



August 13, 2015

Board of Commissioners
Radnor Township
301 Iven Avenue
Wayne, PA 19087

RE: Comments on the Draft Stormwater Ordinance Revision 2015

Dear Board of Commissioners,

The Delaware Riverkeeper Network has reviewed the Draft Stormwater Ordinance Revision, and we are providing our comments along with comments from a stormwater expert, Michele Adams Principal Engineer at Meliora Environmental Design, to further assist in your refinement of the Radnor Township stormwater ordinance revision. Attached please find a red lined version of the draft proposal put out for review and comment.

Overall, we feel that the draft ordinance provides a good start at modifying the township's current stormwater ordinance but there needs to be more focus on volume reduction rather than merely groundwater recharge. Furthermore, existing development should not be grandfathered but instead should be recognized as creating a needed opportunity to address deficiencies of the past when redevelopment occurs. Additional revisions to the stormwater ordinance that encourages best development practices will enhance the community, improve water quality, reduce flooding and flood damages, increase market value and marketability of impacted homes, and will bring Radnor Township into better alignment with modern stormwater legislative and regulatory goals, as well as proposed laws that are anticipated at the state level in the foreseeable future.

As you know, stormwater is a byproduct of human development. In natural conditions, the largest proportion of stormwater runoff is eliminated through evapotranspiration by vegetation. As such, the current draft's focus on recharge to the exclusion of evapotranspiration and volume reduction, the township is ignoring a large portion of the pre-development site hydrology. It is critical that the updated ordinance focuses on volume management such that there is no increase in the volume of runoff from new development and redevelopment projects. The greatest improvement to flooding issues and water quality will occur by maintaining the natural hydrology of impacted watersheds to the greatest degree possible and

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by preventing an increase in the volume of runoff. Some of DRN's suggested edits in the attached redlined document are aimed at more effectively reducing stormwater runoff volume.

Green infrastructure (GI) and low impact development (LID), can infiltrate, capture, and use stormwater runoff for enhancing the health of naturally vegetated areas, while at the same time reducing the impacts to local waterways and reducing the peak flow rates for larger storms. Some of the language in the current proposed revision could actually discourage or make it difficult for developers to use these advanced low impact development methods. As a result, some of DRN's suggested edits are aimed at encouraging the use of GI and LID which can be far more effective at volume reduction.

In addition to volume management, it would benefit Radnor to compliment the increased focus on volume reduction with a complimentary reduction in the peak rate reduction requirements under the current methodology —using this complimentary approach of volume reduction that acknowledges the peak rate reduction benefits such an approach provides an incentive for developers to support Radnor's stormwater approach. If the volume of stormwater is reduced, large detention basins are no longer necessary. If the ordinance fails to recognize the contribution to peak rate reduction that volume reduction provides, and as a result large detention basins are still required, there is no incentive for developers to utilize the best management practices that reduce runoff volume. An ordinance with both volume management and a complimentary reduced peak rate requirement, will encourage the use of the most progressive stormwater approaches resulting in better flood control and water quality improvements.

It is excellent that the revised ordinance uses a design rainfall of 1.5 inches. Based on the research by the National Research Council (NRC)¹ and the U.S. Environmental Protection Agency's (USEPA) guidance,² the Township is best served by the requirement that stormwater management measures capture runoff resulting from the 95% 24-hour storm. The 95% event would be about 1.6 to 1.8 inches, and therefore, the 1.5 inch requirement is a big step to increase runoff retention and pollution loading. Frequently-occurring but small storms account for the majority of the annual precipitation in our region. Runoff produced by these small storms and the initial portions of larger storms have the most impact on receiving waters. Some best management practices (BMPs) that will result from the modifications we are suggesting can actually completely remove many contaminants from small runoff events.

We are concerned that the revised ordinance contains a loop hole for existing development which functionally grandfathers them from doing any additional stormwater management when there is a redevelopment project implemented. Such a loophole actually perpetuates the status quo of flooding and water pollution resulting from stormwater runoff and prevents us from achieving the improvements necessary to protect flooded communities, to reduce pollution, and to comply with existing and soon to be instituted regulatory requirements . Instead, new stormwater management practices should be required every time redevelopment happens. The ordinance should ensure that redevelopment addresses the deficiencies of the past. And so, some of the suggested DRN edits in the attached document are aimed at closing this loop hole.

Because the revision of a township ordinance is a time-intensive and complex process, a primary goal should be to make this ordinance revision in better alignment with legislation and regulatory requirements that are anticipated in the foreseeable future. For example, the Pennsylvania Department of

¹ National Research Council (NRC). 2008. Urban Stormwater Management in the United States, The National Academies Press, Washington, DC.

² USEPA, Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act.

Environmental Protection (PADEP) has proposed changes to the PAG-13 NPDES General Permit for Discharges from Small MS4s. These new rules require that MS4s discharging to impaired surface waters implement specific best management practices that will achieve pollutant reduction to existing pollutant loading. All of the stream reaches in Radnor Township are impaired for either metals, PCBs, or siltation. Since close to 70% of the streams within the township are impaired for siltation, the new rules will have a large impact on regulatory requirements for stormwater management. Furthermore, PADEP will require municipalities to complete a Stormwater Management Ordinance Checklist. If Radnor Township does not have all of the requirements outlined in the Ordinance checklist, it will have one year to update its ordinance. The implications of this is that another new ordinance will have to be developed by 2019 if this current ordinance revision is not progressive enough to pass muster with the proposed rules.

As part of the revision, we urge the Township to add a minimum 100-foot riparian buffer requirement which is scientifically supported as the minimum buffer width needed for flood damage reduction and water quality protection and is aligned with proposed state legislation requirements now moving through the state legislature. It is critical for water quality and flood protection that the Township include a minimum 100-foot riparian forest buffer requirement. Scientific research has continually shown that zones of streamside vegetation are effective at protecting streams and enhancing water resources from land-use impacts.³ Failing to mandate minimum 100-foot stream buffer protections in the draft stormwater ordinance revision fails to support modern science on this important stormwater related subject. Furthermore, local Pennsylvania State Senators have proposed a legislative initiative that seeks to improve the Commonwealth's water quality by ensuring a minimum 100-foot riparian buffer for all streams. By updating your stormwater ordinance to include similar provisions, you will be in compliance with future state requirements if passed and therefore, will not need to revise your ordinance again when this legislation becomes state law. Some of the suggested DRN edits in the attached document would allow Radnor Township to get out ahead of the curve legally while at the same time improve the water quality, flooding and erosion issues by requiring a 100-foot riparian buffer for all streams.

Thank you for your consideration of the Delaware Riverkeeper Network's suggested edits. We would be happy to meet with you in person at an open public forum to explain in greater detail why these edits are so important for Radnor Township. We hope that you will support forward advancement of water quality and water quantity protection in Radnor Township by including these proposed revisions. Please do not hesitate to contact us should you have questions or require additional information.

Respectfully,



Maya K. van Rossum
the Delaware Riverkeeper

Enclosures (1) Meliora Design's suggested modifications to the Draft Stormwater Ordinance Revisions 2015, Michelle Adams, PE, Principal Engineer, Meliora Design, LLC.
(text edits are shown in red underlined text, comments are shown as highlighted text).

Cc: Mr. Bob Zienkowski, Township Manager, Mr. Steve Norcini, P.E., Township Engineer

³ Sweeney, B. W., & Newbold, J. D. (2014). Streamside Forest Buffer Width Needed to Protect Stream Water Quality, Habitat, and Organisms: A Literature Review. *JAWRA Journal of the American Water Resources Association*, 50(3), 560-584.; Sweeney, B.W., (1992). Streamside Forests and the Physical, Chemical and Trophic Characteristics of Piedmont Streams in Eastern North America. *Water Science and Technology* 26:2653-2673.; Welsch, D. (1991). Forest Resources Management, USDA Forest Service, "Riparian Forest Buffers: Function and Design for Protection and Enhancement of Water Resources", NA-PR-07-91.; Newbold et al. (1980). Effects of Logging on Macroinvertebrates in Streams with and without buffer strips. *Canadian Journal of Fisheries and Aquatic Sciences* 37(7): 1076-1085.

Chapter 245. STORMWATER MANAGEMENT

[HISTORY: Adopted by the Board of Commissioners of the Township of Radnor 5-9-2005 by Ord. No. 2005-11. Editor's Note: This ordinance also repealed former Ch. 245, Stormwater Management, consisting of Art. I, Limitations on Increase of Impervious Surfaces, adopted 9-9-1980 by Ord. No. 80-17, as amended. Amendments noted where applicable.]

GENERAL REFERENCES

Building construction — See Ch. 125.
Grading, excavations and fills — See Ch. 175.
Subdivision of land — See Ch. 255.
Zoning — See Ch. 280.

Article I. General Provisions

§ 245-1. Short title.

This chapter shall be known as the "Radnor Township Stormwater Management Ordinance."

§ 245-2. Statement of findings.

The governing body of the municipality finds that:

- A. Increased volumes of runoff and Inadequate-inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows, volumes, and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces ground water recharge, and threatens public health and safety.
- B. Inadequate planning and management of stormwater runoff resulting from land development throughout a watershed can also harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of streambeds and streambanks, thereby elevating sedimentation), destroying aquatic habitat, and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals, and pathogens. Ground water resources are also impacted through loss of recharge.
- C. A comprehensive program of stormwater management, including the use of low impact development practices to restore natural hydrology and the minimization of impacts of development, redevelopment, and activities causing accelerated erosion and loss of natural infiltration, is fundamental to the public health, safety, welfare, and the protection of the people of the municipality and all of the people of the commonwealth, their resources, and the environment.
- D. The harm caused by inadequate stormwater management from existing development must be addressed when redevelopment occurs, and redevelopment is an opportunity to provide adequate stormwater management for developed sites that previously did not have stormwater management.

- ~~D~~E. Stormwater can be an important water resource by providing ground water recharge for water supplies and baseflow of streams, which also protects and maintains surface water quality.
- ~~F~~E. Impacts from stormwater runoff can be minimized by using project designs that maintain the natural hydrologic regime and sustain high water quality, ground water recharge, stream baseflow, and aquatic ecosystems. The most cost-effective and environmentally advantageous way to manage stormwater runoff is through nonstructural project design that minimizes impervious surfaces and sprawl, avoids sensitive areas (i.e., stream buffers, floodplains, steep slopes), and considers topography and soils to maintain the natural hydrologic regime.
- ~~F~~G. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.
- ~~G~~H. Federal and state regulations require certain municipalities to implement a program of stormwater controls. These municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).
- ~~H~~I. Nonstormwater discharges to municipal separate storm sewer systems can contribute to pollution of waters of the commonwealth by the municipality.

§ 245-3. Purpose.

The purpose of this chapter is to promote the public health, safety, and welfare within the municipality by maintaining [and restoring](#) the natural hydrologic regime and minimizing the impacts described in § 245-2 of this chapter through provisions designed to:

- ~~A~~. ~~A~~–Promote alternative project designs and layouts that minimize the impacts on surface and ground water.
- ~~B~~. [Utilize Green Infrastructure, and Lower Impact Development design and practices to promote infiltration, evapotranspiration and re-use of stormwater, and to effectively reduce the total volume of runoff.](#)
- ~~C~~B. Promote nonstructural best management practices (BMPs).
- ~~D~~C. Minimize increases in runoff stormwater volume.
- ~~E~~D. [Mitigate adverse stormwater impacts from existing development when redevelopment occurs by providing stormwater management for redevelopment projects.](#)
- ~~F~~. Minimize impervious surfaces.
- ~~F~~G. ~~E~~. Manage accelerated stormwater runoff and erosion and sedimentation problems and stormwater runoff impacts at their source by regulating activities that cause these problems.
- ~~G~~H~~F~~. Provide review procedures and performance standards for stormwater planning and management.
- ~~H~~I~~G~~. Utilize and preserve existing natural drainage systems as much as possible.
- ~~I~~H. Manage stormwater impacts close to the runoff source, requiring a minimum of structures and relying on natural processes.
- ~~J~~K~~I~~. Focus on infiltration of stormwater to maintain ground water recharge, to prevent degradation of surface and ground water quality, and to otherwise protect water resources.
- ~~K~~L~~J~~. Maintain existing baseflows and quality of streams and watercourses.
- ~~L~~M~~K~~. Meet legal water quality requirements under state law, including regulations at 25 Pennsylvania Code Chapter 93.4.a requiring protection and maintenance of existing uses and

maintenance of the level of water quality to support those uses in all streams, and the protection and maintenance of water quality in "special protection" streams [and the required improvement of streams currently identified on Pennsylvania's 303\(d\) list through the implementation of stormwater policies and practices to address existing causes of impairment.](#)

MNL. Address the quality and quantity of stormwater discharges from the development site.

NOM. Provide a mechanism to identify stormwater controls necessary to meet NPDES permit requirements.

OPN. Implement an illegal discharge detection and elimination program that addresses nonstormwater discharges into the municipality's separate storm sewer system.

PQO. Preserve the flood-carrying [and flood mitigating](#) capacity of streams [and floodplains](#).

QRP. Prevent scour and erosion of streambanks and streambeds.

RSQ. Provide performance standards and design criteria for watershed-wide stormwater management and planning.

STR. Provide proper operation and maintenance of all permanent stormwater management facilities and BMPs that are implemented in the municipality.

§ 245-4. Statutory authority.

The municipality is empowered to regulate land use activities that affect runoff and surface and ground water quality and quantity by the authority of:

- A. The Act of October 4, 1978, 32 P.S., P.L. 864 (Act 167) § 680.1 et seq., as amended, the "Stormwater Management Act" (hereinafter referred to as "the Act");
- B. The Water Resources Management Act of 2002, as amended;
- C. The Pennsylvania Municipalities Planning Code, Act 247, as amended.

§ 245-5. Applicability/regulated activities.

- A. This chapter shall apply to all areas of Radnor Township.
- B. This chapter shall only apply to permanent structural and nonstructural stormwater management BMPs constructed as part of any of the regulated activities listed in this section.
- C. This chapter contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Local stormwater management design criteria (e.g., inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable municipal ordinances and applicable state regulations.
- D. The following activities are defined as "regulated activities" and shall be regulated by this chapter unless exempted by § 245-6.
 - (1) Land development.
 - (2) Subdivisions.
 - (3) Alteration of the natural hydrologic regime.
 - (4) Construction or reconstruction of or addition of new impervious or semiimpervious surfaces (i.e., driveways, parking lots, roads, etc.).
 - (5) Construction of new buildings or additions to existing buildings.
 - (6) Redevelopment.
 - (7) Diversion piping or encroachments in any natural or man-made channel.

- (8) Nonstructural and structural stormwater management BMPs or appurtenances thereto.
- (9) Earth disturbance activities of greater than 5,000 square feet. *Editor's Note: This ordinance applies to any earth disturbance activity greater than or equal to 5,000 square feet that is associated with a development or redevelopment project. Earth disturbance activities of less than one acre that are associated with redevelopment projects are exempt from the § 245-24 streambank erosion requirements. Earth disturbance activities and associated stormwater management controls are also regulated under existing state law and implementing regulations. This ordinance shall operate in coordination with those parallel requirements; the requirements of this ordinance shall be no less restrictive in meeting the purposes of this ordinance than state law.*
- E. Any of the above regulated activities which were approved more than five years prior to the effective date of this chapter and resubmitted for municipal approval.
- F. Table 105.1 summarizes the applicability requirements of the chapter. *Editor's Note: Table 105.1 is included at the end of this chapter.* "Proposed impervious surface" in Table 105.1 includes new, additional, or replacement impervious surface/cover. Repaving existing surfaces without reconstruction does not constitute "replacement."

§ 245-6. Exemptions.

- A. Exemptions for land use activities. The following land use activities are exempt from the drainage plan submission requirements of this chapter.
 - (1) Use of land for gardening for home consumption.
 - (2) Agriculture when operated in accordance with a conservation plan, nutrient management plan, or erosion and sedimentation control plan approved by the County Conservation District, including activities such as growing crops, rotating crops, tilling of soil, and grazing animals. Installation of new or expansion of existing farmsteads, animal housing, waste storage, and production areas having impervious surfaces that result in a net increase in earth disturbance of greater than 5,000 square feet shall be subject to the provisions of this chapter.
 - (3) Forest management operations which are following the Department of Environmental Protection's (DEP) management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an approved erosion and sedimentation plan and must comply with the stream buffer requirements in § 245-23G.
 - (4) Road replacement, development, or redevelopment that has less than 1,500 square feet of new, additional, or replaced impervious surface/cover, or in the case of earth disturbance only, less than 5,000 square feet of disturbance, is exempt from this chapter.
- B. Exemptions for land development activities.
 - (1) The following land development and earthmoving activities are exempt from the drainage plan submission requirements of this chapter.
 - (a) A maximum of 1,500 square feet of new, additional, or replacement proposed impervious surface or, in the case of earth disturbance resulting in less than 1,500 square feet of impervious cover (as noted above).
 - (b) Up to a maximum of 5,000 square feet of disturbed earth.
 - (2) These criteria shall apply to the total development even if the development is to take place in phases. The date of the municipal ordinance adoption shall be the starting point from which to

consider tracts as "parent tracts" upon which future subdivisions and respective earth disturbance computations shall be cumulatively considered.

If a property owner proposes a **150 square foot shed** after adoption of the municipal stormwater management Ordinance, that property owner would be **exempted from water quality and quantity requirements of the Ordinance as noted in Table 105.1 of the Ordinance**. If, at a later date, the property owner proposes to construct a 499 square foot room addition, the applicant would be required to comply with the requirements for the **Simplified Method for the full 649 square feet of impervious cover created since adoption of the municipal Ordinance**. If an additional 700 square foot swimming pool/patio is proposed later, the property owner would be required to implement the full stormwater quantity and quality control submission requirements of this Ordinance for the **total 1,349 square feet of additional impervious surface added to the original property since adoption of the municipal Ordinance**.

- (3) The activities exempted above are still encouraged to implement the voluntary stormwater management practices as indicated in Appendix B. *Editor's Note: Appendix B is on file in Township offices.*
 - (4) The developer should first determine if the proposed activity would result in the introduction of 1,500 square feet or more of new, additional, or replacement impervious surface. If not, the developer should next determine if the proposed activity would involve earthmoving of over 5,000 square feet. If not, then the project is exempt from the drainage plan requirements.
Examples:
 - (a) A project introducing 1,600 square feet of impervious cover, but only 4,900 square feet of earthmoving is regulated by this chapter.
 - (b) A project involving 5,100 square feet of earthmoving, but resulting in 1,400 square feet of impervious cover is regulated.
 - (c) A project introducing 1,400 square feet of impervious cover and involving 4,900 square feet of earthmoving is exempt from the drainage plan requirements of this chapter.
- C. Additional exemption criteria:
- (1) Exemption responsibilities. An exemption shall not relieve the applicant from implementing such measures as are necessary to protect public health, safety, and property.
 - (2) HQ and EV streams. An exemption shall not relieve the applicant from meeting the special requirements for watersheds draining to identified high quality (HQ) or exceptional value (EV) waters and Source Water Protection Areas (SWPA) and requirements for nonstructural project design sequencing (§ 245-21).

- (3) Drainage problems. If a drainage problem is documented or known to exist downstream of or is expected from the proposed activity, then the municipality may require the applicant to comply with this chapter.
- (4) Emergency exemption. Emergency maintenance work performed for the protection of public health, safety, and welfare. A written description of the scope and extent of any emergency work performed shall be submitted to Radnor Township within two calendar days of the commencement of the activity. If Radnor Township finds that the work is not an emergency, then the work shall cease immediately, and the requirements of this chapter shall be addressed, as applicable.
- (5) Maintenance exemption. Any maintenance to an existing stormwater management system made in accordance with plans and specifications approved by the municipal Engineer or Radnor Township.
- (6) Even though the developer is exempt, he is not relieved from complying with other regulations.

§ 245-7. Repealer.

Any ordinance or ordinance provision of the municipality inconsistent with any of the provisions of this chapter is hereby repealed to the extent of the inconsistency only.

§ 245-8. Severability.

Should any section or provision of this chapter be declared invalid by a court of competent jurisdiction, such decision shall not affect the validity of any of the remaining provisions of this chapter.

§ 245-9. Compatibility with other ordinances or legal requirements.

- A. Approvals issued pursuant to this chapter do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance.
- B. To the extent that this chapter imposes more rigorous or stringent requirements for stormwater management, the specific requirements contained in this chapter shall be followed.
- C. Nothing in this chapter shall be construed to affect any of the municipality's requirements regarding stormwater matters that do not conflict with the provisions of this chapter, such as local stormwater management design criteria (e.g., inlet spacing, inlet type, collection system design and details, outlet structure design, etc.). Conflicting provisions in other municipal ordinances or regulations shall be construed to retain the requirements of this chapter addressing state water quality requirements.

Article II. Definitions

§ 245-10. Interpretation.

For the purposes of this chapter, certain terms and words used herein shall be interpreted as follows:

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example, but is intended to extend its meaning to all other instances of like kind and character.
- C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, unit of government, or any other similar entity.
- D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- E. The words "used" or "occupied" include the words "intended, designed, maintained, or arranged to be used, occupied, or maintained."

§ 245-11. Definitions.

As used in this chapter, the following terms shall have the meanings indicated:

ACCELERATED EROSION

The removal of the surface of the land through the combined action of man's activity and the natural processes at a rate greater than would occur because of the natural process alone.

AGRICULTURAL ACTIVITIES

The work of producing crops and raising livestock, including tillage, plowing, disking, harrowing, pasturing, mushroom growing, nursery, and sod operations and installation of conservation measures. Construction of new buildings or impervious area is not considered an agricultural activity.

ALTERATION

As applied to land, a change in topography as a result of the moving of soil and rock from one location or position to another; also the changing of surface conditions by causing the surface to be more or less impervious; land disturbance.

APPLICANT

A person who has filed an application for approval to engage in any regulated activity defined in § 245-5 of this chapter.

AS-BUILT DRAWINGS

Engineering or site drawings maintained by the contractor as he constructs the project and upon which he documents the actual locations of the building components and changes to the original contract documents. These documents, or a copy of same, are turned over to the municipal Engineer at the completion of the project.

BANKFULL

The channel at the top-of-bank or point from where water begins to overflow onto a floodplain.

BASEFLOW

Portion of stream discharge derived from ground water; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

BIORETENTION

A stormwater retention area that utilizes woody and herbaceous plants and soils to remove pollutants before infiltration occurs.

BMP (BEST MANAGEMENT PRACTICE)

Methods, measures, or practices used to prevent or reduce surface runoff and/or water pollution, including but not limited to structural and nonstructural stormwater management practices and operation and maintenance procedures. See also "nonstructural best management practice (BMP)."

BUFFER

The area of land immediately adjacent to any stream, measured perpendicular to and horizontally from the top-of-bank on both sides of a stream (see "top-of-bank").

CHANNEL

An open drainage feature through which stormwater flows. Channels include, but shall not be limited to, natural and man-made drainageways, swales, streams, ditches, canals, and pipes flowing partly full.

CHANNEL EROSION

The widening, deepening, or headward cutting of channels and waterways caused by stormwater runoff or bankfull flows.

CISTERN

An [aboveground or](#) underground reservoir or tank for storing rainwater.

CONSERVATION DISTRICT

The Delaware County Conservation District.

CONVEYANCE

A facility or structure used for the transportation or transmission of something from one place to another.

CULVERT

A structure with its appurtenant works which carries water under or through an embankment or fill.

DAM

A man-made barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semifluid. A dam may include a refuse bank, fill, or structure for highway, railroad, or other purposes which impounds or may impound water or another fluid or semifluid.

DEPARTMENT

The Pennsylvania Department of Environmental Protection.

DESIGNEE

The agent of the Delaware County Planning Commission, Delaware County Conservation District, and/or agent of the governing body involved with the administration, review, or enforcement of any provisions of this chapter by contract or memorandum of understanding.

DESIGN PROFESSIONAL (QUALIFIED)

A Pennsylvania-registered [P](#)rofessional [E](#)ngineer, [Registered Landscape Architect](#), or [R](#)egistered [P](#)rofessional [L](#)and [S](#)urveyor [\[surveyors are not trained to develop](#)

[stormwater plans](#)) trained to develop stormwater management [site plans and calculations](#).

DESIGN STORM

The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g., a five-year storm) and duration (e.g., 24 hours), used in the design and evaluation of stormwater management systems.

DETENTION BASIN

An impoundment designed to collect and retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. Detention basins are designed to drain completely soon after a rainfall event and become dry until the next rainfall event.

DEVELOPER

A person who seeks to undertake any regulated earth disturbance activities at a project site in the municipality.

DEVELOPMENT

Any human-induced change to improved or unimproved real estate, whether public or private, including but not limited to land development, construction, installation, or expansion of a building or other structure, land division, street construction, drilling, and site alteration, such as embankments, dredging, grubbing, grading, paving, parking or storage facilities, excavation, filling, stockpiling, or clearing. As used in this chapter, development encompasses both new development and redevelopment.

DEVELOPMENT SITE

The specific tract or parcel of land where any regulated activity set forth in § 245-5 is planned, conducted, or maintained.

DIAMETER AT BREAST HEIGHT (DBH)

The outside bark diameter at breast height which is defined as 4.5 feet (1.37m) above the forest floor on the uphill side of the tree.

DIFFUSED DRAINAGE DISCHARGE

Drainage discharge that is not confined to a single point location or channel, including sheet flow or shallow concentrated flow.

DISCHARGE

- A. (verb) To release water from a project, site, aquifer, drainage basin, or other point of interest;
- B. (noun) The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second (see "peak discharge").

DISCHARGE POINT

The point of discharge for a stormwater facility.

DISTURBED AREAS

Unstabilized land area where an earth disturbance activity is occurring or has occurred ([milling and paving that does not disturb subbase is not considered disturbance](#)).

DITCH

A man-made waterway constructed for irrigation or stormwater conveyance purposes.

DOWNSLOPE PROPERTY LINE

That portion of the property line of the lot, tract, or parcels of land being developed, located such that overland or pipe flow from the project site would be directed towards it by gravity.

DRAINAGE CONVEYANCE FACILITY

A stormwater management facility designed to transport stormwater runoff that includes channels, swales, pipes, conduits, culverts, and storm sewers.

DRAINAGE EASEMENT

A right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

DRAINAGE PERMIT

A permit issued by the municipality after the drainage plan has been approved.

DRAINAGE PLAN

The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in § 245-13.

EARTH DISTURBANCE ACTIVITY

A construction or other human activity which disturbs the surface of land, including but not limited to clearing and grubbing, grading, excavations, embankments, land development, agricultural plowing or tilling, timber harvesting activities, road maintenance activities, mineral extraction, and the moving, depositing, stockpiling, or storing of soil, rock, or earth materials.

EMERGENCY SPILLWAY

A conveyance area that is used to pass peak discharge greater than the maximum design storm controlled by the stormwater facility.

ENCROACHMENT

A structure or activity that changes, expands, or diminishes the course, current, or cross section of a watercourse, floodway, or body of water.

EROSION

The process by which the surface of the land, including water/stream channels, is worn away by water, wind, or chemical action.

EROSION AND SEDIMENT CONTROL PLAN

A plan that is designed to minimize accelerated erosion and sedimentation. Said plan must be submitted to and approved by the appropriate conservation district before construction can begin.

EXCEPTIONAL VALUE WATERS

Surface waters of high quality which satisfy Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, § 93.4b(b) (relating to antidegradation).

EXISTING CONDITIONS

~~The initial condition of a project site prior to the proposed alteration. If the initial condition of the site is undeveloped land, the land use shall be considered as "meadow" unless the natural land cover is proven to generate a lower curve number or Rational "e" value, such as forested lands.~~ *(It is important that "grandfathering" of existing developed conditions be eliminated. Therefore, this definition should be eliminated and a new*

definition for predevelopment conditions added (below). Then reference the predevelopment definition in the requirements to close the gap.)

FLOOD

A temporary condition of partial or complete inundation of land areas from the overflow of streams, rivers, and other waters of this commonwealth.

FLOODPLAIN

Any land area susceptible to inundation by water from any natural source or as delineated by the applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary Map as being a special flood hazard area. *(This definition would be more rigorous if it used the DEP definition for areas that are not mapped by FEMA. Where floodplains are not mapped, DEP assumes 50' from edge of defined streambank.)*

FLOODWAY

The channel of a watercourse and those portions of the adjoining floodplains which are reasonably required to carry and discharge the one-hundred-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by the Federal Emergency Management Agency (FEMA). In an area where no FEMA maps or studies have defined the boundary of the one-hundred-year frequency floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the stream to 50 feet from the top-of-bank.

FLUVIAL GEOMORPHOLOGY

The study of landforms associated with river channels and the processes that form them.

FOREST MANAGEMENT/TIMBER OPERATIONS

Planning and associated activities necessary for the management of forest lands. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, and reforestation.

FREEBOARD

A vertical distance between the elevation of the design high-water and the top of a dam, levee, tank, basin, swale, or diversion berm. The space is required as a safety margin in a pond or basin.

GRADE

A. (noun) A slope, usually of a road, channel, or natural ground specified in percent and shown on plans as specified herein.

B. (verb) To finish the surface of a roadbed, the top of an embankment, or the bottom of an excavation.

GRASSED WATERWAY

A natural or man-made waterway, usually broad and shallow, covered with erosion-resistant grasses, used to convey surface water.

GREEN INFRASTRUCTURE

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments by retaining all rainfall events 1.5” and less and

[mimicking natural hydrologic conditions during these rainfall events. This volume management reduces flooding during larger rainfall events.](#)

GROUNDWATER

Water beneath the earth's surface that supplies wells and springs and is often between saturated soil and rock.

GROUNDWATER RECHARGE

The replenishment of existing natural underground water supplies from rain or overland flow.

HEC-HMS

The U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) - Hydrologic Modeling System (HMS). This model was used to model the Darby-Cobbs and Crum Creek watersheds during the Act 167 plan development and was the basis for the standards and criteria of this chapter.

HIGH QUALITY WATERS

Surface waters having quality which exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water by satisfying Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, § 93.4b(a).

HOTSPOTS

Areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

HYDROGRAPH

A graph representing the discharge of water versus time for a selected point in the drainage system.

HYDROLOGIC REGIME

The hydrologic cycle or balance that sustains quality and quantity of stormwater, baseflow, storage, and ground water supplies under natural conditions [or undisturbed forest conditions.](#)

HYDROLOGIC SOIL GROUP

A classification of soils by the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), into four runoff potential groups. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

IMPERVIOUS SURFACE

A surface that prevents the infiltration of water into the ground. Impervious surfaces include, but are not limited to, streets, sidewalks, pavements, driveway areas, or roofs. Any surface areas designed to be gravel or crushed stone shall be regarded as impervious surfaces [unless specifically designed and demonstrated to be pervious. Lawns are presumed to be impervious unless bulk density testing demonstrates otherwise.](#)

IMPOUNDMENT

A retention or detention basin designed to retain stormwater runoff and release it at a controlled rate.

INFILL

Development that occurs on smaller parcels that remain undeveloped but are within or in very close proximity to urban or densely developed areas. Infill development usually relies on existing infrastructure and does not require an extension of water, sewer, or other public utilities.

INFILTRATION

Movement of surface water into the soil, where it is absorbed by plant roots, evaporated into the atmosphere, or percolated downward to recharge ground water.

INFILTRATION STRUCTURES

A structure designed to direct runoff into the underground water (e.g., French drains, seepage pits, or seepage trenches).

INFLOW

The flow entering the stormwater management facility and/or BMP.

INLET

The upstream end of any structure through which water may flow.

INTERMITTENT STREAM

A stream that flows only part of the time. Flow generally occurs for several weeks or months in response to seasonal precipitation or ground water discharge.

INVERT

The lowest surface, the floor or bottom of a culvert, drain, sewer, channel, basin, BMP, or orifice.

LAND DEVELOPMENT

Any of the following activities:

A. The improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving:

(1) A group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure; or

(2) The division or allocation of land or space, whether initially or cumulatively, between or among two or more existing or prospective occupants by means of, or for the purpose of, streets, common areas, leaseholds, condominiums, building groups, or other features.

B. A subdivision of land.

C. Development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

LIMITING ZONE

A soil horizon or condition in the soil profile or underlying strata that includes one of the following:

A—A seasonal high-water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.

B. A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.

C. A rock formation, other stratum, or soil condition that is so slowly permeable that it effectively limits downward passage of water.

LOT

A designated parcel, tract, or area of land established by a plat or otherwise as permitted by law and to be used, developed, or built upon as a unit.

LOW IMPACT DEVELOPMENT (LID)

An approach to land development (or redevelopment) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective impervious to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product.

MAIN STEM (MAIN CHANNEL)

Any stream segment or other runoff conveyance used as a reach in watershed-specific hydrologic models.

MANNING EQUATION (MANNING FORMULA)

A method for calculation of velocity of flow (e.g., feet per second) and flow rate (e.g., cubic feet per second) in open channels based upon channel shape, roughness, depth of flow, and slope. "Open channels" may include closed conduits so long as the flow is not under pressure.

MAXIMUM DESIGN STORM

The maximum (largest) design storm that is controlled by the stormwater facility.

MUNICIPAL ENGINEER

A Professional Engineer licensed as such in the Commonwealth of Pennsylvania, duly appointed as the Engineer for a Municipality, planning agency, or joint planning commission.

MUNICIPALITY

Radnor Township, Delaware County, Pennsylvania.

NATURAL CONDITION

Predevelopment condition or undisturbed conditions that existed prior to human alteration and disturbance, assumed to be forest in good condition.

NATURAL HYDROLOGIC REGIME

See "hydrologic regime."

NATURAL RECHARGE AREA

Undisturbed surface area or depression where stormwater collects and a portion of which infiltrates and replenishes the underground and ground water.

NONPOINT SOURCE POLLUTION

Pollution that enters a water body from diffuse origins in the watershed and does not result from discernible, confined, or discrete conveyances.

NONSTORMWATER DISCHARGES

Water flowing in stormwater collection facilities, such as pipes or swales, which is not the result of a rainfall event or snowmelt.

NONSTRUCTURAL BEST MANAGEMENT PRACTICE (BMPs)

Methods of preventing and controlling stormwater runoff quantity and quality, such as innovative site planning, impervious area and grading reduction, protection of natural depression areas, temporary ponding on site, riparian buffer protection and restoration, meadow or forest restoration, and other techniques.

NPDES

National Pollutant Discharge Elimination System, the federal government's system for issuance of permits under the Clean Water Act, which is delegated to DEP in Pennsylvania.

NRCS

Natural Resource Conservation Service (previously SCS).

OPEN CHANNEL

A conveyance channel that is not enclosed.

OUTFALL

"Point source" as described in 40 CFR § 122.2 at the point where the municipality's storm sewer system discharges to surface waters of the commonwealth.

OUTFLOW

The flow exiting the stormwater management facility and/or BMP.

OUTLET

Points of water disposal to a stream, river, lake, tidewater, or artificial drain.

PARENT TRACT

The parcel of land from which a land development or subdivision originates, determined from the date of municipal adoption of this chapter.

PARKING LOT STORAGE

Involves the use of parking areas as temporary impoundments with controlled release rates during rainstorms.

PEAK DISCHARGE

The maximum rate of stormwater runoff from a specific storm event.

PENN STATE RUNOFF MODEL

The computer-based hydrologic model developed at Pennsylvania State University.

PIPE

A culvert, closed conduit, or similar structure (including appurtenances) that conveys stormwater.

PLANNING COMMISSION

The Planning Commission of Radnor Township.

POINT SOURCE

Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, or conduit from which stormwater is or may be discharged, as defined in state regulations at 25 Pennsylvania Code § 92.1.

POSTCONSTRUCTION

Period after construction during which disturbed areas are stabilized, stormwater controls are in place and functioning, and all proposed improvements in the approved land development plan are completed.

PRECONSTRUCTION

Prior to commencing construction activities.

PREDEVELOPMENT CONDITION

Undeveloped/natural condition [assumed to be the initial condition of a project site prior to any human alterations. The initial condition of a site is assumed to be forest in good condition.](#)

PRETREATMENT

Techniques employed in stormwater BMPs to provide storage or filtering to trap coarse materials and other pollutants before they enter the system, but not necessarily designed to meet the water quality volume requirements of § 245-23.

PROJECT SITE

The specific area of land where any regulated activities in the municipality are planned, conducted, or maintained.

RATIONAL FORMULA

A rainfall-runoff relation used to estimate peak flow. [The rational method or the modified rational methods should not be used to estimate runoff volumes.](#)

REACH

Any stream segment or other runoff conveyance used in the watershed-specific hydrologic models.

RECHARGE

The replenishment of ground water through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

RECONSTRUCTION

Demolition and subsequent rebuilding of impervious surface.

RECORD DRAWINGS

Original documents revised to suit the as-built conditions and subsequently provided by the engineer to the client. The engineer reviews the contractor's as-builts against his/her own records for completeness, then either turns these over to the client or transfers the information to a set of reproducible, in both cases for the client's permanent records.

REDEVELOPMENT

Any development that requires demolition or removal of existing structures or impervious surfaces at a site and replacement with new impervious surfaces. Maintenance activities such as top-layer grinding and re-paving are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment.

REGULATED ACTIVITIES

Actions or proposed actions that have an impact on stormwater runoff quality or quantity and that are specified in § 245-5 of this chapter.

REGULATED EARTH DISTURBANCE ACTIVITY

Defined under NPDES Phase II regulations as earth disturbance activity of one acre or more with a point source discharge to surface waters or the municipality's storm sewer system or five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part, or during any stage of a larger common plan of development.

RELEASE RATE

The percentage of existing conditions' peak rate of runoff from a site or subarea to which the proposed conditions' peak rate of runoff must be reduced to protect downstream areas.

REPAVING

Replacement of the impervious surface that does not involve reconstruction of an existing paved (impervious) surface.

REPLACEMENT PAVING

Reconstruction of and full replacement of an existing paved (impervious) surface.

RETENTION BASIN

A structure in which stormwater is stored and not released during the storm event. Retention basins are designed for infiltration [or other volume reduction](#) purposes and do not have an outlet. The retention basin must infiltrate stored [or otherwise remove](#) water in four days or less.

RETURN PERIOD

The average interval, in years, within which a storm event of a given magnitude can be expected to recur. For example, the twenty-five-year return period rainfall would be expected to recur on the average of once every 25 years.

RISER

A vertical pipe extending from the bottom of a pond that is used to control the discharge rate from the pond for a specified design storm.

ROAD MAINTENANCE

Earth disturbance activities within the existing road cross section, such as grading and repairing existing unpaved road surfaces, cutting roadbanks, cleaning or clearing drainage ditches, and other similar activities.

ROOF DRAINS

A drainage conduit or pipe that collects water runoff from a roof and leads it away from the structure.

ROOFTOP DETENTION

The temporary ponding and gradual release of stormwater falling directly onto flat roof surfaces using controlled-flow roof drains in building designs.

RUNOFF

Any part of precipitation that flows over the land surface.

SALDO

Subdivision and Land Development Ordinance. *Editor's Note: See Ch. 255, Subdivision and Land Development.*

SEDIMENT BASIN

A barrier, dam, or retention or detention basin located and designed in such a way as to retain rock, sand, gravel, silt, or other material transported by water during construction.

SEDIMENT POLLUTION

The placement, discharge, or any other introduction of sediment into the waters of the commonwealth.

SEDIMENTATION

The process by which mineral or organic matter is accumulated or deposited by the movement of water or air.

SEEPAGE PIT/SEEPAGE TRENCH

An area of excavated earth filled with loose stone or similar coarse material into which surface water is directed for infiltration into the underground water.

SEPARATE STORM SEWER SYSTEM

A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) primarily used for collecting and conveying stormwater runoff.

SHALLOW CONCENTRATED FLOW

Stormwater runoff flowing in shallow, defined ruts prior to entering a defined channel or waterway.

SHEET FLOW

A flow process associated with broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

SOIL COVER COMPLEX METHOD

A method of runoff computation developed by NRCS that is based on relating soil type and land use/cover to a runoff parameter called curve number (CN).

SOURCE WATER PROTECTION AREAS (SWPA)

The zone through which contaminants, if present, are likely to migrate and reach a drinking water well or surface water intake.

SPECIAL PROTECTION SUBWATERSHEDS

Watersheds that have been designated by DEP as EV or HQ waters.

SPILLWAY

A conveyance that is used to pass the peak discharge of the maximum design storm that is controlled by the stormwater facility.

STATE WATER QUALITY REQUIREMENTS

As defined under state regulations, protection of designated and existing uses (see 25 Pennsylvania Code Chapters 93 and 96), including:

- A. Each stream segment in Pennsylvania has a "designated use," such as "cold water fishery" or "potable water supply," which is listed in Chapter 93. These uses must be protected and maintained under state regulations.
- B. "Existing uses" are those attained as of November 1975, regardless of whether they have been designated in Chapter 93. Regulated earth disturbance activities must be designed to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams and to protect and maintain water quality in special protection streams.
- C. Water quality involves the chemical, biological, and physical characteristics of surface water bodies. After regulated earth disturbance activities are complete, these characteristics can be impacted by the addition of pollutants such as sediment and changes in habitat through increased flow volumes and/or rates as a result of changes in land surface area from those activities. Therefore, permanent discharges to surface waters must be managed to protect the streambank, streambed, and structural integrity of the waterway to prevent these impacts.

STORAGE INDICATION METHOD

A reservoir routing procedure based on solution of the continuity equation (inflow minus outflow equals the change in storage) with outflow defined as a function of storage volume and depth.

STORM FREQUENCY

The number of times that a given storm "event" occurs or is exceeded on the average in a stated period of years (see "return period").

STORM SEWER

A system of pipes and/or open channels that conveys intercepted runoff and stormwater from other sources but excludes domestic sewage and industrial wastes.

STORMWATER

The surface runoff generated by precipitation reaching the ground surface.

STORMWATER MANAGEMENT DISTRICT

Those subareas of a watershed in which some type of detention is required to meet the plan requirements and the goals of Act 167.

STORMWATER MANAGEMENT FACILITY

Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff quality, rate, or quantity. Typical stormwater management facilities include, but are not limited to, [Low Impact Development or Green Infrastructure practices such as bioretention, porous pavement, green roofs, and vegetated swales, and other practices such as](#) detention and retention basins, open channels, storm sewers, pipes, and infiltration structures.

STORMWATER MANAGEMENT PLAN

The watershed plan known as the "Darby and Cobbs Creeks Watershed Act 167 Stormwater Management Plan" for managing those land use activities that will influence stormwater runoff quality and quantity and that would impact the Darby and Cobbs Creeks watershed, adopted by Delaware County, Chester County, Montgomery County, and Philadelphia County as required by the Act of October 4, 1978, P.L. 864 (Act 167).

STORMWATER MANAGEMENT SITE PLAN

The plan prepared by the applicant or his representative indicating how stormwater runoff will be managed at the particular site of interest according to this chapter.

STREAM

A natural watercourse [including springs](#).

STREAM BUFFER

The land area adjacent to each side of a stream essential to maintaining water quality (see "buffer").

STREAM ENCLOSURE

A bridge, culvert, or other structure in excess of 100 feet in length upstream to downstream which encloses a regulated water of the commonwealth.

SUBAREA (SUBWATERSHED)

The smallest drainage unit of a watershed for which stormwater management criteria have been established in the stormwater management plan.

SUBDIVISION

The division or redivision of a lot, tract, or parcel of land, by any means into two or more lots, tracts, parcels, or other divisions of land including changes in existing lot lines, for the purpose, whether immediate or future, of lease, partition by the court for distribution to heirs or devisees, transfer of ownership, or building or lot development; provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than 10 acres not involving any new street or easement of access or any residential dwelling shall be exempted.

SURFACE WATERS OF THE COMMONWEALTH

Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface waters, or parts thereof, whether natural or artificial, within or on the boundaries of the commonwealth.

SWALE

A low-lying stretch of land that gathers or carries surface water runoff.

TIMBER OPERATIONS

See "forest management."

TIME-OF-CONCENTRATION (T_c)

The time required for surface runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. This time is the combined total of overland flow time and flow time in pipes or channels, if any.

TOP-OF-BANK

Highest point of elevation in a stream channel cross section at which a rising water level just begins to flow out of the channel and over the floodplain.

UNDEVELOPED CONDITION

Natural condition (see also "predevelopment condition") [assumed to be forest in good condition](#).

VERNAL POND

Seasonal depressional wetlands that are covered by shallow water for variable periods from winter to spring but may be completely dry for most of the summer and fall.

WATERCOURSE

A channel or conveyance of surface water having a defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

WATERS OF THE COMMONWEALTH

Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of the commonwealth.

WATERSHED

Region or area drained by a river, watercourse, or other body of water, whether natural or artificial.

WELLHEAD

1) A structure built over a well; 2) the source of water for a well.

WELLHEAD PROTECTION AREA

The surface and subsurface area surrounding a water supply well, well field, or spring supplying a public water system, through which contaminants are reasonably likely to move toward and reach the water source.

WET BASIN

Pond for urban runoff management that is designed to detain urban runoff and always contains water.

WETLAND

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, fens, and similar areas.

WOODS

A natural ground cover with more than one viable tree of a DBH of six inches or greater per 1,000 square feet which existed within three years of application; a cover condition for which SCS curve numbers have been assigned or to which equivalent rational method runoff coefficients have been assigned.

Article III. Drainage Plan Requirements

§ 245-12. General requirements.

For any of the activities regulated by this chapter, the preliminary or final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any earth disturbance activity may not proceed until the property owner or applicant or his/her agent has received written approval of a drainage plan from the municipality and an adequate erosion and sediment control plan review by the Conservation District.

§ 245-13. Drainage plan contents.

The drainage plan shall consist of a general description of the project including sequencing items described in § 245-21, calculations, maps, and plans. A note on the maps shall refer to the associated computations and erosion and sediment control plan by title and date. The cover sheet of the computations and erosion and sediment control plan shall refer to the associated maps by title and date. All drainage plan materials shall be submitted to the municipality in a format that is clear, concise, legible, neat, and well organized; otherwise, the drainage plan shall not be accepted for review and shall be returned to the applicant. The following items shall be included in the drainage plan:

A. General:

- (1) General description of the project including those areas described in § 245-21B.
- (2) General description of proposed permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.
- (3) Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.
- (4) An erosion and sediment control plan, including all reviews and letters of adequacy from the Conservation District if necessary.

- (5) A general description of proposed nonpoint source pollution controls.
 - (6) The Drainage Plan Application and completed fee schedule form and associated fee (Appendix C-1 *Editor's Note: Appendix C-1 is on file in Township offices.*).
 - (7) The Drainage Plan Checklist (Appendix C-2 *Editor's Note: Appendix C-2 is on file in Township offices.*).one
- B. Maps. Map(s) of the project area shall be submitted on twenty-four-inch by thirty-six-inch sheets and/or shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Delaware County. If the SALDO has more stringent criteria than this chapter, then the more stringent criteria shall apply. The contents of the map(s) shall include, but not be limited to:
- (1) The location of the project relative to highways, municipal boundaries, or other identifiable landmarks.
 - (2) Existing contours at intervals of ~~two-one~~ feet. ~~feet~~ *(one foot contours are more informative, especially for LID practices and it does not add anything to development costs to have a better survey and plan).*
 - (3) Existing streams, lakes, ponds, or other waters of the commonwealth within the project area.
 - (4) Other physical features, including flood hazard boundaries, stream buffers, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.
 - (5) The locations of all existing and proposed utilities, sanitary sewers, septic systems, wells, and waterlines within 50 feet of property lines.
 - (6) An overlay showing soil names and boundaries.
 - (7) Limits of earth disturbance, including the type and amount of impervious area that would be added.
 - (8) Proposed structures, roads, paved areas, and buildings.
 - (9) Final contours at intervals of ~~one two~~ feet.
 - (10) The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.
 - (11) The date of submission.
 - (12) A graphic and written scale of one inch equals no more than 50 feet; for tracts of 20 acres or more, the scale shall be one inch equals no more than 100 feet.
 - (13) A North arrow.
 - (14) The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
 - (15) Existing and proposed land use(s).
 - (16) A key map showing all existing man-made features beyond the property boundary that would be affected by the project.
 - (17) Location of all open channels.
 - (18) Overland drainage patterns and swales.
 - (19) A twenty-foot-wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way. *(This is appropriate for basins but makes it much harder for LID practices and small stormwater components integrated into the site. A twenty-foot wide access easement does not work for LID practices. Language that allows*

the township to access and inspect/repair any and all stormwater components would be more appropriate. This language should be developed by an attorney so that the ordinance language allows the Township access to LID features, especially if the owner is not maintaining them, without a 20' easement around every feature.)

- (20) The location of all erosion and sediment control facilities.
- (21) A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located off site. All off-site facilities shall meet the performance standards and design criteria specified in this chapter.
- (22) A statement, signed by the applicant, acknowledging that any revision to the approved drainage plan must be approved by the municipality, and that a revised erosion and sediment control plan must be submitted to the Conservation District for a determination of adequacy.
- (23) The following signature block for the design engineer:

"I, (Design Engineer), on this date (date of signature), hereby certify that the drainage plan meets all design standards and criteria of the Radnor Township Stormwater Management Ordinance."

- (24) A statement indicating what has the applicant done to minimize impervious materials on site.
- C. Supplemental information to be submitted to the municipality.
- (1) A written description of the following information shall be submitted by the applicant and shall include:
 - (a) The overall stormwater management concept for the project designed in accordance with § 245-21.
 - (b) Stormwater runoff computations as specified in this chapter.
 - (c) Stormwater management techniques to be applied both during and after development.
 - (d) Expected project time schedule.
 - (e) Development stages or project phases, if so proposed.
 - (f) An operations and maintenance plan in accordance with § 245-32 of this chapter.
 - (2) An erosion and sediment control plan.
 - (3) A description of the effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.
 - (4) A declaration of adequacy and highway occupancy permit from the Pennsylvania Department of Transportation (PennDOT) District office when utilization of a PennDOT storm drainage system is proposed.
- D. Stormwater management facilities.
- (1) All stormwater management facilities must be located on a plan and described in detail.
 - (2) When infiltration measures such as seepage pits, beds, or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.
 - (3) All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.

§ 245-14. Plan submission.

The municipality shall require receipt of a complete drainage plan, as specified in this chapter.

- A. Proof of application or documentation of required permit(s) or approvals for the programs listed below shall be part of the plan if required:
- (1) NPDES Permit for stormwater discharges from construction activities.
 - (2) DEP joint permit application.
 - (3) PennDOT highway occupancy permit.
 - (4) Chapter 105 (Dam Safety and Waterway Management).
 - (5) Chapter 106 (Floodplain Management).
 - (6) Any other permit under applicable state or federal regulations.
- B. The plan shall be coordinated with the state and federal permit process and the municipal SALDO review process. The process implementing the provisions in this chapter is illustrated in Appendixes D-1 and D-2. *Editor's Note: Said appendixes are on file in Township offices.*
- C. For projects that require SALDO approval, the drainage plan shall be submitted by the applicant as part of the preliminary plan submission where applicable for the regulated activity.
- D. For regulated activities that do not require SALDO approval, see § 245-12, General requirements.
- E. Six copies of the drainage plan shall be submitted and distributed as follows:
- (1) Three copies to the municipality accompanied by the requisite municipal review fee, as specified in this chapter.
 - (2) Two copies to the County Conservation District.
 - (3) One copy to the County Planning Commission/Department.
- F. Any submissions to the agencies listed above that are found to be incomplete shall not be accepted for review and shall be returned to the applicant with a notification in writing of the specific manner in which the submission is incomplete.

§ 245-15. Drainage plan review.

- A. The municipal Engineer shall review the drainage plan for consistency with this chapter and the respective Act 167 Stormwater Management Plan. Any found incomplete shall not be accepted for review and shall be returned to the applicant.
- B. The municipal Engineer shall review the drainage plan for any subdivision or land development against the municipal SALDO provisions not otherwise superseded by this chapter.
- C. The municipal Landscape Architect or Arborist shall review the Non-Structural Practices (Section 245-21) to determine compliance with requirements for tree protection, reduced site disturbance, and protection of existing natural features, as well as coordination of the stormwater plan with the Township Tree Ordinance (Chapter 263). (This would allow the Shade Tree Commission or Township LA or arborist the opportunity to review the plans and comment with regard to protecting trees, reducing disturbance, etc. and provide input for the stormwater and grading approval.)
- D. The Conservation District, in accordance with established criteria and procedures, shall review the drainage plan for consistency with stormwater management and erosion and sediment pollution control requirements and provide comments to the municipality. Such comments shall be considered by the municipality prior to final approval of the drainage plan.

- D.E.** For activities regulated by this chapter, the municipal Engineer shall notify the applicant in writing, within 45 calendar days, whether the drainage plan is consistent with the stormwater management plan.
- (1) If the municipal Engineer determines that the drainage plan is consistent with the stormwater management plan, the municipal Engineer shall forward a letter of consistency to the applicant.
 - (2) If the municipal Landscape Architect or Arborist determines that the drainage plan is consistent with the stormwater management plan and the Township Tree Ordinance (Chapter 263), the municipal Landscape Architect or Arborist shall forward a letter of consistency to the applicant
 - (3) If the municipal Engineer determines that the drainage plan is inconsistent or noncompliant with the stormwater management plan, the municipal Engineer shall forward a letter to the applicant citing the reason(s) and specific ordinance sections for the inconsistency or noncompliance. Inconsistency or noncompliance may be due to inadequate information to make a reasonable judgment as to compliance with the stormwater management plan. Any drainage plans that are inconsistent or noncompliant may be revised by the applicant and resubmitted when consistent with this chapter.
- E.F.** For regulated activities specified in § 245-5 of this chapter that require a building permit, the Township Engineer shall notify the Director of Community Development in writing, within a time frame consistent with the municipal Building Code and/or municipal SALDO, whether the drainage plan is consistent with the stormwater management plan. Any drainage plan deemed inconsistent may be revised by the applicant and resubmitted consistent with this chapter.
- F.G.** For regulated activities under this chapter that require an NPDES permit application, the applicant shall forward a copy of the municipal Engineer's letter stating that the drainage plan is consistent with the stormwater management plan to the Conservation District. DEP and the Conservation District may consider the municipal Engineer's review comments in determining whether to issue a permit.
- G.H.** The municipality shall not grant preliminary or final approval to any subdivision or land development for regulated activities specified in § 245-5 of this chapter if the drainage plan has been found by the municipal Engineer to be inconsistent with the stormwater management plan. All required permits from DEP must be obtained prior to approval of any subdivision or land development.
- H.I.** No building permits for any regulated activity specified in § 245-5 of this chapter shall be approved by the municipality if the drainage plan has been found to be inconsistent with the stormwater management plan, as determined by the municipal Engineer and Conservation District, or without considering the comments of the municipal Engineer and Conservation District. All required permits from DEP must be obtained prior to issuance of a building permit.
- I.J.** The applicant shall be responsible for completing record drawings of all stormwater management facilities included in the approved drainage plan. The record drawings and an explanation of any discrepancies with the design plans shall be submitted to the municipal Engineer for final approval. In no case shall the municipality approve the record drawings until the municipality receives a copy of an approved declaration of adequacy and/or highway occupancy permit from the PennDOT District office, NPDES permit, and any other applicable permits or approvals from DEP or the Conservation District. The above permits and approvals must be based on the record drawings.

J.K. The municipality's approval of a drainage plan shall be valid for a period not to exceed five years commencing on the date that the municipality signs the approved drainage plan. If stormwater management facilities included in the approved drainage plan have not been constructed, or if constructed, record drawings of these facilities have not been approved within this five-year time period, then the municipality may consider the drainage plan inconsistent or noncompliant and may revoke any and all permits. Drainage plans that are determined to be inconsistent or noncompliant by the municipality shall be resubmitted in accordance with § 245-17 of this chapter.

§ 245-16. Modification of plans.

- A. A modification to a submitted drainage plan under review by the municipality for a development site that involves the following shall require a resubmission to the municipality of a modified drainage plan consistent with § 245-14 of this chapter and be subject to review as specified in § 245-15 of this chapter:
- (1) Change in stormwater management facilities or techniques;
 - (2) Relocation or redesign of stormwater management facilities; or
 - (3) Is necessary because soil or other conditions are not as stated on the drainage plan as determined by the municipal Engineer.
- B. A modification to an already approved or inconsistent or noncompliant drainage plan shall be submitted to the municipality, accompanied by the applicable municipal review and inspection fee. A modification to a drainage plan for which a formal action has not been taken by the municipality shall be submitted to the municipality accompanied by the applicable municipal review and inspection fee.

§ 245-17. Resubmission of inconsistent or noncompliant drainage plans.

An inconsistent or noncompliant drainage plan may be resubmitted with the revisions addressing the municipal Engineer's concerns documented in writing. It must be addressed to the Township Engineer in accordance with § 245-14 of this chapter, distributed accordingly, and be subject to review as specified in § 245-15 of this chapter. The applicable municipal review and inspection fee must accompany a resubmission of an inconsistent or noncompliant drainage plan.

Article IV. Stormwater Management

§ 245-18. General requirements.

- A. Applicants proposing regulated activities in the municipality which do not fall under the exemption criteria shown in § 245-6 shall submit a drainage plan consistent with this chapter and the respective stormwater management plan to the municipality for review. The stormwater management criteria of this chapter shall apply to the total proposed development even if development is to take place in stages.

- B. The applicant is required to find practicable alternatives to the surface discharge of stormwater, the creation of impervious surfaces, and the degradation of waters of the commonwealth and must maintain as much as possible the natural hydrologic regime.
- C. The drainage plan must be designed consistent with the sequencing provisions of § 245-21 to ensure maintenance of the natural hydrologic regime, to promote ground water recharge, and to protect ground water and surface water quality and quantity. The drainage plan designer must proceed sequentially in accordance with Article IV of this chapter.
- D. Stormwater drainage systems shall be designed in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this chapter.
- E. Existing points of concentrated drainage that discharge onto adjacent property shall not be altered in any manner which could cause property damage without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this chapter.
- F. Areas of existing diffused drainage discharge, whether proposed to be concentrated or maintained as diffused drainage areas, shall be subject to any applicable discharge criteria in the general direction of existing discharge, except as otherwise provided by this chapter. If diffused drainage discharge is proposed to be concentrated and discharged onto adjacent property, the applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge or otherwise prove that no erosion, sedimentation, flooding, or other impacts will result from the concentrated discharge.
- G. Where a development site is traversed by existing streams, drainage easements shall be provided conforming to the line of such streams. The terms of the easement shall conform, at a minimum, to the stream buffer requirements contained in Radnor Township's Stream Buffer Ordinance (Article XVIII A, Riparian Buffer Conservation District). *Editor's Note: See Ch. 280, Zoning.*
- H. Any stormwater management facilities regulated by this chapter that would be located in or adjacent to waters of the commonwealth or delineated wetlands shall be subject to approval by DEP through the joint permit application or the environmental assessment approval process or, where deemed appropriate, by the DEP general permit process. When there is a question as to whether wetlands may be involved, it is the responsibility of the applicant or his agent to show that the land in question cannot be classified as wetlands; otherwise, approval to work in the area must be obtained from DEP.
- I. Any proposed stormwater management facilities regulated by this chapter that would be located on state highway rights-of-way shall be subject to approval by PennDOT.
- J. Minimization of impervious surfaces and, where soil conditions permit, infiltration of runoff through seepage beds, infiltration trenches, etc., are encouraged in order to reduce the size or eliminate the need for detention facilities or other structural BMPs.
- K. All stormwater runoff shall be pretreated for water quality prior to discharge to surface or ground water.
- L. All regulated activities within the municipality shall be designed, implemented, operated, and maintained to meet the purposes of this chapter, through these two elements.
 - (1) Erosion and sediment control during earth disturbance activities (e.g., during construction); and
 - (2) Water quality protection measures after completion of earth disturbance activities (i.e., after construction), including operations and maintenance.

- M. No regulated earth disturbance activities within the municipality shall commence until the requirements of this chapter are met.
- N. Postconstruction water quality protection shall be addressed as required by § 245-23.
- O. Operations and maintenance of permanent stormwater BMPs shall be addressed as required by Article VII.
- P. All BMPs used to meet the requirements of this chapter shall conform to the state water quality requirements and any more stringent requirements as set forth by the municipality.
- Q. Techniques described in Appendix E (Low Impact Development) *Editor's Note: Appendix E is on file in Township offices.* of this chapter shall be considered because they reduce the costs of complying with the requirements of this chapter and the state water quality requirements.
- R. In selecting the appropriate BMPs or combinations thereof, the applicant shall consider the following:
 - (1) Total contributing area.
 - (2) Permeability and infiltration rate of the site's soils.
 - (3) Slope and depth to bedrock.
 - (4) Seasonal high-water table.
 - (5) Proximity to building foundations and wellheads.
 - (6) Erodibility of soils.
 - (7) Land availability and configuration of the topography.
 - (8) Peak discharge and required volume control.
 - (9) Streambank erosion.
 - (10) Efficiency of the BMPs to mitigate potential water quality problems.
 - (11) The volume of runoff that will be effectively treated.
 - (12) The nature of the pollutant being removed.
 - (13) Maintenance requirements.
 - (14) Creation/protection of aquatic and wildlife habitat.
 - (15) Recreational value.
- S. Where necessary, the applicant may meet the stormwater management criteria through off-site stormwater management measures as long as the proposed measures are in the same subwatershed as shown in Appendix A *Editor's Note: Appendix A, Darby-Cobbs Stormwater Management District Watershed Map, is on file in Township offices.* of this chapter. It is strongly recommended the off-site area be located upstream of the development site.

§ 245-19. Permit requirements by other governmental entities.

The following permit requirements may apply to certain regulated earth disturbance activities and must be met prior to commencement of regulated earth disturbance activities, as applicable:

- A. All regulated earth disturbance activities subject to permit requirements by DEP under regulations at 25 Pennsylvania Code Chapter 102.
- B. Work within natural drainageways subject to permit by DEP under 25 Pennsylvania Code Chapter 105.
- C. Any stormwater management facility that would be located in or adjacent to surface waters of the commonwealth, including wetlands, subject to permit by DEP under 25 Pennsylvania Code Chapter 105.

- D. Any stormwater management facility that would be located on a state highway right-of-way or require access from a state highway shall be subject to approval by PennDOT.
- E. Culverts, bridges, storm sewers, or any other facilities which must pass or convey flows from the tributary area and any facility which may constitute a dam subject to permit by DEP under 25 Pennsylvania Code Chapter 105.

§ 245-20. Erosion and sediment control during regulated earth disturbance activities.

- A. No regulated earth disturbance activities within the municipality shall commence until the municipality receives an approval from the Conservation District of an erosion and sediment control plan for construction activities.
- B. DEP has regulations that require ~~an~~ erosion and sediment control ~~plan for any earth disturbance activity of 5,000 square feet or more,~~ under 25 Pennsylvania Code § 102.4(b).
- C. In addition, under 25 Pennsylvania Code Chapter 92, a PADEP "NPDES ~~C~~construction ~~A~~activities" permit is required for regulated earth disturbance activities.
- D. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate PADEP regional office or County Conservation District must be provided to the ~~M~~municipality. The issuance of an NPDES Construction Permit (or permit coverage under the statewide General Permit (PAG-2)) satisfies the requirements of subsection § 245- 14.A.
- E. A copy of the erosion and sediment control plan and any required permit, as required by DEP regulations, shall be available on the project site at all times.
- F. Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed. They shall include the following:
 - (1) Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity.
 - (2) Infiltration BMPs shall not be constructed nor receive runoff until the entire drainage area contributory to the infiltration BMP has achieved final stabilization.

§ 245-21. Nonstructural project design (sequencing to minimize stormwater impacts).

- A. ~~The design of all regulated activities shall include the following to minimize stormwater impacts~~ The design of all regulated activities shall include the following to minimize stormwater impacts to reduce the surface discharge of stormwater, reduce the creation of unnecessary impervious surfaces, prevent the degradation of waters of the Commonwealth, and maintain as much as possible the natural hydrologic regime of the site..
- (1) The applicant shall find practicable alternatives to the surface discharge of stormwater, such as those listed in Appendix F, Table F-5, *Editor's Note: Said Appendix F and its tables are on file in Township offices.* the creation of impervious surfaces, and the degradation of waters of the commonwealth and must maintain as much as possible the natural hydrologic regime of the site.
- (2) An alternative is practicable if it is available and capable of implementation after taking into consideration existing technology and logistics in light of overall project purposes and other municipal requirements.

- (3) All practicable alternatives to the discharge of stormwater are presumed to have less adverse impact on quantity and quality of waters of the commonwealth unless otherwise demonstrated.
- B. The applicant shall demonstrate that the regulated activities were designed in the following sequence. The goal of the sequence is to minimize the increases in stormwater runoff and impacts to water quality resulting from the proposed regulated activity:
- (1) Prepare an existing resource and site analysis map (ERSAM) showing environmentally sensitive areas, including but not limited to steep slopes, ponds, lakes, streams, wetlands, hydric soils, vernal pools, stream buffers, tree masses, all trees 6" DBH and greater including species and canopy extent within the limit of project disturbance, all stream setbacks and riparian buffer extents, and hydrologic soil groups, including erodible and highly erodible soils. Under land development, any existing recharge areas, and other requirements outlined in the municipal SALDO shall also be included.
 - (2) Establish a stream buffer according to § 245-23G.
 - (3) Prepare a draft project layout avoiding sensitive areas identified in § 245-21B(1).
 - (4) Identify site-specific existing condition drainage areas, discharge points, recharge areas, and hydrologic soil groups A and B (areas conducive to infiltration).
 - (5) Evaluate nonstructural stormwater management alternatives:
 - (a) Minimize earth disturbance.
 - (b) Minimize clearing operations (vegetation removal).
 - (c) Minimize impervious surfaces.
 - (d) Break up large impervious surfaces.
 - (6) Satisfy the ground water recharge (infiltration) and volume management objective (§ 245-22) and provide for stormwater pretreatment prior to infiltration.
 - (7) Provide for water quality protection in accordance with § 245-23 water quality requirements.
 - (8) Provide streambank erosion protection in accordance with § 245-24 streambank erosion requirements.
 - (9) Determine into what management district the site falls (Ordinance Appendix A) *Editor's Note: Appendix A, a map of the watershed, is on file in Township offices.* and conduct an existing conditions' runoff analysis.
 - (10) Prepare final project design to maintain existing conditions' drainage areas and discharge points, to minimize earth disturbance and impervious surfaces and, to the maximum extent possible, to ensure that the remaining site development has no surface or point discharge.
 - (11) Conduct a proposed conditions' runoff analysis based on the final design that meets the management district requirements (§ 245-25).
 - (12) Manage any remaining runoff prior to discharge through detention, bioretention, direct discharge, or other structural control.

§ 245-22. Groundwater recharge Volume Management and Infiltration volume requirements.

Preventing increases in runoff volume due to impervious is required. The first 1.5 of runoff from all disturbed areas shall be managed and retained on-site such that there is no surface discharge.

(Language suggested has been taken from EPA MS4 Permit language for impaired waterways.)

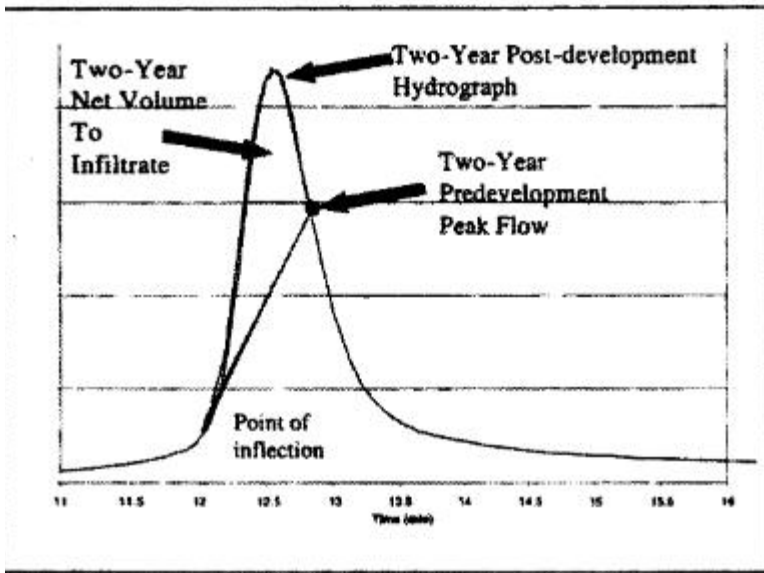
Volume reduction may be achieved through infiltration, capture and reuse,

evaporation/evapotranspiration, or other means. Maximizing the ground-water recharge infiltration volume capacity of the area being developed is required. Design of the infiltration facilities shall consider ground water recharge to compensate for the reduction in the recharge that occurs when the ground surface is disturbed or impervious surface is created. It is recommended that roof runoff be directed to infiltration BMPs that may be designed to compensate for the runoff from parking areas. These measures are required to be consistent with § 245-3 and to take advantage of utilizing any existing recharge areas.

Infiltration may not be feasible on every site due to site-specific limitations such as soil type. If it cannot be physically accomplished, then the design professional shall be responsible to show that this cannot be physically accomplished. ~~If it can be physically accomplished, then the volume of runoff to be infiltrated shall be determined from Subsection A(2) below depending on demonstrated site conditions and shall be the greater of the volumes.~~

- A. Infiltration BMPs shall meet the following minimum requirements:
- (1) Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:
 - (a) A minimum depth of 24 inches between the bottom of the BMP and the top of the limiting zone.
 - (b) An infiltration rate sufficient to accept the additional stormwater load and dewater completely as determined by field tests conducted by the applicant's design professional.
 - (c) The infiltration facility shall be capable of completely infiltrating the retention (infiltration) volume (Re_v) within four days (96 hours).
 - (d) Pretreatment shall be provided prior to infiltration for areas of high sediment and pollutants, such as roads. Roof areas can be considered clean and are not required to have pretreatment.
 - (2) The size of the infiltration facility shall be based upon the following volume criteria:
 - (a) Net two-year volume approach. In areas that involve the addition of 1,500 square feet of new or replacement impervious cover the retention (infiltration) volume (Re_v) to be captured and infiltrated shall be the net two-year volume. The net two-year volume shall be determined in accordance with the calculation methodologies of the Pennsylvania Stormwater BMP Manual. by plotting the two-year project site post-development hydrograph, drawing a straight line from the point of inflection of the rising limb of the hydrograph to the peak flow pre-development two-year storm, and measuring the volume under the curve as shown in Figure 405.1.

GURE 405.1 FILTRATION HYDROGRAPH



- (b) One inch from impervious surface. In all other portions of the watershed that are adding between 500 and 1,500 square feet of new or replacement impervious cover, the retention (infiltration) volume (Re_v) will be equal to capturing one inch of rainfall over all proposed impervious surfaces.

$$Rev = I \times \text{impervious area (square feet)} \div 12 \text{ (inches)} = \text{cubic feet (cf)}$$

Where I = The maximum equivalent infiltration amount (inches) that the site can physically accept or 1.0 inch, whichever is greater.

- (c) Obtaining the Re_v volume in Subsection A(2)(a) (above) may not be feasible on every site due to site-specific limitations such as soil type. If it cannot be physically accomplished, then the design professional shall be responsible for showing that this cannot be physically accomplished. If it cannot be physically accomplished, then the retention (infiltration) volume Re_v required shall be as much as can be physically accomplished with a minimum of 0.50 inch depending on demonstrated site conditions. It has been determined that capturing and infiltrating 0.50 inch of runoff from the impervious areas will aid in maintaining the hydrologic regime (baseflow) of the watershed. If the goals of Subsection A(2)(a) or A(2)(b) cannot be achieved, then 0.50 inch of rainfall shall be retained and infiltrated from all existing and proposed impervious areas.

The minimum recharge volume (Rev) required would, therefore, be computed as:

$$Rev = I \times \text{impervious area (square feet)} \div 12 \text{ (inches)} = \text{cubic feet (cf)}$$

Where I = The maximum equivalent infiltration amount (inches) that the site can physically accept or 1.0 inch, whichever is greater.

- [1] The retention volume values derived from the methods in Subsections A(2)(a), A(2)(b) and/or A(2)(c) is the minimum volume the applicant must control through an infiltration BMP facility. However, if a site has areas of soils where additional

volume of retention can be achieved, the applicant is strongly encouraged to infiltrate as much of the stormwater runoff from the site as possible.

[2] If the minimum of 0.50 inch of infiltration requirement cannot be achieved, a waiver from § 245-22, Ground water recharge, would be required from the [municipality Board of Commissioners](#).

B. Soils. A detailed soils evaluation of the project site shall be required to determine the suitability of infiltration facilities. The evaluation shall be performed by a qualified design professional and at a minimum address soil permeability, depth to bedrock, and subgrade stability. The evaluation must be witnessed by the Township. The general process for designing the infiltration BMP shall be:

- (1) Analyze hydrologic soil groups as well as natural and man-made features within the site to determine general areas of suitability for infiltration practices. In areas where development on fill material is under consideration, conduct geotechnical investigations of subgrade stability; infiltration may not be ruled out without conducting these tests.
- (2) Provide field tests such as a percolation tests, double ring infiltrometer, or hydraulic conductivity tests (at the level of the proposed infiltration surface) to determine the appropriate hydraulic conductivity rate.
- (3) Design the infiltration structure for the required retention (Re_v) volume based on field determined capacity at the level of the proposed infiltration surface.
- (4) If on-lot infiltration structures are proposed by the applicant's design professional, it must be demonstrated to the municipality that the soils are conducive to infiltrate on the lots identified.

C. Stormwater hotspots. Below is a list of examples of designated hotspots. If a site is designated as a hotspot, it has important implications for how stormwater is managed. First and foremost, untreated stormwater runoff from hotspots shall not be allowed to recharge into ground water where it may contaminate water supplies. Therefore, the Re_v requirement shall NOT be applied to development sites that fit into the hotspot category (the entire WQ_v must still be treated). Second, a greater level of stormwater treatment shall be considered at hotspot sites to prevent pollutant washoff after construction. The Environmental Protection Agency's (EPA) NPDES stormwater program requires some industrial sites to prepare and implement a stormwater pollution prevention plan.

(1) Examples of hotspots:

Vehicle salvage yards and recycling facilities

Vehicle fueling stations

Vehicle service and maintenance facilities

Vehicle and equipment cleaning facilities

Fleet storage areas (bus, truck, etc.)

Industrial sites based on standard industrial codes

Marinas (service and maintenance)

Outdoor liquid container storage

Outdoor loading/unloading facilities

Public works storage areas

Facilities that generate or store hazardous materials

Commercial container nursery

Other land uses and activities as designated by an appropriate review authority

(2) The following land uses and activities are not normally considered hotspots:

Residential streets and rural highways

Residential development

Institutional development

Office developments

Nonindustrial rooftops

Pervious areas, (i.e.) nurseries (which may need an integrated pest management (IPM) plan).

(3) While large highways [average daily traffic volume (ADT) greater than 30,000] are not designated as stormwater hotspots, it is important to ensure that highway stormwater management plans adequately protect ground water.

D. Extreme caution shall be exercised where infiltration is proposed in source water protection areas (SWPAs) as defined by the local municipality or water authority.

E. Infiltration facilities shall be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives [and Green building techniques](#).

F. Extreme caution shall be exercised where salt or chloride (municipal salt storage) would be a pollutant since soils do little to filter this pollutant, and it may contaminate the ground water. The qualified design professional shall evaluate the possibility of ground water contamination from the proposed infiltration facility and perform a hydrogeologic justification study if necessary.

G. The infiltration requirement in HQ or EV waters shall be subject to the Department's Chapter 93 antidegradation regulations.

H. An impermeable liner will be required in detention basins where the possibility of ground water contamination exists. A detailed hydrogeologic investigation may be required by the municipality.

I. The municipality shall require the applicant to provide safeguards against ground water contamination for land uses that may cause ground water contamination should there be a mishap or spill.

§ 245-23. Water quality requirements.

The applicant shall comply with the following water quality requirements of this article.

- A. No regulated earth disturbance activities within the municipality shall commence until approval by the municipality of a plan which demonstrates compliance with postconstruction state water quality requirements.
- B. The BMPs shall be designed, implemented, and maintained to meet state water quality requirements and any other more stringent requirements as determined by the ~~municipality~~ Township Engineer.
- C. To control postconstruction stormwater impacts from regulated earth disturbance activities, state water quality requirements can be met by BMPs, including site design, which provide for replication of ~~preconstruction stormwater infiltration and runoff conditions~~ predevelopment or natural stormwater runoff volumes and flow rates *(changing the language to set the standard at "natural" or "predevelopment" meaning before any disturbance, would be keeping with EPA 409 policy and what's needed for water quality protection and improvement)* so that postconstruction stormwater discharges do not degrade the physical, chemical, or biological characteristics of the receiving waters. As described in the PADEP Comprehensive Stormwater Management Policy (No. 392-0300-002, September 28, 2002), this may be achieved by the following:
- (1) Infiltration: replication of preconstruction stormwater infiltration conditions.
 - (2) Treatment: use of water quality treatment BMPs to ensure filtering out of the chemical and physical pollutants from the stormwater runoff.
 - (3) Volume Control: with a goal of replicating infiltration and runoff characteristics of the site prior to development.
 - (4) Streambank and streambed protection: management of volume and rate of postconstruction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring).
- D. Developed areas shall provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff through volume management. The retention volume computed under § 245-22 may be a component of the water quality volume ~~if the applicant chooses to manage both components in a single facility~~. If the retention volume is less than the water quality volume, the remaining water quality volume may be captured and treated by methods other than infiltration BMPs, such as capture and reuse, vegetated roofs, disconnected impervious areas, and other practices as described in the Pennsylvania Stormwater BMP Manual. The required water quality volume (WQ_v) is the storage capacity needed to capture ~~and treat a portion of~~ stormwater runoff from the developed areas of the site. To achieve this goal, the following criterion is established:
- (1) The following calculation formula is to be used to determine the water quality storage volume (WQ_v) in acre-feet of storage required by this chapter:

$$WQ_v = [(P)(R_v)(A)] / 12$$

WHERE:

WQ_v = Water quality volume (acre-feet)

P = 1.5 inches

A = Area of the project contributing to the water quality BMP (acres)

Rv = $0.05 + 0.009(I)$ where I is the percent of the area that is impervious surface
[(impervious area/A) x 100]

- (2) Projects must manage the WQv through volume management with no discharge to surface waters to the greatest extent possible. For the portion of the WQv that cannot be managed without surface discharge, slow release is permitted provided that requirements of § 245-24 are met. This volume requirement can be accomplished by the permanent volume of a wet basin or the detained volume from other BMPs. Where appropriate, wet basins shall be utilized for water quality control and shall follow the guidelines of the BMP manuals referenced in Appendix G. ~~Editor's Note: Appendix G is on file in Township offices.~~
- (3) At minimum, the first 1.5-inch of runoff from impervious surfaces shall be captured and detained for slow release over 24 hours. Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall provide for protection from clogging and unwanted sedimentation.
- E. The temperature and quality of water and streams shall be maintained through the use of temperature-sensitive BMPs and stormwater conveyance systems, and other green techniques, such as green roofs, vegetative swales, concrete paving, and increased tree canopy~~underground detention/storage facilities.~~
- F. To accomplish the above, the applicant shall submit original and innovative designs to the municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of different BMPs.
- G. If a perennial or intermittent stream passes through the site, the applicant shall create a stream riparian buffer setback. Unless a greater buffer width is provided herein or under any other law, regulation or ordinance, a minimum riparian buffer of one hundred (100) feet shall be provided.
- (1) For any waterbody that has been designated as High Quality, Exceptional Value, or any other special protection designation, a minimum riparian buffer of three hundred (300) feet shall be provided.
- (2) For any waterbody that has been designated as Impaired, a minimum riparian buffer of one hundred and fifty (150) feet shall be provided.
- (3) All riparian buffers shall be populated with only native plant species. ~~agreeing with the Township's Riparian Buffer Ordinance (Article XVIII A, Riparian Buffer Conservation District Editor's Note: See Ch. 280, Zoning).~~
- The buffer area shall be maintained with and encouraged to use appropriate native vegetation (refer to Appendix H of the Pennsylvania Handbook of Best Management Practices for Developing Areas for plant lists). If an existing buffer is legally prescribed (i.e., deed, covenant, easement, etc.) and it exceeds the requirements of this chapter, the existing buffer shall be maintained.
- H. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate PADEP regional office must be provided to the municipality.

§ 245-24. Streambank erosion requirements.

- A. In addition to the control of water quality volume (in order to minimize the impact of stormwater runoff on downstream streambank erosion), the primary requirement is to design a BMP to detain the proposed conditions' two-year, twenty-four-hour design storm to the existing conditions' one-year flow using the SCS Type II distribution. ~~Additionally, provisions shall be made (such as adding a small orifice at the bottom of the outlet structure) so that the proposed conditions' one-year storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the one-year storm is captured (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility).~~
- B. ~~The minimum orifice size in the outlet structure to the BMP shall be three inches in diameter where possible, and a trash rack shall be installed to prevent clogging. On sites with small drainage areas contributing to this BMP that do not provide enough runoff volume to allow a twenty-four-hour attenuation with the three-inch orifice, the calculations shall be submitted showing this condition.~~ ~~small Orifice orifice sizes less than three inches~~ can be utilized, provided that the design will prevent clogging of the intake.
- C. In conditional direct discharge districts (District C) only (see § 245-25A), the objective is not to attenuate the storms greater than the two-year recurrence interval. This can be accomplished by configuring the outlet structure not to control the larger storms or by a bypass channel that diverts only the two-year stormwater runoff into the basin or, conversely, diverts flows in excess of the two-year storm away from the basin.

§ 245-25. Stormwater peak rate control and management districts.

- A. Darby and Cobbs Creeks Watershed.
 - (1) The Darby and Cobbs Creeks watershed has been divided into stormwater management districts as shown on the Management District Map in Appendix A. *Editor's Note: Appendix A is on file in Township offices.*
 - (a) In addition to the requirements specified in Table 408.1 below, the erosion and sedimentation control (§ 245-20), the nonstructural project design (§ 245-21), the ground water recharge (§ 245-22), the water quality (§ 245-23), and the streambank erosion (§ 245-24) requirements shall be implemented.
 - (b) Standards for managing runoff from each subarea in the Darby and Cobbs Creeks watershed for the two-, five-, ten-, twenty-five-, fifty-, and one-hundred-year design storms are shown in Table 408.1. Development sites located in each of the management districts must control proposed conditions' runoff rates to existing conditions' runoff rates for the design storms in accordance with Table 408.1.

TABLE 408.1

**PEAK RATE CONTROL STANDARDS BY
STORMWATER MANAGEMENT DISTRICT
IN THE DARBY-COBBS
CREEK WATERSHED**

District	Proposed Condition Design Storm	Existing Condition Design Storm
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District	Proposed Condition Design Storm	Existing Condition Design Storm
A	2-year	1-year
	5-year	5-year
	10-year	10-year
	25-year	25-year
	50-year	50-year
	100-year	100-year
B-1	2-year	1-year
	5-year	1-year
	10-year	5 year
	25-year	10-year
	50-year	25-year
	100-year	100-year
B-2	2-year	1-year
	5-year	2-year
	10-year	5-year
	25-year	5-year
	50-year	10-year
	100-year	100-year
C	Conditional Direct Discharge District	

(c) In District C, development sites that can discharge directly to the Darby-Cobbs Creek main channel, major tributaries, or indirectly to the main channel through an existing stormwater drainage system (i.e., storm sewer or tributary) may do so without control of the proposed conditions' peak rate of runoff greater than the five-year storm. Sites in District C will still have to comply with the ground water recharge criteria, the water quality criteria, and streambank erosion criteria. If the proposed conditions' runoff is intended to be conveyed by an existing stormwater drainage system to the main channel, assurance must be provided that such system has adequate capacity to convey the flows greater than the two-year existing conditions' peak

flow or will be provided with improvements to furnish the required capacity. When adequate capacity in the downstream system does not exist and will not be provided through improvements, the proposed conditions' peak rate of runoff must be controlled to the existing conditions' peak rate as required in District A provisions (i.e., ten-year proposed conditions' flows to ten-year existing conditions' flows) for the specified design storms.

- (2) General. Proposed conditions' rates of runoff from any regulated activity shall not exceed the peak release rates of runoff from existing conditions for the design storms specified on the Stormwater Management District Watershed Map (Appendix A) *Editor's Note: Appendix A is on file in Township offices.* and this section of the chapter.
 - (3) District boundaries. The boundaries of the stormwater management districts are shown on an official map that is available for inspection at the municipal and county planning offices. A copy of the official map at a reduced scale is included in Appendix A. The exact location of the stormwater management district boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two-foot topographic contours (or most accurate data required) provided as part of the drainage plan.
 - (4) Sites located in more than one district. For a proposed development site located within two or more stormwater management district category subareas, the peak discharge rate from any subarea shall meet the management district criteria for which the discharge is located. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the discharge site. In this case, peak discharge in any direction may follow Management District A criteria, provided that the overall site discharge meets the management district criteria for which the discharge is located.
 - (5) Off-site areas. Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.
 - (6) Site areas. Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area utilizing stormwater management measures shall be subject to the management district criteria. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the management district criteria.
 - (7) Alternate criteria for redevelopment sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by Radnor Township;
 - (a) Meet the full requirements specified by Table 408.1 and § 245-25A(1) through A(10); or
 - (b) Reduce the total impervious surface on the site by at least 20% based upon a comparison of existing impervious surface to proposed impervious surface.
- B. Other watersheds.
- (1) Within other watersheds, the criteria for peak runoff control are designed to reduce the postdevelopment peak flow to existing conditions. Development sites must control proposed conditions' runoff rates to existing conditions' runoff rates for the design storms in accordance with Table 408.2.

TABLE 408.2

TABLE 408.2

**PEAK RATE CONTROL STANDARDS IN
OTHER WATERSHED AREAS**

Proposed Condition Design Storm	Reduce to	Existing Conditions Design Storm
2-year		1-year
5-year		2-year
10-year		5-year
25-year		10-year
50-year		25-year
100-year		100-year

- (2) The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the site. In this case, peak discharge in any direction may be a 100% release rate, provided that the overall site discharge meets the weighted average release rate.
- (3) Off-site areas. Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.
- (4) Site areas. Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area utilizing stormwater management measures shall be subject to the peak rate control standards noted above. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the peak rate control standards.
- (5) Alternate criteria for redevelopment sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by Radnor Township:
 - (a) Meet the full requirements specified by Table 408.2 and § 245-25B(1) through B(8); or
 - (b) Reduce the total impervious surface on the site by at least 25%, based upon a comparison of existing impervious surface to proposed impervious surface. Calculations must be provided to show that the peak rate has not increased.

§ 245-26. Calculation methodology.

A. Stormwater runoff from all development sites with a drainage area of greater than 200 acres shall be calculated using a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 409.1 summarizes acceptable computation methods, and the method selected by the design professional shall be based on the individual limitations and suitability of each method for a particular site. The municipality may allow the use of the rational

method to estimate peak discharges from drainage areas that contain less than 200 acres. The soil cover complex method shall be used for drainage areas greater than 200 acres.

TABLE 409.1

**ACCEPTABLE COMPUTATION METHODOLOGIES
FOR STORMWATER MANAGEMENT PLANS**

Method	Developed by	Applicability
TR-20 (or commercial computer package based on TR-20)	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary
TR-55 (or commercial computer package based on TR-55)	USDA NRCS	Applicable for land development plans where limitations described in TR-55
HEC-1/ HEC-HMS	US Army Corps of Engineers	Applicable where use of a full hydrologic computer is desirable or necessary
PSRM	Penn State University	Applicable where use of a hydrologic model is desirable or necessary; simpler than TR-20 or HEC-1
Rational method (or commercial computer (1889) package based on rational method)	Emil Kuichling 200 acres, or as	For sites less than approved by the municipality and/or municipal Engineer

- B. All calculations consistent with this chapter using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms according to the region in which they are located as presented in Table F-1 in Appendix F of this chapter. *Editor's Note: Appendix F is on file in Township offices.* If a hydrologic computer model such as PSRM or HEC-1/HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The alternating block method shown in Figure F-1 or the SCS Type II S Curve, Figure F-3 in Appendix F, shall be used for the rainfall distribution.
- C. The following criteria shall be used for runoff calculations:
- (1) For development sites not considered redevelopment, the ground cover used in determining the existing conditions' flow rates shall be as follows:
 - (a) Wooded sites shall use a ground cover of "woods in good condition." Portions of a site having more than one viable tree of a DBH of six inches or greater per 1,000 square feet shall be considered wooded where such trees existed within three years of application.
 - (b) The undeveloped portion of the site, including agriculture, bare earth, and fallow ground, shall be considered as "meadow in good condition," unless the natural ground cover generates a lower

curve (CN) number or Rational "c" value (i.e., woods) as listed in Tables F-2 or F-3 in Appendix F of this chapter.

- (2) For development and redevelopment sites, the ground cover used in determining the existing conditions' flow rates for the developed portion of the site shall be based upon actual land cover conditions, and twenty five (25) percent of existing impervious area, when present, shall be considered "meadow in good condition".
- D. All calculations using the rational method shall use rainfall intensities consistent with appropriate times-of-concentration for overland flow and return periods presented in the Region 5 Curves from the PennDOT Storm-Duration-Frequency Chart (Figure F-4). *Editor's Note: Figure F-4 is included in Appendix F, which is on file in Township offices.* Times-of-concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times-of-concentration for channel and pipe flow shall be computed using Manning's equation.
- E. Runoff curve numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table F-2 in Appendix F of this chapter.
- F. Runoff coefficients (c) for both existing and proposed conditions for use in the rational method shall be obtained from Table F-3 in Appendix F of this chapter.
- G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table F-4 in Appendix F of the chapter.
- H. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this chapter using any generally accepted hydraulic analysis technique or method.
- I. The design of any stormwater detention facilities intended to meet the performance standards of this chapter shall be verified by routing the design storm hydrograph through these facilities using the storage-indication method. The design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The municipality may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

J. Stormwater facilities that have met the WQv requirement of § 245-23(D)(1) such that there is no discharge to surface waters may adjust the post-construction Curve Number (when calculating peak flow rates for 1-year through 100-year events) in accordance with the following equation (McGuen 1983):

$$CN^* = 200 / [(P + 2Q + 2) - \sqrt{(5PQ + 4Q^2)}]$$

Where P is the design rainfall depth in inches, and Q is the after development runoff depth minus the runoff depth stored by the infiltration or capture/ reuse practices (ΔQ) in inches. The after-development hydrograph computed by the TR-20 program with the revised curve number is the downstream Q hydrograph that accounts for infiltration storage. An adjusted CN value is to be calculated for each design storm.

§ 245-27. Other requirements.

- A. Any stormwater facility located on state highway rights-of-way shall be subject to approval by PennDOT.
- B. All wet basin designs shall incorporate biologic controls consistent with the West Nile Guidance found in Appendix H. *Editor's Note: Appendix H is on file in Township offices.*
- C. Any stormwater management facility (i.e., detention basin) required or regulated by this chapter, designed to store runoff and requiring a berm or earthen embankment, shall be designed to provide an emergency spillway to handle flow up to and including the one-hundred-year proposed conditions. The height of embankment must provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the one-hundred-year proposed conditions' inflow. Should any stormwater management facility require a dam safety permit under PADEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety. Chapter 105 may be required to pass storms larger than the one-hundred-year event.
- D. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures) and any work involving wetlands governed by PADEP Chapter 105 regulations (as amended or replaced from time to time by DEP) shall be designed in accordance with Chapter 105 and will require a permit from PADEP.
- E. Any other drainage conveyance facility that does not fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the twenty-five-year design storm with a minimum one foot of freeboard measured below the lowest point along the top of the roadway. Any facility that constitutes a dam as defined in PADEP Chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements.
- F. Any drainage conveyance facility and/or channel not governed by Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the twenty-five-year design storm. Conveyance facilities to or exiting from stormwater management facilities (i.e., detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a one-hundred-year design storm. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements.
- G. Storm sewers must be able to convey proposed conditions' runoff from a twenty-five-year design storm without surcharging inlets, where appropriate.
- H. Adequate erosion protection shall be provided along all open channels and at all points of discharge.
- I. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The municipality reserves the right to disapprove any design that would result in construction in or continuation of a stormwater problem area.
- J. Underground stormwater management systems must be designed to store the two- through one-hundred-year storms within a pipe or other open system that will permit the inspection and maintenance of the system. The entire storm must be placed in the pipe (i.e., the stone bedding around the pipe is not to be included in the volume calculations).

Article V. Inspections

§ 245-28. Inspections.

- A. The municipal Engineer or his municipal designee shall inspect all phases of the installation of the permanent BMPs and/or stormwater management facilities as deemed appropriate by the municipal Engineer.
- B. During any stage of the work, if the municipal Engineer or his municipal designee determines that the permanent BMPs and/or stormwater management facilities are not being installed in accordance with the approved stormwater management plan, the municipality shall revoke any existing permits or other approvals and issue a cease and desist order until a revised drainage plan is submitted and approved, as specified in this chapter, and until the deficiencies are corrected.
- C. A final inspection of all BMPs and/or stormwater management facilities shall be conducted by the municipal Engineer or his municipal designee to confirm compliance with the approved drainage plan prior to the issuance of any occupancy permit.

Article VI. Fees and Expenses

§ 245-29. Municipality drainage plan review and inspection fee.

Fees shall be established by the municipality to defray plan review and construction inspection costs incurred by the municipality. All fees shall be paid by the applicant at the time of drainage plan submission. A review and inspection fee schedule shall be established by resolution of the municipal governing body based on the size of the regulated activity and based on the municipality's costs for reviewing drainage plans and conducting inspections pursuant to § 245-28. The municipality shall periodically update the review and inspection fee schedule to ensure that review costs are adequately reimbursed.

§ 245-30. Expenses covered by fees.

The fees required by this chapter shall at a minimum cover:

- A. Administrative costs.
- B. The review of the drainage plan by the municipality and the municipal Engineer.
- C. The site inspections.
- D. The inspection of stormwater management facilities and drainage improvements during construction.
- E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the drainage plan.
- F. Any additional work required to enforce any permit provisions regulated by this chapter, correct violations, and assure proper completion of stipulated remedial actions.

Article VII. Maintenance Responsibilities

§ 245-31. Performance guarantee.

- A. For subdivisions and land developments the applicant shall provide a financial guarantee to the municipality for the timely installation and proper construction of all stormwater management controls as:
 - (1) Required by the approved drainage plan equal to or greater than the full construction cost of the required controls; or
 - (2) The amount and method of payment provided for in the SALDO.
- B. For other regulated activities, the municipality may require a financial guarantee from the applicant.

§ 245-32. Responsibilities for operations and maintenance of stormwater controls and BMPs.

- A. No regulated earth disturbance activities within the municipality shall commence until approval by the municipality of a stormwater control and BMP operations and maintenance plan that describes how the permanent (e.g., postconstruction) stormwater controls and BMPs will be properly operated and maintained.
- B. The following items shall be included in the stormwater control and BMP operations and maintenance plan:
 - (1) Map(s) of the project area, in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Delaware County, shall be submitted on thirty-four-inch by twenty-four-inch sheets. The contents of the maps(s) shall include but not be limited to:
 - (a) Clear identification of the location and nature of permanent stormwater controls and BMPs;
 - (b) The location of the project site relative to highways, municipal boundaries, or other identifiable landmarks;
 - (c) Existing and final contours at intervals of two feet, or others as appropriate;
 - (d) Existing streams, lakes, ponds, or other bodies of water within the project site area;
 - (e) Other physical features, including flood hazard boundaries, sinkholes, streams, existing drainage courses, and areas of natural vegetation to be preserved;
 - (f) The locations of all existing and proposed utilities, sanitary sewers, and waterlines within 50 feet of property lines of the project site;
 - (g) Proposed final changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added;
 - (h) Proposed final structures, roads, paved areas, and buildings; and
 - (i) A twenty-foot wide access easement around all stormwater controls and BMPs that would provide ingress to and egress from a public right-of-way.
 - (2) A description of how each permanent stormwater control and BMP will be operated and maintained, and the identity and contact information associated with the person(s) responsible for operations and maintenance.
 - (3) The name of the project site, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.
 - (4) A statement, signed by the landowner, acknowledging that the stormwater controls and BMPs are fixtures that can be altered or removed only after approval by the municipality.

- C. The stormwater control and BMP operations and maintenance plan for the project site shall establish responsibilities for the continuing operation and maintenance of all permanent stormwater controls and BMPs, as follows:
- (1) If a plan includes structures or lots which are to be separately owned and in which streets, sewers, and other public improvements are to be dedicated to the municipality, stormwater controls and BMPs may also be dedicated to and maintained by the municipality;
 - (2) If a plan includes operations and maintenance by a single ownership or if sewers and other public improvements are to be privately owned and maintained, then the operation and maintenance of stormwater controls and BMPs shall be the responsibility of the owner or private management entity.
- D. The municipality shall make the final determination on the continuing operations and maintenance responsibilities. The municipality reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater controls and BMPs.

§ 245-33. Municipal review of a stormwater control and BMP operations and maintenance plan.

- A. The municipality shall review the stormwater control and BMP operations and maintenance plan for consistency with the purposes and requirements of this chapter and any permits issued by DEP.
- B. The municipality shall notify the applicant in writing whether or not the stormwater control and BMP operations and maintenance plan is approved.
- C. The municipality may require a "record drawing" of all stormwater controls and BMPs and an explanation of any discrepancies with the operations and maintenance plan.

§ 245-34. Adherence to an approved stormwater control and BMP operations and maintenance plan.

It shall be unlawful to alter or remove any permanent stormwater control and BMP required by an approved stormwater control and BMP operations and maintenance plan or to allow the property to remain in a condition which does not conform to an approved stormwater control and BMP operations and maintenance plan.

§ 245-35. Operations and maintenance agreement for privately owned stormwater controls and BMPs.

- A. The applicant shall sign an operations and maintenance agreement with the municipality covering all stormwater controls and BMPs that are to be privately owned. The maintenance agreement shall be transferred with transfer of ownership. The agreement shall be substantially the same as the agreement in Appendix I *Editor's Note: Appendix I is on file in Township offices.* of this chapter.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater controls and BMPs. The agreement shall be subject to the review and approval of the municipality.

§ 245-36. Stormwater management easements.

- A. Stormwater management easements are required for all areas used for off-site stormwater control, unless a waiver is granted by the municipal Engineer.
- B. Stormwater management easements shall be provided by the applicant or property owner if necessary for access for inspections and maintenance or the preservation of stormwater runoff conveyance, infiltration, and detention areas and other stormwater controls and BMPs by persons other than the property owner. The purpose of the easement shall be specified in any agreement under § 245-35.

§ 245-37. Maintenance agreement for privately owned stormwater facilities.

- A. Prior to final approval of the site's drainage plan, the applicant shall sign and record the maintenance agreement contained in Appendix I, which is attached and made part hereof, covering all stormwater control facilities that are to be privately owned.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance agreement shall be subject to the review and approval of the municipal Solicitor and governing body.

§ 245-38. Recording of an approved stormwater control and BMP operations and maintenance plan and related agreements.

- A. The owner of any land upon which permanent stormwater controls and BMPs will be placed, constructed, or implemented, as described in the stormwater control and BMP operations and maintenance plan, shall record the following documents in the office of the Recorder of Deeds for Delaware County within 15 days of approval of the stormwater control and BMP operations and maintenance plan by the municipality:
 - (1) The operations and maintenance plan, or a summary thereof;
 - (2) Operations and maintenance agreements under § 245-35; and
 - (3) Easements under § 245-36.
- B. The municipality may suspend or revoke any approvals granted for the project site upon discovery of failure on the part of the owner to comply with this section.

§ 245-39. Municipal Stormwater Control and BMP Operation and Maintenance Fund.

- A. Persons installing stormwater controls or BMPs shall be required to pay a specified amount to the Municipal Stormwater Control and BMP Operation and Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:
 - (1) If the stormwater control or BMP is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the municipality for a period of 10 years, as estimated by the municipal Engineer. After that period of time, inspections will be performed at the expense of the municipality.

- (2) If the stormwater control or BMP is to be owned and maintained by the municipality, the deposit shall cover the estimated costs for maintenance and inspections for 10 years. The municipal Engineer will establish the estimated costs utilizing information submitted by the applicant.
- (3) The amount of the deposit to the fund shall be converted to present worth of the annual series values. The municipal Engineer shall determine the present worth equivalents, which shall be subject to the approval of the governing body.
- B. If a stormwater control or BMP is proposed that also serves as a recreational facility (e.g., ball field or lake), the municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreational purpose.
- C. If at some future time, a stormwater control or BMP (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.
- D. If stormwater controls or BMPs are accepted by the municipality for dedication, the municipality may require persons installing stormwater controls or BMPs to pay a specified amount to the Municipal Stormwater Control and BMP Operation and Maintenance Fund to help defray costs of operations and maintenance activities. The amount may be determined as follows:
 - (1) The amount shall cover the estimated costs for operations and maintenance for 10 years, as determined by the municipality.
 - (2) The amount shall then be converted to present worth of the annual series values.
- E. If a stormwater control or BMP is proposed that also serves as a recreational facility (e.g., ball field or lake), the municipality may adjust the amount due accordingly.
- F. The municipality may shall require applicants to pay a fee to the Municipal Stormwater Control and BMP Operation and Maintenance Fund to cover long-term maintenance of stormwater controls and BMPs.
- G. The municipality may require applicants to pay a fee to the Municipal Stormwater Control and BMP Operation and Maintenance Fund to cover stormwater-related problems which may arise from the land development and earth disturbance.

Article VIII. Prohibitions

§ 245-40. Prohibited discharges.

- A. No person in the municipality shall allow, or cause to allow, stormwater discharges into the municipality's separate storm sewer system which are not composed entirely of stormwater, except as provided in Subsection **B** below, and discharges allowed under a state or federal permit.
- B. Discharges that may be allowed based on a finding by the municipality that the discharge(s) do not significantly contribute to pollution of surface waters of the commonwealth, are:
 - (1) Discharges from fire-fighting activities.
 - (2) Potable water sources including dechlorinated waterline and fire hydrant flushings.
 - (3) Irrigation drainage.
 - (4) Routine external building washdown (which does not use detergents or other compounds).

- (5) Air conditioning condensate.
- (6) Water from individual residential car washing.
- (7) Spring water from crawl space pumps.
- (8) Uncontaminated water from foundation or from footing drains.
- (9) Flows from riparian habitats and wetlands.
- (10) Lawn watering.
- (11) Pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used.
- (12) Dechlorinated swimming pool discharges.
- (13) Uncontaminated groundwater.
- C. In the event that the municipality determines that any of the discharges identified in Subsection **B** significantly contribute to pollution of waters of the commonwealth, or is so notified by DEP, the municipality will notify the responsible person to cease the discharge.
- D. Upon notice provided by the municipality under Subsection **C**, the discharger will have a reasonable time, as determined by the municipality, to cease the discharge, consistent with the degree of pollution caused by the discharge.
- E. Nothing in this section shall affect a discharger's responsibilities under state law.

§ 245-41. Prohibited connections.

- A. The following connections are prohibited, except as provided in § **245-40B** above:
 - (1) Any drain or conveyance, whether on the surface or subsurface, which allows any nonstormwater discharge, including sewage, process wastewater, and wash water to enter the separate storm sewer system and any connections to the storm drain system from indoor drains and sinks; and
 - (2) Any drain or conveyance connected from a commercial or industrial land use to the separate storm sewer system which has not been documented in plans, maps, or equivalent records and approved by the municipality.

§ 245-42. Roof drains.

- A. Roof drains shall not be connected to streets, sanitary or storm sewers, or roadside ditches in order to promote overland flow and infiltration/percolation of stormwater where advantageous to do so.
- B. When it is more advantageous to connect directly to streets or storm sewers, connections of roof drains to streets or roadside ditches may be permitted on a case-by-case basis as determined by the municipality.
- C. Roof drains shall discharge to infiltration areas or vegetative BMPs to the maximum extent practicable.

§ 245-43. Alteration of BMPs.

- A. No person shall modify, remove, fill, landscape, or alter any existing stormwater control or BMP, unless it is part of an approved maintenance program, without the written approval of the municipality.

- B. No person shall place any structure, fill, landscaping, or vegetation into a stormwater control or BMP or within a drainage easement which would limit or alter the functioning of the stormwater control or BMP without the written approval of the municipality.

Article IX. Enforcement and Penalties

§ 245-44. Right-of-entry.

- A. Upon presentation of proper credentials, duly authorized representatives of the municipality may enter at reasonable times upon any property within the municipality to inspect the implementation, condition, or operation and maintenance of the stormwater controls or BMPs in regard to any aspect governed by this chapter.
- B. Stormwater control and BMP owners and operators shall allow persons working on behalf of the municipality ready access to all parts of the premises for the purposes of determining compliance with this chapter.
- C. Persons working on behalf of the municipality shall have the right to temporarily locate on any stormwater control or BMP in the municipality such devices as are necessary to conduct monitoring and/or sampling of the discharges from such stormwater control or BMP.
- D. Unreasonable delays in allowing the municipality access to a stormwater control or BMP is a violation of this article.

§ 245-45. Public nuisance.

- A. The violation of any provision of this chapter is hereby deemed a public nuisance.
- B. Each day that a violation continues shall constitute a separate violation.

§ 245-46. Enforcement generally.

- A. Whenever the municipality finds that a person has violated a prohibition or failed to meet a requirement of this chapter, the municipality may order compliance by written notice to the responsible person. Such notice may, without limitation, require the following remedies:
 - (1) Performance of monitoring, analyses, and reporting;
 - (2) Elimination of prohibited connections or discharges;
 - (3) Cessation of any violating discharges, practices, or operations;
 - (4) Abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
 - (5) Payment of a fine to cover administrative and remediation costs;
 - (6) Implementation of stormwater controls and BMPs; and
 - (7) Operation and maintenance of stormwater controls and BMPs.
- B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by the municipality or designee, and the expense thereof shall be charged to the violator.
- C. Failure to comply within the time specified shall also subject such person to the penalty provisions of this chapter. All such penalties shall be deemed cumulative and shall not prevent the municipality from pursuing any and all other remedies available in law or equity.

§ 245-47. Suspension and revocation of permits and approvals.

- A. Any building, land development, or other permit or approval issued by the municipality may be suspended or revoked by the municipality for:
- (1) Noncompliance with or failure to implement any provision of the permit;
 - (2) A violation of any provision of this chapter; or
 - (3) The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution, or which endangers the life, health, or property of others.
- B. A suspended permit or approval shall be reinstated by the municipality when:
- (1) The municipal Engineer or designee has inspected and approved the corrections to the stormwater controls and BMPs or the elimination of the hazard or nuisance; and/or
 - (2) The municipality is satisfied that the violation of the Ordinance, law, or rule and regulation has been corrected.
- C. A permit or approval that has been revoked by the municipality cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this chapter.

§ 245-48. Penalties.

- A. Any person violating the provisions of this chapter shall be subject to a fine of not less than \$100 nor more than \$1,000 for each violation, recoverable with costs. Each day that the violation continues shall constitute a separate offense, and the applicable fines are cumulative.
- B. In addition, the municipality, through its Solicitor, may institute injunctive, mandamus, or any other appropriate action or proceeding at law or in equity for the enforcement of this chapter. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

§ 245-49. Notification.

In the event that a person fails to comply with the requirements of this chapter or fails to conform to the requirements of any permit issued hereunder, the municipality shall provide written notification of the violation. Such notification shall state the nature of the violation(s) and establish a time limit for correction of these violation(s). Failure to comply within the time specified shall subject such person to the penalty provisions of this chapter. All such penalties shall be deemed cumulative and shall not prevent the municipality from pursuing any and all remedies. It shall be the responsibility of the owner of the real property on which any regulated activity is proposed to occur, is occurring, or has occurred to comply with the terms and conditions of this chapter.

§ 245-50. Enforcement.

The municipal governing body is hereby authorized and directed to enforce all of the provisions of this chapter. All inspections regarding compliance with the drainage plan shall be the responsibility of the municipal Engineer or other qualified persons designated by the municipality.

- A. A set of design plans approved by the municipality shall be on file at the site throughout the duration of the construction activity. Periodic inspections may be made by the municipality or designee during construction.
- B. It shall be unlawful for any person, firm, or corporation to undertake any regulated activity under § 245-4 on any property except as provided for in the approved drainage plan and pursuant to the requirements of this chapter. It shall be unlawful to alter or remove any control structure required by the drainage plan pursuant to this chapter or to allow the property to remain in a condition which does not conform to the approved drainage plan.
- C. At the completion of the project and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:
 - (1) Provide a certification of completion from an engineer, architect, surveyor, or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.
 - (2) Provide a set of as-built (record) drawings.
- D. After receipt of the certification by the municipality, a final inspection shall be conducted by the municipal Engineer or designated representative to certify compliance with this chapter.
- E. Prior to revocation or suspension of a permit and at the request of the applicant, the governing body will schedule a hearing to discuss the noncompliance if there is no immediate danger to life, public health, or property. The expense of a hearing shall be the applicant's responsibility.
- F. Occupancy permit. An occupancy permit shall not be issued unless the certification of completion pursuant to Subsection C(1) has been secured. The occupancy permit shall be required for each lot owner and/or applicant for all subdivisions and land developments in the municipality.

§ 245-51. Appeals.

- A. Any person aggrieved by any action of Radnor Township or its designee may appeal to the Radnor Township Board of Commissioners within 30 days of that action.
- B. Any person aggrieved by any decision of the Radnor Township Board of Commissioners may appeal to the County Court of Common Pleas in Delaware County within 30 days of the municipal decision.

