consider the load reductions achieved through structural BMPs installed after the TMDL was approved. Prior to the TMDL approval date, load reductions associated with structural BMPs installed under Chapter 102 NPDES permits may be credited in full. After the TMDL approval date, load reductions associated with structural BMPs installed under Chapter 102 NPDES permits may be credited only to the extent that the BMPs produce a net load reduction (see example below). Existing BMPs

that are used to reduce the existing load(s) must be documented as functional (see Section II.D).

Remodeled TMDL load calculations will typically use updated methods to better estimate the load that existed at the time of the original TMDL load calculation, using the same land use/land cover information as was used for the original TMDL. In a remodeling effort, TMDL Plans may account for all BMPs, including Chapter 102 BMPs, installed after approval of the original TMDL as long as changes in impervious surface in the drainage area of those BMPs are considered in the effort. In other words, the TMDL Plan must include the impacts of increased development/imperviousness in order to count load reductions from BMPs installed during the construction process. Chapter 102 BMPs installed after TMDL Plan development would be assumed to result in zero net loading change (i.e., no progress toward TMDL objectives), unless there is a demonstration that pollutant loading is less following an earth disturbance project compared to prior conditions.

NOTE – MS4s that calculate existing load(s) through a new modeling effort will need to plan for the same percent reduction in pollutant loads as prescribed by the TMDL. This step is optional. MS4s may elect to use the baseline load reported in a TMDL as the existing load at the time of TMDL Plan submission, rather than conduct modeling to revise the baseline load.

E. **BMP Effectiveness**: All MS4s must use the BMP effectiveness values contained within DEP's BMP Effectiveness Values document (3800-PM-BCW0100m) or Chesapeake Bay Program expert panel reports for BMPs listed in those resources when determining pollutant load reductions in TMDL Plans, except as otherwise approved by DEP. For example, PRPs/TMDL Plans may also apply thoroughly vetted mechanistic models with self-contained BMP modules (e.g. Storm Water Management Model (SWMM), WinSLAMM) to demonstrate achievement of reduction targets. Application of these data intensive models could allow for a streamlining of the planning and design phases of the stormwater control process that may provide future cost savings as municipalities move

toward implementation of the plan. Such resources must be documented in the TMDL Plan, and must reflect both overland flow and in-stream erosion components.

NOTE - Calculation of sediment load reductions for PRP/TMDL Plan purposes using the *Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* report should be done as follows:

- Where existing sediment loads were calculated using modeling at a local watershed scale, the default rate to be used is 115 lb/ft/yr. This default rate comes from a convergence of MapShed modeled streambank erosion loads from a group of urbanized watersheds, the 248 lb/ft/yr default edge-of-field (EOF) rate in the Expert Panel Report with the 50% efficiency uncertainty factor specified for the Protocols applied, and field data that was collected following the BANCS methodology where projects have been implemented and load reductions calculated using the Protocols.

  Alternately, sediment reduction from streambank restoration projects when existing loads are calculated using modeling at a local scale may be estimated using the Protocols outlined in Section 5 of the report and must then apply the 50% efficiency uncertainty factor.

NOTE – Use of default effectiveness value (115 lb/ft/yr) will be accepted for the subsequent permit term. It is recommended that the data required to complete load calculations using the Protocols be collected during the design phase for use in subsequent load reduction calculations.

NOTE - Desktop MapShed users may not use the streambank restoration or street sweeping components included in the MapShed BMP editor for pollutant reduction calculations. Pollutant reductions associated with streambank restoration projects must use the methods described above; whereas, reductions from street sweeping must be calculated in accordance with the *Recommendations of the Expert Panel to Define*

Removal Rates for Street and Storm Drain Cleaning Practices or the BMP Effectiveness Values document.

NOTE – If BMP effectiveness values are updated in DEP's BMP Effectiveness Values document or in Chesapeake Bay Program expert panel reports between the time the TMDL is approved and the time the final report is developed to document compliance with the permit, those updated effectiveness values may optionally be used.

F. **Combining Planning Obligations**: MS4s with multiple TMDL Plan development obligations may develop one TMDL Plan for submission to DEP, if desired. If this is done, MS4s may elect to address each TMDL water separately or in combination. If done in combination, unless specifically restricted in the TMDL, the MS4 has flexibility when locating BMPs between the TMDL Planning Areas. If the MS4 elects to meet the percent reduction requirements (10% sediment or 5% TP) in lieu of meeting the WLA(s) within the first permit term, it may elect to reduce pollutants by a greater percentage in one TMDL Planning Area over another, as long as the overall reduction for the planning effort achieves the percent reduction requirements.

G. **Offsets**. An MS4 may propose stormwater pollutant reduction BMPs outside of the TMDL and/or PRP Planning Area for possible approval as offsets toward meeting TMDL and/or PRP load reduction requirements. Unless approved otherwise by DEP, such projects must be located within the jurisdiction of the developer of the TMDL Plan and/or PRP, and treat or manage stormwater that would drain to the impaired waters of interest under a TMDL Plan or PRP. In all cases where offsets are proposed, an individual permit is required.

Examples of projects where offsets may be approved by DEP include but are not limited to a reduction of impervious areas outside of the Planning Area and BMPs at agricultural operations that are outside of the planning area but within the drainage area of the impaired waters of interest. DEP may grant offsets for the amount (lbs) of pollutants expected to be reduced after baseline and regulatory requirements are met. For the purpose of TMDL Plans and PRPs, baseline requirements are, in general, load reduction

requirements established in TMDLs for sectors that do not require NPDES permits. For example, if a TMDL specifies that a sediment load reduction of 80% is necessary from the unregulated or non-urban stormwater sector in order to meet water quality standards, DEP may approve offsets for a reduction in impervious area outside of the planning area for the amount (lbs) of sediment removed after the 80% reduction requirement is met. Where published load reduction requirements are inapplicable or unavailable, DEP's Bureau of Clean Water will establish the baseline. MS4s that are seeking approval for offsets are encouraged to contact DEP during the development phase of plans in order to understand the amount of offsets that may be approved in an individual permit for a proposed project.

An operation and maintenance (O&M) plan as well as assurances for ongoing O&M must be submitted as an attachment to any TMDL Plan and/or PRP proposing the implementation of BMPs for offsets. Permittees must report actual O&M activities on Annual MS4 Status Reports to continue receiving approval for the use of offsets.

H. **BMP Selection**: MS4s may select BMPs from the Pennsylvania Stormwater Best Management Practices Manual (363-0300-002), BMPs recognized by the EPA Chesapeake Bay Program, or other BMPs where the pollutant reduction efficiency is known or may be determined. Land use changes are not BMPs but may be used to demonstrate pollutant load reductions. For land use changes and BMPs implemented within a TMDL Planning Area as part of an NPDES permit requirement (e.g., post-construction stormwater management BMPs for Chapter 102 NPDES permits), pollutant load reduction credit may be claimed based on an analysis of pre- and post-construction or land use conditions, where the credit is a demonstrated net decrease in pollutant load. BMP effectiveness values must be consistent with sources identified in section I.E of these instructions.

NOTE – Street sweeping may be proposed as a BMP for pollutant loading reductions if 1) street sweeping is not the only method identified for reducing pollutant loading, and 2) the BMP effectiveness values contained in 3800-PM-BCW0100m or Chesapeake Bay Program expert panel reports are utilized.

II. Required TMDL Plan Elements

Each TMDL Plan must include the following elements. The paragraph numbers in these instructions correspond to the organization of the TMDL Plan. For example, Section A of the TMDL Plan must be "Public Participation," Section B must be the "Map," Section C must be "Pollutants of Concern," etc.

A. Public Participation.

The MS4 shall complete the following public participation measures listed below, and report in the TMDL Plan that each was completed and attach copies of applicable information.

- The applicant shall make a complete copy of the TMDL Plan available for public review.

- The applicant shall 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 TMDL Plan to DEP. Attach a copy of the public notice to the TMDL Plan.

- The applicant shall 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 TMDL Plan.

- The applicant shall 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.

- The applicant shall 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 TMDL Plan.

West Chester Borough has completed the above-listed Public Participation measures and all required documentation of public participation is included as Appendix A.

- TMDL public notice was published in: Daily Local News
- Date TMDL public notice was published in newspaper: July 10, 2017
- Date TMDL was made available for public review/comment: June 10, 2017
- End date for receipt of written comments (30 days from the date of public notice): August 10, 2017
- Date TMDL comments were accepted at a public meeting: August 8, 2017

Questions received were of a general nature only, and no comments were made that required a response in, or revision to, this document.

Please note that when the specific stream segments (along which streambank restoration will occur) are known, the PRP shall be revised to note same and re-advertised for public comment.

B. Map.

Attach a map that identifies land uses and/or impervious / pervious surfaces and the storm sewershed boundary associated with each MS4 outfall that discharges to TMDL waters, and calculate the storm sewershed drainage area. In addition, the map must identify the proposed location(s) of structural BMP(s) that will be implemented to achieve required pollutant load reductions.

The map may be the same as that used to satisfy MCM #3 of the permit, with the addition of land use and/or impervious / pervious surfaces, the storm sewershed boundary, and locations of proposed BMPs, or may be a different map.

The map must be sufficiently detailed to identify the planning area relevant to satisfying TMDL Plan objectives, and to demonstrate that BMPs will be located in appropriate TMDL Planning Areas to meet the objectives. For a single MS4, the planning area constitutes the storm sewersheds of all MS4 outfalls within the permittee's jurisdiction. For MS4s participating in a joint TMDL Plan, the planning area constitutes the storm sewersheds of all MS4 outfalls within the jurisdictions of all MS4s in the joint effort. Planning areas may be reduced through parsing.

For additional information and guidance on parsing, see Attachment A, Parsing Guidelines For MS4s in TMDL Plans.

For clarity, land uses within the TMDL Planning Area are shown separately on the West Chester Borough MS4 TMDL Land Uses (MapShed) Map.

The above referenced Maps are included in Appendix B.

C. Pollutant(s) of Concern.

Identify the pollutant(s) of concern for each storm sewershed (see Section I.B of these instructions).

West Chester Borough is listed with a Waste Load Allocation (WLA) for Total Phosphorus in the *Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania* dated June 30, 2008 by the U.S. Environmental Protection Agency, Philadelphia, PA (herein referred to as TMDL Report).

Total Phosphorus (as presented in the applicable TMDL Report listed above) is applicable to West Chester Borough because a Waste Load Allocation has been listed for West Chester Borough. Table C-1 lists the pollutant (total phosphorous, TP) load (lb/day) and Allocated TP Load as presented in the Nutrient TMDL Report for West Chester Borough and for all other municipalities listed in the TMDL Report. The TMDL Report presents WLAs as Required Reduction (%), and the terms and numbers are presented in Table 1 exactly as presented in the TMDL Report.

Table C-1 Nutrient TMDL Goose Creek (Table 3-3)
TP Load in the Goose Creek Watershed by MS4 Area

MS4 Permit Holder	Area by MS4 (ac)	Existing TP Load (lb/day)	Allocated TP Load (lb/day)	Required Reduction
West Goshen Township	1,488	1.16	0.54	53.9%
West Chester Borough	310	0.24	0.11	53.9%
Westtown Township	1,791	1.40	0.64	53.9%
Thornbury Township (Chester County)	772	0.60	.028	53.9%
Thornbury Township (Delaware County)	113	0.09	0.04	53.9%
Total	**4,474**	**3.49**	**1.61**	**53.9%**

D. Existing Load for Pollutant(s) of Concern.

Calculate or report the existing load, in lbs per year, for the pollutant(s) of concern in the TMDL Planning Area. See section I.D of these instructions and Attachment A for guidance.

As noted previously, the options for evaluating existing load for TMDL Plans differs from PRPs. TMDL Plans must use: 1) the baseline load established in a TMDL, or 2) a load that is distributed from a bulk existing load for a group of MS4s in a TMDL, or 3) a recalculated load as determined using the MapShed model or equivalent.

If MapShed or equivalent will be used to estimate existing load, the same model should also be used to estimate future pollutant load for different BMP implementation scenarios to ensure consistency with input parameters between existing and future loading.

MS4s may claim credit for constructed structural BMPs as discussed in Section I.D, assuming those BMPs continue to be maintained and are functioning as designed. In order to claim credit, identify all such structural BMPs in Section D of the TMDL Plan along with the following information:

- A detailed description of the BMP;
- Latitude and longitude coordinates for the BMP;
- Location of the BMP on the storm sewershed map;
- The permit number, if any, that authorized installation of the BMP;
- Calculations demonstrating the pollutant reductions achieved by the BMP;
- The date the BMP was installed and a statement that the BMP continues to serve the function(s) it was designed for; and
- The operation and maintenance (O&M) activities of the BMP, O&M frequencies, and party(ies) who are responsible for O&M.

The MS4 permittee may optionally submit design drawings of the BMP for previously installed or future BMPs with the TMDL Plan.

West Chester Borough is listed with a Waste Load Allocation (WLA) for Total Phosphorus in the TMDL Report. From the TMDL Report *Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania.* June 30, 2008, pg. 3-7:

> *"3.5 Overall Recommended TMDL Allocations*
>
> *At this time, EPA cannot determine what portion of the municipalities are designated/used for collection or conveying stormwater, as opposed to the portions that are truly nonpoint sources. As part of the Phase II stormwater permit process, MS4 facilities will be responsible for evaluating and mapping out areas that are draining to or discharging to storm sewers. Since these systems have not yet been delineated, the TMDL lumps the nonpoint source loads into the WLA portion of the TMDLs. Once these delineations are available, the nonpoint source loads can then be separated from the WLA and added to the LA."*

The West Chester Borough MS4 TMDL Goose Creek Map identifies the TMDL Planning Area, which includes all storm sewershed boundaries. The TMDL Storm Sewershed was delineated for West Chester Borough based on mapping of the MS4 system and topography; and the delineated TMDL Storm Sewershed land area was then used to pro-rate the MS4 Baseline, MS4 Allocation, and Load Reduction requirement. The West Chester TMDL Planning Area in the Goose Creek / Chester Creek watersheds was calculated to be 256 acres.

Table 1, as presented in Section C, lists the applicable pollutant Load Reductions required by the TMDL Report. West Chester Borough is located within the Goose Creek Watershed. Table 1 indicates that a pollutant Load Reduction is required by West Chester Borough for Total Phosphorous.

Phosphorus Reductions: The Nutrient TMDL Report presents pollutant Load Reductions by Municipality by "percent". Calculating the required MS4 Load Reduction (MS4 LR) can be done as follows:

(MS4 Load Reduction) = (MS4 Baseline Load) – (MS4 Allocation)

(MS4 LR) = (Existing TP Load) – (Allocated TP Load)

MS4 LR = 0.24 lb/day – 0.11 lb/day

MS4 LR = 0.13 lb/day

(Percent Required Reduction) = (MS4 Load Reduction) / (MS4 Baseline Load)

% Reduction = (MS4 LR) / (Existing TP Load)

53.9% = MS4 LR / 0.24 lb/day

MS4 LR = 0.13 lb/day

The TMDL Planning Area is the delineation of the MS4 land area(s) to be used to calculate an Adjusted MS4 Baseline, MS4 Allocation, and required Load Reduction using the following Adjustment Equation. MS4 Allocation is used herein to refer to EPA's "MS4 Allocation", EPA's "MS4 Load Allocation", as used in the TMDL Reports, and which appear to be used by EPA as synonyms for "Waste Load Allocation" (WLA).

$$\text{Adjustment Ratio} = \frac{\left(\begin{matrix}Actual\ Contributing\ land\ area\ (acres)\\ as\ delineated\ by\ the\ Municipality\end{matrix}\right)}{\left(\begin{matrix}Land\ area\ (acres)\ used\ by\ EPA\ to\\ calculate\ the\ EPA\ TMDL\ Allocation\end{matrix}\right)}$$

The West Chester TMDL Planning Area in the Goose Creek / Chester Creek watersheds was calculated to be 254 acres. The TMDL Report assigned West Chester Borough 310 acres as the Area by MS4.

$$\text{Adjustment Ratio} = \frac{(256)}{(310)}$$

Therefore, the Adjustment Ratio is 82.58%.

Adjusted MS4 LR = Adjustment Ratio x (MS4 LR) x 365 days/year
Adjusted MS4 LR = 82.58% x 0.13 lb/day x 365 days/year
Adjusted MS4 LR = 0.106 lbs/day x 365 days/year
Adjusted MS4 LR = 39.18 lbs./year

E. Wasteload Allocation(s) (WLA(s)).

For TMDLs with specific WLA(s), report the specific WLA(s) established for the MS4(s). For TMDLs with bulk WLA(s), distribute the portion of the WLA(s) that are specific to the MS4 UNLESS all MS4s identified in a TMDL develop a joint TMDL Plan.

The MS4 Load Reduction for West Chester Borough was calculated in the previous section, and is 38.86 lbs./year.

F. Analysis of TMDL Objectives.

In this section of the Plan, MS4s must present the following:

1. Long-Term Reduction – The pollutant load reduction required to meet the WLA(s), in lbs/yr, and percentage of existing load.

   The percent reduction per the TMDL Report is 53.90%. West Chester Borough is required to reduce 38.86 lbs./year TP (Adjusted MS4 LR) per the TMDL Report.

2. Short-Term Reduction – The MS4's decision on which objective will be pursued for the subsequent permit term, i.e., either 1) achieve the WLA(s) or 2) reduce existing load by 10% (sediment) or 5% (TP), as well as the pollutant load reduction, in lbs/yr.

West Chester Borough's objective is Long-Term Reduction to meet the WLA, with the Short Term Reduction of reducing the existing sediment load by 10%. Please see *West Chester Borough Chester Creek / Goose Creek Pollutant Reduction Plan* (submitted to DEP September 2017 as required and revised July 2018) for sediment reduction calculations. Calculations are included herein to show the potential proposed phosphorous reductions for the subsequent permit term, utilizing the same BMPs as in the *West Chester Borough Chester Creek / Goose Creek Pollutant Reduction Plan*.

MapShed was used to model the Goose Creek (Chester Creek) watershed to ascertain only the land use loading rates, as well as the phosphorous load, from the Planning Area. The Planning Area was modeled as an “Urban Area” in MapShed; Goose Creek is “(0020)” in the included MapShed output.

Note that a portion of the Planning Area that drains to Goose Creek is, per MapShed, included in adjacent watersheds; however, per analysis of the storm collection system and LiDAR contours this drains to Goose Creek. Therefore, the basin delineation between the adjacent Brandywine Creek (Blackhorse Run, Plum Run and Taylor Run) basins and the Goose Creek / Chester Creek (again as an “urban area”) was adjusted accordingly. The Total Load from Phosphorus is 91.5 lbs./year (for the purposes of this TMDL, the Total Load excludes groundwater as the MS4 does not contribute to groundwater); a 5% reduction of 91.5 lbs./yr is 4.57 lbs./yr.

G. Select BMPs To Achieve the Minimum Required Reductions in Pollutant Load.

This section must be divided into two parts if the MS4 determines it will be unable to achieve the WLA(s) in the subsequent permit term: 1) short-term reductions for the permit term, and 2) long-term reductions to meet the WLA(s).

Short-Term Reductions for the Permit Term

Specific BMP(s), their location(s) and estimated date(s) of implementation must be identified along with calculations demonstrating that the TMDL objective will be achieved. The analysis should be similar to the examples presented in the PRP Instructions (see Attachments C and D therein). The number, type and location of BMPs may be modified following DEP's approval of the TMDL Plan, and the process for modifying TMDL Plans will be specified in the individual permit.

West Chester Borough proposes to install several small BMP infiltration facilities consisting of rain gardens, vegetated curb extensions, bioswales and infiltration trenches proposed at three locations, with the goal to capture and infiltrate the runoff generated from 1.5" of rainfall. The locations for these facilities are: John O. Green Memorial Park located at the intersection of Railroad Street, East Miner Street, and South Matlack Street; Fugett Park at Borough Hall located at 401 East Gay Street; and Greenview Alley located off South Franklin Street just north of intersection with East Nields Street. These projects have been designed by others (See Appendix F), with drainage areas supplied for use in the preparation of this TMDL.

The BMP drainage area shape files were loaded into MapShed and the land uses within these drainage areas noted visually. The land use areas were noted to be HD Mixed for John O. Green Park and Fugett Park / Borough Hall, and HD Mixed, LD Mixed, and MD Mixed for Greenview Alley. The total area of 5.53 acres consists of 5.24 acres HD Mixed, 0.22 acres MD Mixed and 0.06 acres LD Mixed.

Note that per the BMP Effectiveness Values from DEP (3800-PM-BCW0100m 5/2016), Infiltration Practices w/Sand, Veg. has a BMP Effectiveness Value of 85% for TP. Note that

once the designs for each BMP have been completed, reductions will be more accurately calculated.

The table below summarizes the small BMP infiltration facilities.

Table G-1: Proposed BMPs and TP Reductions

Location	Drainage Area (ac)	Land Use	Loading (lbs./ac/yr)	Efficiency (%)	Reduction (lbs./yr)
John O. Green Park	1.58	HD Mixed	0.26	85	0.35
Fugett Park / Borough Hall	3.20	HD Mixed	0.26	85	0.70
Greenview Alley	0.47 0.22 0.06	HD Mixed MD Mixed LD Mixed	0.26 0.26 0.06	85 85 85	0.10 0.05 0.0
Total Reduction	5.53				1.20

Stream bank restoration and street sweeping are calculated outside of the MapShed program, per the instructions, with streambank restoration as 115 lbs/ft/yr reduction (for sediment). West Chester Borough will consider the potential of streambank restoration in the Chester Creek watershed. If streambank restoration is undertaken, the Borough would propose to install approximately two-hundred (200) feet of streambank restoration. The DEP's BMP Effectiveness Value for TP removal will be utilized. Therefore, the proposed streambank restoration of two hundred (200) feet would result in 13.6 lbs./yr (i.e., 200 ft * 0.068 lbs/ft/yr) reduction TP.

West Chester Borough is proposing to street sweep all streets in the borough more than 25 times annually. Per the BMP Effectiveness Values (5/2016), street sweeping must be conducted 25 times annually; only count those streets that are swept at least 25 times in a year. The acres associated with all streets that are swept at least 25 times in a year would be eligible

for pollutant reductions consistent with the given BMP effectiveness values. From the "Street and Drain Cleaning Expert Panel Report," the standard street cleaning unit is curb miles swept. In general, one impervious acre is equivalent to one curb lane mile swept, assuming they are swept on one-side only (one acre = one curb lane mile rule of thumb). From Table 4, the Average TP Load is 1.93 lbs/ac/yr. From Table 15, using street sweeping frequency of 25 times annually (as a minimum), the sweeping schedule is 1P2W (one pass every 2 weeks). From Table 17, this corresponds to Practice #SCP-3 with a TP Removal of 5% (see Appendix H). The Borough maintains 33 miles of street; the miles of street within the Chester Creek watershed is approximately 8 miles; since the Borough sweeps both sides of the streets, the curb lane miles would be 16 miles. Therefore, 1.93 lbs/ac/yr * 16 curb lane miles * 1 acre/curb lane mile * 5% TP removal yields 1.54 lbs/yr TP removal.

West Chester Borough also plants trees every year. The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given. The Tree Planting BMP Effectiveness Value is 15% for TP.

In the Chester Creek watershed, the Borough intends to plant a minimum of 100 trees annually. The locations of these trees are unknown at this time; however, given the urban nature of the Borough, the estimate is that 90% are expected to be street trees. The HD Residential loading rate from MapShed for the Chester Creek watershed will be used to best represent paved streets / sidewalks (i.e., land prior to planting the trees is along streets, i.e., pavement and sidewalks). The TP HD Residential loading rate from MapShed is 0.26 lb/ac/year. The reduction is therefore 0.04 lbs/yr. (100 trees/year * 90% street trees * 0.01 * 0.26 lb/ac/year * 15%).

West Chester Borough is also considering using Jellyfish Filters from Contech. There are two discharge points (i.e., endwalls) that discharge runoff from large collection areas. The two endwall identifications are 13 and 37, with drainage areas of 44 and 35 acres respectively. The endwalls are located off of East Nields Street, west of the intersection with South Franklin Street. From the BMP Effectiveness Table, this type of BMP is Storm Sewer System Solids Removal. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the phosphorous removal efficiency specified by the manufacturer may be assumed, but no higher than 80%. The Jellyfish Filter has 59% removal efficiency for Total Phosphorus. Therefore, the Jellyfish Filter removal rate will be used.

To ascertain only the land uses and loading rates of the drainage areas to these endwalls, the drainage areas were modeled as “Urban Areas” in MapShed. The GWLF-E Average Loads by Source for Watershed output from this run is included (Appendix D). The phosphorus load from the drainage area to Endwall 13 (“Area1” in output) is 11.4 lbs./year (from overland flow), and from Endwall 37 (“Area2” in output) the phosphorus load is 9.1 lbs./year (from overland flow). Note that because volume is not reduced, the conservative assumption appears to be that stream bank loading will not be reduced as a result of the Jellyfish Filters. Additionally, since at this time the design of the units has not been completed, size and costs are unknown. Note that the units will need to be sized / designed, which is beyond the scope of this PRP, with the actual removal calculated at that time. Making the assumption that the Borough could remove 25% of the load at either endwall, the reduction at Endwall 13 could be 1.68 lbs./year (11.4 lbs./year * 59% removal * 25% Assumed Load Removal) and the reduction at Endwall 37 could be 1.34 lbs./year (9.1 lbs./year * 59% removal * 25% Assumed Load Removal). Information on the Jellyfish Filter is included as Appendix E.

West Chester Borough also intends to utilize inlet cleaning as a TMDL BMP, i.e., physically / manually removing debris from inlet boxes. This BMP (also referred to as “Storm Drain Cleaning” in the BMP Effectiveness Table) involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal

systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas.

To determine pollutant reductions for this BMP, the following steps must be taken. Note that at this point, there is insufficient information to provide any calculations as to TP removal.

1. Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected.

2. Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter).

3. Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations.

The final total proposed potential phosphorus reduction is summarized below in Table G-2. The actual reductions will be refined at the time of design of each BMP.

Table G-2: Required Reduction and Proposed BMPs

Adjusted MS4 LR in the TMDL Study (lb/yr)	39.18
Required Short-Term Reduction: 5% of the existing load for TP at the time of TMDL Plan submission	4.57 lbs./yr
Proposed Potential Reduction (lbs./yr)	1.20 (Three BMP Locations) 1.54 (Street Sweeping) 0.04 (Plant Street Trees) 13.6 (Streambank Restoration) 1.68 (Endwall 13) 1.34 (Endwall 37) Potential Total of 19.40

For all structural BMPs, MS4s must report the anticipated operation and maintenance (O&M) responsibilities and the anticipated provider of O&M as part of the TMDL Plan.

Table G-3: Operation and Maintenance of BMPs

NAME OF BMP	RESPONSIBLE PARTY	O&M ACTIVITY & FREQUENCY
Street Sweeping	West Chester Borough	Per PA BMP Manual (latest revision) BMP 5.9.1 pg 94-97
Street Tree Planting	West Chester Borough	Per PA BMP Manual (latest revision) BMP 5.6.3 pg 63-67
Streambank Restoration	West Chester Borough	Per PA BMP Manual (latest revision) BMP 6.7.1 pg 191-210
Proposed Infiltration Facilities	West Chester Borough	Per PA BMP Manual (latest revision) BMP 6.4.3/6.4.4 pg 33-47
Jellyfish Filters	West Chester Borough	Per Manufacturer's Instructions
Inlet Cleaning	West Chester Borough	Per PA DEP Direction and Applicable Manufacturer's Instructions

Historic street sweeping practices should not be considered in calculating credit for future practices. All proposed street sweeping practices may be used for credit if the minimum standard is met for credit (see 3800-PM-BCW0100m). In other words, if sweeping was conducted 1/month and will be increased to 25/year in the future, the MS4 does not need to use the "net reduction" resulting from the increased sweeping; it may take credit for the full amount of reductions from 25/year sweeping.

The names and descriptions of BMPs and land uses reported in the TMDL Plan should be in accordance with the Chesapeake Bay Program Model, to the extent possible. The names and descriptions are available through CAST (log into www.casttool.org, select "Documentation," select "Source Data" and see worksheets named "Land Use Definitions" and "BMP Definitions").

Long-Term Reductions to Meet the WLA(s)

In this section of the TMDL Plan (where applicable), the MS4 must present, at a minimum, a conceptual plan for how the WLA(s) will be achieved, long-term. This section may be less detailed than the section addressing short-term reductions, but nonetheless should describe a feasible plan toward achieving the WLA(s). Calculations are not required, but are recommended. An estimate on the number of years it will take the MS4 to achieve the WLA(s) should be reported based on the preliminary analysis.

West Chester Borough is required to remove 38.86 lbs./year total phosphorous. Table G-4 presents the TMDL implementation timeline and milestones for West Chester Borough.

Table G-4. Timeline for Attaining TMDL Pollutant Load Reductions 2018-2033

TMDL Watershed	Pollutant	Load Reduction Required (lb/year)	Timeframe for Attaining Reduction		Cumulative Percent of Required Pollutant Load Reduction		
			Total years	Calendar Year	2023	2028	2033
Goose Creek	Phosphorus	39.18	15	2033	33%	66%	100%

H. Identify Funding Mechanism(s).

Prior to approving coverage DEP will evaluate the feasibility of implementation of an MS4's TMDL Plan. Part of this analysis includes a review of the applicant's proposed method(s) by which BMPs will be funded. Applicants must identify project sponsors and partners and probable funding sources for each BMP. DEP does not expect that sources identified in the TMDL Plan be guaranteed, but does expect that applicants propose their preferred funding options with alternatives in the event the preferred options do not materialize.

West Chester Borough has adopted a Stream Protection Fee, which will be used to fund all BMP projects the Borough will undertake in the next NPDES Permit term.

I. Identify Responsible Parties for Operation and Maintenance (O&M) of BMPs. Once implemented the BMPs must be maintained in order to continue producing the expected pollutant reductions. Applicants must identify the following for each BMP selected for the subsequent permit term:

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

MS4 permittees will need to identify actual O&M activities in Annual MS4 Status Reports submitted under the permit.

Table I-1 Operation and Maintenance of BMPs

NAME OF BMP	RESPONSIBLE PARTY	O&M ACTIVITY & FREQUENCY
Street Sweeping	West Chester Borough	Per PA BMP Manual (latest revision) BMP 5.9.1 pg 94-97
Street Tree Planting	West Chester Borough	Per PA BMP Manual (latest revision) BMP 5.6.3 pg 63-67
Streambank Restoration	West Chester Borough	Per PA BMP Manual (latest revision) BMP 6.7.1 pg 191-210
Proposed Infiltration Facilities	West Chester Borough	Per PA BMP Manual (latest revision) BMP 6.4.3/6.4.4 pg 33-47
Jellyfish Filters	West Chester Borough	Per Manufacturer's Instructions
Inlet Cleaning	West Chester Borough	Per PA DEP Direction and Applicable Manufacturer's Instructions

III. Submission of TMDL Plan

Attach one copy of the TMDL Plan with the individual permit application that is submitted to the regional office of DEP responsible for reviewing the application. In addition, one copy of the TMDL Plan (not the application) must be submitted to DEP's Bureau of Clean Water (BCW). BCW prefers electronic copies of TMDL Plans, if possible. Email the electronic version of the TMDL Plan, including map(s) (if feasible), to RA-EPPAMS4@pa.gov. If the MS4 determines that submission of an electronic copy is not possible, submit a hard copy to: PA Department of Environmental Protection, Bureau of Clean Water, 400 Market Street, PO Box 8774, Harrisburg, PA 17105-8774.

IV. TMDL Plan Implementation and Final Report

Under the individual permit, the permittee must achieve the required pollutant load reductions within 5 years following DEP's issuance of the permit, and must submit a report demonstrating compliance with the minimum pollutant load reductions as an attachment to the first Annual MS4 Status Report that is due following expiration of the permit.

For example, if DEP issues a permit to a permittee on June 1, 2018, the required pollutant load reductions must be implemented by June 1, 2023 and the final report documenting the BMPs that were implemented (with appropriate calculations) must be attached to the annual report that is due September 30, 2023.

ATTACHMENT A
PARSING GUIDELINES FOR MS4s IN TMDL PLANS

Please refer to Attachment A of the PRP Instructions (3800-PM-BCW0100k) for information on where it is possible to parse (remove) land area in the course of developing PRPs. Those instructions are also applicable to TMDL Plans.

Parsing may also be undertaken where a TMDL utilized the entire land area of a municipality instead of the storm sewershed of outfalls discharging to TMDL waters (TMDL Planning Area). In such cases the MS4 is not required to take responsibilities for pollutant loads generated outside of the TMDL Planning Area, and may therefore parse out that area.

Two possible parsing methods are outlined in this document. DEP may accept other methods proposed in TMDL Plans not identified herein if based on sound science and if all other MS4s subject to a bulk WLA use the same method. All parsing must be supported by appropriate calculations and mapping.

1. Land Area Approach

   A. Determine the total land area of the municipality within the TMDL watershed (e.g., 10,000 acres).

   B. Determine the total land area served by the MS4 within the municipality and within the TMDL watershed (e.g., 6,000 acres).

   C. Calculate the ratio of land areas by dividing the land area determined in Step B to the land area determined in Step A (e.g., 6,000 acres / 10,000 acres) and apply it to both the existing MS4 pollutant load(s) and the WLA(s) that are assigned to the MS4 in the TMDL. The required percent (%) reduction of pollutant load should not change.

Example:

Inputs: Existing pollutant load = 5,000 lbs/yr, WLA = 3,500 lbs/yr, % reduction = 30%

- Step A: 10,000 acres
- Step B: 6,000 acres
- Step C: Ratio = 6,000/10,000 = 0.6

Outputs:

- Parsed existing load = 0.6 x 5,000 lbs/yr = 3,000 lbs/yr
- Parsed WLA = 0.6 * 3,500 lbs/yr = 2,100 lbs/yr
- New % reduction [(3,000 – 2,100)/3,000] x 100 = 30%

2. Weighted Land Use Approach

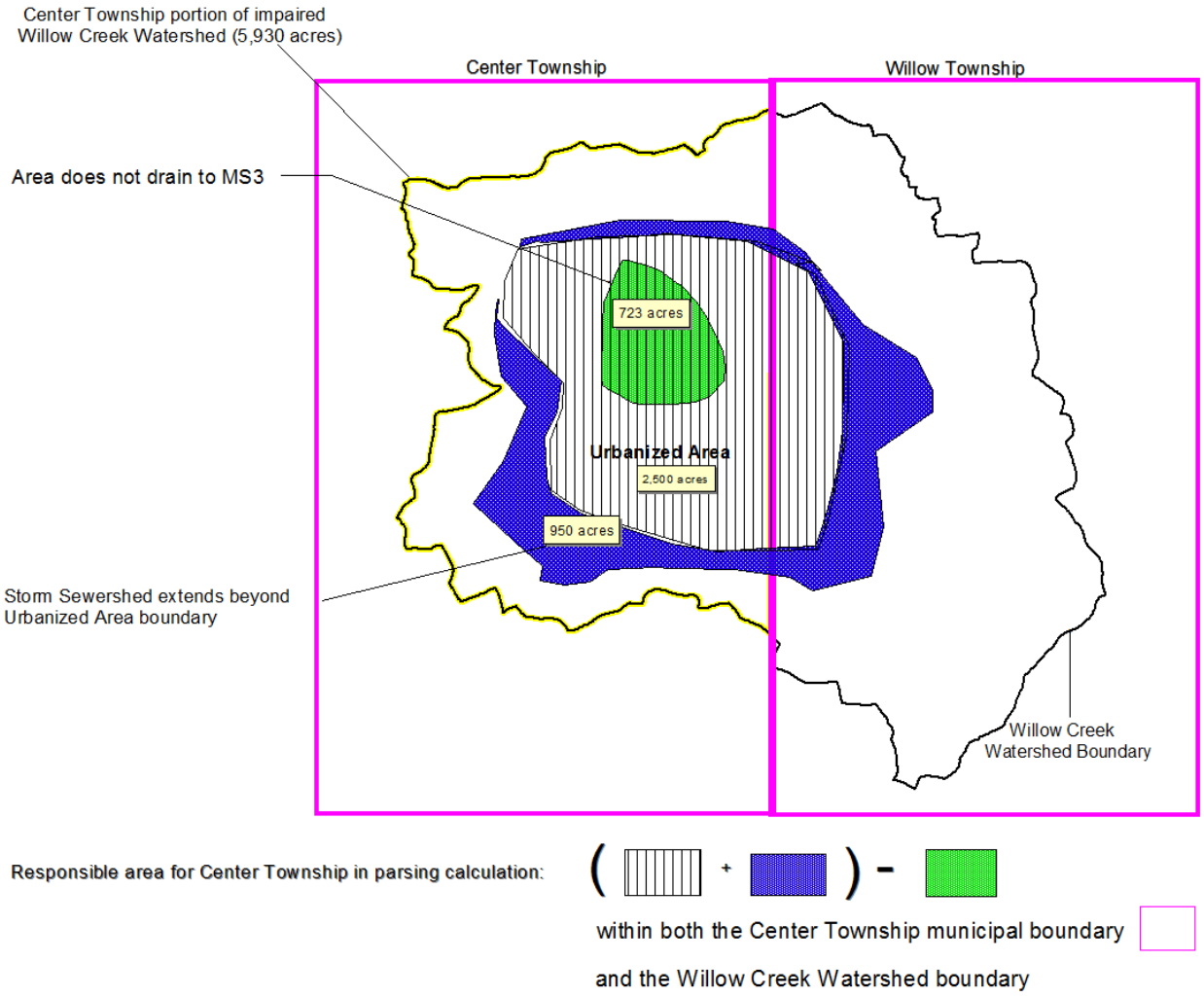
The principle of this approach may be stated as follows: *If the TMDL calculated the WLA based on the entire land area for a municipality that is contained in the impaired watershed, an MS4 permittee may parse (reduce) the WLA using the proportion of the load generated from the TMDL Planning Area. This may be done on a land area basis as described in Example 1. Alternately, another criterion, such as impervious area, may be applied as described in the following example.*

Example: A TMDL was developed and approved for the Willow Creek watershed in 2005. At that time, a bulk WLA was calculated using the entire watershed area. Center Township wishes to use the weighted land use approach to determine its parsed WLAs in the Willow Creek Watershed TMDL (see Figure 1, below). The impaired watershed is 5,930 acres total, including municipalities outside of Center Township. The pink line represents municipal boundaries. The yellow line represents the impaired watershed boundary within Center Township (2,950 acres). The striped area is the UA within Center Township (2,500 acres), and the blue area represents land outside of the UA in Center Township that drains into the MS4 (950 acres). The green area represents land within the UA that does not drain into the MS4 (723 acres). The TMDL Planning Area is

represented by the following formula: UA + Additional Land Draining to MS4 – Land within UA Not Draining to MS4. In this example, the storm sewershed is 2,727 acres (2,500 acres + 950 acres – 723 acres).

Once the planning area is calculated, determine the land uses in the planning area. A GIS-based analysis or assessment using other mapping tools is generally necessary.

Figure 1: Example Storm Sewershed Analysis



APPENDIX A

Public Notice & Proof of Publication

Plan needs to be on July 18 Workshop Agenda

Christine McAllister

To: legals@dailylocal.com
Subject: Public Notice Advertisement
Attachments: ADVERTISEMENT-WC (002).DOCX

Importance: High

7/7/17

Maureen – Please advertise the attached Notice on July 10. E-mail me a Proof of Publication and send the invoice to my attention.

Thank you for your help with EVERYTHING!!!!

Regards,

Christine

Christine M. McAllister
Administrative Assistant to the Borough Manager
Borough of West Chester
cmcallister@west-chester.com
610-344-3246 (W)
484-456-8281 (Cell)
610-436-0009 (F)

BOROUGH OF WEST CHESTER

MS4 POLLUTANT REDUCTION PLANS AND TMDL PLAN

JUNE 30, 2017

The Borough Council of the Borough of West Chester will accept comments from the public beginning on June 10, 2017 and extending through August 10, 2017 associated with the Borough's two (2) Pollutant Reduction Plans (PRPs) and one (1) Total Maximum Daily Load (TMDL) Plan as required by the Pennsylvania Department of Environmental Protection as a component of the Borough's *National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems* (MS4s). The PRPs outline in general terms the Borough's 5-year plan between 2018 and 2023 to reduce sediment loadings from the MS4 stormwater discharges to Chester Creek/Goose Creek, Brandywine Creek, Blackhorse Run, Plum Run, and Taylor Run. The TMDL Plan outlines in general terms the Borough's 5-year plan between 2018 and 2023 to reduce Total Phosphorus loadings from the MS4 stormwater discharges to Goose Creek. The PRPs and TMDL Plan will be available for public review Monday through Friday between the hours of 8:30 AM to 4:00 PM at the municipal offices of the Borough of West Chester located at 401 E. Gay Street, West Chester, PA 19380. The PRPs and TMDL Plan is also available for public review on the Borough's website at www.west-chester.com. Comments may be provided in writing and delivered in person or via e-mail or regular mail and addressed to Michael A. Cotter, Borough Manager at macotter@west-chester.com. The PRPs and TMDL Plan will be on the agenda for the Borough Council Work Session meeting scheduled for July 18, 2017. Comments received after August 10, 2017 will not be considered by the Borough Council.

Michael A. Cotter
Borough Manager

21ST CENTURY media

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307 Derstine Avenue • Lansdale, PA 19446

WEST CHESTER BOROUGH
401 E GAY STREET
WEST CHESTER, PA 19380
Attention:

STATE OF PENNSYLVANIA,
COUNTY OF MONTGOMERY

The undersigned Kathy Vincent, being duly sworn the he/she is the principal clerk of Daily Local News, Daily Local News Digital, published in the English language for the dissemination of local or transmitted news and intelligence of a general character, which are duly qualified newspapers, and the annexed hereto is a copy of certain order, notice, publication or advertisement of:

WEST CHESTER BOROUGH

Published in the following edition(s):

Daily Local News	07/10/17
Daily Local News Digital	07/10/17

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MAUREEN SCHMID, Notary Public
Lansdale Boro., Montgomery County
My Commission Expires March 31, 2021

Sworn to the subscribed before me this 7/11/2017.

Maureen Schmid

Notary Public, State of Pennsylvania
Acting in County of Montgomery

The Borough Council of the Borough of West Chester will accept comments from the public beginning on June 10, 2017 and extending through August 10, 2017 associated with the Borough's two (2) Pollutant Reduction Plans (PRPs) and one (1) Total Maximum Daily Load (TMDL) Plan as required by the Pennsylvania Department of Environmental Protection as a component of the Borough's National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). The PRPs outline in general terms the Borough's 5-year plan between 2018 and 2023 to reduce sediment loadings from the MS4 stormwater discharges to Chester Creek/Goose Creek, Brandywine Creek, Blackhorse Run, Plum Run, and Taylor Run. The TMDL Plan outlines in general terms the Borough's 5-year plan between 2018 and 2023 to reduce Total Phosphorus loadings from the MS4 stormwater discharges to Goose Creek. The PRPs and TMDL Plan will be available for public review Monday through Friday between the hours of 8:30 AM to 4:00 PM at the municipal offices of the Borough of West Chester located at 401 E. Gay Street, West Chester, PA 19380. The PRPs and TMDL Plan is also available for public review on the Borough's website at www.west-chester.com. Comments may be provided in writing and delivered in person or via e-mail or regular mail and addressed to Michael A. Cotter, Borough Manager at macotter@west-chester.com. The PRPs and TMDL Plan will be on the agenda for the Borough Council Work Session meeting scheduled for July 18, 2017. Comments received after August 10, 2017 will not be considered by the Borough Council.
Michael A. Cotter
Borough Manager
DL-July 10-1a

Advertisement Information

Client Id: 884439 **Ad Id:** 1379705 **PO:** **Sales Person:** 093304

and 455-14.C to allow a minimum Front Yard Setback of 30.05 feet and minimum Rear Yard Setback of 55.37 feet where the minimum Front and Rear Yard Setbacks are 75 feet; Section 455-132 to allow a pool and associated structures within the minimum Rear Yard Setback where they are not permitted; and from Section 274-19 to allow land disturbance, improvements, and construction activities within the Riparian Buffer where no disturbance is permitted; and any other relief that may be deemed necessary by the Zoning Hearing Board.

2. ZHB 563 – Nguyen/Vu – 1026A Lancaster Avenue, Berwyn. (VB District TPN 55-2L-4) Applicant has changed the property's use from commercial to single-family detached dwelling without Township approval. Applicant seeks a Variance from Section 455-21.(A)(1) to eliminate the need for commercial uses where second floor apartments are only allowed as accessory uses to nonresidential uses on the ground-level floor; a Special Exception in accordance with Section 455-122.B to change a nonconforming use or in the alternative appeal of the Zoning Officer's determination that the Applicant changed the property's use from commercial to single-family detached dwelling which is not a permitted use, and any other relief that may be deemed necessary by the Zoning Hearing Board.

Copies of applications are available for review in the Easttown Township Building weekdays from 8:00 a.m. through 12:00 p.m. and 12:30 p.m. through 4:30 p.m. If any person wishing to attend the hearing has a disability and/or requires an auxiliary aid, service or other accommodation, he or she should contact the Township at 610-687-3000 to discuss how those needs may be accommodated.
dln. 7/10, 17 - 1a.

The Borough Council of the Borough of West Chester will accept comments from the public beginning on June 10, 2017 and extending through August 10, 2017 associated with the Borough's two (2) Pollutant Reduction Plans (PRPs) and one (1) Total Maximum Daily Load (TMDL) Plan as required by the Pennsylvania Department of Environmental Protection as a component of the Borough's National Pollutant Discharge Elimination System (NPDES) Individual Permit to Discharge Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). The PRPs outline in general terms the Borough's 5-year plan between 2018 and 2023 to reduce sediment loadings from the MS4 stormwater discharges to Chester Creek/Goose Creek, Brandywine Creek, Blackhorse Run, Plum Run, and Taylor Run. The TMDL Plan outlines in general terms the Borough's 5-year plan between 2018 and 2023 to reduce Total Phosphorus loadings from the MS4 stormwater discharges to Goose Creek. The PRPs and TMDL Plan will be available for public review Monday through Friday between the hours of 8:30 AM to 4:00 PM at the municipal offices of the Borough of West Chester located at 401 E. Gay Street, West Chester, PA 19380. The PRPs and TMDL Plan is also available for public review on the Borough's website at www.west-chester.com. Comments may be provided in writing and delivered in person or via e-mail or regular mail and addressed to Michael A. Cotter, Borough Manager at macotter@west-chester.com. The PRPs and TMDL Plan will be on the agenda for the Borough Council Work Session meeting scheduled for July 18, 2017. Comments received after August 10, 2017 will not be considered by the Borough Council.
Michael A. Cotter
Borough Manager
DL-July 10-1a

BIDS & PROPOSALS

ADVERTISEMENT FOR BIDS

Sealed bids for the construction of the **Dogwood / Scott Drive Sewer Extension** will be received by the Caln Township Municipal Authority electronically via PennBid™ until 10:00 **A.M. local time, Tuesday, August 8, 2017** at which time all bids will be opened online.

Construction of the sewer extension will involve the installation of approximately 4,000 linear feet of low pressure sewer lines by open trench and horizontal directional drilling, installation of approximately 400 linear feet of gravity sanitary sewer by open trench, and the completion of all other necessary work to provide public sewer to approximately 55 existing homes located in Caln Township, Chester County Pennsylvania.

All Bid Documents and solicitation details are available at PennBid™ - www.PennBid.net. Click on the "Solicitations" then "View" tabs. Please note the low bidder is responsible for a fee to PennBid™.

Each bid must be accompanied by a bid bond or a certified check in an amount not less than ten percent (10%) of the amount of the bid in the form and subject to the conditions provided in the Instructions to Bidders. No bid may be withdrawn for the

Public Agenda

And

Meeting Minutes

Public Works Committee

July 11, 2017 – 5:35 pm

Committee Members Present:	Don Braceland (Chair) Bernard Flynn (Council Member) Denise Polk
Department Heads Present:	**O'B Laing, Public Works** **Keith Kurowski, Recreation** **Mac Cotter (Borough Manager)**

1. Call to Order – meeting was called to order at 5:35 PM

2. Comments, suggestions, petitions by residents in attendance regarding items not on the agenda:
   a) Keith Kurowski reminded everyone that the 35th Annual Turks Head Music Festival was taking place this Sunday, July 16th at Everhart Park.

3. Discuss the Marshall Square Park sidewalk and fieldstone step reconstruction.
   a) After an extended discussion, this item was tabled for further discussion. It was decided that Jeff Beitel, at his request, would offer reasonable alternative to repair the sidewalk instead of total reconstruction.

4. Discuss substitute material to replace tree well grates throughout the BID.
   a) Alternative material was shown along with photograph of similar product which is currently in place for over eight (8) years. This was well received by Council and members of the public. No decision was made however, Jeff Beitel indicated that as the Chairman of the Shade Tree Commission he had some concerns about the product and would like Council to allow him some time to look at alternative products to which Council complied.

5. Appraise Council of proposed Bid solicitation for 2017 Pavement Markings project.
   a) The Public Works Director gave a brief overview of the Pavement Markings project which included the bid documents to be ready for contract award in August.

6. Appraise Council of proposed Bid solicitation for 2017 Street and Alley Resurfacing/Reconstruction project.
   a) The Public Works Director gave a brief overview of the Street and Alley Resurfacing/Reconstruction project which included the bid documents to be ready for contract award in August.

7. Appraise Council of proposed Bid Solicitation for the Barnard Street Culvert project.
   a) The Public Works Director informed Council that this project is scheduled for bidding as soon as possible. He also noted that this is one of the projects which was long overdue, but would not be possible to expedite had it not been for the newly implemented Stream Protection Fee (SPF) which will cover all cost for the project. Councilman Flynn, however, remarked that he would suggest that the bridge abutment be painted with graffiti resistant paint. No action needed.

8. Consider Planned University Campus Overlay Traffic Planning Proposal
   a) Borough Manager gave a brief overview of this project, highlighting scope of work and also indicated it will be joint effort between WCU, West Goshen Township and The Borough.

9. Consider Proposal for Town Center Closed Loop System Upgrade
   a) Borough Manager gave a synopsis of this project which was subsequently sent through by a vote of 3 – 0.
      - **TO WORK SESSION AGENDA**

10. Consider Stream Protection Program Support Change Order.
    a) Courtney Finneran, Project Manager of CH2, gave a brief overview highlighting the rationale for the change order request. This was followed by a 3 – 0 vote by Council.
       - **TO WORK SESSION AGENDA**

11. Authorization to Advertise the Goose Creek Pollution Reduction Plan
    a) Borough Manager gave a brief overview of this plan which was followed by a 3 – 0 approval by Council.
       - **TO WORK SESSION AGENDA**

12. Discuss Tennis Court maintenance at Hoopes Park 2017
    a) 3 - 0 approval to move ahead with the project
       - **TO WORK SESSION AGENDA**

13. Discuss Kathy McBratnie Park Playground Renovation 2017
    a) Informative only, no action required or taken.

14. Approve June 2017 Public Works Committee minutes

15. Other Business
    a) None

16. Adjourn
    a) Meeting called for adjournment by Don Braceland, all in favor 3 – 0 .

Updated August 8, 2017

AGENDA

Public Works Committee

August 8, 2017 – 5:30 pm

Committee Members: Donald Braceland (Chair)
Denise Polk
Bernard Flynn

Department Heads: O'B Laing, Public Works
Keith Kurowski, Parks & Recreation

Borough Manager: Michael A. Cotter

1. Call to Order
2. Comments, suggestions, petitions by residents in attendance regarding items not on the agenda.
3. Discuss Gilmore PRP/TMDL Plans *(Issue Briefing (see Agenda Bookmark) & Attachment)*
4. Discuss Marshall Square Park proposal for sidewalk and staircase reconstruction *(Issue Briefing (see Agenda Bookmark) & Attachment)*
5. Discuss PennDOT Winter Traffic Services Agreement *(Issue Briefing (see Agenda Bookmark) & Attachment)*
6. Appraise Council of pending Shade Tree Grant application *(Information only)*
7. Review and approval of Bid Award for Barnard Street Culvert project *(Issue Briefing (see Agenda Bookmark) & Attachment)*
8. Review and approval of Paving Project Bid Award *(Issue Briefing (see Agenda Bookmark) & Attachment)*
9. Review and approval of Bid Award for Pavement markings *(Issue Briefing (see Agenda Bookmark) & Attachment)*
10. Discuss request from Councilman Bernie Flynn to remove bench from the North side of Gay Street in the vicinity of Rite Aid Pharmacy *(Information only)*
11. Friends of Marshall Square Park – discuss two granite in-lay park signs *(Issue Briefing (see Agenda Bookmark) & Attachment)*
12. Friends of Marshall Square Park – discuss "No Smoking Inside Gazebo" signs *(Issue Briefing (see Agenda Bookmark))*

13. Approve July's Public Works Committee meeting minutes *(see Agenda Bookmark)*

14. Other Business

15. Adjourn

Attachment Information:

Click here to access the Attachments.

Attachments can also be located at www.west-chester.com in the Document Center's "Agenda Attachments" folder.

****IDENTIFIER KEY = PW****

WEST CHESTER BOROUGH

POLLUTANT REDUCTION PLANS
AND
TOTAL MAXIMUM DAILY LOAD STRATEGY PLAN

EXECUTIVE SUMMARY

- West Chester Borough is currently operating under the PADEP's General (PAG-13) Small Municipal Separate Storm Sewer Systems (MS4) permit. Requirements include the following:

  - Public Education and Outreach
  - Public Participation
  - Illicit Discharge Detection and Elimination
  - Construction Site Runoff Control
  - Post-Construction Runoff Control
  - Pollution Prevention / Good Housekeeping

- The first permit was issued in 2003 with renewals every 5 years. The next permit period extends from 2018 to 2023. The Borough is required to prepare and submit a new permit application by September 16, 2017.

- Past permit requirements were limited to the fulfillment and reporting of the above listed efforts. A key component of this next permit cycle is the submission of a Pollutant Reduction Plan (PRP) and/or a Total Maximum Daily Load (TMDL) Strategy Plan to accomplish a specified percentage reduction in the amount of pollutants contributing to impaired streams. Pollutant reductions must be achieved within the 5-year permit period.

- PADEP has identified the following streams in the Borough as having specific impairments:

Goose Creek:	Nutrients (i.e., Total Phosphorus)*
Chester Creek (Goose Creek):	Siltation (i.e., sediment) and pathogens
Brandywine Creek:	Siltation
Blackhorse Run:	Siltation
Plum Run:	Siltation
Taylor Run:	Siltation

*Per U.S. Environmental Protection Agency, Philadelphia, PA report titled *Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania*, dated June 30, 2008.

As a result, the Borough is required to develop one (1) TMDL Strategy Plan to achieve a 53.9% reduction in the Total Phosphorus loading contributing to Goose Creek and two (2) PRPs to demonstrate a 10% reduction in the sediment loading contributing to Chester Creek/Goose Creek and Brandywine Creek/Blackhorse Run/Plum Run/Taylor Run.

- Because the Borough is subject to the Total Phosphorus TMDL Plan reduction requirements, the Borough will no longer be eligible to be covered by the PAG-13 permit, but now will be required to obtain an Individual MS4 Permit from PADEP.

- The existing sediment and Total Phosphorus loadings and reductions have been calculated based on the land uses within the contributing drainage areas to the impaired streams.

- Effective stormwater Best Management Practices (BMPs) are proposed, including the following combinations of various BMPs:

  - Rain gardens
  - Vegetated curb extensions
  - Bioswales
  - Infiltration trenches
  - Brick pavers with underground infiltration
  - Streambank restoration
  - Street sweeping
  - Tree plantings
  - Pretreatment and membrane filtration systems
  - Storm inlet cleaning

- The above listed BMPs are proposed to be installed at the following locations throughout the Borough:

  - John O. Green Memorial Park
  - Fugett Park/Borough Hall
  - Greenview Alley

- Veterans Park/Pine Alley
- Marshall Square Park
- South Brandywine Street
- Storm sewer system outfalls at E. Nields Street west of S. Franklin Street

- The Public Participation component of the TMDL Strategy Plan and PRPs has been satisfied as follows:

  - The public notice regarding the draft TMDL strategy plan and PRPs was advertised on July 10, 2017.
  - The required public meeting (this discussion) was held on August 8, 2017.
  - Public comments were accepted from July 10, 2017 to August 10, 2017.
  - Public comments will be incorporated, documents will be finalized, and the permit application will be submitted by September 16, 2017 to PADEP.

APPENDIX B

WEST GOSHEN TOWNSHIP

EAST BRADFORD TOWNSHIP

WEST GOSHEN TOWNSHIP

WEST GOSHEN TOWNSHIP

Unnamed Trib Taylor Run

Unnamed Trib Taylor Run

Unnamed Trib Taylor Run

Hannum Trib to Taylor Run

Unnamed Trib Blackhorse Creek

BLACKHORSE CREEK

PLUM RUN

GOOSE CREEK

UNNAMED TRIB TO GOOSE CREEK

Streambank Restoration BMP Approximate Limits

Outfalls 13 & 37

Legend

Stormwater Features

- Inlet
- Manhole
- Junction Manhole Box
- Private Inlet
- Stormwater Outfall
- Pipe Discharge
- Stormwater Pipes
- Streams
- Swale
- Municipal Boundary
- Small BMP Locations

Planning Area

- GOOSE CREEK
- Parsed Areas

Parsed areas - Stormwater Outfall is located along / at the creek; any overland flow that flows into a creek and does not enter MS4 collection system.

WEST CHESTER BOROUGH
MS4 TMDL MAP
GOOSE CREEK

WEST CHESTER BOROUGH, CHESTER COUNTY, PA

GILMORE & ASSOCIATES, INC.
ENGINEERING & CONSULTING SERVICES
65 E. BUTLER AVE. SUITE 100, NEW BRITAIN, PA 18901-5106 - (215) 345-4330
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JOB NO: 15-08026T | DATE: JULY 2018 | 0 100 200 400 Feet

WEST GOSHEN TOWNSHIP

EAST BRADFORD TOWNSHIP

WEST GOSHEN TOWNSHIP

WEST GOSHEN TOWNSHIP

WEST GOSHEN TOWNSHIP

Unnamed Trib Taylor Run

Unnamed Trib Taylor Run

Hannum Trib to Taylor Run

Unnamed Trib Blackhorse Creek

BLACKHORSE CREEK

PLUM RUN

GOOSE CREEK

UNNAMED TRIB TO GOOSE CREEK

GOOSE CREEK

GOSHEN RD

N LOCUST LA

PARKE HOLLOW LA

HOOPES PARK LA

E LOCUST LA

S LOCUST LA

W ASHBRIDGE ST

E ASHBRIDGE ST

CLARKE ST

PENNY LA

CLOVER AL

ELIZABETH ST

EL BOW LA

HILLSIDE DR

MARSHALL DR

E MARSHALL ST

WALDEN DR

MAYFIELD AV

N BRANDYWINE ST

W VIRGINIA AV

E VIRGINIA AV

N MARYLAND AV

S MARYLAND AV

NORRIS LA

EBBS LA

JEAN AL

N DARLINGTON ST

SCOTT AL

WEAVER AL

HOUSE AL

N WALNUT ST

NEWLIN AL

FORD CI

N FRANKLIN ST

CONVENT LA

MARIE AV

LINCOLN AV

W MARSHALL ST

W LAFAYETTE ST

E LAFAYETTE ST

N HIGH ST

PARK AL

E BIDDLE ST

OAK PL

N EVERHART ST

N WAYNE ST

EBBS AL

W STRASBURG RD

BRICK AL

PINE AL

N NEW ST

W BIDDLE ST

SCHOOL AL

CLOVER AL

PROSPECT AL

HISTORY AL

HALE AL

E EVANS ST

E WASHINGTON ST

W WASHINGTON ST

N CHURCH ST

PEARL AL

PATTON AL

EVANS ST

N ADAMS ST

PENN AL

N PENN ST

N BOUNDARY ST

HANNUM AV

W CHESTNUT ST

E CHESTNUT ST

GRANITE AL

W PRESCOTT AL

E PRESCOTT AL

N WALNUT ST

PATTON AV

W GAY ST

E GAY ST

N EVERHART ST

N BRADFORD AV

HARMONY AL

W COURTHOUSE AL

POTTER AL

MIDDLE AL

N FRANKLIN ST

W MARKET ST

E MARKET ST

RAILROAD ST

CEDAR AL

PEARL AL

WOLFERTON AL

WOSPRINE AL

E MINER ST

S FRANKLIN ST

S ADAMS ST

S PENN ST

S BOUNDARY ST

LOCUST AL

E BARNARD ST

S WORTHINGTON ST

HEMLOCK AL

W BARNARD ST

SPRUCE AL

W UNION ST

E UNION ST

HOLLY AL

OAK AL

S CHURCH ST

S NEW ST

S WAYNE ST

S DARLINGTON ST

S HIGH ST

DEAN ST

SHERRY AL

MAGNOLIA ST

BIRCH AL

APPLE AL

PRICE ST

ELM AL

LACEY ST

JUNIPER AL

DOGWOOD DR

SHARPLESS ST

MULBERRY AL

W NIELDS ST

E NIELDS ST

N CAMPUS DR

UNIVERSITY AV

COLLEGE AV

S BRANDYWINE ST

SPRING GROVE LA

W ROSEDALE AV

LINDEN ST

OULANEY AL

S BRADFORD AV

S EVERHART ST

TACIE LYNN DR

W BIDDLE ST

HOOPES AL

DOWNINGTOWN PK

Legend

Stormwater Features

- Inlet
- Manhole
- Junction Manhole Box
- Private Inlet
- Stormwater Outfall
- Pipe Discharge
- Stormwater Pipes
- Streams
- Swale

Mapshed Landuse Code

- Water
- Low-Density Residential
- Medium-Density Residential
- High-Density Residential
- Low-Density Mixed Urban
- Medium-Density Mixed Urban
- High-Density Mixed Urban
- Hay/Pasture
- Cropland
- Coniferous
- Decidious
- Mixed Woodland
- Woody Wetland
- Emergent Wetland
- Disturbed
- Disturbed
- Turf/Golf

WEST CHESTER BOROUGH
MS4 TMDL LAND USE (MAPSHED) MAP
GOOSE CREEK

WEST CHESTER BOROUGH, CHESTER COUNTY, PA

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APPENDIX C

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

APPENDIX D

Select input data file: C:\MapShed\Runfiles\Goose2018\Output\Goose2018-0_ua.csv

Watershed Totals | Municipality Loads | Regulated Loads | Unregulated Loads

GWLF-E Average Loads by Source for Watershed 0

Source	Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	282	26609.80	94.40	122.40	0.43	30.07	0.11
Cropland	151	226833.62	1502.20	808.61	5.36	139.13	0.92
Forest	1144	15498.50	13.50	86.60	0.08	10.96	0.01
Wetland	235	1278.68	5.40	54.81	0.23	3.42	0.01
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	872	165633.30	189.90	924.84	1.06	97.66	0.11
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	148	3637.63	24.60	84.94	0.57	9.24	0.06
MD Mixed	403	40013.90	99.30	928.61	2.30	103.77	0.26
HD Mixed	1152	114397.87	99.30	2654.78	2.30	296.70	0.26
LD Residential	642	15763.05	24.60	368.13	0.57	40.01	0.06
MD Residential	1853	184130.08	99.40	4272.74	2.31	477.52	0.26
HD Residential	57	5643.83	99.00	131.02	2.30	14.64	0.26
Water	2						
Farm Animals				0.0		0.0	
Tile Drainage		0.0		0.0		0.0	
Stream Bank		3261210.1		1631.4		423.3	
Groundwater				10019.7		218.3	
Point Sources				0.0		0.0	
Septic Systems				4532.9		0.0	
Totals	**6941**	**4060650**		**26621**		**1865**	

Print | Export to JPEG | Exit

Select input data file: C:\MapShed\Runfiles\Goose2018\Output\Goose2018-0_ua.csv

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

View loads for municipality: (00200)

Source	Source Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	0	0.00	0.00	0.00	0.00	0.00	0.00
Cropland	0	0.00	0.00	0.00	0.00	0.00	0.00
Forest	2	27.00	13.50	0.20	0.08	0.00	0.00
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Mixed	210	20853.00	99.30	483.00	2.30	54.60	0.26
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	44	4356.00	99.00	101.20	2.30	11.40	0.26
Water	0						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		196376.44		98.2		25.5	0.095
Groundwater				541.1		11.8	0.054
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	256	221612.4		1223.7		103.3	

Print | Export to JPEG | Exit

Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type: Infiltration Basin

Area Treated (ha)		Existing Area (ha)	
LD Residential	0	LD Residential	260
MD Residential	0	MD Residential	750
HD Residential	0	HD Residential	23
LD Mixed	0.02	LD Mixed	60
MD Mixed	0.09	MD Mixed	163
HD Mixed	2.12	HD Mixed	466
Total	2	**Total**	1722

Rainfall Captured (2.54 cm = 1 in)

Depth (cm): 3.81

Volume (m3): 721

Run

Calculated Reduction Efficiency

TN 0.65 TP 0.76 TSS 0.82

New Development

BMP Type: Select BMP Type

Area Developed (ha)		Area Replaced (ha)		Existing Area (ha)	
LD Residential	0	Hay/Pasture	0	Hay/Pasture	114
MD Residential	0	Cropland	0	Cropland	61
HD Residential	0	Forest	0	Forest	463
LD Mixed	0	Disturbed	0	Disturbed	0
MD Mixed	0	Turfgrass	0	Turfgrass	0
HD Mixed	0	Open Land	0	Open Land	353
Total	0	**Total**	0	**Total**	991

Rainfall Captured (2.54 cm = 1 in)

Depth (cm): 7.10

Volume (m3): 0

Run

Calculated Reduction Efficiency

TN 0.00 TP 0.00 TSS 0.00

Stream Protection

Vegetative buffer strip width (m)	0
Fraction of streams treated (0-1)	0.000
Total streams in non-ag areas (km)	31.1
Streams w/bank stabilization (km)	0.0

Street Sweeping

Fraction of area treated (0-1): 1.000

Sweep Type: (•) Mechanical ( ) Vacuum

Times/month

Jan	0	Apr	0	Jul	0	Oct	0
Feb	0	May	0	Aug	0	Nov	0
Mar	0	Jun	0	Sep	0	Dec	0

Rural BMP Editor

BMP Efficiency Editor

Export to JPEG

Save File

Close

Select input data file: C:\MapShed\Runfiles\Gosse2018\Output\Goose2018BMPs-0_ua.csv

Watershed Totals | Municipality Loads | Regulated Loads | Unregulated Loads

GWLF-E Average Loads by Source for Watershed 0

Source	Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	282	26609.80	94.40	122.40	0.43	30.07	0.11
Cropland	151	226833.62	1502.20	808.61	5.36	139.13	0.92
Forest	1144	15498.50	13.50	86.60	0.08	10.96	0.01
Wetland	235	1278.68	5.40	54.81	0.23	3.42	0.01
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	872	165633.30	189.90	924.84	1.06	97.66	0.11
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	148	3637.63	24.60	84.83	0.57	9.22	0.06
MD Mixed	403	39947.76	99.10	927.40	2.30	103.62	0.26
HD Mixed	1152	114221.50	99.20	2651.35	2.30	296.26	0.26
LD Residential	642	15741.01	24.50	367.66	0.57	39.95	0.06
MD Residential	1853	183821.43	99.20	4267.18	2.30	476.79	0.26
HD Residential	57	5643.83	99.00	130.87	2.30	14.62	0.26
Water	2						
Farm Animals				0.0		0.0	
Tile Drainage		0.0		0.0		0.0	
Stream Bank		3256792.0		1629.2		421.1	
Groundwater				10019.7		218.3	
Point Sources				0.0		0.0	
Septic Systems				4532.9		0.0	
Totals	**6941**	**4055659**		**26608**		**1861**	

Print | Export to JPEG | Exit

Select input data file: C:\MapShed\Runfiles\Goose EWs\Output\GooseEWs-0_ua.csv

Watershed Totals | Municipality Loads | Regulated Loads | Unregulated Loads

GWLF-E Average Loads by Source for Watershed 0

Source	Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	282	26609.80	94.40	122.40	0.43	30.07	0.11
Cropland	151	226833.62	1502.20	808.61	5.36	139.13	0.92
Forest	1144	15498.50	13.50	86.60	0.08	10.96	0.01
Wetland	235	1278.68	5.40	54.81	0.23	3.42	0.01
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	872	165633.30	189.90	924.84	1.06	97.66	0.11
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	148	3637.63	24.60	84.94	0.57	9.24	0.06
MD Mixed	403	40013.90	99.30	928.61	2.30	103.77	0.26
HD Mixed	1152	114397.87	99.30	2654.78	2.30	296.70	0.26
LD Residential	642	15763.05	24.60	368.13	0.57	40.01	0.06
MD Residential	1853	184130.08	99.40	4272.74	2.31	477.52	0.26
HD Residential	57	5643.83	99.00	131.02	2.30	14.64	0.26
Water	2						
Farm Animals				0.0		0.0	
Tile Drainage		0.0		0.0		0.0	
Stream Bank		3261194.6		1631.4		423.3	
Groundwater				10019.7		218.3	
Point Sources				0.0		0.0	
Septic Systems				4532.9		0.0	
Totals	**6941**	**4060635**		**26621**		**1865**	

Print | Export to JPEG | Exit

Select input data file: C:\MapShed\Runfiles\Goose EWs\Output\GooseEWs-0_ua.csv

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

View loads for municipality: Area1 (00001)

Source	Source Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	0	0.00	0.00	0.00	0.00	0.00	0.00
Cropland	0	0.00	0.00	0.00	0.00	0.00	0.00
Forest	0	0.00	0.00	0.00	0.00	0.00	0.00
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Mixed	44	4369.20	99.30	101.20	2.30	11.40	0.26
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		34580.03		17.3		4.5	0.017
Groundwater				90.2		2.0	0.009
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	**44**	**38949.2**		**208.7**		**17.9**	

Print | Export to JPEG | Exit

Select input data file: C:\MapShed\Runfiles\Goose EWs\Output\GooseEWs-0_ua.csv

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

View loads for municipality: Area2 (00002)

Source	Source Area (ac)	Sediment Total Load (lb)	Sediment Loading Rate (lb/ac)	Nitrogen Total Load (lb)	Nitrogen Loading Rate (lb/ac)	Phosphorus Total Load (lb)	Phosphorus Loading Rate (lb/ac)
Hay/Pasture	0	0.00	0.00	0.00	0.00	0.00	0.00
Cropland	0	0.00	0.00	0.00	0.00	0.00	0.00
Forest	0	0.00	0.00	0.00	0.00	0.00	0.00
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Mixed	35	3475.50	99.30	80.50	2.30	9.10	0.26
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
HD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
Water	0						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		26824.96		13.4		3.5	0.013
Groundwater				70.1		1.5	0.007
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	**35**	**30300.5**		**164.0**		**14.1**	

Print | Export to JPEG | Exit

APPENDIX E



CONTECH®
ENGINEERED SOLUTIONS

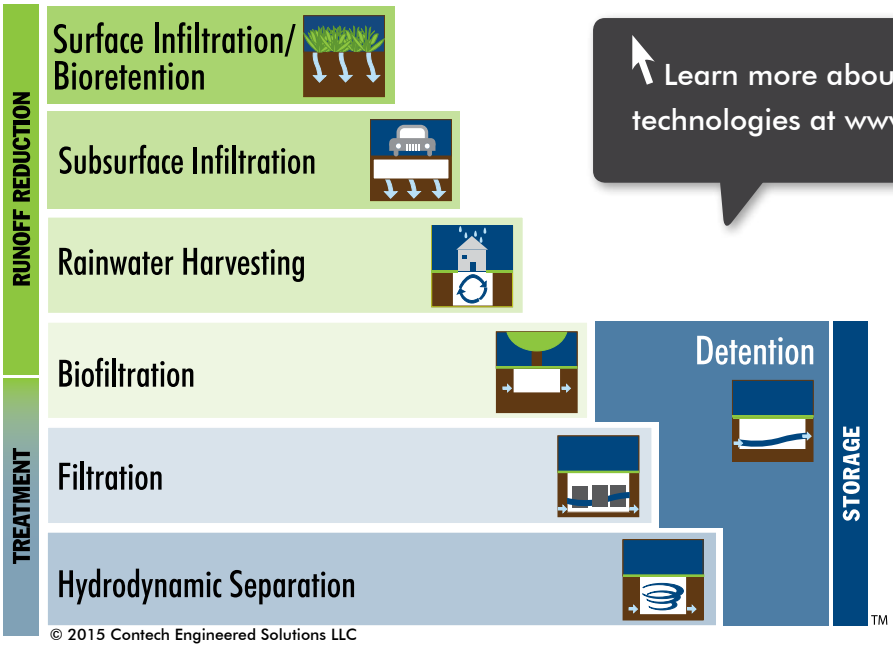
Jellyfish® Filter

Solutions Guide

UrbanGreen® Stormwater Solutions from Contech

Selecting the Right Stormwater Solution Just Got Easier...

It's simple to choose the right low impact development (LID) solution to achieve your runoff reduction and treatment goals with the Contech UrbanGreen® Staircase. First, select the runoff reduction practices that are most appropriate for your site, paying particular attention to pretreatment needs. If the entire design storm cannot be retained, select a best management practice (BMP) to treat the balance. Finally, select a detention system to address any outstanding downstream erosion.



Learn more about all of our stormwater technologies at www.ContechES.com/urbangreen

Learn About the Jellyfish® Filter

Go online and watch our animation to learn how the Jellyfish Filter works. The animation also highlights important features of the Jellyfish Filter including…

- Applications
- Performance test results
- Inspection and maintenance
- Regulatory approvals

To view the Jellyfish Filter animation, visit:
www.conteches.com/jellyfish

Jellyfish® Filter

Filtration as a Stormwater Management Strategy

Stormwater regulations are increasingly calling for more robust treatment levels. In addition to the removal of suspended solids, many regulations now require best management practices to remove significant amounts of nutrients, metals, and other common pollutants found in stormwater runoff. Meeting these regulations often requires the use of a filtration solution.

Low Impact Development (LID) and Green Infrastructure (GI) are complimented by filtration solutions. Benefits of LID and GI systems include retaining runoff and aesthetic appeal. Keeping LID and GI sites free from fine sediments, oils, trash, and debris while functioning as designed can be time consuming and costly.

As a result, the practice of combining LID and GI with filtration is becoming more common. Providing a single point of maintenance promotes proper system functionality and increases the aesthetic appeal by removing unsightly trash and debris.

A Jellyfish Filter Curb Inlet pretreats runoff entering a bioretention system

The Jellyfish® Filter - Setting New Standards in Stormwater Treatment

The Jellyfish Filter is a stormwater quality treatment technology featuring high surface area and high flow rate membrane filtration at low driving head. By incorporating pretreatment with light-weight membrane filtration, the Jellyfish Filter removes floatables, trash, oil, debris, TSS, fine silt-sized particles, and a high percentage of particulate-bound pollutants; including phosphorus and nitrogen, metals and hydrocarbons.

The high surface area membrane cartridges, combined with up flow hydraulics, frequent backwashing, and rinseable/reusable cartridges ensures long-lasting performance.

The Jellyfish Filter.

Jellyfish® Filter Features and Benefits

FEATURES	BENEFITS
1. High surface area, high flow rate membrane filtration	1. Long-lasting and effective stormwater treatment
2. Highest design treatment flow rate per cartridge (up to 80 gpm (5 L/S)	2. Compact system with a small footprint, lower construction cost
3. Low driving head (typically 18 inches or less (457 mm))	3. Design Flexibility, lower construction cost
4. Lightweight cartridges with passive backwash	4. Easy maintenance and low life-cycle cost
5. 3rd party verified field performance per TARP protocol	5. Superior pollutant capture with confidence

Jellyfish® Filter Applications

- Urban development
- Highways, airports, seaports, and military installations
- Commercial and residential development, infill and redevelopment, and stormwater quality retrofit applications
- Pretreatment for Low Impact Development (LID), Green Infrastructure (GI), infiltration, and rainwater harvesting and reuse systems
- Industrial sites

A Jellyfish Filter pretreats a bioretention/ bioswale system at a commercial site in Ontario, Canada.

A catch basin Jellyfish Filter is installed in a commercial development in Virginia.

A Jellyfish Filter provides treatment at an Industrial Park in Lake Tahoe, Nevada.

Jellyfish® Filter Field Performance Test Results

POLLUTANT OF CONCERN	% REMOVAL
Total Trash	99%
Total Suspended Solids (TSS)	89%
Total Phosphorus (TP)	59%
Total Nitrogen (TN)	51%
Total Copper (TCu)	>80%
Total Zinc (TZn)	>50%
Turbidity (NTU)	<15%

Sources:
TARP II Field Study – 2012 JF 4-2-1 Configuration
MRDC Floatables Testing – 2008 JF6-6-1 Configuration

The pleated tentacles of the Jellyfish Filter provide a large surface area for pollutant removal.

Jellyfish® Filter Approvals

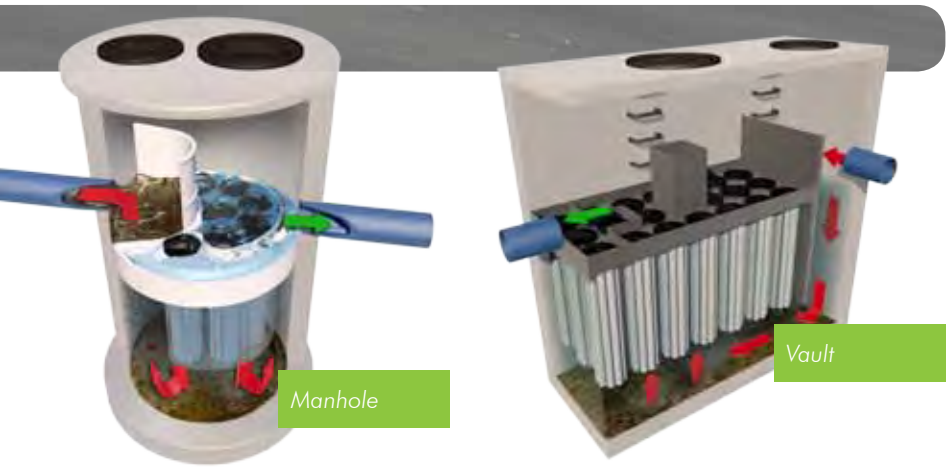
The Jellyfish Filter is approved through numerous state and federal verification programs, including:

- New Jersey Corporation for Advanced Technology (NJCAT) – Field Performance Verification per TARP Tier II Protocol
- New Jersey Department of Environmental Protection (NJDEP) – Certification
- Washington State Department of Ecology (TAPE – CULD)
- Maryland Department of the Environment (MD DOE)
- Texas Commission on Environmental Quality (TCEQ)
- Virginia Department of Environmental Quality (VA DEQ)
- Ontario Ministry of the Environment – New Environmental Technology Evaluation (NETE) – Certification

Learn more at www.ContechES.com/jellyfish

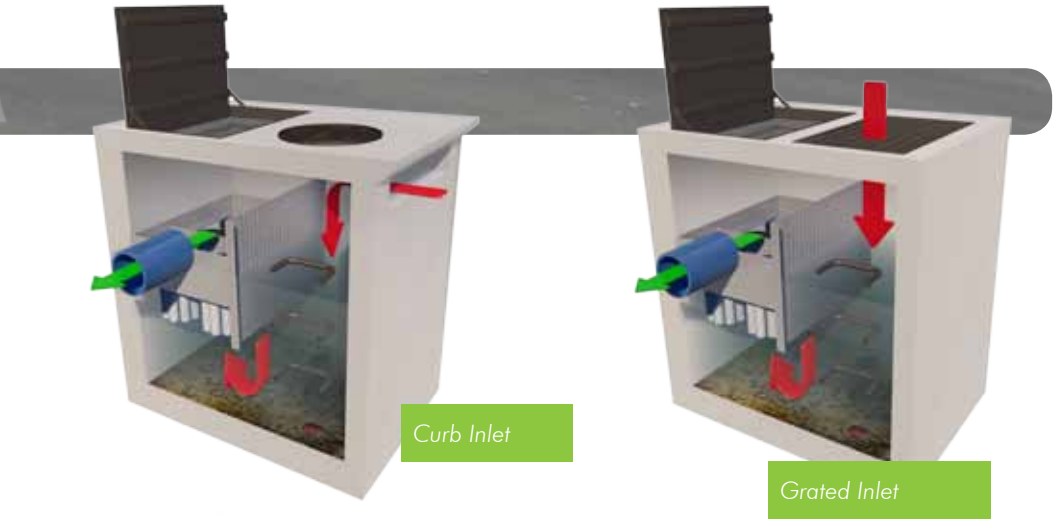
Jellyfish® Filter Configurations

The Jellyfish Filter is available in a variety of configurations. Typically, 18 inches (457 mm) of driving head is designed into the system. For low drop sites, the designed driving head can be less.



Manhole

Vault



Curb Inlet

Grated Inlet

Lightweight Jellyfish Filter Configurations

Custom configurations include Jellyfish Filter tanks made from fiberglass for site specific applications.

A Jellyfish Filter was constructed from fiberglass to reduce the weight of the system, allowing for a suspended installation above an underground parking structure. The reduced weight eliminated the need for structural changes, and suspending the Jellyfish resulted in no loss of parking space, maximizing real-estate value.

Other custom configurations include:

- On-line capability (internal bypass)
- Peak Diversion Vault Configurations

Jellyfish® Filter Maintenance

Inspection and maintenance activities for the Jellyfish Filter typically include:

- Visual inspection of deck, cartridge lids, and maintenance access wall.
- Vacuum extraction of oil, floatable trash/debris, and sediment from manhole sump.
- External rinsing and re-installing of filter cartridges.
- Replacement of filter cartridge tentacles as needed. Cartridge replacement intervals vary by site; typical replacement is anticipated every 2-5 years.

The Jellyfish Filter cartridge is light and easy to clean.

Jellyfish® Filter Inspection and Maintenance Video

Inspecting and maintaining the Jellyfish Filter is easier than you may think. Watch the Jellyfish inspection and maintenance video at **www.ContechES.com/jellyfish**

LEARN MORE

- Access project profiles, photos, videos and more online at **www.ContechES.com/jellyfish**

CONNECT WITH US

- Call us at 800-338-1122
- Contact your local rep at **www.ContechES.com/localresources**

START A PROJECT

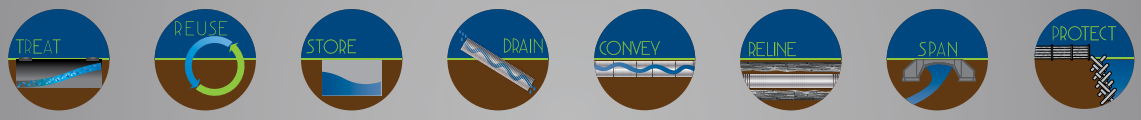
- Submit your system requirements on our product Design Worksheet **www.ContechES.com/start-project**

USE OUR ONLINE TOOLS

- Low Impact Development Site Planner **www.ContechES.com/LIDsiteplanner**

CONTECH® ENGINEERED SOLUTIONS

COMPLETE SITE SOLUTIONS



TREATMENT SOLUTIONS
Helping to satisfy stormwater and wastewater management requirements on land development projects

- Stormwater & Wastewater Treatment
- Detention/Infiltration
- Rainwater Harvesting
- Biofiltration/Bioretention

PIPE SOLUTIONS
Meeting project needs for durability, hydraulics, corrosion resistance, and stiffness

- Corrugated Metal Pipe (CMP)
- Steel Reinforced Polyethylene (SRPE)
- High Density Polyethylene (HDPE)
- Polyvinyl Chloride (PVC)

STRUCTURES SOLUTIONS
Providing innovative options and support for crossings, culverts, and bridges

- Plate, Precast & Truss bridges
- Hard Armor
- Retaining Walls
- Tunnel Liner Plate

Get Social With Us!

Jellyfish Brochure (5M) PDF Revision 4/15

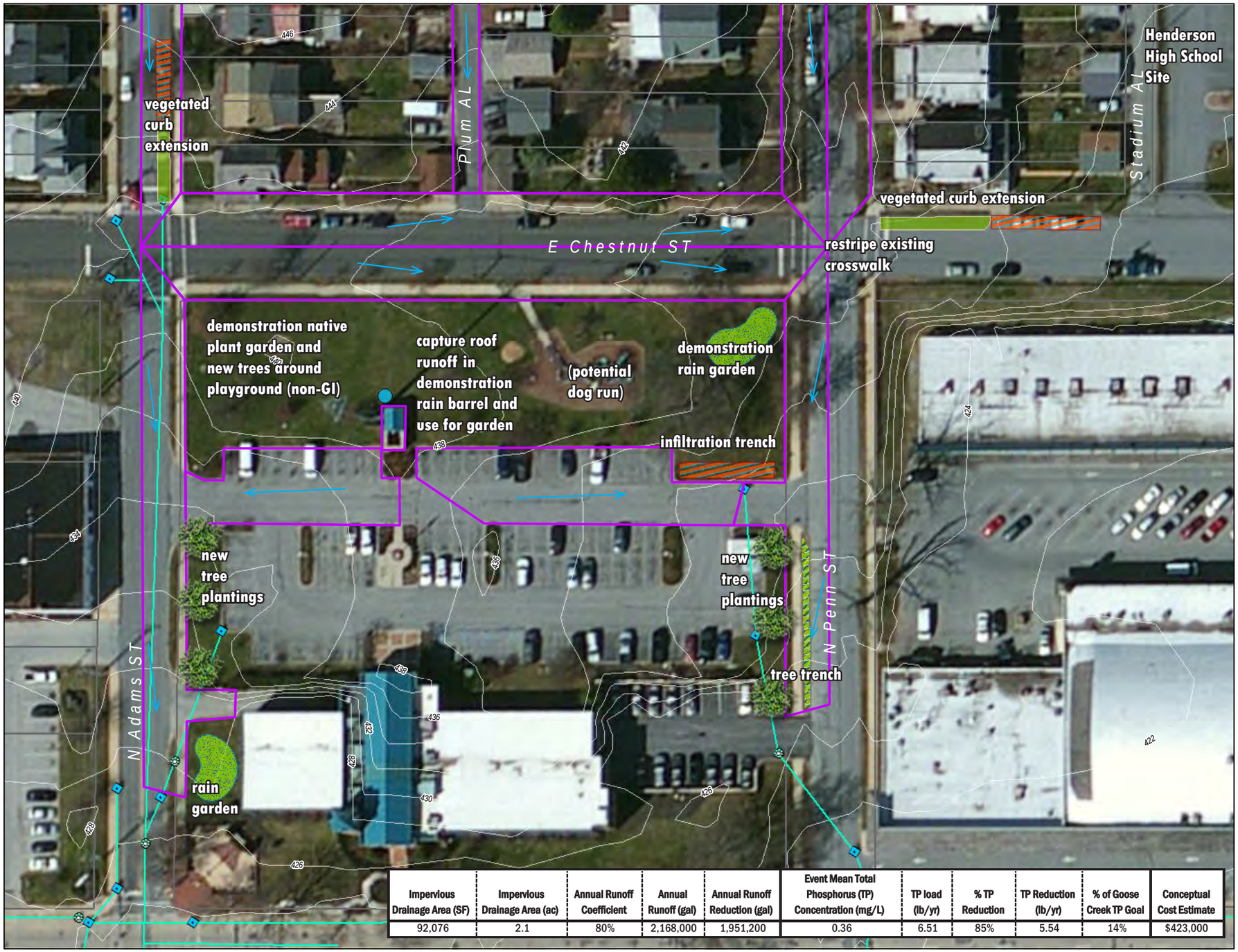
CONTECH® ENGINEERED SOLUTIONS

We print our brochures entirely on Forest Stewardship Council certified paper. FSC certification ensures that the paper in our brochures contain fiber from well-managed and responsibly harvested forests that meet strict environmental and socioeconomic standards.

FSC

APPENDIX F

FUGETT PARK/BOROUGH HALL: PROPOSED GREEN INFRASTRUCTURE CONCEPTS



Impervious Drainage Area (SF)	Impervious Drainage Area (ac)	Annual Runoff Coefficient	Annual Runoff (gal)	Annual Runoff Reduction (gal)	Event Mean Total Phosphorus (TP) Concentration (mg/L)	TP load (lb/yr)	% TP Reduction	TP Reduction (lb/yr)	% of Goose Creek TP Goal	Conceptual Cost Estimate
92,076	2.1	80%	2,168,000	1,951,200	0.36	6.51	85%	5.54	14%	$423,000

Fugett Park and West Chester Borough Hall make up a 2.66 acre site near the eastern border of West Chester Borough. The park features new playground equipment and several established mature trees. The site is bordered by E Chestnut Street, N Adams St, E Gay St, and N Penn St. The park is bordered by residential homes to the north and west, the Henderson High School site to the northeast, and commercial properties to the east.

This high-visibility site has frequent visitors (both Borough residents and others) and therefore has the potential to feature numerous "demonstration" green infrastructure technologies and showcase the Borough's commitment to green infrastructure and stormwater solutions. With that vision in mind, the green infrastructure concepts proposed for the site consist of vegetated curb extensions with subsurface infiltration trench components (one on N Adams St and one on E Chestnut St), a demonstration rain garden in the northeast corner of the park, another rain garden on the western side of Borough Hall, a subsurface infiltration trench to capture parking lot runoff, a tree trench along N Penn St, and a demonstration rain barrel to capture roof runoff from the shed to be used in a potential demonstration native plant/backyard wildlife garden. In addition, new tree plantings are proposed on both edges of the parking lot.

Collectively, these GI features would capture and treat runoff from the site and several adjacent streets as shown on the concept plan. During larger storm events, overflow structures would allow excess runoff to flow into existing storm sewers. In addition to reducing and treating stormwater runoff, these GI features have the potential to add aesthetic value to the park, promote traffic calming, and work in harmony with the site's existing active and passive recreational uses such as the existing playground and proposed dog run areas.

- Inlet
- Stormwater MH
- Existing Stormwater Pipes
- 2 ft Contours
- Surface Flow
- Parcels
- Drainage Area

Proposed GI Features

- Infiltration Trench
- Tree Trench
- Rain Barrel
- Rain Garden
- Vegetated Curb Extension

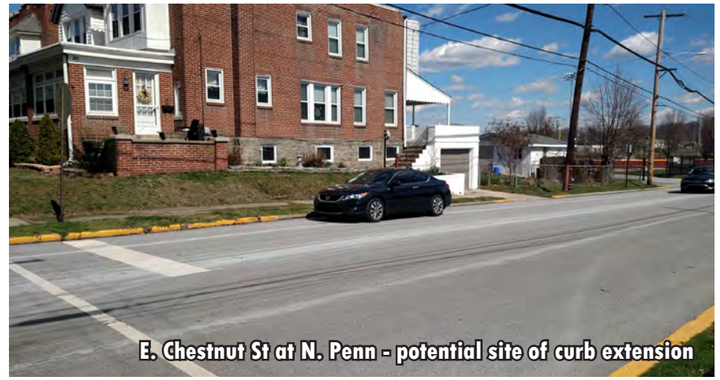
NORTH

0 25 50 Feet

FUGETT PARK/BOROUGH HALL: PROPOSED GREEN INFRASTRUCTURE CONCEPTS


existing view of West Side of Borough Hall


north corner of Fugett Park - potential site of rain garden


E. Chestnut St at N. Penn - potential site of curb extension

Existing Conditions

Proposed Rain Garden on West Side of Borough Hall


rain garden - Syracuse, NY


rain barrel


curb extension - Lancaster, PA

Examples of GI Technology

GREENVIEW ALLEY: PROPOSED GREEN INFRASTRUCTURE CONCEPTS

- Inlet
- Stormwater MH
- Stormwater Outfall (53)
- Existing Stormwater Pipes
- Surface Waterways
- 2 ft Contours
- Surface Flow
- Parcels
- Drainage Area

Proposed GI Features

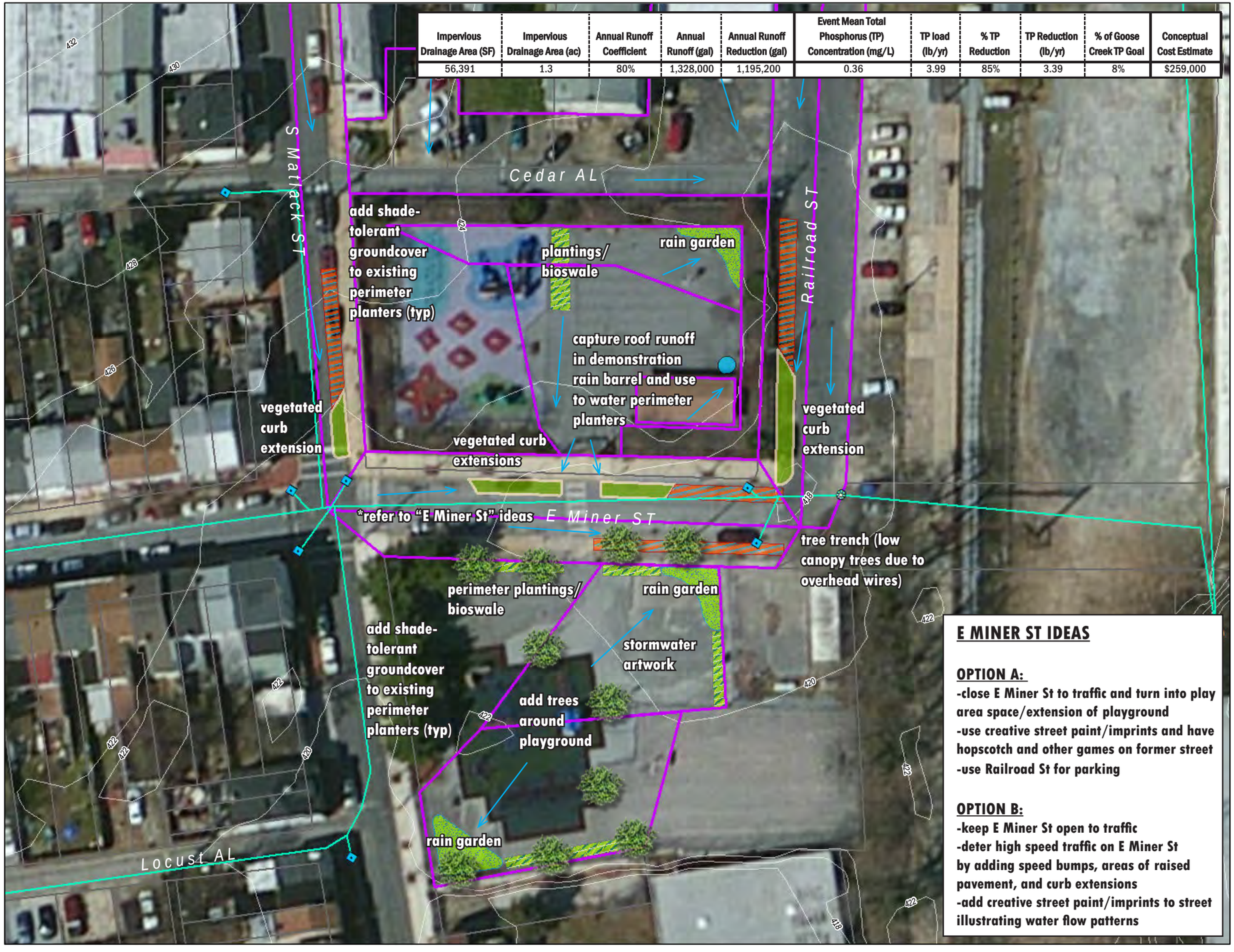
- Infiltration Trench
- Bioswale

NORTH

0 25 50 Feet

JOHN O. GREEN MEMORIAL PARK: PROPOSED GREEN INFRASTRUCTURE CONCEPTS

Impervious Drainage Area (SF)	Impervious Drainage Area (ac)	Annual Runoff Coefficient	Annual Runoff (gal)	Annual Runoff Reduction (gal)	Event Mean Total Phosphorus (TP) Concentration (mg/L)	TP load (lb/yr)	% TP Reduction	TP Reduction (lb/yr)	% of Goose Creek TP Goal	Conceptual Cost Estimate
56,391	1.3	80%	1,328,000	1,195,200	0.36	3.99	85%	3.39	8%	$259,000



E MINER ST IDEAS

OPTION A:

-close E Miner St to traffic and turn into play area space/extension of playground

-use creative street paint/imprints and have hopscotch and other games on former street

-use Railroad St for parking

OPTION B:

-keep E Miner St open to traffic

-deter high speed traffic on E Miner St by adding speed bumps, areas of raised pavement, and curb extensions

-add creative street paint/imprints to street illustrating water flow patterns

John O. Green Memorial Park is a 1.24 acre park in southeast West Chester that features a variety of community amenities such as playgrounds, a full-size basketball court, a spray ground, pavilion with tables, and open areas for free play. This well-used neighborhood park is bordered by S Matlack Street, Cedar Alley, and Railroad Street with E Miner Street dividing the park into two discrete sections. The park is bordered by residential homes to the west and south and is adjacent to the West Chester railroad and parking lot to the east. Formerly a manufactured gas plant owned by PECO, the site was cleaned up and turned over to the Borough in 1998.

The green infrastructure (GI) concepts proposed for the site consist of vegetated curb extensions with subsurface infiltration trench components (one on S Matlack St, one on Railroad St, and two at the northern park entrance on E Miner St), a tree trench on E Miner St, rain gardens in several corners of the park on both parcels, a demonstration rain barrel to capture roof runoff from the pavilion, and overall recommendations for planters, additional groundcover, and new trees to further "green" the park and provide shade to play areas.

Collectively, these GI features would capture and treat runoff from the park property and several adjacent streets as shown on the concept plan. During larger storm events, overflow structures would allow excess runoff to flow into existing storm sewers. In addition to reducing and treating stormwater runoff, these GI features have the potential to add aesthetic value to the park, promote traffic calming, and work in harmony with the park's existing active and passive recreational uses.

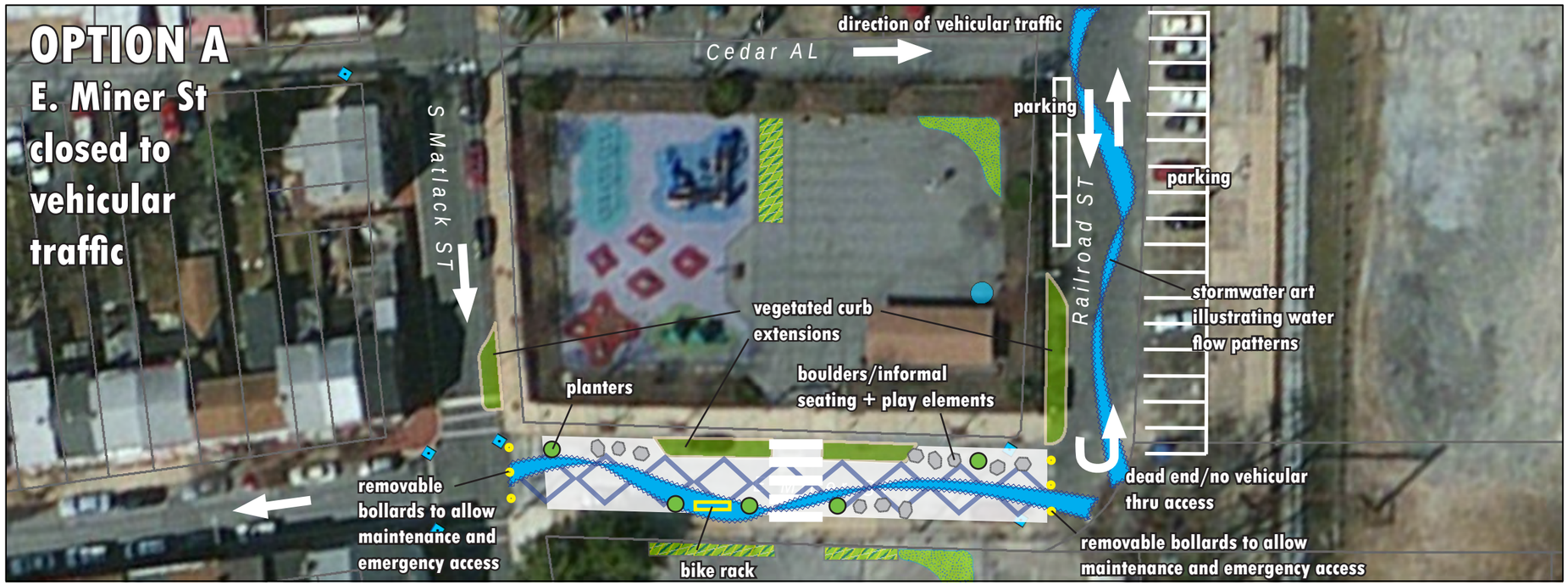
- Inlet
- Stormwater MH
- Stormwater Outfall (53)
- Existing Stormwater Pipes
- 2 ft Contours
- Surface Flow
- Parcels
- Drainage Area

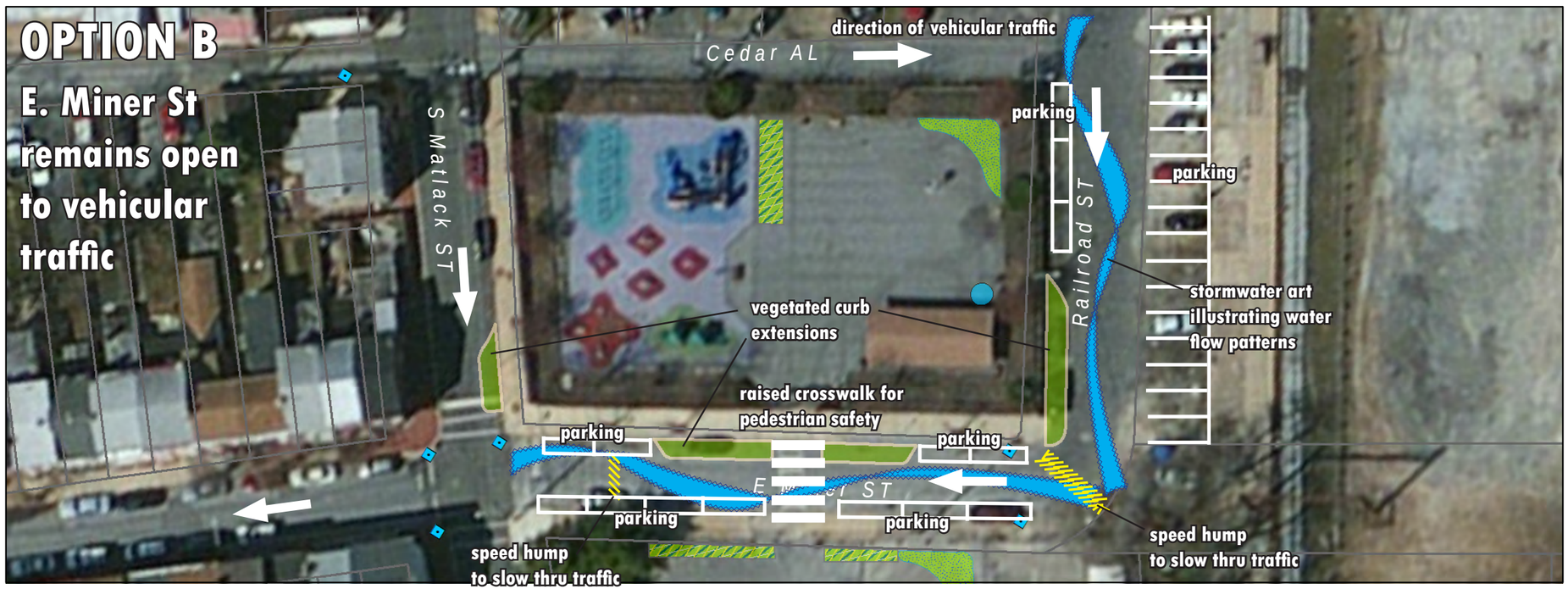
Proposed GI Features

- Bioswale/Plantings
- Infiltration Trench
- Rain Barrel
- Rain Garden
- Vegetated Curb Extension

NORTH 0 20 40 Feet

JOHN O. GREEN MEMORIAL PARK: PROPOSED GREEN INFRASTRUCTURE CONCEPTS





In addition to the proposed green infrastructure elements for John O. Green Memorial Park, there are several potential options for addressing vehicular traffic, pedestrian safety, and parking on the block of E. Miner Street between the two park parcels.

Option A would close E. Miner Street between Railroad Street and S. Matlack Street to vehicular thru-traffic. This portion of E. Miner Street would become a car-free zone and a safe place for pedestrians to sit, children to play, and park-goers to freely move between the north and south park areas. Removable bollards would be placed at either ends of the closed block to enable occasional access for emergency and maintenance vehicles. Parking would not be allowed on E. Miner Street, rather all parking would be directed to Railroad Street.

Option A Pros
-maximizes pedestrian and park-goer safety
-maintains emergency vehicular access
-creates a car-free play zone between the park areas

Option A Cons
-removes parking on E. Miner Street
-removes vehicular thru-way

Option B would keep E. Miner Street between Railroad Street and S. Matlack Street open to vehicular thru-traffic. Parallel parking would be permitted on both sides of the street. Speed humps and a raised crosswalk would be strategically placed to slow vehicular traffic and increase park-user and pedestrian safety.

Option B Pros
-maximizes parking on E. Miner Street
-maintains vehicular thru-way

Option B Cons
-less benefits for pedestrian and park-goer safety
-does not create a car-free play zone

Inlet
Parcels
Proposed GI Features
Bioswale/Plantings
Rain Barrel
Rain Garden
Vegetated Curb Extension

NORTH
0 20 40 Feet

JOHN O. GREEN MEMORIAL PARK: PROPOSED GREEN INFRASTRUCTURE CONCEPTS


existing paved play area


existing park entrance on Miner St


existing stormwater runoff conditions

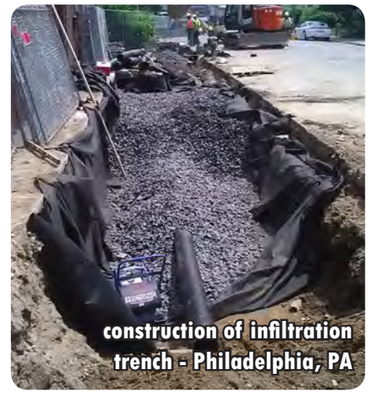

existing playground and basketball court

Existing Conditions

Proposed Rain Garden and Planting Beds


rain garden - Lancaster, PA


curb extension - Lancaster, PA


construction of infiltration trench - Philadelphia, PA

Examples of GI Features

APPENDIX G

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Chester County						
WEST BRANDYWINE TWP	PAI130544	Yes	TMDL Plan, SP, IP	West Branch Brandywine Creek	Appendix C-PCB (4a), Appendix E-Siltation (4a)	Water/Flow Variability (4c)
				Beaver Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Culbertson Run	Appendix E-Siltation (4a)	Other Habitat Alterations (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Unnamed Tributaries to West Branch Brandywine Creek		Cause Unknown (4a)
WEST CALN TWP	PAG130145	Yes	TMDL Plan, SP	Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Indian Spring Run	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Pequea Creek	Appendix E-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				West Branch Brandywine Creek	Appendix C-PCB (4a)	Water/Flow Variability (4c)
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
WEST CHESTER BORO	PAG130002	Yes	TMDL Plan	Blackhorse Run	Appendix E-Siltation (4a)	Other Habitat Alterations, Water/Flow Variability (4c)
				Brandywine Creek	Appendix E-Siltation (4a)	
				Chester Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Flow Alterations, Water/Flow Variability (4c)
				Goose Creek TMDL	TMDL Plan-Nutrients (4a)	Cause Unknown (4a)
				Plum Run	Appendix E-Siltation (4a)	Water/Flow Variability (4c)
				Taylor Run	Appendix E-Siltation (4a)	Cause Unknown (4a), Other Habitat Alterations (4c)
WEST GOSHEN TWP	PAI130532	Yes	TMDL Plan, SP, IP	Broad Run		Water/Flow Variability (4c)
				Taylor Run		Cause Unknown (4a), Other Habitat Alterations (4c)
				Plum Run		Water/Flow Variability (4c)
				John Smedley Run		Water/Flow Variability (4c)
				Goose Creek TMDL	TMDL Plan-Nutrients (4a)	Cause Unknown (4a)
				East Branch Chester Creek	Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Water/Flow Variability (4c)
				Chester Creek	Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Flow Alterations, Water/Flow Variability (4c)
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	

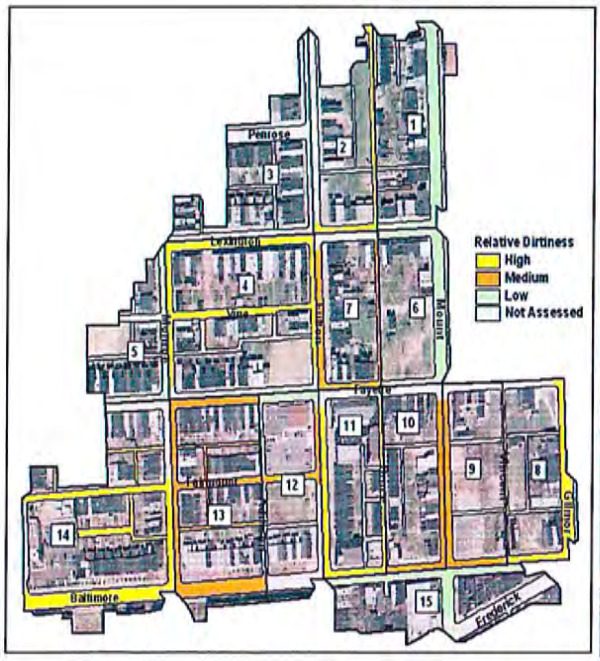
APPENDIX H

Recommendations of the Expert Panel to Define Removal Rates for Street and Storm Drain Cleaning Practices

Sebastian Donner, Bill Frost, Norm Goulet, Marty Hurd, Neely Law, Thomas Maguire, Bill Selbig, Justin Shafer, Steve Stewart and Jenny Tribo

FINAL REPORT

Approved by CBP Management Board



May 19, 2016

Prepared by:

Tom Schueler, Chesapeake Stormwater Network

Table 3. Summary of Street Cleaning Implementation, 2009-2013, as reported and credited in annual progress runs (acres and lbs)

YEAR	DC	DE	PA	WV	VA
2009	1 ac			218,000 lbs	632 ac
2010	1,631 ac			227,000 lbs	
2011	1,540 ac		619 ac		75,385,792 lbs
2012	1,539 ac		413 ac		
2013	1,526 ac	79,541 lbs	3,240,489 lbs	190,000 lbs	218,677 lbs
2014	1,531 ac	413,367 lbs	3,367,040 lbs	700,000 lbs	426,671 lbs

3.4 How the CBWM Simulates Loads From Streets

The Phase 5.3.2 Chesapeake Bay Watershed Model simulates two types of urban land: pervious and impervious cover. These two cover types are used to simulate the full range of urban land use categories (industrial, commercial, residential, institutional and transport). This means that different street types (e.g., highways, arterials, residential streets) are lumped in with other impervious surfaces (e.g., driveways, sidewalks, rooftops, parking lots), and are currently represented as a single impervious layer. As a result, streets and roads do not load differently and are not counted separately in the current version of the CBWM. Table 4 portrays the average annual nutrient and sediment loadings associated with urban impervious cover in the current model.

Table 4. Loading Rates Associated with Urban Impervious Cover in the Chesapeake Bay Watershed Model, Version 5.3.2.

Acres in Watershed [1]	1,269,030
Average TN Load [2]	15.5 lbs/ac/yr
Average TP Load [2]	1.93 lbs/ac/yr
Average TSS Load [2]	0.65 t/ac/yr
Key Inputs	Air Deposition, Build-up/Wash-off, No Groundwater Interaction, No Direct Interaction with Pervious Cover

[1] Acres, as reported in most recent CBWM version 5.3.2
[2] Average values, as reported in Tetra Tech (2014), although actual values are regionally variable across the watershed.

It should be noted that not all of the sediment load generated from urban impervious cover actually reaches the Chesapeake Bay. The sediment loads at the edge of pavement are adjusted downward by a sediment delivery factor in the current version of the CBWM. For a more thorough discussion of the sediment delivery factor, please consult the discussion in SR EP (2014).

The Panel elected to not to use WINSLAMM to explicitly simulate nutrients, and instead estimated them based on empirical nutrient enrichment ratios for street solids (see Section 4.4).

Table 15. Adapting the WINSLAMM Model for the Chesapeake Bay Watershed

Bay rainfall data. The model used the calibration period from 1995 through 2005 using Washington National Airport Station event-based rainfall data. The rainfall data was processed assuming the minimum number of hours between events is 6 hours and the minimum rainfall event depth is 0.01 inch.

East Coast input data files were prepared to represent street conditions across the Chesapeake Bay watershed. The particle size distribution and peak-to-average flow ratio files were set to the program default average pavement and flow ratio files

Four different street types were simulated to represent in different land uses that had curb and gutter drainage systems:

Single-family residential: Approximately 0.25-acre lots, with cul-de-sacs connecting to two-lane residential feeder roads with parallel parking on one side; light traffic; and 25 mile-per-hour (mph) speed limit. Approximately 33 houses in a 10-acre area. The driveways are simulated as draining onto the roads.

Commercial (80 percent impervious): Big box stores and parking lots. Feeder roads (two travel lanes and center turn lane) with no on-street parking, 35 mph speed limit, and heavy traffic.

Ultra-urban downtown (95 percent impervious): Multistory buildings. Two-lane urban roads with parallel parking on both sides of the street, sidewalks, and 25 mph speed limit.

Arterial highway: A four-lane divided road with median with barrier; high-speed traffic with turn lanes; and no on-street parking. Assumed to be commercial land use

Three different sweeping start/stop dates to reflect regional differences in climate across the watershed:

Sweeping occurs over the entire year
Sweeping suspended December 1, restarts March 15
Sweeping suspended December 15, restarts February 15

Six different fixed sweeping schedules

2PW = 2 passes per week	1P4W = 1 pass every 4 weeks
1PW = 1 pass every week	1P8W = 1 pass every 8 weeks
1P2W = 1 pass every 2 weeks	1P12W = 1 pass every 12 weeks

Four seasonal sweeping schedules (more intensive in Spring or Fall)

S1: Spring – One pass every week from March to April. Monthly otherwise
S2: Spring – One pass every other week from March to April. Monthly otherwise
S3: Spring and fall – One pass every week (March to April, October to November). Monthly otherwise
S4: Spring and fall – One pass every other week during the season. Monthly otherwise

Two Levels of Sweeper Technology

MBC = Mechanical broom cleaning	VAC = Vacuum assisted cleaning

Four Options for Street Parking Density and No Parking Enforcement

For more details, consult the technical memo (Tetra Tech, Inc., 2015)

each street cleaning scenario, and subtracting the resulting nutrient load from the unit area nutrient load for impervious cover calculated by the watershed model.

The standard street cleaning unit are curb miles swept. In general, one impervious acre is equivalent to one curb-lane mile swept, assuming they are swept on one-side only. Credit is also provided for cleaning municipal and commercial parking lots (in this case, the acres of parking lot swept are reported, and converted to lane miles using the one acre = one curb lane mile rule of thumb.

The panel elected to consolidate the model results to show specific removal rates for eleven different street cleaning practices, primarily involving the use of advanced street cleaning technology at different frequencies (Table 17).

Table 17. Pollutant Reductions Associated with Different Street Cleaning Practices

Practice #	Description [1]	Approx Passes/Yr [2]	TSS Removal (%)	TN Removal (%)	TP Removal (%)
SCP-1	AST- 2 PW	~100	21	4	10
SCP-2	AST- 1 PW	~50	16	3	8
SCP-3	AST- 1 P2W	~25	11	2	5
SCP-4	AST- 1 P4W	~10	6	1	3
SCP-5	AST- 1 P8W	~6	4	0.7	2
SCP-6	AST- 1 P12W	~4	2	0	1
SCP-7	AST- S1 or S2	~15	7	1	4
SCP-8	AST- S3 or S4	~20	10	2	5
SCP-9	MBT- 2PW	~100	1.0	0	0
SCP-10	MBT- 1 PW	~50	0.5	0	0
SCP-11	MBT- 1 P4W	~10	0.1	0	0

AST: Advanced Sweeping Technology MBT: Mechanical Broom Technology

[1] See Table 15 for the codes used to define street cleaning frequency

[2] Depending on the length of the winter shutdown, the number of passes/yr may be lower than shown