

ORDINANCE NO. HR-375

**Tredyffrin Township
Chester County, Pennsylvania**

**AN ORDINANCE DELETING APPENDIX I, EROSION,
SEDIMENTATION AND STORMWATER CONTROL OF CHAPTER 181,
SUBDIVISION AND LAND DEVELOPMENT, AND CREATING
CHAPTER 174, STORMWATER MANAGEMENT, OF THE CODE OF
TREDYFFRIN TOWNSHIP.**

BE IT ENACTED AND ORDAINED by the Board of Supervisors of Tredyffrin Township as follows:

SECTION I: Chapter 181, Subdivision and Land Development, is hereby amended by deleting Appendix I, Erosion, Sedimentation and Stormwater Control, in its entirety.

SECTION II: Article II, Section 6.B of Chapter 181, Subdivision and Land Development, is hereby amended by deleting the definitions for the following terms and replacing them with the following new definitions:

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 shortly after any given rainfall event and are dry until the next rainfall event.

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

Retention Basins/Ponds – A structure in which stormwater is stored and not released during the storm event. Retention basins/ponds are designed to retain a permanent pool of water during dry weather and potentially detain waters from a specific drainage area, or designed for infiltration purposes and do not have an outlet. The retention basin designed for infiltration purposes must infiltrate stored water in three (3) days or less.

Sediment – Solid material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water or air.

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

SECTION III: Section 53, Drainage and Stormwater Management, of Chapter 181, Subdivision and Land Development, of the Code of Ordinances of Tredyffrin Township is hereby deleted in its entirety and replaced with the following:

The design and construction of all on-site and off-site surface and subsurface drainage and stormwater management facilities shall be accomplished in accordance with the standards and criteria of Chapter 174, Stormwater Management, and any other applicable township, county, state or federal regulations.

SECTION IV: The Code of Tredyffrin Township is amended by adding a new Chapter 174, Stormwater Management, to read as follows:

ARTICLE I: General Provisions

Section 1. Title.

This chapter shall be known and may be cited as the “Tredyffrin Township Stormwater Management Ordinance.”

Section 2. Statement of Findings.

- A. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtakes 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 groundwater recharge, and threatens public health and safety.
- B. Inadequate planning and management of stormwater runoff resulting from land development throughout a watershed can harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of stream beds and stream banks, thereby elevating sedimentation), destroying aquatic habitat, and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals, and pathogens. Groundwater resources are also impacted through loss of recharge.
- C. A comprehensive program of stormwater management, including regulation of development and activities causing accelerated erosion, as well as 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 Commonwealth and the residents of Tredyffrin Township, their resources, and the environment.

- D. Stormwater is an important water resource which provides groundwater recharge for water supplies and baseflow of streams, which also protects and maintains surface water quality.
- E. Impacts from stormwater runoff can be minimized by using project designs that maintain the natural hydrologic regime and sustain high water quality, groundwater 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. Federal and state regulations require Tredyffrin Township to implement a program of stormwater controls. Tredyffrin Township is required to obtain a permit for stormwater discharges from their separate storm sewer system under the National Pollutant Discharge Elimination System (NPDES).
- G. Non-stormwater discharges to the Township's separate storm sewer system can contribute to pollution of waters of the Commonwealth by the Township.

Section 3. Purpose.

The purpose of this chapter is to promote the public health, safety, and welfare within Tredyffrin Township by maintaining the natural hydrologic regime and minimizing the impacts described in §174-2 through provisions designed to:

- A. Accommodate site development and redevelopment in a manner that protects public safety and is consistent with, or reestablishes, the natural hydrologic characteristics of each watershed and sustains groundwater recharge, stream baseflows, stable stream channel (geomorphology) conditions, the carrying capacity of streams and their floodplains, groundwater and surface water quality, and aquatic living resources and their habitats.
- B. Meet legal water quality requirements under state law, including regulations at 25 Pennsylvania Code Chapter 93.4, to protect, maintain, reclaim, and restore the existing and designated uses of the waters of this Commonwealth.
- C. Promote alternative project designs and layouts that minimize the impacts on surface and groundwater.
- D. Conserve the natural drainage systems as much as possible.
- E. Manage stormwater runoff close to the source, requiring a minimum of structures and relying on natural processes.
- F. Provide procedures and performance standards for stormwater planning and management.

- G. Maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources.
- H. Prevent scour and erosion of stream banks and stream beds.
- I. Provide proper operation and maintenance of all permanent Stormwater Management Best Management Practices that are implemented in Tredyffrin Township.
- J. Provide standards to meet the NPDES permit requirements.
- K. Promote non-structural Best Management Practices.
- L. Minimize increases in runoff stormwater volume.
- M. Minimize impervious surfaces.
- N. Manage accelerated stormwater runoff and erosion and sedimentation problems and stormwater runoff impacts at their source by regulating activities that cause these problems.
- O. Utilize and preserve existing natural drainage systems as much as possible.
- P. Maintain existing baseflows and quality of streams and watercourses, where possible.
- Q. Address the quality and quantity of stormwater discharges from the development site.
- R. Implement an illegal discharge detection and elimination program that addresses non-stormwater discharges into the Township's separate storm sewer system. (See Chapter 172, Storm Sewers.)
- S. Preserve the flood-carrying capacity of streams.
- T. Protect water quality by removing and/or treating pollutants prior to discharge to ground- and surface waters throughout Tredyffrin Township, and to protect, restore, and maintain the chemical, physical, and biological quality of ground and surface waters.
- U. Reduce flooding impacts and prevent a significant increase in surface runoff rates and volumes, pre-development to post-development, which could worsen flooding downstream in the watershed, enlarge floodplains, erode stream banks, and create other flood-related health, welfare or property losses; in general, to preserve and restore the natural flood-carrying capacity of streams and their floodplains.
- V. Protect adjacent lands from adverse impacts of direct stormwater discharges.

- W. Maintain the existing water balance in all watersheds, sub-watersheds, and streams in Tredyffrin Township, and protect and/or restore natural characteristics and habitats wherever possible throughout the watershed systems.

Section 4. Statutory Authority.

Tredyffrin Township is empowered to regulate land use activities that affect runoff and surface and groundwater quality and quantity by the authority of:

- A. Pennsylvania Stormwater Management Act (Act 167 of 1978, as amended).
- B. Federal Clean Water Act, 33 U.S.C. 1251;
- C. Clean Streams Law, 35 P.S. 691.1., et seq., since Tredyffrin Township is a municipal separate storm sewer system (MS4) under Phase II of the National Pollution Discharge Elimination System (NPDES) Storm Water Program of the Environmental Protection Agency (EPA).
- D. Home Rule Charter and Optional Plans Law (Act 62 of 1972, as amended) and the Tredyffrin Township Home Rule Charter;
- E. Pennsylvania Municipalities Planning Code, Act 247, as amended.

ARTICLE II: Definitions

Section 5. 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.”

Section 6. Definitions

AASHTO – American Association of State Highway and Transportation Officials.

Accelerated Erosion – The removal of the surface of the land through the combined action of human activity and the natural processes of a rate greater than would occur because of the natural process alone.

Agricultural Activity – 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.

Antecedent Condition – The specified characteristics of the land surface (e.g., meadow) prior to a proposed disturbance or prior to a rainfall event (e.g., amount of moisture in the soil); the basis for calculating increases in runoff attributable to the disturbance or storm which must be controlled.

Applicant – A person, landowner or developer, etc. who has filed an application for approval to engage in any regulated activity defined in §174-7

Aquifer – A geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield useful quantities of groundwater to wells and springs.

As-Built Drawings – Engineering or site drawings maintained by the contractor during construction of the project and upon which are documented 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 Township Engineer at the completion of the project.

Attenuate – To reduce the magnitude of the flow rate by increasing the time it takes to release a specified volume of runoff (for example the 1-year, 24-hour storm event). Attenuation is a method of reducing the peak flow rates for post development compared to the peak flow rates in predevelopment.

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 groundwater; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

Berm – Well-compacted earthfilled ridge.

Best Management Practice (BMP) – Activities, facilities, designs, measures or procedures used to manage stormwater impacts from Regulated Activities, to meet State Water Quality Requirements, to promote groundwater recharge, to prevent or reduce surface runoff and water pollution, and to otherwise meet the purpose of this chapter. Stormwater BMPs are commonly grouped into one of three broad categories or measures: “structural”, “non-structural”, and “operation and maintenance procedures.” In this chapter, non-structural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural BMPs or measures are those that consist of a physical device or practice that is installed to capture, treat and reduce stormwater runoff. Non-Structural BMPs include, but are not limited to, a variety of practices, from low-impact planning and design, reduction of impervious surfaces, protection of existing vegetated cover, and minimization of earth disturbances. Structural BMPs include, but are not limited to, a wide variety of practices and devices, from large-scale retention ponds and constructed wetlands, to smaller scale underground treatment systems, seepage beds and trenches, infiltration facilities, vegetated swales and filter strips, low impact design, bioretention (rain gardens), wet ponds, permeable paving combined with underground seepage beds, detention basins, manufactured devices, and operation and maintenance procedures. Structural Stormwater BMPs are permanent appurtenances to the project site.

Bioretention System (also known as rain garden) – A stormwater retention area that utilizes woody and herbaceous plants and soils to remove pollutants before infiltration occurs.

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).

Capture and Reuse Systems (also known as rainwater harvesting systems) - a structural system that intercepts, diverts, stores, and releases stormwater runoff for future use. Capture and reuse systems can be used for landscaping irrigation during dry weather, non-potable water uses, and on-site stormwater disposal.

CCCD – Chester County Conservation District.

CCHD – Chester County Health Department.

CFR – Code of Federal Regulations

CFS – Cubic feet per second.

Channel – A natural or artificial watercourse that conveys, continuously or periodically, flowing water. Channels include, but shall not be limited to, natural and human-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 underground reservoir or tank for storing rainwater.

Concentrated Storm Runoff – Surface runoff from rainfall events, which converges and flows primarily through water conveyance features such as swales, gullies, waterways, channels or storm sewers and which exceeds the maximum specified flow rates of filters or perimeter controls intended to control sheet flow.

Conservation Design – A series of holistic design practices that maximize protection of key land and environmental resources, preserve significant concentrations of open space and greenways, evaluate and maintain site hydrology, and ensure flexibility in development design to meet community needs and complementary and aesthetically pleasing development. Conservation design encompasses the following objectives: conservation/enhancement of natural resources, wildlife habitat, biodiversity corridors and greenways (interconnected open space); maintenance of a balanced water budget by making use of site characteristics and infiltration; incorporation of unique natural, scenic and historic site features into the configuration of the development; preservation of the integral characteristics of the site as viewed from adjoining roads; and reduction in maintenance required for stormwater management practices. Such objectives can be met on a site through an integrated development process that respects natural site conditions and attempts, to the maximum extent possible, to replicate or improve the natural hydrology of a site.

Conservation District – A conservation district, as defined in § 3(c) of the Conservation District Law (3 P.S. 851(c)), which has the authority under a delegation agreement executed with DEP to administer and enforce all or a portion of the erosion and sediment control program in this Commonwealth. The Chester 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 human-made barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semi-fluid. 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 semi-fluid.

DEP – Pennsylvania Department of Environmental Protection.

Design Professional (Qualified) – A Pennsylvania Registered Professional Engineer or Registered Professional Land Surveyor trained to develop stormwater management plans.

Design Storm – The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g., a 5-year storm) and duration (e.g., twenty-four (24) hours), used in the design and evaluation of stormwater management systems.

Detention – The discharge prevention, either directly or indirectly, of a given volume of stormwater runoff into surface waters by temporary storage. The volume of runoff that is captured and released into the waters of the Commonwealth at a controlled rate.

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 shortly after any given rainfall event and are dry until the next rainfall event.

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

Development – The construction, reconstruction, conversion, structural alteration, relocation or enlargement of buildings or other structures, the placement of mobile homes, mining, dredging, grading, filling, paving, excavation, drilling operations, or any use or extension of land. 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 §174-7 is planned, conducted, or maintained.

Diameter at Breast Height (DBH) – The outside bark diameter at breast height which is defined as four and one half (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 – 1. (verb) To release water from a project, site, aquifer, drainage basin, or other point of interest; 2. (noun) The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second (volume per unit of time).

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.

Ditch – A human-made waterway constructed for irrigation or stormwater conveyance purposes.

Diversion Terrace – Channel or ditch, together with a ridge, constructed across a sloping land surface on the contour or with predetermined grades to intercept and divert surface runoff before it gains sufficient volume and velocity to create harmful erosion.

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 Area – That land area contributing runoff to a single point and that is enclosed by a ridgeline.

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. A right-of-way granted to use private land to facilitate the flow of water, within which the owner shall erect no permanent structures but may use the land in any other way not inconsistent with the grantee's right or other applicable regulations.

Drainage Permit – A permit issued by the Township 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 §174-11.

Drainage System – All facilities and natural features used for the movement of stormwater through and from a drainage area, including, but not limited to, any and all of the following: conduits, pipes and appurtenant features, channels, ditches, flumes, culverts, streets, swales, gutters as well as all watercourses, water bodies and wetlands.

Earth Disturbance Activity (EDA) – 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, building construction, and the moving, depositing, stockpiling, or storing of soil, rock, or earth materials.

Easement – A grant of one or more of the property rights by the property owner and/or for use by the public, corporation or any other or entity.

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.

Energy Dissipator – A concrete, stone, or other similar structure designed to reduce the velocity and force of a concentrated flow of water.

EPA –Environmental Protection Agency

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.

Exceptional Value (EV) Waters – Surface waters of high quality which satisfy Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, §93.4b(b) (relating to anti-degradation).

Existing Condition – 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 “c” value, such as forested lands. If the existing condition is impervious the land use shall be considered “meadow.”

FEMA – Federal Emergency Management Agency

First-Order Stream – Uppermost perennial tributary in a watershed that has not yet confluenced with another perennial stream. The confluence of two first order streams forms a second-order stream.

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

Flood, 100-Year – A flood that has one (1) chance in 100 or a one (1) percent chance of being equaled or exceeded in any given year.

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.

Floodway – The channel of a watercourse and those portions of the adjoining floodplains which are reasonably required to carry and discharge the 100-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 100-year frequency floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the stream to fifty (50) feet from the top-of-bank.

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

Forestry - the management of forests and timberlands when practiced in accordance with accepted silvicultural principles, through developing, cultivating, harvesting, transporting and selling trees for commercial purposes, which does not involve any land development.

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 – 1. (noun) A slope, usually of a road, channel, or natural ground specified in percent and shown on plans as specified herein. 2. (verb) To finish the surface of a roadbed, the top of an embankment, or the bottom of an excavation.

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

Green Roof (also known as vegetated roofs or eco roofs) - Alternative roof surfaces that typically consist of waterproofing and drainage materials and an engineered growth media that is designed to support plant growth. Green Roofs capture and temporarily store stormwater runoff in the engineered growth media before it is conveyed to the storm system. A portion of the captured stormwater evaporates or it is taken up by plants, which helps reduce runoff volumes, peak runoff rates, and pollutant loads on development sites.

Ground Stabilization Fabric – A geotextile material designed to prevent upward or downward movement of soil or other solids while permitting water movement.

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) used to model the Darby-Cobbs, Crum, and Valley Creek watersheds during the Act 167 plan development and 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).

Hotspot – Area where land use or activity generates highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater, including but not limited to: 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 nurseries; and other land uses and activities as designated by an appropriate review authority.

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 groundwater supplies under natural 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. Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate.

Hydrology – The study of the properties, distribution, circulation and effects of water on the earth's surface, soil and atmosphere.

Impervious Surface - A horizontal surface that has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water, including but not limited to buildings, structures, and paved areas such as driveways, sidewalks, parking lots, patios, decks, swimming pools, tennis courts, etc. For the purposes of determining compliance with this chapter, stone surfaces routinely used for vehicle parking and movement shall be considered impervious.

Impoundment – A retention, detention basin, or other stormwater management facility 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 groundwater.

Infiltration Structure – A structure designed to direct runoff into the underground water (e.g., infiltration beds or trenches, dry wells, French drains, seepage pits, or trenches, bio-infiltration areas (rain gardens), porous pavement with underground infiltration beds, etc.).

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

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

Intensity – The depth of accumulated rainfall per unit of time.

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 groundwater discharge.

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

Karst – A type of topography or landscape characterized by surface depressions, sinkholes, rock pinnacles/ uneven bedrock surface, underground drainage, and caves. Karst is formed on carbonate rocks, such as limestone or dolomite.

Land Development – Any of the following activities:

- (i) The improvement of one (1) lot or two (2) or more contiguous lots, tracts, or parcels of land for any purpose involving:
 - a. A group of two (2) 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
 - b. The division or allocation of land or space, whether initially or cumulatively, between or among two (2) or more existing or prospective occupants by means of, or for the purpose of, streets, common areas, leaseholds, condominiums, building groups, or other features.
- (ii) A subdivision of land.

Level Spreader – A low earthen berm constructed perpendicular to the direction of slope and extending across the width of the slope for the purpose of intercepting surface runoff and spreading it behind the berm to enhance infiltration and reduce erosion and runoff from the

slope. The purpose of a level spreader is to prevent concentrated erosive flows from occurring and to spread out stormwater runoff uniformly over the ground as sheet flow.

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

- (i) A seasonal high water table, whether perched or regional, determined by direct observation of the water table or indicated by soil mottling.
- (ii) 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.
- (iii) A rock formation, other stratum, or soil condition that is so slowly permeable that it effectively limits downward passage of water.

Loading – The total amount (generally measured in pounds or kilograms per acre per year) of material (sediment, nutrients, oxygen-demanding material, or other chemicals or compounds) brought into a lake, stream, or waterbody by inflowing streams, runoff, direct discharge through pipes, groundwater, the air (aerial or atmospheric deposition) and other sources over a specific period of time (often annually).

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.

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.

Maintenance – The actions taken to restore or preserve the as-built functional design of any facility or system.

Maximum Design Storm – The maximum (largest) design storm that is controlled by the stormwater facility.

Meadow in Good Condition – A natural groundcover with less than one viable tree of six (6) inches or greater per 1,500 square feet, with continuous grass cover, and typically having greater than 75% uniform grass coverage. A cover condition for which SCS curve numbers have been assigned or to which equivalent Rational Method coefficients have been assigned.

MS4 – Municipal separate storm sewer system.

National Pollution Discharge Elimination System (NPDES) – The system created in 1972 under the Clean Water Act to authorize discharges to local receiving waters only pursuant to governmental permits, in an effort to reduce point source and nonpoint source pollutants.

Natural Condition – Pre-development condition. In terms of stormwater management, the land coverage as identified in the latest edition of TR No. 55, which existed 18 months prior to the application, shall be used for determining land cover type, except in the case where lead cover was impervious, in which case the condition of meadow shall apply.

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 groundwater.

New Development – Any activity regulated by this chapter that is not considered a redevelopment as defined in this chapter.

Nonpoint Source Pollution – Pollution that enters a waterbody from diffuse origins in the watershed and does not result from discernible, confined, or discrete conveyances.

Nonstormwater Discharge – 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 (BMP) – Passive site design approaches or regulatory approaches that positively impact water quality and reduce or minimize the generation of stormwater runoff without requiring the construction of specific or discrete stormwater management control structures. Methods of controlling stormwater runoff quantity and quality, such as innovative site planning, impervious area, land disturbance, and grading reduction, protection of natural depression areas, temporary ponding on-site, and other techniques.

NOAA – National Oceanic and Atmospheric Administration.

NPDES –National Pollutant Discharge Elimination System.

NRCS – Natural Resource Conservation Service (previously SCS).

Open Channel – A natural or human-made watercourse or conduit in which water flows with a free surface. A conveyance channel that is not enclosed.

Open Vegetated Channel – Also known as swales, grass channels, and biofilters or bioswales. These systems are used for the conveyance, retention, infiltration and filtration of stormwater runoff.

Outfall – “Point source” as described in 40 CFR § 122.2 at the point where the Township’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.

PACD – Pennsylvania Association of Conservation Districts

PADOT or PennDOT – Pennsylvania Department of Transportation

Parent Tract – The parcel of land from which a land development or subdivision originates, determined from the date of adoption of this ordinance.

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.

Percolation Rate – The rate of movement of water under hydrostatic pressure through interstices of rock or soil. For stormwater analysis, it is typically measured as a distance per unit time (e.g., inches per hour)

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

Planning Commission – The Planning Commission of Tredyffrin 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.

Post-construction – 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.

Pre-construction – Prior to commencing construction activities.

Pre-development Condition – Undeveloped/natural 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 §174-21.

Project Site – The specific area of land where any regulated activities in the Township are planned, conducted, or maintained.

Qualified Professional – Any person licensed by the Pennsylvania Department of State or otherwise qualified by law to perform work required by this chapter.

Rainfall Intensity – The depth of accumulated rainfall per unit time.

Rate – Volume per unit of time.

Rational Formula – A rainfall-runoff relation used to estimate peak flow.

Rational Method – A method for computing quantities of stormwater runoff. The rational formula relates runoff to rainfall by the following equation: $Q = c * i * a$

Q = Peak runoff in cubic feet per second

c = runoff coefficient which is actually the ratio of the peak runoff rate to the average rainfall rate for a period known as the time of concentration

i = average rainfall intensity in inches per hour for a period equal to the time of concentration

a = drainage area in acres.

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

Receiving Waters – Any water bodies, watercourse or wetlands into which surface waters flow.

Recharge – The replenishment of groundwater 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 Applicant. The engineer reviews the contractor's as-built drawings against his/her own records for completeness, then either turns these over to the Applicant or transfers the information to a set of reproducibles, in both cases for the Applicant's permanent records.

Redevelopment – Any development that proposes or consists of 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, interior remodeling projects and tenant improvements are not considered to be redevelopment.

Regulated Activity – Action or proposed action that involves the alteration or development of the land in a manner that may affect stormwater runoff, have an impact on stormwater runoff quality or quantity and that are specified in §174-7.

Regulated Earth Disturbance Activity – Defined under NPDES Phase II regulations as earth disturbance activity of one (1) acre or more with a point source discharge to surface waters or the Township's storm sewer system or five (5) 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 – A volume of flow being discharged from a storm water management facility or structure per specified unit of time (cubic feet per second, gallons per minute, etc.) or designated design storm (e.g. 10-year predevelopment flow storm). The specified release rates contained within this chapter are the maximum percentages of pre-development peak rate of runoff from a site or subarea that can be released after development.

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.

Reservoir – A basin, either natural or human-made, which contains or will contain the water or other fluid impounded by a dam.

Retention Basin/Pond – A structure in which stormwater is stored and not released during the storm event. A retention basin/pond is designed to retain a permanent pool of water during dry weather and potentially detain waters from a specific drainage area, or designed for infiltration purposes and do not have an outlet. The retention basin/pond designed for infiltration purposes must infiltrate stored water in three (3) 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 100-year return period rainfall would be expected to recur on the average of once every hundred (100) years. The probability of a 100-year storm occurring in any one year is 0.01 (i.e., a 1% chance).

Riparian Buffer – Land adjoining and immediately upgradient from rivers or streams that is vegetated with a combination of trees, shrubs, and herbaceous plants. A riparian buffer functions to maintain the integrity of stream channels to reduce the impact of upland sources of pollution by trapping, filtering and converting sediments, nutrients, and other chemicals, and supply food, cover and thermal protection to fish and other wildlife.

Riser – A vertical pipe extending from the bottom of a detention facility or pond that is used to control the discharge rate from the detention facility or 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 road banks, cleaning or clearing drainage ditches, and other similar activities.

Roof Drain – 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.

Root Mat – The surface and subsurface network of roots which support a tree.

Runoff – Any part of precipitation that flows over the land surface.

SALDO – Tredyffrin Township Subdivision and Land Development Ordinance.

SCS – Soil Conservation Service, United States Department of Agriculture.

Sediment – Solid material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water or air.

Sediment Basin – A barrier, dam, 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. The process occurs when sediment particles that have been suspended within flowing waters are deposited on the stream bottom or floodplain.

Seepage Pit/Seepage Trench – An area of the earth excavated, having an uncompacted bottom, completely wrapped with geotextile material and filled with loose clean 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, human-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 Area (SWPA) – The zone through which contaminants, if present, are likely to migrate and reach a drinking water well or surface water intake.

Special Protection Subwatershed – A watershed that has been designated by DEP as Exceptional Value (EV) or High Quality (HQ) waters.

Spillway – A conveyance that is used to pass and control the discharge of a design storm that is controlled by the stormwater facility. The emergency spillway is the conveyance that is used to

pass the peak discharge of the maximum design storm that is controlled by the stormwater facility.

Spring – A place where water flows naturally from a rock or soil upon the land or into a body of surface water.

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 stream bank, stream bed, 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 Event – The storm of a specific duration, intensity, and frequency.

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 Management – Procedures involved in the control of water that runs off the surface of the land from rain and melting snow.

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 human-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, infiltration seepage beds and trenches, bioretention areas (rain gardens), detention and

retention basins, green roof systems, capture and reuse systems, open channels, storm sewers, pipes, and water quality devices.

Stormwater Management Plan – A watershed plan for managing those land use activities that will influence stormwater runoff quality and quantity and that would impact the watersheds of Tredyffrin Township. The stormwater management plan includes the approved detailed analysis, design, and drawings of the stormwater management system required for activities regulated by this chapter.

Stormwater Runoff – The surface runoff generated by precipitation reaching the ground surface during and immediately after a rainfall event.

Stream – A natural watercourse with perennial or intermittent flow.

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 one hundred (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 (2) 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 ten (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.

SWMM – Stormwater Management Model developed by EPA for analyzing stormwater quantity and quality associated with runoff from urban areas. Both single event and continuous simulation can be performed on catchments having storm sewers, or combined sewers and natural drainage, for prediction of flows, stages and pollution concentrations.

Timber Operations – See Forestry.

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.

Township – Tredyffrin Township, Chester County, Pennsylvania.

Township Engineer – A professional engineer licensed as such in the Commonwealth of Pennsylvania, duly appointed as the Engineer for the Township.

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.

Water Table – The uppermost level of saturation of pore space or fractures by subsurface water in an aquifer. Seasonal high water table refers to a water table that rises and falls with the seasons due either to natural or human-made causes.

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.

Water Resources of the Township – 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 Tredyffrin Township.

Watershed – Region or area drained by a river, watercourse, or other body of water, whether natural or artificial. The area upstream and tributary to a point along a stream, lake, drainage facility or any point of interest that contributes runoff to that point.

Wellhead – A structure built over a well or 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 groundwater 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. For the purposes of regulation under this appendix, wetlands shall be construed to be all areas meeting the definition of wetlands, as then currently specified by the United States Army Corps of Engineers and/or the Pennsylvania Department of Environmental Protection. In any situation in which these sources do not coincide, the more inclusive area shall be considered to be wetlands under this chapter.

Woodlands - Areas characterized by dense and extensive tree cover growing closely together so that the driplines touch or overlap and in which there is more than one (1) viable tree of a diameter of six (6) inches or greater per 1,500 square feet of lot area; a cover condition for which SCS curve numbers have been assigned or to which equivalent Rational Method runoff coefficients have been assigned. This definition also includes groves of flowering or subcanopy trees, such as dogwood trees and young forests where the immature branches may not yet be interlocking. [To determine if an area has more than one (1) viable tree of six (6) inches or greater caliper per 1,500 square feet, the total area of the land in question (in square feet) shall be divided by 1,500. If the result is equal to or less than the number of viable trees of a diameter of six (6) inches or greater and meets the other stated characteristics, the area in question is considered a woodland.]

Woodlands in Good Condition – A natural groundcover with more than one (1) viable tree of six (6) inches or greater caliber per 1,500 square feet, protected from grazing, with leaf and organic litter and brush adequately covering the soil. A cover condition for which SCS curve numbers have been assigned or to which equivalent rational method coefficients have been assigned.

Zoning Ordinance - The Tredyffrin Township Zoning Ordinance of 1939, as amended.

ARTICLE III: Applicability

Section 7. Applicability/Regulated Activities

This chapter shall apply to all watersheds and areas in Tredyffrin Township. Additional standards for peak rate of runoff control shall apply if they are more stringent for areas within certain watersheds, subject to an adopted Act 167 Plan.

This chapter shall only apply to temporary erosion and sediment control measures, and all permanent structural and nonstructural stormwater management BMPs constructed as part of any of the regulated activities listed in this section.

The following activities shall be regulated by this chapter unless exempted by §174-8:

- A. Subdivisions.
- B. Land developments.
- C. Redevelopments.
- D. Construction of proposed, new or additional impervious surfaces (driveways, parking lots, roads, etc.).
- E. Construction of proposed buildings or additions to existing buildings.
- F. Alteration of the natural hydrologic regime.
- G. Diversion, piping or encroachments in any natural or human-made drainage channel.
- H. Installation of nonstructural and structural stormwater management BMPs or appurtenances thereto.
- I. Earth disturbance activities, whether or not they are associated with a development or redevelopment project, of greater than five thousand (5,000) square feet where slopes less than or equal to 15% are impacted by grading, disturbance or construction activities.
- J. Earth disturbance activities, whether or not they are associated with a development or redevelopment project, of greater than one thousand (1,000) square feet where slopes greater than 15% are impacted by proposed grading, disturbance or construction activities.
- K. Earth disturbances within 50 feet of other sensitive environmental features, such as streams, ponds, lakes and wetlands.
- L. Any of the above regulated activities which were approved more than five (5) years prior to the effective date of this chapter (date of adoption) and resubmitted for municipal approval.

Table 7.1 summarizes the applicability requirements. “Proposed Impervious Surface” in Table 7.1 includes new, additional, or replacement impervious surface/cover. Repaving existing surfaces without reconstruction does not constitute “replacement.”

**TABLE 7.1
APPLICABILITY**

| | Type of Project | Proposed Impervious Surface | | | | Earth Disturbance | |
|---|-------------------|---|------------------------------------|------------------------------------|--|----------------------|----------|
| | | 0 - 499 s.f. | 500 – 1,000 s. f. | >1,000 s. f. | > 1 acre | 5,000 s.f. to 1 acre | > 1 acre |
| Article III Drainage Plan Requirements | Development | Exempt | Modified | Yes | Yes | Yes | Yes |
| | Redevelopment | Exempt | Modified | Yes | Yes | Yes | Yes |
| §174-19 Nonstructural Project Design | Development | Exempt | Yes | Yes | Yes | Yes | Yes |
| | Redevelopment | Exempt | Yes | Yes | Yes | Yes | Yes |
| §174-20 Groundwater Recharge | Development | Exempt | Yes | Yes | Yes | Yes | Yes |
| | Redevelopment | Exempt | Yes | Yes | Yes | Yes | Yes |
| §174-21 Water Quality Requirements | Development | Exempt | Exempt | Yes | Yes | N/A | Yes |
| | Redevelopment | Exempt | Exempt | Yes | Yes | N/A | Yes |
| §174-22 Stream Bank Erosion Requirements | Development | Exempt | Exempt | Yes | Yes | N/A | Yes |
| | Redevelopment | Exempt | Exempt | Yes | Yes | N/A | Yes |
| §174-23 Stormwater Peak Rate Control and Management Districts | Development | Exempt | Exempt | Yes | Yes | Yes | Yes |
| | Redevelopment | Exempt | Exempt | Yes | Yes | Yes | Yes |
| Erosion and Sediment Pollution Control (E&SC) Plan | Earth Disturbance | See Earth Disturbance Requirements | See Earth Disturbance Requirements | See Earth Disturbance Requirements | See Earth Disturbance Requirements & NPDES Permit Req'd. | Yes | Yes |
| | | <ul style="list-style-type: none">0 - 5,000 SF – NO SWG PERMIT REQD FROM TWP, BUT E&SC BMPS REQD TO BE IMPLEMENTED ON-SITE0 – 1,000 SF – SWG PERMIT REQD FROM TWP, WITH E&SC PLAN AND BMPS IF IMPACTS SLOPES > 15%5,000 SF – 1 ACRE – SWG PERMIT REQD FROM TWP, WITH E&SC PLAN AND BMPS<ul style="list-style-type: none">➤ 1 ACRE – SWG PERMIT REQD FROM TWP, AND NPDES PERMIT REQD FROM CCCD AND/OR DEP (Refer to municipal earth disturbance requirements) | | | | | |

Legend:

Yes – Drainage Plan with Stormwater Management Controls necessary to meet the section provision.

Exempt - Exempt from required section provision – Drainage plan submission may still be required if other section provisions are applicable (yes in box).

Modified Drainage Plan – For sites with 500 SF to 1,000 SF of proposed impervious surfaces. This Stormwater and Grading Permit (SWG) shall follow the groundwater recharge requirements found in §174-20.A(2)a.

E&SC Plan - Erosion and Sediment Control Pollution Plans are required for earth disturbances greater than 5,000 SF. E&SC Plans are also required for earth disturbances greater than 1,000 SF if impacts to slopes >15%.

Section 8. 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. Agricultural activity when operated in accordance with a conservation plan, nutrient management plan, or erosion and sedimentation control plan approved by the County Conservation District. Installation of new or expansion of existing farmsteads, animal housing, waste storage, and production areas having a net increase of impervious surfaces greater than 1,000 square feet shall be subject to the provisions of this chapter.
 3. Forestry 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," operating under an approved erosion and sedimentation plan and complying with the stream buffer requirements in §174-21.J.
 4. Roadway replacement, development, or redevelopment that has less than 2,000 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.
 5. Proposed improvements not exceeding 499 square feet and where the total cumulative square footage of all impervious surfaces does not exceed the impervious surface standards of the applicable zoning district.
 6. Maintenance to any existing stormwater management system made in accordance with plans and specifications approved by the Township Engineer.
 7. 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 the Township Engineer within two (2) calendar days of the commencement of the activity. If the Township Engineer 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.
 8. Replacement of residential impervious coverage listed below is exempt from the provisions of this chapter:
 - a. Repair, maintenance, replacement, and/or resurfacing of existing asphalt, concrete, or impervious driveways. Relocation of existing driveways or reconstruction of driveways proposing additional impervious coverage exceeding 499 square feet are not exempt from the provisions of this chapter.

- b. Repair, maintenance, or replacement of existing stone, concrete, or impervious patios, wooden or composite decks, and sidewalks. Relocation of existing decks, patios, or sidewalks, or reconstruction proposing additional impervious coverage exceeding 499 square feet are not exempt from the provisions of this chapter.
 - c. Repair or maintenance to existing building structures, including interior and exterior renovations. Proposed building replacement projects, including complete rebuilds or partial knock down rebuilds exceeding 499 square feet are not exempt from the provisions of this chapter.
- 9. Resurfacing and/or milling and resurfacing of existing roadway and highway impervious surfaces without reconstruction.
- B. Exemptions for Development Activities. The following development and earthmoving activities are exempt from the drainage plan submission requirements of this chapter:
 - 1. Projects with up to a maximum of 499 square feet of new or additional proposed impervious surface.
 - 2. Projects with up to a maximum of five thousand (5,000) square feet of disturbed earth.

These criteria shall apply to the total development even if the development is to take place in phases. The date of the ordinance adoption shall be the starting point from which to consider tracts as “parent tracts” upon which future land development activities and respective earth disturbance computations shall be cumulatively considered.

- 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 (see §174-19).
 - 3. Drainage Problems - If a drainage problem is documented or known to exist downstream of or is expected to result from the proposed activity, then the Township may require the Applicant to comply with this chapter.
 - 4. Exemptions from provision of this chapter still require compliance with all other applicable regulations.

Section 9. Compatibility with Other Ordinances or Legal Requirements

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.

Nothing in this chapter shall be construed to affect any of the Township'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.).

ARTICLE IV: Drainage Plan Requirements

Section 10. General Requirements

Any of the activities regulated by this chapter, the preliminary or final approval of subdivision and/or land development plans, or the commencement of any regulated earth disturbance activity may not proceed until the Applicant or his/her agent has received written approval of a drainage plan from the Township Engineer and an adequate erosion and sediment control plan review by Tredyffrin Township and the Chester County Conservation District (if required).

Section 11. Drainage Plan Contents

The drainage plan shall consist of a general description of the project including sequencing items described in §174-19, 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, erosion and sediment control plan, and stormwater management plan shall refer to the associated maps by title and date. All drainage plan materials shall be submitted to the Township in a clear and well organized format.

The following items shall be included in the drainage plan:

A. General

1. General description of the project including those areas described in §174-19.B and §174-11.C.1.
2. General narrative and description of proposed permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities. A description of the effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing Township stormwater collection system that may receive runoff from the project site is to be included with this submission.
3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.
4. An erosion and sediment control plan, including all reviews, letters of adequacy and approval from the Chester Conservation District and/or DEP.
5. A general description of proposed non-point source pollution controls.
6. The drainage plan application and associated fee.

B. Plans/Maps

Plans/Map(s) of the project area shall be submitted on 24-inch x 36-inch (maximum of 30-inch x 42-inch if required for clarity) sheets and/or shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Chester 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 (2) feet.
3. Existing streams, lakes, ponds, wetlands or other Waters of the Commonwealth within the project area and which may be impacted by the project and are within 300 feet of the site.
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 and storm sewers, water, gas, and communication lines within three hundred (300) feet of property lines.
6. An overlay showing soil names and boundaries.
7. Limits of earth disturbance (L.O.D.), including the type and amount of impervious area that is proposed to be added to the site.
8. Proposed structures, roads, paved areas, and buildings. The total amount of impervious surface to be added shall be shown on the plan.
9. Proposed final contours at intervals of two (2) 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 (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (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 human-made features beyond the property boundary that would be affected by the project.
17. Location of all open ditches, drainage channels, overland drainage patterns and swales.
18. 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. All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.
19. A 20-foot wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way.
20. The location of all erosion and sediment control facilities and all stormwater management facilities.
21. In situations where approved stormwater management facilities are to be located off-site, notes shall be provided on the plans that clearly identify the responsibility for operation and maintenance of all stormwater management facilities. 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:
 - a. any revision to the approved drainage plan must be submitted to and approved by the Township; and
 - b. a revised erosion and sediment control plan must be submitted to and approved by the Chester County 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 within referenced drainage plan meets all design standards and criteria of the Tredyffrin Township Stormwater Management Ordinance.”

C. Supplemental Information

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 §174-20, §174-21, §174-22, §174-23 and §174-24.
 - 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 §174-28 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 Township stormwater collection systems that may receive runoff from the project site.
 - 4. A Declaration of Adequacy and Highway Occupancy Permit from the Pennsylvania Department of Transportation 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, wells, foundation walls, steep slopes, streams, and any other information requested by the Township Engineer must be shown.
- 3. When infiltration measures such as seepage pits, beds, or trenches are used, the maximum loading ratios, both impervious loading and total loading, to the infiltration area should be considered in the design. Separation from wells, septic system drains, and basement foundations should also be identified on the stormwater plans.
- 4. All calculations, assumptions, and criteria used in design of the stormwater management facilities must be shown.

Section 12. Plan Submission

The Township requires 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:
 - 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, where applicable.
- C. For projects that require subdivision or land development 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 subdivision or land development approval, see §174-10, General Requirements.
- E. Six (6) copies of the drainage plan shall be submitted and distributed as follows:
 - 1. Three (3) copies to the Township accompanied by the requisite review fee.
 - 2. Two (2) copies to the Chester County Conservation District.
 - 3. One (1) copy to the Chester County Planning Commission
- 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.

Section 13. Drainage Plan Review

- A. The Township Engineer shall review the drainage plan for compliance with the provisions of this chapter.

- B. The Township Engineer shall review the drainage plan for any subdivision or land development for compliance with the Township's SALDO provisions not otherwise superseded by this ordinance.
- C. The Chester County Conservation District, in accordance with established criteria and procedures, will review the drainage plan for consistency with stormwater management and erosion and sediment pollution control requirements and provide comments to the Township. Such comments shall be considered by the Township prior to final approval of the drainage plan.
- D. For activities regulated by this chapter, the Township Engineer shall notify the Applicant in writing, within 90 calendar days of submission of the drainage plan, whether the drainage plan is consistent with the provisions of this chapter.
- E. For regulated activities under this chapter that require an NPDES Permit Application, the Applicant shall forward a copy of the Township Engineer's review letter with comments regarding the drainage plan to the Conservation District. DEP and the Conservation District may consider the Township Engineer's review comments in determining whether to issue a permit.
- F. The Township will not grant preliminary or final approval to any subdivision or land development for regulated activities specified in §174-7 if the drainage plan has been found by the Township Engineer to be noncompliant with this stormwater management ordinance. All required permits from DEP must be obtained prior to approval of any subdivision or land development.
- G. No building permits for any regulated activity specified in §174-7 shall be approved by the Township if the drainage plan has been found to be noncompliant with this stormwater management ordinance, as determined by the Township Engineer and Chester County Conservation District, or without considering the comments of the Township Engineer and Chester County Conservation District. All required permits from DEP must be obtained by the Applicant prior to issuance of a building permit.
- H. The Applicant shall be responsible for completing as-built drawings of all stormwater management facilities included in the approved drainage plan. The as-built drawings and an explanation of any discrepancies with the design plans shall be submitted to the Township Engineer for final approval within 60 days of completion. As-built plans must be submitted to the Township Engineer prior to issuance of a Use and Occupancy Permit.
- I. Tredyffrin Township will not approve the record drawing until it 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.

- K. The Township's approval of a drainage plan shall be valid for a period not to exceed five (5) years commencing on the date of final approval of the project and the approved drainage plan. If stormwater management facilities included in the approved drainage plan have not been constructed, then the Township may consider the drainage plan noncompliant and may revoke any and all permits. Drainage plans that are determined to be noncompliant by the Township shall be resubmitted in accordance with §174-15.

Section 14. Modification of Plans

- A. A modification to a submitted drainage plan under review by the Township for a development site that involves the following shall require a resubmission to the Township of a modified drainage plan and applicable review and inspection fee consistent with §174-12 and be subject to review as specified in §174-13:
1. Change in stormwater management facilities or techniques,
 2. Relocation or redesign of stormwater management facilities, or
 3. Determination by the Township Engineer that the soil or other conditions are not as stated on the drainage plan.
- B. A modification to an already approved or noncompliant drainage plan shall be submitted to the Township, accompanied by the applicable review and inspection fee. A modification to a drainage plan for which a formal action has not been taken by the Township shall be submitted to the Township accompanied by the applicable review and inspection fee.

Section 15. Resubmission of Inconsistent or Noncompliant Drainage Plans

An inconsistent or noncompliant drainage plan may be resubmitted with the revisions addressing the Township's concerns documented in writing. One full copy of the plan package shall include all changes highlighted in yellow and/or tabbed when located within a report. It must be addressed to the Township Engineer in accordance with §174-12, distributed accordingly, and be subject to review as specified in §174-13. The applicable review and inspection fee must accompany a resubmission of an inconsistent or noncompliant plan.

ARTICLE V: Stormwater Management

Section 16. General Requirements

- A. Applicants proposing regulated activities in the Township which do not fall under the exemption criteria shown in §174-8 shall submit a drainage plan consistent with this chapter to the Township 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 explore and submit 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 §174-19 to ensure maintenance of the natural hydrologic regime, to promote groundwater recharge, and to protect groundwater 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.
- E. Stormwater flows onto adjacent property shall not be created, increased, decreased, relocated, or otherwise altered without the permission of the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of this chapter. 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. Proof of permission from all affected property owners shall be submitted in writing to the Township prior to issuance of a permit.
- 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 accelerated erosion, sedimentation, flooding, or other impacts will result from the concentrated discharge. Proof of permission from all affected property owners shall be submitted to the Township prior to issuance of a Stormwater and Grading Permit.
- G. Where a development site is traversed by existing streams, drainage easements shall be provided conforming to the line of such streams. At a minimum the drainage easement shall include the streambed, banks, and 10 feet extending from the top of each bank. It is

recommended that the drainage easement also includes the limits of the 100-year floodway.

- H. Minimization of impervious surfaces and the use of green roofs, and infiltration of runoff through seepage beds, infiltration trenches, rain gardens, etc., is encouraged where soil conditions permit in order to reduce the size or eliminate the need for detention facilities or other structural BMPs.
- I. All stormwater runoff shall be pretreated for water quality prior to discharge to surface or groundwater. Pretreatment devices may consist of a variety of BMPs, such as vegetative swales, water quality inlet devices, bioretention areas or rain gardens, etc., and are subject to review and approval by the Township Engineer. Pretreatment devices should be examined for pollutant removal efficiency for specific types of pollutants generated by proposed land development activities.
- J. All regulated activities within the Township 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 (i.e., during construction), and
 - 2. Water quality protection measures after completion of earth disturbance activities (i.e., after construction), including operations and maintenance.
- K. No regulated earth disturbance activities within the Township shall commence until the requirements of this chapter are met.
- L. Post-construction water quality protection shall be addressed as required by §174-21.
- M. Operations and maintenance of permanent stormwater BMPs shall be addressed as required by Article VIII.
- N. All BMPs used to meet the requirements of this chapter shall conform to the state water quality requirements, the provisions in Appendix B of this chapter, and any more stringent requirements as set forth by the Township.
- O. 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, wellheads, and on-site wastewater disposal systems.
6. Erodibility of soils.
7. Land availability and configuration of the topography.
8. Peak discharge and required volume control.
9. Stream bank 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.

Q. The stormwater management criteria are to be met on-site to the maximum extent possible to comply with the requirements of this chapter. In specific cases where the Applicant has demonstrated, to the satisfaction of the Township Engineer, that the requirements of this chapter cannot be achieved on-site with the use of non-structural and structural stormwater BMPs, the Applicant may, with Township approval, meet the stormwater management criteria through off-site stormwater management measures as long as the proposed measures are in the same subwatershed. It is strongly recommended that such off-site area be located upstream of the proposed developed site. It will be the Applicant's responsibility to locate adequate off-site areas and obtain all easements, agreements and permits to construct such facilities on property other than that which is proposed to be developed and currently owned by the Applicant. All easements, agreements and permits must be obtained and provided along with the stormwater plan submission to the Township for review and approval prior to the start of any construction activities. Furthermore, these agreements and plans will be recorded at the Office of the Recorder of Deeds for Chester County and two (2) copies of those dated/signed plans provided to the Township.

Section 17. Permit Requirements by Other Governmental Entities

Where any of the following permit requirements apply, they 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 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.

Section 18. Erosion and Sediment Control during Regulated Earth Disturbance Activities

- A. No regulated earth disturbance activities within the Township shall commence until the Applicant receives an approval from the Chester County Conservation District of an erosion and sediment control plan for construction activities. Township approval for earth disturbances is still required for all sites containing earth disturbances exceeding 1,000 square feet on steep slopes, and within 50 feet of other sensitive environmental features, such as, streams, ponds, lakes and wetlands, as well as for all earth disturbances greater than 5,000 square feet.
- B. DEP has regulations that require an erosion and sediment control plan for any earth disturbance activity of five thousand (5,000) square feet or more, under 25 Pennsylvania Code § 102.4(b).
- C. In addition, under 25 Pennsylvania Code Chapter 92, a DEP “NPDES Construction Activities” Permit is required for regulated earth disturbance activities. All earth disturbances exceeding one acre require NPDES permits submittal and approval by the Chester County Conservation District and/ or Pennsylvania Department of Environmental Protection.
- D. Evidence of any necessary permit(s) for regulated earth disturbance activities from the DEP Southeast Regional Office or Chester County Conservation District must be provided in writing to the Township.
- 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. All erosion and sediment control measures shall be inspected daily, as well as after each rainfall event during construction. Maintenance of all erosion and sediment control

measures shall be performed at a minimum on a weekly basis, unless sediment or other pollutants are observed leaving the site onto roadways, adjacent properties and/or environmentally sensitive areas, such as streams, ponds, lakes, wetlands, etc., in which case maintenance shall be performed immediately. Failure to maintain sites in accordance with approved erosion and control plans will result in temporary shut down of all site construction and disturbance activities until repairs and maintenance is performed to the satisfaction of the Township Engineer. An inspection and maintenance log shall be maintained on-site and available for inspection by Township staff during the full extent of site construction.

- G. Additional erosion and sediment control design standards and criteria shall be applied where infiltration BMPs are proposed. They shall include but are not limited to the following:
1. Proposed infiltration areas shall not be used as temporary sediment control BMPs during the construction phases of the project, unless such a proposal is approved by the Township Engineer. Sedimentation and compaction of soils can greatly reduce the permeability of underlying soils and negatively impact the ability of infiltration systems to function. In cases where proposed infiltration areas are proposed for dual-use as temporary sedimentation basins or traps, the following conditions, at a minimum, shall apply:
 - A minimum of 18-inches or greater of separation shall be maintained between the bottom of any proposed sedimentation BMP and the proposed infiltration bed bottom,
 - Additional soil testing shall be performed by the applicant prior to final installation and conversion of the BMP to ensure previous designs and soil testing values still apply,
 - A soil remediation plan shall be submitted to show a minimum of 18-inches of soil amendments, including incorporation of sand, organic matter, and tilling, to further improve site soils and permeability rates, and
 - An approved erosion and sedimentation inspection and maintenance plan shall be followed to reduce the risk of soil clogging and negative effects to proposed Infiltration BMPs.
 2. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity. Such protection measures should include measures, such as installation of orange construction fencing around proposed infiltration areas, protection from vehicular traffic and material laydown during construction, and erosion and sediment controls that minimize to the maximum extent practical sedimentation and uncontrolled runoff from unstabilized site areas to the proposed infiltration areas on-site.
 3. If at all possible, infiltration BMPs shall not be constructed nor receive runoff until the entire drainage area contributory to the infiltration BMP has achieved final stabilization.

4. Infiltration BMPs shall be constructed with equipment outside the limits of the proposed system or that will not compact the bottom of proposed beds or trenches. Equipment shall not be allowed on excavated areas of infiltration BMPs at any time during construction.
5. Infiltration BMPs shall be protected during and after excavation so as to eliminate and reduce to the maximum extent practicable sediment backwash into the BMP while the bottom and sides of the bed or trench is open, and once stone and filter fabric is in place.
6. Clean stone aggregate to be placed into infiltration BMPs shall be kept out of contact with site soils and disturbed areas, and shall be absent of fines. Stone aggregate for all proposed infiltration BMPs shall be delivered and placed directly into the BMP or stored in an appropriate manner to prevent sediment and soil contamination.
7. All contributing drainage to infiltration BMPs shall be protected with appropriate erosion and sediment control measures, in conformance with the Pennsylvania DEP Chapter 102 regulations, as well as the PA Stormwater BMP Manual. At a minimum, inlet protection and other measures shall remain until the contributory drainage area has achieved full stabilization.
8. Contributing drainage areas to infiltration BMPs shall be fully stabilized prior to allowance of stormwater runoff into the BMPs.

Section 19. Nonstructural Project Design (Sequencing to Minimize Stormwater Impacts)

- A. The design of all regulated activities shall include the following to minimize stormwater impacts.
 1. The Applicant shall explore and submit practicable alternatives to the surface discharge of stormwater (such as those listed in Appendix C, Table C-4), the creation of impervious surfaces, and the degradation of waters of the Commonwealth and must strive to 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 Township 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 design the proposed project according to 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 (springs), stream buffers, hydrologic soil groups, and geology. Land development, any existing recharge areas, and other requirements outlined in the Township SALDO shall also be included.
 2. Establish a stream buffer according to §174-21.J.
 3. Prepare a sketch plan showing avoidance of sensitive areas identified in §174-19.B.1.
 4. Identify site-specific existing conditions drainage areas, discharge points, recharge areas, and hydrologic soil groups A and B (areas conducive to infiltration).
 5. Evaluate nonstructural stormwater management alternatives, including:
 - a. Minimize earth disturbance.
 - b. Minimize impervious surfaces.
 - c. Break up large impervious surfaces.
 - d. Minimize clearing operations (vegetation removal).
 6. Satisfy the groundwater recharge (infiltration) objective in accordance with §174-20 and provide for stormwater pretreatment prior to infiltration.
 7. Provide for water quality protection in accordance with §174-21 water quality requirements.
 8. Provide stream bank erosion protection in accordance with §174-22 stream bank erosion requirements.
 9. Determine the peak rate control standard in accordance with §174-23 and conduct an existing and proposed 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 peak rate control standard.
12. Manage any remaining runoff prior to discharge through infiltration, detention, bioretention, green roof, retention, capture and reuse, direct discharge, or other structural control.

Section 20. Groundwater Recharge and Volume Control Standards

The Applicant shall comply with the following groundwater recharge and volume control requirements of this chapter.

Maximizing the groundwater recharge capacity of the area being developed is required. Design of the infiltration facilities shall consider groundwater recharge to compensate for the reduction in the recharge that occurs when the ground surface is disturbed or impervious surface is created. These measures are required to be consistent with §174-3 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 to the satisfaction of the Township Engineer that this cannot be physically accomplished (e.g., shallow depth to bedrock or limiting zone, etc.). In situations where it has been adequately demonstrated that the recharge requirement cannot be fully accomplished, the Applicant shall examine other alternative BMPs, such as green roofs, capture and reuse systems, wet ponds, and low-impact design measures employed to the maximum extent possible to achieve the maximum reduction in volume identified in this chapter. If it can be physically accomplished, then the volume of runoff to be infiltrated shall be determined from §174-20.A.2 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 twenty-four (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 three (3) days (72 hours).

- d. Pretreatment shall be provided prior to infiltration.
 - e. The design professional is required to follow Hotspot Investigation, Subsurface Stability, and Suitability of Infiltration procedures as set forth in the PA Stormwater BMP Manual, dated December 2006, and as amended, to determine whether the proposed infiltration on the development site is appropriate.
 - f. If soil and/or geotechnical analysis and testing reports demonstrate that the soil is unsuitable for infiltration, the Design Professional shall be responsible for providing written documentation showing that the required volume cannot physically be infiltrated within the required time period. Alternative BMPs, such as green Roofs, stormwater capture and reuse systems, bioretention areas, etc., shall be incorporated into the proposed design to maximize stormwater runoff volume reduction and achieve water quality protection in accordance with Sections 20 and 21 of this ordinance.
2. The size of the infiltration facility and Re_v shall be based upon the following volume criteria:
- a. Net Two-Year Volume Approach – The retention (infiltration) volume (Re_v) to be captured and infiltrated shall be the net 2-year 24-hour volume. The net volume is the difference between the post-development runoff volume and predevelopment runoff volume. The post-development total runoff volume for all storms equal to or less than the 2-year 24-hour duration precipitation shall not be increased. For modeling purposes existing (pre-development) non-forested pervious areas must be considered meadow in good condition or its equivalent, and existing impervious areas must be considered as meadow in good condition.
 - (i) In all plans and designs for stormwater management systems and facilities submitted to the Township Engineer for approval, stormwater peak discharge and runoff volume shall be determined through the use of the NRCS Soil Cover Complex Method as set forth in Urban Hydrology for Small Watersheds, Technical Release No. 55 (USDA, 1986), with specific attention given to antecedent moisture conditions, flood routing, time of concentration, and peak discharge specifications included therein and in Hydrology National Engineering Handbook, Section 4, (USDA, 1985) both by the U.S. Department of Agriculture, Natural Resources Conservation Service.
 - (ii) Note that when TR-55 is used for natural system-based approaches and practices encouraged herein, calculations must be performed on a detailed small subarea basis.

- (iii) Use of Technical Release No. 20 and other methods listed in Table 1 are also acceptable, provided the Township Engineer provides written approval to the methods prior to submission.
- (iv) The design professional's selection of a specific method shall be based on the suitability of the method for the given project site conditions with due consideration to the limitations of the method chosen. Table 1 herein summarizes the computational methods available.
- (v) Calculations shall be based on average antecedent moisture conditions (for the Soil Cover Complex Method only for example, TR-55, TR-20)
- (vi) Calculations shall be based on a type II distribution storm (for Soil Cover Complex Method, TR-55, TR-20)
- (vii) Calculations shall be based on the entire disturbed area (including disturbed pervious area) and must be performed for detailed sub-drainage areas for the project site.
- (viii) The averaging or weighting of a composite curve number (CN) or runoff coefficient is prohibited. Runoff shall be referenced from the Urban Hydrology for Small Watersheds Technical Release No. 55 (USDA, 1986). Coefficients for equivalent ground cover conditions shall be used if a runoff method other than the Soil Cover Complex Method is used.
- (ix) Predevelopment runoff calculations for wooded areas shall use a CN for ground cover of "woodland in good condition". Portions of a site having more than one viable tree of SBH of six (6) inches or greater per fifteen-hundred (1500) square feet shall be considered wooded were such trees existed within three (3) years of application.
- (x) Pre-development runoff calculations for all other portions of a site shall use a CN for ground cover of "meadow in good condition", even if the area is impervious.
- (xi) The following design storms shall be analyzed for the peak discharge and volumes from the pre and post development conditions. These values are applicable to the Soil-Cover Complex Method:
 - A one-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);

- A two-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);
- A ten-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);
- A twenty-five-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);
- A fifty-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);
- A one-hundred-year, twenty-four hour storm (rainfall per NOAA Atlas 14, Volume 2);

(xii) The Township Engineer may permit the use of the Rational Method for calculation of runoff on land developments of five (5) acres or less and for the design of storm sewers.

- b. Infiltrating the entire Re_v volume in §174-20.A.2.a (above) may not be feasible on every site due to site-specific limitations such as soil type or shallow depth to bedrock. 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 the first one inch (1.0") of runoff from all proposed impervious and disturbed pervious areas. Control of the first 1.0 inch of runoff by alternative BMP designs, such as Green Roofs, Capture and Reuse Systems, etc. may be allowed on sites where it has been demonstrated to the satisfaction of the Township Engineer that infiltration of the first one inch (1.0") of runoff cannot be achieved.

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

$$Re_v = I \text{ (inches)} * [\text{impervious area (square feet)} + \text{disturbed pervious area (square feet)}] \div 12 \text{ (inches/ft)} = \text{cubic feet (cf)}$$

An asterisk (*) in equations denotes multiplication.

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

The retention volume values derived from the methods in §174-20.A.2.a, and/or §174-20.A.2.b 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

encouraged to infiltrate as much of the stormwater runoff from the site as possible.

- c. The ground cover assumptions used for selection of runoff coefficient for calculation of the predevelopment runoff for both redevelopment and development shall be as follows:
 - (i) Woodland areas shall use a ground cover of woodland in good condition. Portions of a site having more than one viable tree of a DBH of six (6) inches or greater per fifteen hundred (1,500) square feet shall be considered wooded where such trees existed within three (3) years of application.
 - (ii) Agricultural sites shall use ground cover of pasture in good condition.
 - (iii) All other portions of a site shall use ground cover of meadow in good condition even if the area is impervious.
 - (iv) Weighted averaging of ground cover for calculation purposes is not permitted.

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, depth to groundwater and/or seasonal high water, and subgrade stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and human-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 sub-grade stability; infiltration may not be ruled out without conducting these tests.
2. Conduct field tests such as double ring infiltrometer or hydraulic conductivity tests (at the level of the proposed infiltration surface) to determine the appropriate hydraulic conductivity rate. Percolation tests are not recommended for design purposes.
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 Township that the soils are conducive to infiltrate by actual field tests on the lots identified.

- C. Karst and/or Carbonate Geology Areas. In areas underlain by karst and/or carbonate geology, the viability and specific design standards of infiltration BMPs at a given site must be determined on a site-specific basis to avoid groundwater contamination and formation and/or expansion of solution channels, sinkholes, and other potentially dangerous karst features. A site evaluation shall be conducted by a qualified professional geologist, geotechnical engineer, or other qualified professional, licensed by the Commonwealth of Pennsylvania, to ascertain the subsurface conditions of soil, rock and groundwater relevant to formation of karst features. Such an evaluation shall include, but not limited to:
1. Soil thickness, gradation, anisotropy, and permeability (from existing soil data, borings, and on-site testing) to determine the capacity and rate of infiltration of the soil, and relative depth of soil necessary to protect against sinkhole formation.
 2. Karst characteristics of geologic units underlying the site (from current publications, maps and information of U.S. Geological Survey, PA Geological Survey, PA Department of Transportation, etc.)
 3. Inventory of existing karst landforms, visual indications and/or surface manifestations of subsurface features or other karst features (from interviews with Township representatives' familiar with known problem areas, review of aerial photography, and site reconnaissance.)
 4. Geophysical survey of the site to identify locations and extent of existing subsurface karst features.
 5. Effectiveness of soil mantle to remove pollutants from infiltrating water to determine whether or not the need exists for removal of pollutants from stormwater runoff prior to infiltration (for example, soil thickness and soil cation exchange capacity, etc.)
 6. Depth to groundwater and vertical location of water table to carbonate geologic unit (from existing information and/or borings)
 7. Other appropriate site specific parameters affecting infiltration.
- D. Stormwater Hotspots.
1. Untreated stormwater runoff from hotspots shall not be allowed to recharge into groundwater 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) without adequate prior pretreatment suitable to address the pollution or contaminant(s) in question.
 2. A greater level of stormwater treatment shall be considered at hotspot sites to prevent pollutant washoff after construction.

3. Residential streets are not normally considered hotspots.
 4. While large highways (average daily traffic volume greater than 30,000) are not designated as stormwater hotspots, highway stormwater management plans shall include BMP's to adequately protect groundwater.
 5. The design of all facilities at hotspots over karst shall include an evaluation of measures to minimize adverse effects.
- E. Extreme caution shall be exercised where infiltration is proposed in SWPAs as defined by the Township or the Chester County Water Resources Authority.
 - F. Infiltration facilities shall be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives.
 - G. Extreme caution shall be exercised where salt or chloride would be a pollutant since soils do little to filter this pollutant, and it may contaminate the groundwater. A qualified design professional shall evaluate the possibility of groundwater contamination from the proposed infiltration facility and perform a hydrogeologic justification study if necessary.
 - H. The infiltration requirement in High Quality (HQ) or Exceptional Value (EV) waters shall be subject to DEP's Chapter 93 anti-degradation regulations.
 - I. A detailed hydrogeologic investigation shall be required by the Township. An impermeable liner may be required in detention basins where the possibility of groundwater contamination exists.
 - J. The Applicant shall provide safeguards against groundwater contamination for land uses that may cause groundwater contamination should there be a mishap or spill. A narrative shall be provided describing the proposed material to be used and the possibility of contamination occurring.

Section 21. Water Quality Requirements

The Applicant shall comply with the following water quality requirements.

- A. Developed and redeveloped areas shall provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff. The retention volume computed under §174-20 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. The required water quality volume (WQv) is the storage capacity needed to capture and treat a portion of stormwater runoff from the developed areas of the site.

- B. The first one (1) inch of runoff from all disturbed areas must be captured and treated prior to release.
- C. Any volume captured and not released from the site as part of the volume control may be subtracted from the volume required to be managed under this standard. To achieve this goal, the following calculation formula is to be used to determine the water quality storage volume (WQv) in acre-feet of storage required by this chapter:

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

Where: WQv = Water Quality Volume (acre-feet)

P = 1 inch

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

Rv = $0.05 + 0.0009(I)$ where I is the percent of the area that is
impervious surface ((impervious area/A)*100)

This volume requirement can be accomplished by the permanent volume of a wet basin or the detained volume from other BMPs, such as bioretention. Where appropriate, wet basins shall be utilized for water quality control and shall follow the guidelines of the PA Stormwater BMP Manual.

- D. 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. No regulated earth disturbance activities within the Township shall commence until approval by the Township of a plan which demonstrates compliance with post-construction state water quality requirements.
- F. The BMPs shall be designed, implemented, and maintained to meet state water quality requirements and any other more stringent requirements as determined by the Township.
- G. To control post-construction stormwater impacts from regulated earth disturbance activities, state water quality requirements can be met by BMPs, including site design, which provide for replication of pre-construction stormwater infiltration and runoff conditions so that post-construction stormwater discharges do not degrade the physical, chemical, or biological characteristics of the receiving waters. As described in the DEP Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:
1. Infiltration: replication of pre-construction 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, and

3. Stream bank and stream bed protection: management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g., from scouring).
- H. The temperature and quality of waters and streams shall be maintained through the use of temperature sensitive BMPs and stormwater conveyance systems.
- I. To accomplish the above, the Applicant shall submit designs to the Township Engineer for review and approval. Such designs shall achieve the water quality objectives through a combination of different BMPs.
- J. If a perennial or intermittent stream passes through the site, the Applicant shall create a stream buffer extending a minimum of ten (10) feet to either side of the top-of-bank of the channel. The buffer shall be maintained with appropriate native vegetation (refer to Appendix H of the Handbook of Best Management Practices for Developing Areas and Section 6.7 of the PA Stormwater BMP Manual (December 2006)). 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.
- K. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate DEP regional office must be provided to the Township prior to any site activity.

Section 22. Stream Bank Erosion Requirements

- A. The Applicant must design a BMP to detain the proposed conditions 2-year, 24-hour design storm to the existing conditions 1-year flow using the SCS Type II distribution.
- B. Provisions shall be made (such as adding a small orifice at the bottom of the outlet structure) so that the proposed conditions 1-year storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the 1-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).
- C. The minimum orifice size in the outlet structure to the BMP shall be three (3) 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 24-hour attenuation with the 3-inch orifice, the calculations shall be submitted showing this condition. Orifice sizes less than three (3) inches can be utilized, provided that the design will prevent clogging of the intake.

Section 23. Stormwater Peak Rate Control and Management Standards

- A. Watershed Criteria. Developments must control proposed condition peak runoff rates to predeveloped condition peak runoff rates for the design storms in accordance with Table

23.1. The criteria for peak runoff control are designed to reduce post-development peak flow to pre-developed conditions.

Table 23.1
Peak Rate Control Standards for Tredyffrin Township Watersheds

| Proposed Condition | Reduce to > | Predeveloped Condition |
|---------------------------|-----------------------|-------------------------------|
| Design Storm | | Design Storm |
| 2-year | | 1-year |
| 5-year | | 1-year |
| 10-year | | 10-year |
| 25-year | | 25-year |
| 50-year | | 50-year |
| 100-year | | 100-year |

- B. The ground cover assumptions used for selection of the runoff coefficient for calculation of the predevelopment runoff for both redevelopment and new development shall be as follows:
1. Woodland areas shall use a ground cover of woodland in good condition. Portions of a site having more than one viable tree of a DBH of six (6) inches or greater per fifteen hundred (1,500) square feet shall be considered wooded where such trees existed within three (3) years of application.
 2. Agricultural sites shall use ground cover of pasture in good condition.
 3. All other portions of a site shall use ground cover of meadow in good condition even if the area is impervious.
 4. Weighted averaging of ground cover for calculation purposes is not permitted.
- C. General. Proposed conditions rates of runoff from any regulated activity shall not exceed the predeveloped peak rate of runoff as specified in §174-23.A and the criteria identified in Table 23.1.
- D. Watershed Boundaries. The exact location of the stormwater management watershed boundaries as they apply to a given site development shall be determined by mapping the boundaries using 2-foot topographic contours (or most accurate data required) provided as part of the drainage plan.
- E. 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.

- F. Site Areas. Where 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 watershed criteria. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the management criteria.
- G. Alternate Criteria for Redevelopment Sites. For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is the most appropriate for the given site conditions as determined by the Township Engineer:
1. Meet the full requirements specified by Table 23.1 and §174-23.A through 23.G., or
 2. Reduce the total impervious surface coverage on the site by at least twenty (20) percent based upon a comparison of existing impervious surface to proposed impervious surface.
- H. A Modified Rational Method analysis may be used for drainage areas smaller than five (5) acres when permitted by the Township Engineer. The term “Modified Rational Method” used herein refers to a procedure for manipulation of the basic rational method techniques to reflect the fact that storms with a duration greater than the normal time of concentration for a basin will result in a larger volume of runoff even though the peak discharge is reduced. The methodology and model chosen for use shall be well documented as being appropriate for use in this region, and all relevant assumptions, methodologies, calculations and data used shall be provided to the Township Engineer for review. Information on the Modified Rational Method is presented in the Recommended Hydrologic Procedures for Computing Urban Runoff from Small Watersheds in Pennsylvania (DEP, 1982).
- I. Rainfall intensities used for the Modified Rational Method shall be based on the current PennDOT Storm Intensity-Duration-Frequency chart appropriate to the specific site.
- J. The Rational Method (that is, $Q=CIA$) shall be used for calculations of the peak rate of runoff for the design storm sewers and drainage swales but not for the design of stormwater management facilities where a full hydrograph is needed. The equation representing the Rational Method is comprised of the following (in English units):
- Q = Peak flow rate, cubic feet per second (CFS)
 - C = Runoff coefficient, dependent on land use/cover
 - I = Design rainfall intensity, inches per hour
 - A = Drainage area, acres

Section 24. Calculation Methodology

Stormwater runoff from all development sites with a drainage area of greater than two hundred (200) acres shall be calculated using a generally accepted calculation technique that is based on the NRCS Soil Cover Complex Method. Table 24.1 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 as approved by the Township Engineer. The Township Engineer may allow the use of the Rational Method to estimate peak discharges from drainage areas that contain less than five (5) acres. The Soil Cover Complex Method shall be used for drainage areas greater than five (5) acres.

TABLE 24.1

**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 within the limitations described in TR-55. |
| HEC-1/ HEC-HMS | US Army Corps of Engineers | Applicable where use of a full hydrologic model 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. |
| Modified Rational Method (or commercial computer package based on this method) | Emil Kuichling (1889) | For sites less than five (5) acres, or as approved by the Township and/or Township Engineer. |
| Other Methods | Varies | Other computation methodologies approved by the Township 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 NOAA Atlas 14. If a hydrologic computer model such as HEC-1/ HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be twenty-four (24) hours.
- 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 woodlands in good condition.

Portions of a site having more than one viable tree of a DBH of six (6) inches or greater per fifteen hundred (1,500) square feet shall be considered wooded where such trees existed within three (3) years of application.

- b. For all other development and redevelopment sites, the ground cover used in determining the existing conditions flow rates for the developed portion of the site shall be considered as meadow in good condition, even if the area is impervious.
 - c. Weighted averaging of ground cover for calculation purposes is not permitted.
- 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 NOAA Atlas 14, or the PADOT Storm Duration Frequency Charts. 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 C-1 in Appendix C.
- F. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational Method shall be obtained from Table C-2 in Appendix C.
- 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 C-3 in Appendix C.
- 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 an acceptable method. The design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Township Engineer 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.

Section 25. Other Requirements

- A. Any stormwater facility located on state highway rights-of-way shall be subject to approval by PennDOT.
- B. All wetland treatment systems, wet ponds, and wet basin designs shall incorporate the following biologic controls to deter mosquitoes that can cause West Nile Virus:
 - 1. If a wetland is planned, proper hydrologic soil conditions and the establishment of hydrophytic vegetation should be included to promote the population of the wetland by amphibians and other mosquito predators. Species of emergent vegetation with little submerged growth are preferable. By limiting the vegetation growing below the water surface, larvae lose protective cover, and there is less chance of anaerobic conditions occurring in the water.
 - 2. Stormwater ponds should include aeration fountains and stocked fish to keep larval mosquito populations in check.
- 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 100-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 100-year proposed conditions inflow. Should any stormwater management facility require a dam safety permit under DEP 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 100-year event.
- D. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures) and any work involving wetlands governed by DEP 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 DEP.
- 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 25-year design storm with a minimum one (1.0) foot of freeboard measured below the lowest point along the top of the roadway. Any facility that constitutes a dam as defined in DEP 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 25-year design storm. Conveyance facilities to or exiting from stormwater management facilities (e.g. 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 100-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 25-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 Township reserves the right to disapprove any design that would result in construction in or continuation of a stormwater problem area.
- I. Underground stormwater management systems must be designed to store the required recharge volume below the invert of any positive overflow pipe.
- J. Roof drains shall discharge to infiltration areas or vegetative BMPs to the maximum extent practicable.
- K. Roof drains shall not be connected to streets, sanitary sewer or storm sewers, roadside ditches, or into the legal ROW of streets.
- L. 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 Township Engineer.
- M. No person shall modify, remove, fill, landscape, or alter any existing stormwater control or BMP without written approval by the Township unless it is part of an approved maintenance program.
- N. 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 Township.

ARTICLE VI: Inspections

Section 26. Inspections

- A. The Township Engineer or his representative shall inspect all phases of the installation of the permanent BMPs and/or stormwater management facilities as deemed appropriate by the Township Engineer. Additional inspections will be required to ensure that Erosion and Sediment Control Measures have been installed and are functioning per the approved E&SC Plan.
- B. During any stage of the project, if the Township Engineer or his designee determines that the permanent BMPs and/or stormwater management facilities are not being installed in accordance with the approved erosion and sediment control and/or stormwater management plan, the Township may revoke any existing permits or other approvals and issue a cease and desist order, as specified in this chapter, until the deficiencies are corrected and approved by the Engineer.
- C. A final inspection of all BMPs and/or stormwater management facilities shall be conducted by the Township Engineer or his representative to confirm compliance with the approved drainage plan prior to the issuance of any occupancy permit.
- D. Prior to final inspection, As-Built Plans of all stormwater management facilities including, but not limited to, the site grading and other related physical improvements shall be submitted certifying that the facilities are built and conform to the approved design. As-built plans shall be submitted to the Township Engineer for review prior to the issuance of the Use and Occupancy Permit.
- E. For all permanent stormwater management facilities approved as part of a Plan approved by the Township, the Applicant and/or property owner shall be responsible for implementing routine and emergency inspections, as defined within the Applicant's Stormwater Management Operation and Maintenance Plan submitted along with the Stormwater Management Plan.

ARTICLE VII: Fees and Expenses

Section 27. Township Drainage Plan Review and Inspection Fee

Fees shall be established by the Township to defray plan review and construction inspection costs incurred by the Township. A review and inspection fee schedule shall be established by resolution of the Township Board of Supervisors.

ARTICLE VIII: Maintenance Responsibilities

Section 28. Responsibilities for Operations and Maintenance of Stormwater Controls and BMPs

- A. No regulated earth disturbance activities within the Township shall commence until approval by the Township of a Stormwater Management Operations and Maintenance Plan that describes how the permanent (e.g., post-construction) 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 Chester County, shall be submitted on 24-inch x 36-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, adjacent properties, and/or other identifiable landmarks,
 - c. Existing and final contours at intervals of two (2) 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 and natural features to be preserved,
 - f. The locations of all existing and proposed utilities, sanitary sewers, storm sewers, water and gas lines within three hundred (300) 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, utilities, roads, sidewalks, paved areas, and buildings, and
 - i. A 20-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. At a minimum the stormwater management operation and maintenance plan shall include the following items:

- a. Who is responsible for the long-term Operation and Maintenance (Owner, as well as any affiliated Management Firm responsible for conducting the inspections and maintenance activities). Contact information, including telephone number, cell phone, email addresses, addresses, names and title, as well as emergency contacts should be included in the O&M Plan.
 - b. What are the permanent Stormwater facilities and controls that will be operated and maintained per the approved Plan, including but not limited to items such as inlets, pipes, outfalls, headwalls, endwalls, basins, underground seepage and detention beds, swales, etc. Specific elements of the stormwater management plan should be identified for the inspection.
 - c. When – A timeframe for routine and emergency inspections and maintenance of all permanent stormwater management facilities shall be provided on the plan. At a minimum all facilities will be inspected at least once per quarter of each year and after all rainstorms exceeding 2.0 inches per 24-hour period.
 - d. How – A description of how inspections will be conducted, as well as reports kept on file with the property owner shall be included in the Plan. At a minimum inspection reports shall be signed by the owner and owner's engineer and submitted to the Township on a yearly basis to ensure that all permanent stormwater management facilities are operating according to the approved Stormwater Management Plan. In addition, all maintenance activities shall be documented and provide with the yearly report.
 - e. Where – The owner shall submit yearly reports to the Township Engineer setting forth the location of all stormwater facilities to be inspected and maintained.
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, and
 4. A statement, signed by the landowner, acknowledging that the stormwater controls and BMPs are fixtures that cannot be altered or removed without first obtaining approval from the Township Engineer.
- 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

Township, stormwater controls and BMPs may also be dedicated to and maintained by the Township;

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 Township shall make the final determination on the continuing operations and maintenance responsibilities. The Township reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater controls and BMPs.

Section 29. Municipal Review of a Stormwater Control and BMP Operations and Maintenance Plan

- A. The Township Engineer or designee shall review the Stormwater Management Operations and Maintenance Plan for consistency with the purposes and requirements of this chapter and any permits issued by DEP.
- B. The Township Engineer or designee shall notify the Applicant in writing whether or not the Stormwater Management Operations and Maintenance Plan is approved.
- C. The Stormwater Drainage Plan and Stormwater Management Operations and Maintenance Plans shall be recorded at the Office of the Recorder of Deeds of Chester County, and proof of the recording submitted to the Township Engineer.

Section 30. Adherence to an Approved Stormwater Control and BMP Operations and Maintenance Plan

It shall be a violation of this ordinance for any person or entity to alter or remove any permanent stormwater control and BMP required by an approved Stormwater Management Operations and Maintenance Plan or to allow the property to remain in a condition which does not conform to an approved Stormwater Management Operations and Maintenance Plan.

Section 31. Operations and 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 Operation and Maintenance Agreement covering all stormwater facilities that are to be privately owned and operated. The maintenance agreement shall be transferred with transfer of ownership.
- 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 Township Engineer.

Section 32. 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 Township 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 §174-32.
- C. At the discretion of the Township Engineer, applicants may be required to obtain off-site stormwater easements with adjacent downstream property owners in cases where flows are not controlled on-site and not conveyed to defined drainage channels, streams, etc.

Section 33. Recording of an Approved Stormwater Control, 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 Management Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of Deeds for Chester County within fifteen (15) days of approval of the Stormwater Management Operations and Maintenance Plan by the Township:
 - 1. The Stormwater Management Plan and Details approved by Tredyffrin Township,
 - 2. The Operations and Maintenance Plan approved by Tredyffrin Township and signed by the property owner and design engineer, or a summary thereof,
 - 3. Operations and Maintenance Agreement(s) under §174-31, and
 - 4. Easements under §174-32.
- B. The Township 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.

ARTICLE IX: Enforcement and Penalties

Section 34. Right-of-Entry

- A. Upon presentation of proper credentials, duly authorized representatives of the Township may enter at reasonable times upon any property within the Township to inspect the implementation, condition, or operation and maintenance of the stormwater controls or BMPs, such as drain, conveyance, discharge or stormwater facility, in regard to any aspect governed by this chapter, consistent with federal and state laws.
- B. Stormwater control and BMP owners and operators shall allow persons working for or on behalf of the Township ready access to all parts of the premises for the purposes of determining compliance with this chapter.
- C. Persons working for or on behalf of the Township shall have the right to temporarily locate on any stormwater control or BMP in the Township 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 Township access to a stormwater control or BMP is a violation of this ordinance.

Section 35. Enforcement Generally

- A. Whenever the Township finds that a person or entity has violated a prohibition or failed to meet a requirement of this chapter, the Township 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 such violation(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 Township or designee, and the expense thereof shall be charged to the violator.

- B. 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 Township from pursuing any and all other remedies available in law or equity.

Section 36. Suspension and Revocation of Permits and Approvals

- A. Any building, land development, or other permit or approval issued by the Township may be suspended or revoked by the Township 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 when:
 - 1. The Township Engineer or designee has inspected and approved in writing the corrections to the stormwater controls and BMPs or the elimination of the hazard or nuisance, and/or
 - 2. The Township Engineer is satisfied and states in writing 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 Township cannot be reinstated. The Applicant may apply for a new permit under the procedures outlined in this chapter.

Section 37. Penalties

- A. Any person or entity violating the provisions of this ordinance shall be subject to a fine of not 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. In default of payment of the above-referenced fines and costs, the violator may be sentenced to a term of imprisonment not to exceed 90 days. The determination of a violation shall be made by a magisterial district justice with jurisdiction and venue over the location of the violation and such an action will be subject to the procedures provided for the enforcement of summary offenses under the Pennsylvania Rules of Criminal Procedure.

- B. In addition, the Township, 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.

Section 38. Notification

In the event that a person or entity fails to comply with the requirements of this chapter or fails to conform to the requirements of any permit issued hereunder, the Township 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 such 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 Township from pursuing any and all possible 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.

Section 39. Enforcement

The Township Engineer or designee is hereby authorized and directed to enforce all of the provisions of this chapter.

- A. A set of design plans approved by the Township Engineer or designee shall be on file at the site throughout the duration of the construction activity. Periodic inspections may be made by the Township Engineer or designee during construction.
- B. It shall be unlawful for any person or entity to undertake any regulated activity under §174-7 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, the owner or his representatives shall provide in writing to the Township Engineer:
 - 1. 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; and
 - 2. A set of as-built (record) drawings.
- D. After receipt of the certification, a final inspection shall be conducted by the Township Engineer or designated representative to certify compliance with this chapter.

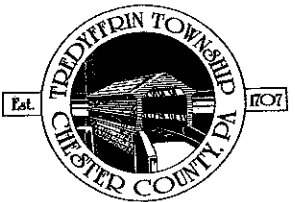
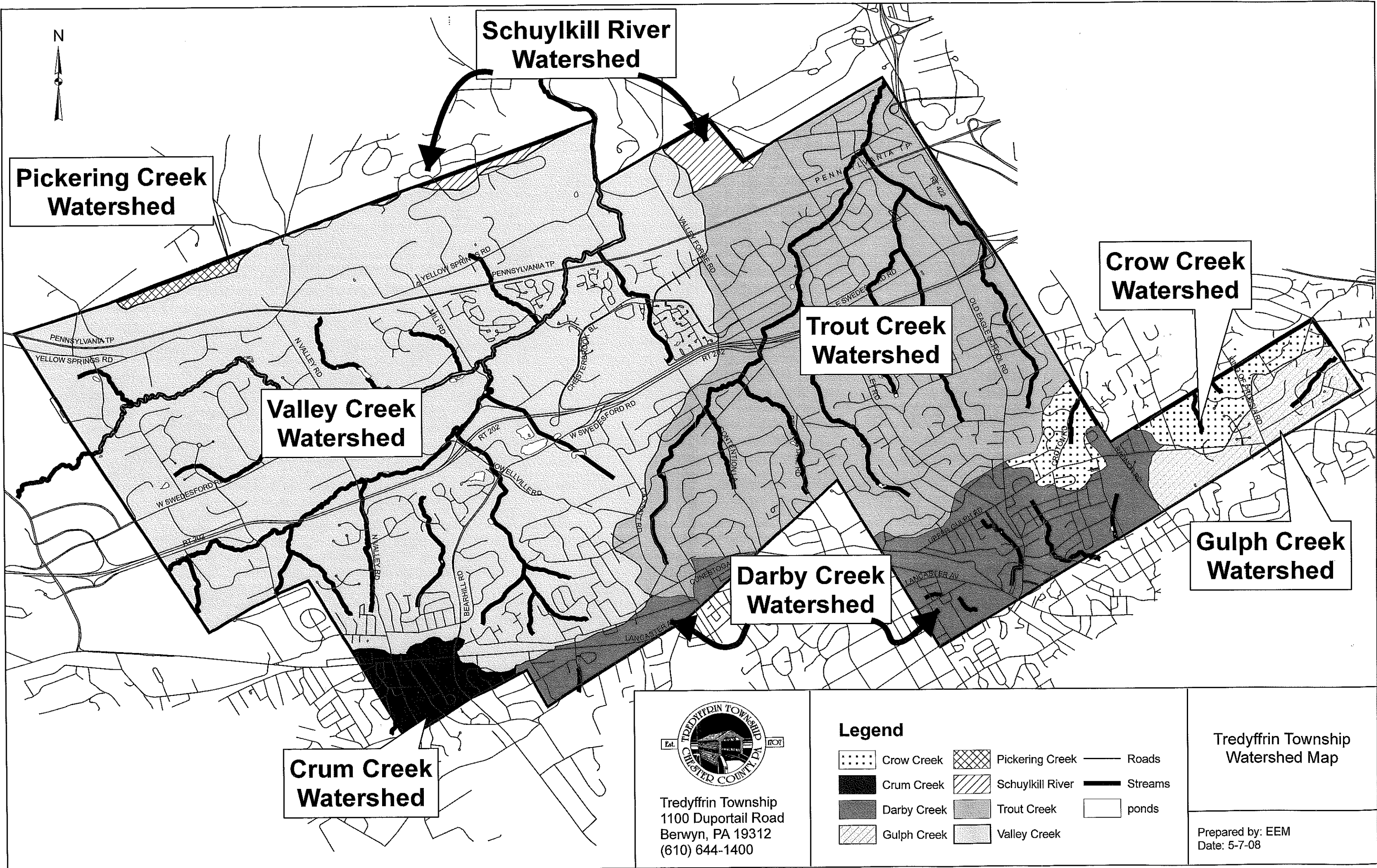
- E. An occupancy permit shall not be issued unless the certification of completion pursuant to §174-39.C has been secured. The occupancy permit shall be required for each lot owner and/or Applicant for all subdivisions and land developments in the Township.

Section 40. Appeals

Any person aggrieved by any action of Tredyffrin Township or its designee, with the exception of the finding of a violation(s) pursuant to Sections 34-41 this chapter, may appeal to the Township Manager or designee within thirty (30) days of that action.

Section 41. Miscellaneous

- A. The violation of any provision of this ordinance is hereby deemed a public nuisance.
- B. Each day that a violation continues shall constitute a separate violation.
- C. To the extent that the Township does not enforce any provision of this ordinance, such action or inaction shall not constitute a waiver by the Township of its rights of future enforcement hereunder.



Tredyffrin Township
1100 Duportail Road
Berwyn, PA 19312
(610) 644-1400

Legend

- | | | |
|-------------|------------------|---------|
| Crow Creek | Pickering Creek | Roads |
| Crum Creek | Schuylkill River | Streams |
| Darby Creek | Trout Creek | ponds |
| Gulph Creek | Valley Creek | |

Tredyffrin Township
Watershed Map

Prepared by: EEM
Date: 5-7-08

APPENDIX B

STORMWATER BEST MANAGEMENT PRACTICES (BMP) DESIGN STANDARDS

The following design standards shall be followed for stormwater controls and BMPs. Additional design standards for BMPs not included in this Appendix can be found in the Pennsylvania Stormwater Best Management Practices Manual (PADEP, December 2006).

A. Infiltration Measures

1. Site Conditions and Constraints

- a. Infiltration BMPs shall maintain a 2-foot clearance above regularly occurring seasonally high water table. This clearance reduces the likelihood that temporary ground water mounding will affect the system, and allows sufficient distance of water movement through the soil to allow adequate pollutant removal.
- b. Infiltration BMPs shall maintain a minimum depth to bedrock of 2-feet to assure adequate pollutant removal.
- c. Infiltration BMPs should be located on soils having infiltration rates between 0.33 and 10 inches per hour, which in most development programs should result in reasonably sized infiltration systems. Where soil permeability is extremely low, infiltration may still be possible but the surface area required could be large, and other volume reduction methods may be warranted. Undisturbed hydrologic soil groups B and C often fall within this range and cover most of the state. Soils with rates in excess of 6.0 inches per hour may require an additional soil buffer (such as an organic layer over the bed bottom) if the cation exchange capacity (CEC) is less than 5 and pollutant loading is expected to be significant. In carbonate soils, excessively rapid drainage may increase the risk of sinkhole formation, and some compaction or additional soil may be appropriate.
- d. Infiltration BMPs shall be sited at least 50 feet from individual water supply wells, and 100 feet from community or municipal water supply wells so that any risk to ground water quality is minimized. Horizontal separation distances or buffers may also be appropriate from special geologic features, such as fractures traces and faults, depending on water supply sources.
- e. To ensure that they present no threat to sub-surface structures, infiltration BMPs shall be sited at least 15 feet down gradient or 50 feet up gradient from building basement foundations, and 50 feet from septic system drain

fields unless specific circumstances allow for reduced separation distances.

2. Design Considerations

- a. Infiltration BMPs shall not be located on compacted fill. Infiltration in native soil without prior fill or disturbance is preferred but not always possible. Areas that have experienced historic disturbance or fill are suitable for infiltration provided the soil testing indicates the infiltration is feasible. In disturbed areas it may be necessary to infiltrate at a depth that is beneath soils that have previously been compacted by construction methods or long periods of mowing.
- b. Infiltration BMP bottom areas shall be level and in no case shall have a slope greater than 0.5%. Bed bottoms should always be graded into the existing soil mantle, with terracing as required to construct flat structures. Sloped bottoms tend to pool and concentrate water in small areas, reducing the overall rate of infiltration and longevity of the BMP. Infiltration areas should be flat, nearly so, or on contour.
- c. The soil mantle should be preserved to the maximum extent possible and excavation should be minimized. Those soils that do not need to be disturbed for the building program should be left undisturbed. Macropores can provide a significant mechanism for water movement in infiltration systems, and the extent of macropores often decreases with depth. Maximizing the soil mantle also increases the pollutant removal capacity and reduces concerns about ground water mounding. Therefore, excessive excavation for the construction of infiltration systems is strongly discouraged.
- d. Isolate hotspot areas. Site plans that include hotspots need to be considered to ensure BMPs that protect groundwater are provided.

Infiltration may occur in areas of hotspots provided pretreatment is suitable to address concerns. Pretreatment requirements shall be analyzed, especially for hotspots and areas that produce high sediment loading. Pretreatment devices that operate effectively in conjunction with infiltration include grass swales, vegetated filter strips, settling chambers, oil/grit separators, constructed wetlands, sediment sumps, and water quality inserts. The pollutants of greatest concern, site by site, should guide selection of pretreatment depending upon the nature and extent of the land development under consideration. Selection of pretreatment techniques will vary depending upon whether the pollutants are of a particulate (sediment, phosphorus, metals, etc.) versus soluble (nitrogen and others) nature. Types of pretreatment (e.g., filters) should be matched with the nature of the pollutants expected to be generated.

- e. The loading ratio of impervious area to bed bottom area must be considered in all Infiltration BMP designs. One of the more common reasons for infiltration system failure is the design of a system that attempts to infiltrate a substantial volume of water in a very small area. Infiltration systems work best when the water is “spread out,” made as shallow as practicable, and located to maximize use of natural on-site infiltration features. The Loading Ratio describes the ratio of impervious drainage area to infiltration area, or the ratio of total drainage area to infiltration area. In general, the following loading ratio guidelines are recommended:

- (1) Maximum impervious loading ratio of 5:1 relating impervious drainage area to infiltration area.
- (2) Maximum total loading ratio of 8:1 relating total drainage area to infiltration area.
- (3) Maximum impervious loading ratio of 3:1 relating impervious drainage area to infiltration area for karst areas (see section on Karst/Carbonate Geology below).

Loading ratios can vary depending on various circumstances. If a project cannot meet the recommended loading ratios the design engineer should meet with the Township Engineer.

- f. The hydraulic head or depth of water should be limited. The total effective depth of water should generally not be greater than two feet to avoid excessive pressure and potential sealing of the bed bottom. Typically the water depth is limited by the loading ratio and drawdown time and is not an issue.
- g. Drawdown time must be considered. Storage facilities should completely drain both the volume control and rate control capacities over a period of time not less than 24 hours and not more than 72 hours from the end of the design storm.
- h. All infiltration BMPs shall be designed with a positive overflow that discharges excess volume in a non-erosive manner and allows for controlled discharge during extreme rainfall events or frozen bed conditions. Infiltration BMPs shall never be closed systems dependent entirely upon infiltration in all situations.
- i. Geotextiles shall be incorporated into the design as necessary in certain infiltration BMPs. Infiltration BMPs that are subject to soil movement and deposition must be constructed with suitably well-draining non-woven

geotextiles to prevent movement of fines and sediment into the infiltration system. The designer should use geotextiles as necessary at the soil/BMP interface.

- j. Avoid severe slopes (>20%), and toes of slopes, where possible. Specific on-site investigations by experienced personnel need to be made to determine acceptability of each case.
- k. Where roof drains are designed to discharge to infiltration practices, they shall have appropriate measures to prevent clogging by unwanted debris (e.g., silt, leaves, and vegetation). Such measures shall include but are not limited to leaf traps, gutter guards, and cleanouts.
- l. All surface inflows shall be pretreated to prevent the direct discharge of sediment into the infiltration practice. Accumulated sediment reduces stormwater storage capacity and ultimately clogs the infiltration mechanism. No sand, cinders, or other particulate matter may be applied to a porous (pervious) surface for winter ice conditions. Salt application can be made to a porous pavement, if necessary, but it should not be mixed with any sand or cinders.

3. Construction Requirements

- a. Underlying soils beneath infiltration beds shall not be compacted during construction. During site construction, all infiltration practice components shall be protected from compaction due to heavy equipment operation or storage of fill or construction material. Excavation for the infiltration facility shall be performed with equipment that will not compact the bottom of the seepage bed/trench or like facility.
- b. Infiltration areas shall also be protected from sedimentation. Where geotextile is used as a bed bottom liner, this geotextile shall be extended several feet beyond the bed and folded over the edge to protect from sediment wash into the bed during construction, and then trimmed.

Runoff from construction areas shall not drain to infiltration BMPs. Such drainage can usually be avoided by diversion berms and immediate vegetative stabilization.

The infiltration area may be used as a temporary sediment trap or basin during earlier stages of construction. However, if an infiltration area is also to be utilized as a temporary sediment basin, excavation shall be limited to within 18-inches of the final bottom invert of the infiltration BMP to prevent clogging and compacting the soil horizon, and final grade removed when the contributing site is fully stabilized.

Areas that are accidentally compacted or graded shall be remediated to restore soil composition and porosity. Adequate documentation to this effect shall be submitted for review by the Township Engineer.

All areas designated for infiltration shall not receive runoff until the contributory drainage area has achieved final stabilization.

- c. The bottom of the bed and/or trench shall be scarified prior to the placement of aggregate.
- d. Only clean washed aggregate with documented porosity, free of fines, shall be allowed for use in Infiltration BMPs.

4. Consideration of Infiltration Rate in Design and Modeling Application

- a. For the purposes of site suitability, areas with tested soil infiltration rates as low as 0.33 inches per hour may be used for infiltration BMPs. However, in the design of these BMPs and the sizing of the BMP, the designer shall incorporate a safety factor. Safety factors between 1 (no adjustment) and 10 have commonly been used in the design of stormwater infiltration systems, with a factor of two being recommended for most cases.
- b. The minimum safety factor for design purposes that may be used for any type of tests is 2. For percolation tests this safety factor is only applicable for soils more coarse than a loam.
- c. For percolation tests in loams and finer soils (silty loam, clay loams, silty clay loams, sandy clay loams, clays) a minimum design safety factor of 3 is recommended after using the reduction formula in PADEP BMP Manual Appendix C, Protocol 1, Site Evaluation and Soil Infiltration Testing. This higher factor is to account for the unwanted capillary suction force that can occur from unsaturated conditions during percolation testing. Therefore, a percolation rate of 0.5 inches per hour (after reduction formula) should generally be considered as a rate of 0.25 inches per hour when designing an infiltration BMP for a sandy loam. The same rate for a loam would yield a design rate of 0.17 inches/hour. For other test procedures a safety factor of 3 should also be considered for problem or less preferred locations, basins, swales, toe of slopes, and loadings greater than 5:1 (drainage area to infiltration area) where saturated hydraulic conductivity rate (K_{sat}) was not determined.
- d. The Applicant shall follow PADEP BMP Manual Appendix C, Protocol 1 – Site Evaluation and Soil Infiltration Testing procedures.

5. Karst/Carbonate Geology

- a. In areas underlain by karst and/or carbonate geology, the viability and specific design standards of infiltration BMPs at a given site must be determined on a site-specific basis to avoid ground water contamination and formation and/or expansion of solution channels, sinkholes, and other potentially dangerous karst features. A site evaluation shall be conducted by a qualified professional geologist, geotechnical engineer, or other qualified professional, licensed by the Commonwealth of Pennsylvania, to ascertain the subsurface conditions of soil, rock and ground water relevant to formation of karst features. Such an evaluation shall include, but not be limited to:
- (i) Soil thickness, gradation, anisotropy, and permeability (from existing soil data and soil borings) to determine the capacity and rate of infiltration of the soil and relative depth of soil necessary to protect against sinkhole formation.
 - (ii) Karst characteristics of geologic units underlying the site (from current publications, maps and information of U.S. Geological Survey, PA Geological Survey, PA Department of Transportation, etc.).
 - (iii) Inventory of existing karst landforms, visual indications and/or surface manifestations of subsurface features or other karst features (from interviews with municipal representatives familiar with known problem areas, review of aerial photography, and site reconnaissance).
 - (iv). Geophysical survey of the site to identify locations and extent of existing subsurface karst features.
 - (v) Effectiveness of soil mantle to remove pollutants from infiltrating water to determine whether or not the need exists for removal of pollutants from stormwater runoff prior to infiltration (for example, soil thickness and soil cation exchange capacity, etc.).
 - (vi) Depth to ground water and vertical location of water table relative to carbonate geologic unit (from existing information and/or borings).
 - (vii) Other appropriate site specific parameters affecting infiltration.
- b. Location of infiltration BMPs is critical and shall be considered early on in the site planning process. Where karst conditions exist, infiltration BMPs shall be located and designed based on the subsurface conditions identified in the site evaluation, to avoid formation of new karst features and to

protect existing karst features from accelerated development. Infiltration BMPs shall be located at least 100 feet away from existing karst features and sited away from buildings, roadways or other structures where subsidence could damage the structure and create an unsafe condition. Where underlying geologic units are prone to formation of karst features, but no karst features are identified on the site, infiltration BMPs shall be designed to avoid formation of new karst features.

- c. Ground water quality of the carbonate aquifer shall be protected from infiltration of pollutants. At a minimum, stormwater runoff from hotspots shall first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration. Where soil characteristics are insufficient to provide removal of pollutants from sources other than hotspots, stormwater runoff shall first be discharged through a water quality BMP(s) to remove pollutants prior to infiltration.

B. Open Vegetated Channels

1. Open vegetated channels are conveyance systems that are engineered to perform also as water quality and infiltration practices. Such systems can be used for the conveyance, retention, infiltration and filtration of stormwater runoff.
2. Open vegetated channels primarily serve a water quality function (water quality volume); they also have the potential to augment infiltration. Examples of such systems include, but are not limited to: dry swales, wet swales, grass channels, and biofilters. Open vegetated channels are primarily applicable for land uses such as roads, highways, residential developments (dry swales only) and pervious areas.
3. Open vegetated channels shall be designed to meet the following minimum standards:
 - a. The channel shall be designed to convey safely the ten-year frequency storm event with a freeboard of at least twelve (12) inches. Freeboard is the difference between the elevation of the design flow in the channel and the top elevation of the channel.
 - b. The peak velocity of the runoff from the ten-year storm shall be non-erosive for the soil and ground cover provided in the channel.
 - c. The longitudinal slope shall be no greater than four percent (4%).
 - d. Channels shall be trapezoidal in cross section. The minimum bottom width shall be two (2) feet. The maximum bottom width shall be eight (8) feet.

- e. Channels shall be designed with moderate side slopes of four (4) horizontal to one (1) vertical. Flatter side slopes may be necessary under certain circumstances.
 - f. The maximum allowable ponding time in the channel shall be less than 48 hours.
 - g. Channels (for example, dry swales) may require an underdrain in order to function and dewater.
 - h. Channels shall be designed to store temporarily the water quality volume within the system for a maximum period of 48 hours and a minimum period of one (1) hour.
 - i. Landscape specifications shall address the grass species, wetland plantings (if applicable), soil amendment and hydric conditions present along the channel.
 - j. Accumulated sediment within the channel bottom shall be removed when twenty-five (25%) of the original water quality volume has been exceeded.
 - k. Check dams along the channel length may be warranted.
 - l. The bottom of dry swales shall be situated at least two (2) feet above the seasonal high water table.
4. Additional design information for open vegetated channels is available in “Design of Stormwater Filtering Systems” (Center for Watershed Protection, 1996).

C. Retention (Wet) Basins

- 1. Retention basins shall be designed to create a healthy ecological community with sufficient circulation of water to prevent the growth of unwanted vegetation and mosquitoes. Care should be taken to landscape retention basins.
- 2. The retention basin shall be of sufficient size to allow the appropriate aquatic community needed to maintain healthy pond ecology and avoid mosquitoes capable of carrying West Nile Virus and other diseases. The Chester County Health Department, Pennsylvania Fish and Boat Commission, the Natural Resource Conservation Service, the Pennsylvania Extension Service, or other qualified professional consultant shall be consulted during the design of these facilities in order to ensure the health of aquatic communities and minimize the risk of creating mosquito breeding areas. All wet basin designs shall incorporate biologic controls consistent with the West Nile Guidance found in Appendix H, DEP document 363-0300-001 “Design Criteria – Wetlands Replacement/Monitoring, or contact the Pennsylvania State Cooperative Wetland

Center (www.wetlands.psu.edu/) or the Penn State Cooperative Extension Office (www.extension.psu.edu/extmap.html).

3. An outlet structure shall be designed to allow complete drainage of the pond for maintenance.
4. The design of a retention basin shall include the determination of the proposed site's ability to support a viable permanent pool. The design shall take into account such factors as the available and required rate and quality of dry weather inflow, the stormwater inflow, seasonal and longer-term variations in ground water table, and impacts of potential pollutant loadings.
5. Sediment storage volume equal to at least twenty percent (20%) of the volume of the permanent pool shall be provided.
6. A sediment forebay with a hardened bottom shall be provided at each inlet into the retention basin. The forebay storage capacity shall at minimum be ten percent (10%) of the permanent pool storage. The forebay shall be designed to allow for access by maintenance equipment for periodic cleaning.
7. Emergency spillways shall be sized and located to permit the safe passage of stormwater flows from a 100-year storm. The maximum velocities in vegetated spillways excavated in otherwise undisturbed soil shall be analyzed based upon the velocity of peak flow in the emergency spillway during an assumed clogged primary outlet condition. Where maximum velocities exceed design standards contained in the Engineering Field Manual for Conservation Practices (USDA, SCS, July 1984), suitable lining shall be provided. All emergency spillways placed on fill materials shall be lined. Lining for emergency spillways shall incorporate native colors and materials where possible including mono slab revetments, grass pavers and native stone.
8. Should any stormwater management facility require a dam safety permit under DEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety.
9. Existing ponds or permanent pool basins can be used for stormwater management provided that it can be demonstrated that the ponds are structurally sound and meet the design requirements of this chapter.
10. Inlet structures and outlet structures shall be separated to the greatest extent possible in order to maximize the flow path through the retention basin.
11. Retention basins shall be designed to provide a length-to-width ratio of at least 3L:1W as measured in plan view.

12. The retention basin depth shall average three (3) to six (6) feet with no area shallower than three (3) feet. In residential areas, ponds shall be equipped with management practices that reduce the potential for unauthorized entry and use of the pond by the general public. Preference shall be given to split rail fences equipped with mesh wire or other such practices that are both functional and attractive. A securable gate shall be provided to allow for periodic maintenance equipment/vehicle access. Any fence or barrier around a retention basin shall be no less than 42 inches in height or as otherwise required by local building codes or ordinances.
13. An aquatic bench/shelf at least ten (10) feet wide and with a gentle slope not exceeding 10H:1V shall be provided along the entire perimeter of the retention basin.
14. Any side slopes below the permanent water surface level shall not exceed 5H:1V. Side slopes above the permanent water surface level shall not exceed 3H:1V.
15. Proper stabilization structures, including stilling basins, energy dissipaters, and channel lining shall be constructed at the outlets of all retention basins and emergency spillways. The stabilization structures shall control water to: avoid erosion; reduce velocities of released water; and direct water so that it does not interfere with downstream activities.
16. Energy dissipaters and/or level spreaders shall be installed to prevent erosion and/or initiate sheet flow at points where pipes or drainage ways discharge to or from basins. Energy dissipaters shall comply with criteria in Hydraulic Engineering Circular No. 15 Design for Stable Channels with Flexible Linings (USDOT, FHWA, 1986) or the Engineering Field Manual for Conservation Practices (USDA, SCS, July 1984). Such facilities shall be both functional and harmonious with the surrounding environment; for example, native rock shall be used in constructing dissipaters where practical.
17. The minimum distance between a proposed basin discharge point (including the energy dissipater, etc.) and a downstream property boundary shall in no case be less than fifteen (15) feet. Where there is discharge onto or through adjacent properties prior to release to a stream, designers shall demonstrate how downstream properties are to be protected. The Township Engineer may require that the setback distance be increased based upon factors such as topography, soil conditions, the size of structures, the location of structures, and discharge rates. A drainage easement may also be required.
18. Outlet structures shall meet the following specifications:
 - a. To minimize clogging and to facilitate cleaning and inspecting, outlet pipes shall have an internal diameter of at least eighteen (18) inches and a minimum grade of one percent (1%).

- b. Anti-seep collars shall be provided on all outlet pipes within a constructed berm.
- c. All principal outlet structures shall be built using reinforced concrete with watertight construction joints.
- d. The use of architecturally treated concrete, stucco, painted surface or stone facade treatment shall be considered for enhancing the outlet structure. Such facilities shall be both functional and harmonious in design with the surrounding environment.
- e. Outlet pipes shall be constructed of reinforced concrete with rubber gaskets in conformance with AASHTO M170, M198 and M207.
- f. Basin outlet structures shall have childproof non-clogging trash racks, except those openings designed to carry perennial stream flows, with overall design openings exceeding twelve (12) inches in diameter. Periodic cleaning of debris from trash racks shall be included in the operation and maintenance plan.
- g. Anti-vortex devices, consisting of a thin vertical plate normal to the basin berm, shall be provided at the top of all circular risers or stand pipes.

D. Detention Basins

Detention basins should be considered only where other practices cannot be used effectively. Detention basins have historically been used in stormwater management systems that concentrate flows to the low end of a project site to quickly release downstream. Such an approach is ineffective in meeting the full stormwater management requirements of this chapter. Stormwater management techniques described in this model ordinance strive to disconnect flows (rather than concentrate them), provide infiltration and water quality treatment, maintain or increase the predevelopment time of concentration (rather than decrease it), and manage flows as close to where they are generated as possible. Detention basins typically do not accomplish these goals.

- 1. Detention basins are generally discouraged as a stormwater management practice and should only be used as a last resort where no other management facility is practical. Detention basins typically collect and quickly release runoff from a site in a manner that still requires additional volume control BMPs to be provided in a design.
- 2. The maximum inside side slopes shall not exceed three (3) horizontal to one (1) vertical (3H:1V). The minimum required slope for the basin bottom is one percent (1%).

3. The inlet pipe invert into a basin shall be six (6) inches above the basin floor or lining so that the pipe can adequately drain after rainstorms. Inlets shall discharge into areas of the basin that slope toward the outlet structure.
4. Inlet structures and outlet structures shall be separated to the greatest extent possible in order to maximize the flow path through the basin.
5. Low flow channels constructed of concrete or asphalt are not permitted. Low flow channels composed of a natural or bioengineered material are permitted and where necessary shall be designed to promote water quality and slow the rate of flow through the basin. Low flow channels also may be designed to infiltrate where practical.
6. Outlet structures shall meet the following specifications:
 - a. To minimize clogging and to facilitate cleaning and inspection, outlet pipes shall have an internal diameter of at least eighteen (18) inches and a minimum grade of one percent (1%).
 - b. Anti-seep collars shall be provided on all outlet pipes within a constructed berm.
 - c. All principal outlet structures shall be built using reinforced concrete with watertight construction joints.
 - d. The use of architecturally treated concrete, stucco, painted surface or stone facade treatment shall be considered for enhancing the outlet structure. Such facilities shall be both functional and harmonious in design with the surrounding environment.
 - e. Outlet pipes shall be constructed of reinforced concrete with rubber gaskets in conformance with AASHTO M170, M198 and M207.
 - f. Energy dissipation practices that convert concentrated flow to uniform shallow sheet flow shall be used where appropriate.
 - g. Basin outlet structures shall have childproof non-clogging trash racks, except those openings designed to carry perennial flows, with overall design opening exceeding twelve (12) inches in diameter.
 - h. Anti-vortex devices, consisting of a thin vertical plate normal to the basin berm, shall be provided at the top of all circular risers or stand pipes.
7. Emergency spillways shall be sized and located to permit the safe passage of stormwater flows from a 100-year storm. The maximum velocities in vegetated spillways excavated in otherwise undisturbed soil shall be analyzed based upon

the velocity of peak flow in the emergency spillway during an assumed clogged primary outlet condition. Where maximum velocities exceed design standards contained in the Engineering Field Manual for Conservation Practices (USDA, SCS, July 1984), suitable lining shall be provided. In general, emergency spillways should not be located in fill areas; all such practices placed on fill materials shall be lined. Lining for emergency spillways shall incorporate native colors and materials where possible, including mono slab revetments, grass pavers and native stone.

8. Should any stormwater management facility require a dam safety permit under DEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety.
9. Freeboard is the difference between the elevation of the design flow in the emergency spillway (usually the 100-year peak elevation) and the top elevation of the settled basin embankment (that is, top of berm). The minimum freeboard shall be one (1) foot.
10. Energy dissipaters and/or level spreaders shall be installed to prevent erosion and/or initiate sheet flow at points where pipes or drainage ways discharge to or from basins. Energy dissipaters shall comply with criteria in Hydraulic Engineering Circular No. 15 Design for Stable Channels with Flexible Linings (USDOT, FHWA, 1986) or the Engineering Field Manual for Conservation Practices (USDA, SCS, July 1984). Such facilities shall be both functional and attractive; for example, native rock shall be used in constructing dissipaters where practical.
11. Proper stabilization structures, including stilling basins, energy dissipaters, and channel lining, shall be constructed at the outlets of all basins and emergency spillways. The stabilization structures shall control water to: avoid erosion, reduce velocities of released water, and direct water so that it does not interfere with downstream activities.
12. The minimum distance between a proposed basin discharge point (including the energy dissipater, etc.) and a downstream property boundary shall in no case be less than fifteen (15) feet. Where there is discharge onto or through adjacent properties prior to release to a stream, designers shall demonstrate how downstream properties are to be protected. The Township Engineer may require that the setback distance be increased based upon factors such as topography, soil conditions, the size of structures, the location of structures, and discharge rates. A drainage easement also may be required.
13. A sediment forebay with a hardened bottom shall be provided at each inlet into the detention basin. The forebay storage capacity shall at minimum be ten (10) percent of the permanent pool storage. The forebay shall be designed to allow for access by maintenance equipment for periodic cleaning.

E. Conveyance Systems

1. Applicants are encouraged to design conveyance systems that encourage infiltration and improve water quality wherever practicable.
2. Wherever conveyance channels are necessary, drainage shall be maintained by an open channel with landscaped banks designed to carry the 25-year, 24-hour stormwater runoff from upstream contributory areas. The Township Engineer may increase the design storm, as conditions require. All open channels shall be designed with one (1) foot of freeboard above the design water surface elevation of the design runoff condition.
3. Storm sewers must be able to convey proposed conditions runoff from a 25-year design storm without surcharging inlets, where appropriate.
4. Adequate erosion protection shall be provided along all open channels and at all points of discharge.
5. Roadway crossings over streams must be able to convey runoff from a 100-year design storm.
6. Flood relief channels shall be provided and designed to convey the runoff from the 100-year, 24-hour storm, such that a positive discharge of this runoff to an adequate receiving stream or conveyance system occurs without allowing this runoff to encroach upon other properties.
7. Open channels along existing roadways may be required to be enclosed by the Township if Penn DOT standards for safety and maintenance cannot be satisfied. All drainage structures shall conform to the latest edition of Form 408, Penn DOT specifications.
8. Manholes and/or inlets shall not be spaced more than three hundred (300) feet apart for pipe sizes up to twenty-four (24) inches in diameter and not more than four hundred fifty (450) feet apart for larger pipe sizes.
9. Where drainage swales are used in lieu of or in addition to storm sewers, they shall be designed to carry the required runoff without erosion and in a manner not detrimental to the properties they cross. Drainage swales shall provide a minimum grade of two percent (2%) but shall not exceed a grade of nine percent (9%). Drainage swales used strictly for conveyance are not the same as open vegetated channels.
10. Street curbing for the purpose of stormwater conveyance is discouraged. On streets that must contain curbing, storm sewers shall be placed in front of the curbing. To the greatest extent possible, storm sewers shall not be placed directly

under curbing. At curbed street intersections, storm inlets shall be placed in the tangent section of the road.

11. Use of grassed swales or open vegetated swales in lieu of curbing to convey, infiltrate and/or treat stormwater runoff from roadways is encouraged. Inlets shall be placed at the center of the shoulder swale draining the street and shall be located no closer than four (4) feet from the edge of the cartway.
12. Tredyffrin Township shall be granted a minimum twenty (20)-foot-wide drainage easement over all storm sewers, drainage swales, channels, etc., that are a component of the stormwater management system when located within undedicated land. All permanent detention basins and/or other stormwater management facilities providing stormwater control for other than a single residential lot shall be located within a defined drainage easement that allows proper legal access and maintenance vehicle access by Tredyffrin Township personnel if the need arises for such access.
13. No property owner shall obstruct or alter the flow, location or carrying capacity of a stream, channel or drainage swale to the detriment of any other property owner, whether upstream or downstream. All subdivision and/or land development plans containing streams, channels, drainage swales, storm sewers or other conveyance systems that cross property boundaries, existing or proposed, or whose discharge crosses such boundaries shall contain a note stating the above.
14. Storm drainage systems that collect runoff from parking areas and/or loading areas exceeding 10,000 square feet of impervious coverage and discharge to stormwater management systems, including surface or subsurface infiltration systems, shall have a minimum of one (1) water quality inlet per each acre of drainage area. The purpose of water quality inlets is to remove oil, grease, and heavy particulates or total suspended solids, hydrocarbons, and other floating substances from stormwater runoff. Methods other than water quality inlets may be permitted if the Applicant demonstrates to the Township Engineer's satisfaction that any such alternative will be as effective and as easily maintained. Periodic cleaning of these systems shall be addressed in the operation and maintenance plan submitted to the Township.
15. All inlets, manholes, covers, frames, etc. shall conform to PennDOT specifications.
16. All inlets shall be installed with a 12-inch (12") minimum pipe invert leaving the structure to provide a sediment trap for retaining accumulated roadway debris, trash, leaves, etc.

F. Landscaping of Stormwater Management Practices

Stormwater management practices shall be landscaped in order to create more natural facilities that blend into the landscape, as well as address water quality in accordance with the following standards. Such landscaping can contribute to the effectiveness of the facility to hold and filter water as well. Landscape plans shall be prepared by a professional Landscape Architect licensed in the Commonwealth of Pennsylvania.

1. Landscaping shall be required in and around all constructed stormwater management BMPs with a minimum surface area of one thousand (1,000) square feet for the purposes of:
 - a. Assisting in the management of stormwater;
 - b. Stabilizing the soil within such facilities to minimize and control erosion;
 - c. Enhancing the visual appearance of such facilities; and
 - d. Mitigating maintenance problems commonly associated with the creation of such facilities.
2. A planting plan and planting schedule shall be submitted in accordance with the following:
 - a. Wet meadows and floors of stormwater management practices
 - (i) Wet meadows and floors of stormwater management practices shall be planted with wildflowers and nonaggressive grasses, the intent being to create a mixed meadow of such plantings, where appropriate. Selection of plantings shall be based on whether the area in question is usually well drained or permanently wet and whether the area will be used for recreation purposes. No woody plants shall be planted within the saturated zone (phreatic line) of a stormwater management practice or on a berm constructed for impounded water.
 - (ii) Seeding by drills, corrugated rollers, cyclone or drop seeders or hand seeding of such areas is preferred; however, hydroseeding followed by hydromulching can be used on wet ground and steep slopes.
 - (iii) Fertilizers, as a nutrient supplement, shall not be used unless it is documented that soil conditions warrant such use and nutrient applied does not exceed plant uptake. Soil for planting of wildflowers shall contain not less than three percent (3%) or more than ten percent (10%) organic matter, as determined by an agricultural chemist, with certification of the test before planting.
 - (iv) Seeding shall take place either between April 1 and May 15 or between September 1 and October 15. Planting areas shall be soaked to maintain a consistent level of moisture for at least four (4) to six (6) weeks after planting.

- (v) Once established, a single annual mowing when plants are dormant should be sufficient to maintain a wet meadow and/or floor of a stormwater management practice.
- b. Wet edges that remain wet all or most of the year shall be planted with wildflowers, grasses and shrubs. Plants to be located on rims or banks, which remain dry most of the year, shall be planted with species tolerant of dry soil conditions.
- c. Wooded areas
 - (i) Where stormwater management practices adjoin wooded areas, trees and shrubs shall be selected and planted outside the practice so as to blend with existing surroundings.
 - (ii) Plantings in such areas shall be of sufficient density to eliminate the need for mowing.
 - (iii) It is recommended that clusters of trees and shrubs be planted around stormwater management facilities but well away from outfalls and any constructed berms, where applicable, to provide for wildlife habitat, wind control and buffering and screening.
 - (iv) Vegetation shall be planted during appropriate times of the year, predominantly between late March and mid May or from early October until evidence of ground freezing, depending upon the species selected. Most deciduous trees and shrubs can be planted in either spring or fall. Evergreens are best planted in late summer or early fall.
- d. Slopes
 - (i) Where slopes are gentle, a mixture of meadow grasses and wildflowers (for wet meadows) shall be planted.
 - (ii) On steep slopes as defined by the Township's Zoning Ordinance, dense spreading shrubs (shrubs tolerant of dry soils) shall be planted. Heavy mat mulch shall be used during the period of establishment.
 - (iii) No woody plant materials or trees shall be located on a constructed or natural berm acting as the impoundment structure of a stormwater management practice. Trees shall be located downstream of an impoundment berm a sufficient distance from the toe of the constructed slope to assure that the toe of the slope is

outside the dripline of the species planted at maturity but in no case less than fifteen (15) feet from the berm.

- e. In cases where stormwater management practices are to be located in proximity to wetlands or waterways, the Applicant's planting plan and schedule shall consider the sensitive conditions existing therein and be modified accordingly to reflect existing flora.
- f. Stormwater management practices shall be screened in a manner which complements the existing landscape and provides sufficient access for maintenance.

APPENDIX C

STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE C-1

RUNOFF CURVE NUMBERS

| LAND USE DESCRIPTION | | HYDROLOGIC SOIL GROUP | | | | |
|-------------------------------|--------------------------------|-----------------------|----|----|----|----|
| | | Hydrologic Condition | | | | |
| | | | A | B | C | D |
| Open Space | | | | | | |
| | Grass cover < 50% | Poor | 68 | 79 | 86 | 89 |
| | Grass cover 50% to 75% | Fair | 49 | 69 | 79 | 84 |
| | Grass cover > 75% | Good | 39 | 61 | 74 | 80 |
| Meadow | | | 30 | 58 | 71 | 78 |
| Agricultural | | | | | | |
| | Pasture, grassland, or range – | | | | | |
| | Continuous forage for grazing | Poor | 68 | 79 | 86 | 89 |
| | Pasture, grassland, or range – | | | | | |
| | Continuous forage for grazing | Fair | 49 | 69 | 79 | 84 |
| | Pasture, grassland, or range – | | | | | |
| | Continuous forage for grazing | Good | 39 | 61 | 74 | 80 |
| | Brush—brush-weed-grass mixture | | | | | |
| | with brush the major element | Poor | 48 | 67 | 77 | 83 |
| | Brush—brush-weed-grass mixture | | | | | |
| | with brush the major element | Fair | 35 | 56 | 70 | 77 |
| | Brush—brush-weed-grass mixture | | | | | |
| | with brush the major element | Good | 30 | 48 | 65 | 73 |
| | Fallow Bare soil ----- | | 77 | 86 | 91 | 94 |
| | Crop residue cover (CR) | Poor | 76 | 85 | 90 | 93 |
| | | Good | 74 | 83 | 88 | 90 |
| Woodlands – grass combination | | | | | | |
| (orchard or tree farm) | | Poor | 57 | 73 | 82 | 86 |
| | | Fair | 43 | 65 | 76 | 82 |
| | | Good | 32 | 58 | 72 | 79 |

| | | | | | |
|--|------|----|---------------------|----|----|
| Woodlands | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | 30 | 55 | 70 | 77 |
| Commercial (85% impervious) | | 89 | 92 | 94 | 95 |
| Industrial (72% impervious) | | 81 | 88 | 91 | 93 |
| Institutional (50% impervious) | | 71 | 82 | 88 | 90 |
| <u>Residential districts by average lot size:</u> | | | <u>% Impervious</u> | | |
| 1/8 acre or less * (townhouses) | | 65 | 77 | 85 | 90 |
| 1/4 acre | | 38 | 61 | 75 | 83 |
| 1/3 acre | | 30 | 57 | 72 | 81 |
| 1/2 acre | | 25 | 54 | 70 | 80 |
| 1 acre | | 20 | 51 | 68 | 79 |
| 2 acres | | 12 | 46 | 65 | 77 |
| Farmstead | | 59 | 74 | 82 | 86 |
| Smooth surfaces (concrete, asphalt, gravel, or bare compacted soil) | | 98 | 98 | 98 | 98 |
| Water | | 98 | 98 | 98 | 98 |
| Mining/newly graded areas (pervious areas only) | | 77 | 86 | 91 | 94 |

* Includes multi-family housing unless justified lower density can be provided.

Note: Existing site conditions of bare earth or fallow ground shall be considered as meadow when choosing a CN value.

Source: NRCS (SCS) TR-55

TABLE C-2

| LAND USE DESCRIPTION | HYDROLOGIC SOIL GROUP | | | |
|--|-----------------------|------|-----|-----|
| | A | B | C | D |
| Cultivated land : without conservation treatment | .49 | .67 | .81 | .88 |
| : with conservation treatment | .27 | .43 | .61 | .67 |
| Pasture or range land: poor condition | .38 | .63 | .78 | .84 |
| : good condition | ---* | .25 | .51 | .65 |
| Meadow: good condition | ---* | ---* | .44 | .61 |
| Woodlands: thin stand, poor cover, no mulch | ---* | .34 | .59 | .70 |
| : good cover | ---* | ---* | .45 | .59 |
| Open spaces, lawns, parks, golf courses, cemeteries | | | | |
| Good condition: grass cover on 75% or more of the area | ---* | .25 | .51 | .65 |
| Fair condition: grass cover on 50% to 75% of the area | ---* | .45 | .63 | .74 |
| Commercial and business areas (85% impervious) | .84 | .90 | .93 | .96 |
| Industrial districts (72% impervious) | .67 | .81 | .88 | .92 |
| Residential: | | | | |
| Average lot size Average % impervious | | | | |
| 1/8 acre or less 65 | .59 | .76 | .86 | .90 |
| 1/4 acre 38 | .25 | .49 | .67 | .78 |
| 1/3 acre 30 | ---* | .49 | .67 | .78 |
| 1/2 acre 25 | ---* | .45 | .65 | .76 |
| 1 acre 20 | ---* | .41 | .63 | .74 |
| Paved parking lots, roofs, driveways, etc. | .99 | .99 | .99 | .99 |
| Streets and roads: | | | | |
| Paved with curbs and storm sewers | .99 | .99 | .99 | .99 |
| Gravel | .57 | .76 | .84 | .88 |
| Dirt | .49 | .69 | .80 | .84 |

Notes: Values are based on SCS definitions and are average values.

Values indicated by ---* should be determined by the design engineer based on-site characteristics.

Source : New Jersey Department of Environmental Protection, Technical Manual for Stream Encroachment, August 1984

TABLE C-3

MANNING'S ROUGHNESS COEFFICIENTS

Roughness Coefficients (Manning's "n") for Overland Flow

| <u>Surface Description</u> | | | <u>n</u> |
|--|------|---|----------|
| Dense growth | 0.4 | - | 0.5 |
| Pasture | 0.3 | - | 0.4 |
| Lawns | 0.2 | - | 0.3 |
| Bluegrass sod | 0.2 | - | 0.5 |
| Short grass prairie | 0.1 | - | 0.2 |
| Sparse vegetation | 0.05 | - | 0.13 |
| Bare clay-loam soil (eroded) | 0.01 | - | 0.03 |
| Concrete/asphalt - very shallow depths (less than 1/4 inch) | 0.10 | - | 0.15 |
| - small depths (1/4 inch to several inches) | 0.05 | - | 0.10 |

Roughness Coefficients (Manning's "n") for Channel Flow

| <u>Reach Description</u> | <u>n</u> |
|---|----------------------------|
| Natural stream, clean, straight, no rifts or pools | 0.03 |
| Natural stream, clean, winding, some pools or shoals | 0.04 |
| Natural stream, winding, pools, shoals, stony with some weeds | 0.05 |
| Natural stream, sluggish deep pools and weeds | 0.07 |
| Natural stream or swale, very weedy or with timber underbrush | 0.10 |
| Concrete pipe, culvert, or channel | 0.012 |
| Corrugated metal pipe | 0.012-0.027 ⁽¹⁾ |
| High density polyethylene (HDPE) pipe | |
| Corrugated | 0.021-0.029 ⁽²⁾ |
| Smooth lined | 0.012-0.020 ⁽²⁾ |

(1) Depending upon type, coating, and diameter

(2) Values recommended by the American Concrete Pipe Association, check manufacturer's recommended value

Source: U.S. Army Corps of Engineers, HEC-1 Users Manual

TABLE C-4

NONSTRUCTURAL STORMWATER MANAGEMENT MEASURES

| Nonstructural Stormwater Measure | Description |
|---|---|
| Natural Area Conservation | Conservation of natural areas such as forest, wetlands, or other sensitive areas in a protected easement, thereby retaining their existing hydrologic and water quality characteristics. |
| Disconnection of Rooftop Runoff | Rooftop runoff is disconnected and then directed over a pervious area where it may either infiltrate into the soil or filter over it. This is typically obtained by grading the site to promote overland flow or by providing bioretention on single-family residential lots. |
| Disconnection of Nonrooftop Runoff | Disconnect surface impervious cover by directing it to pervious areas where it is either infiltrated or filtered through the soil. |
| Buffers | Buffers effectively treat stormwater runoff. Effective treatment constitutes capturing runoff from pervious and impervious areas adjacent to the buffer and treating the runoff through overland flow across a grassy or forested area. |
| Grass Channel (Open Section Roads) | Open grass channels are used to reduce the volume of runoff and pollutants during smaller storms. |
| Environmentally Sensitive Rural Development | Environmental site design techniques are applied to low-density or rural residential development. |

Source: Maryland Department of the Environment, "Maryland Stormwater Design Manual," Baltimore, MD, 2000

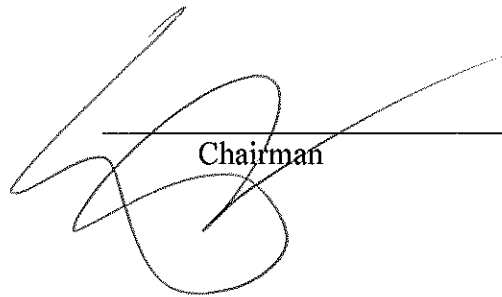
SECTION V. All other sections, parts or provisions of the Code of Tredyffrin Township shall remain unchanged.

SECTION VI. If any sentence, clause, section or part of this ordinance is for any reason found to be unconstitutional, illegal or invalid, such unconstitutionality, illegality or invalidity shall not affect or impair any of the remaining provisions, sentences, clauses, sections or parts hereof. It is hereby declared as the intent of the Board of Supervisors that chapter would have been adopted had such unconstitutional, illegal or invalid sentence, clause, section or part thereof not been included herein.

SECTION VII. This ordinance shall become effective on the 31st day following enactment.


ENACTED and ORDAINED by the Board of Supervisors this 6th day of April , 2009.

BOARD OF SUPERVISORS
TREDYFFRIN TOWNSHIP



Chairman

ATTEST:



Manager