TOWNSHIP OF LOWER MERION

Public Works Committee

Issue Briefing


Prepared By: Ernie B. McNeely, Township Manager

Date: March 31, 2016

I. Action To Be Considered By The Board:


II. Why This Issue Requires Board Consideration:

The Board has an established practice of formally receiving reports prepared by advisory committees and consultants.

III. Current Policy Or Practice (If Applicable):

The Board has a practice of formally receiving reports prepared by advisory committees and consultants.

IV. Other Relevant Background Information:

The Storm Water Management Evaluation Task Force Report provides recommendations to the Board of Commissioners for future management of stormwater needs. The Task Force met multiple times in 2015 after they were created in March. They researched stormwater practices and needs in order to address the questions posed by the Board of Commissioners then prepared a report with recommendations for the future.

Issuance of this final report was somewhat delayed to ensure there were no major changes made to the Water Resources Chapter of the new Comprehensive Plan prior to adoption because there are recommendations in this report that mirror a number of those found in the Comprehensive Plan.

V. Impact On Township Finances:

There is no financial impact to receive the report.

VI. Staff Recommendation:

The recommendation is to receive the report.
Report of the Lower Merion Storm Water Management Evaluation Task Force

March 1, 2016
I. Background

By resolution dated March 18, 2015, the Board of Commissioners (BOC) created the Lower Merion Storm Water Management Evaluation Task Force (Task Force), to which it appointed representatives from several Township advisory committees (the Planning Commission, the Shade Tree Commission, and the Environmental Advisory Council), the Federation of Civic Associations, the commercial community (large and small businesses), several institutions (representing educational, healthcare, and religious missions), and the Lower Merion Conservancy. While the BOC assigned nine specific tasks to the Task Force (addressed below), collectively they boil down to two questions: Is the Township’s current storm water management program sufficient to meet the current and expected future needs of the Township in a fair, fiscally responsible manner? If not, what are the appropriate next steps to address these needs?

The Task Force held 7 meetings over the next five months, during which it heard presentations from representatives of the Township’s engineering and Department of Public Works staff, the Lower Merion Conservancy, PennFuture, Radnor Township’s Department of Public Works, and AMEC Foster Wheeler, an engineering company with expertise in storm water management. At these meetings members of the Task Force also discussed the issues, bringing to bear their personal knowledge as well as that of the constituencies (residents, businesses, institutions) they represented. Finally, the Task Force reviewed a number of written resources, including (among others) the Lower Merion Township Township-Wide Stormwater Program, Jan. 2006, rev. Feb. 2007, Lower Merion Township Stormwater Damage Investigations Progress Report (June 15, 2015) (Stormwater Progress Report), Lower Merion Township Environmental Action Plan, Rev. No. 1, 2012 to 2016 (EAP), the Lower Merion Conservancy’s Rushing Forward: The 2013 Mill Creek Report, reports prepared for the cities of Philadelphia and Lancaster regarding how they should address storm water, and several studies of different options for paying for improved storm water management. Perhaps most importantly, the Task Force reviewed the Water Resources Element of the then-draft Comprehensive Plan (CP), itself the product of over two years of work by the CP Water

1 The members of the Task Force, including affiliation, are listed in Attachment 1. While this report represents the consensus of the members of the Task Force, its conclusions do not necessarily represent the views of the members’ affiliated organizations.

2 The BOC’s questions directed to the Task Force are included as Attachment 2[along with the Task Force’s specific responses, and are also discussed below].

3 A list of these and other resources relevant to Lower Merion’s storm water issues is included as Att. 3.
II. Discussion

From the Township’s founding bordering the Schuylkill River to the present day, our streams, valleys and related natural features have provided the backbone to our identity as a green, high quality, residential suburban community. Meanwhile, like most communities, Lower Merion has long used many of those same streams as the last steps in its storm water management system, carrying runoff to the Schuylkill and Delaware Rivers. Increasingly those functions have come into conflict. As discussed below and in greater detail in the Water Resources element of the CP, storm water currently presents several fundamental problems in the Township, problems which are expected to grow worse in the coming decades: (1) the increased peak discharge and velocity of storm water during storm events results in periodic localized flooding and erosion to properties, (2) the transport of pollutants from originating properties to Township streams harms land and stream ecosystems, and will subject the Township to increasing regulatory requirements; (3) and the failure to infiltrate rain where it first falls reduces the recharge of ground water, a key source for drinking water.\(^5\) The key to reducing high rate, flow, volume, and pollutant loading on the Township’s waterways is to maximize infiltration closer to where storm water is generated, either onsite or nearby.

Preliminarily, the Task Force recognizes that the Township has already made substantial capital expenditures in the Township’s storm water conveyance system – roadways, storm sewers, and certain Township streams – including substantial upgrades made in response to severe flooding from two major storm events in the Fall of 2004.\(^6\) These investments, combined with ongoing maintenance, have thus far served the Township well in meeting what historically has been the primary goal of the system: to protect human health and property from the direct physical danger of flooding as efficiently as possible, by transporting storm water (i.e. non infiltrated rainfall) offsite from Township properties through our streams to the Schuylkill and Delaware Rivers. The Task Force further notes that the Township has undertaken a number of demonstration projects on Township park and other land (i.e. rain gardens, stream bank restoration, retention basins, a green roof) which incorporate Best Management Practices (BMPs) to help infiltrate storm water closer to its source and remove contaminants, thereby

\(^4\) [http://www.lowermerion.org/Modules/ShowDocument.aspx?documentid=12115](http://www.lowermerion.org/Modules/ShowDocument.aspx?documentid=12115). While in December, 2015 the Board made a number of changes to the draft Executive Summary of the CP as part of its final review and adoption of the CP, including to three of the draft Water Resources Element recommendations that had been reviewed by the Task Force (W8, W9.b, and W11.a), those changes were congruent with the Task Force’s ultimate findings.


\(^6\) Many of the specific capital projects that the Township has completed to address stormwater in recent years are detailed in the **2007 Township-Wide Stormwater Program.** [avail. at](http://www.lowermerion.org/index.aspx?page=1408) and the **2015 Stormwater Progress Report.** Essentially all of the “Priority 1” projects have been completed, which included projects on Township owned or controlled property at which there a history of stormwater problems. The 2015 report also details a number of additional locations where stormwater problems have been reported but await further investigation.
lessening the stress on the storm water conveyance system as well as pollutant loading to its streams and area water bodies.\textsuperscript{7}

All together, these activities represent a substantial monetary investment by the Township. Between 2006 and 2014 the Township spent between $300,000 and $1,206,000 on capital expenditures to maintain and upgrade storm water infrastructure on Priority 1 and 2 projects as identified in the Township-wide Stormwater Program, in recent years averaging $520,000 in capital expenditures, $250,000 in operating costs, and $185,000 in various professional services supporting this work.\textsuperscript{8} Additionally, the township spends an average of $1.3 million each year on urban forestry programs, which work (among other benefits) helps lessen the loading on the existing storm water management system by helping support trees absorb and slow down storm water.\textsuperscript{9}

Unfortunately, and notwithstanding this substantial investment, inadequately controlled storm water runoff in the Township is still harming our properties and natural environment, creating negative impacts and regulatory risks which are expected to grow worse in the coming years. The Task Force reviewed reports showing that many of the most intense local storm events of the last 72 years have occurred in the last 10.\textsuperscript{10} Storm events of even greater intensity, frequency, and duration are expected for the foreseeable future.\textsuperscript{11} Meanwhile several studies, over the course of a number of years, show the increasingly harmful impact that storm events are having on the Township’s streams, from both physical erosion and chemical runoff. For example, since 1996 Mill Creek has been the subject of intensive study by the Lower Merion Conservancy and others. Mill Creek serves as an excellent case study because its headwaters lie in one of the most developed areas of the township, and because as the largest creek in the Township its conditions tend to be broadly representative of the Township’s other streams.\textsuperscript{12} The data shows that stormwater runoff has caused Mill Creek to be among the most degraded tributaries of any on the Schuylkill River, principally from excessive amounts of salts, sediment,

\textsuperscript{7} Representatives of the Public Works Department summarized the Township’s existing storm water management program for the Task Force at several of its meetings. See Current Storm Water Program & Policy (April 29, 2015), Att. 4, Storm Water Best Management Practices, (May 14, 2015) Att. 5. Additionally, some of the Township’s recent capital improvements to address stormwater issues are discussed on pp. 124-26 of the CP.

\textsuperscript{8} See CP, p. 125. A summary the Township’s average capital and operating expenses for stormwater (current and projected) is included as Table 1.

\textsuperscript{9} More detailed information about the historic and predicted costs of addressing storm water is presented below.

\textsuperscript{10} Reviewing the last 72 years of rainfall data in the Philadelphia area, 7 of the maximum rainfalls in a given month have occurred in the last ten years, as have 6 of the maximum rainfalls per a 24 hour period in a given month. A summary of NOAA data showing precipitation in the Philadelphia area is included as Attachment 6.


\textsuperscript{12} Rushing Forward: The 2013 Mill Creek Report, p. 1.
pesticides and nutrients, and the impacts are growing worse. Moreover, the evidence, including that discussed in the CP and elsewhere, shows that the Township’s other streams are similarly severely harmed by stormwater runoff.

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13 See, e.g., Rushing Forward: The 2013 Mill Creek Report, pp. 5 (“The combination of these increasingly severe storms and the amount of impervious surface in Lower Merion has been devastating to Mill Creek”), 9 (“nearly every metric we use to calculate Mill Creek’s health has revealed it is on a downward trend”). See also Mikah C.M. Schlesinger, The Effects Of Suburban Land Use Practices On The Mill Creek (2014), p. 25 (“Mill Creek is biologically impaired mainly because of excess nitrate and sediment in its waters... In fact, chloride concentrations were so high that in many cases they exceeded the USEPA’s surface/drinking standards, and thus are likely to be detrimental to aquatic organisms”).

14 See CP, Fig. 4.7, p. 129, listing each of the Township’s streams and detailing the impacts from stormwater runoff.
The degraded conditions in the Township’s streams have not gone unnoticed by the Pennsylvania Department of Environmental Protection (PADEP). In response to the growing impact of stormwater runoff and other environmental stressors on streams and rivers statewide, as well as the Commonwealth’s obligations under several Total Maximum Daily Load plans required under the federal Clean Water Act, PADEP has determined that a number of the state’s streams, including most of the larger streams in the Township, continue to be impaired by contaminants carried in storm water runoff, including sediment, nutrients, and other harmful substances. As a result, in 2015 PADEP proposed stricter regulatory requirements under its Municipal Storm Sewer System (MS4) permit regulations, to be reflected in part in the next PAG-13 General Permit (applicable to small municipalities such as Lower Merion) which are expected to go into effect in March, 2018. In addition to the six types of Minimum Control Measures (MCMs) required under the current MS4 PAG-13 permit program, the Township will be required to prepare a detailed base line assessment of pollutant loadings that are impairing its streams, and most significantly, implement specific remediation measures that will ensure an overall 5% reduction in Total Phosphorous loading, and of 10% Sediment Total loading, to be achieved over the five years of the MS4 permit cycle (i.e. 2018-2023). Under PAG-13, municipalities are given substantial discretion in choosing the BMPs they will deploy to meet  

15 Under PADEP’s MS4 PAG-13 regulations, the term “nutrients” generally refers to “Total Nitrogen” (TN) and “Total Phosphorous” (TP), and the terms “sediment,” “siltation,” and “suspended solids” all refer to inorganic solids and are generally referred to as “sediment.” In addition to nutrients and sediments, PADEP has determined that some of the Township’s streams are also impaired for PCBs and metals.

See also
http://files.dep.state.pa.us/Water/BNP/StormwaterManagement/MunicipalStormwater/Draft_MS4_Requirements_Table.pdf.

16 See pp. 126-27 of the CP for further details of TMDLs and Pennsylvania’s current MS4 requirements. Under Pennsylvania’s MS4 stormwater regulations, a smaller municipality such as Lower Merion can choose to comply by following the generic requirements of General Permit PAG-13, rather than obtaining a specific permit.

17 Under the PADEP’s MS4 Program, permittees such as Lower Merion are required to incorporate the following six MCMs into their stormwater management programs: Public education and outreach, Public involvement and participation, Illicit discharge detection and elimination, Construction site runoff control, Post-construction stormwater management in new development and redevelopment, and Pollution prevention and good housekeeping for municipal operations and maintenance. PADEP has suggested a number of BMPs to accomplish each MCM, many of which the Township has incorporated in its codes, capital budget choices, and outreach programs.

18 A summary of the proposed MS4 requirements that would apply to each of the Township’s impaired streams is included as Attachment 7. The requirements themselves are contained in the draft PAG-13 permit, available at http://www.elibrary.dep.state.pa.us/dseweb/Get/Document-107389/3800-PM-PNPSM01000d%20perm%20(Draft).pdf. It appears that the problems posed by metals and PCBs are much more localized in nature than those posed by nutrients and sediments, and therefore will require more limited, discrete remedial measures.
their regulatory requirements. Finally, the Township’s permit application will now be subject to a public comment period, and all MS4-related plans, programs, maps and reports on the Township website.

In sum, there are several drivers, including changing weather patterns, ‘quality of life’ expectations, and regulatory initiatives, that suggest that the Township’s current stormwater management program needs to be fundamentally rethought.

III. Recommendations

The Task Force endorses a slightly refined version of the three pronged approach recommended in the CP to address the Township’s current and anticipated future storm water needs. The Task Force finds that:

(1) Select additional public infrastructure projects will likely need to be built, working off of a refined version of the Township’s existing list of potential storm water-related infrastructure projects. The Task Force notes that a number of the stormwater ‘hotspots’ identified in the 2015 Stormwater Progress Report have not yet been addressed, in part because they are on private land, although they appear to be caused at least in part by ‘upstream’ properties. The Task Force believes that mechanisms including public/private partnerships may well be appropriate.

(2) New and amended regulatory controls should be enacted that are applicable to new and redevelopment projects to further encourage onsite infiltration of storm water. For example, as recommended in the CP, the Task Force specifically endorses revisions to the Township’s stormwater regulations to require stormwater BMPs on smaller property expansions, i.e. under 1,500 square feet. The Task Force also endorses finding ways to encourage stormwater management, or otherwise facilitate sharing responsibility for dealing with stormwater, on properties that will likely never be subject to stormwater management regulations because they were developed before the introduction of stormwater management requirements, and are covered by 100% impervious surface.

(3) A more discrete, detailed program should be developed and implemented to encourage retrofit improvements and BMPs on both private and public property, apart from any storm water management requirements that may be triggered already under the land development process.

In short, the Township should:

“shift the current orientation of storm water management from a focus on public infrastructure and new land development property only towards a model where traditional grey infrastructure is complemented by smaller, decentralized green
infrastructure on public as well as individual private properties (including commercial and institutional)."  

The Water Resources Element of the CP sets forth 13 specific recommendations which would implement the three pronged approach discussed above, each of which the Task Force endorses. Generally the specific mechanisms for implementing these recommendations are not particularly novel. They do not require use of untested project technology or regulatory tools. However, the Task Force agrees with the CP that the next step for the Township should be preparation of a comprehensive storm water management plan.

The Task Force recommends that the plan be prepared in two parts, with the scope of the second part dependent on the results of the first. As a minimum part of the initial study, a pollutant baseline study should be prepared for all of the Township’s streams, a task which will in any event be required of the Township to meet its MS4 permit in 2018 for the majority of streams which are known to be water quality impaired. Additionally, this initial study should lay the groundwork for achieving the recommended three pronged approach for addressing storm water, by (1) further refining the Township’s list of needed storm water related capital projects, including costs, (2) identifying specific additional amendments to the Township’s land development codes that will further encourage onsite infiltration of storm water in an equitable manner, and (3) identifying key, proven elements of programs for encouraging retrofits and improved land use practices to reduce storm water runoff in communities similar to Lower Merion in topography and land use, in part based on a review of other successful municipalities’ programs.

The scope of the second part of storm water management plan should turn in large part on the needs assessment developed in the first part, and be focused on presenting a prioritized list of projects under the first prong, including an estimation of costs.

IV Funding

The Task Force explored in depth the issue of how best to fund those storm water measures that require public funding. While it believes the issue is not ripe for final recommendation at this time, it offers the following thoughts to help guide future decisions.

Several options are available, including (1) funding specific capital projects as part of the yearly review of the five year Capital Improvement Plan (CIP), which is funded through long term bond financing (current approach), (2) funding operating costs of the existing storm water management system, and other programs that help address storm water issues (e.g. street sweeping, stream clearing, educational programs, subsidized provision of rain barrels) from the annual budget (current approach), and (3) creation of a storm water authority as a funding vehicle for all storm water measures (capital, programmatic, O&M), as explicitly authorized in Pennsylvania in 2013.

19 CP, p. 143.

Which of these funding mechanisms is most appropriate depends in part on the size of the expected increased cost,\textsuperscript{21} and in part on one’s view of the implications of using general property tax revenue to address a problem which is correlated with one specific aspect of property ownership: amount of impervious surface. Turning to the first issue, at the request of the Task Force, the Township Engineer prepared a rough ‘order of magnitude’ cost estimate of the measures necessary to meet the new MS4 requirements between 2018 and 2023 with respect to sediment and nutrients.\textsuperscript{22} The memorandum made a number of key assumptions:

- It assumed installation of measures that would provide only the minimum improvements needed to meet the proposed reduction in two categories of pollutants – 10% sediments and 5% phosphorous -- and not the full restoration of streams to an unimpaired condition, which may ultimately be appropriate or even required.\textsuperscript{23}
- It assumed that measures that address sediment will also address phosphorous.
- It did not address requirements to meet any other pollutants which are causing impairments.
- It used pollutant loading estimates for the Trout Run watershed (which includes North Ardmore, including Suburban Square shopping center and Lower Merion High School) as a proxy for other impaired streams in the Township.
- For costs, it assumed the BMPs to be deployed included streambank stabilization (based on recent projects at Shortridge Park and Merion Botanical Park), and rain gardens and bioretention areas (based on recent projects at Ashbridge Park).
- It assumed that the most cost effective BMPs to address sediment are streambank restoration projects, and therefore maximized their use where possible, looking for projects whose “streams are either located within Township parkland or on private property where such a project would be a minimum disturbance to the property owner,”\textsuperscript{24} and assumed the remaining projects were a 50/50 mix of rain gardens and bioretention basins.
- Since most new development trigger Township stormwater and related water quality regulations that exceed PADEP’s current regulations, it is possible that the Township will be able to take credit for future BMPs installed for private development. However, this was not considered in the Engineer’s analysis.

\textsuperscript{21} As noted above, in recent years the Township’s stormwater-related expenditures have averaged $520,000 in capital expenditures, $250,000 in operating costs, and $185,000 in related professional services, which have been funded from existing capital and operations budgets.

\textsuperscript{22} See 7/23/15 Memorandum to the Task Force, Stormwater Pollutant Reduction Analysis, Att. #6.

\textsuperscript{23} “Improvements beyond the minimum will most likely need to be made to take advantage of economies of scale and in anticipation of other, more restrictive requirements expected in future MS4 Permit renewals (and TMDL’s), resulting in even higher expenditures. We expect that expenditures for improvement in water quality will extend well into the future as we turn the focus from grey infrastructure to green, sustainable solutions that address stormwater at the source in partnership with private and institutional property owners.” Township Engineer’s Memorandum, ATT 6.P1.

\textsuperscript{24} Stormwater Pollutant Reduction Analysis, p. 5.
Taking these and other assumptions into account, the Township Engineer concluded that the capital costs to meet the minimum regulatory requirements for sediment and phosphorous under the proposed revised MS4 PAG-13 permit would be an additional $350,000 to $450,000 per year or increasing the total in the Estimated Annual Expenditures summary for Capital and Operational Costs with urban Forestry from $2.255 Million to $2.695 Million.\textsuperscript{25} It should be noted that this estimate used only a few of the thousands of BMPs that have been developed to implement more effective, ‘green’ stormwater management mechanisms.\textsuperscript{26}

Turning to the second issue, of using general tax revenue to address stormwater, the Task Force spent considerable time debating the merits of creating a new stormwater authority versus using the existing capital and operational budget process. The Task Force recognized that currently, general tax revenue is used to address a problem whose cause is directly related to the relative amount of impervious surface on one’s property, which varies greatly across the Township, and without regard to the taxing status of the property owner. In 2013 Pennsylvania amended the Municipal Authorities Act, explicitly adding stormwater management activities to the list of projects that can be funded by a municipal authority.\textsuperscript{27} Today nearly 1,500 stormwater authorities have been formed in 40 states and the District of Columbia.\textsuperscript{28} In Pennsylvania the Cities of Philadelphia, Lancaster, and Hazleton, Mt. Lebanon and Radnor Townships, and Jonestown Borough, have each created stormwater utilities or established stormwater fee systems. The stormwater utility typically charges each property owner in proportion to their impervious surface. Across the country the average monthly single family residential fee was $4.79 and the median fee was $4.00.\textsuperscript{29}

\textsuperscript{25} See Lower Merion Twp. Stormwater Management Activities Estimated Annual Expenditures, Table 1

\textsuperscript{26} A partial list of sources of BMPs is included in the Stormwater Resources document, Att. 3.

\textsuperscript{27} Act 68 amended Section 5607(a) of Title 53 of the Municipal Authorities Act by amending the following provision: Sec. 5607. Purposes and powers. (a) Scope of Projects permitted. – Every authority incorporated under this chapter shall be a body corporate and politic and shall be for the purposes of financing working capital; acquiring, holding, constructing, financing, improving, maintaining and operating, owning or leasing, either in the capacity of lessor or lessee, projects of the following kind and character and providing financing for insurance reserves: (18) Storm water planning, management and implementation as defined in the articles of incorporation by the governing body.


\textsuperscript{29} Id. at 2. Closer to home, Radnor Township has adopted a user fee (not an Act 68 Authority) to fund capital projects and continued operation and maintenance costs. The fee is based on a flat fee for single family residential property (SFR), and an escalating fee for other developed property (ODP) tied to impervious area. ODP is defined to include multi-family properties such as apartments and condominium complexes, commercial, institutional, governmental and industrial properties. Both fees are tiered based on square footage of lot size (for SFR) and impervious surface (for ODP). Annual fees for SFR’s range from $29.00 to $116.00 per year. The ODP fee is $29.00 for each 1,500 square feet of impervious surface area. See http://www.radnor.com/221/Stormwater-Fee-Information.
Some of the benefits of forming a stormwater authority include:

- Creates an entity that focuses exclusively on stormwater management
- Allows stormwater management services to be funded on a more equitable, ‘pay for use,’ basis similar to sewer and water fees.
- Improves on the need to regularly layer new bond debt for capital projects which can vary more greatly in size and frequency than is typically the case for other uses for capital debt.
- Establishes a dedicated funding source for projects, with a process that is better able to fund projects more quickly as they arise than is typically possible with a municipality’s typical yearly capital budget calendar.
- When combined with a credit system (providing credits for stormwater management projects on site) can incentivize capital and other improvements that would not otherwise have been required under the existing code requirements applicable only to new and redevelopment (i.e. prongs 2 and 3 of the Task Force’s recommendations).
- Is better able to match federal and state grants under tight deadlines.
- Can maintain the existing infrastructure and plan for short and long term capital projects.

The Task Force also discussed some of the cons of forming a municipal stormwater authority, or at least issues to be kept in mind when designing one, including some unique to Lower Merion:

- Creating a stormwater authority before developing a list of specific projects and accompanying budgets is premature.
- Existing commercial property owners, as well as untaxed institutional property owners (educational, church, hospitals, etc.) often express concern about ‘yet another tax.’ Additionally, several on the Task Force noted that many of the Township’s institutions and had undertaken significant expansions in recent years, as part of which they had invested heavily in stormwater management facilities as required by Township code, and asked whether it would be fair to ignore that work as part of any fee assessment.
- The upfront investment of time and capital to set up an authority
- Political loss of control over storm water projects.

As noted above, the Task Force ultimately concluded that there was insufficient data available to recommend any particular funding method. As discussed earlier, the Task Force has reviewed in detail projected costs for various measures to meet the Township’s storm water needs. However these numbers are necessarily rough, and the merits of particular approaches vary greatly depending on how much funds are needed. Therefore the Task Force recommends that the second part of the Storm Water Management Plan be undertaken to make recommendations on appropriate funding mechanisms, after costs have been better quantified in the first part.
V Conclusion

Plainly, the issue of stormwater management is a current and growing problem for the Township. The evidence is all around us, in the increase in severe storm events, in the occasional flooded basement, in our eroded streams devoid of a full range of aquatic life, and in the pollutants we’re sending across our lawns, through our streams, and into our rivers. While the need to address this issue is in part impelled by the expected tightening of state regulations, time and again during the Task Force’s discussions, the reason most frequently expressed to take action was not fear of government enforcement, but a desire to return more of the Township to its natural environs, to lower the manmade burden we’ve inflicted on our streams and valleys. And while the Task Force is at this point agnostic about how best to pay for the work ahead, any recommendation that increased capital and operations costs for storm water management should be paid for using the Township’s existing capital and operations budgets, or via some other mechanism such as a storm water authority as is now explicitly authorized by the Pennsylvania municipal Planning Code, is premature. However, the Task Force did review this issue in detail and its members, representing residents, small and large businesses, and the gamut of the Township’s institutions, are unanimous in their belief that the responsibility for addressing the growing storm water problem should be equitably shared by all citizens (residential, commercial, institutional) of the Township, taking into account both their contribution to the problem essentially their impervious surface and their contribution (past and current) to the solutions.
The Task Force was asked to address the following:

a. Review the 2007 Township-Wide Storm Water Program and the 2015 update.

The Task Force reviewed these plans and finds that many of the projects identified, most of which address storm water conveyance not quality, have been completed where they involve public property. There are a number of improvements listed that have not been addressed because they require work on private property.

b. Review and compile current stormwater management capital and operational activities and associated costs, including administrative costs associated w/MS4 compliance.

See Table 1.

c. Identify and enumerate anticipated storm water management activities that should or can be expected, as well as desirable storm water management activities to manage the quantity and quality of runoff.

The new focus of regulatory bodies like the Pennsylvania Department of Environmental Protection and the federal EPA is clearly on water quality so the Township needs to develop and fund a plan that addresses stormwater quality using best practices both on public property but also using ways to incentivize private property owners.

d. Identify advantages, shortcomings and/or adjustments related to the Township’s current stormwater management policies and practices.

The Township current practice of requiring best practices in development plans, doing demonstration type best practices on public projects and actively addressing stormwater conveyance issues with as much as $400K per year in CIP bond financing has it ahead of many other communities. That said an overall plan to address storm water quality issues is lacking and that is where a new Storm Water Management Plan is needed to not only address the pending regulatory requirement but also to serve as a blueprint for future long term focus.

e. Identify how private property owners might be incentivized to improve stormwater management on their property.

Municipalities with modern stormwater management approaches are using a variety of means to incentivize private property owners to be a part of the solution. Some are using grants to assist private owners with best management practices, some are using public dollars on privately installed systems to go beyond what the private property owners might be required to install in order to create more public benefit. Others charging a stormwater fee are providing credits against the fee for owners who install best management stormwater facilities. The key to using public dollars in conjunction with private dollars to leverage a stormwater benefit is to have a flexible source of funds that can be employed when the opportunity arises. Private sector projects cannot generally wait a year for a new municipal budgetary cycle. There are also programs purchasing or subsidizing small best practice items such as rain barrels.
f. Discuss, in general, funding options for stormwater management activities, such as general fund tax dollars, capital improvement funds &/or a special assessment.

As stated above several options are available, including (with respect to at least the capital portion of expenditures) (1) the current approach of funding specific projects as part of the yearly review of the five year Capital Improvement Plan (CIP) which is funded through long term bond financing, and (2) use of a storm water authority for a funding vehicle, as recently authorized by the Pennsylvania state legislature in 2013. To be successful a storm water management program needs to have steady dedicated funding because there is no once and done solution it has to be an ongoing commitment. Secondly, the Township needs to consider whether layering in new 20 year bonded debt every year for storm water improvements is the right approach for a task that is never likely completed but instead a continuing and likely a growing commitment. Some communities using a special assessment fee have applied the fee to cover all of their stormwater expenses some have only applied it to any increased expenditures. As stated it is felt any discussion on how to fund stormwater activities should be part of a phase two of a study that first develops a long term plan and approach to stormwater management in the Township.

g. Discuss if a consultant should be retained to analyze/develop a stormwater program/assessment and, if so, what scope of services is needed.

It is recommended that a consultant be employed to develop a long term stormwater management plan. A draft scope of services is attached.

h. Prioritize the options and recommendations.

The primary recommendation is that the Township should proceed with preparation of a comprehensive storm water management plan in two steps as described in the report. The cost of at least the initial phase is estimated to be in a range of $100K - $200K which could be funded within the current CIP annual allocation for stormwater management activities. It would be money well spent to establish a direction that will allow compliance with future regulatory issues and provide a new direction for future stormwater management projects or programs.

i. Provide recommendations for Board of Commissioners consideration.

The Task Force’s principal recommendation is that the Township should proceed with preparation of the first phase a comprehensive Stormwater Management Plan. It is further recommended that the development process for a Stormwater Management Plan include a steering committee consisting of stakeholders and the process itself be designed to foster public participation.
Table 1

Lower Merion Township
Stormwater Management Activities
Estimated Annual Expenditures ($1,000s)

<table>
<thead>
<tr>
<th>Operating Costs</th>
<th>Current</th>
<th>Projected 2018-2023, adding in projected minimum measures necessary to meet the projected MS4 requirements</th>
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<td>$200</td>
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<thead>
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<th>Capital</th>
<th>Current</th>
<th>Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>$50</td>
<td>$50</td>
</tr>
<tr>
<td>Township Infrastructure Projects</td>
<td>$200</td>
<td>$200</td>
</tr>
<tr>
<td>Contracted Infrastructure Projects</td>
<td>$200</td>
<td>$600</td>
</tr>
<tr>
<td>Stream Improvements</td>
<td>$70</td>
<td>$70</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$520</strong></td>
<td><strong>$920</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional Services</th>
<th>Current</th>
<th>Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Projects</td>
<td>$90</td>
<td>$90</td>
</tr>
<tr>
<td>Studies</td>
<td>$55</td>
<td>$55</td>
</tr>
<tr>
<td>Complaint Investigation</td>
<td>$25</td>
<td>$25</td>
</tr>
<tr>
<td>Dams</td>
<td>$15</td>
<td>$15</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$185</strong></td>
<td><strong>$185</strong></td>
</tr>
</tbody>
</table>

| Urban Forestry                   | $1,300  | $1,300    |

| Total w/ Urban Forestry          | $2,255  | $2,695    |
| Total w/o Urban Forestry         | $955    | $1,395    |
Attachment 1  Stormwater Management Evaluation Task Force

Task Force Membership

Charlie Howland - Planning Commission

Patty Thompson - Lower Merion Conservancy

Jay Einspanier - Parish Administrator Church of the Redeemer

Jo Ann Magnatta - Sr. VP Facilities Main Line Health

Carl Watson - Federation of Civic Associations

Hugh Gordon - Federation of Civic Associations

Christine Vilardo - Ardmore Initiative

Terry Foley - City Ave District

Steve Pitch - Shipley School

Rich Cipollone, Rosemont College Director of Facilities

Pat Guinnane - Facilities Dir. Lower Merion School District

Bruce Bayne - Environmental Advisory Comm / Comprehensive Plan Water Resources Subcommittee

Richard Widman - Shade Tree Commission

Ex Officio:
Liz Rogan, BOC representative

Staff Support:
Ernie McNeely - Township Manager
Bob Duncan - Asst. Township Manager

Technical Support:
Don Cannon - Director of Public Works
Ed Pluciennik - Township Engineer
Attachment 2  Stormwater Management Evaluation Task Force

Created 3-18-15

Purpose/Tasks:

1. Review the 2007 Township-Wide Storm Water Program and the 2015 update.

2. Review and compile current stormwater management capital and operational activities and associated costs, including administrative costs associated w/MS4 compliance.

3. Identify and enumerate anticipated stormwater management activities that should or can be expected, as well as desirable stormwater management activities to manage the quantity and quality of runoff.

4. Identify advantages, shortcomings and/or adjustments related to the Township’s current stormwater management policies and practices.

5. Identify how private property owners might be incentivized to improve stormwater management on their property.

6. Discuss, in general, funding options for stormwater management activities, such as general fund tax dollars, capital improvement funds &/or a special assessment.

7. Discuss if a consultant should be retained to analyze/develop a stormwater program/assessment and, if so, what scope of services is needed.

8. Prioritize the options and recommendations.

9. Provide recommendations for Board of Commissioners consideration.
Attachment 3 Information Resources:

a) Lower Merion
   a. LMT Comprehensive Plan draft Water Resources Chapter,
   b. Lower Merion Township Environmental Action Plan,

b) Radnor Twp. Stormwater

c) Philadelphia Stormwater (note, involves both MS4 & combined sewer overflow issues)

d) Lancaster City Stormwater Program


f) EPA Stormwater
   b. EPA Cost-Benefit Resources re green infrastructure,
      http://water.epa.gov/infrastructure/greeninfrastructure/gi_costbenefits.cfm

c) Community Based Public-Private Partnerships (CBP3) and Alternative Market-Based Tools for Integrated Green Stormwater Infrastructure: A Guide for Local Governments (2015),

g) Pennsylvania DEP Stormwater
   b. PAG-13 Appendix A, Stormwater Management Program, current BMPs,
      http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-95044/08_3800-PM-BPNPSM0100h-AppendixA.pdf
c. Draft PAG-13 (2018 permit cycle),
http://files.dep.state.pa.us/Water/BPNPSM/StormwaterManagement/MunicipalStormwater/Draft_MS4_Requirements_Table.pdf

d. Draft PAG-13 list of impaired waters, by Township/jurisdiction, (2018 permit cycle) (see also separate pdf for Lower Merion-specific),
http://files.dep.state.pa.us/Water/BPNPSM/StormwaterManagement/MunicipalStormwater/Draft_MS4_Requirements_Table.pdf

h) Western Kentucky University Stormwater Utility Survey, introduction provides good overview of common issues encountered

Current Stormwater Program & Policy

- Goals of Presentation
  - Explain stormwater runoff
  - Define Township’s role
  - Define Property Owner’s responsibility
  - Explain Township’s stormwater management program and policy
Current Stormwater Program & Policy

- What is stormwater runoff?
  - Product of rainfall
  - Varies based on storm intensity and duration
  - Varies due to surface conditions
  - Natural vs. Manmade
    - Type of ground cover (lawn vs. woodlands)
    - Soil characteristics (clay vs. sand)
    - Time of year (winter vs. summer)
  - Note: Most of the Township was developed prior to the existence of stormwater control regulations
Current Stormwater Program & Policy

• Storm Designation
  • Based on historical data
• Statistical Modeling
  • 100-Year Storm – 1 in 100 probability of occurring in any one year
• Township criteria for design
  • Roadway drainage - 25 year
  • Detention basins – 2, 5, 10, 25, 50, 100
  • PennDOT roadway - typically 10 year
Current Stormwater Program & Policy

- **Historical Perspective**
  - 100-Year Storm – 8.4 inches in 24 hours
  - August 2004 – 6 inches in 90 minutes
  - September 2004 – 10 inches in 12 hours
  - 1893 Great Mill Creek Flood destroyed 5 mills along Mill Creek
Current Stormwater Program & Policy

- Township's Role
  - Within the limits of authority and ability
    - Protect the public
    - Protect property
    - Protect the environment
Current Stormwater Program & Policy

- Means available to the Township
  - Local codes related to land use and development
  - Regional watershed planning under Act 167 PA Stormwater Management Act
  - Drainage infrastructure
  - PaDEP Permit for the Township's storm sewer system (MS-4 Permit)
Current Stormwater Program & Policy

- Local Codes – Act 167 Authorization
  - General goal:
    - To minimize impact of improvements and to improve existing conditions when and where possible
  - Land development
  - Land disturbance
  - Flood plain management
Current Stormwater Program & Policy

- Watershed Management Plan
  - Specifically tailored to a watershed and its unique characteristics
    - Mill Creek Basin
    - Darby / Cobbs Creek
Current Stormwater Program & Policy

- Drainage Infrastructure
  - Streets and roads
  - Storm sewers
  - Watercourse crossings (bridges and culverts)
  - Open watercourses
  - Knox and Remington Stormwater Management Facilities
Current Stormwater Program & Policy

- MS-4 Permit Requirements
  - Public education and outreach
  - Public participation / involvement
  - Illicit discharge detection and elimination
  - Construction site stormwater runoff control
  - Post-construction stormwater management
  - Pollution prevention / housekeeping
Current Stormwater Program & Policy

- Responsibility of Property Owners
  - Comply with Codes related to disturbance of the land
    - Land Development
    - Permit Plans
    - Maintenance of facilities
      - Collection (grading, swales, inlets, pipes)
      - Rate control – detention basins
      - Volume Control / Water Quality
        - Recharge beds
        - Vegetative filter strips
        - Rain gardens
Current Stormwater Program & Policy

- Township-Wide Stormwater Program
  - Purpose
    - Investigate localized flooding and damage
    - Identify cause
    - Identify potential conceptual solutions
    - Determine responsible party (private vs. public)
    - Prioritize public projects
    - Complete public projects as funded in the CIP
Current Stormwater Program & Policy

- Township-Wide Stormwater Program
  - What it is not:
    - A regional flood control program
Current Stormwater Program & Policy

- Open Watercourse Policy
  - Established in the 1990's
  - Township can adopt a natural watercourse as part of its stormwater system
  - Township responsible for removal of debris that would obstruct natural flow
  - Abutting property owner, not Township, responsible for maintenance and repair of artificial or natural bed and banks of watercourse
  - Township not responsible for the incidental increase in flow due to normal, gradual development
Stormwater
Best Management Practices
BMP?

Examples?
WHAT IS A STORMWATER BMP?

Activities, facilities, measures or procedures used to manage the volume, rate, and water quality of stormwater runoff

- NON-STRUCTURAL BMPs
- STRUCTURAL BMPs

(PA stormwater BMP Manual, 2006)
Non-Structural BMPs

- Protect Special Value Resources (Wetlands, Natural Drainage Channels, etc.)
- Cluster and Concentrate Uses at Sites
- Stormwater Disconnection (Rooftop, Sewer)
- Minimize Disturbance (minimize grading and compaction)
- Street Sweeping
Best Practices

- Bioretention cells
- Curb and gutter elimination
- Grassed swales
- Green parking design
- Infiltration trenches
- Inlet protection devices
- Permeable pavement
- Permeable pavers
- Rain barrels and cisterns
- Riparian buffers
- Sand and organic filters
- Soil amendments
- Stormwater planters
- Tree box filters
- Vegetated filter strips
- Vegetated roofs
In terms of MS4 permits ...

1. **Public Education** – BMPs for MS4s to inform individuals and households about ways to reduce stormwater pollution.

2. **Public Involvement** – BMPs for MS4s to involve the public in the development, implementation, and review of an MS4's stormwater management program.

3. **Illicit Discharge Detection & Elimination** – BMPs for identifying and eliminating illicit discharges and spills to storm drain systems.

4. **Construction** – BMPs for MS4s and construction site operators to address stormwater runoff from active construction sites.

5. **Post-construction** – BMPs for MS4s, developers, and property owners to address stormwater runoff after construction activities have completed.

6. **Pollution Prevention/Good Housekeeping** – BMPs for MS4s to address stormwater runoff from their own facilities and activities.
Comprehensive Stormwater Management

SITE PLANNING AND DESIGN PROCEDURE

SITE ANALYSIS
- Background Factors
- Site Factors Inventory
- Sensitive Areas
- Site Analysis: Constraints vs. Opportunities

NON-STRUCTURAL BMPs
- Concentration & Clustering
- Minimum Disturbance, Minimum Maintenance
- Impervious Coverage
- Disconnect, Distribute, Decentralize
- Source Control

STRUCTURAL BMPs
- Soil Infiltration-based BMPs
- Volume Reduction BMPs
- Runoff Quality BMPs
- Restoration BMPs

APPLICATION SUBMISSION ➔ PRE-SUBMISSION MEETING ➔ MUNICIPAL INPUTS
- Zoning Guidance
- Township Comprehensive Plan, Act 167 Plan, Other
- SLDO Guidance

STORMWATER MANAGEMENT PLAN
Traditional urban drainage

Quantity

Sustainable urban drainage

Quantity

Quality

Amenity
MEMORANDUM

TO: Charlie Howland, Chair, Stormwater Management Evaluation Task Force

FROM: Edward P. Pluciennik, PE, LEEP AP, Township Engineer

DATE: July 23, 2015; Revised July 24, 2015 (see footnotes)

SUBJECT: Stormwater Pollutant Reduction Analysis

I am providing this memorandum as a follow-up to my presentation of the "Order of Magnitude" Estimated Cost of the Minimum Capital Improvements necessary to reduce the level of pollutants (phosphorus by 5%, sediments by 10%) contained in the draft 2018 Department of Environmental Protection (DEP) General Permit No. 13, for those streams in Lower Merion Township that were identified as impaired.

This "Order of Magnitude" Cost Estimate was prepared in response to a question asked at the June 18th Stormwater Management Evaluation Task Force Meeting. Other costs contained in the Estimated Annual Expenditures summary provided previously in a table, dated April 29th, copy attached, are still valid with the exception of "Infrastructure Projects by Contractor" and "Related Professional Services". These expenditures in the recent past were approximately $150,000 to $250,000. They will be replaced with the cost to perform the improvements needed to reduce the pollutants mentioned above. As you will see later in this memorandum, those costs are estimated to be in the $600,000 range per year, or $3 million over the five-year permit period. This is an increase of $350,000 to $450,000 per year or increasing the total in the Estimated Annual Expenditures summary for Capital and Operational Costs from $1.975 Million to $2.425 Million\(^1\). Further, this estimate is based solely on the minimum improvements needed to meet the proposed reduction in pollutants, and not to fully restore the stream to an unimpaired condition. Improvements beyond the minimum will most likely need to be made to take advantage of economies of scale and in anticipation of other, more restrictive requirements expected in future MS4 Permit renewals (and TMDL's), resulting in even higher expenditures. We anticipate the increased expenditures will be for operations as well as capital\(^2\). We expect that expenditures for improvement in water quality will extend well into the future as we turn the focus from grey infrastructure to green, sustainable solutions that address stormwater at the source in partnership with private and institutional property owners. In order to more accurately estimate these future costs, a comprehensive, Township wide study of the stormwater management needs is needed. Given the increased focus on water quality and the available opportunities to address these needs as mentioned above, the study will need to define those

\(^1\) Corrected math error from $2.575 Million to $2.425 Million

\(^2\) Added sentence for clarification
viable opportunities, establish priorities and develop a capital improvement program for the next
five year permit cycle.

Along with this, we anticipate the MS4 activities

The following is how we developed the Order of Magnitude costs to implement the
improvements needed to reduce the pollutants by the minimum required amount.

By way of background, DEP has an ongoing program to assess the quality of surface waters in
Pennsylvania and identify streams and bodies of water that are not attaining designated and
existing uses as "impaired". The results of this assessment were published in the "2014
Pennsylvania Integrated Water Quality Monitoring and Assessment Report". There are a total of
16 separate watersheds that drain to waters of the Commonwealth within Lower Merion
Township. In this report, 14 watersheds are listed as impaired - a listing is attached. However, a
subsequent conversation with the representative from the PA DEP Southeast Region indicated
that this listing contains errors and that only 9 watersheds within the Township are impaired. A
majority of the streams are impaired due to sediment or suspended solids. Therefore, for the
purpose of this Order of Magnitude cost estimate, we focused on a pollution reduction plan to
reduce the total suspended solids (TSS) within the impaired streams. The stormwater best
management practices (BMPs) used to reduce the TSS level will also reduce the phosphorous
level. Some of the impaired streams are located outside of the borders of the Township, but
portions of the Township drain towards these streams and were therefore included in our
analysis. Please see the attached map which shows the watersheds analyzed within the
Township.

In order to determine the pollutant load reduction needed, we first had to determine the baseline
pollutant load produced by the Township within the various impaired watersheds as it exists
now. We anticipate PA DEP will require a pollution reduction plan that shows a reduction of
10% of the total suspended solids and 5% of the total phosphorous based on their 2018 draft
permit requirements.

**Step 1- Baseline Loading Assessment**

To determine the baseline pollutant load, we reviewed the land use within each of the impaired
watersheds and selected one watershed to analyze which would best represent the overall mixed
land use throughout the Township. We chose to analyze the Trout Run watershed. The Trout
Run watershed extends from Lancaster Avenue in Ardmore, to the point where Trout Run joins
Mill Creek, along Mill Creek Road, as it approaches Old Gulph Road. This watershed
encompasses all of North Ardmore, including Suburban Square shopping center and Lower
Merion High School. We obtained land use information for this watershed from PA Stream Stats
(USGS) and confirmed the areas with the Township Geographic Information System (GIS)
records.

Once the watershed characteristics were obtained, we modeled the baseline pollutant load for the
Trout Run watershed using a modeling software recommended by PA DEP, which generally
calculates the pollutant load carried within the runoff based on the type of land from which it is
generated using 2014 land use data coverage. The pollutant loads were determined for the
impervious, pervious, and forested areas of the watershed.
### Representative Load Assessment for Trout Run Watershed

<table>
<thead>
<tr>
<th>Land Use Description</th>
<th>Area (Ac)</th>
<th>Average Load² (lb/ac/yr)</th>
<th>Unadjusted Baseline Load Assessment (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Phosphorus</td>
<td>Suspended Solids</td>
</tr>
<tr>
<td>Drainage Area Impervious</td>
<td>132</td>
<td>0.67</td>
<td>1188</td>
</tr>
<tr>
<td>Drainage Area Pervious</td>
<td>742</td>
<td>0.24</td>
<td>164</td>
</tr>
<tr>
<td>Water</td>
<td>9</td>
<td>0.64</td>
<td>0</td>
</tr>
<tr>
<td>Woods</td>
<td>9</td>
<td>0.05</td>
<td>721</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>892</strong></td>
<td></td>
<td><strong>272.7</strong></td>
</tr>
</tbody>
</table>

Notes:
1. Watershed land use areas determined using PA Stream Stats.
2. Average Loading taken from the modelling software tool recommended by PA DEP, based on land use. Note a portion of the load is attributed to streambank erosion.

### Step 2 – Baseline Loading Adjustment

We then obtained a listing of the BMPs implemented within this watershed up to 2014 from the Township database. As the installed BMPs would reduce the pollutant load within the watershed, we calculated the pollutants removed from the system by the installed BMPs using the recommended pollutant removal rate for each BMP as provided in the PA BMP Manual and determined an adjusted baseline pollutant load for the watershed.

<table>
<thead>
<tr>
<th>Trout Run Watershed</th>
<th>Total Phosphorous</th>
<th>Total Suspended Solids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted Baseline Load Total (lbs)</td>
<td>272.7</td>
<td>284,993</td>
</tr>
<tr>
<td>Reduction from Existing BMPs (lbs)</td>
<td>-12.9</td>
<td>-22842</td>
</tr>
<tr>
<td><strong>ADJUSTED BASELINE LOAD TOTAL (lbs)</strong></td>
<td><strong>259.8</strong></td>
<td><strong>262,151</strong></td>
</tr>
</tbody>
</table>

### Step 3 – Determining the Required Pollution Reduction Needed

Therefore, the anticipated load reduction required for the pollutant reduction plan for the Trout Run Watershed would be:

<table>
<thead>
<tr>
<th>Trout Run Watershed</th>
<th>Phosphorus (%)</th>
<th>Phosphorus (lbs)</th>
<th>Suspended Solids (%)</th>
<th>Suspended Solids (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction Needed</td>
<td>5</td>
<td>13</td>
<td>10</td>
<td>26,215</td>
</tr>
</tbody>
</table>

Since the total phosphorous will be addressed at no additional cost by addressing the total suspended solids, the remainder of our analysis focused on the anticipated pollutant reduction load requirement for suspended solids based on a required amount of lbs per acre of watershed:

**Trout Run Watershed:** 26,215 lbs ÷ 892 acres = 29.4 lbs/acre
We then took this loading ratio and multiplied it by the area of each impaired watershed throughout the Township:

<table>
<thead>
<tr>
<th>Total Township Area</th>
<th>Area¹</th>
<th>Estimated Required Reduction²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed</td>
<td>(ac)</td>
<td>(lbs)</td>
</tr>
<tr>
<td>Mill Creek</td>
<td>4,987</td>
<td>146,618</td>
</tr>
<tr>
<td>Meadowbrook Run</td>
<td>111</td>
<td>3,263</td>
</tr>
<tr>
<td>Hardings Run</td>
<td>53</td>
<td>1,558</td>
</tr>
<tr>
<td>E.B. Indian Creek</td>
<td>2,058</td>
<td>60,505</td>
</tr>
<tr>
<td>W.B. Indian Creek</td>
<td>1,599</td>
<td>47,011</td>
</tr>
<tr>
<td>Cobbs Creek</td>
<td>78</td>
<td>2,293</td>
</tr>
<tr>
<td>Gulph Creek</td>
<td>328</td>
<td>9,643</td>
</tr>
<tr>
<td>Unnamed Trib to Gulph Creek</td>
<td>251</td>
<td>7,379</td>
</tr>
<tr>
<td>Trout Run</td>
<td>892</td>
<td>26,225</td>
</tr>
<tr>
<td>TOTAL</td>
<td>10,357</td>
<td>304,496</td>
</tr>
</tbody>
</table>

Notes:
1. Watershed area is taken from Township GIS Information
2. All estimated loads represent the minimum amount of pollutant removal required to meet the pollutant reduction plan

Pollutant loads expected from future land development within the Township will be offset by the stormwater management BMPs required to be installed to meet the Township’s regulations. Since in most development cases, the Township’s water quality regulations exceed DEP’s current regulations, it is possible that the Township will be able to take credit for future BMPs installed for private development. However, in order to be conservative, this was not considered in our analysis.

Step 4 – Determining the Costs per BMP

Next, using the costs associated with installing various BMPs within the Township over the past several years (including the streambank stabilization projects at Shortridge Park and Merion Botanical Park, the rain gardens and bioretention areas at Ashbridge Park, and a stormwater management system installed under a parking lot at Audi of Ardmore), we anticipated the costs that would be required within the Capital Program to reduce the pollutant load by the required amount.

<table>
<thead>
<tr>
<th>STREAMBANK RESTORATION PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name</td>
</tr>
<tr>
<td>Shortridge Park</td>
</tr>
<tr>
<td>Merion Botanical Park</td>
</tr>
</tbody>
</table>
The loading removal rate of 52.5 lbs per foot of streambank restoration was taken from Table 1 on Page 7 of the Cost Effectiveness Study of Urban Stormwater BMPs in the James River Basin, as produced by the Center for Watershed Protection in Maryland. A copy of this table is attached. PA DEP has recommended this study for use in determining loading removal efficiency. The project costs above include costs for design, permitting, bidding, construction, and construction management of the installed restoration. These costs do not include land acquisition or costs associated with obtaining easements. The costs were then adjusted by 3% per year to 2020, the midyear of the 5-year program, for estimating purposes. Finally, since individual project costs varied based on the size of the project, a weighted average cost was determined for this type of work.

Our research showed, and PA DEP and Center for Watershed Protection has confirmed, that the most cost effective use of the funding would be through streambank restoration projects. Therefore, we reviewed the limits of each impaired watershed to determine potential project locations for streambank restoration. Most of the impaired watersheds within the Township have a reasonable location for performing streambank restoration where streams are either located within Township parkland or on private property where such a project would be a minimum disturbance to the property owner. For these areas, the cost used for meeting the pollutant reduction plan in that particular watershed was the cost associated with streambank restoration.

We then used the weighted average cost determined above and applied it to each impaired watershed within the Township where streambank restoration was feasible:

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Estimated Required Reduction (lbs)</th>
<th>($/lb)</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Creek</td>
<td>146,618</td>
<td>$2.55</td>
<td>$373,875</td>
</tr>
<tr>
<td>E.B. Indian Creek</td>
<td>60,505</td>
<td>$2.55</td>
<td>$154,290</td>
</tr>
<tr>
<td>W.B. Indian Creek</td>
<td>47,011</td>
<td>$2.55</td>
<td>$119,880</td>
</tr>
<tr>
<td>Trout Run</td>
<td>26,225</td>
<td>$2.55</td>
<td>$66,875</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$714,920</strong></td>
</tr>
</tbody>
</table>

The total costs above have been rounded off for convenience.

We then used the same methodology for determining the cost for reducing the required pollutant load in the remaining watersheds using a mix of Rain Gardens and Infiltration Basins. As several of these BMPs have recently been installed within the Township, we were able to determine a weighted average cost for both rain gardens and infiltration basins:
### RAIN GARDEN PROJECTS

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Area of Rain Garden (SF)</th>
<th>Suspended Solids Removed (lb)</th>
<th>Estimated Project Costs ($)</th>
<th>Project Cost ($/lb)</th>
<th>2020 Cost ($/lb)</th>
<th>Weighted Average Cost ($/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ashbridge Park</td>
<td>6,050</td>
<td>1,005</td>
<td>20,000</td>
<td>$19.90</td>
<td>$25.21</td>
<td>$26.99</td>
</tr>
<tr>
<td>S. Ardmore Park</td>
<td>1,650</td>
<td>363</td>
<td>10,500</td>
<td>$28.90</td>
<td>$33.50</td>
<td></td>
</tr>
</tbody>
</table>

### INFILTRATION BASIN PROJECTS

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Area of Basin (SF)</th>
<th>Sediment Removed (lb)</th>
<th>Estimated Project Costs ($)</th>
<th>Project Cost ($/lb)</th>
<th>2020 Cost ($/lb)</th>
<th>Weighted Average Cost ($/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi of Ardmore</td>
<td>6,050</td>
<td>1,527</td>
<td>125,000</td>
<td>$81.85</td>
<td>$97.73</td>
<td>$90.59</td>
</tr>
<tr>
<td>503 Waldron Park Dr.</td>
<td>1,650</td>
<td>743</td>
<td>20,000</td>
<td>$26.93</td>
<td>$31.22</td>
<td></td>
</tr>
</tbody>
</table>

For the purposes of the analysis, the weighted average costs above were rounded to $27 for rain gardens and $90 for infiltration basins.

The remaining watersheds drain to streams located in other municipalities. In these instances, we estimated that 50% of the costs would be completed with rain gardens and 50% of the costs would be completed with infiltration basins. At the weighted average costs to remove suspended solids using a rain garden at $27 per lb and with an infiltration basin was $90 per lb, the blended cost was simply an average of those two numbers:

\[
\frac{27 + 90}{2} = 58.50/\text{lb}
\]

The costs for these watersheds are:

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Estimated Required Reduction (lbs)</th>
<th>Rain Garden / Infiltration Basin Costs ($/lb)</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meadowbrook Run</td>
<td>3,263</td>
<td>$58.50</td>
<td>$190,885</td>
</tr>
<tr>
<td>Hardings Run</td>
<td>1,558</td>
<td>$58.50</td>
<td>$91,145</td>
</tr>
<tr>
<td>Cobbs Creek</td>
<td>2,293</td>
<td>$58.50</td>
<td>$134,140</td>
</tr>
<tr>
<td>Gulph Creek</td>
<td>9,643</td>
<td>$58.50</td>
<td>$564,115</td>
</tr>
<tr>
<td>Unnamed Trib to Gulph Creek</td>
<td>7,379</td>
<td>$58.50</td>
<td>$431,670</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>$1,411,950</td>
</tr>
</tbody>
</table>

The total costs above have been rounded off for convenience.
It shall be noted that all of these watersheds are primarily located within other municipalities. Conversations with PA DEP have encouraged collaboration among municipalities to address the pollutant load reduction for impaired streams. It is possible that these costs could be further reduced with collaborative efforts.

Therefore, totaling the costs for all of the watersheds impaired within the Township, we determined the estimated cost to be:

<table>
<thead>
<tr>
<th>Type of Project</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streambank Restoration</td>
<td>$714,920</td>
</tr>
<tr>
<td>Rain Garden/Infiltration Basin</td>
<td>$1,411,950</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$2,126,870</strong></td>
</tr>
</tbody>
</table>

Where watersheds had no Township parkland, additional costs were considered for potential land acquisition. Therefore, we added approximately 50% for an estimated total budget of $3 Million.

Since the intended goal of this effort was to determine an Order of Magnitude estimate of the costs associated with reducing the pollutant load by the minimum required amount in advance of a TMDL being established, the estimated value provided of $3 Million, would be the cost to implement the initial BMPs over a five year period from 2018 to 2023. It is possible and expected that DEP will establish a TMDL for the impaired watersheds in 2023, which would require an ongoing and likely larger capital expenditure in the future.

I trust that this memo adequately addresses your request. As always, please do not hesitate to contact me if you have any questions or require additional information.

Attachments:

1. Estimated Annual Expenditures Township Stormwater Management Activities, dated April 29, 2015
2. PA DEP Listing of Impaired Watersheds, excerpt from Draft MS4 Requirements Table, revised June 17, 2015
3. Lower Merion Watersheds and Terminus Outfalls Map
4. Urban Stormwater BMPs Included in the Study Table excerpt from the Cost Effectiveness Study of Urban Stormwater BMPs in the James River Basin by the Center for Watershed Protection, revised June 2013

cc: Task Force Members

File: \Projects\LOWM093831\2015 Stormwater Project\Stormwater Evaluation\July Meeting2015-07-23 Memo\2015-07-24 Memorandum Cost Analysis.doc
<table>
<thead>
<tr>
<th>MS4 Name</th>
<th>NPDES ID</th>
<th>Individual Permit Required?</th>
<th>Impaired Downstream Waters or Applicable TMDL Name</th>
<th>Requirement(s)</th>
<th>Other Cause(s) of Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montgomery County</td>
<td></td>
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<tr>
<td>Lansdale Boro</td>
<td>PAG130038</td>
<td>Yes</td>
<td>Wissahickon Creek</td>
<td>Appendix E-Nutrients (4a), Appendix B-Pathogens (5)</td>
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<td></td>
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<td>West Branch Nesaminy Creek</td>
<td>Appendix E-Excessive Algal Growth, Nutrients, Organic Enrichment/Low D.O. (5)</td>
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<tr>
<td></td>
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<td></td>
<td>Nesaminy Creek</td>
<td>Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)</td>
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<tr>
<td></td>
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<td>Wissahickon TMDL</td>
<td>TMDL Plan-Siltation (4a)</td>
<td>Cause Unknown (4a)</td>
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<td></td>
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<td>TMDL Plan-Siltation (4a)</td>
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<td>Skippack Creek</td>
<td>Appendix E-Excessive Algal Growth, Nutrients (5)</td>
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<td>Nesaminy Creek TMDL</td>
<td>TMDL Plan-Siltation, Suspended Solids (4a)</td>
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<td>Parkison Creek</td>
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<td>Schuylkill River PCB TMDL</td>
<td>Appendix C-PCB (4a)</td>
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<td>Yes</td>
<td>Park Creek</td>
<td>Appendix B-Pathogens (5), Appendix C-PCB (5), Appendix E-Nutrients (5)</td>
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<td>TMDL Plan-Siltation (4a)</td>
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<td>Nesaminy Creek TMDL</td>
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<td>Mill Creek</td>
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<td></td>
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<td>Appendix C-PCB (5), Appendix E-Siltation (5)</td>
<td>Cause Unknown (5)</td>
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<td></td>
<td>East Branch Indian Creek</td>
<td>Appendix C-PCB (5), Appendix E-Siltation (5)</td>
<td>Cause Unknown (5)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Darby Creek</td>
<td>Appendix C-PCB (5), Appendix E-Siltation (5)</td>
<td>Cause Unknown (5)</td>
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<td></td>
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<td></td>
<td>Gulph Creek</td>
<td>Appendix A-Metals (5), Appendix E-Siltation (8)</td>
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<td></td>
<td></td>
<td>Schuylkill River PCB TMDL</td>
<td>Appendix C-PCB (4a)</td>
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<td>Appendix A-Metals (5), Appendix E-Siltation (5)</td>
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<td>West Branch Indian Creek</td>
<td>Appendix C-PCB (5), Appendix E-Siltation (5)</td>
<td>Cause Unknown (5)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Trout Run</td>
<td>Appendix E-Nutrients, Siltation (5)</td>
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</tr>
</tbody>
</table>
Cost-Effectiveness Study of Urban Stormwater BMPs in the James River Basin

Prepared by:
The Center for Watershed Protection
8390 Main Street, 2nd Floor
Ellicott City, Maryland 21043

Prepared for:
James River Association
9 South 12th Street, 4th Floor
Richmond, Virginia 23219

1st Release: March 2013
REVISED: June 2013

The James River Watershed
<table>
<thead>
<tr>
<th>BMP</th>
<th>Current Status (as of April 2013)</th>
<th>TN Efficiency (%)</th>
<th>TP Efficiency (%)</th>
<th>TSS Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Growth Reduction</td>
<td>Approved by CBP</td>
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<td></td>
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<tr>
<td>Urban nutrient management (recommended efficiencies)</td>
<td>CBP panel recommendations approved by Water Quality Goal Implementation Team March 11, 2013</td>
<td>9</td>
<td>4.5</td>
<td>0</td>
</tr>
<tr>
<td>Urban Stream Restoration (original efficiencies)</td>
<td>No longer recommended by CBP</td>
<td>0.02 lbs/ft</td>
<td>0.003 lbs/ft</td>
<td>2 lbs/ft</td>
</tr>
<tr>
<td>Urban Stream Restoration (recommended interim efficiencies)</td>
<td>Approved by CBP in January 2012</td>
<td>0.2 lbs/ft</td>
<td>0.068 lbs/ft</td>
<td>52.5 lbs/ft</td>
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<tr>
<td>Vegetated Open Channels, A/B soils, no underdrain</td>
<td>Approved by CBP</td>
<td>45</td>
<td>45</td>
<td>70</td>
</tr>
<tr>
<td>Vegetated Open Channels, C/D soils, no underdrain</td>
<td>Approved by CBP</td>
<td>10</td>
<td>10</td>
<td>50</td>
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<tr>
<td>Wet Ponds and Wetlands (new)</td>
<td>Approved by CBP</td>
<td>25</td>
<td>45</td>
<td>60</td>
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<tr>
<td>Wetlands (retrofit)</td>
<td>CBP panel recommendations approved by Water Quality Goal Implementation Team October 9, 2012</td>
<td>25</td>
<td>40</td>
<td>51</td>
</tr>
</tbody>
</table>

Other BMPs have been proposed by states and localities for review by CBP, but the review and research process is not far enough along to derive an initial performance value. Pet waste programs and illicit discharge elimination were considered to be important in Virginia because of their potential to address both the Bay TMDL and the numerous local bacteria TMDLs. Recent findings by CWP have identified illicit discharges as a potentially large contributor to nutrient loads and correcting these discharges may be a very cost-effective way to achieve nutrient reductions (Lilly et al., 2012). Illicit discharges can be caused by a variety of sources, such as

---

5 This BMP includes an automatic three-year credit for adoption of statewide P fertilizer legislation, beginning in 2013. Schueler and Lane (2013) recommend this credit be implemented by applying a 26.7% unit area TP load reduction to all pervious acres in the jurisdiction. See Appendix B for details.

6 As recommended by Schueler and Stack (2013), a sediment delivery ratio of 0.175 was applied to the edge-of-stream interim approved removal rate of 310 lbs/ft to get to the resulting value of 52.5 lbs/ft.

7 Removal efficiencies calculated using retrofit adjustor curves from Schueler and Lane (2012) based on the following assumptions: 40 acre drainage area, 50% impervious, 50% pervious, C soils, facility is 4% of drainage area with 0.5 foot of ponding, and treats 0.48 inches per acre of impervious cover (see Appendix B for details).
<table>
<thead>
<tr>
<th>MS4 Name</th>
<th>NPDES ID</th>
<th>Individual Permit Required?</th>
<th>Impaired Downstream Waters or Applicable TMDL Name</th>
<th>Requirement(s)</th>
<th>Other Cause(s) of Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Montgomery County</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lansdale Boro</td>
<td>PAG130033</td>
<td>Yes</td>
<td>Wissahickon Creek, West Branch Neshaminy Creek, Neshaminy Creek, Wissahickon TMDL, Towamencin Creek, Skippack Creek TMDL, Skippack Creek, Neshaminy Creek TMDL</td>
<td>Appendix E-Nutrients (4a), Appendix B-Pathogens (5), Appendix E-Excessive Algal Growth, Nutrients, Organic Enrichment/Low D.O. (5), Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5), TMDL Plan-Siltation (4a)</td>
<td>Cause Unknown (4a)</td>
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<td>PAG130148</td>
<td>No</td>
<td>Perkiomen Creek, Schuylkill River PCB TMDL</td>
<td>Appendix B-Pathogens (5), Appendix E-Siltation (5), Appendix C-PCB (4a)</td>
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<tr>
<td>Lower Frederick Twp</td>
<td>PAG130116</td>
<td>No</td>
<td>Perkiomen Creek, Goshenhoppen Creek</td>
<td>Appendix B-Pathogens (5)</td>
<td></td>
</tr>
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<td>Lower Gwynedd Twp</td>
<td>PAG130072</td>
<td>Yes</td>
<td>Park Creek, Wissahickon Creek, Little Neshaminy Creek, Trexylon Creek, Wissahickon TMDL, Neshaminy Creek TMDL</td>
<td>Appendix B-Pathogens (5), Appendix C-PCB (5), Appendix E-Nutrients (5), Appendix E-Nutrients (4a), Appendix B-Pathogens (5), Appendix E-Nutrients (4a), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5), Appendix E-Nutrients (4a), TMDL Plan-Siltation (4a)</td>
<td>Cause Unknown (4a)</td>
</tr>
<tr>
<td>Lower Merion Twp</td>
<td>PAG130054</td>
<td>No</td>
<td>Crofts Creek, Finn Run, Glensfian Creek, Mill Creek, Musconetcon Run, Indian Creek, Indian Creek, Indian Creek, East Branch Indian Creek, Darby Creek, Gulph Creek, Schuylkill River PCB TMDL, Bieber Creek, West Branch Indian Creek, Trout Run</td>
<td>Appendix B-Pathogens (5), Appendix C-PCB (5), Appendix E-Siltation (5), Appendix A-Metals (4a), Appendix E-Suspended Solids (4a), Appendix E-Nutrients, Siltation (5), Appendix C-PCB (5), Appendix E-Siltation (5), Appendix C-PCB (5), Appendix E-Siltation (5), Appendix C-PCB (5), Appendix E-Siltation (5), Appendix C-PCB (5), Appendix E-Siltation (5), Appendix C-PCB (4a), Appendix A-Metals (5), Appendix E-Siltation (5), Appendix E-Nutrients, Siltation (5)</td>
<td>Cause Unknown (5)</td>
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