

**EAST PENN TOWNSHIP
STORMWATER MANAGEMENT
ORDINANCE**

ORDINANCE NO. 2007-09

ADOPTED SEPTEMBER 19, 2007

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ORDINANCE NO. 2007-09

AN ORDINANCE OF THE TOWNSHIP OF EAST PENN,
CARBON COUNTY, PENNSYLVANIA, ESTABLISHING THE
EAST PENN TOWNSHIP STORMWATER MANAGEMENT
ORDINANCE

ARTICLE I
GENERAL PROVISIONS

SECTION 101. Short Title

This Ordinance shall be known and may be cited as the "East Penn Township Stormwater Management Ordinance." This Ordinance provides stormwater management requirements for regulated activities within East Penn Township and storm drainage system requirements as provided in Article IV.

SECTION 102. Statement of Findings

The Board of Supervisors of East Penn Township finds that:

- A. Inadequate management of accelerated runoff of storm water resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, changes the natural hydrologic patterns, destroys aquatic habitat, elevates aquatic pollutant concentrations and loadings, overtakes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to carry and control stormwater, undermines floodplain management and flood control efforts in downstream communities, reduces groundwater recharge and threatens public health and safety.
- B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion and loss of protection of the people of East Penn Township and all of the people of the Commonwealth, their resources and the environment.
- C. Stormwater runoff can be an important resource by providing groundwater recharge for water supplies and baseflow of streams, while also protecting and maintaining surface water quality.
- D. Public education on the control of pollution from stormwater discharges is an essential component in successfully addressing stormwater management concerns.

- E. Federal and State regulations require certain Municipalities to implement a program of stormwater controls. These Municipalities are required to obtain a permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (NPDES).
- F. Nonstormwater discharges to Municipal separate storm sewer systems can contribute to pollution of waters of the Commonwealth (by Land Developments).

SECTION 103. Purpose

The purpose of this Ordinance is to promote the public health, safety and welfare within East Penn Township by minimizing damages and maximizing the benefits of stormwater control as described in Article 1, Section 102 of this Ordinance by enacting provisions designed to:

- A. Manage stormwater runoff impacts at their source by regulating activities which cause such problems.
- B. Utilize and preserve the desirable existing natural drainage systems.
- C. Encourage infiltration of stormwater, where appropriate, to maintain groundwater recharge, to prevent degradation of surface and groundwater quality and to otherwise protect water resources.
- D. Maintain the existing flows and quality of streams and watercourse in East Penn Township and in the Commonwealth.
- E. Preserve and restore flood carrying capacity of streams.
- F. Provide for proper maintenance of all permanent stormwater management Best Management Practices (BMPs) that are implemented in East Penn Township.
- G. Provide review procedures and performance standards for stormwater planning, design, and management.
- H. Manage stormwater impacts close to the runoff source which requires a minimum of structures and relies on natural processes.

- I. Meet legal water quality requirements under State law, including regulations at 25 Pa. Code Chapter 93.4a to protect and maintain "existing uses" and maintain the level of water quality to support those uses in all streams and to protect and maintain water quality in "special protection" high quality and exceptional value streams.
- J. Prevent scour and erosion of streambanks and streambeds.
- K. Provide standards to meet NPDES permit requirements.

SECTION 104. Statutory Authority.

East Penn Township is empowered to regulate these activities by the authority of the "Stormwater Management Act", Act of October 4, 1978, P.S. 864 (Act 167), 32 P.S. § 680.1 et seq., as amended, the Second Class Township Code, the Act of the 1968 General Assembly No. 247, the "Pennsylvania Municipalities Planning Guide", as amended, the East Penn Township Zoning Ordinance, as amended from time to time, the East Penn Township Subdivision and Land Development Ordinance, as amended.

SECTION 105. Applicability.

This Ordinance shall apply to all watersheds and permanent stormwater management facilities constructed within the East Penn Township as part of any of the Regulated Activities listed in this Section. Stormwater management and erosion and sedimentation control during construction activities are specifically not regulated by this Ordinance, but shall continue to be regulated under existing laws and Ordinances.

The following activities are defined as "Regulated Activities" and shall be governed by this Ordinance:

- A. Land development.
- B. Subdivision.
- C. Construction of new or additional impervious surfaces (driveways, parking lots, etc.).
- D. Construction of new buildings or additions to existing buildings.
- E. Diversion or piping of any natural or man-made stream channel.
- F. Installation of stormwater systems or appurtenances thereto.

G. Regulated Earth Disturbance Activities.

SECTION 106. Exemptions

- A. Impervious Cover - Any proposed Regulated Activity, except those defined in Section 105.E and Section 105.F, which would create 10,000 square feet or less of additional impervious cover is exempt from the Drainage Plan preparation provisions of this Ordinance. For development taking place in stages, the entire Development Plan must be used in determining conformance with these criteria. Additional impervious cover shall include, but not be limited to additional indoor living spaces, decks, patios, garages, driveways, storage sheds and similar structures, any roof, parking or driveway areas and any new streets and sidewalks constructed as part of or for the proposed Regulated Activity. Any additional areas proposed to initially be gravel, crushed stone, porous pavement, etc. shall be assumed to be impervious for the purpose of comparison to the exemption criteria. Any existing gravel, crushed stone, or hard packed soil areas on a site shall be considered as pervious cover for the purpose of exemption evaluation. All of the impervious cover added incrementally to a site above the initial 10,000 square feet shall be subject to the provisions of this Ordinance.
- B. Prior Drainage Plan Approval - Any Regulated Activity for which a Drainage Plan was previously prepared as part of a Subdivision or Land Development proposal that received Preliminary Plan approval from East Penn Township prior to the effective date of this Ordinance is exempt from the Drainage Plan preparation provisions of this Ordinance, except as cited in Section 106.C, provided that the approved Drainage Plan included design of stormwater facilities to control runoff from the site currently proposed for Regulated Activities consistent with Ordinance provisions in effect at the time of approval and the approval has not lapsed under the Municipalities Planning Code ("MPC"). If significant revisions are made to the Drainage Plan after both the Preliminary Plan approval and the effective date of this Ordinance, preparation of a new Drainage Plan, subject to the provisions of this Ordinance, shall be required. Significant revisions would include a change in control methods or techniques, relocation or redesign of control measures or changes necessary because soil or other conditions are not as Stated on the original Drainage Plan.
- C. Use of land for gardening for home consumption.

- D. Agriculture when operated in accordance with a Conservation Plan or Erosion and Sedimentation Control Plan found adequate by the Conservation District. The agricultural activities such as growing crops, rotating crops, tilling of soil and grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance.
- E. Forest Management operations which are following the Department of Environmental Protection's management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an Erosion and Sedimentation Control Plan.
- F. These exemptions shall not relieve the applicant from implementing such measures as are necessary to protect health, safety, property, and State Water Quality Requirements. These measures include adequate and safe conveyance of stormwater on the site and as it leaves the site. These exemptions do not relieve the applicant from the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act or ordinance.
- G. No exemptions shall be provided for Regulated Activities as defined in Sections 105.E and 105.F.
- H. Any Regulated Activity that meet the exemption criteria in Sections 106.A or 106.B, in lieu of meeting the water quality criteria in Section 304, will be consistent with the Ordinance if one of the BMPs listed below is employed on the site to control water quality.
 - 1. Controlling runoff through a "sheet flow" system of vegetative or similar buffers having a minimum flow length equal to the length of the impervious areas.
 - 2. Infiltration designed in such a manner as to meet the provisions of this Ordinance.
 - 3. Employing any one of the BMPs listed in Article III Section 303.O.

SECTION 107. Repealer

Any Ordinance or parts of Ordinances of East Penn Township that were adopted prior to this Ordinance and are clearly inconsistent with any of the provisions of this Ordinance are hereby repealed to the extent of the inconsistency only.

SECTION 108. Severability

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

SECTION 109. Compatibility With Other Ordinance Requirements

Approvals issued pursuant to this Ordinance 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.

SECTION 110. Duty of Persons Engaged in the Development of Land

Notwithstanding any provisions of this Ordinance, including exemption and waiver provisions, any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures as are reasonably necessary to prevent injury to health, safety or other property. Such measures shall include such actions as are required to manage the rate, volume, direction and quality of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

ARTICLE II DEFINITIONS

For the purpose of this Ordinance, 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 words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- D. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used or occupied".

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

Agricultural Activities - The work of producing crops and raising livestock including tillage, plowing, discing, harrowing, pasturing and installation of conservation measures. Construction of new buildings or impervious area is not considered an agricultural activity.

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

Applicant - A landowner or Developer who has filed an application for approval to engage in any Regulated Activities as defined in this Ordinance.

Best Management Practice ("BMP") - Activities, facilities, measures, or procedures used to manage stormwater quantity and quality impacts from the Regulated Activities listed in Section 5, to meet State Water Quality Requirements, to promote groundwater recharge, and to otherwise meet the purposes of this Ordinance.

Best Management Practice Operations and Maintenance Plan - Documentation, included as part of a Drainage Plan, detailing the proposed BMPs, how they will be operated and maintained and who will be responsible.

Bioretention - Densely vegetated, depressed features that store stormwater and filter it through vegetation, mulch, planting soil, etc. Ultimately stormwater is evapotranspired, infiltrated, or discharged. Optimal bioretention areas mimic natural forest ecosystems in terms of species diversity, density, distribution, use of native plants, etc.

Buffer -

- (1) **Streamside Buffer** - A zone of variable width located along a stream that is vegetated and is designed to filter pollutants from runoff.
- (2) **Special Geologic Feature Buffer** - A required isolation distance from a special geologic feature to a proposed BMP needed to reduce the risk of sinkhole formation due to stormwater management activities.

Capture/Reuse - Stormwater management techniques such as cisterns and rain barrels which direct runoff into storage devices, surface or sub-surface, for later reuse, such as for irrigation of gardens and other planted areas. Because this stormwater is utilized and no pollutant discharge results, water quality performance is superior to other noninfiltration BMPs.

Carbonate Bedrock - Rock consisting chiefly of carbonate minerals, such as limestone and dolomite; specifically a sedimentary rock composed of more than 50% by weight of carbonate minerals that underlies soil or other unconsolidated, superficial material.

Channel Erosion - The widening, deepening, and headward cutting of small channels and waterways, due to erosion caused by moderate to large floods.

Cistern - An underground reservoir or tank for storing rainwater.

Closed Depression - A distinctive bowl-shaped depression in land surface. It is characterized by internal drainage, varying magnitude, and an unbroken ground surface.

Conservation District - The Carbon County Conservation District.

Constructed Wetlands - Constructed wetlands are similar to wet ponds (see below) and consist of a basin which provides for necessary stormwater storage as well as a permanent pool or water level, planted with wetland vegetation. To be successful, constructed wetlands must have adequate natural hydrology (both runoff inputs as well as soils and water table which allow for maintenance of a permanent pool of water). In these cases, the permanent pool must be designed carefully, usually with shallow edge benches, so that water levels are appropriate to support carefully selected wetland vegetation.

Culvert - A pipe, conduit, or similar structure including appurtenant works which carries surface water.

Dam - An artificial barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semifluid or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semifluid.

DEP - The Pennsylvania Department of Environmental Protection (formerly the Pennsylvania Department of Environmental Resources).

Designee - The agent of the East Penn Township Board of Supervisors and/or agent of the Governing Body involved with the administration, review or enforcement of any provisions of this Ordinance by contract or memorandum of understanding.

Design Storm - The depth and time distribution of precipitation from a storm event measured in probability of occurrence (e.g., 50-year storm) and duration (e.g. 24-hour), and used in computing stormwater management control systems.

Detention Basin - A basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

Developer - A person, partnership, association, corporation or other entity, or any responsible person therein or agent thereof, that undertakes any Regulated Activity of this Ordinance.

Development Site (Site) - The specific tract of land for which a Regulated Activity is proposed.

Diffused Drainage - See Sheet Flow.

Drainage Conveyance Facility - A Stormwater Management Facility designed to transmit stormwater runoff and include streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

Drainage Easement - A right granted by a landowner to a grantee, allowing the use of private land for storm water management purposes.

Drainage Permit - A permit issued by the East Penn Township Governing Body after a Drainage Plan has been approved. Said permit shall be issued prior to any activity governed by this Ordinance.

Drainage Plan - The documentation of the proposed stormwater quantity and quality management controls to be used for a given site development, including a BMP Operations and Maintenance Plan, the contents of which are established in Article V, Section 503.

Earth Disturbance Activity - A construction or other human activity which disturbs the surface of the land, including, but not limited to clearing and grubbing, grading, excavations, embankments, road maintenance, building construction and moving, depositing, stockpiling or storing of soil, rock or earth materials.

Erosion - The removal of soil particles by the action of water, wind, ice, or other geological agents.

Erosion and Sediment Pollution Control Plan - A plan which is designed to minimize accelerated erosion and sedimentation.

Existing Conditions - The initial condition of a project site prior to the proposed construction. If the initial condition of the site is undeveloped land, the land use shall be considered as a "meadow" unless the natural land cover is proven to generate lower curve numbers or Rational "C" value, such as forested lands.

Existing Uses - Those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards. (25 Pa. Code Chapter 93.1).

Fill - Man-made deposits of natural soils or rock products and waste materials.

Filter Strips - See Vegetated Buffers.

Flood - A general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, and other waters of this Commonwealth.

Floodplain - Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary-Mapped as being special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PaDEP) Technical Manual for Sewage Enforcement Officers (as amended or replaced from time to time by PaDEP).

Floodway - The channel of the 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 FEMA. In the 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 50 feet from the top of the bank of the stream.

Forest Management/Timber Operations - Planning and activities necessary for the management of forest land. These include timber inventory and preparation of Forest Management Plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation, and reforestation.

Freeboard - The incremental depth in a stormwater management structure, provided as a safety factor of design, above that required to convey the design runoff event.

Grade - A slope, usually of a road, channel or natural ground specified in percent and shown on plans as specified herein. **(To) Grade** - to finish the surface of a road bed, top of embankment or bottom of excavation.

Grassed Waterway - A natural or constructed waterway, usually broad and shallow, covered with erosion - resistant grasses, used to conduct surface water from cropland.

Groundwater Recharge - Replenishment of existing natural underground water supplies.

Hardship Waiver Request - A written request for a waiver alleging that the provisions of this Ordinance inflict unnecessary hardship upon the applicant. A Hardship Waiver does not apply to and is not available from the water quality provisions of this Ordinance and should not be granted.

Hot Spot Land Uses - A Land Use or activity that generates higher concentrations of hydrocarbons, trace metals or other toxic substances than typically found in stormwater runoff. These are listed in Article III, Section 304.P.

Hydrologic Soil Group (HSG) - Soils are classified into four HSGs (A, B, C and D) to indicate the minimum infiltration rates, which are obtained for bare soil after prolonged wetting. The Natural Resources Conservation Service (NRCS) of the US Department of Agriculture defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the development site may be identified from a Soil Survey Report, that can be obtained from local NRCS offices or Conservation District offices. Soils become less permeable as the HSG varies from A to D.

Impervious Surface (Impervious Cover) - A surface which prevents the percolation of water into the ground.

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

Infiltration Practice - A practice designed to direct runoff into the ground, e.g. french drain, seepage pit, seepage trench or bioretention area.

Inlet - A surface connection to a closed drain. A structure at the diversion end of a conduit. The upstream end of any structure through which water may flow.

Karst - A type of topography or landscape characterized by depressions, sinkholes, limestone towers and steep-sided hills, underground drainage, and caves. Karst is usually formed on carbonate rocks, such as limestones or dolomites and sometimes gypsum.

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

Loading Rate - The ratio of the land area draining to the system, as modified by the weighting factors in Article III, Section 307.b, compared to the base area of the infiltration system.

Low Impact Development - A development approach that promotes practices that will minimize postdevelopment runoff rates and volumes thereby minimizing needs for artificial conveyance and storage facilities. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces, and protecting natural depression storage.

"Local" Runoff Conveyance Facilities - Any natural channel or manmade conveyance system which has the purpose of transporting runoff from the Site to the mainstem.

Mainstem (main channel) - Any stream segment or other conveyance used as a reach in hydrologic modeling.

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.

Maryland Stormwater Design Manual - A Stormwater Design Manual written by the Maryland Department of the Environment and the Center for Watershed Protection. As of January 2004, the Manual can be obtained through the following web site: www.mde.state.md.us.

Minimum Disturbance/Minimum Maintenance Practices (MD/MM) - A site design practice in which careful limits are placed on site clearance prior to development allowing for maximum retention of existing vegetation (woodlands and other), minimum disturbance and compaction of existing soil mantle and minimum site application of chemicals post-development. Typically, MD/MM includes disturbance setback criteria from buildings as well as related site improvements such as walkways, driveways, roadways, and other improvements. These criteria may vary by community context, as well as by type of development being proposed. Additionally, MD/MM also shall include provisions (e.g., deed restrictions, conservation easements) to protect these areas from future disturbance and from application of fertilizers, pesticides, and herbicides.

Municipality/Township - East Penn Township, Carbon County, Pennsylvania.

No Harm Option - The option of using a less restrictive runoff quantity control if it can be shown that adequate and safe runoff conveyance exists and that the less restrictive control would not adversely affect health, safety, and property.

NPDES - National Pollutant Discharge Elimination System.

NRCS - Natural Resource Conservation Service - U.S. Department of Agriculture (formerly the Soil Conservation Service).

Oil/Water Separator - A structural mechanism designed to remove free oil and grease (and possibly solids) from stormwater runoff.

Outfall - "Point source" as described in 40 C.F.R. § 122.2 at the point where East Penn Township's storm sewer system discharges to surface waters of the Commonwealth.

Parking Lot Storage - Involves the use of impervious parking areas as temporary impoundments with controlled release rates during rainstorms.

Peak Discharge - The maximum rate of flow of stormwater runoff at a given location and time resulting from a specified storm event.

Penn State Runoff Model (PSRM) - The computer-based hydrologic modeling technique used in previous Act 167 Plans. PSRM was also updated to include water quality modeling capabilities and renamed PSRM-QUAL. The PSRM and PSRM-QUAL calculation methodologies were used as the basis for writing the WATERSHED Model.

Person - An individual, partnership, public or private association or corporation, firm, trust, estate, Municipality, governmental unit, public utility or any other legal entity whatsoever which is recognized by law as the subject of rights and duties.

Pipe - A culvert, closed conduit, or structure (including appurtenances) that conveys storm water.

Planning Commission - The East Penn Township Planning Commission.

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 Pa. Code § 92.1.

Preliminary Site Investigation - The determination of the depth to bedrock, the depth to the seasonal high water table and the soil permeability for a possible infiltration location on a site through the use of published data and on-site surveys. In carbonate bedrock areas, the location of special geologic features must also be determined along with the associated buffer distance to the possible infiltration area.

Public Water Supplier - A person who owns or operates a public water system.

Public Water System - A system which provides water to the public for human consumption which has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. (See, 25 Pa. Code Chapter 109).

Qualified Geotechnical Professional - A Licensed Professional Geologist or a Licensed Professional Engineer who has a background or expertise in geology or hydrogeology.

Rational Method - A method of peak runoff calculation using a standardized runoff coefficient (rational 'c'), acreage of tract and rainfall intensity determined by return period and by the time necessary for the entire tract to contribute runoff. The rational method formula is Stated as follows: $Q=ciA$, where "Q" is the calculated peak flow rate in cubic feet per second, 'c' is the dimensionless runoff coefficient, "i" is the rainfall intensity in inches per hour, and "A" is the area of the tract in acres.

Reach - Any of the natural or man-made runoff conveyance channels used for watershed runoff modeling purposes to connect the subareas and transport flows downstream.

Regulated Activities - Actions or proposed actions which impact upon proper management of stormwater runoff and which are governed by this Ordinance as specified in Article I, Section 105.

Regulated Earth Disturbance Activities - Earth disturbance activity other than agricultural plowing or tilling of one acre or more with a point source discharge to surface waters or to the East Penn Township's storm sewer system or earth disturbance activity of five acres or more regardless of the planned runoff. This includes earth disturbance on any portion of, part or during any stage of a larger common plan of development.

Release Rate - The percentage of predevelopment peak rate of runoff for a development site to which the postdevelopment peak rate of runoff must be controlled to avoid peak flow increases throughout the watershed.

Retention Basin - An impoundment in which storm water is stored and not released during the storm event. Stored water may be released from the basin at some time after the end of the storm.

Return Period - The average interval in years over which an event of a given magnitude can be expected to recur. For example, the twenty-five 25-year return period rainfall or runoff event would be expected to recur on the average once every twenty-five (25) years.

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.

Rooftop Detention - Temporary ponding and gradual release of stormwater falling directly onto flat roof surfaces by incorporating controlled-flow roof drains into building designs.

Runoff - The part of precipitation which flows over the land.

Sediment Traps/Catch Basin Sumps - A chamber which provides storage below the outlet in a storm inlet to collect sediment, debris and associated pollutants, typically requiring periodic clean out.

Seepage Pit/Seepage Trench - An area of excavated earth filled with loose stone or similar material and into which surface water is directed for infiltration into the ground.

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

Sheet Flow - Stormwater runoff flowing in a thin layer over the ground surface.

Soil-Cover-Complex Method - A method of runoff computation developed by NRCS which is based upon relating soil type and land use/cover to a runoff parameter called a Curve Number.

Special Geologic Features - Carbonate bedrock features, including but not limited to closed depressions, existing sinkholes, fracture traces, lineaments, joints, faults, caves and pinnacles, and geologic contacts between carbonate and noncarbonate bedrock which may exist and must be identified on a site when stormwater management BMPs are being considered.

Spill Prevention and Response Program - A program that identifies procedures for preventing and, as needed, cleaning up potential spills and makes such procedures known and the necessary equipment available to appropriate personnel.

Spillway - A depression in the embankment of a pond or basin which is used to pass a peak discharge greater than the maximum, design storm controlled by the pond.

State Water Quality Requirements - As defined under Commonwealth of Pennsylvania (State) regulations - protection of designated and existing uses (See, 25 Pa. Code Chapters 93 and 96) - including:

- A. Each stream segment in Pennsylvania has a "designated use," such as "cold water fishes" or "potable water supply," which are listed in Chapters 93. These uses must be protected and maintained, under State regulations.
- B. "Existing uses" are those attained as of November 1975, regardless 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 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, streambed and structural integrity of the waterway, to prevent these impacts.

Storage Indication Method - A method of routing or moving an inflow hydrograph through a reservoir or detention structure. The method solves the

mass conservation equation to determine an outflow hydrograph as it leaves the storage facility.

Storm Drainage Problem Areas - Areas which lack adequate stormwater collection and/or conveyance facilities and which prevent a hazard to persons or property as identified by East Penn Township or East Penn Township's Engineer.

Storm Sewer - A system of pipes or other conduits which carries intercepted surface runoff, street water and other wash waters, or drainage, but excludes domestic sewage and industrial wastes.

Stormwater - The surface runoff generated by precipitation reaching the groundwater.

Stormwater Filters - Any number of structural mechanisms such as multi-chamber catch basins, sand/peat filters, sand filters, and so forth which are installed to intercept stormwater flow and remove pollutants prior to discharge. Typically, these systems require periodic maintenance and cleanout.

Stormwater Management Plan - The plan for managing stormwater runoff.

Stream - A watercourse.

Subarea - The smallest unit of watershed breakdown for hydrologic modeling purposes for which the runoff control criteria have been established in the Stormwater Management Plan.

Subdivision - The division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land including changes in existing lot lines for the purpose, whether immediate or future, of lease, partition by the court for distribution to heirs or devisees, transfer of ownership or building or lot ownership.

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

Swale - A low-lying stretch of land which gathers or carries surface water runoff. See also, Vegetated Swale.

Technical Best Management Practice Manual & Infiltration Feasibility Report, November 2002 - The report written by Cahill Associates that addresses the feasibility of infiltration in carbonate bedrock areas.

Timber Operations - See Forest Management.

Time of Concentration (Tc) - The time 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.

Trash/Debris Collectors - Racks, screens or other similar devices installed in a storm drainage system to capture coarse pollutants (trash, leaves, etc.).

Vegetated Buffers - Gently sloping areas that convey stormwater as sheet flow over a broad, densely vegetated earthen area, possibly coupled with the use of level spreading devices. Vegetated buffers should be situated on minimally disturbed soils, have low-flow velocities and extended residence times.

Vegetated Roofs - Vegetated systems installed on roofs that generally consist of a waterproof layer, a root-barrier, drainage layer (optional), growth media, and suitable vegetation. Vegetated roofs store and eventually evapotranspire the collected rooftop rainfall; overflows may be provided for larger storms.

Vegetated Swales - (1) Vegetated earthen channels designed to convey stormwater. These swales are not considered to be water quality BMPs; (2) Broad, shallow, densely vegetated, earthen channels designed to treat stormwater while slowly infiltrating, evapotranspiring, and conveying it. Swales should be gently sloping with low flow velocities to prevent erosion. Check dams may be added to enhance performance.

Water Quality Inserts - Any number of commercially available devices that are inserted into storm inlets to capture sediment, oil, grease, metals, trash, debris, etc.

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

Watershed - The entire region or area drained by a river or other body of water, whether natural or artificial.

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 this Commonwealth.

Wet Detention Ponds - A basin that provides for necessary stormwater storage, as well as a permanent pool of water. To be successful, wet ponds must have adequate natural hydrology (both runoff inputs, as well as soils and water table which allow for maintenance of a permanent pool of water) and must be able to support a healthy aquatic community so as to avoid creation of mosquito and other health and nuisance problems.

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

ARTICLE III STORMWATER MANAGEMENT REQUIREMENTS

SECTION 301. General Requirements

- A. All Regulated Activities located within East Penn Township shall be subject to the stormwater management requirements of this Ordinance.
- B. Storm drainage systems shall be provided to permit unimpeded flow in natural watercourses except as modified by stormwater detention facilities, pipe systems, or open channels consistent with this Ordinance.
- C. The existing locations of concentrated drainage discharge onto adjacent property shall not be altered without written approval of the affected property owner(s).
- D. Areas of existing diffused drainage discharge onto adjacent property shall be managed such that, at minimum, the peak diffused flow does not increase in the general direction of discharge, except as otherwise provided in this Ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Developer must document that there are adequate downstream conveyance facilities to safely transport the concentrated discharge to the point of predevelopment flow concentration, to the stream reach or otherwise prove that no harm will result from the concentrated discharge. Areas of existing diffused drainage discharge shall be subject to any applicable release rate criteria in the general direction of existing discharge whether they are proposed to be concentrated or maintained as diffused drainage areas.
- E. Where a site is traversed by watercourses other than those for which a 100-year floodplain is defined by East Penn Township, there shall be provided drainage easements conforming substantially with the line of such watercourses. The width of any easement shall be adequate to provide for unimpeded flow of storm runoff based on calculations made in conformance with Section 307 for the 100-year return period runoff and to provide a freeboard allowance of one-half (0.5) foot above the design water surface level. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations which may adversely affect the flow of stormwater within any portion of the easement. Also, periodic maintenance of the easement to ensure proper runoff conveyance shall be required. Watercourses for which the 100-year floodplain is

formally defined are subject to the applicable East Penn Township floodplain regulations.

- F. When it can be shown that, due to topographic conditions, natural drainage swales on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainage swales. Capacities of open channels shall be calculated using the Manning Equation.
- G. Postconstruction BMPs shall be designed, installed, operated, and maintained to meet the requirements of the Clean Streams Law and implementing regulations, including the established practices in 25 Pa. Code Chapter 102 and the specifications of this Ordinance as to prevent accelerated erosion in watercourse channels and at all points of discharge.
- H. No Earth Disturbance activities associated with any Regulated Activities shall commence until approval by East Penn Township of a plan which demonstrates compliance with the requirements of this Ordinance.
- I. Techniques utilizing Low Impact Development are encouraged because they reduce the costs of complying with the requirements of this Ordinance and the State Water Quality Requirements.
- J. Infiltration for stormwater management is encouraged where soils and geology permit, consistent with the provisions of this Ordinance and, where appropriate, the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock.
- K. Low Point Drainage
 - 1. Developer shall grade and install all necessary drainage facilities to insure the drainage of all low points on subdivided lots or within the subdivision or developed land area.
 - 2. Underdrains are required at a minimum for 50 feet upward from a road low point along each approach road to the low point.
- L. Lots shall be laid out to encourage positive discharge away from proposed building areas and sewage disposal facilities. Wherever desirable, natural drainage courses shall be maintained.

SECTION 302. Permit Requirements by Other Government Entities

- A. The following permit requirements apply to certain Regulated and Earth Disturbance Activities and must be met prior to commencement of Regulated and Earth Disturbance Activities, as applicable:
1. All Regulated and Earth Disturbance Activities subject to permit requirements by DEP under regulations at 25 Pa. Code Chapter 102.
 2. Work within natural drainageways subject to permit by DEP under 25 Pa. Code Chapter 102.
 3. 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 Pa. Code Chapter 105.
 4. Any stormwater management facility that would be located on a State highway right-of-way or require access from a State highway shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).
 5. 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 Pa. Code Chapter 105.

SECTION 303. Erosion and Sediment Control During Regulated Earth Disturbance Activities

- A. No Regulated Earth Disturbance activities within East Penn Township shall commence until approval by East Penn Township of an Erosion and Sediment Control Plan for construction activities. Written approval by DEP or a delegated County Conservation District shall satisfy this requirement.
- B. An Erosion and Sediment Control Plan is required by DEP regulations for any Earth Disturbance Activity of 5,000 square feet or more under Pa. Code § 102.4(b).

- C. A DEP NPDES Stormwater Discharges Associated with Construction Activities Permit is required for Regulated Earth Disturbance Activities under Pa. Code Chapter 92.
- D. Evidence of any necessary permit(s) for Regulated Earth Disturbance Activities from the appropriate DEP regional office or County Conservation District must be provided to East Penn Township before the commencement of Earth Disturbance Activity.
- E. A copy of the approved Erosion and Sediment Control Plan Narrative and any permit, as required by DEP regulations, shall be available at the project site at all times.

SECTION 304. Post Construction Water Quality Criteria

- A. No Regulated Earth Disturbance Activities within East Penn Township shall commence until approval by East Penn Township of a plan which demonstrates compliance with this Ordinance.
- B. The Water Quality Volume (WQv) shall be captured and treated. The WQv shall be calculated two ways. First, WQv shall be calculated using the following formula:

$$WQv = (c)(P)(A) / 12$$

Where WQv = water quality volume in acre-feet

c = Rational Method post-development runoff coefficient for the 2-year storm

P = 1.25 inches

A = Area in acres of proposed Regulated Activity

Second, the WQv shall be calculated as the difference in runoff volume from predevelopment to postdevelopment for the 2-year return period storm. The effect of closed depressions on the site shall be considered in this calculation. The larger of these two calculated volumes shall be used as the WQv to be captured and treated, except that in no case shall the WQv be permitted to exceed 1.25-inches of runoff over the site area.

- C. The WQv shall be calculated for each postdevelopment drainage direction on a site for sizing BMPs. Site areas having no impervious cover and no proposed disturbance during development may be excluded from the WQv calculations and do not require treatment.

- D. If an applicant is proposing to use a wet pond, constructed wetland, or other BMP that ponds water on the land surface and may receive direct sunlight, the discharge from that BMP must be treated by infiltration, a vegetated buffer, filter strip, bioretention, vegetated swale, or other BMP that provides a thermal benefit.
- E. The WQv for a site as a result of the Regulated Activities must either be treated with infiltration or two acceptable BMPs such as those listed in Section 304.O.
- F. Infiltration BMPs shall not be constructed on fill.
- G. The applicant shall document the bedrock type(s) present on the site from published sources. Any apparent boundaries between carbonate and noncarbonate bedrock shall be verified through more detailed site evaluations by a qualified geotechnical professional.
- H. For each proposed Regulated Activity in the watershed where an applicant intends to use infiltration BMPs, the applicant shall conduct a Preliminary Site Investigation, including gathering data from published sources, a field inspection of the site, a minimum of one test pit and a minimum of two percolation tests, as outlined in Appendix E. This investigation will determine depth to bedrock, depth to the seasonal high water table, soil permeability and location of special geologic features, if applicable. The location(s) of special geologic features shall be verified by a qualified geotechnical professional.
- I. Sites where applicants intend to use infiltration BMPs must meet the following criteria:
- Depth to bedrock from the bottom most point of any BMP shall be greater than or equal to 2 feet
 - Depth to seasonal high water table below the invert of the BMP greater than or equal to 3 feet; except for infiltration of residential roof runoff where the seasonal high water table must be below the bottom most point of the BMP. (If the depth to bedrock is between 2 and 3 feet and the evidence of the seasonal high water table are not found in the soil, no further testing to locate the depth to seasonal high water table is required.)

- Soil permeability (as measured by the adapted 25 PA Code §. 73.15. percolation test in Appendix F) greater than or equal to 0.5 inches/hour and less than or equal to 12 inches per hour
- Setback distances or buffers as follows:
 - 100 feet from water supply wells
 - 15 feet downgradient or 100 feet upgradient from building foundations; except for residential development where the required setback is 15 feet downgradient or 40 feet upgradient from building foundations
 - 50 feet from septic system drainfields; except for residential development where the required setback is 25 feet from septic system drainfields
 - 50 feet from a geologic contact with carbonate bedrock unless a Preliminary Site Investigation is done in the carbonate bedrock to show the absence of special geologic features within 50 feet of the proposed infiltration area
 - 100 feet from the property line unless documentation is provided to show that all setbacks from existing or potential future wells, foundations and drain fields on neighboring properties will be met; if so then 25 feet from the property line

J. For entirely noncarbonate sites, the Recharge Volume (REv) shall be infiltrated unless the applicant demonstrates that it is infeasible to infiltrate the REv for reasons of seasonal high water table, permeability rate, soil depth, or isolation distances; or except as provided in Section 304.U.

1. The REv shall be calculated as follows:

$$REv = (0.25) * (I)/12$$

Where REv = Recharge Volume in acre-feet

I = impervious area in acres

2. The Preliminary Site Investigation described in Article III, Section 304.H is required and shall continue on different areas of the site until a potentially suitable infiltration location is found or the entire site is determined to be infeasible for infiltration. For infiltration areas that appear to be feasible based on the Preliminary Site Investigation, the Additional Site Investigation and Testing as outlined in Appendix F shall be completed.

3. If an Applicant proposes infiltration, East Penn Township may determine infiltration to be infeasible if there are known existing conditions or problems that may be worsened by the use of infiltration.
 4. The site must meet the conditions listed in Article III, Section 304.I.
 5. If it is not feasible to infiltrate the full REv, the applicant shall infiltrate that portion of the REv that is feasible based on the site characteristics. If none of the REv can be infiltrated, REv shall be considered as part of the WQv and shall be captured and treated as described in Article III, Section 304.O.
 6. If REv is infiltrated, it may be subtracted from the WQv required to be captured and treated.
- K. In entirely carbonate areas, where the applicant intends to use infiltration BMPs, the Preliminary Site Investigation described in Section 304.H shall be conducted. For infiltration areas that appear feasible based on the Preliminary Site Investigation, the applicant shall conduct the Additional Site Investigation and Testing as outlined in Appendix E. The soil depth, percolation rate and proposed loading rate, each weighted as described in Section 307, along with the buffer from special geologic features shall be compared to the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix C to determine if the site is recommended for infiltration. In addition to the recommendation from Appendix C, the conditions listed in Section 304.I are required for infiltration in carbonate areas.

Applicants are encouraged to infiltrate the REv, as calculated in Section 304.J, but are not required to use infiltration BMPs on a carbonate site even if the site falls in the "Recommended" range on the chart in Appendix C. Any amount of volume infiltrated can be subtracted from the WQv to be treated by noninfiltration BMPs. If infiltration is not proposed, the full WQv shall be treated by two acceptable BMPs, as specified in Section 304.O.

- L. If a site has both carbonate and noncarbonate areas, the applicant shall investigate the ability of the noncarbonate portion of the site to fully meet this Ordinance to meet the requirements for REv for the whole site through infiltration. If that proves infeasible, infiltration in the carbonate area or 2 other noninfiltration BMPs must be used. No infiltration

structure in the noncarbonate area shall be located within 50 feet of a boundary with carbonate bedrock, except when a Preliminary Site Investigation has been done showing the absence of special geologic features within 50 feet of the proposed infiltration area.

- M. If infiltration BMPs are proposed in carbonate areas, the post-development 2-year runoff volume leaving the site shall be 80 percent or more of the predevelopment runoff volume for the carbonate portion of the site to prevent infiltration of volumes far in excess of the predevelopment infiltration volume.
- N. Site areas proposed for infiltration shall be protected from disturbance and compaction except as necessary for construction of infiltration BMPs.
- O. If infiltration of the entire WQv is not proposed, the remainder of the WQv shall be treated by two acceptable BMPs in series for each discharge location. Sheet flow draining across a pervious area can be considered as one BMP. Sheet flow across impervious areas and concentrated flow shall flow through two BMPs. If sheet flow from an impervious area is to be drained across a pervious area as one BMP, the length of the pervious area must be equal to or greater than the length of impervious area. In no case may the same BMP be employed consecutively to meet the requirement of this section. Acceptable BMPs are listed as follows along with the recommended reference for design.

Best Management Practice	Design Reference Number ^C
Bioretention ^A	4, 5, 11, 16
Capture/Reuse ^B	4, 14
Constructed Wetlands	4, 5, 8, 10, 16
Dry Extended Detention Ponds	4, 5, 8, 12, 18
Minimum Disturbance/ Minimum Maintenance Practices	1, 9
Significant Reduction of Existing Impervious Cover	N/A
Stormwater Filters ^A (Sand, Peat, Compost, etc.)	4, 5, 10, 16
Vegetated Buffers/Filter Strips	2, 3, 5, 11, 16, 17
Vegetated Roofs	4, 13
Vegetated Swales ^A	2, 3, 5, 11, 16, 17
Water Quality Inlets ^D	4, 7, 15, 16, 19
Wet Detention Ponds	4, 5, 6, 8

^A This BMP could be designed with or without an infiltration component. If infiltration is proposed, the site and BMP will be subject to the testing and other infiltration requirements in this Ordinance.

^B If this BMP is used to treat the entire WQv then it is the only BMP required because of this BMP's superior water quality performance.

^C See table below.

^D Water Quality Inlets include such BMPs as Oil/Water Separators, Sediment Traps/Catch Basin Sumps, and Trash/Debris Collectors in Catch Basins.

Number	Design Reference Title
1	"Conservation Design For Stormwater Management - A Design Approach to Reduce Stormwater Impacts From Land Development and Achieve Multiple Objectives Related to Land Use," Delaware Department of Natural Resources and Environmental Control, The Environmental Management Center of the Brandywine Conservancy, September 1997.
2	"A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone," Schueler, T. R., Kumble, P. and Heraty, M., Metropolitan Washington Council of Governments, 1992.
3	"Design of Roadside Channels with Flexible Linings," Federal Highway Administration, Chen, Y. H. and Cotton, G. K., Hydraulic Engineering Circular 15, FHWA-IP-87-7, McLean Virginia, 1988.
4	"Draft Stormwater Best Management Practices Manual," Pennsylvania Department of Environmental Protection, January 2005.
5	"Evaluation and Management of Highway Runoff Water Quality," Federal Highway Administration, FHWA-PD-96-032, Washington, D.C., 1996.
6	"Evaporation Maps of the United States," U.S. Weather Bureau (now NOAA/National Weather Service) Technical Paper 37, Published by Department of Commerce, Washington, D.C., 1959.
7	"Georgia Stormwater Manual," AMEC Earth and Environmental, Center for Watershed Protection, Debo and Associates, Jordan Jones and Goulding, Atlanta Regional Commission, Atlanta, Georgia, 2001.
8	"Hydraulic Design of Highway Culverts," Federal Highway Administration, FHWA HDS 5, Washington, D.C., 1985 (revised may 2005).
9	"Low Impact Development Design Strategies <i>An Integrated Design Approach</i> ," Prince Georges County, Maryland Department of Environmental Resources, June 1999.
10	"Maryland Stormwater Design Manual," Maryland Department of the Environment, Baltimore, Maryland, 2000.
11	"Pennsylvania Handbook of Best Management Practices for Developing Areas," Pennsylvania Department of Environmental Protection, 1998.
12	"Recommended Procedures for Act 167 Drainage Plan Design," LVPC, Revised 1997.
13	"Roof Gardens History, Design, and Construction," Osmundson, Theodore. New York: W.W. Norton & Company, 1999.
14	"The Texas Manual on Rainwater Harvesting," Texas Water Development Board, Austin, Texas, Third Edition, 2005.
15	"VDOT Manual of Practice for Stormwater Management," Virginia Transportation Research Council, Charlottesville, Virginia, 2004.
16	"Virginia Stormwater Management Handbook," Virginia Department of Conservation and Recreation, Richmond, Virginia, 1999.
17	"Water Resources Engineering," Mays, L. W., John Wiley & Sons, Inc., 2005.
18	"Urban Hydrology for Small Watersheds," Technical Report 55, US Department of Agriculture, Natural Resources Conservation Service, 1986.
19	US EPA, Region 1 New England web site (as of August 2005) http://www.epa.gov/NE/assistance/ceitts/stormwater/techs/html .

- P. Stormwater runoff from Hot Spot land uses shall be pretreated. In no case, may the same BMP be employed consecutively to meet this

requirement and the requirement in Section 304.O. Acceptable methods of pretreatment are listed as follows.

Hot Spot Land Use	Pre-treatment Method(s)
Vehicle Maintenance and Repair Facilities including Auto Parts Stores	-Water Quality Inlets -Use of Drip Pans and/or Dry Sweep Material Under Vehicles/Equipment -Use of Absorbent Devices to Reduce Liquid Releases -Spill Prevention and Response Program
Vehicle Fueling Stations	-Water Quality Inlets -Spill Prevention and Response Program
Storage Areas for Public Works	-Water Quality Inlets -Use of Drip Pans and/or Dry Sweep Material Under Vehicles/Equipment -Use of Absorbent Devices to Reduce Liquid Releases -Spill Prevention and Response Program -Diversion of Stormwater away from Potential Contamination Areas
Outdoor Storage of Liquids	-Spill Prevention and Response Program
Commercial Nursery Operations	-Vegetated Swales/Filter Strips -Constructed Wetlands -Stormwater Collection and Reuse
Salvage Yards and Recycling Facilities*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Fleet Storage Yards and Vehicle Cleaning Facilities*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Facilities that Store or Generate Regulated Substances*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Marinas*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Certain Industrial Uses (listed under NPDES)*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit

*Regulated under the NPDES Stormwater Program

Design references for the pretreatment methods, as necessary, are listed below. If the applicant can demonstrate to the satisfaction of East Penn Township that the proposed land use is not a Hot Spot, then the pretreatment requirement would not apply.

Pre-treatment Method	Design Reference Number ^A
Constructed Wetlands	5, 6, 10, 12, 18
Diversion of Stormwater Away from Potential Contamination Areas	5, 13
Stormwater Collection and Reuse (especially for irrigation)	5, 16
Stormwater Filters (Sand, Peat, Compost, etc.)	5, 6, 12, 18
Vegetated Swales	2, 4, 6, 13, 18, 19
Water Quality Inlets	5, 9, 17, 18, 21

^A These numbers refer to the Design Reference Title Chart in Section 4.O. above.

- Q. The use of infiltration BMPs is prohibited on Hot Spot land use areas.
- R. Stormwater infiltration BMPs shall not be placed in or on a special geologic feature(s). Additionally, stormwater runoff shall not be discharged into existing on-site sinkholes.
- S. Applicants shall request, in writing, Public Water Suppliers to provide the Zone I Wellhead Protection radius, as calculated by the method outlined in the Pennsylvania Department of Environmental Protection Wellhead Protection regulations, for any public water supply well within 400 feet of the site. In addition to the setback distances specified in Article III, Section 4.I, infiltration is prohibited in the Zone I radius as defined and substantiated by the Public Water Supplier in writing. If the applicant does not receive a response from the Public Water Supplier, the Zone I radius is assumed to be 100 feet.
- T. The volume and rate of the net increase in stormwater runoff from the Regulated Activities must be managed to prevent the physical degradation of receiving waters from such effects as scour and streambank destabilization, to satisfy State Water Quality Requirements, by controlling the 2-year postdevelopment runoff to a 30% Release Rate.
- U. East Penn Township may, after consultation with DEP, approve alternative methods for meeting the State Water Quality Requirements other than those in this Section, provided that they meet the minimum requirements of and do not conflict with State law including, but not limited to the Clean Streams Law.

SECTION 305. Stormwater Management Districts

- A. Mapping of Stormwater Management Districts – To implement the provisions of the Mahoning Creek and Lizard Creek Watershed Stormwater Management Plans, the Municipality is hereby divided into Stormwater Management Districts consistent with the Mahoning Creek and Lizard Creek Watershed Stormwater Release Rate Maps presented in the Appendix A on Plates. The boundaries of the Stormwater Management Districts are shown on an official map, which is available for inspection at the Municipal office.
- B. Description of Stormwater Management Districts – Two types of Stormwater Management Districts may be applicable to East Penn

Township, namely Conditional/Provisional No Detention Districts and Dual Release Rate Districts as described below.

1. Conditional/Provisional No Detention Districts - Within these Districts, the capacity of the "local" runoff conveyance facilities (as defined in Article 2) must be calculated to determine if adequate capacity exists. For this determination, the Developer must calculate peak flows assuming that the site is developed as proposed and that the remainder of the local watershed is in the existing condition. The Developer must also calculate peak flows assuming that the entire local watershed is developed per current zoning and that all new development would use the runoff controls specified by this Ordinance. The larger of the two peak flows calculated will be used in determining if adequate capacity exists. If adequate capacity exists to safely transport runoff from the site to the main channel as defined in Article 2), these watershed areas may discharge postdevelopment peak runoff without detention facilities. If the capacity calculations show that the "local" runoff conveyance facilities lack adequate capacity, the Developer shall either use a 100% release rate control or provide increased capacity of downstream elements to convey increased peak flows consistent with Section 306.P. Any capacity improvements must be designed to convey runoff from development of all areas tributary to the improvement consistent with the capacity criteria specified in Section 306.D. By definition, a storm drainage problem area associated with the "local" runoff conveyance facilities indicates that adequate capacity does not exist. Sites in these Districts are still required to meet all of the water quality requirements in Section 304.
2. Dual Release Rate Districts - Within these Districts, the 2-year postdevelopment peak discharge must be controlled to 30% of the pre-development 2-year runoff peak. Further, the 10-year, 25-year and 100-year postdevelopment peak runoff must be controlled to the stated percentage of the predevelopment peak within each specific watershed subarea. Release Rates associated with the 10-through 100-year events vary from 50% to 100% depending upon the location of the watershed. The applicable performance standards for managing runoff from each subarea. The applicable performance standards for managing runoff from each subarea in the Mahoning Creek and Lizard Creek Watersheds for the 2-year, 10-year, 25- year, and the 100-year design storms are provided in the release rate tables found below. Post Development peak flows at the discharge of any proposed Regulated Activity within a

particular subarea shown on Plate 10 and 14 shall not exceed the arithmetic product of the applicable subarea release rate times the pre-development peak flow for the 2-, 10-, 25-, and 100-year event.

RELEASE RATE SUMMARY TABLE

Dual Release Rate Categories (30/--) define a 30% Release Rate for the 2-Year storm and the indicated Release Rate for the 10-, 25-, and 100-Year storms.

MAHONING CREEK WATERSHED (PLATES 10 - 13)	
Subarea	Release Rate (%)
53	30/50

* Provisional No Detention Areas do not need detention controls for the 10-, 25-, or 100-year storms provided that adequate downstream capacity can be shown for increased peak flows. (See Plan Update for additional details.)

RELEASE RATE SUMMARY TABLE

Dual Release Rate Categories (30/--) define a 30% Release Rate for the 2-Year storm and the indicated Release Rate for the 10-, 25-, and 100-Year storms.

LIZARD CREEK WATERSHED (PLATES 14 - 17)	
Subarea	Release Rate (%)
58 - 66	30/50
67 - 68	30/PND*
69 - 73	30/50
74	30/PND*
75 - 86	30/50
87	30/PND*
88 - 91	30/50
92	30/PND*
93 - 97	30/50
98	30/PND*
99	30/50
100	30/PND*

* Provisional No Detention Areas do not need detention controls for the 10-, 25-, or 100-year storms provided that adequate downstream capacity can be shown for increased peak flows. (See Plan Update for additional details.)

SECTION 306. Stormwater Management District Implementation Provisions

- A. Applicants shall provide a comparative preconstruction and postconstruction stormwater management hydrograph analysis for each direction of discharge and for the site overall to demonstrate compliance with the provisions of this Ordinance.
- B. Any stormwater management controls required by this Ordinance and subject to a dual release rate criteria shall meet the applicable release rate criteria for each of the 2-, 10-, 25- and 100-year return period runoff events consistent with the calculation methodology specified in Section 307.
- C. The exact location of the Stormwater Management District boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two-foot topographic contours provided as part of the Drainage Plan. The District boundaries as originally drawn coincide with topographic divides or, in certain instances, are drawn from the intersection of the watercourse and a physical feature such as the confluence with another watercourse or a potential flow obstruction (e.g. road, culvert, bridge, etc.). The physical feature is the downstream limit of the subarea and the subarea boundary is drawn from that point up slope to each topographic divide along the path perpendicular to the contour lines.
- D. Any downstream capacity analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:
 - 1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion.
 - 2. Natural or man-made channels or swales must be able to convey the increased 25-year return period runoff without creating any hazard to persons or property.
 - 3. Culverts, bridges, storm sewers, or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP Chapter 105 regulations (if applicable) and, at minimum, pass the increased 25-year return period runoff.
- E. For a proposed development site located within one release rate category subarea, the total runoff from the site shall meet the applicable release rate criteria. For development sites with multiple directions of runoff discharge,

individual drainage directions may be designed for up to a 100% release rate so long as the total runoff from the site is controlled to the applicable release rate.

- F. For a proposed development site located within two or more release category subareas, the peak discharge rate from any subarea shall be the predevelopment peak discharge for that subarea multiplied by the applicable release rate. The calculated peak discharges shall apply regardless of whether the Grading Plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas recombine in proximity to the site. In this case, peak discharge in any direction may be a 100% release rate provided that the overall site discharge meets the weighted average release rate.
- G. For a proposed development site located partially within a release rate category subarea and partially within a Conditional/Provisional No Detention subarea, the size of the predevelopment drainage area on a site may not be changed postdevelopment to create potentially adverse conditions on downstream properties except as part of a "No Harm" or Hardship waiver procedure.
- H. No portion of a site may be regraded between the Mahoning Creek or Lizard Creek Watershed and any adjacent watershed except as part of a "No Harm" or Hardship Waiver procedure.
- I. Within a release rate category area, for a proposed development site which has areas which drain to a closed depression(s), the design release from the site will be the lesser of (a) the applicable release rate flow assuming no closed depression(s) or (b) the existing peak flow actually leaving the site. In cases where (b) would result in an unreasonably small design release, the design discharge of less than or equal to the release rate will be determined by the available downstream conveyance capacity to the main channel calculated using Section 306.D. and the minimum orifice criteria.
- J. Off-site areas which 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 using the capacity criteria in Section 306.D. and the detention criteria in Section 307.
- K. For development sites proposed to take place in phases, all detention ponds shall be designed to meet the applicable release rate(s) applied to all site areas tributary to the proposed pond discharge direction. All site tributary areas will be assumed as developed, regardless of whether all site tributary acres are proposed for development at that time. An exception shall be sites with multiple detention ponds in series where only the downstream pond must be designed to the stated release rate.

- L. Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area shall be subject to the release rate criteria. The impact area includes any proposed cover or grading changes.
- M. Development proposals which, through groundwater recharge or other means, do not increase either the rate or volume of runoff discharged from the site compared to predevelopment are not subject to the release rate provisions of this Ordinance.
- N. "No Harm" Water Quantity Option - For any proposed development site not located in a Conditional/Provisional No Detention District, the Developer has the option of using a less restrictive runoff control (including no detention) if the Developer can prove that special circumstances exist for the proposed development site and that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. Special circumstances are defined as any hydrologic or hydraulic aspects of the development itself not specifically considered in the development of the plan runoff control strategy. Proof of "no harm" would have to be shown from the development site through the remainder of the downstream drainage network to the confluence of the creek with the Delaware or Lehigh River. Proof of "no harm" must be shown using the capacity criteria specified in Section 306.D. if downstream capacity analysis is a part of the "no harm" justification.

Attempts to prove "no harm" based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

1. The peak flow values to be used for downstream areas for the design return period storms (2-, 10-, 25- and 100-year) shall be the values from the calibrated PSRM Model for the Mahoning Creek or Lizard Creek or as calculated by an applicant using an alternate method acceptable to the Municipality. The flow values from the PSRM Model would be supplied to the Developer by the Municipality upon request.
2. Any available capacity in the downstream conveyance system as documented by a Developer may be used by the Developer only in proportion to his development site acreage relative to the total upstream undeveloped acreage from the identified capacity (i.e. if his site is 10% of the upstream undeveloped acreage, he may use up to 10% of the documented downstream available capacity).
3. Developer-proposed runoff controls which would generate increased peak flow rates at storm drainage problem areas would, by definition, be

precluded from successful attempts to prove "no harm", except in conjunction with proposed capacity improvements for the problem areas consistent with Section 306.P.

Any "no harm" justifications shall be submitted by the Developer as part of the Drainage Plan submission per Article 4. Developers submitting "no harm" justifications must still meet all of the water quality requirements in Section 304.

- O. Regional Detention Alternatives - For certain areas within the study area, it may be more cost-effective to provide one control facility for more than one development site than to provide an individual control facility for each development site. The initiative and funding for any regional runoff control alternatives are the responsibility of prospective Developers. The design of any regional control basins must incorporate reasonable development of the entire upstream watershed. The peak outflow of a regional basin would be determined based on the required release rate at the point of discharge.
- P. Capacity Improvements - In certain instances, primarily within the Conditional/Provisional No Detention areas, local drainage conditions may dictate more stringent levels of runoff control than those based upon protection of the entire watershed. In these instances, if the Developer could prove that it would be feasible to provide capacity improvements to relieve the capacity deficiency in the local drainage network, then the capacity improvements could be provided by the Developer in lieu of runoff controls on the development site. Peak flow calculations shall be done assuming that the local watershed is in the existing condition and then assuming that the local watershed is developed per current zoning and using the specified runoff controls. Any capacity improvements would be designed using the larger of the above peak flows and the capacity criteria specified in Section 306.D. All new development in the entire subarea(s) within which the proposed development site is located shall be assumed to implement the Developer's proposed discharge control, if any.

Capacity improvements may also be provided as necessary to implement any regional detention alternatives or to implement a modified "no harm" option which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

SECTION 307. Stormwater Management Design Provisions

- A. Peak rates of postdevelopment stormwater runoff (measured in cubic feet per second) shall not exceed 100% of the predevelopment flow rates for any area as mandated by this Ordinance unless otherwise specified by Section 305.

- B. At a minimum, the applicant shall prove to the satisfaction of the Township Engineer that during earthmoving, construction or after development, peak stormwater discharge rates will not exceed the pre-development release rate(s) when compared with those that occurred prior to any of these activities.

The following conditions and storm frequencies (considered individually) shall apply, unless any more restrictive requirements of an applicable official Stormwater Management Plan are adopted by DEP and the County pursuant to State Act 167 of 1978, as amended:

1. 2-year storm,
 2. 10-year storm,
 3. 25-year storm, and
 4. 100-year storm.
- C. Control of runoff from a site shall occur using appropriate means of detention of the water on the site and/or other approved types of stormwater management, within the requirements of this Ordinance.
- D. Runoff that is detained shall be held and released at a predetermined controlled rate by appropriately installed devices. The release shall be in the same manner as the natural or predevelopment means of discharge from a site (such as point discharge or sheet flow).
- E. Stormwater runoff shall not be increased or redirected in such a way that it results in hazards to persons or property or interferes with the normal movement of vehicles.

SECTION 308. Calculation Methodology

- A. Stormwater runoff from all development sites shall be calculated using either the rational method or the soil-cover-complex methodology.
- B. Infiltration BMP loading rate percentages in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix C shall be calculated as follows:

$$\left(\frac{\text{Area Tributary to Infiltration BMP}}{\text{Base Area of Infiltration BMP}} \right) * 100\%$$

The area tributary to the infiltration BMP shall be weighted as follows:

All disturbed areas to be made impervious:	weight at 100%
All disturbed areas to be made pervious:	weight at 50%
All undisturbed pervious areas:	weight at 0%
All existing impervious areas:	weight at 100%

- C. Soil thickness is to be measured from the bottom of any proposed infiltration system. The effective soil thickness in the Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock in Appendix C is the measured soil thickness multiplied by the thickness factor based on soil permeability (as measured by the adapted 25 PA Code . 73.15. percolation test in Appendix F), as follows:

PERMEABILITY RANGE*	THICKNESS FACTOR
6.0 to 12.0 inches/hour	0.8
2.0 to 6.0 inches/hour	1.0
1.0 to 2.0 inches/hour	1.4
0.75 to 1.0 inches/hour	1.2
0.5 to 0.75 inches/hour	1.0

*If the permeability rate (as measured by the adapted 25 PA Code §. 73.15. percolation test in Appendix E) falls on a break between two thickness factors, the smaller thickness factor shall be used.

Sites with soil permeability greater than 12.0 in./hr. or less than 0.5 in./hr., as measured by the adapted 25 PA Code § 73.15. percolation test in Appendix F, are not recommended for infiltration.

- D. The design of any detention basin intended to meet the requirements of this Ordinance shall be verified by routing the design storm hydrograph through the proposed basin using the storage indication method or other methodology demonstrated to be more appropriate. For basins designed using the Rational Method technique, the design hydrograph for routing shall be either the Universal Rational Hydrograph or the Modified Rational Method trapezoidal hydrograph which maximizes detention volume. Use of the Modified Rational hydrograph shall be consistent with the procedure described in Section "PIPE.RAT" of the Users' Manual for the Penn State Urban Hydrograph Method (1987).

- E. BMPs designed to store or infiltrate runoff and discharge to surface runoff or pipe flow shall be routed using the storage indication method.
- F. BMPs designed to store or infiltrate runoff and discharge to surface runoff or pipe flow shall provide storage volume for the full WQv below the lowest outlet invert.
- G. Wet Detention Ponds designed to have a permanent pool for the WQv shall assume that the permanent pool volume below the primary outlet is full at the beginning of design event routing for the purposes of evaluating peak outflows.
- H. Any stormwater runoff calculations involving drainage areas greater than 200 acres, including on- and off-site areas, shall use generally accepted calculation technique that is based upon the NRCS soil cover complex methods.
- I. All stormwater detention facilities shall provide a minimum 1.0 foot freeboard above the maximum pool elevation associated with the 2-through 25-year runoff events. A 0.5-foot freeboard shall be provided above the maximum pool elevation of the 100-year runoff event. The freeboard shall be measured from the maximum pool elevation to the invert of the emergency spillway. The 2- through 100-year storm events shall be controlled by the primary outlet structure. An emergency spillway for each basin shall be designed to pass the 100-year return frequency storm peak basin inflow rate with a minimum 0.5-foot freeboard measured to the top of basin. The freeboard criteria shall be met considering any offsite areas tributary to the basin as developed, as applicable. If this detention facility is considered to be a dam as per DEP Chapter 105, the design of the facility must be consistent with the Chapter 105 regulations, and may be required to pass a storm greater than the 100-year event.
- J. The minimum circular orifice diameter for controlling discharge rates from detention facilities shall be 3 inches. Designs where a lesser size orifice would be required to fully meet release rates shall be acceptable with a 3-inch orifice provided that as much of the site runoff as practical is directed to the detention facilities. The minimum 3-inch diameter does not apply to the control of the WQv.
- K. Runoff calculations using the soil-cover-complex method shall use the Natural Resources Conservation Service Type II 24-hour rainfall distribution. The 24-hour rainfall depths for the various return periods to

be used consistent with this Ordinance may be taken from NOAA Atlas 14, Volume 2 Version 2.1, 2004 or the PennDOT Intensity - Duration - Frequency Field Manual ("PDT-IDF") (May 1986) for Regions 4 + 5. The following values are taken from the PDT-IDF Field Manual:

	<u>Region 4</u>	<u>Region 5</u>
Return Period	24-Hour Rainfall Depth	
1-year	2.40 inches	2.64 inches
2- year	3.00 inches	3.36 inches
5- year	3.60 inches	4.32 inches
10-year	4.56 inches	5.28 inches
25-year	5.52 inches	6.24 inches
50-year	6.48 inches	7.20 inches
100-year	7.44 inches	8.40 inches

A graphical and tabular presentation of the Type II-24 hour distribution is included in Appendix B.

- L. Runoff calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration and return periods and NOAA Atlas 14, Volume 2 Version 2.1, 2004 or the Intensity-Duration-Frequency Curves as presented in Appendix B.
- M. Runoff Curve Numbers (CN's) to be used in the soil-cover-complex method shall be based upon the matrix presented in Appendix B.
- N. Runoff coefficients for use in the Rational Method shall be based upon the table presented in Appendix B.
- O. All time of concentration calculations shall use a segmental approach which may include one or all of the flow types below:
 - 1. Sheet Flow (overland flow) calculations shall use either the NRCS average velocity chart (Figure 3-1, Technical Release-55, 1975) or the modified kinematic wave travel time equation (equation 3-3, NRCS TR-55, June 1986). If using the modified kinematic wave travel time equation, the sheet flow length shall be limited to 50 feet for designs using the Rational Method and limited to 150 feet for designs using the Soil-Cover-Complex method.

2. Shallow Concentrated Flow travel times shall be determined from the watercourse slope, type of surface and the velocity from Figure 3-1 of TR-55, June 1986.
 3. Open Channel Flow travel times shall be determined from velocities calculated by the Manning Equation. Bankfull flows shall be used for determining velocities. Manning 'n' values shall be based on the table presented in Appendix B.
 4. Pipe Flow travel times shall be determined from velocities calculated using the Manning Equation assuming full flow and the Manning 'n' values from Appendix B.
- P. If using the Rational Method, all predevelopment calculations for a given discharge direction shall be based on a common time of concentration considering both on-site and any off-site drainage areas. If using the Rational Method, all postdevelopment calculations for a given discharge direction shall be based on a common time of concentration considering both on-site and any off-site drainage areas.
- Q. The Manning Equation shall be used to calculate the capacity of watercourses. Manning 'n' values used in the calculations shall be consistent with the table presented in Appendix B or other appropriate standard engineering 'n' value resources. Pipe capacities shall be determined by methods acceptable to the East Penn Township Engineer.
- R. The Pennsylvania DEP, Chapter 105, Rules and Regulations, apply to the construction, modification, operation or maintenance of both existing and proposed dams, water obstructions and encroachments throughout the watershed. Criteria for design and construction of stormwater management facilities according to this Ordinance may differ from the criteria that are used in the permitting of dams under the Dam Safety Program.

ARTICLE IV
STORM DRAINAGE SYSTEM REQUIREMENTS

SECTION 401. General Principals for Storm Drainage Systems

- A. Storm sewers, culverts, endwalls, inlets, and related installations and improvements shall be provided in order to:
1. Permit unimpeded flow of natural water courses;
 2. Ensure adequate drainage of all streets including all low points;
 3. Intercept storm water runoff along streets at intervals related to the extent and grade of the area drained;
 4. Provide positive drainage away from on-site sewage disposal facilities and buildings;
 5. Accommodate runoff so that there shall be no increase in rate of stormwater peak discharge leaving the subdivision or Land Development during or after construction based on the required release rates established in this Ordinance, except as allowed by the Ordinance;
 6. Ensure adequate drainage at intersections of driveways with streets;
 7. Provide that where existing storm sewers are reasonably accessible and of adequate capacity, subdivisions and Land Developments shall connect to the existing storm sewers;
 8. Provide that when no existing storm sewer is accessible and of adequate capacity, storm water shall discharge to an existing watercourse with defined bed and barriers. Runoff shall not be increased or concentrated onto adjacent properties, nor the velocity of flow increased beyond that existing prior to Subdivision or Land Development unless written approval is given by the adjacent property owners for the proposed discharge of surface runoff and the written agreements are approved by the Township;
 9. Provide that when storm drainage will be directed into an adjacent Municipality, all provisions for accommodating such storm

drainage shall be submitted to the Governing Body of that Municipality for review.

- B. Any proposed Storm Drainage Plans which affect the drainage basin of any river or stream shall be approved by the Division of Dams & Waterway management of the Pennsylvania Department of Environmental Protection if the affected drainage area is more than 100 acres.

SECTION 402. Design of Storm Drainage Systems

- A. Complete stormwater calculations shall be prepared in accordance with the design standards and Appendices of this Ordinance. All designs for drainage facilities shall be submitted to the Township for review and approval.
- B. Where a Subdivision or Land Development is traversed by or contains a pond, lake, watercourse, drainage way, channel, storm drainage system, or stream a drainage easement shall be provided. The minimum easement width shall be 10 feet from each side of the watercourse, waterbody, stream, pond, lake or drainage facility, but the Township may require a greater easement when necessary. When required by the Township, bearings and distances shall be provided to define the boundaries of the easements.
- C. Any changes in an existing drainageway shall be subject to the approval of the Pennsylvania Department of Environmental Protection; the Army Corps of Engineers; or the Federal Emergency Management Agency when each or all have jurisdiction. All permits and approvals shall be issued prior to construction of storm drainage related improvements.
- D. The Developer shall properly grade and seed slopes, and fence open ditches when a safety hazard can result. Areas within easements shall be kept as lawn or in natural conditions to allow maintenance and entrance.
- E. All drainage facilities shall be designed to adequately handle surface runoff and carry it to suitable outlets and shall be designed in accordance with the minimum design standards established by this Ordinance.
- F. Storm sewers, culverts, swales, channels, and related facilities shall be designed to accommodate and discharge all runoff from adjacent upstream drainage areas, assuming the upstream area is fully developed.

- G. Flood Protection: No stormwater runoff or natural drainage water shall be so diverted as to overload existing drainage systems, or create flooding or the need for additional drainage structures on other private properties or public lands, without proper and approved provisions being made for taking care of these conditions.

SECTION 403. Design of Retention and Detention Facilities

A. General Requirements

1. Where retention (permanent pool) and detention (dry bottom) basins are required by the Township, adequate assurances of maintenance, indemnification, liability insurance, and security shall be provided and approved by the Township.
2. Retention and detention facilities shall be designed and located so as to not present a hazard to the public health or safety. Their design shall be approved by the Township.
3. Such facilities shall be designed so that no adverse effects will result from backwater flooding.

B. General Design Considerations

1. The required volume for stormwater detention or retention shall be calculated to reduce the increased rate of runoff caused by development of the property as established by this Ordinance.
2. The number and location of detention facilities are subject to the approval of the Township.
3. The detention facilities shall be designed to retard stormwater runoff rates after development to the established peak pre-development runoff rate.
4. All land within the subdivision which are farm fields shall be considered as pasture with good ground cover.

C. Specific Design Considerations

1. Detention basins shall meet the following restrictions to minimize the negative visual impact, to prevent hazard to public health and safety and to avoid the need for fencing:

- a. Maximum depth of detained runoff shall be 24 inches for a 10-year storm event, and
 - b. Maximum depth of detained runoff shall be 36 inches for a 100-year storm event, and
 - c. Interior slopes shall not be steeper than a ratio of 4:1 horizontal to vertical;
 - d. A water surface limit shall be no closer than 100 feet to any residential building and no closer than 25 feet to any other type of building.
2. These depths may be exceeded by permission of the Board of Supervisors of the Township, on a case-by-case basis if lot runoff, topography, and/or existing downstream systems make the required pond area unreasonably large. In such a case, a deeper depth may be allowed if the basin is designed to the following specifications:
 - a. A maximum depth of detained runoff shall be 24-inches for a 2-year storm event, and
 - b. A maximum depth of detained runoff shall be 36-inches for a 10-year storm event, and
 - c. A maximum depth of detained runoff shall be forty-eight inches (48") for a 100-year storm event, and
 - d. Interior side slopes shall not be steeper than a ratio of 5:1, horizontal to vertical, and
 - e. A water surface limit no closer than 100 feet to any residential building and no closer than 25 feet to any other type of building.
3. If the maximum water depths as stipulated in Article IV, Section 403.C.1 and 403.C.2 above are exceeded, a 4-foot high chain link fence is required to fully surround the detention ponds. The fence shall be landscaped from adjacent streets and properties. A fenced detention pond shall have a maximum berm outside side slope of 4:1.

4. An access ramp of 10:1, 10 feet wide, shall be provided to allow maintenance equipment to reach the basin floor of detention basins.
5. The minimum slope of the bottom of a detention basin shall be 2% or a concrete low flow channel at a minimum 1% slope shall be provided.
6. If percolation of runoff is considered as a method of runoff abatement, percolation tests shall be taken at the site of proposed detention facilities and the results submitted to the Township for review in accordance with the provisions of this Ordinance.
7. All detention/retention facilities utilized in areas of limestone geology, whether ultimately privately or publicly owned, shall be lined with a synthetic impervious liner meeting the following minimum requirements:
 - a. The minimum liner allowed is 30 mil PVC. Actual individual liner specifications shall be provided by the manufacturer for each individual pond.
 - b. The liner must be placed on a layer of fine grained soil that has been rolled with a smooth drum roller in both directions to produce a smooth level base for the liner. The soil may not contain sharp angular rock or other debris which could puncture the liner, and must meet all manufacturer's specifications for a liner bedding. All vegetation, roots, and grass must be removed and any cracks or voids shall be filled.
 - c. If rock is encountered in the bedding area, this rock must be excavated to a depth of 6-inches below the liner and backfilled with a fine grained soil. This area should then be covered with geotextile fabric, extending 3 feet beyond the limits of the rock outcrop before placing the pond liner.
 - d. Installation of the liner may only take place when the ambient temperature is within the manufacturer's recommended range. Installation and testing shall be in accordance with manufacturer's specifications. The number of field seams shall be minimized by requiring factory

fabrication of large panels. Any field seams performed must be in accordance with the manufacturer's specifications.

- e. All structures (i.e. headwalls, pipes, outlet structures) which come in contact with the liner must have a waterproof seal installed to prevent leaks around the structure. These seals shall be installed per manufacturer's recommendations.
 - f. A minimum of 12-inches of earth cover shall be placed over the lining. Soil containing sharp jagged rocks, roots, debris, or any other material which may puncture the liner shall not be used as cover material.
 - g. The liner must be installed to a minimum height of the 100-year flood water elevation in the facility.
- 8. Every stormwater storage area shall be provided with an emergency spillway in accordance with Section 306.N. The spillway shall either be placed in undisturbed earth or be of concrete construction and shall be designed to function without attention.
 - 9. Paved surfaces that are to serve as stormwater storage areas shall have minimum grades of $\frac{1}{2}\%$ and shall be restricted to storage depths of $\frac{1}{2}'$ maximum.
 - 10. If a portion of an area within a stormwater storage area is to be paved for parking or recreation purposes, the paved surface shall be placed at the highest elevation within the storage area as possible.
 - 11. The following additional conditions shall be complied with for wet bottom stormwater storage areas.
 - a. Water surface area shall not exceed $\frac{1}{10}$ of the tributary drainage area.
 - b. Shoreline protection shall be provided to prevent erosion from wave action.
 - c. Minimum normal water depth shall be 4 feet. If fish are to be used to keep the pond clean, a minimum of $\frac{1}{4}$ of the pond area shall be a minimum of 10 feet deep.

- d. Facilities shall be provided to allow the pond level to be lowered by gravity flow for cleaning purposes and shoreline maintenance.
 - e. Aeration facilities as may be required to prevent pond stagnation shall be provided. Design calculations to substantiate the effectiveness of these aeration facilities shall be submitted with Final Engineering Plans. Agreements for the perpetual operation and maintenance of aeration facilities shall be prepared to the satisfaction of the Township.
 - f. In the event that the water surface of the pond is to be raised for the purpose of storing water for irrigation or in anticipation of the evapotranspiration demands of dry weather, the volume remaining for storage of excess stormwater runoff shall still be sufficient to contain the design year storm runoff.
12. Retention and/or detention basins which are designed with earth fill dams shall incorporate the following minimum standards:
- a. The height of berm shall not exceed 15 feet, unless approved by the Township.
 - b. The minimum top width of berms up to 15 feet in height shall be equal to three-fourths of the dam height, but in no case shall the top width be less than 8 feet.
 - c. A key trench shall be provided under all berms. The key trench shall be at least 2 feet deep, or extend down to stable subgrade, whichever is deeper. Minimum bottom widths for the cutoff trench and key trench shall be 4 feet. Maximum side slopes for key trenches shall be one (1) horizontal to one (1) vertical. A compacted impervious core at least 8 feet wide at the top, having a maximum side slope of one (1) horizontal to one (1) vertical, shall extend for the full length of the embankment, and the top elevation shall be set at the 25-year design water surface elevation.

- d. All pipes and culverts through berms shall have properly spaced concrete anti-seep collars.
- e. The top-of-berm shall be constructed at least 6 inches above the design elevations to allow for settlement of the embankment.
- f. The emergency spillway shall be constructed in undisturbed earth, or be of concrete construction along its bottom and sides.

SECTION 404. Design of Street Drainage

- A. All streets shall be designed to provide for the discharge of surface water from their rights-of-way.
- B. Unless a more conservative design is required by another regulation, or is required because of conditions particular to an individual development, the design storm for fixed pipe systems shall be a 25-year frequency for all subdivisions, Land Developments or crossings of any road through culverts. In all instances listed above, total conveyance systems shall be provided to carry the 100-year design storm to the detention basin or drainage facility.
- C. The pavement cross slope on streets shall not be less than $\frac{1}{4}$ - inch per foot and not more than $\frac{1}{2}$ - inch per foot. The slope of the shoulder areas shall not be less than $\frac{3}{4}$ - inch per foot and not more than 1 inch per foot.
- D. Surface cross drainage at intersections or other roadway sections is not permitted.
- E. Inlets shall be spaced to limit the gutter flow spread into the travel lanes to $\frac{1}{2}$ the lane width during the design storm or exceed $\frac{1}{2}$ of an inch crossing a street intersection.
- F. Inlet efficiency and bypass flows, per PennDOT design charts, shall be considered in the design of storm sewer systems.
- G. To minimize flow of stormwater across land located on the lower side of streets or roads, the cross-section of the street shall provide for parallel swales or curbing on the lower side which shall discharge only at drainage easements.

- H. No open pipes shall be allowed to end within the Township road right-of-way.
- I. Culverts shall be designed to be the full width of the right-of-way and be designed to the standards set forth by PennDOT.
- J. No stormwater conveyance within the road right-of-way, parallel to the road, shall exceed five (5) cubic feet per second. Flows exceeding five (5) cubic feet per second must be collected within a closed-pipe system and/or directed to drainage easements outside the right-of-way of the road.

SECTION 405. Design of Collection System

- A. The collection system shall be designed by the Rational Method of Design in accordance with American Society of Civil Engineers Manual No. 37 except where noted, using the formula $Q = CiA$, unless otherwise approved by the Township.
 - 1. Capacity: "Q" is the required capacity in cubic feet per second for the collection system at the point of design.
 - 2. Runoff Coefficient: "C" is the runoff coefficient applicable to the entire drainage area. It shall be based on consideration of soil conditions, slope of the drainage area and the ultimate development of the entire drainage area according to comprehensive plans. For the various types of ultimate development, the runoff coefficient shall be taken from the appropriate table in Appendix B, unless sufficient engineering data has been presented to the Township Engineer by the Developer which information in the judgment of the Township Engineer and the Board of Supervisors is sufficient to warrant the use of an alternate runoff coefficient.
 - 3. Rainfall Intensity Formula: "i" is the rainfall intensity in inches per hour and shall be determined from rainfall intensity charts for this area, based on time of concentrations, including Overland Flow Time, Manning Formula for channelized flow time and pipe flow time. The design rainfall frequency shall be taken from the PennDOT Intensity-Duration-Frequency Field Manual, Region 4 as and/or Region 5 presented in Appendix B.

4. Drainage Area: "A" is the drainage area, in acres, tributary to the point of design, and shall include areas tributary from outside sources as well as from within the subdivision or developed land area itself.
- B. The collection system shall be designed and installed in accordance with the design standards and requirements set forth in this Ordinance, the Township, the Township Engineer and as follows:
1. Subsurface drainage systems shall have accessible manholes spaced at intervals not exceeding 400 feet and shall be located wherever branches are connected or sizes are changed and wherever there is a change in alignment or grade. Inlets or other means of interconnection may be used instead of manholes when approved by the Township, or as required for curbed streets.
 2. On curbed streets, inlets shall be placed at points of abrupt changes in the horizontal or vertical directions of storm sewers, at curb tangents on uphill side of street intersections, at maximum distances as specified in accordance with the required pipe size, and to limit gutter flow as required. The Manning Equation shall be used to calculate the capacities of gutters. Pennsylvania Department of Transportation inlets should be used in accordance with the design procedures outlined in PennDOT Design Manual, Part 2. Manholes may be substituted for inlets at locations where inlets are not required to handle surface runoff.
 3. Inlets shall be designed and located to prevent hazards to vehicles, bicycles, and pedestrians.
 4. Storm sewer lines, within street rights-of-way, shall be located between the centerline of the street and the curb line and shall parallel the centerline of the street as far as practical. Locating storm sewers under curbs in curves or at street intersections will not be permitted. If no curbing is present, storm sewer lines shall be located adjacent to the edge of cartway within the shoulder of the road.
 5. Drainage structures that are to be located within State Highway rights-of-way shall be approved by the Pennsylvania Department of Transportation, and a letter from that Department indicating such approval shall be submitted to the Township.

6. Storm sewers shall have a minimum diameter of 18 inches. A minimum pipe size of 12 inches is permitted on private facilities, which receive no off-site drainage.
7. Storm drains shall be designed to produce a minimum velocity of 3.0 feet per second when flowing full and shall not be designed or installed at less than a 0.5% slope. The maximum permissible velocity shall be 15 feet per second.
8. Reinforced concrete pipe shall be used for all storm sewer lines, including retention/detention facilities. Smooth-lined High Density Polyethylene Pipe with watertight joints may be used if approved by the Township. All pipe materials shall meet PennDOT requirements.
9. PennDOT approved endwalls or end sections shall be used in lieu of inlets where feasible to minimize clogging of grates with leaves, debris, etc.
10. Headwalls shall be used where storm runoff enters the storm sewer horizontally from a natural or man-made channel. The capacity of such storm sewers shall be evaluated using both Manning Equation and Inlet/Outlet Control procedures. The lower flow derived from these two procedures shall be the design capacity of the storm sewer.
11. Provisions shall be made to minimize erosion within watercourses and at points of discharge from storm drainage facilities through the use of proper ground cover. Any riprap swale area shall be constructed with mixed stone sizes in accordance with PennDOT criteria for riprap and shall be lined with PennDOT approved geotextile fabric.
12. Roof Drainage: Stormwater roof drains and pipes shall not discharge water over a sidewalk, driveway or paved area.
13. Open swales shall be designed on the basis of Manning Formula as indicated for collection systems with the following considerations:
 - a. Roughness Coefficient: The roughness coefficient shall be 0.040 for earth swales and 0.015 for paved swales.

- b. Bank Slopes: Slopes for swale banks shall not be steeper than one (1) vertical for three (3) horizontal.
 - c. Flow Velocity: Design velocity in grass or vegetated swales shall not exceed 4 feet per second.
 - d. Right-of-Way: A swale right-of-way of sufficient minimum width to include a 10 foot access strip in addition to the width of the swale from bank top shall be shown as an easement for drainage purposes. The Township may, under unusual conditions, require a wider swale right-of-way.
- 14. Discharge structures shall be designed to minimize the impact of development on downstream properties. Flow retarding and dissipating facilities are required to meet this goal. Such structures shall be no closer than 20 feet to downstream, off-site properties or drainage easement boundaries.
- 15. Open pipe ends must be fitted with concrete endwalls or wing walls.
- 16. All pipe endwalls or wing walls and all detention basin intake and discharge structures shall be protected from frost related movement and scour activity by the construction of a concrete footer with a minimum depth of 30 inches below ground level.
- 17. Trash racks shall be placed on all stormwater entrance structures.
- C. Materials and construction requirements shall be as specified by the Township, the Township Engineer and as follows:
 - 1. Pipe Materials
 - a. All pipe materials shall be Reinforced Cement Concrete Pipe, Class III and shall comply with PennDOT Publication 408, Section 601.
 - b. Joints for concrete pipe shall be of the "O" Ring Type III per current ASTM Specifications C425 or mortared type as approved.

- c. If the use of Smooth-Lined High Density Polyethylene Pipe is approved by the Township, pipe shall be provided with watertight joints meeting all PennDOT requirements.
2. Manholes and inlets shall be equivalent to PennDOT Design Standards.
 - a. All curbed street inlet tops shall be PennDOT type "C".
 - b. In private parking areas and on streets with no curbing PennDOT type "M" inlets shall be used.
3. Manhole frames and covers must be heavy duty, have a minimum clear opening of 24 inches, and be equal to Neenah Foundry Co. Model P-1030 or Campbell Foundry Co. Pattern 1004 and shall have the words "Storm Sewer" cast thereon in letters 2 inches high.
4. Appropriate safety grates shall be attached to all catch basins, stormwater inlets, pipe openings and other stormwater receiving structures, as needed, to ensure that maximum openings do not exceed 25 square inches. Along streets and pedestrian areas, safety grates shall be used as needed for bicycle safety.

D. Installation

1. All pipe laying shall carefully progress uphill with hubs up grade and ends fully and closely jointed. Trench widths shall not exceed the outside diameter of the pipe plus 16 inches and depths shall be as required. Trench walls shall be vertical and bottoms shall be horizontal.
2. Prior to laying the pipe in the trench, a bedding of PennDOT 2A Coarse Aggregate shall be placed on the trench bottom in accordance with PennDOT Publication 408. This material shall be a minimum of 4 inches in depth and thoroughly compacted with approved mechanical tampers. The bedding shall be graded by hand to provide a uniform and continuous bearing support for the pipe throughout its entire length.

E. Backfill

After proper installation of the pipe, backfilling may be performed. All backfill shall be thoroughly compacted through the use of approved mechanical tampers. All backfill material is subject to Township approval. Trenches within street rights-of-way shall be backfilled for the entire width and depth with PennDOT Type 2A coarse aggregate, in accordance with PennDOT Publication 408. A 12 inch cap consisting of clean dry earth or granular material with a maximum stone size of 8 inches may be required at the Township's discretion to be seeded and/or sodded. Trenches outside street rights-of-way may be backfilled to a depth of 12 inches above the top of the pipe with PennDOT Type 2A coarse aggregate. The remainder of the trench may be backfilled with ordinary backfill material consisting of clean dry earth or granular material with a maximum stone size of 8 inches in accordance with PennDOT Publication 408.

Trenches within or through berms associated with detention or retention facilities should be bedded and backfilled with suitable clay material, in addition to any required anti-seep collars required by other sections of this Ordinance.

All trench material shall be installed in equal lifts not to exceed 8-inch compacted depth. All trench material shall be mechanically compacted by an approved device as required under all the sections of this Ordinance.

ARTICLE V DRAINAGE PLAN REQUIREMENTS

SECTION 501. General Requirements

For any of the Regulated Activities of this Ordinance, prior to the final approval of subdivision and/or Land Development plans, or the issuance of any permit, or the commencement of any Regulated Earth Disturbance activity, the owner, Subdivider, Developer or his agent shall submit a Drainage Plan and receive Municipal approval of the Plan.

SECTION 502. Exemptions

Exemptions from the Drainage Plan Requirements are as specified in Section 106.

SECTION 503. Drainage Plan Contents.

The Drainage Plan shall consist of all applicable calculations, maps, and plans. All Drainage Plan materials shall be submitted to East Penn Township in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant.

The following items shall be included in the Drainage Plan:

A. General

1. General description of project.
2. General description of proposed permanent stormwater controls.
3. The name and address of the project site, the name and address of the owner of the property and the name of the individual or firm preparing the Drainage Plan.

B. Map(s) of the Project Area Showing:

1. The location of the project relative to highways, Municipalities or other identifiable landmarks.
2. Existing contours at intervals of 2 feet. Off-site drainage areas impacting the project including topographic detail.
3. Streams, lakes, ponds or other bodies of water and their associated 100 TR floodplains within the project area.

4. Other physical features including existing drainage swales, wetlands, closed depressions, sinkholes, and areas of natural vegetation to be preserved.
5. Locations of proposed underground utilities, sewers, and water lines. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines of the project site.
6. An overlay showing soil types, their boundaries, and their characteristics based on the Carbon County Soil Survey, as applicable, latest edition.
7. An overlay showing geologic types, boundaries, and any special geologic features present on the site.
8. Proposed changes to land surface and vegetative cover.
9. Proposed structures, roads, paved areas and buildings.
10. Final contours at intervals of 2 feet.
11. Stormwater Management District boundaries applicable to the site.
12. Clear identification of the location and nature of permanent stormwater BMPs.
13. An adequate access easement around all stormwater BMPs that would provide Municipal ingress to and egress from a public right-of-way.
14. A schematic showing all tributaries contributing flow to the site and all existing man-made features beyond the property boundary that would be affected by the project.
15. The location of all public water supply wells within 400 feet of the project and all private water supply wells within 100 feet of the project.
16. The date of submission.

17. A graphic and written scale of one (1) inch equals no more than 50 feet; for tracts of 20 acres or more the scale shall be 1 inch equals no more than 100 feet.
18. A north arrow.
19. A total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
20. Existing and proposed land use(s).
21. A Key Map showing all existing man-made features beyond the property boundary that would be affected by the project.
22. Overland drainage paths.
23. NPDES boundary.

C. Stormwater Management Controls and BMPs

1. All stormwater management controls and BMPs shall be shown on a map and described, including:
 - a. Groundwater recharge methods such as seepage pits, beds or trenches. When these structures are used, the locations of septic tank infiltration areas and wells shall be shown.
 - b. Other control devices or methods such as roof-top storage, semi-pervious paving materials, grass swales, parking lot ponding, vegetated strips, detention or retention ponds, storm sewers, etc.
2. All calculations, assumptions, and criteria used in the design of the stormwater management facilities and in the establishment of the calculated pre and postdevelopment peak discharge, including mapping of the watershed areas and indication of runoff for all points of runoff concentration shall be provided.
3. All plans and profiles of proposed stormwater management facilities including horizontal and vertical location, size, and type of material. This information shall provide sufficient information required for the construction of all facilities.

4. A map(s) clearly delineating and labeling all drainage areas used in the design of storm sewer facilities, swales, and retention/detention basins.
5. For all detention and retention basins, a plotting or tabulation of storage volumes with corresponding water surface elevations and of the outflow rates for those water surfaces.
6. For all detention and retention basins, the Design Inflow and Outflow Hydrographs.
7. For all retention basins which hold 2-1/2 acre feet or more of water and have an embankment that is 10 feet or more in height, soil structures and characteristics shall be investigated. Plans and data prepared by a registered professional, experienced and educated in soil mechanics, shall be submitted.
8. A map(s) clearly delineating any existing wetlands as classified by a qualified environmental scientist experienced in wetland determination. Wetland determination shall be performed in accordance with U.S. Army Corps of Engineers procedures as outlined in Publication TRY-87-1, "Wetlands Delineation Manual," latest edition.

No construction or development shall be permitted in wetlands without approval from the U.S. Army Corps of Engineers and the Pennsylvania Department of Environmental Protection, Bureau of Dams and Waterway Management.

9. All calculations, assumptions, and criteria used in the design of the BMPs shall be shown.
10. All site testing data used to determine the feasibility of infiltration on a site.
11. A Statement, signed by the landowner, acknowledging that the stormwater BMPs are fixtures that cannot be altered or removed without approval by the Municipality.

- D. Proposals for the ownership and maintenance responsibilities for all proposed storm drainage and erosion and sediment control facilities shall be submitted to the Township for review and approval at Preliminary Plan stage. The Township shall be satisfied that sufficient provisions have

been made for adequate and perpetual maintenance of all such facilities. All drainage facilities to be owned by the Developer or his assigns shall be maintained to retain their design capacity. Such assurances shall be in a form to act as a covenant that shall run with the land, and shall provide for Municipal maintenance, assessment of cost and penalties, in case of lack of maintenance.

E. An Environmental Resources Site Design Assessment that describes the following:

1. The extent to which the proposed grading and impervious cover avoid disturbance of significant environmental resources and preserve existing site hydrology.
2. An assessment of whether alternative grading and impervious cover site design could lessen the disturbance of significant environmental resources and/or make better use of the site hydrologic resources.
3. A description of how the proposed stormwater management controls and BMPs serve to mitigate any adverse impacts on environmental resources on the site.

Significant environmental resources considered in the site design assessment include, but are not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, floodplains, riparian vegetation, native vegetation and special geologic features.

SECTION 504. Plan Submission

For all activities regulated by this Ordinance, the steps below shall be followed for submission. For any activities that require a PaDEP Joint Permit Application and regulated under Chapter 105 (Dam Safety and Waterway Management) or Chapter 106 (Floodplain Management) of PaDEP's Rules and Regulations, require a PaDOT Highway Occupancy Permit, or require any other permit under applicable State or federal regulations, the permit(s) shall be part of the plan.

A. For Regulated Activities specified in Article I, Sections 5.A and 5.B:

1. The Drainage Plan shall be submitted by the Developer to the Municipal Secretary (or other appropriate person) as part of the Preliminary Plan submission for the Subdivision or Land Development.

2. Seven (7) copies of the Drainage Plan shall be submitted.
3. Distribution of the Drainage Plan will be as follows:
 - a. Three (3) copies to East Penn Township.
 - b. Two (2) copies to East Penn Township Engineer.
 - c. One (1) copy to the East Penn Township Solicitor.
 - d. One (1) copy to the Carbon County Planning Commission.
- B. For Regulated Activities specified in Sections 105.C and 105.D, the Drainage Plan shall be submitted by the Developer to the Municipal Building Permit Officer as part of the building permit application.
- C. For Regulated Activities specified in Sections 105.E, 105.F and 105.G:
 1. The Drainage Plan shall be submitted by the Developer to East Penn Township for coordination with the DEP permit application process under Chapter 105 (Dam Safety and Waterway Management), Chapter 106 (Flood Plain Management) of DEP's Rules and Regulations, and the NPDES regulations.
 2. Two (2) copies of the Drainage Plan shall be submitted.
- D. Earthmoving for all regulated activities under Article I, Section 5 shall be conducted in accordance with the current Federal and State regulations relative to the NPDES and DEP Chapter 102 Regulations.

SECTION 505. Drainage Plan Review

- A. East Penn Township shall review the Drainage Plan, including the BMP Operations and Maintenance Plan, for consistency with the East Penn Township Stormwater Management Plan as embodied by this Ordinance and with any permits issued by DEP. East Penn Township shall also review the Drainage Plan against any additional storm drainage provisions contained in the Municipal Subdivision and Land Development Zoning Ordinance, or other Township Act 167 Stormwater Ordinances as applicable.

- B. For activities regulated by the Ordinance, the East Penn Township Engineer shall notify East Penn Township in writing, within 45 calendar days, whether the Drainage Plan is consistent with the Stormwater Management Plan. Should the Drainage Plan be determined to be consistent with the Stormwater Management Plan, the East Penn Township Engineer will forward an approval letter to the East Penn Township Secretary with a copy to the Developer.

Should the Drainage Plan be determined to be inconsistent with the Stormwater Management Plan, the East Penn Township Engineer will forward a disapproval letter to the East Penn Township Secretary and Developer citing the reason(s) for the disapproval. Any disapproved Drainage Plans may be revised by the Developer and resubmitted consistent with this Ordinance.

- C. For Regulated Activities specified in Section 105.C and Section 105.D of this Ordinance, the East Penn Township Engineer shall notify the East Penn Township Building Permit Officer in writing, within a time frame consistent with the East Penn Township Building Code and/or East Penn Township Subdivision Ordinance, whether the Drainage Plan is consistent with the Stormwater Management Plan and forward a copy of approval/disapproval letter to the Developer. Any disapproved drainage plan may be revised by the Developer and resubmitted consistent with this Ordinance.
- D. East Penn Township shall not approve any subdivision or Land Development for Regulated Activities specified in Sections 105.A and 105.B of this Ordinance if the Drainage Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the East Penn Township Engineer. All required permits from PaDEP must be obtained prior to approval.
- E. The East Penn Township Building Permit Office shall not issue a building permit for any Regulated Activity specified in Section 105 of this Ordinance if the Drainage Plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the East Penn Township Engineer, or without considering the comments of the East Penn Township Engineer. All required permits from PaDEP must be obtained prior to issuance of a building permit.
- F. East Penn Township shall not approve any Subdivision or Land Development(Regulated Activities, Sections 105.A and 105.B) or building permit application (Regulated Activities, Sections 105.C and 105.D) if the

Drainage Plan has been found to be inconsistent with the Stormwater Management Plan.

- G. East Penn Township may require an "As-Built Survey" of all stormwater BMPs and an explanation of any discrepancies with the Drainage Plan.

SECTION 506. Modification of Plans

A modification to a submitted Drainage Plan for a proposed development site which involves a change in control methods or techniques, or which involves the relocation or redesign of control measures, or which is necessary because soil or other conditions are not as Stated on the Drainage Plan (as determined by East Penn Township) shall require a resubmission of the modified Drainage Plan consistent with Section 504 and Section 505 of this Ordinance.

A modification to an already approved or disapproved Drainage Plan shall be submitted to East Penn Township, accompanied by the applicable review fee. A modification to a Drainage Plan for which a formal action has not been taken by East Penn Township shall be submitted to East Penn Township, accompanied by the applicable East Penn Township Review Fee.

SECTION 507. Resubmission of Disapproved Drainage Plans

A disapproved Drainage Plan may be resubmitted, with the revisions addressing the East Penn Township Engineer's concerns documented, in writing, to East Penn Township in accordance with Article V, Section 504 of this Ordinance and subject to the applicable review as specified in Article V, Section 505 of this Ordinance. The applicable East Penn Township Review Fee must accompany a resubmission of a disapproved Drainage Plan.

SECTION 508. Hardship Waiver Procedure

East Penn Township Board of Supervisors may hear requests for waivers where it is alleged that the provisions of this Ordinance inflict unnecessary hardship upon the applicant. The waiver request shall be in writing and accompanied by the requisite fee based upon a fee schedule adopted by East Penn Township. A copy of the waiver request shall be provided to each of the following: East Penn Township, East Penn Township Engineer, East Penn Township Solicitor and Carbon County Planning Commission. The request shall fully document the nature of the alleged hardship.

East Penn Township may grant a waiver provided that all of the following findings are made in a given case:

1. That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this Ordinance in the Stormwater Management District in which the property is located;
2. That because of such physical circumstances or conditions, there is no possibility that the property can be developed in strict conformity with the provisions of this Ordinance, including the "no harm" provisions, and that the authorization of a waiver is, therefore, necessary to enable the reasonable use of the property;
3. That such unnecessary hardship has not been created by the applicant;
4. That the waiver, if authorized, will represent the minimum waiver that will afford relief and will represent the least modification possible of the regulation in issue; and
5. That financial hardship is not the criteria for granting of a hardship waiver.

In granting any waiver, East Penn Township Board of Supervisors may attach such conditions and safeguards as it may deem necessary to implement the purposes of this Ordinance. If a Hardship Waiver is granted, the applicant must still manage the quantity, velocity, direction and quality of resulting storm runoff as is necessary to prevent injury to health, safety or other property.

- A. For all Regulated Activities described in Section 105, the Board of Supervisors shall hear requests for and decide on hardship waiver requests on behalf of East Penn Township.
- B. East Penn Township shall not waive the water quality provisions of this Ordinance.

ARTICLE VI INSPECTIONS

SECTION 601. Schedule of Inspections

- A. The Department of Environmental Protection or its designees (e.g. County Conservation District) normally ensure compliance with any permits issued, including those of stormwater management. In addition to DEP compliance programs, East Penn Township or its designee may inspect all phases of the construction, operations, maintenance, and any other implementation of stormwater control facilities and stormwater BMPs.
- B. During any stage of the Regulated Earth Disturbance Activities, if East Penn Township or its designee determines that any stormwater control facility or BMPs are not being implemented in accordance with this Ordinance, East Penn Township may suspend or revoke any existing permits or other approvals issued by the Township until the deficiencies are corrected.

ARTICLE VII FEES AND EXPENSES

SECTION 701. General

The fees required by this Ordinance are the East Penn Township Municipal Review Fee. The East Penn Township Municipal Review Fee shall be established by Resolution to defray review costs incurred by East Penn Township. All fees shall be paid by the Applicant.

SECTION 702. East Penn Township Drainage Review Fee

East Penn Township shall establish a Review Fee Schedule based on the size of the Regulated Activity and based on East Penn Township's costs for reviewing Drainage Plans. East Penn Township shall periodically update the Review Fee Schedule to ensure that review costs are adequately reimbursed.

SECTION 703. Expenses Covered by Fees

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

- A. The review of the Drainage Plan by the Township Engineer.
- B. The review of the BMP Operations and Maintenance Plan by East Penn Township.
- C. The site inspection.
- D. The inspection of required controls and improvements during construction.
- E. The final inspection upon completion of the controls and improvements required in the plan.
- F. Any additional work required to monitor and enforce any permit provisions, regulated by this Ordinance, correct violations, and assure the completion of stipulated remedial actions.
- G. Administrative and clerical costs.
- H. Legal and engineering review expenses and document preparation.

SECTION 704. Duplication of Fees

Fees required under this Ordinance shall not be in excess of costs incurred by the Township and shall not duplicate fees already required by the Zoning Ordinance and/or the Subdivision and Land Development Ordinance.

**ARTICLE VIII
STORMWATER BMP OPERATIONS AND MAINTENANCE PLAN
REQUIREMENTS**

SECTION 801. General Requirements

No Regulated Earth Disturbance activities within East Penn Township shall commence until approval by the Township of the BMP Operations and Maintenance Plan which describes how the permanent (e.g. post-construction) stormwater BMPs will be properly operated and maintained.

SECTION 802. Performance Guarantee

The applicant, at the discretion of the Township, may be required to provide financial guarantee to East Penn Township for the timely installation and proper construction of all stormwater management controls as required by the approved and proper construction all stormwater management controls, including BMPs and this Ordinance equal to full construction cost of the required controls, plus 10% contingencies, in accordance with the Municipality Planning Code and East Penn Township Subdivision and Land Development Ordinance.

SECTION 803. Responsibilities for Operations and Maintenance of Stormwater Facilities, Including BMPs

- A. The Drainage Plan, including BMP Operations and Maintenance Plan, for the project site shall contain an Operation and Maintenance Plan prepared by the Developer and approved by East Penn Township. The Operation and Maintenance Plan shall outline required routine maintenance and schedules necessary to insure proper operation of the facility(ies). The Operation and Maintenance Plan shall be the exclusive responsibility of the Developer.
- B. The Drainage Plan, including BMP Operations and Maintenance Plan, for the project site shall establish responsibilities for the continuing operation and maintenance of all proposed stormwater control facilities, consistent with the following principles:
 - 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 East Penn Township, stormwater facilities, including BMPs, may also be dedicated to and maintained by East Penn Township, after a Maintenance Agreement is established per Section 5;
 - 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 facilities, including BMPs, shall be the responsibility of the owner or private management entity.

- C. East Penn Township shall make the final determination on the continuing operations and maintenance responsibilities. East Penn Township reserves the right to accept or reject the operations and maintenance responsibility for any or all of the stormwater facilities, including BMPs.

SECTION 804. Adherence to Approved Drainage Plan, Including BMP Operations and Maintenance Plan

It shall be unlawful to alter or remove any permanent stormwater facility, including BMPs, required by an approved Drainage Plan, including BMP Operations and Maintenance Plan, or to allow the property to remain in a condition which does not conform to an approved Drainage Plan, including BMP Operations and Maintenance Plan, unless an exception is granted in writing by East Penn Township.

SECTION 805. Operations and Maintenance Agreement for Privately Owned Stormwater Facilities, Including BMPs

- A. The property owner shall sign and record an Operations and Maintenance Agreement covering all stormwater facilities, including BMPs, with East Penn Township that are to be privately owned. The Agreement shall include the terms of the format Agreement referenced in Appendix D of this Ordinance.
- B. Other items may be included in the Agreement where determined by East Penn Township to be reasonable or necessary to guarantee the satisfactory operation and maintenance of all permanent stormwater facilities, including BMPs. The Agreement shall be subject to the review and approval of East Penn Township.

SECTION 806. Stormwater Maintenance Easements

Stormwater management easements shall be provided by the property owner if necessary for access for inspections and maintenance or for preservation of stormwater conveyance, infiltration, detention areas, and other BMPs by persons other than the property owner. The purpose of the easement shall be specified in an Agreement under Section 805.

SECTION 807. Recording of Approved Drainage Plan, Including BMP Operations and Maintenance Plan and Related Agreements

- A. The owner of any land upon which permanent Stormwater Facilities, including BMPs will be placed, constructed or implemented, as described in the Drainage Plan, including the BMP Operations and Maintenance Plan, shall record the following documents in the Office of the Recorder of

Deeds for Carbon County, within 90 days of approval of the Drainage Plan, including BMP Operations Plan, by East Penn Township:

1. The Operations and Maintenance Plan or a summary thereof.
 2. Operations and Maintenance Agreements under Section 805.
 3. Easements under Section 806.
- B. East Penn Township may suspend or revoke any approvals granted for the project site upon discovery of the failure of the owner to comply with this Section.

SECTION 808. East Penn Township Stormwater Maintenance Fund

- A. Persons installing stormwater facilities, including BMPs, shall be required to pay a specified amount to the East Penn Township Stormwater Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:
1. If the stormwater facility, including BMPs is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by East Penn Township for a period of ten (10) years, as estimated by the Township.
 2. If the stormwater facility, including BMPs is to be owned and maintained by East Penn Township, the deposit shall cover the estimated costs for maintenance and inspections for ten (10) years, as determined by the Township.
 3. The amount of the deposit to the fund shall be converted to present worth of the annual series value.
- B. If a stormwater facility, including BMPs is proposed that also serves as a recreation facility (e.g. ball field, lake), East Penn Township may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.

ARTICLE IX PROHIBITIONS

SECTION 901. Prohibited Discharges

- A. No person in East Penn Township shall allow or cause to allow stormwater discharges into East Penn Township's storm sewer system which are not composed entirely of stormwater except as provided in subsection B below or as allowed under a State or Federal permit.
- B. Discharges that may be allowed based on East Penn Township finding that the discharge(s) do not significantly contribute pollution to surface waters of the Commonwealth are listed below.
 - 1. Discharges from fire fighting activities
 - 2. Potable water sources including dechlorinated water line and fire hydrant flushings
 - 3. Irrigation drainage
 - 4. Routine external building washdown which does not use detergents or other compounds
 - 5. Air conditioning condensate
 - 6. Water from individual residential car washing
 - 7. Springs
 - 8. Water from crawl space pumps
 - 9. Uncontaminated water from foundation or from footing drains
 - 10. Flows from riparian habitats and wetlands
 - 11. Lawn watering
 - 12. Pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spill material has been removed) and where detergents are not used
 - 13. Dechlorinated swimming pool discharges
 - 14. Uncontaminated groundwater
- C. In the event that East Penn Township determines that any of the discharges identified in Section 901.B significantly contribute to pollution of waters of the Commonwealth or is so notified by DEP, East Penn

Township will notify the responsible person to cease the discharge.

- D. Upon notice provided by East Penn Township under Section 901.C, the discharger will have a reasonable time, as determined by East Penn Township, to cease the discharge consistent with the degree of pollution caused by the discharge.
- E. Nothing in this Section shall affect a discharger's responsibilities under State law.

SECTION 902. Prohibited Connections

- A. The following connections are prohibited, except as provided in Section 901.B above:
 - 1. Any drain or conveyance, whether on the surface or subsurface, which allows any nonstormwater discharge including sewage, process wastewater and wash water to enter the separate storm sewer system and any connections to the storm drain system from indoor drains and sinks.
 - 2. Any drain or conveyance connected from a commercial or industrial land use to the storm sewer system which has not been documented in plans, maps, or equivalent records and approved by East Penn Township.

SECTION 903. Roof Drains

- A. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches, except as provided in Section 903.B.
- B. When it is more advantageous to connect directly to streets or storm sewers, connections of roof drains to streets or roadside ditches may be permitted by East Penn Township.
- C. Roof drains shall discharge to infiltration areas or vegetative BMPs to the maximum extent practicable.

SECTION 904. Alteration of BMPs

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

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

ARTICLE X
RIGHT OF ENTRY, NOTIFICATION AND ENFORCEMENT

SECTION 1001. Right of Entry

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

SECTION 1002. Notification

- A. Whenever East Penn Township finds that a person has violated a prohibition or failed to meet a requirement of this Ordinance, East Penn Township may order compliance by written notice to the responsible person. Such notice may require without limitation:
 - 1. The elimination of prohibited connections or discharges.
 - 2. Cessation of any violating discharges, practices or operations.
 - 3. The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property.
 - 4. Payment of a fine to cover administrative and remediation costs.
 - 5. The implementation of Stormwater facilities and/or BMPs.
 - 6. Operation and maintenance of stormwater facilities and/or BMPs.
- B. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of the violation(s). Said notice may further advise that should the violator fail to take the required action within the

established deadline, the work will be done by East Penn Township or designee and the expense thereof, together with all related lien and enforcement fees, charges and expenses, shall be charged to the violator.

- C. Failure to comply within the time specified shall also subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent East Penn Township from pursuing any and all other remedies available in law or equity.
- D. It shall be the responsibility of the owner of the real property on which the Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

SECTION 1003. Public Nuisance

- A. The violation of any provision of this Ordinance is hereby deemed a Public Nuisance.
- B. Each day that an offense continues shall constitute a separate violation.

SECTION 1004. Liability Disclaimer

- A. Neither the granting of any approval nor the compliance with the provisions of this Ordinance or with any condition imposed by East Penn Township, its officials, employees or designated representatives hereunder, shall relieve any person from any responsibility for damage to persons or property resulting therefrom, or as otherwise imposed by law, nor impose any liability upon East Penn Township, its officials, employees or designated representatives to the maximum extent permitted by law.
- B. The granting of any permit which includes any stormwater management and/or BMP requirements shall not constitute a representation, guarantee or warranty of any kind by the East Penn Township officials, employees or designated representatives thereof, of the practicability or safety of any stormwater structure or facility or BMP, use or other plan proposed, and shall create no liability or cause of action upon East Penn Township, its officials, employees, or designated representatives for any damage that may result pursuant thereto to the maximum extent permitted by law.

SECTION 1005. Suspension and Revocation of Permits and Approvals

- A. Any building, Land Development or other permit or approval issued by East Penn Township may be suspended or revoked by East Penn Township for:
 - 1. Noncompliance with or failure to implement any provision of the permit
 - 2. A violation of any provision of this Ordinance
 - 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 or property of others.
- B. A suspended permit or approval shall be reinstated by East Penn Township when:
 - 1. East Penn Township or designee has inspected and approved the corrections to the stormwater facilities and/or BMPs or the elimination of the hazard or nuisance.
 - 2. East Penn Township is satisfied that the violation of the Ordinance, law or rule and regulation has been corrected.
 - 3. Payment of all Municipal fees, costs and expenses related to or arising from the violation has been made.
- C. A permit or approval which has been revoked by East Penn Township cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

SECTION 1006. Enforcement

A. Notices

Whenever East Penn Township or designee determines that there are reasonable grounds to believe that there has been a violation of any provisions of the Ordinance, or of any regulation adopted pursuant thereto, the Township or Township designee shall give notice of such alleged violation as hereinafter provided. Such notice shall (a) be in writing; (b) include a Statement of the reasons for its issuance; (c) allow a reasonable time not to exceed a period of 30 days for the performance of any act it requires; (d) be served upon the property owner or his agent as the case may require; provided, however, that such notice or order shall be deemed to have been properly served upon such owner or agent when a copy thereof has been served with such notice by any other method

authorized or required by the laws of this State; and (e) contain an outline of remedial action which, if taken, will effect compliance with the provisions of this Ordinance.

B. Penalties

1. Any person or entity who fails to comply with any or all of the requirements or provisions of this Ordinance or who fails or refuses to comply with any notice, order or direction of the Building Permit Officer or any other authorized employee of East Penn Township shall be subject to the civil enforcement procedures, fines and schedule of fines as set forth in the "Civil/Criminal Enforcement Procedure Ordinance of East Penn Township." The imposition of a fine or penalty for any violation of, or noncompliance with, this Ordinance shall not excuse the violation or noncompliance within a reasonable time. Any development initiated for any structure or building constructed, reconstructed, enlarged, altered, or relocated, in noncompliance with this Ordinance may be declared by the Township to be a public nuisance and abatable as such.
2. In addition, East Penn 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 ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunction, mandamus or other appropriate forms of remedy or relief. A violation of this Ordinance shall constitute irreparable harm for purposes of injunctive relief.

SECTION 1007. Appeals

Any person aggrieved by any action of East Penn Township or its designee relevant to the provisions of this Ordinance may appeal using the appeal procedures established in the Pennsylvania Municipalities Planning Code.

SECTION 1008. Miscellaneous.

- A. All Ordinances or parts of Ordinances inconsistent with the provisions of this Ordinance are hereby repealed insofar, but only insofar, as the same are inconsistent herewith.
- B. The provisions of this Ordinance are severable and if any provisions or part thereof shall be held invalid, unconstitutional or inapplicable to any

person or circumstances, such invalidity, unconstitutionality or inapplicability shall not effect or impair the remaining provisions or parts thereof of this Ordinance.

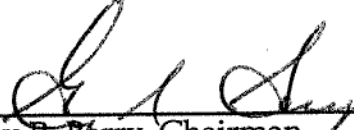
- C. This Ordinance shall become effective five days after its adoption.

**ARTICLE XI
APPENDIXES**

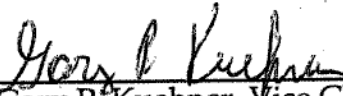
- A. East Penn Township Watershed Map
- B. Rainfall Distributions and Runoff Coefficients.
- C. Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock
- D. Stormwater Facilities and Best Management Practices Operations and Maintenance Agreement
- E. Low Impact Development Practices
- F. Preliminary Site Investigation and Testing Requirements

ORDAINED and ENACTED as an Ordinance by the Board of Supervisors of the Township of East Penn, Carbon County, Pennsylvania, in lawful session duly assembled this 19th day of September, 2007.

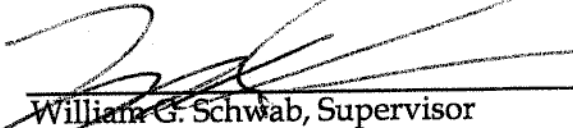
BOARD OF SUPERVISORS OF EAST
PENN TOWNSHIP,
CARBON COUNTY, PA



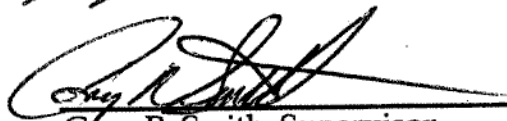
Guy R. Barry, Chairman



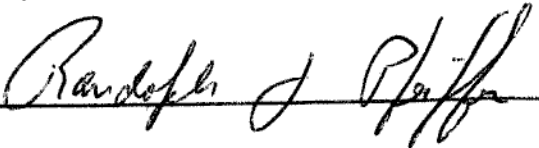
Gary P. Kuehner, Vice Chairman



William G. Schwab, Supervisor

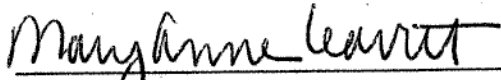


Cory R. Smith, Supervisor



Randolph J. Pfeffer

Attest:

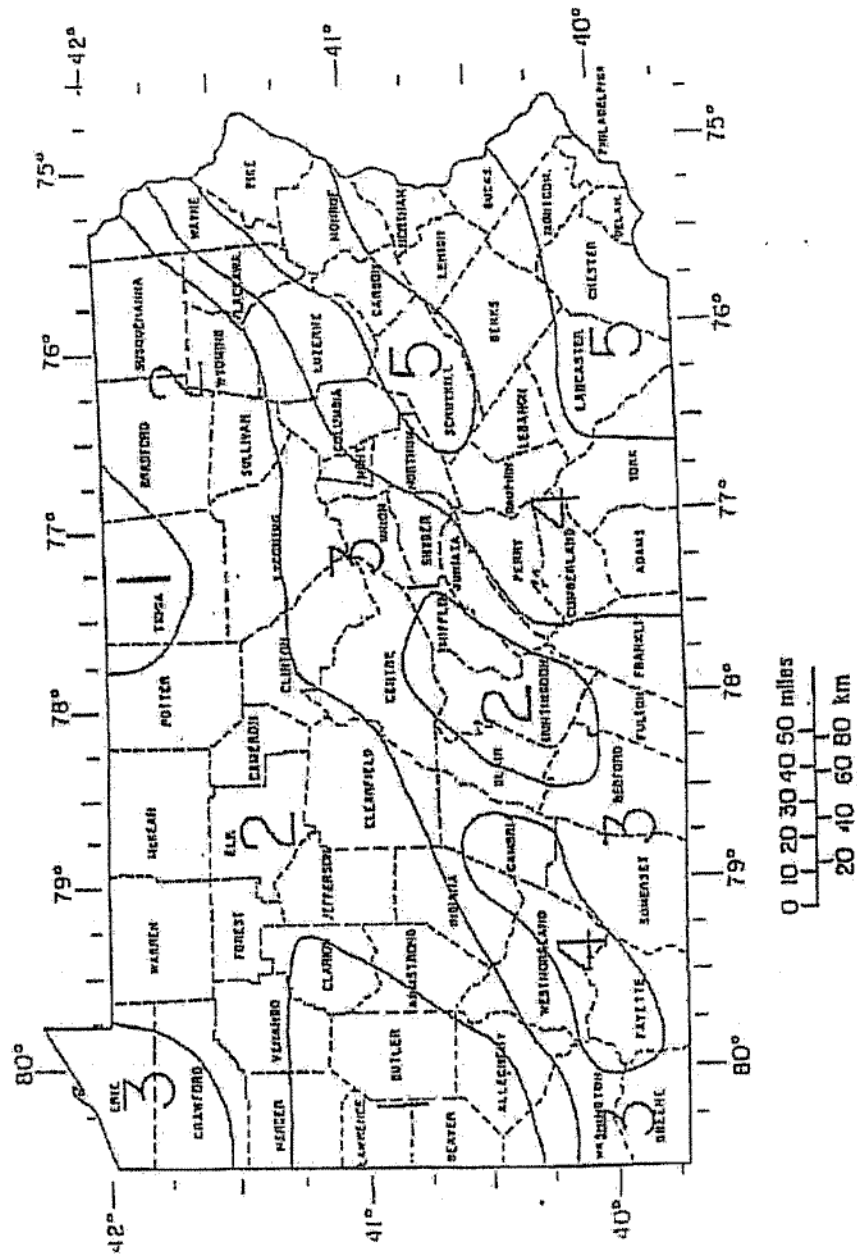


Maryanne Leavitt
Township Secretary

ARTICLE XI - APPENDICES

- APPENDIX A - PLATES 10 – 13, CARBON COUNTY ACT 167 FOR THE MAHONING CREEK WATERSHED**
- APPENDIX A - PLATES 14 – 15, CARBON COUNTY ACT 167 FOR THE LIZARD CREEK WATERSHED**
- APPENDIX A - PLATES 16 – 17, CARBON COUNTY ACT 167 FOR THE LIZARD CREEK WATERSHED**
- APPENDIX B-1-B-10 - RAINFALL DISTRIBUTIONS AND RUNOFF COEFFICIENTS**
- APPENDIX C-1 - RECOMMENDATION CHART FOR INFILTRATION STORMWATER MANAGEMENT BMPS IN CARBONATE BEDROCK**
- APPENDIX D-1-D-3 - STORMWATER FACILITIES AND BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT**
- APPENDIX E-1-E-3 - PRELIMINARY SITE INVESTIGATION AND TESTING REQUIREMENTS**
- APPENDIX F-1-F-2 - LOW IMPACT DEVELOPMENT PRACTICES**

PENNDOT DELINEATED REGIONS



Source: "Field Manual of Pennsylvania Department of Transportation,"
Storm Intensity-Duration-Frequency Charts, PDT- IDF, May 1986.

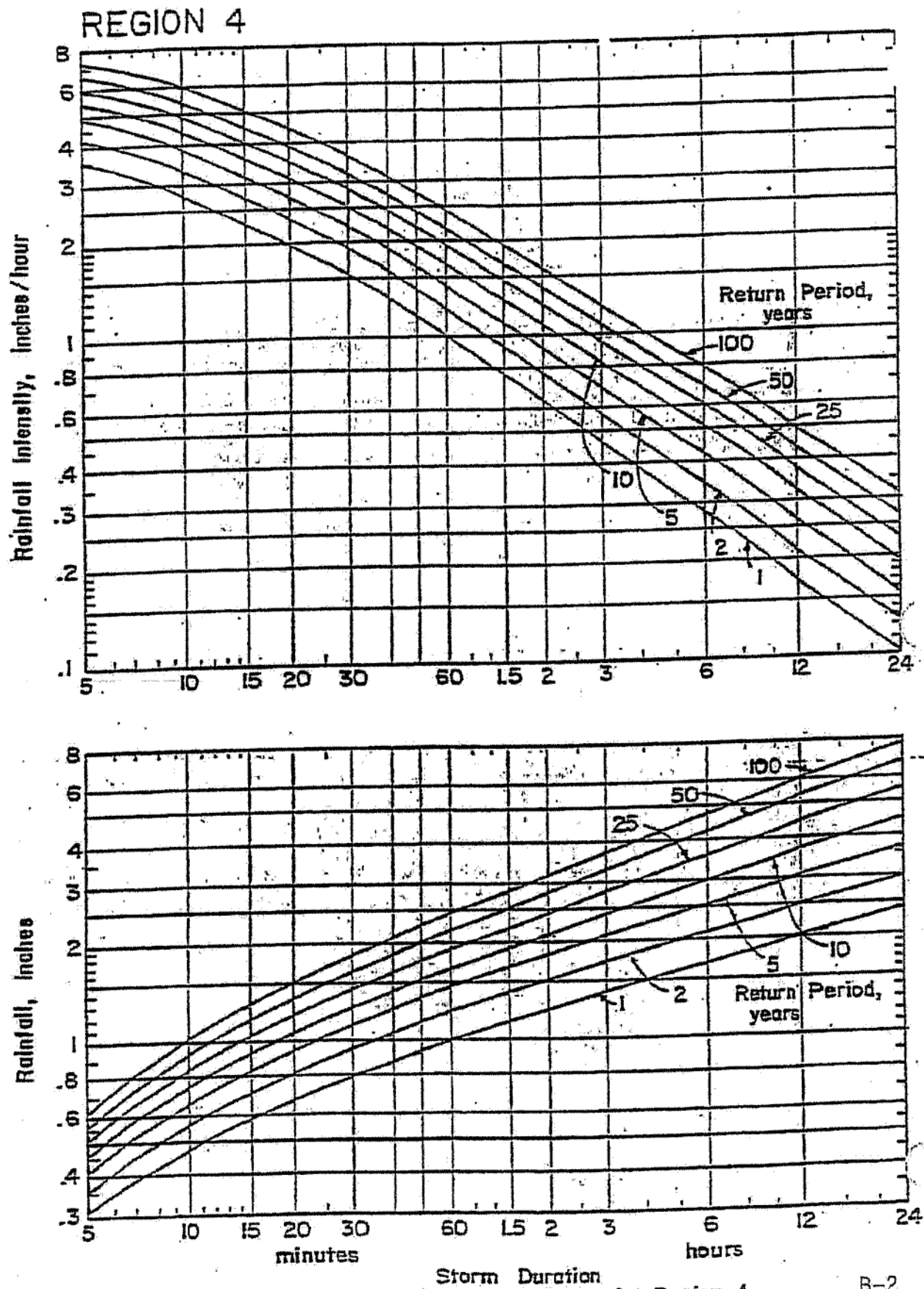


FIG. 5. Rainfall intensity-duration-frequency curves for Region 4.

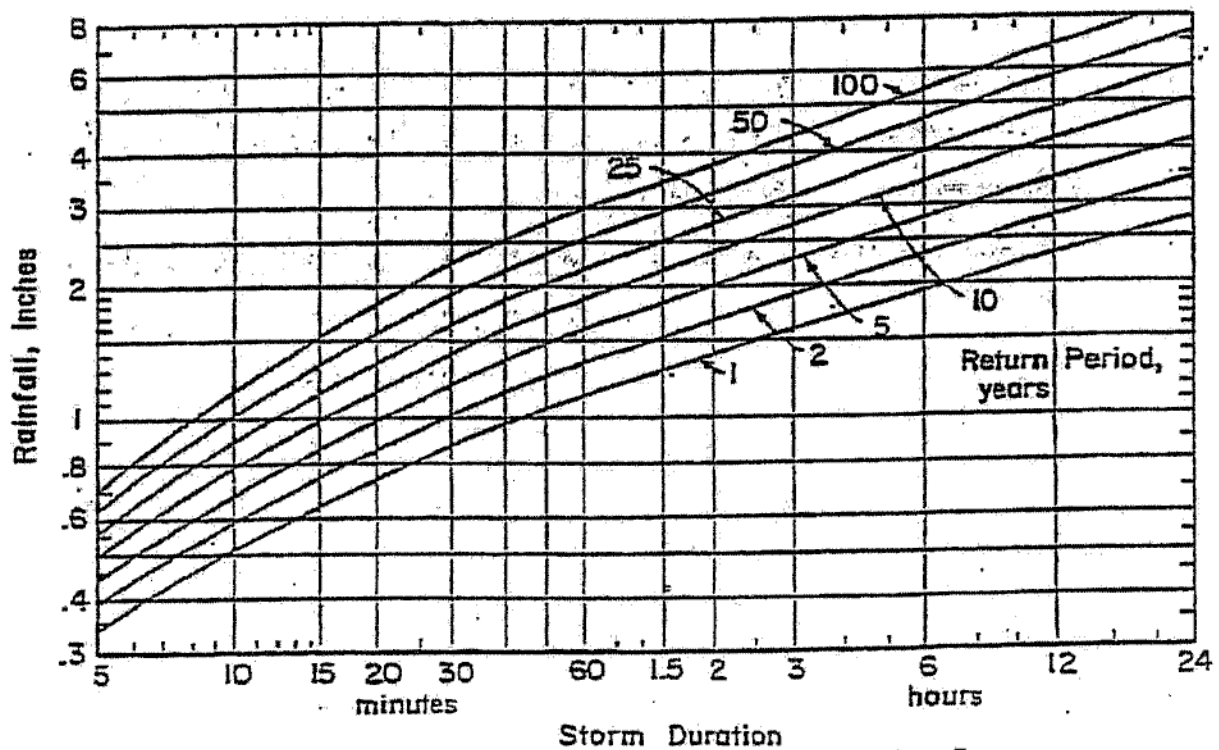
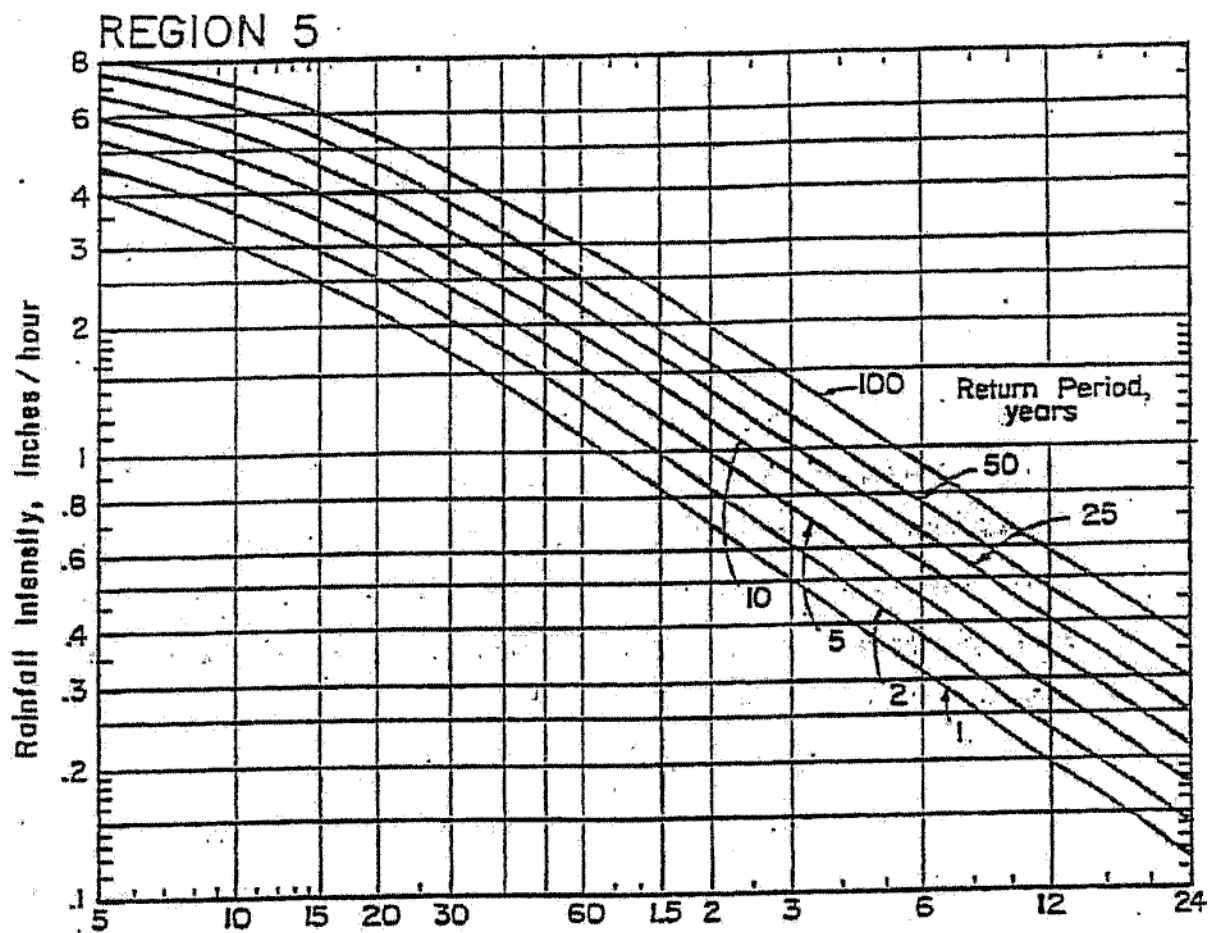


Fig. 6. Rainfall intensity-duration-frequency curves for Region 5.

NRCS TYPE II RAINFALL DISTRIBUTION

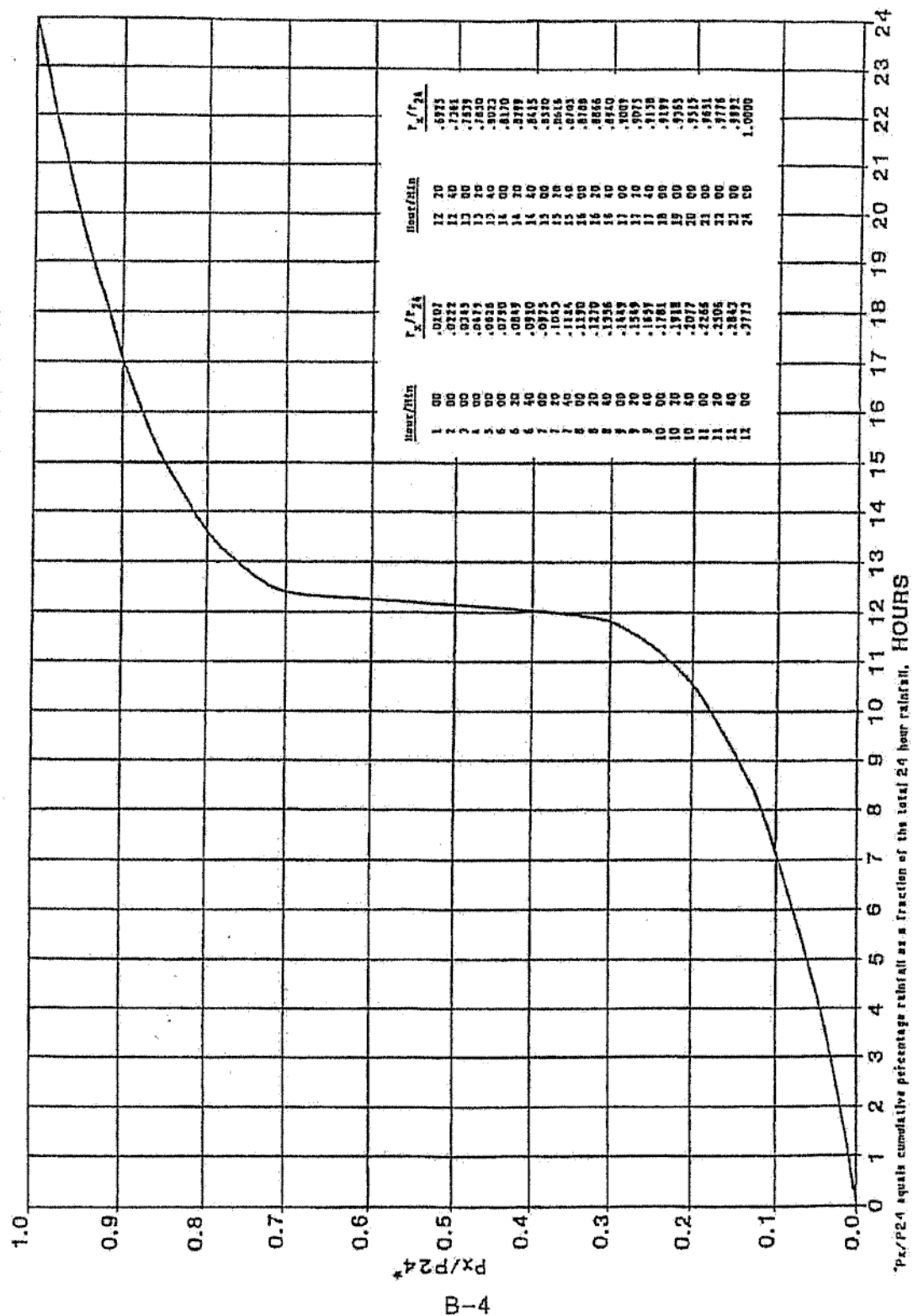
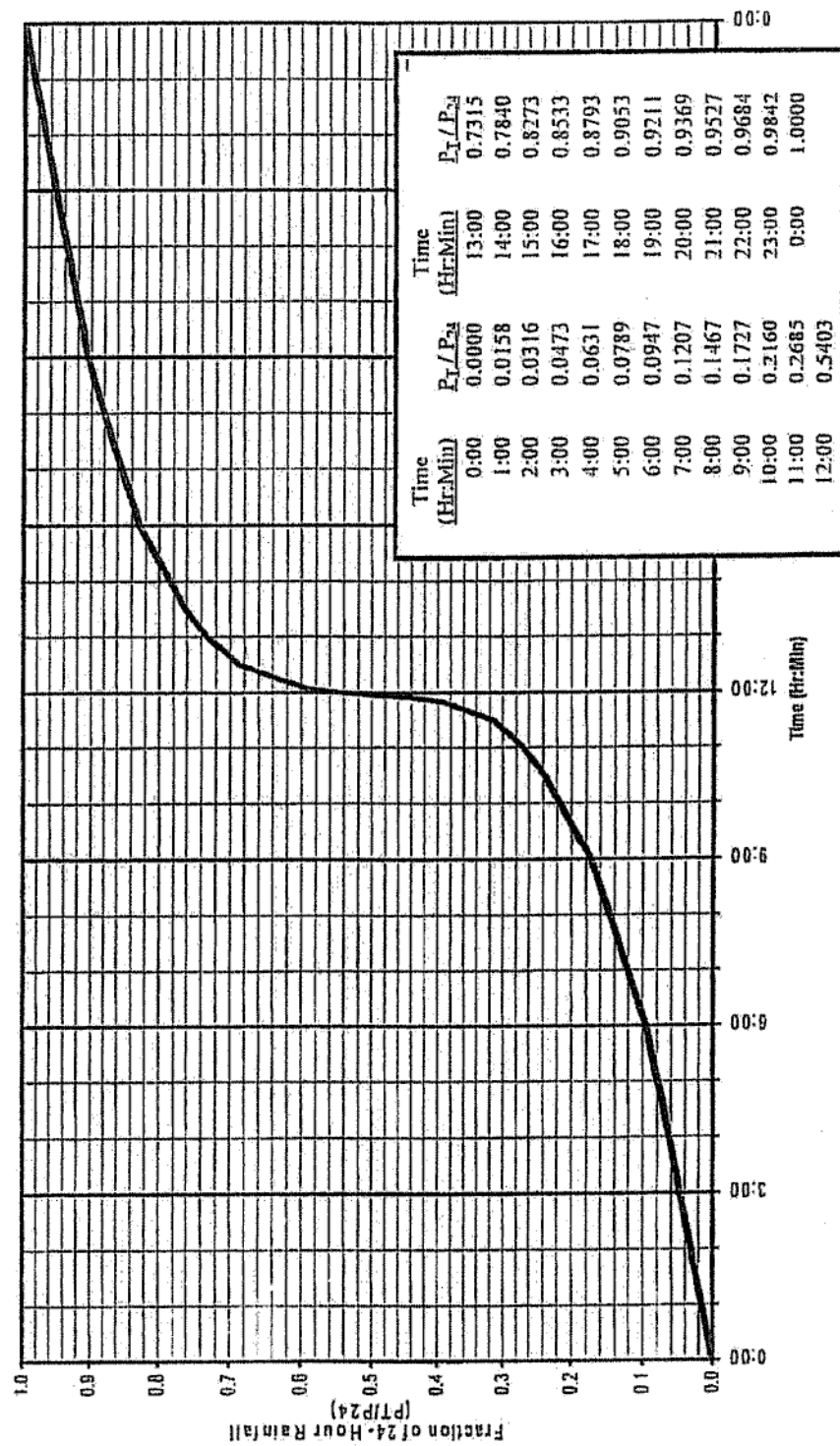


FIGURE F-3
NRCS (SCS) TYPE II
RAINFALL DISTRIBUTION - S CURVE



Note: Rainfall Distribution Curve developed from PennDOT Rainfall Intensity-Duration-Frequency Curves (Aron, 1986)
F-5

Table 2-2a Runoff curve numbers for urban areas ^{1/}

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area ^{2/}	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ^{3/} :					
Poor condition (grass cover < 50%)		68	70	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ^{4/}		63	77	85	88
Artificial desert landscaping (Impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	76	83	87
1/3 acre	30	67	72	81	86
1/2 acre	25	64	70	80	86
1 acre	20	61	68	78	84
2 acres	12	46	65	77	82
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) ^{5/}					
		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

^{1/} Average runoff condition, and $I_a = 0.25$.^{2/} The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.^{3/} CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.^{4/} Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.^{5/} Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands ^{1/}

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment ^{2/}	Hydrologic condition ^{3/}	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	79	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	86
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	86
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
Small grain	SR	Poor	66	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	86
		Good	56	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

^{1/} Average runoff condition, and $I_a = 0.25$.^{2/} Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.^{3/} Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good $\geq 20\%$), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands ^{1/}

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ^{2/}	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	76
Brush—brush-weed-grass mixture with brush the major element. ^{3/}	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 ^{4/}	48	65	73
Woods—grass combination (orchard or tree farm). ^{5/}	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ^{6/}	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 ^{4/}	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

^{1/} Average runoff condition, and $I_a = 0.25$.^{2/} *Poor*: <50% ground cover or heavily grazed with no mulch.*Fair*: 60 to 75% ground cover and not heavily grazed.*Good*: > 75% ground cover and lightly or only occasionally grazed.^{3/} *Poor*: <50% ground cover.*Fair*: 60 to 75% ground cover.*Good*: >75% ground cover.^{4/} Actual curve number is less than 30; use CN = 30 for runoff computations.^{5/} CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.^{6/} *Poor*: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.*Fair*: Woods are grazed but not burned, and some forest litter covers the soil.*Good*: Woods are protected from grazing, and litter and brush adequately cover the soil.

RUNOFF COEFFICIENTS FOR THE RATIONAL METHOD*									
HYDROLOGIC SOIL GROUP AND SLOPE RANGE**									
LAND USE	A			B			C		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Cultivated ^a	0.18 0.23	0.23 0.29	0.28 0.34	0.24 0.30	0.29 0.36	0.33 0.40	0.30 0.36	0.34 0.41	0.38 0.45
Pasture ^b	0.09 0.12	0.13 0.17	0.17 0.23	0.19 0.24	0.24 0.30	0.29 0.36	0.27 0.33	0.31 0.38	0.36 0.43
Meadow, Lawn ^c	0.05 0.07	0.08 0.12	0.12 0.17	0.15 0.19	0.20 0.25	0.24 0.30	0.23 0.28	0.28 0.34	0.32 0.39
Forest, Woods	0.03 0.04	0.05 0.08	0.08 0.12	0.11 0.15	0.16 0.21	0.20 0.26	0.20 0.25	0.25 0.31	0.29 0.36
Gravel	0.24 0.30	0.29 0.36	0.33 0.40	0.32 0.38	0.36 0.43	0.40 0.47	0.35 0.42	0.39 0.46	0.43 0.50
Parking, Other Impervious	0.85 0.95	0.86 0.96	0.87 0.97	0.85 0.95	0.86 0.96	0.87 0.97	0.85 0.95	0.86 0.96	0.87 0.97
Residential, Commercial, Industrial and Other "Developed"	Runoff coefficients should be calculated based upon weighted average of impervious area coefficients and pervious area coefficients from above based upon soil type, slope and the particular development proposal.								

*Coefficients for all land uses except parking and other impervious cover are based on the Rossmiller Equation for translating NRCS curve numbers into Rational Method 'c' values. The source for the parking and other impervious cover coefficients is RAWLS, W.J., S.L. WONG and R.H. McCUEN, 1981. Comparison of urban flood frequency procedures. Preliminary draft report prepared for the Soil Conservation Service, Beltsville, MD.

**Hydrologic Soil Group based on the county soil survey latest edition.

a - Runoff coefficients for storm recurrence intervals less than 25 years.

b - Runoff coefficients for storm recurrence intervals of 25 years or more.

^aRepresents average of cultivated land with and without conservation treatment from TR-55, January 1975. These values are consistent with several categories of cultivated lands from TR-55, June 1986.

^bRepresents grasslands in fair condition with 50% to 75% grass cover.

^cRepresents grasslands in good condition with greater than 75% grass cover.

MANNING 'n' VALUES BY TYPICAL REACH DESCRIPTION

<u>Reach Description</u>	<u>Manning 'n'</u>
Natural stream, clean, straight, no rifts Or pools	0.030
Natural stream, clean, winding, some pools And shoals	0.040
Natural stream, winding, pools, shoals, Stony with some weeds	0.050
Natural stream, sluggish with deep pools And weeds	0.070
Natural stream or swale, very weedy or With timber under brush	0.100
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027*

*Depending upon type and diameter.

ROUGHNESS COEFFICIENTS (MANNING 'n') FOR SHEET FLOW

<u>Surface Description</u>	<u>Manning 'n'</u> ¹
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.050
Cultivated soils:	
Residue cover <= 20%	0.060
Residue cover > 20%	0.170
Grass:	
Short grass prairie	0.150
Dense grasses ²	0.240
Bermuda grass	0.410
Range (natural)	0.130
Woods: ³	
Light underbrush	0.400
Dense underbrush	0.800

¹The n values are a composite of information compiled by Engman (1986).

²Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass and native grass mixtures.

³When selecting n, consider cover to a height of about 0.1 ft. this is the only part of the plant cover that will obstruct sheet flow.

APPENDIX C

Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock*												
Geology Type		CARBONATE BEDROCK										
Effective Soil Thickness		Less than 2 Feet	2 to 4 Feet				Over 4 Feet to 8 Feet				Over 8 Feet	
Special Geologic Features**		Low/Medium/High Buffer	Low Buffer	Medium Buffer	High Buffer	Low Buffer	Medium Buffer	High Buffer	Low Buffer	Medium Buffer	High Buffer	High Buffer
SITE INVESTIGATION RECOMMENDED		(Unacceptable)	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary	Preliminary
DESIGN FACTORS		Infiltration Loading Rates (% Increase)***	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%	0-100% 100% 300% 500%
PROGRAM SUMMARY GUIDANCE****			1	1	1	2	2	2	2	2	2	2



RECOMMENDED



NOT RECOMMENDED

* Source: Developed by Cahill Associates based on information in "Technical Best Management Practice Manual & Infiltration Feasibility Report", November 2002 and input from the LVPC, 2003.

** Special Geologic Feature Buffer widths are as follows:

- Low Buffer is less than 50 feet
- Medium Buffer is 50 feet to 100 feet
- High Buffer is greater than 100 feet

*** Rates greater than 500% not recommended.

**** Assumes adequately permeable soils and lack of natural constraints as required for all infiltration systems.

1 Infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken which confirms nature of rock, location of Special Geologic Features, and adequacy of the buffer between the SGF and the proposed stormwater system(s).

2 In these Special Geologic Features: Low Buffer situations, infiltration systems may be allowed at the determination of the Engineer and/or Geologist, provided that a Detailed Site Investigation is undertaken and a 25 foot buffer from SGFs is maintained.

APPENDIX D

STORMWATER BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 200____, by and between _____, (hereinafter the "Landowner"), and _____ County, Pennsylvania, (hereinafter "municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of _____ County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the stormwater management BMP Operations and Maintenance Plan approved by the municipality (hereinafter referred to as the "Plan") for the property identified herein, which is attached hereto as Appendix A and made part hereof, as approved by the municipality, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMP's); and

WHEREAS, the municipality, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the municipality and the protection and maintenance of water quality require that on-site stormwater Best Management Practices be constructed and maintained on the Property; and

WHEREAS, for the purposes of this agreement, the following definitions shall apply:

- BMP – "Best Management Practice;" activities, facilities, designs, measures or procedures used to manage stormwater impacts from land development, to protect and maintain water quality and groundwater recharge and to otherwise meet the purposes of the Municipal Stormwater Management Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.
- Infiltration Trench – A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,
- Seepage Pit – An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer,
- Rain Garden – A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or underground aquifer, and

WHEREAS, the municipality requires, through the implementation of the Plan, that stormwater management BMPs as required by said Plan and the Municipal Stormwater

Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns, and

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The BMPs shall be constructed by the Landowner in accordance with the plans and specifications identified in the Plan.
2. The Landowner shall operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the municipality and in accordance with the specific maintenance requirements noted on the Plan.
3. The Landowner hereby grants permission to the municipality, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper identification, to inspect the BMP(s) whenever it deems necessary. Whenever possible, the municipality shall notify the Landowner prior to entering the property.
4. In the event the Landowner fails to operate and maintain the BMP(s) as shown on the Plan in good working order acceptable to the municipality, the municipality or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said BMP(s). This provision shall not be construed to allow the municipality to erect any permanent structure on the land of the Landowner. It is expressly understood and agreed that the municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the municipality.
5. In the event the municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the municipality for all expenses (direct and indirect) incurred within 10 days of receipt of invoice from the municipality *and if not timely paid, a municipal lien shall be placed upon the premises for 110% of the invoice amount, plus statutorily allowed fees, expenses and costs.*
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.
7. The Landowner, its executors, administrators, assigns, and other successors in interests, *hereby release and hold harmless* the municipality's employees and designated representatives from all damages, accidents, casualties, occurrences or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or municipality. In the event that a claim is asserted against the municipality, its designated representatives or employees, the municipality shall promptly notify the Landowner and the Landowner shall defend, at his own expense, any suit based on the claim. If any judgment or claims against the municipality's employees or designated representatives shall be allowed, the Landowner shall pay all costs and expenses regarding said judgment or claim.
8. The municipality shall inspect the BMP(s) *as necessary* to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of _____ County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL)

For the municipality:

(SEAL)

For the Landowner:

ATTEST:

_____ (City, Borough, Township)

County of _____, Pennsylvania

I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 200_, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 200_, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ day of _____, 200_.

NOTARY PUBLIC

(SEAL)

APPENDIX E

PRELIMINARY SITE INVESTIGATION AND TESTING REQUIREMENTS

Required Data and Site Information: The following data shall be gathered utilizing standard testing procedures as part of a Preliminary Site Investigation:

- Bedrock composition – Any apparent boundaries between carbonate and non-carbonate bedrock must be verified by a qualified geotechnical professional.
- Bedrock structural geology – This includes the possible presence of faults and mapping of conspicuous fracture traces or lineaments.
- Overburden and soil mantle composition and thickness
- Permeability of the soil
- Depth to the seasonal high water table
- Presence of special geologic features – This includes sinkholes, closed depressions, fracture traces, lineaments, joints, faults, caves, pinacles and geologic contacts between carbonate and non-carbonate bedrock

Preliminary Site Investigation Required for Sites Intending to Use Infiltration

Review of Available Data, Maps and Reports: Some of the required information, as listed above, can be found in existing published data. Suggested resources include the following:

- Geologic maps and references for the development area
- The Little Lehigh Creek Basin Carbonate Prototype Area Closed Depression Map – available at the LVPC
- USGS topographic maps
- Lehigh and Northampton County soil survey maps
- Aerial photographs from the LVPC or other sources
- Relevant Pennsylvania Geologic Survey Open File Reports that provide maps of sinkholes and Karst features for Lehigh County (OF 87-01) and Northampton County (OF 87-02)
- Kochanov and Reese (2003). Density of Mapped Karst Feature in South-Central and Southeastern Pennsylvania (Map 68)
- DCNR Online Sinkhole Inventory - (<http://www.dcnr.state.pa.us/topogeo/hazards/sinkhole/default.asp>)

Field Inspections: In addition to gathering data from published sources, a field inspection of the proposed site is required. A field inspection can provide additional information relating to site features such as carbonate bedrock features, indicators of seasonal high stream-level or water table levels, streams, springs, etc.

Soil Test Pit and Percolation Test Requirements: A minimum of one test pit and a minimum of 2 percolation tests are required for every site. A test pit is a 2-3 foot wide, 8 foot deep trench excavated with a backhoe for observing subsurface conditions. The test pits will be used to describe soil depth and quality, including soil horizons, and testing of permeability or percolation rates and can be conducted by a certified Sewage Enforcement Officer.

Percolation tests are to be conducted as follows (adapted from § 73.15. "Percolation Tests" of the Pennsylvania Code)

1. The percolation tests shall be made in separate holes uniformly spaced over the possible infiltration area.
2. An "Initial Presoak" should not be performed.
3. Percolation holes located within the possible infiltration area shall be used in the calculation of the average percolation rate.
4. Holes having a uniform diameter of 6 to 10-inches shall be bored or dug as follows:
 - a. To the depth of the bottom of the possible infiltration BMP
 - b. Alternate depths if the test pits/auger holes indicate that the soils are more suitable at a different depth (i.e., if a clay horizon is identified and more suitable soils are located beneath the horizon, and infiltration test should be performed in the suitable horizon).
5. The bottom and sides of the hole shall be scarified with a knife blade or sharp-pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material shall be removed from the hole. Two inches of coarse sand or fine gravel shall be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.
6. Immediately before the percolation test, as a final presoak, water shall be placed in the hole to a minimum depth of 6-inches over the gravel and readjusted every 30 minutes for 1 hour.
7. The drop in the water level during the last 30 minutes of the final presoaking period shall be applied to the following standard to determine the time interval between readings for each percolation hole:
 - a. If water remains in the hole, the interval for readings during the percolation test shall be 30 minutes.
 - b. If no water remains in the hole, the interval for readings during the percolation test may be reduced to 10 minutes.
8. After the final presoaking period, water in the hole shall again be adjusted to approximately 6-inches over the gravel and readjusted when necessary after each reading.
 - a. Measurement to the water level in the individual percolation holes shall be made from a fixed reference point and shall continue at the interval determined from step No. 7 (above) for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of 1/4-inch or less of drop between the highest and lowest readings of four consecutive readings.
 - b. The drop that occurs in the final period in percolation test holes, expressed as inches per hour, shall be used to calculate the average percolation rate.
 - c. When the rate of drop in a percolation test is too slow to obtain a measurable rate, the rate of 0.25 inches per hour shall be assigned to that

hole for use in calculating the average percolation rate. The infiltration area may be placed over holes with no measurable rate when the average percolation rate for the possible infiltration area is within the acceptable range.

When a percolation test hole yields a percolation rate of greater than 12-inches per hour, the proposed infiltration area may not be designed or installed within 25-feet of this hole unless the municipality determines that a testing anomaly caused the fast percolation rate and a retest of the area yields acceptable percolation rates. This percolation rate limit is established to protect groundwater quality and to minimize the risk of subsidence.

Additional Site Investigation and Testing Required if Infiltration is Proposed

Soil Test Pit Requirements: The required number of test pits varies with Effective Soil Thickness. As risk factors increase, the number of test pits increases. A minimum of 2 test pits, uniformly spaced within the proposed infiltration area (e.g. the 2 pits should be centered on each half of the proposed infiltration area), are required for any site proposing infiltration unless the applicant can demonstrate that one test pit is adequately representative of the area proposed for infiltration. For larger infiltration areas, multiple test pits shall be developed at the densities as listed below:

Effective Soil Thickness (ft.)	Test Pit Density (per acre of proposed infiltration area)*	Percolation Tests (per acre of proposed infiltration area)**	Auger Grid Spacing (Feet On-Center)***
8	4	8	50
4 to 8	6	12	35
2 to 4	8	16	25

*No. of Test Pits required = Infiltration sq. ft./43,560 sq. ft. x test pit density from chart rounded up to the nearest whole number.

** No. of Percolation Tests required = Infiltration sq. ft./43,560 sq. ft. x percolation tests from chart rounded up to the nearest whole number

*** Auger testing is only required on Carbonate sites.

Soil Auger Testing Requirements for Carbonate Areas: Because soil depth is not uniform in many carbonate areas, test pits will not be sufficient to accurately determine the depth to bedrock. Augering provides this essential data as inexpensively as possible. Track-rig rotary soil auger test drilling allows relatively inexpensive, qualitative determination of the presence of overburden voids and will generally penetrate to the top-of-bedrock. Augers typically extend to depths of 20 feet. Special augers extend to as much as 50 feet. Augers do not extend into the bedrock. Auger testing should be performed in a grid pattern across the proposed infiltration area, spaced as indicated in the above table.

Percolation Testing Requirements: For each proposed infiltration area, a minimum of six percolation tests shall be conducted with a vertical component permeability test unless the applicant can demonstrate that fewer tests accurately represent the percolation rate of the proposed infiltration area. Additional testing shall be required if the initial test results show significant variability in the vertical component percolation rate. For larger infiltration areas, percolation tests shall be conducted at the densities listed in the table above.

APPENDIX F

LOW IMPACT DEVELOPMENT PRACTICES

ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

Natural hydrologic conditions may be altered radically by poorly planned development practices, such as introducing unneeded impervious surfaces, destroying existing drainage swales, constructing unnecessary storm sewers, and changing local topography. A traditional drainage approach of development has been to remove runoff from a site as quickly as possible and capture it in a detention basin. This approach may lead ultimately to the degradation of water quality as well as expenditure of additional resources for detaining and managing concentrated runoff at some downstream location.

The recommended alternative approach is to promote practices that will minimize post-development runoff rates and volumes, which will minimize needs for artificial conveyance and storage facilities. To simulate pre-development hydrologic conditions, forced infiltration is often necessary to offset the loss of infiltration by creation of impervious surfaces. The ability of the ground to infiltrate depends upon the soil types and its conditions.

Preserving natural hydrologic conditions requires careful alternative site design considerations. Site design practices include preserving natural drainage features, minimizing impervious surface area, reducing the hydraulic connectivity of impervious surfaces, and protecting natural depression storage. A well-designed site will contain a mix of all those features. The following describes various techniques to achieve the alternative approach:

- **Preserving Natural Drainage Features.** Protecting natural drainage features, particularly vegetated drainage swales and channels, is desirable because of their ability to infiltrate and attenuate flows and to filter pollutants. However, this objective is often not accomplished in land development. In fact, commonly held drainage philosophy encourages just the opposite pattern -- streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. As a result, runoff and pollutants generated from impervious surfaces flow directly into storm sewers with no opportunity for attenuation, infiltration, or filtration. Developments designed to fit site topography also minimizes the amount of grading on site.
- **Protecting Natural Depression Storage Areas.** Depression storage areas have no surface outlet, or drain very slowly following a storm event. They can be commonly seen as ponded areas in farm fields during the wet season or after large runoff events. Traditional development practices eliminate these depressions by filling or draining, thereby obliterating their ability to reduce surface runoff volumes and trap pollutants. The volume and release-rate characteristics of depressions should be protected in the design of the development site. The depressions can be protected by simply avoiding the depression or by incorporating its storage as additional capacity in required detention facilities.

- **Avoiding Introduction of Impervious Areas.** Careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.
- **Reducing the Hydraulic Connectivity of Impervious Surfaces.** Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of stormwater runoff, and should help reduce concentration of runoff to a single point in the development.
- **Routing Roof Runoff Over Lawns.** Roof runoff can be easily routed over lawns in most site designs. The practice discourages direct connections of downspouts to storm sewers or parking lots. The practice also discourages sloping driveways and parking lots to the street. By routing roof drains and crowning the driveway to run off to the lawn, the lawn is essentially used as a filter strip.
- **Reducing the Use of Storm Sewers.** By reducing use of storm sewers for draining streets, parking lots, and back yards, the potential for accelerating runoff from the development can be greatly reduced. The practice requires greater use of swales and may not be practical for some development sites, especially if there are concerns for areas that do not drain in a "reasonable" time. The practice requires educating local citizens and public works officials, who expect runoff to disappear shortly after a rainfall event.
- **Reducing Street Widths.** Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.
- **Limiting Sidewalks to One Side of the Street.** A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.
- **Using Permeable Paving Materials.** These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.
- **Reducing Building Setbacks.** Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low-traffic streets where traffic noise is not a problem.
- **Constructing Cluster Developments.** Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.

