

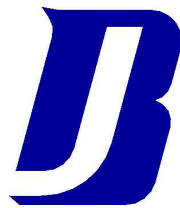
SPRINGFIELD TOWNSHIP

Comprehensive Township-Wide Stormwater Analysis



May 1, 2013

Prepared by:



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A. INTRODUCTION

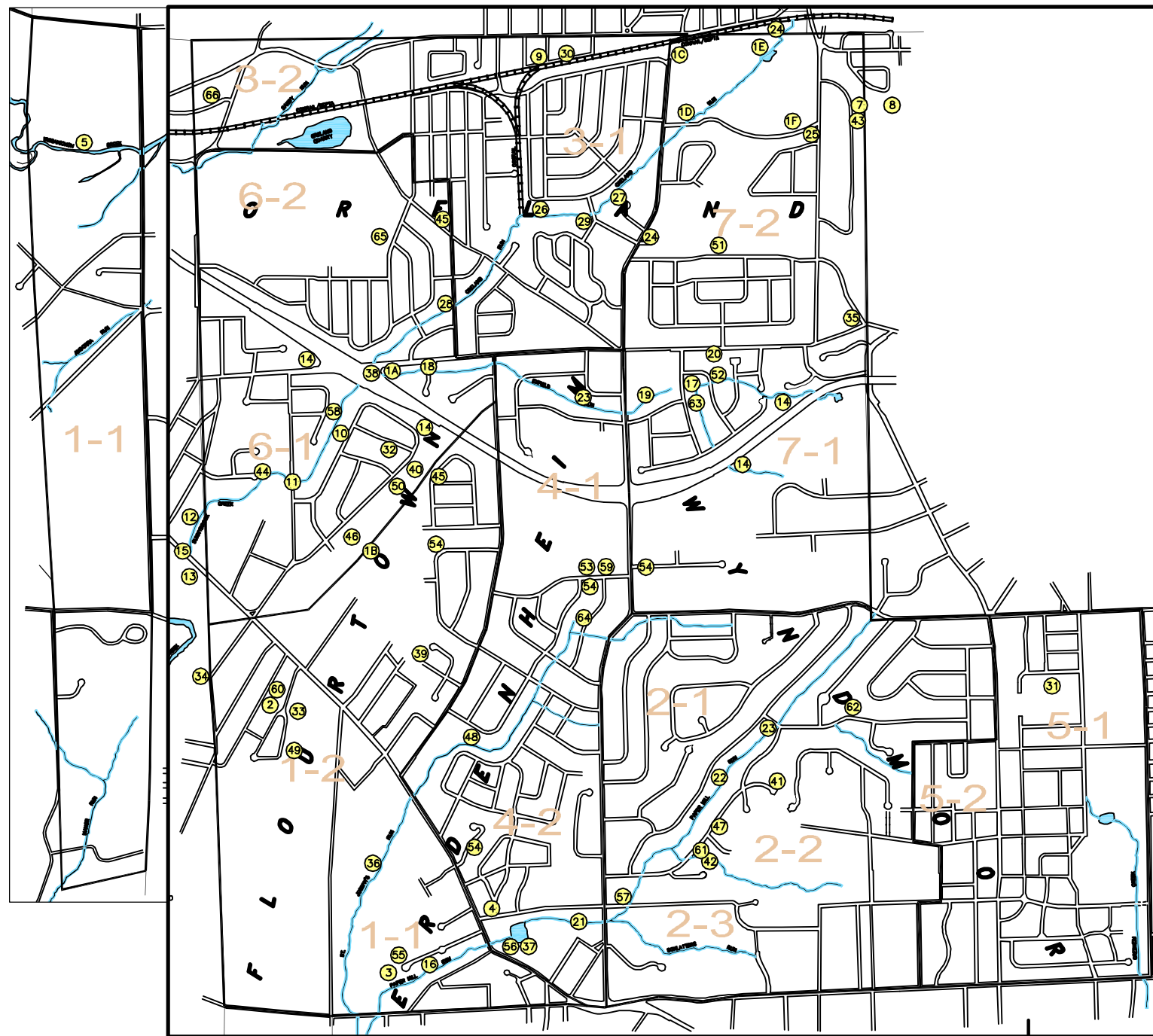
Springfield Township, Montgomery County, Pennsylvania, like many of the other adjacent communities, saw a majority of its development occur at a time before stormwater management was a consideration. Most lots are individual residential tracts where owners have constructed homes, driveways, patios, and other impervious surfaces. Impervious surfaces were constructed without thought of implementing controls for increased runoff. Storm pipes and catch basins were often constructed in reaction to perceived needs rather than designed engineered plans. Recent advances in the study of stormwater management have led many to reconsider older methods in favor of new. As a result, the existing problems associated with stormwater management are both varied and significant.

The issue of stormwater management concerns is not new to Springfield Township. Likewise, action by the Township to address stormwater management is not new. Springfield Township has been working for many years to address problems affecting various properties and water courses. In 1997 the Township Engineering firm at the time, Remington & Vernick Engineering, prepared a study of the Sunnybrook Creek watershed. Also, the Township has performed in excess of 100 stormwater management projects over the past several years to reduce the stormwater management concerns of residents and property owners. Public and Private funds in excess of two million dollars (\$2,000,000) have been expended over the past 10 year and longer. A map provided on the following page highlights some of these projects (Figure 1, Township Stormwater Map of Improvements). This map can also be viewed on the Township website by selecting the “Department” tab and the “Stormwater” listing.

Yet with all of these previous efforts, stormwater runoff remains a problem for a number of property owners, resulting in flooding and/or streambank erosion. The Township is aware of many of these current areas and provided residents with a forum to identify additional localized areas by holding stormwater meetings during March of 2010. The issues raised by residents are numerous and varied. Concerns surround streambank erosion, maintenance of existing facilities, undersized storm sewers, and flooding of roads and properties, among others.

This analysis is prepared to;

- Identify current problem areas (identified by residents and staff).
- Prioritize these areas of concern.
- Discuss conceptual solutions to address these prioritized flooding areas.
- Pinpoint feasible solutions from this conceptual list
- Provide a schedule of design and construction projects to address the targeted flooding areas.
- Provide associated costs.



CONSTRUCTION PROJECTS COMPLETED

10. Redirected the trapezoidal channels behind Hemlock Road to reduce turbidity and increase flows.
11. Removed the sediment in the right, left and center bridge cells under the East Mill Road bridge. Widened the existing channel to taper into the bridge to allow water to flow freely through the full span. Placed a concrete bottom under the structure to eliminate undermining. Established a capital project fund to begin saving for a total bridge replacement in 2015. The new bridge is intended to be a clear-span structure to further facilitate flows and reduce maintenance.
12. Created a large detention area between Bethlehem Pike and the East Mill Road bridge.
13. Purchased the vacant PECO substation property on Bethlehem Pike and performed grading operations to facilitate the flow of stormwater.
14. Encouraged PennDOT to construct 4 detention basins adjacent to Route 309 as part of the State Route 309 reconstruction project.
15. Adjusted existing utilities and excavated under the Bethlehem Pike bridge to increase water flow.
16. Removed the sediment build-up and selectively removed trees within Paper Mill Run behind Gordon Lane and Brookside Road.
17. Reconstructed the headwall and adjusted the wing wall within Enfield Run behind Lantern and Quill Lane. As a result of this adjustment, flows were increased by 26%.
18. Removed sediment from bridge cell at Overbrook Lane. Bridge is inspected after each heavy storm occurrence to ensure 100% flow capacity. Sediment removed as needed.
19. Required the School District to construct a large detention area as part of the Enfield Elementary School addition.
20. Required stormwater improvements to be performed in conjunction with the construction of a new dwelling at 1000 Church Road. Improvements included new storm pipes, tree removal and construction of a new headwall.
21. Submitted multiple grant requests to stabilize the stream embankments within Cisco Park. Obtained in 2009 a grant from Merck & Co. to perform streambank stabilization activities and to install a riparian buffer.
22. On-going stream bank stabilization along Paper Mill Run to protect the sanitary sewer line and reduce erosion. Activities include tree removal, gabion installation, and strategic placement of rip-rap.
23. Repaired severe erosion at Hull Drive and Marshall Road by removing trees and strategically placing rip-rap along banks.
24. Encouraged North Hills Country Club to construct two oversized stormwater detention basins as part of the land development process.
25. Increased the storage capacity of the Township's stormwater detention basin located along Station Avenue by restricting the outflow.
26. Constructed an over-land swale to reduce street flooding and private property damage in the 300 block of Lyster Road.
27. Required the stormwater management system at the Susan Circle/Truscott Woods subdivision to be oversized.
28. Added a secondary outflow structure at Lorraine Avenue bridge to help drain the 300 block of Oreland Mill Road.
29. Removed sediment from the bridge cells at Enfield Road. The bridge is inspected following severe storm events to ensure 100% flow capacity.
30. Constructed the Weldy Avenue stormwater detention basin to detain flows entering the Oreland Run and Sunnybrook Creek.
31. Constructed a large detention facility and stormwater swales as part of the Laurel Beech Park improvements.
32. Reconstructed concrete drainage channels in the Flourtown Gardens and Malinda Road/Bradford Road subdivisions.
33. Constructed a large detention basin and overland swale at Carson Valley School.
34. Removed trees and obstructions from drainage swale in Fort Washington State Park, to allow proper drainage from College, Grove and Weiss Avenue storm sewers.
35. Required PennDOT to construct a detention basin within Edann Road cu-de-sac as part of the Church Road/Willow Grove Avenue realignment project.
36. Removed trees and obstructions from within the St. Joseph's Run from Bethlehem Pike to Stenton Avenue.
37. Removed 2,500 cubic yards of silt and sediment from Hillcrest Pond in Summer 2008. Hillcrest Pond serves as an informal detention facility during severe rainfall events.
38. Encouraged PennDOT to remove the old concrete bridge foundation and abandoned utility pipes that were blocking flows within the Enfield Run at SR 309 and Church Road.
39. Reconstructed and re-oriented the parking lot at Flourtown Country Club resulting in a reduction in impervious surface area. Constructed an above-ground infiltration/detention basin to further capture stormwater runoff from entering the St. Joseph's Run.
40. Constructed a new stormwater detention basin at the 4th tee of the Flourtown Country Club.
41. Completed stormwater drainage improvements in the Marshall/Carlisle Road neighborhood to improve drainage from Elliston Road neighborhood above.
42. Reconstructed the headwall in the 8800 block of Carlisle Road to more effectively capture and convey flows to the storm sewer system.
43. Constructed a large detention basin above Woods Road in Cheltenham Township.
44. Constructed an over-land swale to reduce street flooding and private property damage in the Carlton Way cu-de-sac.
45. Constructed a below-ground stormwater detention system in the 300 block of Oreland Mill Road.
46. Constructed a stormwater detention basin at the 2nd tee of the Flourtown Country Club.
47. Installed additional stormwater inlets within the 8800 block of Carlisle Road to improve roadway drainage during severe rain events.
48. Completed the St. Joseph's Run stormwater drainage improvements to alleviate flooding in the Atwood Road and Longfield Road neighborhoods.
49. Constructed a second stormwater detention basin on lands owned by Carson Valley School to improve drainage in the College Avenue neighborhood.
50. Constructed a second stormwater detention basin at the 4th tee of the Flourtown Country Club to reduce flows entering the Sunnybrook Creek behind Hemlock Road.
51. Constructed a combination swale/berm and detention area at the North Hills Country Club to contain overland run off on the golf course and reduce flooding along the 1000 block of Edann Road.
52. Constructed an overflow drainage swale in the 1000 block of Quill Lane to direct water to/from the adjacent creek.
53. Required the School District to examine their existing storm sewer facilities to ensure proper operation; bolted down manhole cover near the high school stadium that surcharged during severe storm events and exacerbated Fraser Road flooding.
54. Retrofit existing "city style" stormwater inlets with more efficient street grade inlets at numerous locations throughout the Township.
55. Created a swale at Mount Saint Joseph's Academy to direct overland run off to the Paper Mill Run/Wissahickon Creek.

RECURRING MAINTENANCE ACTIVITIES (NOT SHOWN ON PLAN)

1. Quarterly Creek Inspections - Township staff monitors the integrity of the creek beds and the utilities every 3 months. Perform maintenance as needed, and cite violations for illegal dumping.
2. Annual Creek Maintenance Program - remove all woody vegetation, obstructions and dumping within creek ways. Annually, the Sunnybrook Creek (Bethlehem Pike to Overbrook Lane), Oreland Run (309 to St. Clair Rd.) and Enfield Run (309 to Haws) are cut.
3. Perform annual detention basin inspections.
4. Regular cleaning and maintenance of streets and stormwater inlets and catch basins.
5. Remove sediment and sand bars from creek beds following severe storm events.
6. Utilize concrete blocks, gabion baskets, rip-rap and native vegetation on stream banks to minimize future erosion.

OTHER (NOT SHOWN ON PLAN)

1. August 1997 Township-wide stormwater management study completed by Remington & Vernick Engineers. A majority of the Township's early stormwater mitigation efforts were identified in the plan with the majority of the least costly projects already completed. Examples include detention basins that were constructed at North Hills Country Club and as part of the State Route 309 reconstruction project.
2. Researched, assembled and distributed a stream bank maintenance pamphlet.
3. Participated in various watershed coalition groups to minimize and mitigate the effects of floodwater entering Springfield Township from other municipalities.
4. Provide flood management updates within the bi-annual newsletter.
5. Submitted a grant application to Montgomery County Housing and Urban Development to fund waterproofing improvement projects on households located within the floodplain. Project was denied funding, however, all residential structures located in floodplains have received information on flood-proofing measures for their homes, such as glass blocks for window wells, and flood proof doors.
6. Continue participation in various watershed coalition groups to coordinate regional stormwater management efforts.
7. Installed inverted infiltration manhole inserts in all low-lying sanitary sewer manholes - MS-1, MS-2, MS-3 sewer lines.
8. Rehabilitated 125 manholes in the sanitary sewer system in MS-2 line. Parallels Wissahickon Creek and Sunnybrook Creek.
9. Rehabilitated 155 manholes in the sanitary sewer system in MS-3 line. Parallels Paper Mill Run creek.
10. Additional 50 manholes to be rehabilitated in 2004 and 2005.
11. Rehabilitation efforts in items 7 - 10 have reduced stormwater inflow and infiltration within sanitary sewer system. Stormwater inflow and infiltration increases sewage treatment fees and the likelihood of surcharging within the sanitary sewer system during extreme weather events.
12. Submitted grant application to Montgomery County Housing and Urban Development to fund the construction of an above-ground stormwater management basin at Weldy Avenue. Application was approved in November 2003 and construction will begin in Autumn 2004.
13. Submitted 3 Hazard Mitigation Grants to Commonwealth of PA as follows:
 - (1) Construct wing walls at Bethlehem Pike bridge at Flourtown Shopping Center
 - (2) Install concrete bottom and upstream cut-off wall at Paper Mill Road bridge
 - (3) Remove earthen embankment at former PECO property within Sunnybrook Creek.
 All three of the above projects were denied funding, but Township performed project #3 at our expense.
14. Directed residents who experience sewage back-ups during rain events to install back flow preventers to prevent future flooding.
15. Require Insert caps to be installed on all sanitary sewer curb vents. Inserts are available, free of charge, to all residents.
16. Constructed large detention facility as part of the Laurel Beech Park redevelopment project.
17. Submitted a grant to Montgomery County Department of Housing and Community Development to dredge Hillcrest Pond within Paper Mill Run. Hillcrest Pond serves as an informal detention facility during severe rainfall events.
18. Requested a Township-wide stormwater management study to be performed by the Pennsylvania Department of Environmental Protection. The study was completed in February 2009 and recommendations are being followed.
19. Submitted 2 Hazard Mitigation Grant Project applications to acquire or elevate 12 homes in the 400 and 500 block of Hemlock Road.
20. Requested funding from the U.S. Department of Agriculture Emergency Watershed Protection program to complete streambank stabilization work at 9 locations. Two locations, 403 Meadow Lane and 1500 Church Road were approved for funding.
21. Met with the Army Corps of Engineers and PA DEP to investigate the feasibility of fast-tracking the permit process for Hillcrest Pond, Lantern Lane, 8911 Montgomery Avenue and Paper Mill Run/Stenton Avenue stormwater projects.

PROJECTS NO LONGER FEASIBLE OR OF LIMITED/INSUFFICIENT BENEFIT

1. 1997 Township-wide Stormwater Study basins:
 - 1A. Lot adjacent to State Route 309 northbound off-ramp at Church Road (site of private residences 1706 and 1708 Church Road)
 - 1B. Enlarge the existing pond at Flourtown Country Club (pond enlargement provides limited benefit related to cost; stormwater basin at 2nd tee was constructed instead)
 - 1C. Northern corner of North Hills Country Club by Bruce and Paper Mill Roads (private property)
 - 1D. Enlarge the existing pond at North Hills Country Club by Paper Mill and Golf Roads (private property; pond enlargement provides limited benefit related to cost)
 - 1E. Enlarge the existing pond at North Hills Country Club above basin 4D (private property; pond enlargement provides limited benefit related to cost)
 - 1F. North Hills Country Club driving range adjacent to existing parking lot (private property)
2. Install additional stormwater inlets within the College Avenue neighborhood to improve roadway drainage during severe rain events (Inlets will provide limited benefit due to the size of the existing drainage culvert; Investigating the feasibility of constructing a second stormwater basin on lands owned by Carson Valley School)

PROPOSED OR PENDING PROJECTS

3. Reconstruct the concrete channel at the end of Brookside Road to more effectively capture and convey flows from the cul-de-sac.
4. Construct a new storm sewer system at the intersection of Terminal and Montgomery Avenues in Erdenheim to capture water exiting Lower Erdenheim Village (grant application submitted April 2012)
5. Complete Inflow/Infiltration improvements within the main line of the sanitary sewer interceptor pipe along the Wissahickon Creek.
6. Install caps on all sanitary sewer lateral vents located in flood prone areas.
7. Modify the cross slope of Woods Road to direct water away from homes on the north (downhill) side of the street.
8. Construct a series of check-dams on lands owned by Cheltenham Township above Woods Road.
9. Expand the existing Penn Weldy Detention Basin into the unimproved portion of Apel Avenue to increase capacity during severe storm events.

NEIGHBORHOOD FLOOD/CONCEPT STUDIES

- | | |
|---|--|
| 56. Brookside Road - Hillcrest Pond | 62. Hull Drive |
| 57. Brookside Road - 8911 Montgomery Avenue | 63. Lantern Lane |
| 58. Hemlock Road - 10 Concept Points for Implementation | 64. Glenway Road |
| 59. Fraser Road | 65. Burton Road - Sandy Run Country Club |
| 60. College/Grove/Weiss Avenue | 66. Fairwold Lane |
| 61. Carlisle Road | |

NO SCALE



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B. IDENTIFIED FLOODING AREAS

Due to the many stormwater problems communicated by residents, the Township held an Open House in March of 2010 to allow residents to inform Township staff of existing problem areas within the Springfield Township. In addition, various Township Commissioners and Staff have heard directly from residents noting areas of concern. A “Townshipwide Stormwater Management Study” was performed by Remington & Vernick Engineers during August of 1997. **Boucher & James, Inc.** has reviewed all of these sources in an attempt to quantify the full extent of stormwater issues within Springfield Township.

The stormwater “Open House” was held on March 18, 2010. The result of this meeting was a log of 82 separate residential concerns comprising 49 separate areas within Springfield Township. Each of the 49 separate flooding areas has been identified with a number on a prepared Springfield Township Watersheds map. The following is a summary of those issues, corresponding to those numbers.

Summary of Residents Concerns from Meeting of March 2010

Ward #1

1. Residents of Brookside Road: Residents are affected by rising floodwaters from Paper Mill Road. Yards and homes are affected.
2. Residents of Brookside Road: Residents receive large amounts of runoff from the neighboring school property. Yards and homes are affected.
3. Residents of Brookside Road: Residents receive large amount of runoff from Bethlehem Pike. Flow that should be maintained within the roadway travels through the rear of their properties.
4. Residents of Northwestern Avenue: A single individual has logged a concern regarding 100 and 305 Northwestern Avenue. The concern notes that flooding of Paper Mill Run and the Wissahickon Creek creates flooding of the entrance drive to the Morris Arboretum, disrupting activities and educational programs.
5. 128 N. College Avenue: Resident notes runoff from Bethlehem Pike and adjacent fields of Carson Valley School floods roadway and surrounding lots.
6. 62 N. College Avenue: Resident notes runoff from neighboring properties is directed to, and floods, his yard.
7. 51 N. College Avenue: Resident notes runoff from Bethlehem Pike and adjacent fields of Carson Valley School floods roadway and surrounding lots.
8. 27 N. College Avenue: Resident notes runoff from Bethlehem Pike and adjacent fields of Carson Valley School floods roadway and surrounding lots.
9. 203 Haws Lane: Resident notes that a large amount of runoff from a neighbor flows onto his property. There is no mention of damage to home or property.

Ward #2

1. Residents of Montgomery Avenue: Residents experience flooding of yards from Paper Mill Run.
2. 8702 Montgomery Avenue: Resident notes concentrated runoff from adjacent nursing home created erosive conditions on his property.

3. 1011 Farrell Road: Resident experiences issues with groundwater. Notices water seeping up through cracks in sidewalks and notes regular running of basement sump pump.
4. 8822 Patton Road: Resident notes erosion of Paper Mill Run streambanks.
5. 8819 Patton Road: Resident notes constant running of sump pump due to groundwater intrusion. Suggests possible existence of underground spring.
6. Residents of Patton Road: Residents observe stormwater runoff from neighboring properties flooding yards and homes.
7. Residents of Patton Road: Residents request maintenance of existing basin and stormwater management conveyance systems to prevent current yard and road flooding.
8. 8816 Carlisle Road: Resident notes flooding of yard and adjacent roadway.
9. 8811 Carlisle Road: Resident notes Paper Mill Run floods rear yard and the yard is typically in saturated condition.
10. 511 E. Gravers Lane: Resident comments about ponding water at end of driveway.
11. 8525 Ardmore Avenue: Resident concerned with deteriorating drainage system.
12. 8608 Hull Drive: Resident complains of yard flooding from combination of runoff along Hull Drive and from Elliston Drive in the rear.
13. 8012 Hull Drive: Resident complains about yard runoff from neighboring properties.

Ward #3

1. 2109 Fairwold Lane: Resident comments about runoff from a neighboring property that causes erosive damage.
2. 18 Weldy Avenue: Resident notes yard flooding during large storm events.
3. 1503 Church Road: Resident notes that Erdenheim Run tops the roadway crossing at Haws Lane during large storm events and runs down the adjacent Church Road. Resident further notes that portions of Erdenheim Run are eroding.

Ward #4

1. 14 Haws Lane: Resident notes that stormwater runoff within the roadway of Haws Lane flows down his driveway and floods his rear yard.
2. Residents of Longfield Road: Residents are greatly concerned over streambank erosion and the loss of their land. Residents noted flooding of yards, but the stream erosion seems to be their greatest concern.
3. 208 Terminal Avenue: Resident notes constant running of sump pump.
4. 218 Glendalough Road: Similar to 700 Avondale, resident notes severe runoff from above causing erosion and home flooding.
5. Residents of Avondale Road. 700 Avondale Road notes severe runoff volumes from above causing flooding in garage and basement. 641 Avondale Road notes groundwater seepage from below.
6. 406 Arden Lane: Similar to 700 Avondale, resident notes severe runoff from above causing erosion.
7. 908 Frasier Road: Residents notes flooding of yard and roadway and suggests cause is runoff from High School.
8. 805 Frasier Road: Resident notes flooding of yard and home and suggests cause is runoff from High School.
9. 804 Frasier Road: Resident notes flooding of yard and roadway and suggests cause is runoff from High School.

10. 800 Frasier Road: Resident notes flooding of yard and roadway and suggests cause is runoff from High School.

Ward #5

1. 7721 Beech Lane: Resident comments that her property is a localized low area prone to standing water, resulting in saturated soils and a mosquito breeding area.
2. 917 E. Abington Avenue: Resident notes existing storm culvert under Southampton Avenue is leaking and is concerned about possible effects to property.
3. 806 Wyndmoor Avenue: Resident complains of water in basement after any rainfall event. Resident notes the entire block lies on a downward slope.

Ward #6

1. 227 Arlingham Road: Resident notes yard flooding and basement flooding due to runoff from neighboring properties.
2. 243 Arlingham Road: Resident notes yard flooding due to runoff from neighboring properties.
3. Residents of East Mill Road: Residents complain about stream bank erosion leading to loss of property.
4. Residents of Hemlock Road: Residents experience flooded lower levels of homes during large rainfall events due to flooding of Sunnybrook Creek. Project being considered at this time.
5. 1521 Lucon Road: Resident complains of flooded rear yard after every rainfall event and flooded basement after large order storms. Identifies S.R. 309 as a drainage barrier.
6. 307 Oreland Mill Road: Resident complains that roadway floods to point of closure during large order storms and notes that basement floods as well. Log Book record is dated March 18, 2010. Project completed recently provided underground detention basin in area. Unsure of flooding occurrences since completion of construction.

Ward #7

1. 1108 Summit Lane: Resident complains of yard flooding that sometimes affects basement. Identifies S.R. 309 as a drainage barrier.
2. Residents of Lantern Lane: Flooding of rear yards due to confluence of channel and culvert at this location. Projects have been considered in the past.
3. 1019 Pheasant Lane: Resident complains of yard flooding from large volume of runoff from neighboring properties.
4. 11 Shepherd's Way: Resident complains that fallen tree has blocked stormwater culvert and is creating yard flooding.
5. 607 Station Avenue: Resident complain of sewage backup in yard and notes existence of sink hole in front yard and other yard damage around property.

Additional Concerns

Since the March 2010 open forum stormwater meeting there have been a number of different concerns brought to the attention Township Commissioners and/or Staff. The following is a list of those additional concerns.

1. Flooding near the intersections of Andorra Road, Thomas Road and Northwestern Avenue.

2. Flooding of a Glenn Circle home at the low point of Glenn Circle.
3. Flooding along Atwood Road from Haws Lane runoff.
4. Flooding at Glenway Road from stream backup and runoff from Paper Mill Road.
5. Stream erosion between Stotesbury Avenue and Paper Mill Road, near Cheltenham Avenue.
6. Patton Road residents homes flood due to runoff from Stotesbury development uphill.
7. Hull Drive home flooded due to runoff from MacArthur Road area.
8. Rear yard flooding between Campbell Lane and Pheasant Avenue.
9. Flooding from Sunnybrook Creek at Carlton Way cul-de-sac.
10. Stream erosion between S.R. 309, Church Road and Overbrook Lane.
11. Stream erosion of Erdenheim Run south of Haws Lane.
12. Flooding at Surrey Road due to runoff from Sandy Run Country Club.
13. Flooding at Walnut Avenue where it crosses over Sandy Run Creek.
14. Flooding from Lyster Road runoff onto resident yards.
15. Oreland Run eroding and flooding onto residents' yards along Lyster Road.
16. Flooding of Woods Road and Station Avenue from higher areas of Cheltenham Twp.
17. Flooding at Hull Drive due to runoff from Elliston Drive.
18. Flooding at the Pump Station near Eagle View Drive.

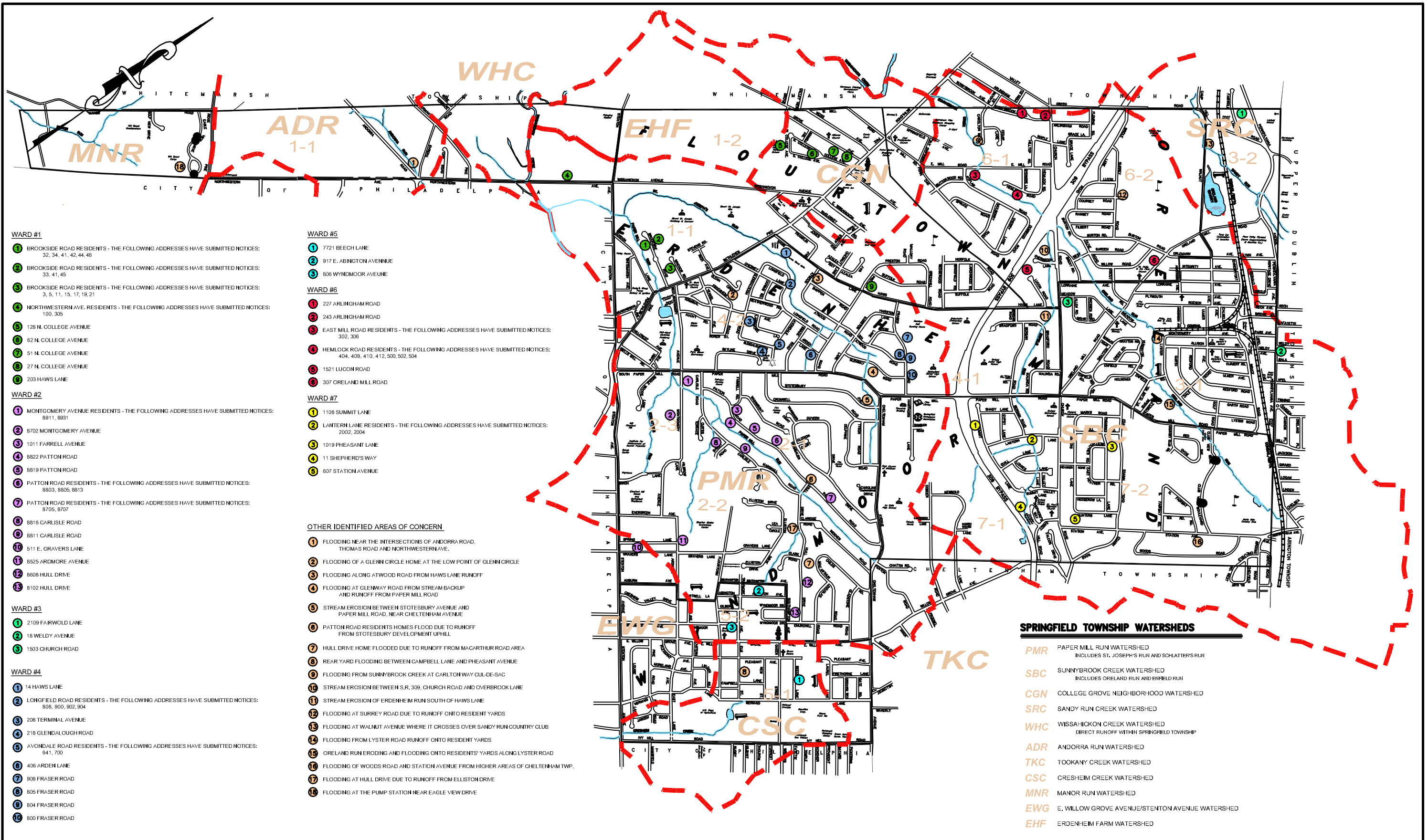
These 18 additional areas of concern raise the Township-Wide total to 100 watershed issues. These issues have been located within a Township-Wide watershed map (Figure 2, Overall Watershed Map), located on the following page.

Remington & Vernick Study, 1997


Finally, we have reviewed the study performed by Remington & Vernick Engineers during August of 1997. As the text of that report notes, "While the title of the study is 'Townshipwide', the actual study area is the drainage basin which feeds the Sunnybrook Creek." This report analyzed 13 separate sub-watersheds within the Sunnybrook Creek drainage area in an effort to determine the feasibility of constructing stormwater management facilities to address the flooding areas noted at that time. The result was the proposal of ten (10) separate detention basins, for a total cost of \$441,335 in 1997. A review of these proposals against current Township facilities shows that four (4) of these ten basins were constructed.

In contemplating that construction of the remaining basins would yield a significant benefit to the current flooding situation it is important to note the following text from the Summary page found at the end of the study; **"Out of the twenty-six homes identified in this study as being flooded, only six homes would benefit from the construction of the proposed basins, which have an estimated construction cost of \$441,335.00. The actual drops in the flood elevations range from one-quarter to one twelfth of the needed drops to benefit all wet homes."**

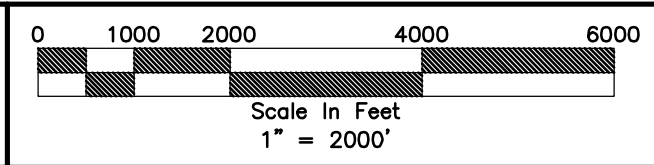
Clearly there is a need to address the flooding of various residential and other areas within the Township. Many projects have already been completed toward that goal, but additional stormwater projects are still necessary. The remaining narrative provides additional recommendations towards meeting that goal.



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Township-wide Watershed Analysis
 Springfield Township
 Montgomery County, Pennsylvania

FIGURE 2
OVERALL WATERSHED MAP

C. PRIORITIZED LIST OF CONCERNS TO ADDRESS

The previous section provided an overview of the stormwater issues within Springfield Township. There are a variety of issues related to flooding of roadways, yards and homes and streambank erosion. With such a large number of concerns it is necessary to take time and develop a thoughtful list of areas where the situation is most dire, either due to the danger to a specific location or to the number of residents affected. **Boucher & James, Inc.** utilized the following four (4) criteria to establish a priorities list; **a) Quantity of Residents Affected, b) Health, Safety and Welfare of Surrounding Residents, c) Frequency of Property Damage, and d) Alterations of Existing Watercourses.** Each noted area of flooding or erosion was weighed against these four criteria to find those areas in most need of attention. The following list identifies the top ten areas within Springfield Township that **Boucher & James, Inc.** recommends be addressed when proposing stormwater management projects.

1. Hemlock Road Community: Located within the Sunnybrook Creek (SBC) Watershed, this area is regularly inundated with flooding from the adjacent Sunnybrook Creek. Seven (7) residents filed statements of concern at the meeting of March 18, 2010, experiencing severe flooding of yards and homes.
2. Brookside Road Community: Located within the Paper Mill Run (PMR) Watershed, this area is regularly inundated with flooding from the adjacent Paper Mill Run creek, as well as overland flows from Bethlehem Pike and the adjacent St. Joseph's Academy. Seventeen (17) residents filed statements of concern at the meeting of March 18, 2010, experiencing flooding of yards, roadways and homes.
3. College/Grove Community: Located within the College Grove Neighborhood (CGN) Watershed, these residents experience yard and roadway flooding due to undersized storm pipes and large volumes of overland runoff from Bethlehem Pike. Four (4) residents filed statements of concern at the meeting of March 18, 2010, experiencing undersized storm systems, and flooding of yards and roadways.
4. Carlisle Road, between Bailey and Curtis: Located within the Paper Mill Run (PMR) Watershed, this area is regularly inundated with flooding from an adjacent tributary to the Paper Mill Run creek, due in large part to an undersized storm system designed to convey water across Carlisle Road. Two (2) residents filed statements of concern at the meeting of March 18, 2010, experiencing flooding of yards, roadways and homes.
5. Lantern Lane between Bergan and Quill: Located within the Sunnybrook Creek (SBC) Watershed, this area is regularly inundated with flooding because it is located at the confluence of two large volume stream channels. Two (2) residents filed statements of concern at the meeting of March 18, 2010, experiencing undersized storm systems, and flooding of yards and roadways.
6. Stotesbury Community/Patton Road: Located within the Paper Mill Run (PMR) Watershed, these residents, along Patton Road, experience large volumes of overland runoff from the Stotesbury Community located uphill from their location. This particular issue is not directly related to the nearby watercourse. Five (5) residents filed statements of concern at the meeting of March 18, 2010, and additional concerns were raised separately, experiencing flooding of yards and homes.

7. Glenway Road: Located within the Paper Mill Run (PMR) Watershed, this area is regularly inundated with flooding from the adjacent St. Joseph's Run creek and runoff from Paper Mill Road. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes.
8. Hull Drive, between Clark and Claridge: Located within the Paper Mill Run (PMR) Watershed, this area is regularly inundated with flooding from the adjacent tributary of Paper Mill Run on one side of Hull Drive, and from MacArthur Road homes on the other side. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes.
9. Woods Road/Station Avenue: Located within the Sunnybrook Creek (SBC) Watershed, this area is regularly inundated with flooding from overland flows originating from upland areas of adjacent Cheltenham Township lands. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes.
10. Private Property Watercourse Erosion: Several residents have noted that the adjacent watercourses to their properties are suffering severe bank erosion. This is leading, in many cases, to a loss of property for the residents.

In further sections of this report we will offer recommended stormwater management projects to address the above problem areas.

D. SPRINGFIELD TOWNSHIP WATERSHED SUMMARY

Springfield Township contains a number of streams, creeks and drainage channels. The majority of the lands of Springfield Township drain into the Wissahickon Creek, however, portions are also tributary to the Schuylkill River and to the Tookany Creek. This report has reviewed these various water courses and established eleven (11) separate watersheds existing within the Township boundaries. Of the noted eleven, there are two (2) major watersheds that comprise the bulk of Township area; Paper Mill Run and Sunnybrook Creek.

The following page shows a map of the Springfield Township watersheds highlighting those watersheds where the majority of the issues are located (Figure 3, Priorities Watershed Map). It is significant to note that of the nine (9) flooding areas contained within the priority list, eight (8) of them fall within one of the two major watersheds. The remaining area of concern, the College/Grove Neighborhood, contains no defined watercourse, being directly tributary to the Wissahickon Creek via overland flow or storm pipe drainage systems. While eleven (11) separate watersheds have been identified, the remainder of this report will concentrate only on these three (3) watersheds in a effort to address the list of priorities.

Paper Mill Run Watershed (PMR)

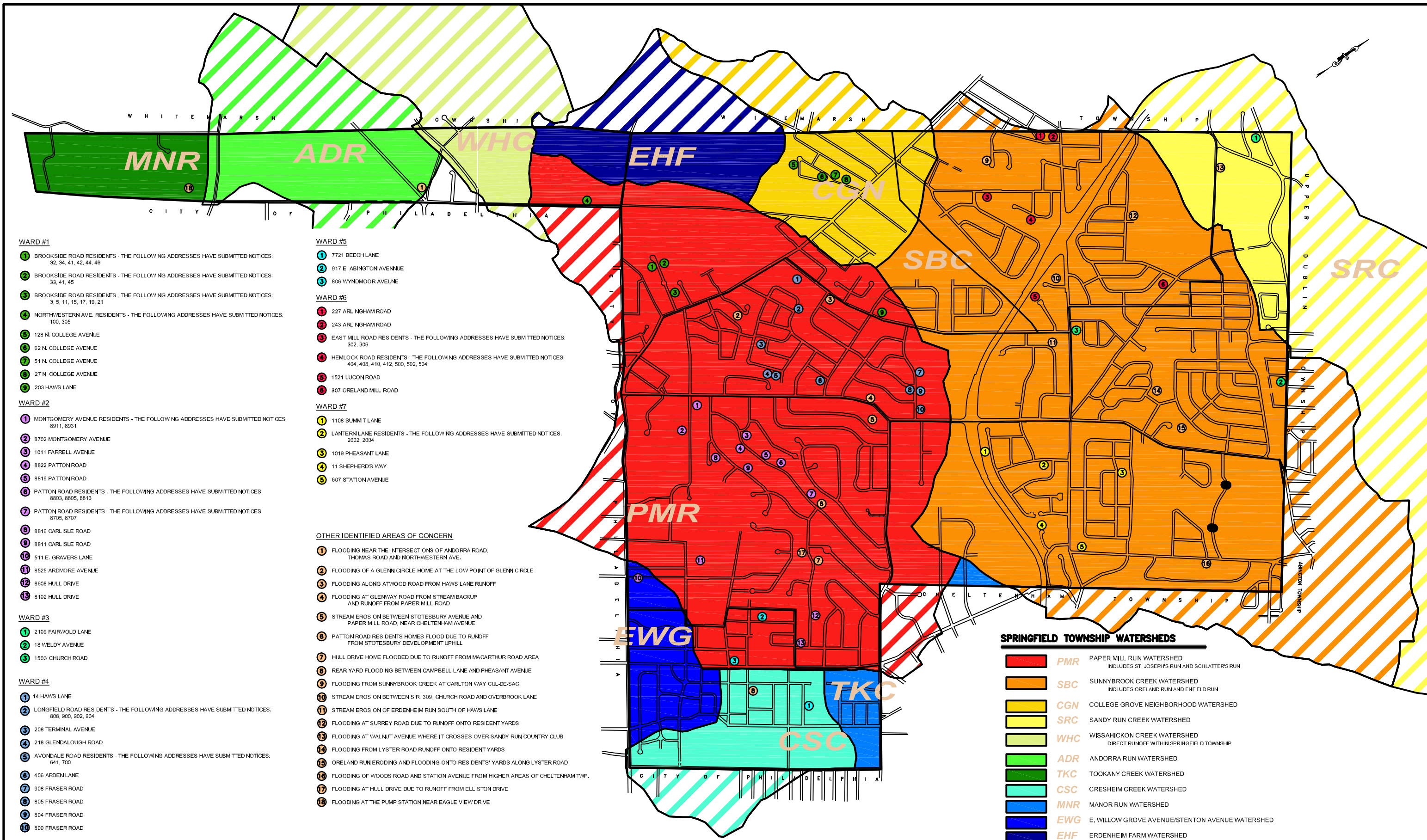
The Watershed Map (Figure 2) identifies 51 separate residential concerns falling within the Paper Mill Run Watershed, representing over half of the total issues. An analysis of this watershed is paramount when considering solutions to the Township stormwater and erosion problems. Within this watershed there are a number of different stream channels and stormwater conveyance systems responsible for transporting runoff. Of these systems, the study examines seven (7) separate reaches. Each reach has been chosen because it contains either one or more of the top ten priority areas of concerns, or a defined stream channel tributary to Paper Mill Run.

Sunnybrook Creek Watershed (SBC)

The Watershed Map (Figure 2) identifies 29 separate residential concerns falling within the Sunnybrook Creek Watershed, representing nearly one third of the total issues. In conjunction with the Paper Mill Run Watershed, these two watersheds account for 80% of the Township problem areas. As with the Paper Mill Run Watershed, an analysis of this watershed is paramount when considering solutions to the Township stormwater and erosion problems. Within this watershed there are a number of different stream channels and stormwater conveyance systems responsible for transporting runoff. Of these systems, the study examines three (3) separate reaches. Each reach has been chosen because it contains either one or more of the top ten priority areas of concerns, or a defined stream channel tributary to Sunnybrook Creek.

College/Grove Neighborhood Watershed (CGN)

The Watershed Map (Figure 2) identifies 4 separate residential concerns falling within the College/Grove Neighborhood Watershed. Residents experience yard and roadway flooding due to undersized storm pipes and large volumes of overland runoff from Bethlehem Pike. The stormwater problems within this neighborhood are exacerbated by very small residential lots that have been improved with a great deal of impervious coverage in the form of homes, driveways, patios, and other impervious surfaces. There are no individual reaches within this watershed as the watershed is directly tributary to the Wissahickon Creek.



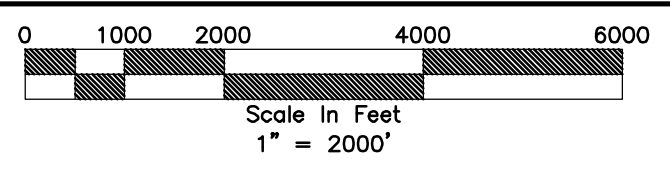
- WARD #1**
- 1 BROOKSIDE ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 32, 34, 41, 42, 44, 46
 - 2 BROOKSIDE ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 33, 41, 45
 - 3 BROOKSIDE ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 3, 5, 11, 15, 17, 19, 21
 - 4 NORTHWESTERN AVE. RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 100, 305
 - 5 128 N. COLLEGE AVENUE
 - 6 62 N. COLLEGE AVENUE
 - 7 51 N. COLLEGE AVENUE
 - 8 27 N. COLLEGE AVENUE
 - 9 203 HAWS LANE
- WARD #2**
- 1 MONTGOMERY AVENUE RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 8911, 8931
 - 2 8702 MONTGOMERY AVENUE
 - 3 1011 FARRELL AVENUE
 - 4 8822 PATTON ROAD
 - 5 8819 PATTON ROAD
 - 6 PATTON ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 8803, 8805, 8813
 - 7 PATTON ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 8705, 8707
 - 8 8816 CARLISLE ROAD
 - 9 8811 CARLISLE ROAD
 - 10 511 E. GRAVERS LANE
 - 11 8525 ARDMORE AVENUE
 - 12 8608 HULL DRIVE
 - 13 8102 HULL DRIVE
- WARD #3**
- 1 2109 FAIRWOLD LANE
 - 2 18 WELDY AVENUE
 - 3 1503 CHURCH ROAD
- WARD #4**
- 1 14 HAWS LANE
 - 2 LONGFIELD ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 808, 900, 902, 904
 - 3 208 TERMINAL AVENUE
 - 4 218 GLENDALOUGH ROAD
 - 5 AVONDALE ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 641, 700
 - 6 406 ARDEN LANE
 - 7 908 FRASER ROAD
 - 8 805 FRASER ROAD
 - 9 804 FRASER ROAD
 - 10 800 FRASER ROAD

- WARD #5**
- 1 7721 BEECH LANE
 - 2 917 E. ABINGTON AVENUE
 - 3 806 WYNDMOOR AVENUE
- WARD #6**
- 1 227 ARLINGHAM ROAD
 - 2 243 ARLINGHAM ROAD
 - 3 EAST MILL ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 302, 306
 - 4 HEMLOCK ROAD RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 404, 408, 410, 412, 500, 502, 504
 - 5 1521 LUCON ROAD
 - 6 307 ORELAND MILL ROAD
- WARD #7**
- 1 1108 SUMMIT LANE
 - 2 LANTERN LANE RESIDENTS - THE FOLLOWING ADDRESSES HAVE SUBMITTED NOTICES: 2002, 2004
 - 3 1019 PHEASANT LANE
 - 4 11 SHEPHERD'S WAY
 - 5 607 STATION AVENUE
- OTHER IDENTIFIED AREAS OF CONCERN**
- 1 FLOODING NEAR THE INTERSECTIONS OF ANDORRA ROAD, THOMAS ROAD AND NORTHWESTERN AVE.
 - 2 FLOODING OF A GLENN CIRCLE HOME AT THE LOW POINT OF GLENN CIRCLE
 - 3 FLOODING ALONG ATWOOD ROAD FROM HAWS LANE RUNOFF
 - 4 FLOODING AT GLENWAY ROAD FROM STREAM BACKUP AND RUNOFF FROM PAPER MILL ROAD
 - 5 STREAM EROSION BETWEEN STOTESBURY AVENUE AND PAPER MILL ROAD, NEAR CHELTENHAM AVENUE
 - 6 PATTON ROAD RESIDENTS HOMES FLOOD DUE TO RUNOFF FROM STOTESBURY DEVELOPMENT UPHILL
 - 7 HULL DRIVE HOME FLOODED DUE TO RUNOFF FROM MACARTHUR ROAD AREA
 - 8 REAR YARD FLOODING BETWEEN CAMPBELL LANE AND PHEASANT AVENUE
 - 9 FLOODING FROM SUNNYBROOK CREEK AT CARLTON WAY CUL-DE-SAC
 - 10 STREAM EROSION BETWEEN S.R. 309, CHURCH ROAD AND OVERBROOK LANE
 - 11 STREAM EROSION OF ERDENHEIM RUN SOUTH OF HAWS LANE
 - 12 FLOODING AT SURREY ROAD DUE TO RUNOFF ONTO RESIDENT YARDS
 - 13 FLOODING AT WALNUT AVENUE WHERE IT CROSSES OVER SANDY RUN COUNTRY CLUB
 - 14 FLOODING FROM LYSTER ROAD RUNOFF ONTO RESIDENT YARDS
 - 15 ORELAND RUN ERODING AND FLOODING ONTO RESIDENTS' YARDS ALONG LYSTER ROAD
 - 16 FLOODING OF WOODS ROAD AND STATION AVENUE FROM HIGHER AREAS OF CHELTENHAM TWP.
 - 17 FLOODING AT HULL DRIVE DUE TO RUNOFF FROM ELLISTON DRIVE
 - 18 FLOODING AT THE PUMP STATION NEAR EAGLE VIEW DRIVE

SPRINGFIELD TOWNSHIP WATERSHEDS

| | | |
|--|------------|---|
| | PMR | PAPER MILL RUN WATERSHED INCLUDES ST. JOSEPH'S RUN AND SCHLATTER'S RUN |
| | SBC | SUNNYBROOK CREEK WATERSHED INCLUDES ORELAND RUN AND ENFIELD RUN |
| | CGN | COLLEGE GROVE NEIGHBORHOOD WATERSHED |
| | SRC | SANDY RUN CREEK WATERSHED |
| | WHC | WISSAHICKON CREEK WATERSHED DIRECT RUNOFF WITHIN SPRINGFIELD TOWNSHIP |
| | ADR | ANDORRA RUN WATERSHED |
| | TKC | TOOKANY CREEK WATERSHED |
| | CSC | CRESHEM CREEK WATERSHED |
| | MNR | MANOR RUN WATERSHED |
| | EWG | E. WILLOW GROVE AVENUE/STENTON AVENUE WATERSHED |
| | EHF | ERDENHEIM FARM WATERSHED |

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Township-wide Watershed Analysis
 Springfield Township
 Montgomery County, Pennsylvania

FIGURE 3
PRIORITIES WATERSHED MAP

E. AVAILABLE OPTIONS FOR STORMWATER MANAGEMENT

There are a number of different stormwater management solutions that can be offered to any problem. Each solution will have reasons for and against its use in any given area of concern. The Pennsylvania Stormwater Best Management Practices Manual, December 2006 (the BMP Manual), lists as many as 13 “Non-Structural” BMPs and 22 “Structural” BMPs, and many more can be found in other State-wide and Federal publications.

This following provides a general listing and description of various stormwater management solutions considered to address the flooding issues within Springfield Township. Where the solutions are representative of solutions contained within the BMP Manual, reference to the Manual section is included. The first section provides large-scale solutions, while the second section provides solutions that can be used that may have a cumulative effect if utilized by many locations throughout the Township. This list should not be considered as complete, and many other forms of stormwater management can be proposed.

Large Scale Solutions

1. Wet Ponds/Retention Basins, BMP Manual Section 6.6.2: a Wet Pond, or Retention Basin, is a permanent water impoundment designed to accept additional stormwater runoff volume during large storm events and to offer a controlled release of this runoff over time.
2. Dry Extend Detention Basin, BMP Manual Section 6.6.3: Detention basin or small Dams can be constructed in certain areas of the Township located along or adjacent to watercourses. Such constructions would hold back both the volume and rate of a portion of a watershed’s runoff reducing the flooding potential.
3. Subsurface Infiltration Bed, BMP Manual Section 6.4.3; Infiltration Trench, BMP Manual Section 6.4.4: A Subsurface Infiltration Bed or Infiltration Trench generally consists of a deposit of clean, large-sized aggregate placed above a permeable soils layer. Surface runoff is directed to the stone bed via piping and the collected stormwater is allowed to percolate back into the groundwater, thus removing the collected volume from overland flow to downstream areas.
4. Buyouts: Areas prone to flooding due to increased elevations of watercourse flows will always suffer from severe rainfall events, and residents of these areas will therefore be required to spend dollars regularly on repair and maintenance. Buyouts consider purchasing the lots of such residents and restoring the lands to floodplain.
5. Riparian Buffer Restoration, BMP Manual Section 6.7.1: In conjunction with buyouts as noted above, any reclaimed lands should be revised through grading operations and planting operations to provide an area to increase the stormwater volume retention capacity of the area, the evapo-transpiration capacity of the area, and the water quality of the groundwater recharge.
6. Improved Stormwater Conveyance Systems: Stormwater runoff flows off of yards, onto roadways, and then into storm pipes and/or culvert systems. These culverts convey the stormwater to streams and creeks. If the flows into the culverts is in excess of the carrying capacity of the pipes, the flows will back-up into roadways and sometimes into resident yards. Improved stormwater conveyance systems can include fixing damaged pipes or

- replacing inadequate pipes and inlets, allowing larger volumes of flows to be conveyed within the storm pipes rather than left to flow overland through yards or roadways.
7. Replace and/or Reconstruct Bridge Structures: During large order storm events flows within stream channels can reach an elevation where stream flow under a bridge may reach the height of the bridge structure itself, leading to the bridge structure becoming an impediment in stream flows. Reconstruction of the bridge structure to raise its elevation and/or remove existing piers can increase the capacity of the stream channel to pass this possible constricting situation.
 8. Floodwalls/Levees: Floodwalls or levees are vertical walls constructed along the banks or the various water courses within the flood-prone areas to allow the stream water elevation to rise within the stream channel, further defined by the wall construction, in order to prevent the water from flooding adjacent homes.
 9. Debris and Sediment Removal: Often the stream channel bed has become full of debris and/or sediment laden over time, reducing the capacity of the channel. Removal of such debris and/or sediment can reclaim this lost capacity and reduce flood levels.
 10. Streambank Stabilization: Stabilization of existing erosive watercourses and their banks can prevent future sedimentation of the existing watercourses and protect residential properties.
 11. Flood Proofing: Residential homes prone to flooding can be provided with manufactured doors, windows and other appurtenances that may help prevent water from entering the structure.

Small Scale Solutions

1. Reduce Parking Imperviousness, BMP Manual Section 5.7.2: Review existing large area pavement surfaces within the Township to determine if any additional green space can be added via parking islands or even reconstruction of pavement into impervious pavement.
2. Pervious Pavement with Infiltration Bed, BMP Manual Section 6.4.1: As per the previous comment, review existing large areas of pavement surface within a watershed to determine if reconstruction of pavement into impervious pavement is feasible.
3. Rain Garden/Bioretenion, BMP Manual Section 6.4.5: Where possible with appropriate soil types, encourage residents to install rain gardens to capture roof runoff.
4. Vegetated Roof, BMP Manual Section 6.5.1: Encourage new institutional/commercial construction to employ vegetated roofs.
5. Runoff Capture & Reuse, BMP Manual Section 6.5.2: Encourage residents and commercial/institutional establishments to utilize rain barrels or cisterns to collect roof runoff for re-use.
6. Maintenance of Existing Facilities: Many times existing stormwater management basins or conveyance systems are sufficient to handle the flows received, but their condition has deteriorated or a separate physical feature may be affecting performance. Maintenance of these existing facilities can increase the performance of existing systems at little cost to the municipality.

In reality, any or all of these stormwater management facilities could be employed in every area of the Township. Yet for practical reasons certain choices must be made. Further sections of this report will review the watersheds tributary to each of the problem areas and recommend stormwater management facilities from the above list.



F. PRIORITY WATERSHED REACH ANALYSIS

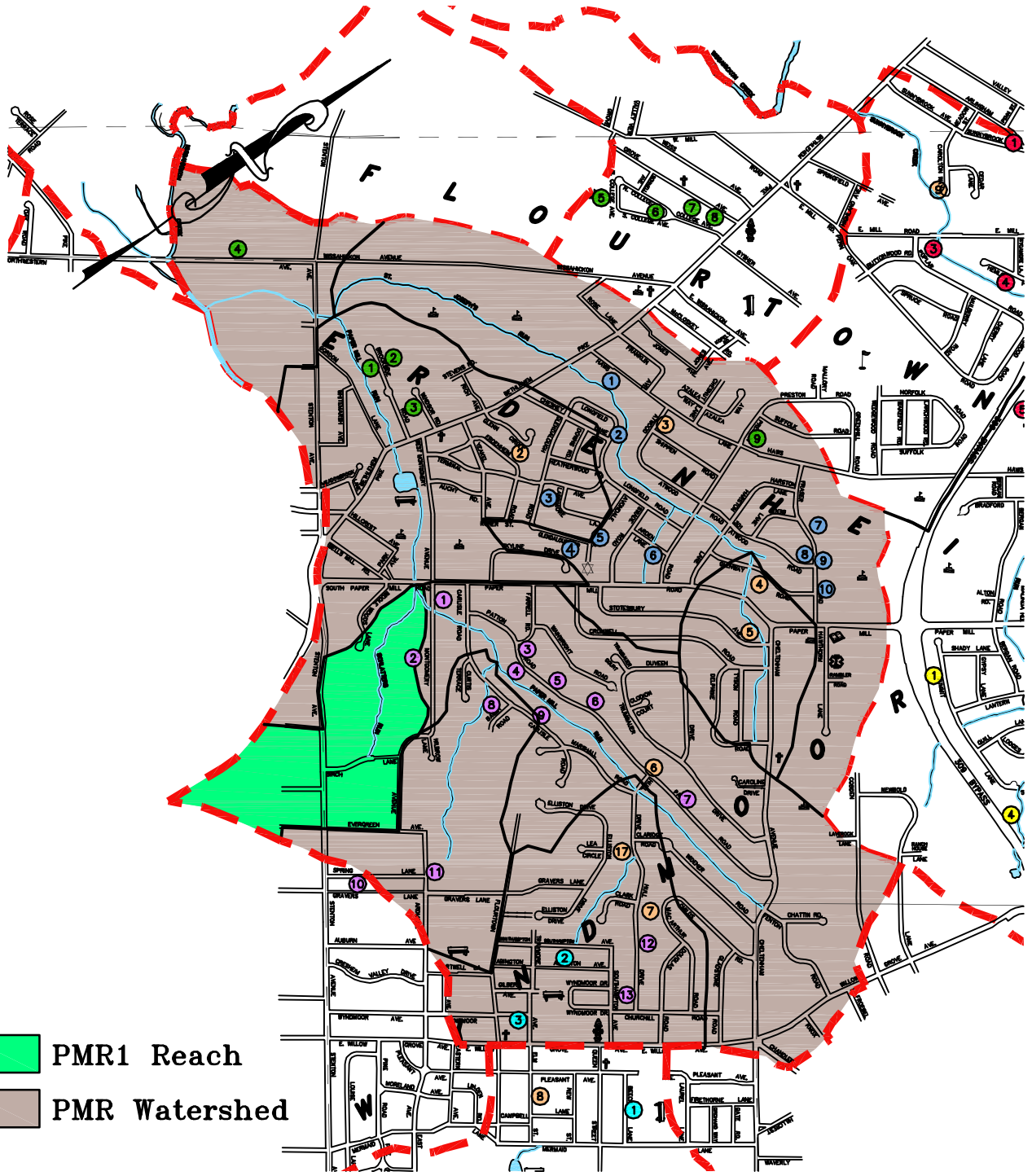
A “reach” is defined as the length along a watercourse between any two points. Within this report the term “reach” is applied to the tributary watercourse areas leading to the ten priority stormwater management areas of concern. As noted previously there are seven (7) reaches identified within the Paper Mill Run Watershed (PMR), three (3) within the Sunnybrook Creek Watershed (SBC), and the College/Grove Neighborhood Watershed (CGN), while containing no true “reach” because there is no defined watercourse, has also be analyzed.

The following paragraphs describe the characteristics of each reach. Much of the reach descriptions, with respect to geologic formations, topography, and soils, is taken from the Springfield Township Comprehensive Plan, September 9, 1998. Maps of each reach follow the written descriptions on the following pages.

PMR1 Reach

PRM1 Reach is Schlatter’s Run. The watershed area upstream of the run is developed with several residential homes and institutional properties. The watershed adjacent to the watercourse is heavily wooded. The majority of the reach is comprised of Wissahickon Schist/Felsic Gneiss geologic formations. The reach contains small pockets of Prime Farmland and Farmland of Statewide Importance, though the majority of the latter is located along the watercourse. The topography is fairly level at the top of the watershed, but the watercourse is located in a valley with steep side slopes. The current FEMA floodplain maps identify no floodplain within the reach, however, the soils surrounding Schlatter’s run have been identified as Alluvial. There are no known flow obstructions within the reach that might be creating issues of flooding. This reach contains none of the top ten priority issues of concern, but is tributary to Paper Mill Run, and any flow reduction that can occur within this area will be a benefit to the downstream problem areas. Opportunities for placement of stormwater management facilities within this reach are limited. The only undeveloped or underdeveloped areas are located within private property adjacent to Schlatter’s Run, and the upstream areas of the reach are in fact located within lands of the City of Philadelphia. Possible stormwater management facilities could include Wet Ponds/Retention Basin, Dry Extend Detention Basins, Debris/Sediment Removal, and Streambank Stabilization.

 PMR1 Reach
 PMR Watershed



Township-wide Watershed Analysis
Springfield Township
Montgomery County, Pennsylvania

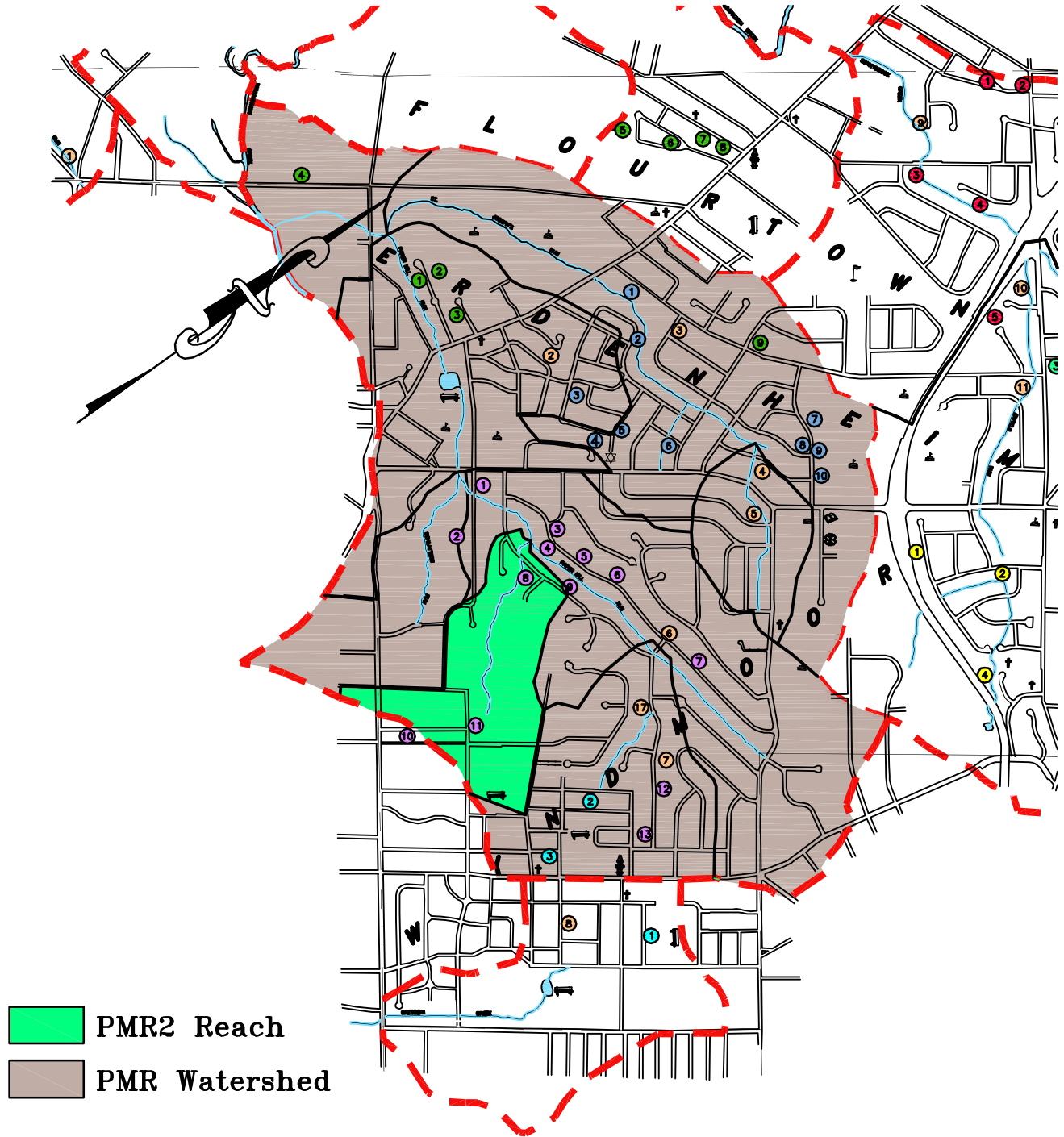
FIGURE 4
PMR1 REACH

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PMR2 Reach

PRM2 Reach is the unnamed tributary of Paper Mill Run located adjacent to Carlisle Road extending up towards Gravers Lane. The watershed area upstream of the channel is developed with several residential homes and a few commercial properties. The areas adjacent to the watercourse are heavily wooded. The majority of the reach is comprised of Wissahickon Schist/Felsic Gneiss geologic formations. The reach contains small pockets of Prime Farmland and Farmland of Statewide Importance, though the majority of the latter is located along the watercourse. The topography is fairly level at the top of the watershed, but the watercourse is located in a valley with steep side slopes. The current FEMA floodplain maps identify no floodplain within the reach, however, the soils surrounding the stream channel have been identified as Alluvial. At the bottom of the stream channel the flow enters into an existing storm pipe system which is undersized to handle the flow received, creating flooding issues along Carlisle Road. This reach contains Priority Issue #4 and is tributary to Paper Mill Run. Any flow reduction that can occur within this area will be a benefit to the downstream problem areas. There are opportunities for stormwater management solutions within the watershed of this reach. The only undeveloped or underdeveloped areas are located within private property adjacent to the stream channel or Wyndhill Park. Possible stormwater management facilities include Wet Ponds/Retention Basin, Dry Extend Detention Basins, Improved Stormwater Conveyance Systems, Debris/Sediment Removal, and Streambank Stabilization.



Township-wide Watershed Analysis
Springfield Township
Montgomery County, Pennsylvania

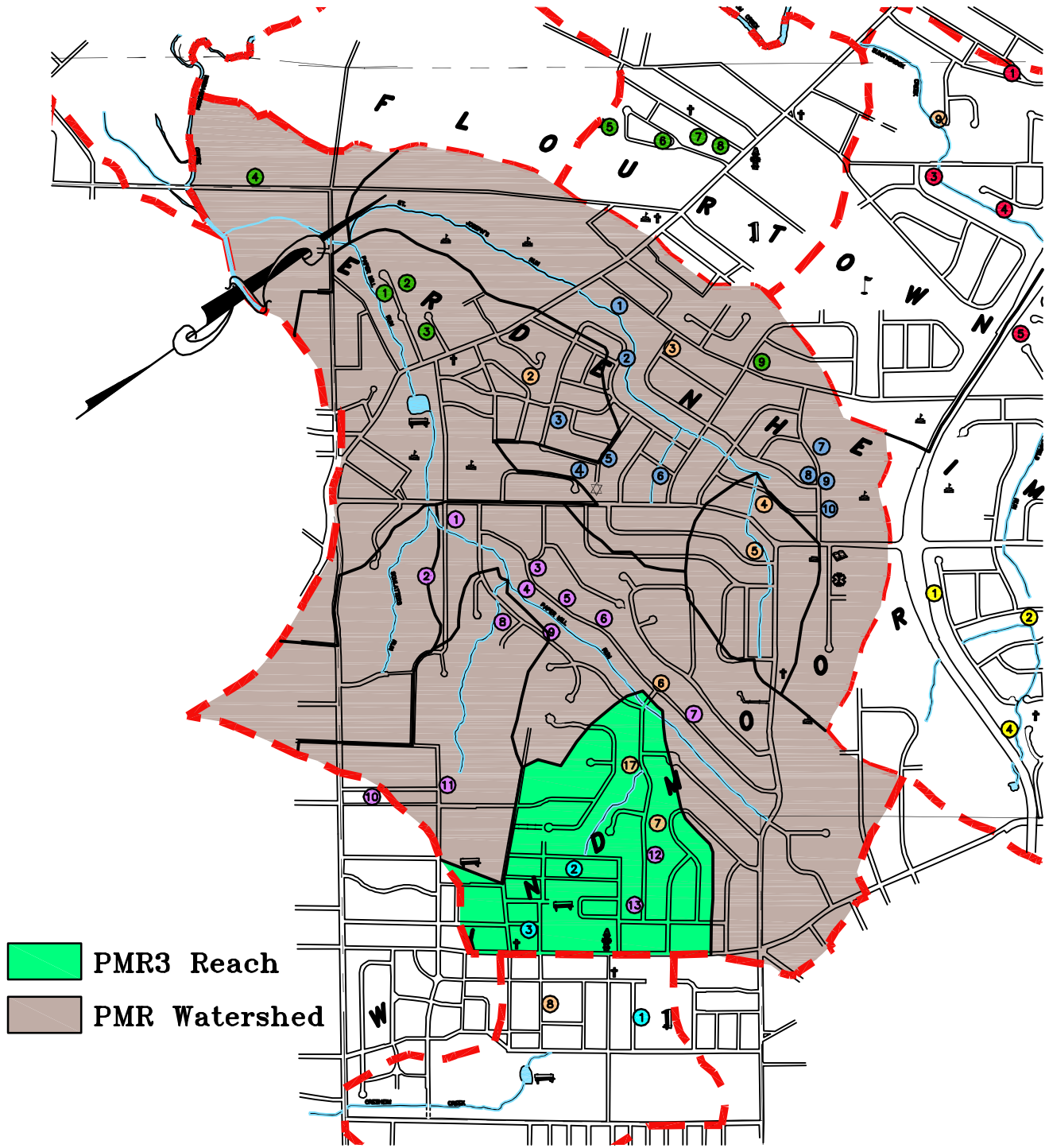
FIGURE 5
PMR2 REACH

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PMR3 Reach

PRM3 Reach is the unnamed tributary of Paper Mill Run located near the intersection of Marshall Road and Hull Drive extending up, along the southern side of Hull Drive, towards Southampton Avenue. Almost the entire area of the watershed is developed with residential homes. The watercourse runs through the rear yard of residential properties. The majority of the reach is comprised of Wissahickon Schist/Felsic Gneiss geologic formations. The reach contains pockets of Prime Farmland and Farmland of Statewide Importance. The topography is fairly level at the top of the watershed, but the watercourse is located in a valley with steep side slopes. The current FEMA floodplain maps identify no floodplain within the reach. At the bottom of the stream channel the flow enters into an existing storm pipe system within Hull Drive. An issue with the watershed surrounding this reach is that a separate valley exists along the northern side of Hull Drive that also collects stormwater runoff, though there is no defined watercourse. The volume of runoff from this valley area flows through residential properties near the intersection of Hull Drive and Claridge Road, prior to entering into the storm pipe system conveying the reach flow down to Paper Mill Run. This reach contains Priority Issue #8 and is tributary to Paper Mill Run. Any flow reduction that can occur within this area will be a benefit to the downstream problem areas. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the area is comprised of residential properties. Possible stormwater management facilities include Dry Extend Detention Basins, Infiltration Basins, Buyouts, Improved Stormwater Conveyance Systems, Streambank Stabilization, and Flood Proofing.



Township-wide Watershed Analysis
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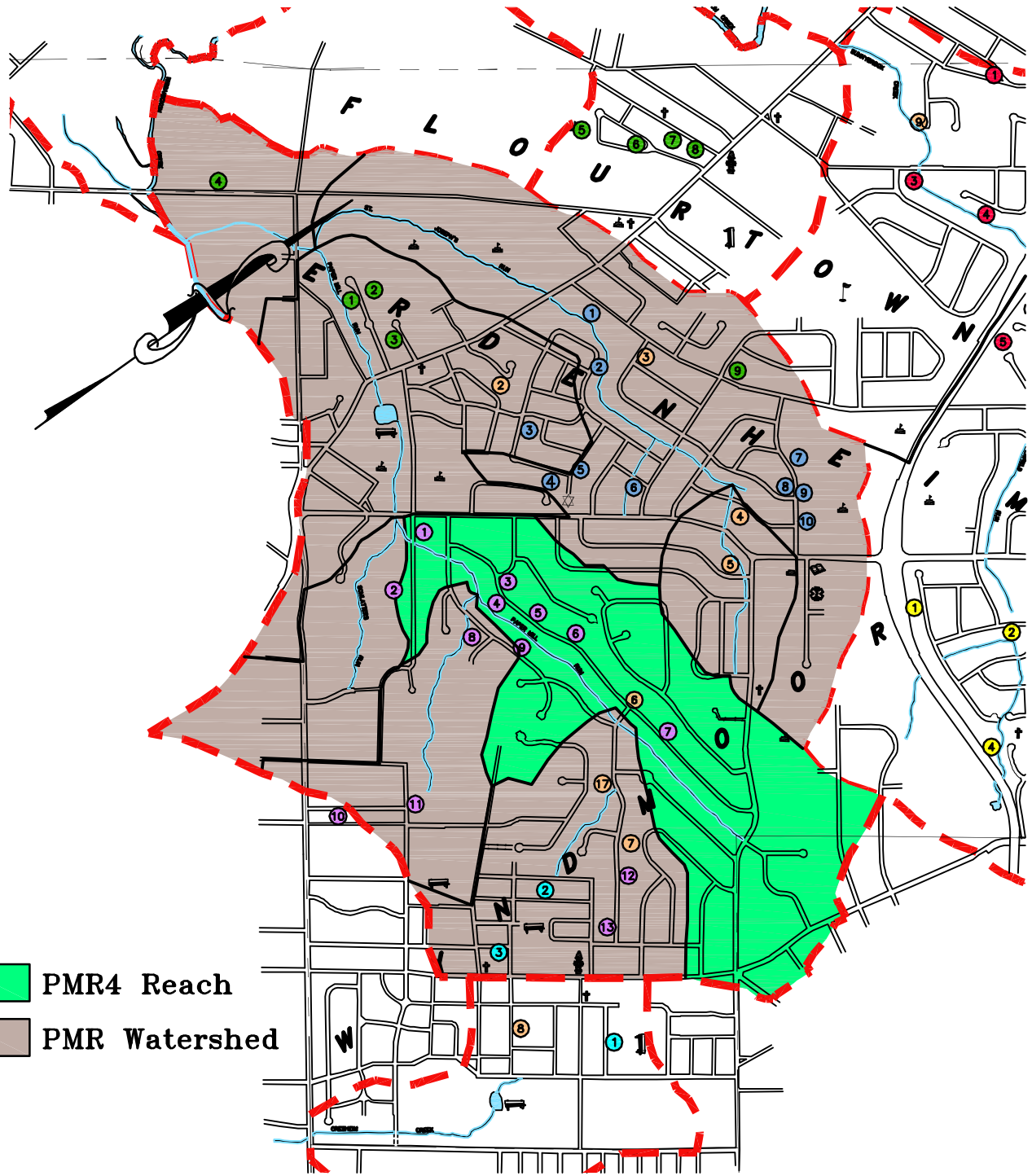
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FIGURE 6
PMR3 REACH



PMR4 Reach

PRM4 Reach is the portion of Paper Mill Run extending from its intersection with Schlatter's Run up to its source, near Fenton Road. Almost the entire area of the watershed is developed with residential homes, though the watershed includes portions of LaSalle High School. Paper Mill Run runs through the rear yard of residential properties between Carlisle/Marshall Roads and Patton Road. The majority of the reach is comprised of Wissahickon Schist/Felsic Gneiss geologic formations, though the area surrounding the stream is identified as Chickies Quartzite. The reach contains pockets of Prime Farmland and Farmland of Statewide Importance. The topography is fairly level adjacent to the watercourses but residential lands extending away from the reach become extremely steep. The current FEMA floodplain maps identify the floodplain extending up to a point just past Hull Drive. The floodplain appears to extend into the rear yards of most of the homes along Patton Road and into the homes as well. This effect is present along Carlisle Road as well, but is contained to the rear yards and does not affect the homes. The floodplain also covers the entire intersection of Marshall Road and Hull Drive. Soils along the reach are classified as Alluvial, and potential wetland areas have been identified as well. The flow within the reach crosses through three (3) separate bridge structures; Hull Drive, Carlisle Road, and Montgomery Avenue. There are very few areas of open space for stormwater facilities. It should be noted that the volume of flow within this reach would include the flow from the previous three reaches when considering flooding areas. This reach contains Priority Issue #6, and because it is a part of Paper Mill Run, any flow reduction that can occur within this area will be a benefit to the downstream problem areas. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the area is comprised of residential properties. Possible stormwater management facilities include Dry Extend Detention Basins, Buyouts, Replace and/or Reconstruct Bridge Structures, Streambank Stabilization, Flood Proofing, and Maintenance of Existing Facilities.



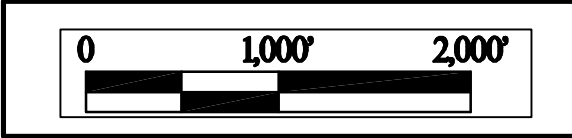
 PMR4 Reach
 PMR Watershed

Township-wide Watershed Analysis
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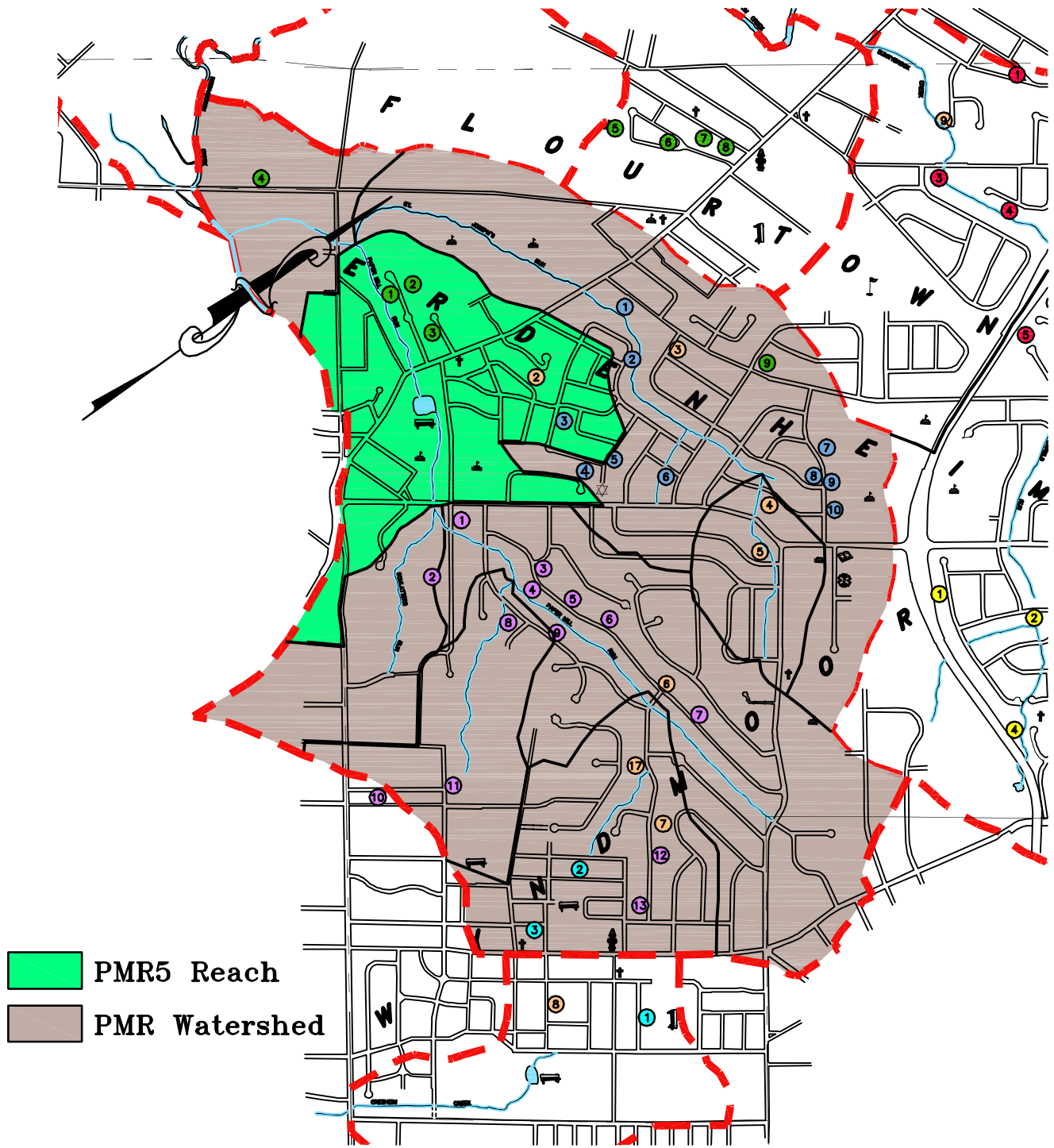
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FIGURE 7
PMR4 REACH



PMR5 Reach

PRM5 Reach is the portion of Paper Mill Run extending from its intersection with St. Joseph's Run up to the start of PRM4 where the stream meets Schlatter's Run. There are a diversity of land uses within the watershed of the reach, from residential and commercial, to parks and schools. Paper Mill Run in this reach runs through Cisco Park leading to the rear yards of residential properties at the Brookside Community. The majority of the reach is comprised of Chickies Quartzite geologic formations, though the watershed also includes Wissahickon Schist/Felsic Gneiss, Patapsco, Pennsauken/Bridgeton and Ledger Dolomite/Elbrook/Conestoga Limestone. The reach contains pockets of Prime Farmland and Farmland of Statewide Importance, primarily within the lands of the park or the surrounding schools. The topography is fairly level in the neighborhoods around the watercourse. Slopes increase north of the stream, and the area south of the reach increases steeply in elevation, explaining why residents of Gordon Lane, opposite Brookside Road, are not affected by flood waters. The current FEMA floodplain maps identify the floodplain within the entire reach, appearing to extend into the rear yards of most of the homes along Brookside Road and covering most of the land area of Cisco Park and the Philadelphia/Montgomery Christian Academy. Soils along the reach are classified as Alluvial, and potential wetland areas have been identified as well. The flow within the reach crosses through two (2) separate bridge structures; Paper Mill Road and Bethlehem Pike. While there are various areas of open space for stormwater facilities, most of these areas are either public parks or lands of existing schools. It should be noted that the volume of flow within this reach would include the flow from the previous three reaches when considering flooding areas. This reach contains Priority Issue #2. As noted previously, projects performed within the reach, in conjunction with the upstream PRM reaches, can yield and increased benefit to the Brookside Road Community. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the open land is not available, being part of parks or schools, and remaining lands have been developed. Possible stormwater management facilities include Dry Extend Detention Basins, Buyouts, Replace and/or Reconstruct Bridge Structures, Floodwalls/Levees, Improved Stormwater Conveyance Systems, Streambank Stabilization, Flood Proofing, and Reduce Parking Imperviousness.



Township-wide Watershed Analysis
Springfield Township
Montgomery County, Pennsylvania

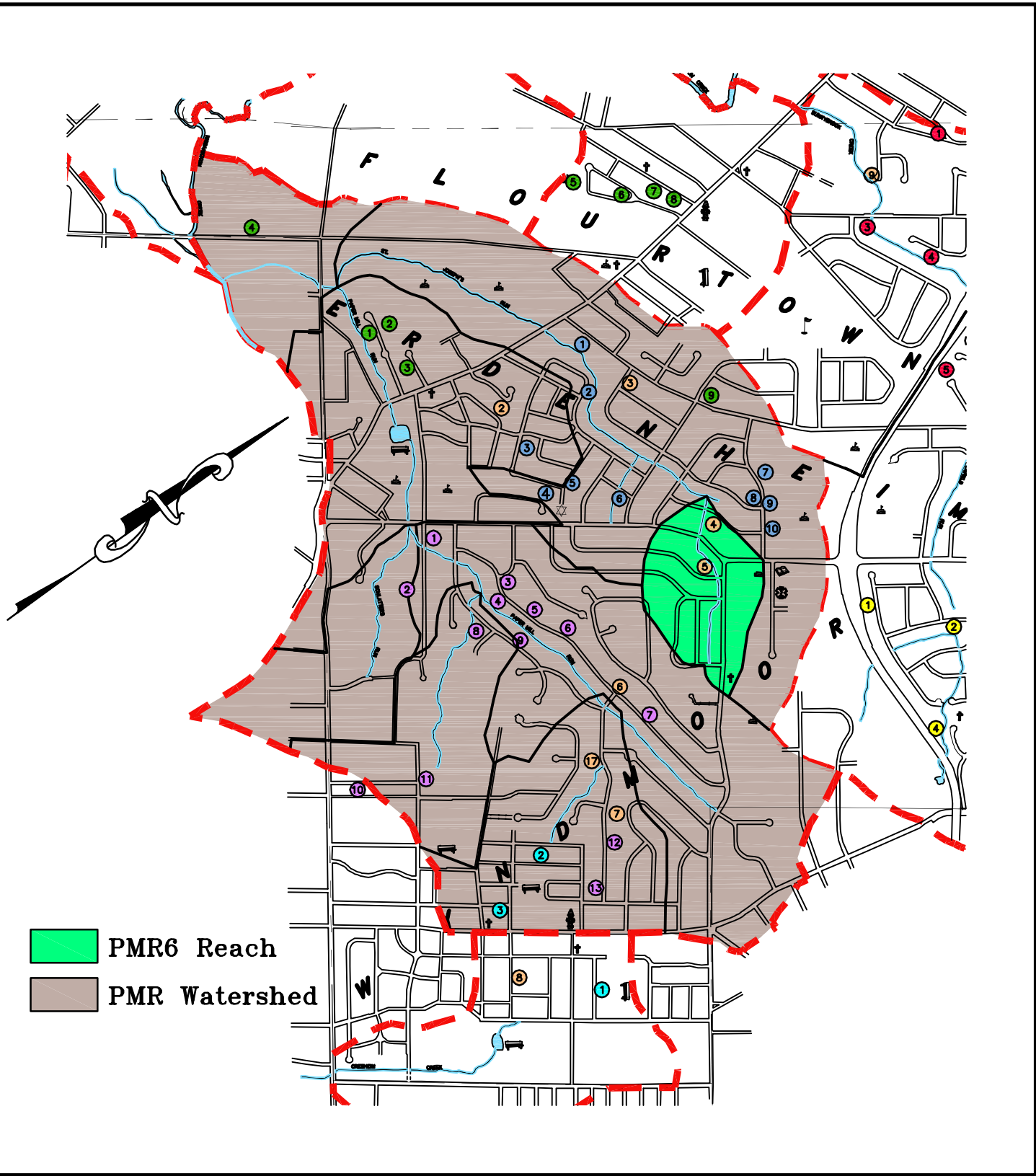
FIGURE 8
PMR5 REACH

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PMR6 Reach

PRM6 Reach is the tributary of St. Joseph's Run extending south along Cheltenham Avenue. The majority of land use within the watershed of the reach is residential, but a few commercial and institutional lands. The geologic formations of the reach vary between Wissahickon Schist/Felsic Gneiss or Chickies Quartzite. The reach contains almost no areas of Prime Farmland nor Farmland of Statewide Importance. The topography is fairly level though the slope around the watercourse is steep. The current FEMA floodplain maps identify no floodplain within the entire reach, and soils along the reach are not classified Alluvial; no potential wetland areas were identified. The flow within the reach is often piped within culverts to cross under roadways and then released into open channel flow again where possible. This change in conveyance from channel flow to piped flow occurs on at least two occasions prior to the reach connecting with St. Joseph's Run north of Glenway Road. It is likely this flow restriction has created an increase in flow velocity resulting in the erosion experienced by the stream channel. This reach contains Priority Issue #7. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the lands have been developed. Possible stormwater management facilities include Dry Extend Detention Basins, Infiltration Basins, Buyouts, Floodwalls/Levees, Improved Stormwater Conveyance Systems, Streambank Stabilization, Flood Proofing, and Reduce Parking Imperviousness.

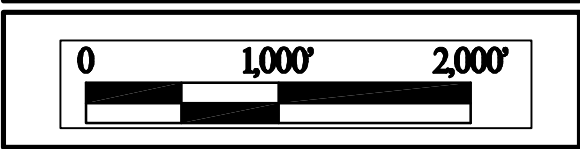


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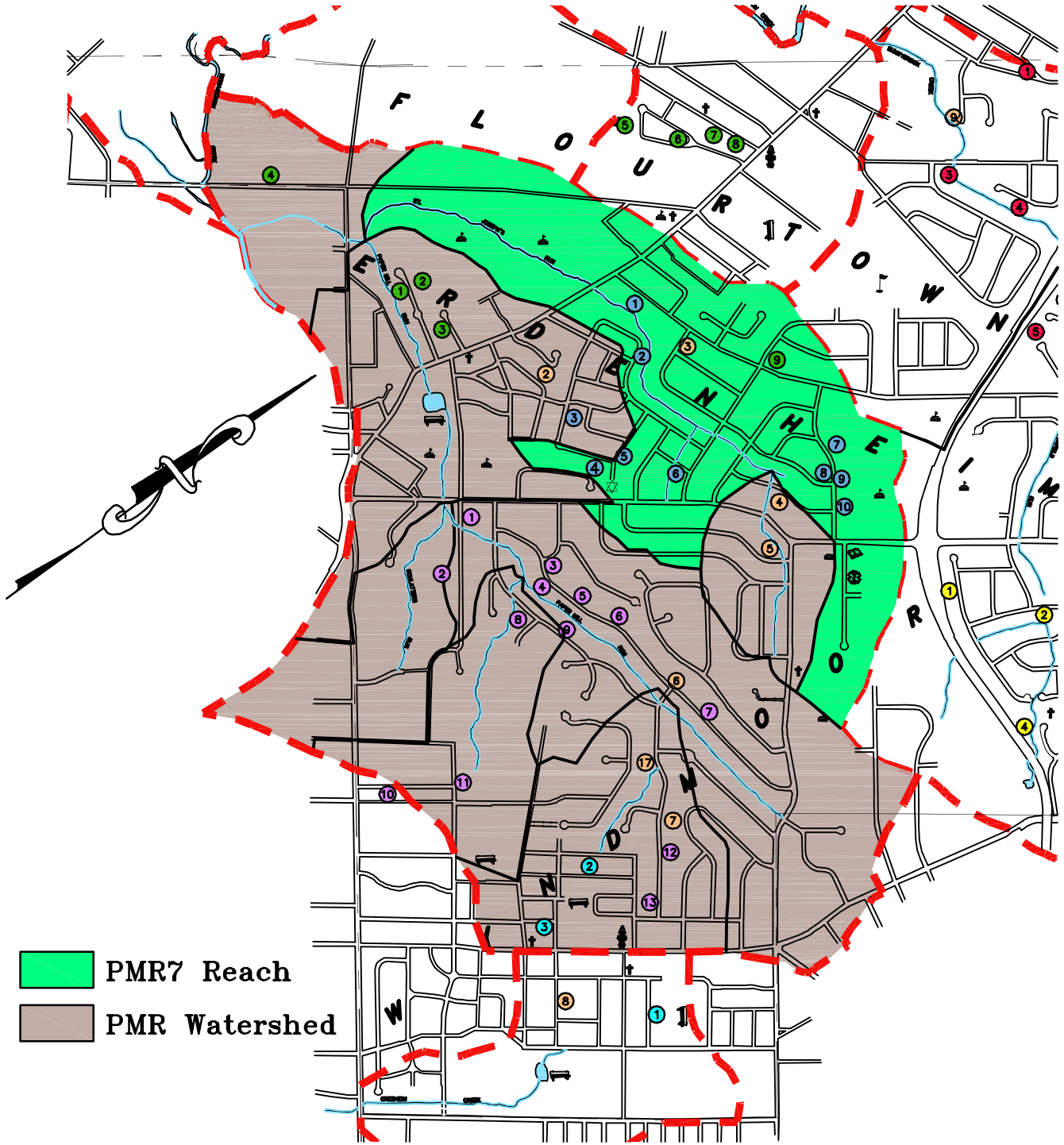


FIGURE 9
PMR6 REACH



PMR7 Reach

PRM7 Reach is St. Joseph's Run extending from Glenway Road to its confluence with Paper Mill Run. There are a diversity of land uses within the watershed of the reach; residential, institutional, and commercial. St. Joseph's Run in this reach runs westward through a number of residential neighborhoods, ultimately traveling through the lands of St. Joseph's Academy and joining with Paper Mill Run. The majority of the reach is comprised of Ledger Dolomite/Elbrook/Conestoga Limestone geologic formations, though the watershed also includes Chickies Quartzite, Patapsco and Pennsauken/Bridgeton. Lands within the St. Joseph's Academy have been classified as Prime Farmland or Farmland of Statewide Importance, but no such classifications exist outside the Academy lands. The topography is fairly level at the lower elevations of the reach, but the neighborhoods up near Paper Mill Run become steeper. The current FEMA floodplain maps identify no floodplain within the entire reach, though soils along the reach within the lands of St. Joseph's Academy are classified as Alluvial with no potential wetlands present. The flow within the reach crosses through three (3) separate culvert structures; Harston Road, Preston Road and Bethlehem Pike. While there are various areas of open space for stormwater facilities, most of these areas are lands of existing institutional uses. It should be noted that the volume of flow within this reach would include the flow from the previous PRM6 reach when considering flooding areas. This reach contains none of the top ten priority issues of concern, but is tributary to Paper Mill Run, and any flow reduction that can occur within this area will be a benefit to the downstream problem areas. Opportunities for placement of stormwater management facilities within this reach exist as both large scale solutions and small scale solutions. Possible stormwater management facilities include Wet Ponds/Retention Basins, Dry Extend Detention Basins, Improved Stormwater Conveyance Systems, Streambank Stabilization, and Reduce Parking Imperviousness.



Township-wide Watershed Analysis
Springfield Township
Montgomery County, Pennsylvania

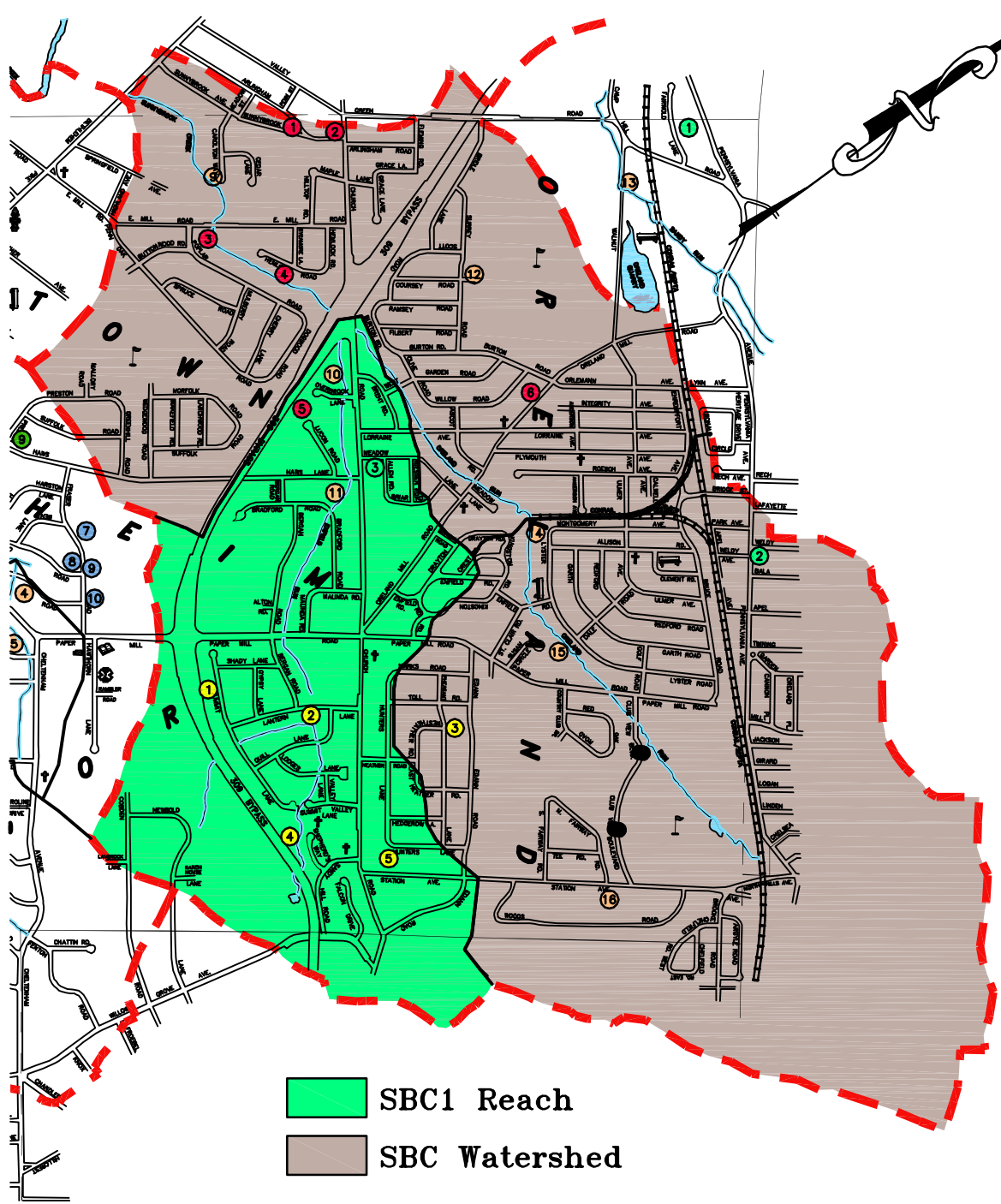
FIGURE 10
PMR7 REACH



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SBC1 Reach

SBC1 Reach is Erdenheim Run and its watershed. There are a diversity of land uses within the watershed of the reach; residential, institutional, and commercial. Flows from Erdenheim Run originate within the open areas south of S.R. 309 near Newbold Lane, and travel mostly through residential neighborhoods to its confluence with Sunnybrook Creek near the intersection of S.R. 309 and Church Road. The majority of the reach is comprised of Ledger Dolomite/Elbrook/Conestoga Limestone geologic formations, though the watershed also includes Chickies Quartzite, Patapsco and Pennsauken/Bridgeton. Lands at the upper elevations of the watershed, near S.R. 309, have been classified as Prime Farmland or Farmland of Statewide Importance, but no such classifications exist within the lower flood-prone areas. Similarly, the topography is rather steep at the upper elevations of the watershed, near Willow Grove Avenue, but much less so within the lower neighborhood areas. The current FEMA floodplain maps identify the floodplain within the reach extending up slightly past Paper Mill Road, though Alluvial soils are present only up to Haws Lane with no potential wetlands present. The flow within the reach crosses through several culvert structures; S.R. 309, Summit Lane, Lodges Lane, Quill Lane, Lantern Lane, Paper Mill Road, Bradford Road, Haws Lane, and Overbrook Lane. This reach contains Priority Issue #5 and is tributary to Sunnybrook Creek. Any flow reduction that can occur within this area will be a benefit to the downstream problem areas. There are many open areas available for stormwater management facilities. However, most of these open areas are located at the upper reach elevations. Possible stormwater management facilities include Wet Ponds/Retention Basins, Dry Extend Detention Basins, Improved Stormwater Conveyance Systems, Streambank Stabilization, Reduce Parking Imperviousness.



 SBC1 Reach
 SBC Watershed

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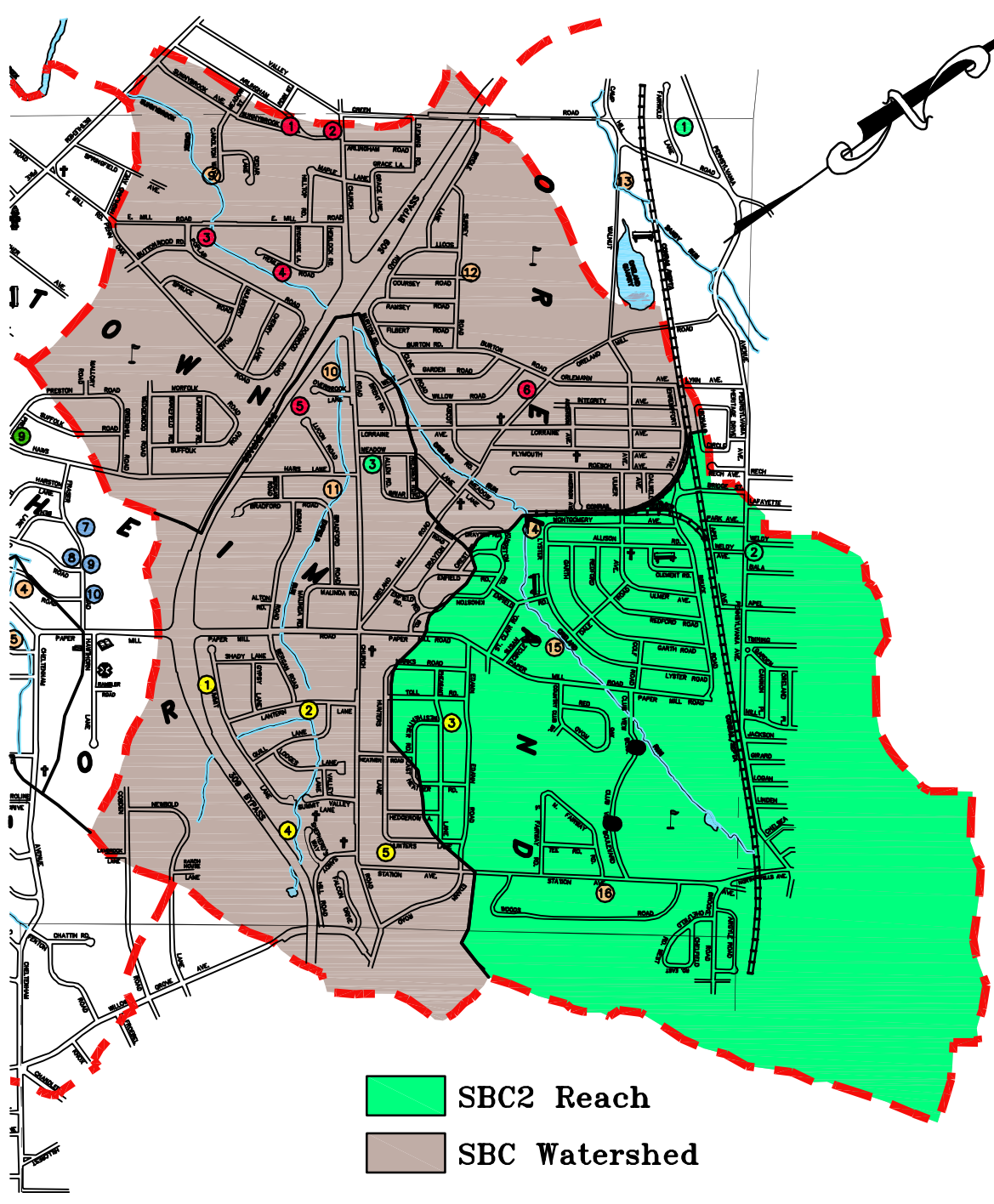


FIGURE 11
SBC1 REACH



SBC2 Reach

SBC2 Reach is that portion of Oreland Run beginning near the corner of the lands of Philadelphia Suburban Gas & Electric Company in Oreland, extending to the source of the watercourse. There are a diversity of land uses within the watershed of the reach, from residential and commercial, a golf course, and institutional uses. Flows from Sunnybrook Creek originate within the residential neighborhoods of Abington, Cheltenham, and Upper Dublin Townships, and the City of Philadelphia, traveling westward to the analysis point at the Gas/Electric Station. The majority of the reach is comprised of Ledger Dolomite/Elbrook/Conestoga Limestone geologic formations, though there is a pocket of Pennsauken/Bridgeton surrounding the Red Oak Road development. Lands within North Hills Country Club have been classified as Prime Farmland or Farmland of Statewide Importance, but no such classifications exist within other areas. The topography outside of Springfield Township, at the top of the ridge that bounds the reach watershed, can be very steep. Yet the reach lands within the Township remain fairly level. The current FEMA floodplain maps identify the floodplain within the reach extending up to a point just short of Club View Boulevard, while Alluvial soils are present only from this point upstream. Potential wetlands are present along the entire length of the reach. The flow within the reach crosses through three (3) culvert structures; Club View Boulevard, Paper Mill Road, and Enfield Road. This reach contains Priority Issue #9 and is tributary to Sunnybrook Creek. Any flow reduction that can occur within this area will be a benefit to the downstream problem areas. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the open land is part of the Country Club, and remaining lands have been developed. Possible stormwater management facilities include Wet Ponds/Retention Basins, Dry Extend Detention Basins, Improved Stormwater Conveyance Systems, Streambank Stabilization, and Reduce Parking Imperviousness.

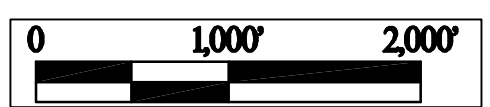


Township-wide Watershed Analysis
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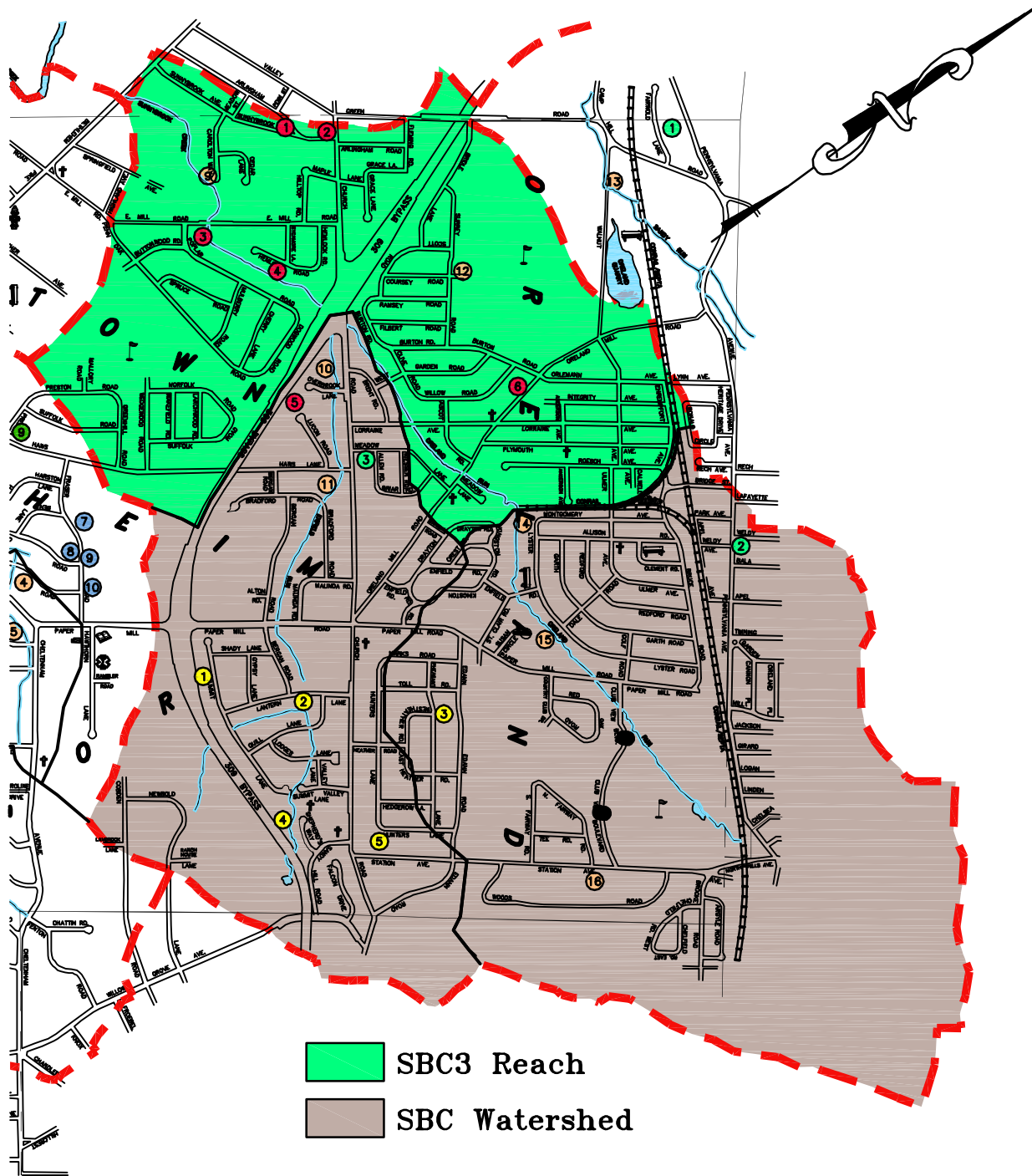


FIGURE 12
SBC2 REACH



SBC3 Reach

SBC3 is that portion of Sunnybrook Creek beginning at Bethlehem Pike, extending to the corner of the lands of Philadelphia Suburban Gas & Electric Company in Oreland. There are a diversity of land uses within the watershed of the reach, from residential and commercial, to golf courses and institutional uses, though the vast majority of land is comprised of residential properties. The reach flows westward from the Gas/Electric Station, through various residential neighborhoods to the study point along Bethlehem Pike adjacent to the Flourtown Shopping Center. The full length of the reach is comprised of Ledger Dolomite/Elbrook/Conestoga Limestone geologic formations. Lands within Sandy Run Country Club and Flourtown Country Club have been classified as Prime Farmland, with pockets of Farmland of Statewide Importance, but no such classifications exist within other areas. There are no areas of steep topography within the reach watershed. The current FEMA floodplain maps identify the floodplain within the entire reach, while Alluvial soils are present only from East Mill Road up to S.R. 309. No potential wetlands are present along the length of the reach. The flow within the reach crosses through several culvert or bridge structures; Oreland Mill Road, Lorraine Avenue, W. Garden Road, S.R. 309, East Mill Road and Bethlehem Pike. This reach contains Priority Issue #1. As noted previously, projects performed within the reach, in conjunction with the upstream SBC reaches, can yield an increased benefit to the problem areas. Opportunities for placement of stormwater management facilities within this reach are limited given that most of the open land is part of golf courses, and remaining lands have been developed. Possible stormwater management facilities include Wet Ponds/Retention Basins, Dry Extend Detention Basins, Improved Stormwater Conveyance Systems, Streambank Stabilization, Reduce Parking Imperviousness.



Township-wide Watershed Analysis
Springfield Township
Montgomery County, Pennsylvania

FIGURE 13
SBC3 REACH

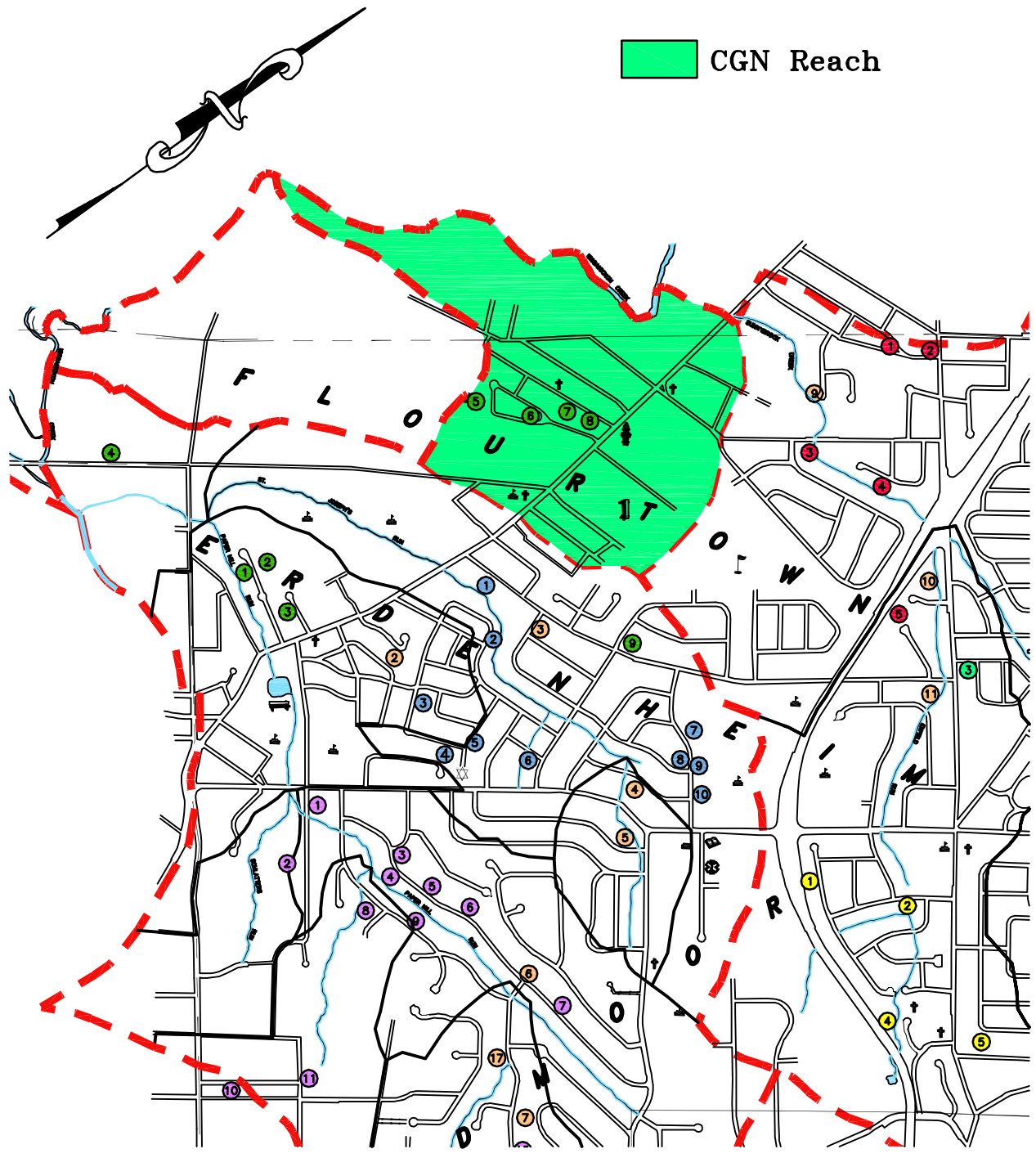
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CGN Reach

CGN is a watershed, more so than a reach, as there is no defined watercourse within the watershed. The watershed includes a portions of Flourtown Country Club, Bucher Park, and the neighborhoods, commercial and Institutional properties on either side of Bethlehem Pike from Wissahickon Avenue to the Township line. There are a diversity of land uses within the watershed of the reach, from residential and commercial, to institutional and farmland, including wooded areas bounding Wissahickon Creek, which is contained within the watershed though located outside of the Township. Surface runoff within the watershed from the Flourtown Country Club flows overland to Bethlehem Pike into storm sewers. Additional surface runoff within the watershed from the Carson Valley School flows overland into the neighborhoods of College Avenue and Grove Avenue, conveyed by storm sewers to the Wissahickon Creek. The majority of the watershed is comprised of Ledger Dolomite/Elbrook/Conestoga Limestone geologic formations, though there is a line of Diabase geology along the ridge line separating Sunnybrook Creek. Lands within Flourtown Country Club and Carson Valley School have been classified as Prime Farmland, with pockets of Farmland of Statewide Importance. There are no areas of steep topography within the watershed. Given the lack of any defined watercourse within the watershed, the current FEMA floodplain maps identify no floodplain within the watershed, nor are Alluvial soils or wetlands present. Surface runoff flow within the watershed is largely dependent on culverts to convey stormwater to Wissahickon Creek. This reach contains Priority Issue #3. Opportunities for placement of stormwater management facilities within this reach are limited. Other than the lands within Flourtown Country Club and Carson Valley School, no undeveloped areas exist within the Township. Large open areas adjacent to the Wissahickon Creek are located within Whitmarsh Township, and the State park, and are located within the floodplain of the Wissahickon Creek. Possible stormwater management facilities include Buyouts, Improved Stormwater Conveyance Systems, and Reduce Parking Imperviousness.

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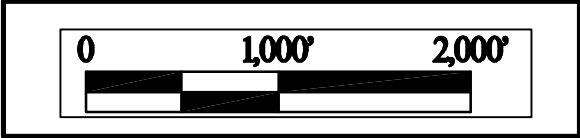


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FIGURE 14
CGN REACH



G. RECOMMENDED STORMWATER MANAGEMENT PROJECTS

Section C of this report provided a list of ten (10) areas of priority when addressing the issues of flooding and/or streambank erosion within Springfield Township. Number ten on that list was Township-wide Watercourse Erosion. Areas of erosion are present within every watercourse in Springfield Township. Developing projects to stabilize eroding streambanks and prevent continued alteration of the watercourse flow is an important consideration in determining where to spend future monies. However, the top nine projects focus on areas of flooding that affect the health and welfare of Springfield Township residents and their homes. The following projects are recommended for consideration by Springfield Township.

1. Hemlock Road Community

Located within the SBC3 reach of Sunny Brook Creek, this area is regularly inundated with flooding from the adjacent Sunnybrook Creek. Seven (7) residents filed statements of concern at the meeting, experiencing flooding of yards and homes. The following projects are recommended;

- The Township provide a Buyout option to the residents (Buyout). All of the homes prone to flooding in this location suffer because the yards and homes are located within the floodplain. During large order storms the flood waters can reach heights of 4-5 feet within the lower levels of the homes. Removing the homes will have the added benefit of allowing a project of Riparian Buffer Restoration.
- Should the Township be unable to proceed with the Buyout recommendation it is suggested that residents be provided guidance and direction for flood proofing their homes (Flood Proofing). Currently, most of the residents maintain living spaces in these lower levels. Due to previous flood damage some residents have begun their own projects of flood proofing, either by blocking off the lower levels entirely or by installing flood gates on the lower level doorways.

Construction of one or more of these projects is recommended within Reach SBC3, either by the Township or the property owners. Construction of additional projects in other reaches, primarily focused on other priority issues, will also provide a benefit to the flooding problems of this community. Mentions will be made of same within the projects recommended for those priority issues.

2. Brookside Road Community

Located within the PRM5 reach of Paper Mill Run, this area is regularly inundated with flooding from the adjacent Paper Mill Run creek, as well as overland flows from Bethlehem Pike and the adjacent St. Joseph's Academy. Seventeen (17) residents filed statements of concern at the meeting, experiencing flooding of yards, roadways and homes. The following projects are recommended;

- The storm system leading to the intersection of Terminal Avenue and Montgomery Avenue be improved (Improved Stormwater Conveyance Systems). The current storm system is old and undersized. Surface runoff flows down Terminal Avenue and Montgomery Avenue without entering the existing catch basins and flows on towards Bethlehem Pike, adding to the surface flow within that roadway.

- Extend the existing berm along Paper Mill Run in the rear yard of the residents located along the southern side of Brookside Road (Floodwalls/Levees). Currently the existing earthen berm extends slightly past the central roadway circle in Brookside road before meeting existing yard grades. It is at this location where residents' yards and homes begin to flood. Extending the berm can either be performed via extension of the existing earthen berm or via the construction of floodwalls adjacent to the stream channel.
- The storm system leading to the intersection of Bethlehem Pike and Brookside Road be improved (Improved Stormwater Conveyance Systems). The current inlet system fails to adequately collect the roadway runoff, leading to large volumes of overland flow flooding the rear yards of the residents along the northern side of Brookside Road. This is in large part due to reduced inlet capacities from many roadway overlays which have further limited stormwater runoff access to the inlets. Improvements to storm systems within Bethlehem Pike (S.R. 2018) are owned by PennDOT, and are the responsibility of the State. State elected officials should be contacted for assistance in establishing any future projects.

Construction of one or more of these projects is recommended within Reach PRM5. Construction of additional projects in other reaches, primarily focused on other priority issues, will also provide a benefit to the flooding problems of this community. Of note is the recommended detention facility above Carlisle Road within the PMR2 Reach. The facility will provide a substantial reduction in the flow volume to the Brookside Road community. Mention of additional projects will be made of same within the text of other priority issues.

3. College/Grove Community

Located within the CGN reach/watershed, undersized storm pipes and large volumes of overland runoff from Bethlehem Pike cause yard and roadway flooding. The stormwater problems within this neighborhood are exacerbated by very small residential lots that have been improved with a great deal of impervious coverage in the form of homes, driveways, patios, and other impervious surfaces. Four (4) residents filed statements of concern at the meeting, experiencing undersized storm systems, and flooding of yards and roadways. The following projects are recommended;

- Flooding within this neighborhood is primarily the result existing storm sewer pipes that are undersized to handle the flow generated during large order storm events. The existing system runs from College Avenue to Mill Street at the Township border with Whitemarsh Township. It is recommended that these systems be improved (Improved Stormwater Conveyance Systems).
- Additional surface runoff is directed to this neighborhood via roadway runoff from Bethlehem Pike. Storm sewers within this roadway are also undersized. It is recommended that these systems be improved (Improved Stormwater Conveyance Systems).
- It is herein noted that Springfield Township has completed two (2) earlier stormwater management projects to address this issue. Within the lands of the adjacent Carson Valley School two (2) separate, but consecutive, Dry Extend Detention Basins have been constructed to reduce the rate of stormwater runoff discharged to this neighboring development. These basins have been successful in reducing the overland stormwater runoff from these adjacent lands.

Construction of one or more of these projects is recommended within Reach CGN. Again, it is noted that the CGN watershed contains no defined stream channel or watercourse, so the term reach as applied here may be misleading.

4. **Carlisle Road between Curtis Terrace and Bailey Road**

Located within the PMR2 reach of Paper Mill Run, this area is regularly inundated with flooding from an adjacent tributary to the Paper Mill Run creek, due in large part an undersized storm system designed to convey water across Carlisle Road. Two (2) residents filed statements of concern at the meeting of March 18, 2010, experiencing flooding of yards, roadways and homes. The following projects are recommended;

- Construct a basin (Dry Extend Detention Basin or Wet Pond/Retention Basin) within the undeveloped lands above Carlisle Road. Preliminary analysis shows that such a structure could eliminate much of the stormwater management issues at Carlisle Road. In addition, as this reach is tributary to Paper Mill Run, construction of such a stormwater management facility will provide a secondary benefit to the Brookside Community (Priority #1) as well. This would be the result of a reduction in flow directed to that community retained in the proposed basin.
- The storm conveyance system across Carlisle Road should be improved (Improved Stormwater Conveyance Systems). Should the basin project be constructed it may be unnecessary to perform such a project. However, consideration should still be given to increasing the size of pipes across the roadway, and perhaps to increasing the number of catch basins within the roadway, to reduce the occurrence of flooding within the roadway.

It is noted that this reach part of Paper Mill Run, upstream from the Brookside Road Community. Construction of one or more of these projects is recommended within Reach PRM2. Construction of any stormwater management improvement will provide a secondary benefit to this community (Priority #1) as well. This would be the result of a reduction in flow directed to that community retained in any constructed facility.

5. **Lantern Lane between Bergan Road and Quill Lane**

Located within the SBC1 reach of Sunnybrook Creek, this area is regularly inundated with flooding because it is located at the confluence of two large volume stream channels. Two (2) residents filed statements of concern at the meeting of March 18, 2010, experiencing undersized storm systems, and flooding of yards and roadways. It is noted that this problem area is downstream from an existing basin constructed as part of the Remington & Vernick 1997 study. This basin, located adjacent to the south side of S.R. 309, was recently altered to reduce the flow from this basin to the residents. The following other solutions are also recommended. The following projects are recommended;

- First, that the Township provide a Buyout option to the residents (Buyout). The two homes prone to flooding in this location suffer because the yards and homes are located at the confluence of two large volume stream channels. During large order storms the flood waters can reach heights of 2-3 feet within the lower levels of the homes. Removing the homes will have the added benefit of allowing a project of Riparian Buffer Restoration.
- Should the Township be unable to proceed with the Buyout recommendation it is suggested that residents be provided guidance and direction for their flood proofing homes (Flood

Proofing). Flood levels within this area are not as severe as those for the Hemlock Road residents. It is estimated that flood proofing of the doors alone would be required, rather than both doors and windows.

- Also, the watershed above Lantern Lane includes runoff from the adjacent neighborhood to the north, bounded by Edann Road and Hunters Lane. This neighborhood contains no storm sewer systems to direct and convey runoff. Provision of new systems could re-direct surface runoff away from the Lantern Lane Area(Improved Stormwater Conveyance Systems).

It is noted that this reach part of the Sunnybrook Creek watershed. Construction of one or more of these projects is recommended within Reach SBC1, either by the Township or the property owners. Construction of any stormwater management improvement will provide a secondary benefit to downstream communities.

6. Stotesbury Community/Patton Road

Located within the PMR4 reach of Paper Mill Run, these residents, along Patton Road, experience large volumes of overland runoff from the Stotesbury Community located uphill from their location. Five (5) residents filed statements of concern at the meeting, and additional issues are known, experiencing flooding of yards and homes. The following projects are recommended;

- Existing stormwater management and conveyance facilities within the Stotesbury Community should be examined to determine if maintenance is required to improve the function of same (Maintenance of Existing Facilities). Also, it is recommended that a thorough analysis of these basins be performed in an effort to determine if increases in the basin capacity can be provided through retrofits (Dry Extend Detention Basins or Infiltration Basins). Maintenance and construction projects such as these would help reduce the stormwater runoff directed to the residents along Patton Road.
- Additional stormwater conveyance systems be provided behind the homes on Trumbauer Drive. All surface runoff from the Trumbauer Drive area flows downhill into some of the rear yards of the residents along Patton Road (Improved Stormwater Conveyance Systems). Improved collection of this surface runoff into stormwater culverts, pipes, or infiltration trenches will remove it from surface runoff and reduce flooding to yards and homes.

It is noted that this reach part of Paper Mill Run, upstream from the Brookside Road Community. Construction of one or more of these projects is recommended within Reach PRM4. Construction of any stormwater management improvement will provide a secondary benefit to this community (Priority #1) as well. This would be the result of a reduction in flow directed to that community retained in any constructed facility.

7. Glenway Road

Located within the PMR6 reach of Paper Mill Run, these residents, where the reach crosses under Glenway Road, this area is regularly inundated with flooding from Paper Mill Road and the adjacent tributary to St. Joseph's Run. This concern was raised separate from the meeting, and it is known that residents experience severe flooding of yards, roadways and homes. The following projects are recommended;

- The stormwater runoff conveyance systems within Paper Mill Road, Glenway Road, and between, should be improved (Improved Stormwater Conveyance Systems). This

neighborhood received a large volume of surface runoff from the higher elevation areas along Paper Mill Road. Providing storm systems that maintain these flows within Paper Mill Road, as well as improvements to the other systems, rather than bypassing these flows into the neighborhood, will reduce runoff to the already overburden systems therein.

- Existing stormwater management and conveyance facilities within Stotesbury Development, should be examined to determine if maintenance is required to improve the function of same (Maintenance of Existing Facilities). Also, it is recommended that a thorough analysis of these basins be performed in an effort to determine if increases in the basin capacity can be provided through retrofits (Dry Extend Detention Basins or Infiltration Basins). Maintenance and construction projects such as these would help reduce the stormwater runoff directed to Paper Mill Road, reducing the volume of flow to this area, as well as to the downstream problem areas surrounding Glenway Road.

It is noted that this reach part of Paper Mill Run, upstream from the Brookside Road Community. Construction of one or more of these projects is recommended within Reach PRM6. Construction of any stormwater management improvement will provide a secondary benefit to this community (Priority #1) as well. This would be the result of a reduction in flow directed to that community retained in any constructed facility.

8. Hull Drive between Clark and Claridge Roads

Located within the PMR3 reach of Paper Mill Run, this area is regularly inundated with flooding from the adjacent tributary of Paper Mill Run on one side of Hull Drive, and from MacArthur Road homes on the other side. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes. The following projects are recommended;

- Existing stormwater management and conveyance facilities along MacArthur Road, should be examined to determine if maintenance is required to improve the function of same (Maintenance of Existing Facilities). Also, it is recommended that a thorough analysis of existing basins be performed in an effort to determine if increases in the basin capacity can be provided through retrofits (Dry Extend Detention Basins or Infiltration Basins). Maintenance and construction projects such as these would help reduce the stormwater runoff directed to Claridge Road, reducing the volume of flow to downstream areas.
- The stormwater runoff conveyance system behind Hull Drive, between MacArthur Road, should be improved (Improved Stormwater Conveyance Systems). This neighborhood received a large volume of surface runoff from the higher elevation areas along MacArthur Road. Providing storm systems that maintain these flows within the rear yards leading to Claridge Road, as well as improvements to the other systems within MacArthur Road, will reduce runoff to the already overburden systems therein.
- Consideration should be given to providing a basin within the area behind MacArthur Road and Above Claridge Road (Wet Ponds/Retention Basin, Dry Extend Detention Basins). This area is currently woods, and is located within residential lands. Yet room exists for placement of a stormwater management facility to reduce runoff flows and volumes.

It is noted that this reach part of Paper Mill Run, upstream from the Brookside Road Community. Construction of one or more of these projects is recommended within Reach PRM3. Construction of any stormwater management improvement will provide a secondary

benefit to this community (Priority #1) as well. This would be the result of a reduction in flow directed to that community retained in any constructed facility.

9. Woods Road/Station Avenue

Located within the SBC2 reach of Sunnybrook Creek, this area is regularly inundated with flooding from overland flows originating from upland areas of adjacent Cheltenham Township lands. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes. The following projects are recommended;

- Stormwater runoff conveyance system should be provided behind Woods Road (Improved Stormwater Conveyance Systems). This neighborhood received a large volume of surface runoff from the higher elevation areas within Cheltenham Township. Collection of this surface runoff in advance of the rear yards along Woods Road can prevent future flooding events.
- Existing stormwater management and conveyance facilities along Woods Road and Station Road should be examined to determine if maintenance is required to improve the function of same (Maintenance of Existing Facilities). Maintenance projects such as these would help reduce the stormwater runoff directed to Station Road, reducing the volume of flow to downstream areas.
- Provide flood proofing for the homes (Flood Proofing). If controlling the volume of runoff is difficult due to its origination within Cheltenham Township it is suggested that residents be provided guidance and direction for flood proofing their homes.

Springfield Township has had previous discussions with Cheltenham Township in an effort to construct stormwater management facilities within that municipality for the benefit of Springfield Township residents; specifically the possibility of a detention facility being constructed on the lands of Glasgow, Inc. Discussions of this nature should begin again anew. It is noted that this reach part of the Sunnybrook Creek watershed. Construction of one or more of these projects is recommended within Reach SBC1. Construction of any stormwater management improvement will provide a secondary benefit to downstream communities

10. Private Property Watercourse Erosion

Streambank erosion is a problem in various watercourses within Springfield Township. Several residents have noted that the adjacent watercourses to their properties are suffering severe bank erosion. This is leading, in many cases, to a loss of property for these residents. Springfield Township has recently completed projects within Cisco Park to prevent future streambank erosion. Various streambank stabilization methods were demonstrated. The nature of the stabilization will vary based upon the local conditions. The benefit is the maintenance of the stream channel and the prevention of future losses to lands and loss of capacity within the stream beds due to sedimentation. The Springfield Township Board of Commissioners should reaffirm the Township policy concerning streambank stabilization activities. The Springfield Township Environmental Advisory Committee should be made available to residents to offer information and guidance to individual property owners on stream bank stabilization methodologies.

11. Additional Stormwater Management BMPs for Discussion

The above proposed projects are offered to address the list of 10 priorities contained within this analysis. Yet additional stormwater management BMPs are available (as described within Section E) and input from property owners, residents and staff is always beneficial. One important issue that has not been discussed is the elective implementation of the small scale solutions. Reduce Parking Imperviousness (BMP Manual Section 5.7.2) was listed as an alternative, and noted within a few of the Reach descriptions as possible overall solutions, though not ultimately selected as a proposed project. Yet existing pavement areas, particularly in large area parking lots (commercial and institutional centers), that can add additional green space can provide measurable reductions in stormwater runoff. Similarly, while facilities like rain barrels, cisterns and rain gardens will not resolve the Township-wide issues by themselves, the education of Township property owners to elect to implement these on their own will help the overall stormwater management situation. Springfield Township, through the Environmental Advisory Committee, should consider providing educational and advise programs and resources for residents on stormwater management solutions that can be implemented within individual properties that can assist in the overall effort to manage the resource of stormwater runoff.

The projects offered within this analysis are primarily large scale solutions due to the fact that the Township stormwater management issues are also large in nature. The primary stormwater management facility that can be implemented to reduce stormwater runoff rate and flow volume is a detention/retention basin. A basin can be either above ground or underground, and can be a wet pond or a dry basin. Basins are proposed within a few of the priority problem areas. However, in order to provide a thorough analysis for discussion, the following locations are also offered for consideration for placement of a basin facility;

- The fields at the southwest corner of Paper Mill Road and Montgomery Avenue (PRM5 Reach). This location falls within the watercourse of Paper Mill Run, upstream of the Brookside Road Community. Construction of a basin in this location would reduce flow rates or volumes and, if constructed in conjunction with a facility above Carlisle Road, the benefit to that community would be augmented.
- The open area along St. Joseph's Run immediately west of Bethlehem Pike. These lands fall within the property of St. Joseph's Academy and the St. Joseph's Housing Corporation Bethlehem Retirement Village. While this structure would fall within the PRM6 Reach, placement of a stormwater management facility in this location would also provide a benefit to the Brookside Road Community by reducing the flow to the confluence of St. Joseph's Run and Paper Mill Run, reducing stormwater back-up potential.

The other item that was briefly mentioned is that not all of the stormwater management basins suggested by the Remington and Vernick study have been implemented. There are several areas of detention that appear to still be viable such as previously proposed expansions to ponds within the North Hills or Flourtown Country Clubs, or basins within or adjacent to the S.R. 309 Right-of-Way. While the summary of the narrative noted minimal benefit, construction of these facilities along with those proposed herein can provide greater reduction in flows.

H. RECOMMENDED PROJECTS COST / BENEFIT ANALYSIS

The recommended projects within the previous sections are proposed to offer relief for the affected residents. This section attempts to quantify the extent of that relief and provide associated costs to allow Springfield Township Commissioners to consider the benefit completion of these projects might offer the residents when weighed against costs.

Quantifying the level of relief is difficult for a feasibility such as this. Precise surveys of the various storm sewers have not been completed, so it is not possible to offer precise figures for reduced flooding within these areas. Accurate surveys of existing stormwater management facilities have not been performed, so it is difficult to determine the existing functionality of these systems, and then to suggest how altering or maintaining them may provide relief. However, a variety of projects have been proposed and this report offers, with the best available information, the following comments concerning a cost/benefit analysis.

10. Private Property Watercourse Erosion

Stream bank erosion is occurring in a number of places throughout Springfield Township. This erosion can be due to excessive flow rate and/or volume, and also due to flows impacting bends within the stream wall. This report has identified three (3) locations that should be addressed; Orelan Run near Dale Road (SBC2 Reach), Erdenheim Run near Haws Lane (SBC1 Reach), and PMR6 Reach above Paper Mill Road, below Stotesbury Avenue.

Stabilization of the streambank can be performed utilizing various techniques. Selection of the appropriate method should be based upon extent of erosion, flow rates, depth, and input from adjacent residents. Costs associated with a number of different techniques are provided below. The Township performed a streambank stabilization project just west of Paper Mill Road, near the Philadelphia/Montgomery Christian Academy, along Paper Mill Run that demonstrates a number of such techniques, and figures presented herein are based upon those project costs. The benefit in each case would be elimination of future streambank erosion. The Springfield Township Board of Commissioners should reaffirm the Township policy concerning streambank stabilization activities. The Springfield Township Environmental Advisory Committee should be offered to residents as a source of information and guidance for property owners to construct lasting, cost effective stream bank stabilization projects to reduce the effects of erosion.

Method #1: Gabions - Gabion stabilization is estimated at approximately \$150-\$200 per cubic yard.

Method #2: Large Block Retaining Walls - Use of large block retaining walls, as opposed to segmental retaining walls typically used in residential site projects, is estimated at approximately \$40-\$60 per face square foot.

Method #3: Live Stakes - Use of "Live Stakes" for stabilization is estimated at approximately \$30-\$50 per square foot.

Method #4: Large Stone Stabilization - Use of large stone for stabilization is estimated at approximately \$40-\$50 per ton.

Costs associated with design and permitting of projects in not included within the above costs.

9. **Woods Road/Station Avenue**

Located within the SBC2 reach of Sunnybrook Creek, this area is regularly inundated with flooding from overland flows originating from upland areas of adjacent Cheltenham Township lands. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes.

8. **Hull Drive between Clark and Claridge Roads**

Located within the PMR3 reach of Paper Mill Run, this area is regularly inundated with flooding from the adjacent tributary of Paper Mill Run on one side of Hull Drive, and from MacArthur Road homes on the other side. This concern was raised separate from the March 18, 2010 meeting, and it is known that residents experience severe flooding of yards, roadways and homes.

7. **Glenway Road**

Located within the PMR6 reach of Paper Mill Run, these residents, where the reach crosses under Glenway Road, this area is regularly inundated with flooding from Paper Mill Road and the adjacent tributary to St. Joseph's Run. This concern was raised separate from the meeting, and it is known that residents experience severe flooding of yards, roadways and homes.

6. **Stotesbury Community/Patton Road**

Located within the PMR4 reach of Paper Mill Run, these residents, along Patton Road, experience large volumes of overland runoff from the Stotesbury Community located uphill from their location. Five (5) residents filed statements of concern at the meeting, and additional issues are known, experiencing flooding of yards and homes.

5. **Lantern Lane between Bergan Road and Quill Lane**

This area experiences repeated flooding of two (2) homes; 2002 Lantern Lane and 2004 Lantern Lane. These homes experience flooding within their yards and homes. This flooding is caused by two (2) major factors; the rear yards are located at the confluence of two watercourses creating a sudden increase in flow volume, and the existing culvert conveying stormwater flows beneath Lantern Lane is undersized. Design and construction of storm sewer and stream improvements at Lantern Lane to relieve this frequent flooding could exceed one million dollars, due to the size of culvert required. Flood proofing of the homes could be performed to eliminate water intrusion within the dwelling units, yet continued flooding of the yards and damage to property would occur. New storm systems to re-direct storm water runoff away from this problem area would reduce, but not eliminate, flooding. As such, it has been recommended that the Township perform a buyout of these two homes.

Solution #1: Buyout – Benefit: Would eliminate future flooding of residential properties. – Estimated cost: \$600,000.

Solution #2: Flood Proofing – Benefit: Reduced flood damage to home interiors. Anticipated continued damage to yard and property, including home exterior. – Estimated cost: \$40,000.

Solution #3: Improved Stormwater Conveyance Systems – Provision of new storm sewer conveyance systems within the adjacent neighborhood to the north could reduce the flow toward Lantern Lane, thereby reducing the extent of flooding. – Estimated cost: \$250,000 for design and construction.

4. **Carlisle Road between Curtis Terrace and Bailey Road**

Carlisle Road experiences flooding within the roadway, and to some of the properties located upstream above Carlisle Road. Stormwater runoff from neighboring properties collects within the stream channel at the bottom of the valley above the roadway and is conveyed to a storm pipe located between the properties at 8818 and 8816 Carlisle Road. Unfortunately, this storm pipe is undersized, resulting in the channelized runoff flowing past the storm pipe into the street. The preferred project would be the construction of a basin, or dam, above the undersized pipe. This earthen structure would be located within the stream channel, approximately at the midpoint between the ends of Curtis Terrace and Bailey Road. The basin could be designed to reduce the flow of stormwater discharge within the channel during large order storm events (10-Year and above) down to the levels typical for the smaller 2-Year storm. In addition, this solution would provide the added benefit of reducing the rate of runoff directed towards downstream neighborhoods.

Without the ability to detain a portion of the flow and reduce the concentrated runoff directed toward the roadway, as is offered through a basin/dam, it would be necessary to increase the size of the existing storm sewer to reduce the flooding; project option #2. Increasing the size of the storm system would eliminate the roadway and yard flooding by providing additional storage and conveyance capacity within the storm system. However, an increase in the size of the system would provide no reduction in the rate of runoff to downstream neighborhoods.

Solution #1: Dry Extend Detention Basin – Benefit: 66% reduction in flow rate during the 100-Year storm event. Reduces 100-Year flow rate to that of the 10-Year storm. Will eliminate flooding of street and yards caused by flow from the channel. Will provide an approximate 10% reduction to the rate of flow directed downstream, including the residents of Brookside Road. – Estimated cost: \$600,000 for design and construction. Cost to obtain permanent easements from property owners would also need to be considered.

Solution #2: Improved Stormwater Conveyance Systems – Will eliminate flooding of street and yards caused by flow from the channel. No realized benefit to downstream communities. – Estimated cost: \$400,000 for design and construction.

3. College/Grove Community

The neighborhood north of the Carson Valley School contains College Avenue (north and south), Grove Avenue, Weiss Avenue, and Schnell Avenue. These first three roadways, for the most part, are parallel with one another and contain a storm system that conveys surface runoff under the roadways, through surrounding properties, towards W. Mill Road, and ultimately to the Wissahickon Creek within neighboring Whitemarsh Township. Flooding within these 3 roads occurs because the storm pipe leading to Wissahickon Creek is undersized. The preferred project would be to construct improvements to this undersized system. This improvement would extend from W. Mill Road back up to College Avenue and could be performed in phases if budgetary needs require. A proposed second project is to improve the capacity of the storm system along Bethlehem Pike. This would maintain flows within this roadway rather than permitting gutter flows from entering the College/Grove neighborhood, a current occurrence.

Solution #1: Improved Stormwater Conveyance Systems (Within neighborhood) –

Benefit: Will reduce occurrence of roadway flooding. Unfortunately, the pipe size necessary to limit flooding to only in excess of the 100-Year storm would not be possible within such a dense residential neighborhood. However, construction of a large concrete box culvert would be possible and would limit the occurrence of flooding to only the 25-year storm or above, and would reduce the extent of flooding – Estimated cost: \$750,000 for design and construction, recommended as a three (3) phase project to cost \$250,000 per phase.

It is again noted that Springfield Township has completed two (2) earlier stormwater management projects to reduce runoff to the neighborhood, providing Dry Extend Detention Basins within the lands of the adjacent Carson Valley School. These basins have been successful in reducing the overland stormwater runoff from these adjacent lands, but the phased project of additional stormwater management controls is recommended.

2. Brookside Road Community

Located within the PRM5 reach of Paper Mill Run, this area is regularly inundated with flooding from the adjacent Paper Mill Run creek, as well as overland flows from Bethlehem Pike and the adjacent St. Joseph's Academy. The extent and variety of the surface runoff has led to three separate and distinct areas of flooding concern. First, flow within the neighborhood surrounding Terminal Avenue is in excess of the capacity of the storm sewer conveyance system. As a result, the storm runoff floods within the roadways and contributes to excessive flooding within Montgomery Avenue and Bethlehem Pike. This runoff is augmented by flows down Bethlehem Pike leading to Brookside Road. The combination of these two flow areas creates a severe flooding condition near the intersection of Brookside Road and Bethlehem Pike. The flood waters travel through the localized low point of the area and are directed to the rear of the yards of several residents along the northern edge of Brookside Road.

Second, overland runoff from St. Joseph's Academy flows downhill and affect the rear yards of adjacent residents. Springfield Township has performed a recent channel construction behind these residential homes in an effort to divert the surface runoff from reaching the homes. Third, the residential homes along the southern end of the Brookside Road cul-de-sac experience severe flooding of their homes and properties during large order storms. Unfortunately, this is due to the fact that the homes are built within the floodplain of Paper Mill Run.

In order to address this area listed as priority #1 three possible solutions have been offered. It is strongly recommended that the first two (2) be considered.

Solution #1: Improved Stormwater Conveyance Systems (Terminal Avenue) –

Benefit: Project #1 would be improvements to the storm sewer system within the Terminal Avenue neighborhood. This system was originally constructed to collect surface runoff and convey it down Terminal Avenue, through the adjacent school bus depot, and ultimately into Paper Mill Run below the pond. However, the existing system cannot accept this volume of runoff and excess runoff flows down Montgomery Avenue into Bethlehem Pike. Improvements to the system will reduce occurrence of roadway flooding. Unfortunately, the pipe sizes necessary to limit flooding to only in excess of the 100-Year storm would not be possible within such a dense residential neighborhood. However, construction of larger capacity pipes would be possible and would limit the occurrence of flooding to only the 10-year storm or above, and would reduce the extent of remaining flooding – Estimated cost: \$900,000 for design and construction, recommended as a three (3) phase project to cost \$300,000 per phase.

Solution #2: Floodwalls/Levees (Adjacent to Paper Mill Run/South of Brookside Rd.) –

Benefit: Project #2 would be the construction of an extended earthen berm adjacent to Paper Mill Run. Currently, flooding is experienced by approximately half of the residents along the southern portion of Brookside Road; those homes west of the center 'circle' roadway feature. The remaining southern homes fronting on Brookside Road, east of the center 'circle' roadway feature, experience no such flooding. This is due to the nature of the existing streambank. For the eastern homes the streambank is much higher than the stream bed and, as a result, the homes are also much higher. However, near the center 'circle' roadway feature the streambank slopes down and exposes the remaining homes to flooding during large storm events. Constructing an earthen berm adjacent to the streambank to extend this natural floodwall/levee will reduce the occurrences of future flooding events. Estimated cost: \$300,000 for design and construction.

Solution #3: Improved Stormwater Conveyance Systems (Bethlehem Pike) –

The final solution would be to improve the storm sewer capacity along Bethlehem Pike, as surface runoff from adjacent commercial districts contributes to the flooding within the affected neighborhood. The difficulty surrounding work along Bethlehem Pike surrounds the flow of traffic and controlling this flow during any contemplated construction project. Benefit

– Reduction in overland flow directed towards the affected neighborhood. Estimated cost: \$400,000 for design and construction, primarily due to costs associated with PennDOT coordination and pavement restoration.

1. **Hemlock Road Community**

This area experiences the flooding of several homes adjacent to Sunnybrook Creek. These residents experience flooding within their yards and homes. Some residents have noted flooding as high as 4' within the lower level of their houses. The primary reason for the flooding is simply location. As indicated within the current FEMA Floodplain Maps most of the houses along the southern side of Hemlock Road have been built within the floodplain. It is for this reason that a Buyout has been offered as the primary solution. In fact, a recent Federal Grant has been received by Springfield Township dedicated to the proposed Buyout solution. Proceeding with a buyout of the existing homes would allow for their demolition, and the vacated area can be regarded and planted to create a new Riparian Buffer area adjacent to Sunnybrook Creek.

Flood Proofing is offered as the alternative to the Buyout. Unlike the residents of Lantern Lane the extent of flood proofing for the Hemlock Road residents would be more extensive, due to the fact that the water reaches to the height of the windows, requiring flood proofing of same.

Solution #1: Buyout – Benefit: Would eliminate future flooding of residential properties. Would also allow for – Estimated cost: \$3,200,000.00 for Buyout; \$300,000 for design and construction of Riparian Restoration. Note: Federal grant monies allocated for buyouts.

Solution #2: Flood Proofing – Benefit: Reduced flood damage to home interiors. Anticipated continued damage to yard and property, including home exterior. – Estimated cost: \$35,000 per home.

Solution #3: Bridge Replacement - It is also noted that Springfield Township is currently completing a design project for the reconstruction of the existing bridge carrying East Mill Road over Sunnybrook Creek. The proposed structure would offer greater flow capacity within the creek bed in that the existing bridge includes two large piers, whereas the proposed structure is a single span. Analyses performed during the design of this new bridge structure suggest a measureable benefit to the water levels after construction of the single span bridge structure. However, provision of additional stormwater management controls remains warranted: \$800,000 for design and construction.

The projects offered within the report are primarily large scale solutions due to the fact that the Township stormwater management issues are also large in nature. The primary stormwater management facility that can be implemented to reduce flow volume is a basin. A basin can be either above ground or underground, and can be a wet pond or a dry basin. Basins are proposed within a

few of the priority problem areas. However, in order to provide a thorough analysis for discussion, the following locations are also offered for consideration for placement of a basin facility;

- The fields at the southwest corner of Paper Mill Road and Montgomery Avenue (PRM5 Reach). This location falls within the watercourse of Paper Mill Run, upstream of the Brookside Road Community. Construction of a basin in this location would reduce flow rates or volumes and, if constructed in conjunction with a facility above Carlisle Road, the benefit to that community would be augmented.
- The open area along St. Joseph's Run immediately west of Bethlehem Pike. These lands fall within the property of St. Joseph's Academy and the St. Joseph's Housing Corporation Bethlehem Retirement Village. While this structure would fall within the PRM6 Reach, placement of a stormwater management facility in this location would also provide a benefit to the Brookside Road Community by reducing the flow to the confluence of St. Joseph's Run and Paper Mill Run, reducing stormwater back-up potential.
- Consideration should be given to constructing the remaining basins recommended within the Remington & Vernick study from 1997.

I. SUMMARY

This narrative has been titled the “Springfield Township Comprehensive Township-Wide Stormwater Analysis”. It has been prepared to describe locations of stormwater related problems within the full Township area, to propose solutions to those problem areas, and to quantify the benefits and costs associated with same. Within such a broad analysis of the entire municipality it is possible that some locations have not been taken into account. Yet every effort has been made to include all known areas of concern within Township communities.

Assessing the problems has been completed with the help of everyone affected; residents, property owners, staff and Commissioners. **Boucher & James, Inc.** has taken these concerns and performed a thorough analysis of the watersheds surrounding the locations in an effort to recommend project solutions that provide quantifiable benefits to the affected properties. In so doing we hope to provide the Township Staff and Commissioners with significant information to assist in their future decisions to provide real solutions to the concerns of Springfield Township residents and property owners.

As is evident by this analysis, while the overall concerns related to stormwater are similar, they are also very diverse. The projects offered also represent a diverse array of solutions, while each yielding a similar result; reduced flooding or protection against erosion. While some of the remedies may be relatively easy to implement, the general concept of more stormwater detention or control of stormwater conveyance will be difficult due to the highly developed nature of Springfield Township. There are some difficult decisions which the community will need to consider for the “greater good” even though they may be painful from both the financial and emotional perspectives.

SPRINGFIELD TOWNSHIP
Comprehensive Township-Wide Stormwater Analysis
PROJECT NO. 13-40-114



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APPENDICES

SPRINGFIELD TOWNSHIP
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SMALL SCALE PRIVATE
PROPERTY IMPROVEMENTS

SMALL SCALE PRIVATE PROPERTY IMPROVEMENTS - GOALS

In December 2006 the Commonwealth of Pennsylvania issue its new Pennsylvania Stormwater Best Management Practices Manual (BMP Manual). Its purpose was to provide guidance, options and tools that can be used to protect water quality, enhance water availability and reduce flooding potential through effective stormwater management. The manual presents design standards and planning concepts for use by local authorities, planners, land developers, engineers, contractors, and others involved with planning, designing, reviewing, approving, and constructing land development projects.

As noted within the BMP Manual, in Pennsylvania, average annual precipitation ranges from 37 inches to more than 45 inches per year, and reflects a humid pattern. Nearly all of the annual rainfall occurs in small storm events. Precipitation of an inch or less is frequent and well distributed throughout the year. However, large storms, hurricanes, and periods of intense rainfall can occur at any time. Yet over 90 percent of the average annual rainfall occurs in storms of 2 inches or less, and over 95 percent of average annual rainfall occurs in storms of 3 inches or less. This pattern is typical of the entire state.

By focusing stormwater management efforts of these storm events that occur most frequently Springfield Township can reduce the occurrence of flooding. This rainfall level of 95% average is typically identified as the 2-Year storm event. Within Springfield Township the 2-Year storm event has been determined to produce 3.29 inches of rainfall during a 24-hour period. Any stormwater management facility that can be provided to capture this rainfall can have an effect on the larger watershed. The Springfield Township Board of Commissioners should reaffirm the Township policy concerning streambank stabilization activities. It is recommended that Springfield Township provide education, information and guidance to residents and property owners on how to construct individual small scale stormwater management facilities, and to show how this construction can provide a cumulative and significant effect on reducing flooding both locally and to downstream watershed communities.

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RAINFALL QUANTITIES

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RECOMMENDED SMALL SCALE BMPs

RECOMMENDED SMALL SCALE BMPs

A residential property, typically, cannot support the construction of a detention basin for stormwater management control. Likewise, there are many other large scale BMPs recommended within the BMP Manual that are not appropriate for residential lots and private property owners and residents. However, there are a number of BMPs identified within the BMP Manual that are practical for private property use and that, when used in significant numbers within a watershed, can have a measureable effect on reducing flooding locally and on downstream watershed communities.

The following small scale BMPs are recommended for consideration;

- Rain Barrels (Runoff Capture and Reuse)
- Cisterns (Runoff Capture and Reuse)
- Rain Gardens (Rain Garden/Bioretenion)
- Infiltration Trench
- Infiltration Bed

Within any residential lot the primary areas of impervious coverage are the residential structures, the accessory structures, and the driveway. A typical home having a footprint of 30' x 50' creates approximately 410 cubic feet of rainfall runoff during the 2-Year storm event. Construction of any of the above listed BMPs within the residential lot could capture this runoff and prevent it from contributing to the downstream watershed, thereby reducing the volume of water responsible for the current flooding problems.

The following examples are offered:

- Rain Barrels/Cisterns (Runoff Capture and Reuse): a single 3' diameter rain barrel at a height of 5' could capture approximately 35 cf. Four (4) such barrels, at the corners of a structure, could capture 140 cf; over one third of the 2-Year storm volume. If the dimensions of the rain barrel were raised to 4' x 6' the storage capacity of four barrels would be increased to 300 cf, or nearly 75% of the 2-Year storm runoff volume from a typical residential structure.
- Rain Gardens (Rain Garden/Bioretenion): a 20' x 20' decorative rain garden in a residential yard could remove the full volume of stormwater runoff generated by the roof of a residential home during the 2-Year storm event.
- Subsurface Infiltration Systems (Infiltration Trench or Infiltration Bed): a 20' x 35' subsurface infiltration system constructed with stone on soils (as provided within the detail following) could remove the full volume of stormwater runoff generated by the roof of a residential home during the 2-Year storm event

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BMP REPRESENTATIVE DETAILS

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STREAMBANK STABILIZATION

STREAMBANK STABILIZATION

In addition to flooding concerns, Springfield Township residents and property owners also experience streambank erosion. Erosion is primarily due to large volumes of water flowing through existing stream channels, the volume of which has been increasing over the years as a result of development and construction of new impervious surfaces. While stormwater management has been employed over the recent past to control the rate of runoff from new development, it has been only within the last decade that the engineering community has begun to realize that an associated increase in the volume of runoff has resulted in increased flooding and erosion adjacent to stream, creeks and rivers.

Stabilization of a streambank can be performed using a number of different methods. The primary difference in these methods is reflected in cost and aesthetics. In addition to construction costs any streambank stabilization project would also require residents to obtain a General Permit #11 (GP-11) from the Pennsylvania Department of Environmental Protection (PaDEP). Springfield Township has constructed a number of different streambank stabilization projects in recent years. Residents should be directed to the projects along Paper Mill Run in Cisco Park, and those adjacent to the Philadelphia Montgomery Christian Academy for examples.

Please note that there are many other streambank stabilizations available. However, the following methods are recommended due to their low cost, ease of construction, or aesthetics;

- Gabions
- Large Block Retaining Walls
- Rock Slope Construction
- Stacked Rock Construction
- Live Stakes

Typical construction details showing each of the above methods are provided within the following section.

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STREAMBANK STABILIZATION
TYPICAL DETAILS