

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

Prepared for:
Radnor Township
301 Iven Avenue
Wayne, Pennsylvania 19087



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

- On September 30, 2010 Tropical Storm Nicole produced over eight inches of rain over a 24 hour period which resulted in widespread flooding throughout Radnor Township.
- CVE was authorized in December of 2010 by the Township Commissioners to perform a comprehensive stormwater management study.
- CVE's three objectives:
 - ✓ Review and assess stormwater regulations, previous stormwater studies , stream channel and sewer maintenance conditions
 - ✓ Document township residents' stormwater issues and difficulties related to stormwater
 - ✓ Provide short term and long term recommendations for each watersheds within the Township

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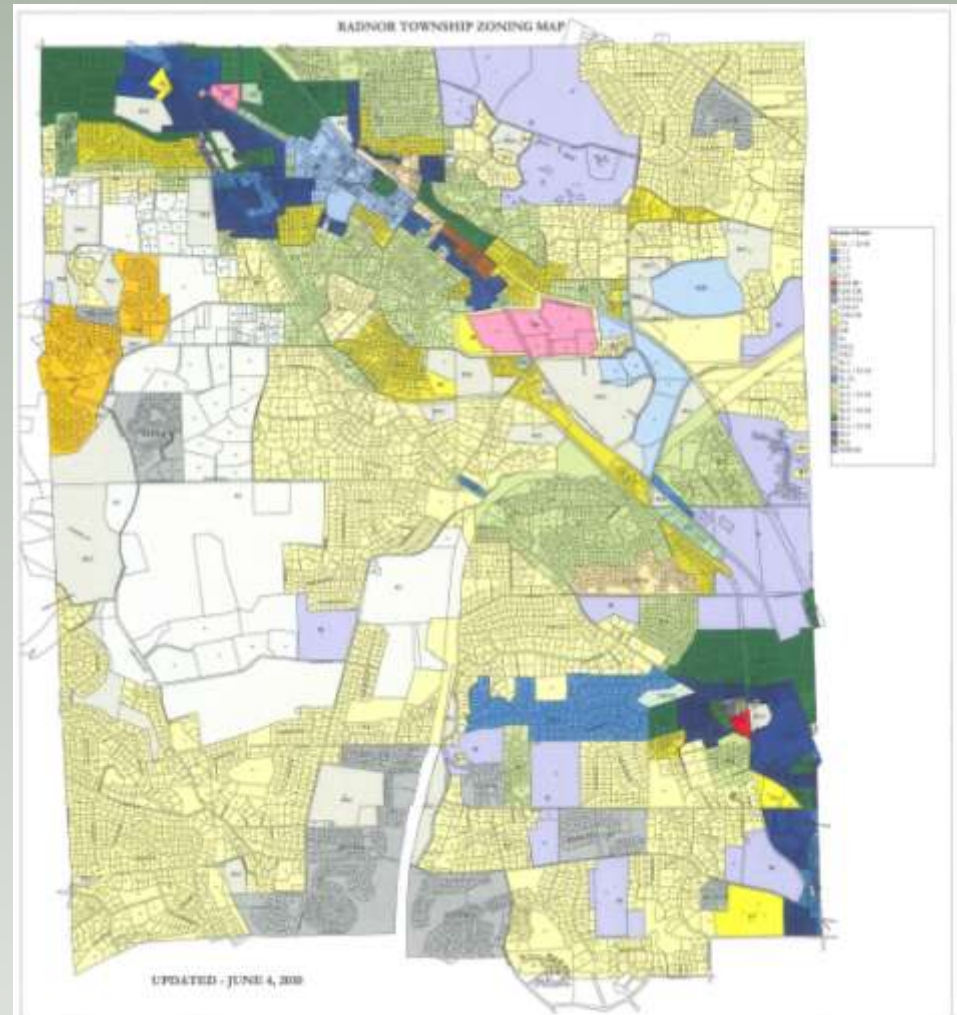
➤ Radnor Township Specifics:

- ✓ Located in Delaware County, Pennsylvania
- ✓ Approximately 13.8 square miles
- ✓ Population of approximately 31,000 residents
- ✓ The Village of Wayne lies within Radnor and is the commercial heart of Radnor Township
- ✓ Very diverse land uses

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➤ ZONING DISTRICTS:

- ✓ Urban Commercial
- ✓ Office Complexes
- ✓ Educational Campuses
- ✓ Multi-Family Housing
- ✓ Single Family Housing
- ✓ Big Box Retail
- ✓ Agricultural



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ *Watersheds*

✓ *Two Regional Watersheds: Schuylkill River and Darby Creek*

❑ **The Schuylkill River**

- The river flows into the Delaware River
- The watershed covers approximately 1,916 square miles
- The river Originates at Tuscarora Springs in Schuylkill County and travels approximately 130 miles

❑ **The Darby Creek**

- ❑ The creek flows into the Delaware River
- ❑ The watershed covers approximately 77 square miles
- ❑ The Darby Creek watershed touches three counties and thirty one municipalities

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➤ *Watersheds (cont.)*

✓ *Four Regional Watersheds:*

- Little Darby/Darby Creek – Tributary to Darby Creek
- Ithan Creek – Tributary to Darby Creek
- Meadow Brook Run – Tributary to Darby Creek
- Gulph Creek – Tributary to Schuylkill



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➤ Key Township Documents in Stormwater Management Plan

- ✓ Stormwater Management Ordinance
- ✓ Federal Emergency Management Agency (FEMA) - Flood Insurance Rate Maps (FIRMs)
- ✓ Master Plans
- ✓ Riparian Buffer Conservation Ordinance
- ✓ NPDES Phase II MS4 General Permit (PAG130102)

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➤ *Stormwater Management Ordinance Development*

✓ **Pennsylvania's Stormwater Management Act (Act 167) passed on October 9, 1978 and amended May 24, 1984.**

Required counties, or multiple counties, prepare and adopt watershed based stormwater management plans and ordinances establishing stormwater control of runoff from new development activities

The goal was to control post-development stormwater runoff rates, volumes and water quality to replicate pre-development conditions with consideration given to tributary timing, flow volume reduction, base flow augmentation and ecological protection

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➤ *Stormwater Management Ordinance Development (cont.)*

✓ **Radnor Adopts Model Ordinance (Darby Creek Act 167) on May 9, 2005 (Ordinance No. 2005-11)**

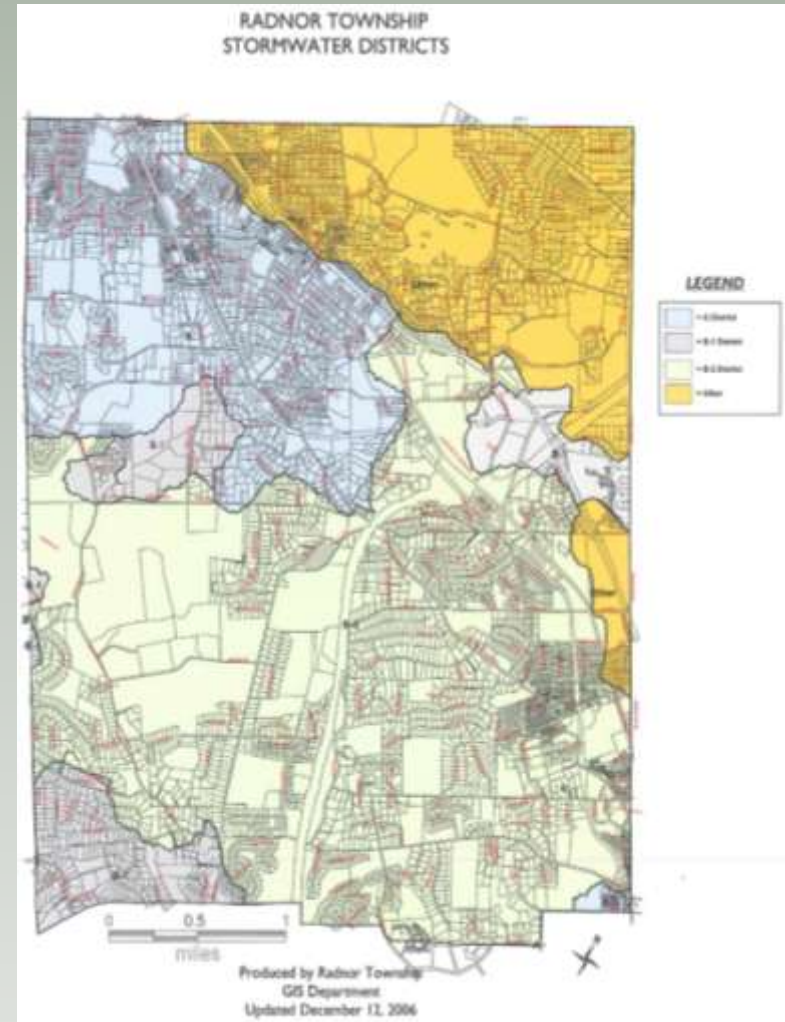
- Addresses improvements either development or redevelopment
- Prohibits connection of roof drains to public drainage systems such as streets, sewers or ditches
- Prohibits illicit discharge into the public drainage system
- Earth disturbance over 5,000 sq. ft. requires drainage plans to be submitted /approved and the stormwater peak rate control requirements are met
- Earth disturbance over 1 acre, the requirements for 5,000 sq. ft. disturbance plus additional requirements such as, groundwater recharge, water quality aspects, stream bank erosion controls and that an Erosion and Sediment Pollution Control Plan to be submitted to the Conservation District

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➤ *Stormwater Management Ordinance Development (cont.)*

✓ Projects that increase impervious surfaces between 501 to 1,499 sq. ft. need to adhere to the drainage plan requirements, and groundwater recharge requirements; Projects that increase the impervious surface over 1,500 sq. ft., the requirements for the smaller areas still apply as well as the addition of water quality requirements, stream bank erosion requirements and stormwater peak control requirements.

✓ Establishes four types of “Stormwater Districts” - Three of the four local stream watersheds are tributary to Darby Creek and the other is tributary to the Schuylkill River.



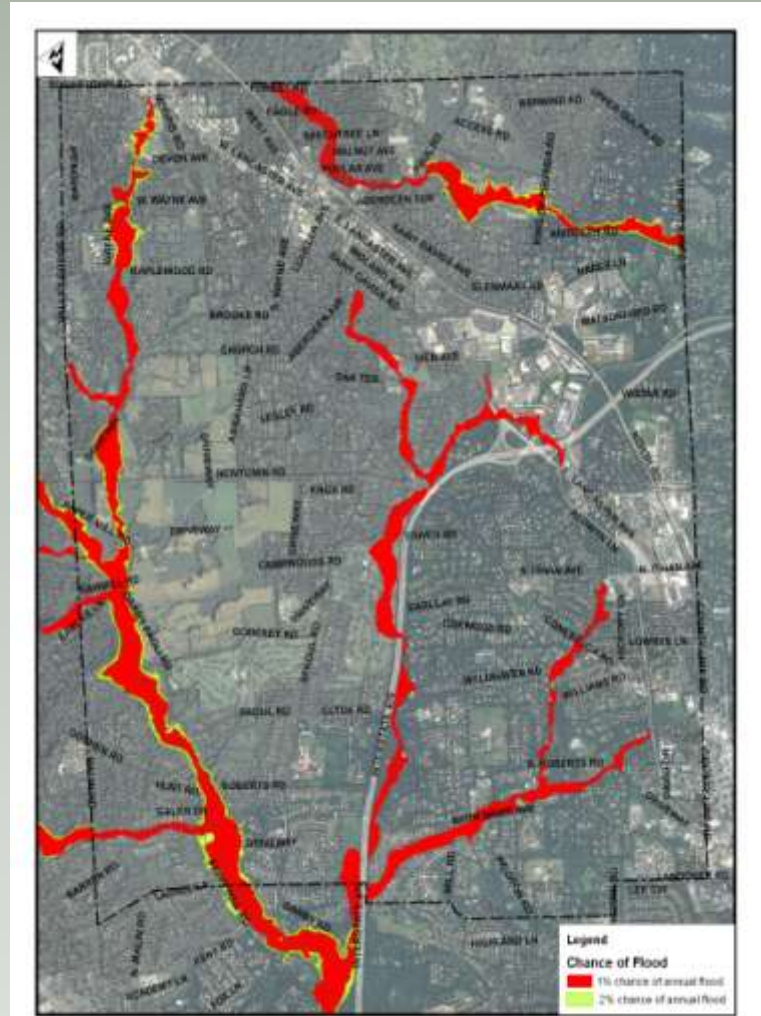
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➤ **Federal Emergency Management Agency (FEMA) - Flood Insurance Rate Maps (FIRMs); revised November 18, 2009.**

✓ FIRMs delineate the special flood hazard areas, commonly known as floodplain areas, which have been developed and/or accepted by FEMA.

✓ Radnor Township adopted a Floodplain Conservation District ordinance January 1, 1969.

✓ Floodplain Conservation District are areas subject to the one-hundred-year flood. Exempt areas are described as areas where the effects of the development would be offset by accompanying stream improvements. The adopted ordinance also prohibits the grading either by cut or fill in the floodplain conservation districts if the grading alters the cross-sectional area of the floodplain or increases the elevation of the one-hundred-year flood.



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➤ Master Plans

✓ *Comprehensive Land Use Plan*

Adopted June 16, 2003 – Covers Natural Resources, Housing, Economics and Business, Transportation, Open Space and Recreation, Historical and Archaeological Resource, Institutions, Community Services and Facilities and Existing Land Use

Promotes the acquisition of open space by acquiring properties and encouraging the development of conservation easements for permanent protection of open space in to have a positive impact on stormwater control.

✓ *Wayne Business District Master Plan*

Adopted September of 2006

Planning elements such as pedestrian crossings, enhancing streetscape, maintaining the townscape, keeping historic character, improving stormwater to name a few.

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➤ ***Riparian Buffer Conservation Ordinance***

- ✓ Adopted in 1989
- ✓ Establishes minimum setback distances based on zoning code

➤ ***NPDES Phase II MS4 General Permit (PAG130102)***

- ✓ Legal obligation to obtain a National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Separate Storm Sewer System (MS4) General Permit from the Pennsylvania Department of Environmental Protection.
- ✓ As an MS4 permittee, Radnor Township must develop and implement best management practices that address six Minimum Control Measures (MCMs):
 - Public Education
 - Public Involvement
 - Illicit Discharge Detection & Elimination
 - Construction
 - Post Construction
 - Good Housekeeping/Pollution Prevention

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➤ **Public Input & Information Gathering** - Upon receiving authorization to proceed with this study, CVE began a multi-dimensional process to collect public input and gather information related to the public system of drainage within Radnor Township.

✓ Distribute and Post Questionnaires on the web site for Residents regarding drainage

Watershed Name	No. of Surveys Collected	Basement Flooding Reported	No Basement Flooding Reported	Residents Called But No Answer & No Return Call	Residents Spoken To
Darby / Little Darby Creek	23	8	15	3	4
Ithan Creek	24	16	8	2	6
Gulph Creek	41	30	11	2	7
Meadowbrook Run	14	4	10	2	1
Total Radnor Township	102	58	44	9	18

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➤ Public Input & Information Gathering (cont.)

✓ *Perform multiple site visits to the Township (12/14/10, 02/09/11, 03/10/11 and 07/14/11)*

✓ *Phone Interviews with residents*

✓ **Review of Previously Commissioned Engineering Studies – Studies done by engineering consultants and the Commonwealth of Pennsylvania, Department of Environmental Resources in 1973, 1975, 1976, 1980, 1992, 1994, 2000, 2005**

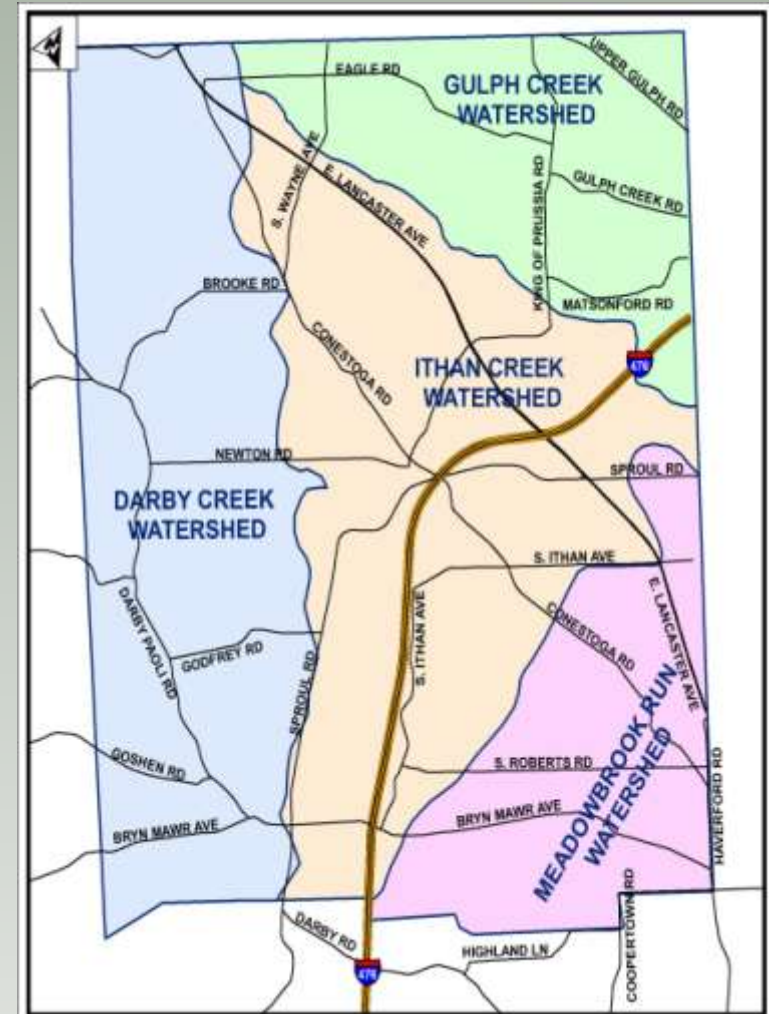
STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Darby & Little Darby Creek Watershed*

❑ The Little Darby Creek and Darby Creek has a 9,600 acre tributary as it leaves the Township

❑ Wide variety of land use from commercial to residential to agricultural



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Darby & Little Darby Creek Watershed (cont.)*

❑ **Watershed Drainage Issues**

- Periodic structure flooding during large rain events in the area of Oakford Circle and Arbordale Road
- Mostly overland flooding and/or flooding in yards that deposit debris, leave yards saturated for long periods of time and ruin landscaping
- Culverts along the creek are undersized, banks are not tall enough, inconsistent stream maintenance
- Concern over the impact that the operation of the Mill Dam Club dam has on adjacent residents upstream and downstream of the dam

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Darby & Little Darby Creek Watershed (cont.)*

☐ Watershed Drainage Recommendations

- Darby Creek Watershed (DCW) - Recommendation #1: Work cooperatively with Tredyffrin Township

- DCW Recommendation #2:

Installation of a regional detention basin within South Devon and/or Filipone Parks



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Darby & Little Darby Creek Watershed (cont.)*

□ Watershed Drainage Recommendations (cont.)

- **DCW Recommendation #3:** Develop and implement an aggressive stormwater infrastructure maintenance program
- **DCW Recommendation #4:** Work with Haverford Township to facilitate the removal of floodplain fill materials
- **DCW Recommendation #5:** West Wayne Preserve (Levin Tract) design be implemented to maximize stormwater detention and water quality
- **DCW Recommendation #6:** Hydrologic and hydraulic studies be undertaken to define the impact of the Mill Pond Dam

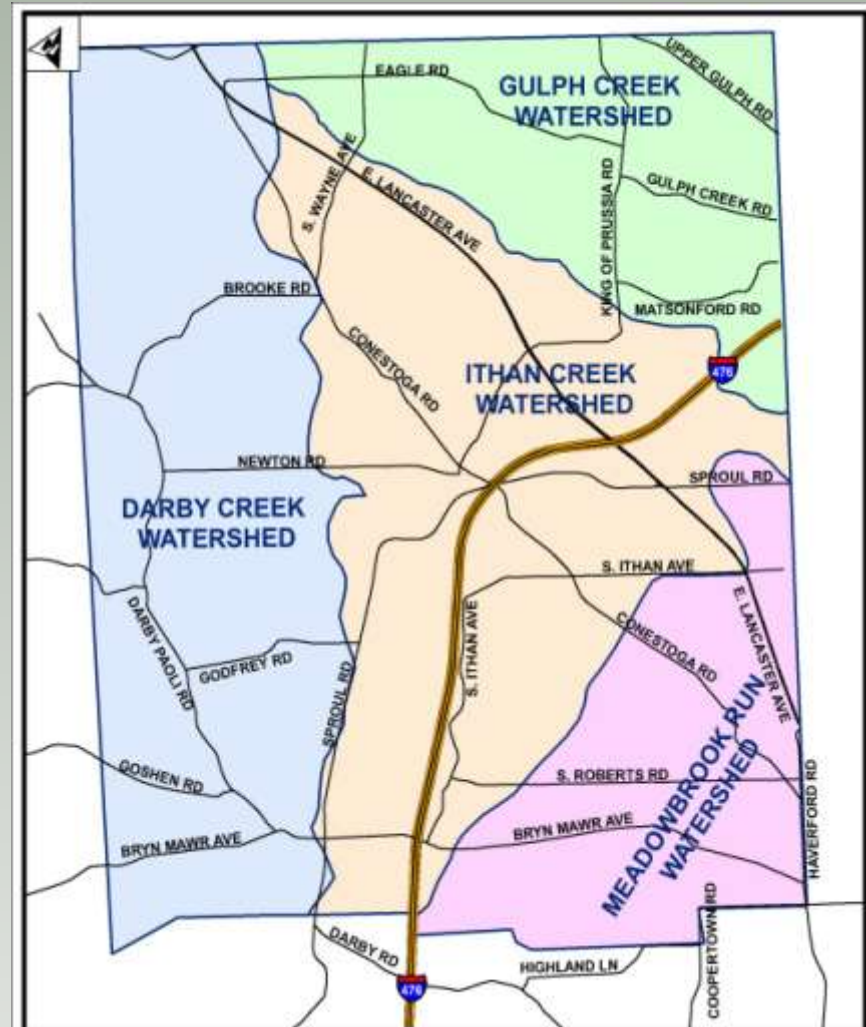
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➤ Summary of Findings

✓ *Ithan Creek Watershed*

❑ Ithan Creek Watershed has a 3,200 acre tributary as it leaves the Township

❑ Wide variety of land use high density residential, low density residential, transportation facilities, office building complexes, college campuses and historical areas - some of the oldest neighborhoods and commercial areas in Radnor



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Ithan Creek Watershed (cont.)*

❑ **Watershed Drainage Issues**

- Flooding problems in the South Wayne, Midland and St. Davids area, homeowners not only receive storm water rushing through their yards but residents on Midland experience sanitary sewer backups in their basements
- All culverts from the Sproul Road to Iven Avenue crossing upstream are not sized to adequately accommodate the 5-year storm.
- Numerous “bottlenecks” and pipe/brick structure inconsistent and in poor structural condition
- The Township received many surveys that indicated flooding adjacent to Ithan Creek as far south as the Township Hall

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Ithan Creek Watershed (cont.)*

□ Watershed Drainage Recommendations

- **Ithan Creek Watershed (ICW) - Recommendation #1:** All stormwater improvements approved as part of the Radnor Middle School improvements be constructed

- **ICW - Recommendation #2:** Replace the existing sanitary sewer system (main and house connections) along Midland Avenue between Louella and Aberdeen Avenues

- **ICW - Recommendation #3:** Replace the culverts at Iven Avenue and the Township Building Driveway

- **ICW - Recommendation #4:** Installation of an auxiliary culvert to supplement the flow capacity of the existing brick culvert

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Ithan Creek Watershed (cont.)*

□ **Watershed Drainage Recommendations (cont.)**

- **ICW - Recommendation #5:** Outfit the commercial district corridor on Lancaster Avenue with Green Infrastructure facilities and convey in a new storm sewer system to Ithan Creek via Lancaster and Pembroke Avenues
- **ICW - Recommendation #6:** The Township should establish permanent recorded easements on parcels along the route of the existing brick culvert
- **ICW - Recommendation #7:** The existing brick culvert be inspected on at least an annual basis
- **ICW - Recommendation #8:** The Township notify and educate residents in the Upper Ithan Creek Watershed of the flooding issues in that area

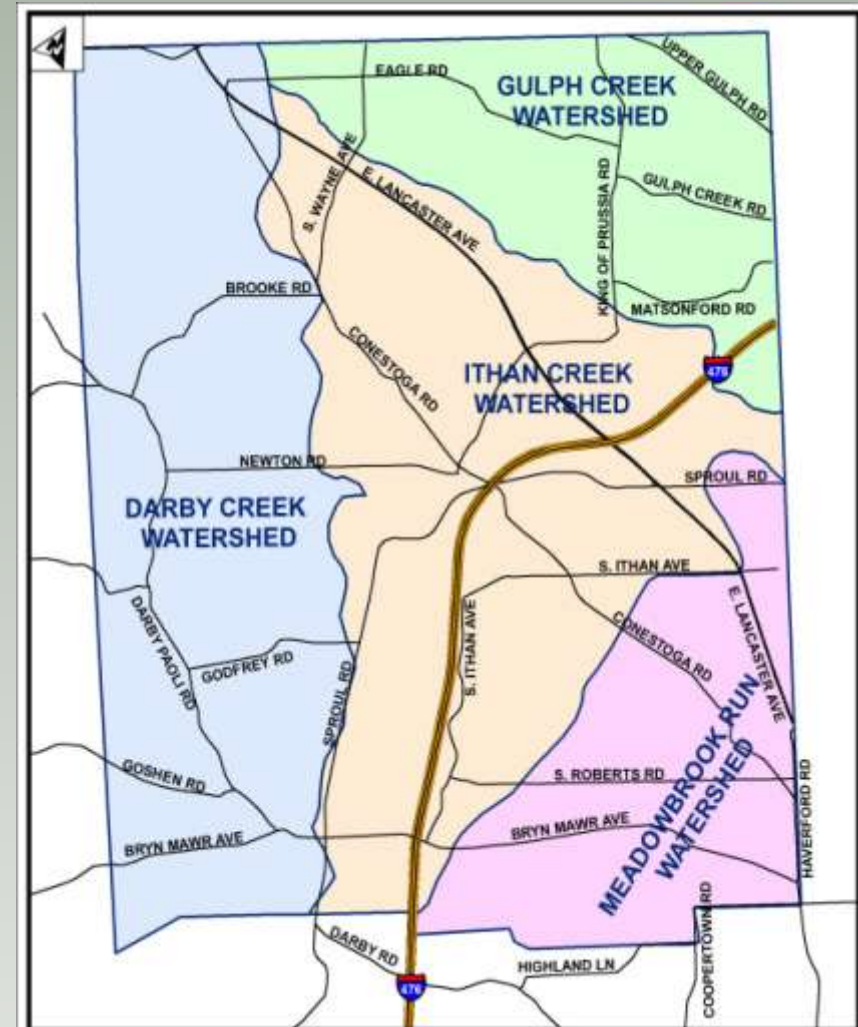
STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Gulph Creek Watershed*

❑ Gulph Creek Watershed has a 2,000 acre tributary as it leaves the Township

❑ The land use is primarily single family residential, transportation facilities, college/educational campuses



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Gulph Creek Watershed (cont.)*

☐ Watershed Drainage Issues

- The existing Gulph Creek channel and its culvert crossings are undersized even for the 5-year storm event and existing utilities cross the creek above the channel bottom reducing the capacity of the creek and other encroachments and obstructions within the stream corridor



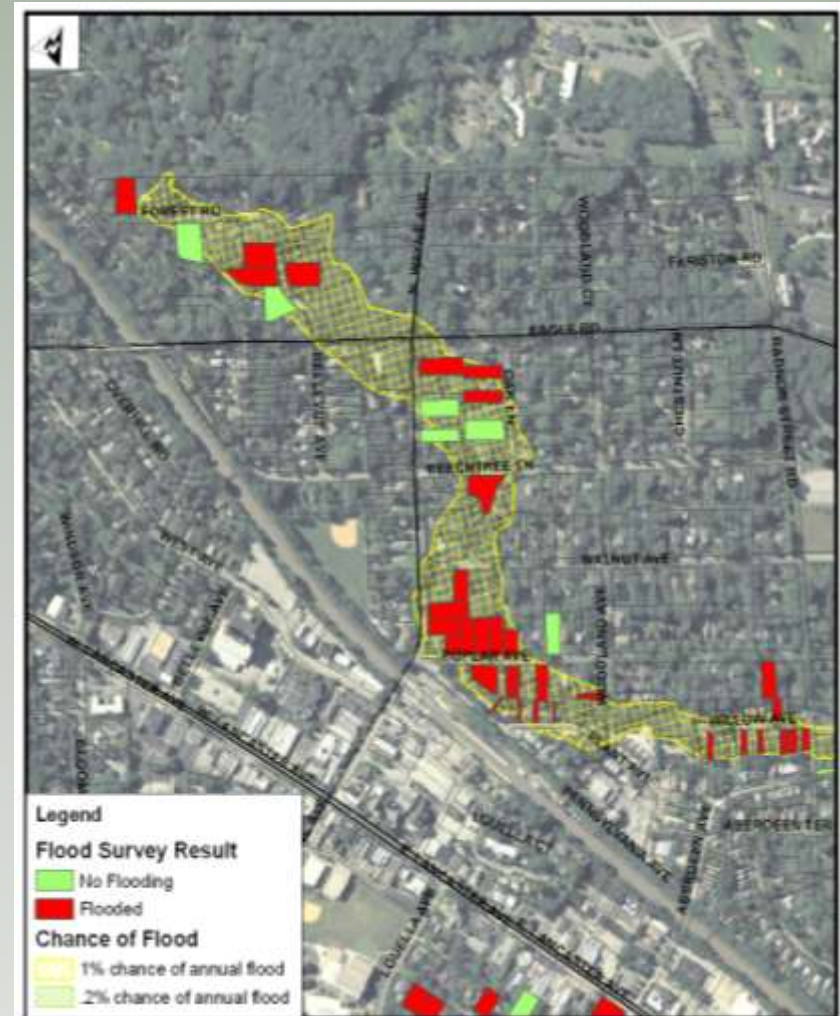
STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Gulph Creek Watershed (cont.)*

□ Watershed Drainage Issues (cont.)

- The correlation of survey respondents and the location of those parcels relative to the established FEMA floodplain



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Gulph Creek Watershed (cont.)*

☐ **Watershed Drainage Issues (cont.)**

- The detention basin at North Wayne Field has experienced problems in the past and is believed to not be functioning properly.
- Numerous other maintenance issues throughout the corridor.



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Gulph Creek Watershed (cont.)*

□ Watershed Drainage Recommendations

- **Gulph Creek Watershed (GCW) - Recommendation #1:** Radnor Township take immediate steps to remove debris and obstructions along the drainage corridor and establish and on-going maintenance plan for all existing creeks, streams and culverts along Gulph Creek and its tributaries
- **GCW - Recommendation #2:** Correct and re-establish the underground detention system at North Wayne Park
- **GCW - Recommendation #3:** Install control measures to direct the stormwater adequate flood routing along the Forest Road Corridor.
- **GCW - Recommendation #4:** Create a more uniform stream channel between Woodland Avenue and Willow Avenue
- **GCW - Recommendation #5:** The Township consider a program to purchase properties that have a documented history of consistent re-occurring structural flooding.

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Meadowbrook Run Watershed*

❑ Meadowbrook Run Watershed has a 1,530 acre tributary as it leaves the Township

❑ The land use is urban residential, retail, college campus, rural or low density residential



STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Meadowbrook Run Watershed*

☐ **Watershed Drainage Issues**

- According to the surveys collected problems in the Meadowbrook Run Watershed seem to be in isolated areas
- Residents in the Fairfax Road and Hickory Lane areas noted that substantial storm water flows came from the culvert under the Trolley Line and caused repeated backyard and structural flooding

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *Meadowbrook Run Watershed (cont.)*

□ Watershed Drainage Recommendations

- **Meadowbrook Run Watershed (MRW) Recommendation #1:** The Township should work cooperatively with Villanova University to test and implement state of the art stormwater best management practices

- **MRW - Recommendation #2:** The Township should notify and educate residents in the Upper Meadowbrook Run Watershed of the flooding issues in that area of the community

STORMWATER MANAGEMENT STUDY OF RADNOR TOWNSHIP, PENNSYLVANIA

➤ Summary of Findings

✓ *General Watershed*

□ **General Watershed Drainage Recommendations**

- **Other Recommendation #1**: The Township Develop and implement a stormwater utility to provide an equitable and uniform funding stream to maintain and improve the common system of public drainage

- **Other Recommendation #2**: The Township should include a credit program in any stormwater utility developed so to incentivize innovative and effective stormwater management initiatives