

Chapter 23

Stormwater Management and Grading

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Part 1**General Provisions****§23-101. Short Title.**

This Chapter shall be known and may be cited as the “Northampton Township Stormwater Management and Grading Ordinance.”

(*Ord. 559, 7/27/2011, §113-1*)

§23-102. Statement of Findings.

The Board of Supervisors of Northampton Township finds that:

A. Inadequate management of accelerated stormwater runoff resulting from development and redevelopment throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.

B. Inadequate planning and management of stormwater runoff resulting from land development and redevelopment throughout a watershed can also harm surface water resources by changing the natural hydrologic patterns, accelerating stream flows (which increase scour and erosion of streambeds and streambanks, thereby elevating sedimentation), destroying aquatic habitat, and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals, and pathogens.

C. A comprehensive program of stormwater management (SWM), including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety, welfare, and the protection of the people of the Township and all the people of the Commonwealth, their resources, and the environment.

D. Stormwater is an important water resource by providing groundwater recharge for water supplies and base flow of streams, which also protects and maintains surface water quality.

E. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.

F. 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).

G. Non-stormwater discharges to the Township’s separate storm sewer system can contribute to pollution of waters of the Commonwealth by the Township.

(*Ord. 559, 7/27/2011, §113-2*)

§23-103. Purpose.

The purpose of this Chapter is to promote the public health, safety, and welfare within the Township and its watershed by maintaining the natural hydrologic regime and by minimizing the harms and maximizing the benefits described in §23-102 of this Chapter, through provisions designed to:

- A. Meet legal water quality requirements under State law, including regulations at 25 Pa.Code, Chapter 93, to protect, maintain, reclaim, and restore the existing and designated uses of the waters of this Commonwealth.
- B. Minimize increases in stormwater volume and control peak flows.
- C. Provide review procedures and performance standards for stormwater planning and management.
- D. Utilize and preserve the natural drainage systems as much as possible.
- E. Manage stormwater impacts close to the runoff source by regulating activities that cause the problem and by requiring a minimum of structures and relying on natural processes.
- F. Focus on infiltration of stormwater to maintain groundwater recharge, to prevent degradation of surface and groundwater quality, and to otherwise protect water resources.
- G. Preserve and restore the flood-carrying capacity of streams.
- H. Prevent scour and erosion of streambanks and stream beds.
- I. Provide standards to meet National Pollution Discharge Elimination System (NPDES) permit requirements.
- J. Address certain requirements of the Municipal Separate Stormwater Sewer System (MS4) NPDES Phase II stormwater regulations.
- K. Provide for proper operation and maintenance of all stormwater management facilities and best management practices (BMPs) that are implemented in the Township.

(Ord. 559, 7/27/2011, §113-3)

§23-104. Statutory Authority.

The Township is empowered to regulate land use activities that affect stormwater runoff by the authority of the Act of July 31, 1968, P.L. 805, No. 247, the Municipalities Planning Code, 53 P.S. §10101 *et seq.*, as amended, the Act of October 4, 1978, P.L. 864, No. 167, the Stormwater Management Act, 32 P.S. §680.1 *et seq.*, and the Water Resources Act of 2002, 27 Pa.C.S.A. §3101 *et seq.*, and the Second Class Township Code, 53 P.S. §65101 *et seq.*

(Ord. 559, 7/27/2011, §113-4)

§23-105. Applicability.

1. All regulated activities and all activities that may affect stormwater runoff, including land development and earth disturbance activity, are subject to regulation by this Chapter.

2. Regulated activities include, but are not limited to:

- A. Land development.
- B. Subdivisions.
- C. Prohibited or polluted discharges.
- D. Alteration of the natural hydrologic regime.
- E. Construction or reconstruction of, or addition of new impervious or semi-pervious surfaces (i.e., driveways, parking lots, roads, etc.), except for reconstruction of roads where there is no increase in impervious surface.
- F. Construction of new buildings or additions to existing buildings.
- G. Redevelopment.
- H. Diversion piping or encroachments in any natural or man-made channel.
- I. Nonstructural and structural stormwater management best management practices (BMPs) or appurtenances thereto.

(Ord. 559, 7/27/2011, §113-5)

§23-106. Exemptions.

1. Regulated activities that create impervious surfaces less than or equal to 1,000 square feet are exempt from the peak rate control and the SWM site plan preparation requirements of this Chapter and are not applicable to the volume requirements of this Chapter, unless the activity is found to be a contributor of pollution to the waters of the Commonwealth. [Ord. 562]

2. Regulated activities that create impervious surfaces greater than 1,000 square feet, up to and including 5,000 square feet, are exempt only from the peak rate control requirements of this Chapter unless the activity is found to be a contributor of pollution to the waters of the Commonwealth. These activities are not exempt from the SWM site plan requirements and the volume requirements of this Chapter. The non-engineered small projects site plan detailed in Appendix 23-G can be used to satisfy the SWM site plan requirements for residential activities only.

Table 23-106.2				
Impervious Surface Exemption Threshold				
Chapter Part or Section	Type of Project	Proposed Impervious Surface		
		0–1,000 sq. ft.	1,001–5,000 sq. ft.	5,000 + sq. ft.
§23-402, SWM Site Plan Requirements	All Development	Exempt	Not Exempt (except residential activity)	Not Exempt
Appendix 23-G, Non-engineered Small Project Site Plan	Only Residential Development Applicable	Exempt	Applicable	Non-applicable
§23-304, Volume Control Requirements	All Development	Non-applicable	Not Exempt	Not Exempt
§23-305, Peak Rate Control Requirements	All Development	Exempt	Exempt	Not Exempt
§23-303, Erosion and Sediment Pollution Control Requirements	Must comply with Title 25, Chapter 102, of the Pa.Code and any other applicable State, County, and Township codes. PADEP requires an engineered post-construction SWM Plan with projects proposing earth disturbance greater than 1 acre.			

[Ord. 562]

3. Earth disturbance activity of less than 10,000 square feet in area that includes no additional impervious surfaces.

4. Agricultural activity is exempt from the peak rate control requirements and SWM site plan preparation requirements of this Chapter provided the activities are performed according to the requirements of 25 Pa.Code, Chapter 102.

5. Forest management and timber operations are exempt from the peak rate control requirements and SWM site plan preparation requirements of this Chapter provided the activities are performed according to the requirements of 25 Pa.Code, Chapter 102.

6. Any aspect of BMP maintenance to an existing SWM system made in accordance with plans and specifications approved by Northampton Township is exempt.

7. The use of land for gardening for home consumption and residential landscaping that does not include any increase in impervious coverage is exempt from the requirements of this Chapter.

8. Exemptions from any provisions of this Chapter shall not relieve the applicant from the requirements in §23-301.4 through .12.

9. *Exception for Hardship.* The Township Engineer, with the concurrence of the Board of Supervisors, may waive or modify any mandatory provision of this Chapter when the literal compliance with a mandatory provision is shown to the satisfaction of the Township Engineer to be unreasonable or cause undue hardship because of peculiar conditions pertaining to the land in question, provided that a modification will not be contrary to the public interest or when an alternative standard can be demonstrated to provide equal or better results.

10. *Additional Exemption Criteria.*

A. *Exemption Responsibilities.* An exemption shall not relieve the applicant from the requirements of other Township codes and/or implementing such measures as are necessary to protect public health, safety, and property. The Township shall have the discretion to deny exemptions where other permits are required.

B. *Drainage Problems.* Where drainage problems are documented or known to exist downstream of or is expected from the proposed activity, Northampton Township may deny exemptions.

C. Exemptions are limited to specific portions of this Chapter.

D. *HQ and EV Streams.* Northampton Township may deny exemptions in high quality (HQ) or exceptional value (EV) waters and source water protection areas (SWPA).

E. The exemptions are limited to the increase in impervious coverage amounts listed in Table 23-106.2 for each property as of the adoption of this Chapter. Any increase in impervious coverage is cumulative from the date of adoption of this Chapter. All cumulative activities that increase the impervious coverage over the amounts stated in Table 23-106.2 will not be exempt from the stated requirements. [Ord. 562]

(*Ord. 559*, 7/27/2011, §113-6; as amended by *Ord. 562*, 4/25/2012, §§1–4)

§23-107. Compatibility with Other Ordinance or Legal Requirements.

1. Approvals issued and actions taken pursuant to this Chapter do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. To the extent that this Chapter imposes more rigorous or stringent requirements for stormwater management, the specific requirements contained in this Chapter shall be followed.

2. Nothing in this Chapter shall be construed to affect any of the Township requirements regarding stormwater matters which do not conflict with the provisions of this Chapter. Conflicting provisions in other Township ordinances or regulations shall be construed to retain the requirements of this Chapter by addressing State water quality requirements.

(*Ord. 559*, 7/27/2011, §113-9)

Part 2**Definitions****§23-201. Word Usage.**

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

A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.

B. The word “includes” or “including” shall not limit the term to the specific example, but is intended to extend its meaning to all other instances of like kind and character.

C. The word “person” includes an individual, firm, association, organization, partnership, trust, company, corporation, unit of government, or any other similar entity.

D. The words “shall” and “must” are mandatory; the words “may” and “should” are permissive.

E. The words “used” or “occupied” include the words “intended, designed, maintained, or arranged to be used, occupied or maintained.”

F. The following definitions are frequently cross-referenced with other words of similar meaning. The term “Supervisors” shall always mean the “Board of Township Supervisors of Northampton Township.” The term “municipality” or “Township” shall always mean the “Township of Northampton, Bucks County, Pennsylvania.”

(Ord. 559, 7/27/2011, §13-10)

§23-202. Terms Defined.

As used in this Chapter, the following terms shall have the meaning indicated:

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

Agricultural activity—activities associated with agriculture such as agricultural cultivation, agricultural operation, and animal heavy use areas. This includes the work of producing crops including tillage, land clearing, plowing, disking, harrowing, planting, harvesting crops or pasturing and raising of livestock 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 as the result of changing the land cover including the water, vegetation and bare soil.

Applicant—a person who has filed an application for approval to engage in any

regulated activity defined in §23-105 of this Chapter at a project site in the Township.

As-built drawings—engineering or site drawings maintained by the contractor as he constructs the project and upon which he documents the actual locations of the building components, stormwater BMPs and changes to the original contract documents. These documents, or a copy of same, are turned over to the Township Engineer at the completion of the project.

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

Base flow—portion of stream discharge derived from groundwater; the sustained discharge that does not result from direct runoff or from water diversions, reservoir releases, piped discharges, or other human activities.

Best management practices (BMP)—activities, facilities, designs, measures, or procedures used to manage stormwater impacts from regulated activities, to meet State water quality requirements, to promote groundwater recharge, and to otherwise meet the purposes of this Chapter. Stormwater BMPs are commonly grouped into one of two broad categories or measures: “structural” or “nonstructural.” In this Chapter, nonstructural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff whereas structural BMPs or measures are those that consist of a physical device or practice that is installed to capture and treat stormwater runoff. Structural BMPs include, but are not limited to, a wide variety of practices and devices, from large-scale retention ponds and constructed wetlands, to small-scale underground treatment systems, infiltration facilities, filter strips, low impact design, bioretention, wet ponds, permeable paving, grassed swales, riparian or forested buffers, sand filters, detention basins, and manufactured devices. Structural stormwater BMPs are permanent appurtenances to the project site.

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

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

Channel—an open drainage feature through which stormwater flows. Channels include, but shall not be limited to, natural and man-made watercourses, swales, streams, ditches, canals, and pipes that convey continuously or periodically flowing water.

Cistern—an underground reservoir or tank for storing rainwater.

Conservation District—the Bucks County Conservation District.

Culvert—a structure with its appurtenant works, which carries water under or through an embankment or fill.

Curve number—value used in the soil cover complex method. It is a measure of the percentage of precipitation which is expected to run off from the watershed and is a function of the soil, vegetative cover, and tillage method.

Cut—

(1) An excavation.

(2) The difference in vertical elevation between a point on the surface of original ground and a designated point of lower elevation on the final grade.

(3) The material removed in excavation.

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

Department—the Pennsylvania Department of Environmental Protection (PADEP).

Designee—the agent of the Bucks County Conservation District, and/or agent of Northampton Township involved with the administration, review, or enforcement of any provisions of this Chapter by contract or memorandum of understanding.

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

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

Detention volume—the volume of runoff that is captured and released into the waters of the Commonwealth at a controlled rate.

Developer—a person that seeks to undertake any regulated activities at the project site in the Township.

Development—see “earth disturbance activity.”

Development site—the specific tract or parcel of land where any regulated activity set forth in §23-105 is planned, conducted or maintained.

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

Discharge—(1) (verb) To release water from a project, site, aquifer, drainage basin or other point of interest; (2) (noun) The rate and volume of flow of water such as in a stream, generally expressed in cubic feet per second.

Discharge point—the point of discharge for a stormwater facility.

Disconnected impervious area (DIA)—an impervious or impermeable surface that is disconnected from any stormwater drainage or conveyance system and is redirected or directed to a pervious area, which allows for infiltration, filtration, and increased time of concentration as specified in Appendix 23-F, “Disconnected Impervious Area.”

Disturbed areas—unstabilized land area where an earth disturbance activity is occurring or has occurred.

Ditch—a man-made waterway constructed for irrigation or stormwater

conveyance purposes.

Drainage conveyance facility—a stormwater management facility designed to transport stormwater runoff that includes channels, streams, swales, pipes, conduits, culverts, and storm sewers, etc.

Drainage easement—a right granted by a landowner to a grantee, allowing the use of private land for stormwater management purposes.

Drainage permit—a permit issued by the Township after the SWM site plan has been approved.

Earth disturbance activity—a construction or other human activity that disturbs the surface of land, including, but not limited to, clearing and grubbing, grading, excavations, embankments, land development, agricultural plowing or tilling, timber harvesting activities, road maintenance activities, building construction, mineral extraction, and the moving, depositing, stockpiling, or storing of soil, rock or earth materials. As used in this Chapter, earth disturbance activity encompasses both new development and redevelopment.

Emergency spillway—a conveyance area that is used to pass the peak discharge of the maximum design storm controlled by the stormwater facility.

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

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

Erosion and sediment control plan—a site-specific plan identifying BMPs to minimize accelerated erosion and sedimentation. For agricultural plowing or tilling activities, the erosion and sediment control plan is that portion of a conservation plan identifying BMPs to minimize accelerated erosion and sedimentation.

Excavation—any act by which earth, sand, gravel, rock or any other similar material is cut into, dug, quarried, uncovered, removed, displaced or relocated and shall include the conditions resulting there from.

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

Existing conditions—the initial condition of a project site prior to the proposed alteration.

Existing recharge area—undisturbed surface area or depression where stormwater collects and a portion of which infiltrates and replenishes the groundwater.

Fill—any act by which earth, sand, gravel, rock or any other material is placed, pushed, dumped, pulled, transported or moved to a new location above the natural surface of the ground or on top of the stripped surface, including the conditions resulting there from; the difference in elevation between a point on the original ground and a designated point of higher elevation on the final grade; or the material used to make a fill.

Finished grade—the final vertical elevation of the ground after development.

Flood—a temporary condition of partial or complete inundation of land areas

from the overflow of streams, rivers, and other waters of the Commonwealth.

Floodplain or flood hazard area (or district)—that land within Northampton Township adjoining any stream or adjoining any pond or lake adopted and/or designated by the Northampton Township Board of Supervisors as derived from:

(1) The Flood Insurance Rate Map (FIRM), Township of Northampton, Pennsylvania, prepared by the Federal Insurance Administration of the Federal Emergency management Agency (FEMA), effective April 2, 2002, and any subsequent revisions.

(2) Floodplain soils, as identified in the Soil Survey of Bucks County, Pennsylvania, United States Department of Agriculture, Natural Resources Conservation Service; in cooperation with the Pennsylvania State University, College of Agricultural Sciences; the Pennsylvania Department of Environmental Protection; the Pennsylvania Department of Agriculture; and the Bucks County Conservation District, dated September 2002.

(3) The Builders' Association Floodplain Analysis as approved by FEMA.

Floodplain soil—soil in a current floodplain that has a flooding occurrence greater than none. Floodplain soils shall be the following soils so classified by the Soil Survey of Bucks County, Pennsylvania, United States Department of Agriculture, Natural Resources Conservation Service; in cooperation with the Pennsylvania State University, College of Agricultural Sciences; the Pennsylvania Department of Environmental Protection; the Pennsylvania Department of Agriculture; and the Bucks County Conservation District, dated September 2002:

- (1) Bowmansville-Knauers silt loam (Bo).
- (2) Delaware loam (DaA, DaB).
- (3) Fluvaquents (Fl).
- (4) Hatboro Silt Loam (Ha).
- (5) Holly silt loam (Ho).
- (6) Linden loam (U).
- (7) Nanticoke-Hatboro silt loam (Na).
- (8) Psamments (Ps).
- (9) Rowland silt loam (Ro).
- (10) Urban land, Occasionally flooded (Ufw).
- (11) Urban land, Delaware complex (UIB).

Floodway—the designated area of a floodplain required to carry and discharge floodwaters of the 100-year storm. In areas of the Township where no detailed flood profiles or elevations have been provided by the Flood Insurance Study, the Floodplain District shall include the approximate 100-year flood boundary as shown on the Flood Insurance Rate Map for the Township and land areas which contain soil characteristics indicative of flooding conditions, herein referred to as “floodplain soils.”

Forest management/timber operations—planning and associated activities necessary for the management of forestland. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets,

logging road design and construction, timber harvesting, and reforestation.

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

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

Ground cover—low-growing plant materials planted and growing in such a manner so as to conceal the earth surface.

Groundwater—water beneath the earth's surface that supplies wells and springs, and is often between saturated soil and rock.

Groundwater recharge—the replenishment of existing natural underground water supplies from rain or overland flow.

HEC-HMS—the U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC)-Hydrologic Modeling System (HMS). This model was used to model the Neshaminy Creek watershed during the Act 167 Plan development and was the basis for the standards and criteria of this Chapter.

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

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

Hydrologic regime—the hydrologic cycle or balance that sustains quality and quantity of stormwater, baseflow, storage, and groundwater supplies under natural conditions.

Hydrologic soil group—a classification of soils by the Natural Resources Conservation Service, formerly the Soil Conservation Service, into four runoff potential groups. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

Impervious surface—a surface that prevents the infiltration of water into the ground. Impervious surfaces include, but are not limited to, streets, sidewalks, pavement roofs, parking areas, or driveway areas. Any surface areas designed to be gravel or crushed stone shall be regarded as impervious surfaces. In addition, other areas determined by the Township Engineer to be impervious within the meaning of this definition will also be classified as impervious.

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

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

Infiltration—movement of surface water into the soil, where it is absorbed by

plant roots, evaporated into the atmosphere, or percolated downward to recharge groundwater.

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

Initial abstraction (Ia)—the value used to calculate the volume or peak rate of runoff in the soil cover complex method. It represents the depth of rain retained on vegetation plus the depth of rain stored on the soil surface plus the depth of rain infiltrated prior to the start of runoff.

Inlet—a surface connection to a closed drain, a structure at the diversion end of a conduit or the upstream end of any structure through which water may flow.

Intermittent stream—a stream that flows only part of the time. Flow generally occurs for several weeks or months in response to seasonal precipitation or groundwater discharge.

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

Land development—any of the following activities:

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

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

(2) A subdivision of land.

(3) Development in accordance with Article V, §503(1.1) of the Pennsylvania Municipalities Planning Code, Act of 1968, P.L. 805, No. 247, 53 P.S. §10503(1.1), as reenacted and amended.

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

Low impact development (LID) practices—practices that will minimize proposed conditions runoff rates and volumes, which will minimize needs for artificial conveyance and storage facilities.

Main stem (main channel)—any stream segment or other runoff conveyance used as a reach in the Neshaminy Creek hydrologic model.

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.

Municipal engineer—a professional engineer licensed as such in the Commonwealth of Pennsylvania, duly appointed as the engineer for Northampton Township.

Municipality—Northampton Township, Bucks County, Pennsylvania.

Natural hydrologic regime—see “hydrologic regime.”

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

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

Nonstructural best management practice (BMP)—methods of controlling stormwater runoff quantity and quality, such as innovative site planning, impervious area and grading reduction, protection of natural depression area, temporary ponding onsite and other techniques.

NPDES—National Pollutant Discharge Elimination System, the Federal government’s system for issuance of permits under the Clean Water Act, which is delegated to PADEP in Pennsylvania.

NRCS—Natural Resource Conservation Service (previously Soil Conservation Service).

Outfall—“point source” as described in 40 CFR §122.2 at the point where the Township’s storm sewer system discharges to surface waters of the Commonwealth.

Outlet—points of water disposal to or from a stream, river, lake, tidewater or artificial drain.

Parent tract—the parcel of land from which a land development or subdivision originates, determined from the date of municipal adoption of this Chapter.

Peak discharge—the maximum rate of stormwater runoff from a specific storm event.

Penn State Runoff Model (PSRM)—the computer-based hydrologic model developed at the Pennsylvania State University.

Perennial stream—a stream which contains water at all times except during extreme drought.

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

Planning Commission—the Planning Commission of Northampton Township, Bucks County.

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.

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

Predevelopment—see “existing condition.”

Pretreatment—techniques employed in stormwater BMPs to provide storage or filtering to trap coarse materials and other pollutants before they enter the system, but not necessarily designed to meet the volume requirements of this Chapter.

Pervious surface—a surface that allows the infiltration of water into the ground.

Project site—the specific area of land where any regulated activities in the Township are planned, conducted or maintained.

Qualified professional—any person licensed by the Pennsylvania Department of State or otherwise qualified by law to perform the work required by this Chapter.

Rational method—a rainfall-runoff relation used to estimate peak flow.

Recharge—the replenishment of groundwater through the infiltration of rainfall, other surface waters, or land application of water or treated wastewater.

Redevelopment—any development that requires demolition or removal of existing structures or impervious surfaces at a site and replacement with new impervious surfaces. Maintenance activities such as top-layer grinding and repaving are not considered to be redevelopment. Interior remodeling projects and tenant improvements are also not considered to be redevelopment. Utility trenches in streets are not considered redevelopment.

Regulated activities—any earth disturbance activities or any activities that involve the alteration or development of land in a manner that may affect stormwater runoff.

Regulated earth disturbance activity—activity involving earth disturbance subject to regulation under 25 Pa.Code, Chapter 92, 25 Pa.Code, Chapter 102, or the Clean Streams Law, 35 P.S. §691.1 *et seq.*

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

Retention basin—a structure in which stormwater is stored and designed to infiltrate into the ground. Retention basins are designed for infiltration purposes. The retention basin must infiltrate stored water in 4 days or less.

Retention volume / removed runoff—the volume of runoff that is captured and not released directly into the surface waters of the Commonwealth during or after a storm event.

Return period—the probability an event will occur in any given year. Typically displayed as a whole number, e.g., 25-year event, and represents the inverse of the frequency of that event. For example, the 25-year return period rainfall gives the probability, $1/_{25}$ or 4 percent, which that size storm will occur in any given year.

Road maintenance—earth disturbance activities within the existing road cross-section, such as grading and repairing existing unpaved road surfaces, cutting road banks, cleaning or clearing drainage ditches and other similar activities.

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

Runoff—any part of precipitation that flows over the land surface.

Runoff coefficient—that portion of a total volume of water which can be expected to flow off a particular surface.

SALDO—Subdivision and Land Development Ordinance [Chapter 22].

Sediment—soils or other materials transported by surface water as a product of erosion.

Sediment basin—a barrier, dam, retention or detention basin located and

designed to retain rock, sand, gravel, silt, or other material transported by water.

Sediment pollution—the placement, discharge or any other introduction of sediment into the waters of the Commonwealth occurring from the failure to design, construct, implement or maintain control measures and control facilities in accordance with the requirements of this Chapter.

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

Seepage pit / seepage trench—an area of excavated earth filled with loose stone or similar coarse material, into which surface water is directed for infiltration into the ground.

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

Shallow concentrated flow—stormwater runoff flowing in shallow, defined ruts prior to entering a defined channel or waterway.

Sheet flow—runoff that flows over the land as a thin broad, shallow water movement on sloping ground surfaces that is not channelized or concentrated.

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

Source water protection areas (SWPA)—the zone through which contaminants, if present, are likely to migrate and reach a drinking water well or surface water intake.

Special protection subwatersheds—watersheds that have been designated in Pennsylvania Code Title 25, Environmental Protection, Chapter 93, Water Quality Standards, as exceptional value (EV) or high quality (HQ) waters.

State water quality requirements—the regulatory requirements to protect, maintain, reclaim, and restore water quality under Title 25 of the Pennsylvania Code and the Clean Streams Law, 35 P.S. §691.1 *et seq.*

Storm frequency—the number of times that a given storm “event” occurs or is exceeded on the average in a stated period of years. See “return period.”

Storm sewer—a system of pipes and/or open channels that convey intercepted runoff and stormwater from other sources, but exclude domestic sewage and industrial wastes.

Stormwater—the surface runoff generated by precipitation reaching the ground surface.

Stormwater management best management practices—is abbreviated as BMPs or SWM BMPs throughout this Chapter.

Stormwater management facility—any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff quality, rate or quantity. Typical stormwater management facilities include, but are not limited to, detention and retention basins, open channels, storm sewers, pipes, and infiltration structures.

Stormwater Management Plan—the watershed plan, known as the “Neshaminy Creek Watershed Act 167 Stormwater Management Plan,” for managing those land use activities that will influence stormwater runoff quality and quantity and that would impact the Neshaminy Creek Watershed adopted by Bucks and Montgomery Counties as required by the Act of October 4, 1978, P.L. 864 (Act 167), 32 P.S. §680.1 *et seq.*

Stormwater management site plan (SWM site plan)—the plan prepared by the applicant or his representative indicating how stormwater runoff will be managed at the particular site of interest according to this Chapter.

Stream—a flow of water in a natural channel or bed, as a brook, rivulet, or a small river.

Stream buffer—the land area adjacent to each side of a stream, essential to maintaining water quality. (See “buffer.”)

Stream enclosure—a bridge, culvert, or other structure in excess of 100 feet in length upstream to downstream which encloses a regulated water of the Commonwealth.

Streambank erosion—the widening, deepening, or headward cutting of channels and waterways, caused by stormwater runoff or bankfull flows.

Subarea (subwatershed)—the smallest drainage unit of a watershed for which stormwater management criteria have been established in the Stormwater Management Plan.

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

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

Swale—a low lying stretch of land that gathers or carries surface water runoff.

Timber operations—see “forest management.”

Time-of-concentration (Tc)—the time required for surface runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. This time is the combined total of overland flow time, concentrated flow time, and flow time in pipes or channels, if any. The time of concentration flow path must be approved by the Township Engineer.

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

Tree drip line—a boundary line marking the outer edges of the branches of a

tree.

Tree protection zone—an area 15 feet radially from the trunk of the tree to be retained, or the distance from the trunk to the tree dripline, whichever is greater, in which no construction activity shall occur. Where there is a group of trees or woodlands, the tree protection zone shall be the aggregate of the protection zones for the individual trees.

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

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

Watercourse—a channel or conveyance of surface water such as a stream or creek having a defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

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

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

Wet basin—pond for urban runoff management that is designed to detain urban runoff and always contains water.

Wetland—those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, fens, and similar areas. The term includes but is not limited to wetland areas listed in the State Water Plan, the United States Forest Service Wetlands Inventory of Pennsylvania, the Pennsylvania Coastal Zone Management Plan and wetland areas designated by a river basin commission.

(Ord. 559, 7/27/2011, §113-11)

Part 3**Stormwater Management****§23-301. General Requirements.**

1. Applicants proposing regulated activities in Northampton Township that do not fall under the exemption criteria shown in §23-106 shall submit a stormwater management (SWM) site plan consistent with this Chapter to the Township for review. The SWM criteria of this Chapter shall apply to the total proposed development even if development is to take place in stages. Preparation and implementation of an approved SWM site plan is required. No regulated activities shall commence until the Township issues written approval of a SWM site plan, which demonstrates compliance with the requirements of this Chapter.

2. SWM site plans approved by the Township shall be on-site throughout the duration of the regulated activity.

3. The Township may, after consultation with the Department of Environmental Protection (PADEP), approve measures for meeting the State water quality requirements other than those in this Chapter, provided that they meet the minimum requirements of, and do not conflict with, State law including, but not limited to, the Clean Streams Law, 35 P.S. §691.1 *et seq.*

4. For all regulated earth disturbance activities, erosion and sediment (E&S) control best management practices (BMPs) shall be designed, implemented, operated, and maintained during the regulated earth disturbance activities to meet the purposes and requirements of this Chapter and to meet all requirements under Title 25 of the Pennsylvania Code and the Clean Streams Law, 35 P.S. §691.1 *et seq.* Various BMPs and their design standards are listed in the *Erosion and Sediment Pollution Control Program Manual*, (April 15, 2000), as amended and updated.

5. For all regulated activities, implementation of the volume controls as listed in this Chapter is required.

6. *Impervious Areas.*

A. The measurement of impervious areas shall include all of the impervious areas in the total proposed development even if development is to take place in stages.

B. For development taking place in stages, the entire development plan must be used in determining conformance with this Chapter.

C. For projects that add impervious area to a parcel, the total impervious area on the parcel is subject to the requirements of this Chapter.

7. Stormwater flows onto adjacent property shall not be altered without written notification of the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of this Chapter.

8. All regulated activities shall include such measures as necessary to:

A. Protect health, safety, and property.

B. Meet the water quality goals of this Chapter by implementing measures

to:

- (1) Minimize disturbance to floodplains, wetlands, and wooded areas.
- (2) Create, maintain, repair or extend riparian buffers.
- (3) Avoid erosive flow conditions in natural flow pathways.
- (4) Minimize thermal impacts to waters of this Commonwealth.
- (5) Disconnect impervious surfaces (i.e., disconnected impervious areas, DIAs) by directing runoff to pervious areas, wherever possible. See Appendix 23-F for detail on DIAs.

C. To the maximum extent practicable, incorporate the techniques for low impact development practices (e.g., protecting existing trees, reducing area of impervious surface, cluster development, and protecting open space) described in the *Pennsylvania Stormwater Best Management Practices Manual*, Pennsylvania Department of Environmental Protection (PADEP) (2006), as updated and amended. See Appendix 23-E for a summary description.

9. Infiltration BMPs should be spread out, made as shallow as practicable, and located to maximize the use of natural on-site infiltration features while still meeting the other requirements of this Chapter.

10. The design of all facilities over karst shall include an evaluation of measures to minimize the risk of adverse effects.

11. Storage facilities should completely drain both the volume control and rate control capacities over a period of time not less than 24 and not more than 72 hours from the end of the design storm.

12. The design storm volumes to be used in the analysis of peak rates of discharge should be obtained from the *Precipitation-Frequency Atlas of the United States*, Atlas 14, Volume 2, Version 3.0, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland.

13. Areas of existing diffused drainage discharge, whether proposed to be concentrated or maintained as diffused drainage areas, shall be subject to any applicable discharge criteria in the general direction of existing discharge, except as otherwise provided by this Chapter. If diffused drainage discharge is proposed to be concentrated and discharged onto adjacent property, the applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other impacts will result from the concentrated discharge.

14. For all regulated activities, SWM BMPs shall be designed, implemented, operated, and maintained to meet the purposes and requirements of this Chapter and to meet all requirements under Title 25 of the Pennsylvania Code, the Clean Streams Law, 35 P.S. §691.1 *et seq.*, and the Storm Water Management Act, 32 P.S. §680.1 *et seq.*

(Ord. 559, 7/27/2011, §113-12)

§23-302. Permit Requirements by Other Governmental Entities.

The following permit requirements may apply to certain regulated earth

disturbance activities, and must be met prior to commencement of regulated earth disturbance activities, as applicable:

A. All regulated earth disturbance activities subject to permit requirements by DEP under regulations at 25 Pa.Code, Chapter 102.

B. Work within natural drainage ways subject to permit by DEP under 25 Pa.Code, Chapter 105.

C. Any stormwater management facility that would be located in or adjacent to surface waters of the Commonwealth, including wetlands, subject to permit by DEP under 25 Pa.Code, Chapter 105.

D. Any stormwater management facility that would be located on a State highway right-of-way, or require access from a State highway, shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).

E. Culverts, bridges, storm sewers or any other facilities, which must pass or convey flows from the tributary area and any facility which may constitute a dam subject to permit by DEP under 25 Pa.Code, Chapter 105.

(Ord. 559, 7/27/2011, §113-13)

§23-303. Erosion and Sedimentation Control During Regulated Activities.

1. No regulated earth disturbance activities within Northampton Township shall commence until Northampton Township approves an erosion and sediment control plan for construction activities.

2. DEP has regulations that require an erosion and sediment control plan for any earth disturbance activity of 5,000 square feet or more, under Title 25, Pa.Code. The Bucks County Conservation District requires their approval of an erosion and sedimentation control plan for any earth disturbance activity of 1,000 square feet or more.

3. In addition, under 25 Pa.Code, Chapter 102.5, a DEP “NPDES permit for stormwater discharges associated with construction activities” permit is required for any earth disturbance activity that involves equal to or greater than 1 acre of earth disturbance prior to commencing the earth disturbance activity, this includes earth disturbance on any portion, part or during any stage of a larger common plan of development or sale.

4. Detailed construction schedules shall be included in all erosion and sedimentation plans and stormwater management plan reviews by the Bucks County Conservation District.

5. Evidence of any necessary permit(s) for regulated earth disturbance activities from the appropriate DEP regional office or the Bucks County Conservation District must be provided to Northampton Township. The issuance of an NPDES permit for stormwater discharges associated with construction activities or permit under the Statewide general permit (PAG-2) satisfies the requirements of subsection .1.

6. A copy of the erosion and sediment control plan and any required permit, as required by DEP regulations, shall be available on the project site at all times.

7. Additional erosion and sediment control design standards and criteria are recommended to be applied where infiltration BMPs are proposed. They shall include

the following:

A. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain maximum infiltration capacity. Barriers such as construction fencing should be used to protect and keep construction traffic out of the area where infiltration BMPs are proposed. Inlet or pipes that are installed to these systems should be completely sealed or protected and monitored until the drainage areas are completely stabilized.

B. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has achieved final stabilization, or as approved by the engineer.

(Ord. 559, 7/27/2011, §113-14)

§23-304. Volume Control.

1. Volume controls will mitigate increased runoff impacts, protect stream channel morphology, maintain groundwater recharge, and contribute to water quality improvements. Stormwater runoff volume control methods are based on the net change in runoff volume for the 2-year storm event.

2. Volume controls shall be implemented using the design storm method in paragraph .A or the simplified method in paragraph .B below. For regulated activities equal to or less than 1 acre, this Chapter establishes no preference for either methodology; therefore, the applicant may select either methodology on the basis of economic considerations, the intrinsic limitations of the procedures associated with each methodology, and other factors. All regulated activities greater than 1 acre must use the design storm method.

A. *Design Storm Method* (any regulated activity). This method requires detailed modeling based on site conditions. For modeling assumptions refer to §23-306.1.

(1) Post-development total runoff should not be increased from pre-development total runoff for all storms equal to or less than the 2-year 24-hour duration precipitation.

(2) The following applies in order to estimate the increased volume of runoff for the 2-year 24-hour duration precipitation event:

To calculate the runoff volume (cubic feet) for existing site conditions (pre-development) and for the proposed developed site conditions (post-development), it is recommended to use the soil cover complex method as shown on the following page. Table 23-B-3 in Appendix 23-B is available to guide a qualified professional and/or an applicant to calculate the stormwater runoff volume. The calculated volume shall be either reused, evapotranspired, or infiltrated through structural or nonstructural means.

Soil Cover Complex Method:

$$\text{Step 1: Runoff (in)} = Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \text{ where}$$

P = 2-year Rainfall (in)

$$S = \left(\frac{1000}{CN} \right) - 10, \text{ the potential maximum retention (including initial abstraction, } I_a)$$

Step 2: Runoff Volume (Cubic Feet) = Q x Area x 1/12

Q = Runoff (in)

Area = SWM Area (sq ft)

B. *Simplified Method* (regulated activities less than or equal to 1 acre):

(1) Stormwater facilities shall capture the runoff volume from at least the first 2 inches of runoff from all new impervious surfaces.

Volume (cubic feet) = (2" runoff / 12 inches) * impervious surface (sq ft)

(2) At least the first 1 inch of runoff volume from the new impervious surfaces shall be permanently removed from the runoff flow—i.e., it shall not be released into the surface waters of the Commonwealth. The calculated volume shall be either reused, evapotranspired or infiltrated through structural or nonstructural means.

Volume (cubic feet) = (1" runoff / 12 inches) * impervious surface (sq ft)

(3) Infiltration facilities should be designed to accommodate the first 0.5 inch of the permanently removed runoff.

(4) No more than 1 inch of runoff volume from impervious surfaces shall be released from the site. The release time must be over 24 to 72 hours.

C. *Stormwater Control Measures*. The applicant must demonstrate how the required volume is controlled through stormwater best management practices (BMPs) which shall provide the means necessary to capture, reuse, evaporate, transpire or infiltrate the total runoff volume.

(1) If natural resources exist on the site, the applicant is required to submit a SWM site plan shall determine the total acreage of protected area where no disturbance is proposed. The acreage of the protected area should be subtracted from the total site area and not included in the stormwater management site area acreage used in determining the volume controls.

**Stormwater Management Site Area =
{Total Site Area (for both pre and post development conditions) - Protected Area}**

Natural resource areas should be calculated based upon the Township's own natural resource protection standards. See Table 23-B-2 in Appendix 23-B for guidance to assess the total protected area. For additional reference see Chapter 5, §5.4.1, of the PA BMP Manual.

(2) Calculate the volume controls provided through nonstructural BMPs. Table 23-B-5 in Appendix 23-B is recommended as guidance.

(3) Volume controls provided through nonstructural BMPs should be subtracted from the required volume to determine the necessary structural

BMPs.

$$\text{Required Volume Control (ft}^3\text{)} - \text{Nonstructural Volume Control (ft}^3\text{)} = \text{Structural Volume Requirement (ft}^3\text{)}$$

(4) Calculate the volume controls provided through structural BMPs. Table 23-B-6 in Appendix 23-B is recommended as guidance. See PA BMP Manual, Chapter 6, for description of the BMPs.

(5) Infiltration BMPs intended to receive runoff from developed areas shall be selected based on the suitability of soils and site conditions (see Table 23-B-6 in Appendix 23-B for a list of infiltration BMPs). Infiltration BMPs shall be constructed on soils that have the following characteristics:

(a) A minimum soil depth of 24 inches between the bottom of the infiltration BMPs and the top of bedrock or seasonally high water table.

(b) An infiltration rate sufficient to accept the additional stormwater load and dewater completely as determined by field tests. A minimum of 0.2 inches/hour (in/hr) should be utilized and for acceptable rates a safety factor of 50 percent should be applied for design purposes (e.g., for soil which measured 0.4 in/hr, the BMP design should use 0.2 in/hr to insure safe infiltration rates after construction).

(c) All open-air infiltration facilities shall be designed to completely infiltrate runoff volume within 3 days (72 hours) from the start of the design storm.

(6) *Soils.* A soils evaluation of the project site shall be required to determine the suitability of infiltration facilities. All regulated activities are required to perform a detailed soils evaluation by a qualified design professional which at minimum address soil permeability, depth to bedrock, and subgrade stability. The general process for designing the infiltration BMP shall be:

(a) Analyze hydrologic soil groups as well as natural and man-made features within the site to determine general areas of suitability for infiltration practices. In areas where development on fill material is under consideration, conduct geotechnical investigations of sub-grade stability; infiltration may not be ruled out without conducting these tests.

(b) Provide field tests such as percolation tests, double ring infiltrometer or hydraulic conductivity tests (at the level of the proposed infiltration surface) to determine the appropriate hydraulic conductivity rate.

(c) Design the infiltration structure based on field determined capacity at the level of the proposed infiltration surface and based on the safety factor of 50 percent.

(d) If on-lot infiltration structures are proposed, it must be demonstrated to the Township that the soils are conducive to infiltrate on the lots identified.

(e) An impermeable liner will be required in detention basins where the possibility of groundwater contamination exists. A detailed

hydrogeologic investigation may be required by the Township.
(Ord. 559, 7/27/2011, §113-15)

§23-305. Stormwater Peak Rate Control and Management Districts.

1. Standards for managing runoff in Northampton Township for the 2-, 5-, 10-, 25-, 50-, and 100-year design storms are shown in Table 23-305.1. Northampton Township only contains Watershed District B in the Neshaminy Creek Watershed Act 167 Stormwater Management Plan. Development sites must control proposed development conditions runoff rates to existing conditions runoff rates for the design storms in accordance with Table 23-305.1.

Table 23-305.1
Peak Rate Runoff Control Standards by Stormwater Management Districts
In the Neshaminy Creek Watershed
(includes Little Neshaminy Creek)

District	Design Storm Postdevelopment (Proposed Conditions)	Design Storm Predevelopment (Existing Conditions)
B	2-year	1-year
	5-year	2-year
	10-year	5-year
	25-year	10-year
	50-year	25-year
	100-year	50-year

2. *General.* Proposed conditions rates of runoff from any regulated activity shall not exceed the peak release rates of runoff from existing conditions for the design storms specified on the Peak Rate Control Management District Map (Appendix 23-D) and in this Section of this Chapter.

3. *District Boundaries.* The boundaries of the Stormwater Management Districts are shown on official maps and are available for inspection at the Township office and County planning offices. A copy of the map is included in Appendix 23-D. 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 2-foot topographic contours (or most accurate data required) provided as part of the SWM site plan.

4. *Sites Located in More than One District.* For a proposed development site located within two or more stormwater management district category subareas, the peak discharge rate from any subarea shall meet the management district criteria for the district in which the discharge is located.

5. *Off-Site Areas.* When calculating the allowable peak runoff rates, developers do not have to account for runoff draining into the subject development site from an off-site area. On-site drainage facilities shall be designed to safely convey off-site flows through the development site.

6. *Site Areas.* The stormwater management site area is the only area subject to the management district criteria. Non-impacted areas or non-regulated activities bypassing the stormwater management facilities would not be subject to the

management district criteria.

7. *Alternate Criteria for Redevelopment Sites.* For redevelopment sites, one of the following minimum design parameters shall be accomplished, whichever is most appropriate for the given site conditions as determined by Northampton Township:

- A. Meet the full requirements specified by Table 23-305.1 and subsection .1 through .6; or,
- B. Reduce the total impervious surface on the site by at least 20 percent based upon a comparison of existing impervious surface to proposed impervious surface.

(Ord. 559, 7/27/2011, §113-16)

§23-306. Calculation Methodology.

1. The following criteria shall be used for runoff calculations:

A. For development sites not considered redevelopment, the ground cover used to determine the existing conditions runoff volume and flow rate shall be as follows:

(1) Wooded sites shall use a ground cover of “woods in good condition.” A site is classified as wooded if a continuous canopy of trees exists over a ¼ acre.

(2) The undeveloped portion of the site including agriculture, bare earth, and fallow ground shall be considered as “meadow in good condition,” unless the natural ground cover generates a lower curve number (CN) or rational “c” value (i.e., woods) as listed in Tables 23-B-4 or 23-B-7 in Appendix 23-B of this Chapter.

B. For development and redevelopment sites, the ground cover used to determine the existing conditions runoff volume and flow rate for the developed portion of the site shall be based upon actual land cover conditions. If the developed site contains impervious surfaces, 20 percent of the impervious surface area shall be considered meadow in the model for existing conditions.

2. Stormwater runoff peak discharges from all development sites with a drainage area equal to or greater than 200 acres shall be calculated using a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 23-306.1 summarizes acceptable computation methods. The method selected by the design professional shall be based on the individual limitations and suitability of each method for a particular site. The Township may allow the use of the rational method ($Q=CIA$) to estimate peak discharges from drainage areas that contain less than 20 acres.

Q = Peak flow rate, cubic feet per second (CFS)

C = Runoff coefficient, dependent on land use/cover

I = Design rainfall intensity, inches per hour

A = Drainage area, acres.

3. All calculations consistent with this Chapter using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms according to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 rain data corresponding to the Doylestown rain gage, seen in Table 23-B-1 in Appendix 23-B. The SCS Type II rainfall curve from NOAA is found on Figure 23-B-1 in Appendix 23-B. If a hydrologic computer model such as PSRM or HEC-1/HEC-HMS

is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours.

4. All calculations using the rational method shall use rainfall intensities consistent with appropriate times-of-concentration for overland flow and return periods from NOAA Atlas 14, Volume 2 Version 2.1. Times-of-concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of *Urban Hydrology for Small Watersheds*, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times-of-concentration for channel and pipe flow shall be computed using Manning's equation.

5. Runoff curve numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be based on Table 23-B-4 in Appendix 23-B.

Table 23-306.1
Acceptable Computation Methodologies For
Stormwater Management Plans

METHOD	METHOD DEVELOPED BY	APPLICABILITY
TR-20 (or commercial computer package based on TR-20)	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary.
TR-55 (or commercial computer package based on TR-55)	USDA NRCS	Applicable for land development plans within limitations described in TR-55.
HEC-1/HEC-HMS	U.S. Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
PSRM	Penn State University	Applicable where use of a hydrologic computer model is desirable or necessary; simpler than TR-20 or HEC-1.
Rational method (or commercial computer package based on rational method)	Emil Kuichling (1889)	For sites less than 20 acres, or as approved by the Township and/or Township Engineer.
Other methods	Varies	Other computation methodologies approved by the Township and/or Township Engineer.

6. Runoff coefficients (C) for both existing and proposed conditions for use in the rational method shall be consistent with Table 23-B-7 in Appendix 23-B.

7. Runoff from proposed sites graded to the subsoil will not have the same runoff conditions as the site under existing conditions because of soil compaction, even after top-soiling or seeding. The proposed condition "CN" or "C" shall increase by 5 percent to better reflect proposed soil conditions.

8. The Manning equation is preferred for one-dimensional, gradually-varied, open channel flow. In other cases, appropriate, applicable methods should be applied, however, early coordination with the Township is necessary.

9. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Chapter using the generally accepted hydraulic

analysis technique or method.

10. The design of any stormwater detention facilities intended to meet the performance standards of this Chapter shall be verified by routing the design storm hydrograph through these facilities using the storage-indication method. For drainage areas greater than 200 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Township may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

(Ord. 559, 7/27/2011, §113-17)

Part 4**Stormwater Management (SWM) Site Plan Requirements****§23-401. General Requirements.**

For any of the activities regulated by this Chapter, the final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, the commencement of any earth disturbance, or activity may not proceed until the property owner or applicant or his/her agent has received written approval of a SWM site plan from Northampton Township and an approval of an erosion and sediment (E&S) control plan review from Northampton Township and/or the County Conservation District. (Ord. 559, 7/27/2011, §113-18)

§23-402. SWM Site Plan Requirements.

The SWM site plan shall consist of a general description of the project, including calculations, maps, and plans. A note on the maps shall refer to the associated computations and E&S control plan by title and date. The cover sheet of the computations and E&S control plan shall refer to the associated maps by title and date. All SWM site plan materials shall be submitted to the Township in a format that is clear, concise, legible, neat, and well organized; otherwise, the SWM site plan shall not be accepted for review and shall be returned to the applicant.

The following items shall be included in the SWM site plan:

A. General.

- (1) General description of the project including plan contents.
- (2) General description of proposed SWM techniques to be used for SWM facilities.
- (3) Complete hydrologic and hydraulic computations for all SWM facilities.
- (4) All reviews and letters of adequacy from the Conservation District for the erosion and sedimentation plan as required by Township, County or State regulations.
- (5) A general description of proposed nonpoint source pollution controls.
- (6) The SWM site plan application and associated fee for all regulated activities not already paying fees under the SALDO regulations.
- (7) The SWM site plan checklist.
- (8) Appropriate sections from the Township's Subdivision and Land Development Ordinance [Chapter 22], and other applicable local ordinances, shall be followed in preparing the SWM site plan.

B. Plans. SWM site plan shall provide the following information:

- (1) The overall stormwater management concept for the project.
- (2) A determination of natural site conditions and stormwater management needs. This shall include, but not be limited to:

(a) *Site Features.*

- 1) The location of the project relative to highways, municipal boundaries or other identifiable landmarks.
- 2) The locations of all existing and proposed utilities, sanitary sewers, on-site septic systems, wells, stormwater BMPs and water lines on site and within 50 feet of property lines.
- 3) Proposed structures, roads, paved areas, and buildings and other impervious areas; and the listing of the total amount of impervious surfaces and total land disturbance.
- 4) The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
- 5) Plan, profile and cross-section drawings of all SWM BMP's, including drainage structures, pipes, open channels, and swales. At a minimum this should include pre- and post-drainage area maps, including drainage areas to each inlet or structure, an overall post construction stormwater management plan, stormwater details sheets, and landscape plans (if proposing a rain garden, bio-retention facilities, low impact development, or vegetative basins) or as required in the SALDO [Chapter 22].
- 6) The location of all erosion and sediment control facilities.
- 7) Alterations to the land surface and vegetative cover.
- 8) Locations and details of retaining walls.

(b) *Natural Site Conditions.*

- 1) Natural features within the subject site and within one-hundred (100) feet of any boundary of the site including, but not limited to:
 - a) Steep slopes.
 - b) Ponds.
 - c) Lakes.
 - d) Streams.
 - e) Wetlands.
 - f) Hydric soils.
 - g) Hydrologic soil groups A and B.
 - h) Vernal pools.
 - i) Stream buffers.
 - j) Open channels.
 - k) Existing recharge areas.
 - l) Floodplains.
 - m) Prominent land forms, underlying geologic formations and sinkholes.
 - n) Woodlands and natural vegetation areas.

- 2) A detailed site evaluation for projects proposed in areas of frequent flooding, karst topography, and other environmentally sensitive areas, such as brownfield areas and source water protection areas.
 - 3) Existing and proposed contour lines (2 ft).
 - 4) The total extent of the drainage area upstream from the site and all down gradient receiving channels, swales and waters to which stormwater runoff or drainage will be discharged.
- (c) The effect of the project (in terms of runoff volumes, water quality, and peak flows) on surrounding properties and aquatic features and on any existing stormwater conveyance system that may be affected by the project.
- (3) The format of the plan shall include the following:
- (a) The expected project time schedule.
 - (b) The name of the development, the name and address of the owner and/or equitable owner of the property, and the name of the individual or firm preparing the plan.
 - (c) The tax map parcel number and the address of the site.
 - (d) The date of submission.
 - (e) A graphic and written scale of 1 inch equals no more than 50 feet.
 - (f) A north arrow.
 - (g) The size of the plan shall be 11 inches by 17 inches only for plans that are not part of a subdivision or land development submission, 24 inches by 36 inches or 30 inches by 42 inches.
 - (h) An access easement around all stormwater management facilities is required that would provide ingress to and egress from a public right-of-way. The size of the easement shall commensurate with the maintenance and access requirements determined in the design of the BMP and approved by the Township Engineer.
 - (i) A location map showing the relation of the project site to adjoining properties, streets, Township boundaries or other identifiable landmarks.
 - (j) A key map showing all existing man-made features beyond the property boundary that would be affected by the project.
 - (k) All proposed landscape and vegetative BMP measures, including a planting, schedule indicating the locations, species and sizes of plantings and seeding as may be required, including seeding mixes and rates.
 - (l) A note on the plan indicating the location and a description of how each stormwater management facility will be operated and maintained and the identity and contact information with the persons responsible for the operation and maintenance. All facilities shall meet the performance standards and design criteria specified in this Chapter.
 - (m) The name and address of the individual or firm preparing the plan and if required, the name, address and seal of the registered,

professional engineer responsible for the preparation of the plan.

(n) The following signature block for the design engineer: “I, (Design Engineer), on this date (date of signature), hereby certify that the SWM site plan meets all design standards and criteria of the Northampton Township Stormwater Management Ordinance.”

(o) A statement, signed by the applicant or site owner, acknowledging that any revision to the approved SWM site plan must be approved by the Township and that a revised E&S plan may be required to be submitted to the Conservation District. The statement should also include a note acknowledging that the stormwater BMPs are fixtures that cannot be altered or removed unless approved by the Township.

(p) A detailed plan of all required off-site improvements.

(4) A soil erosion and sediment control plan, where applicable, as prepared for and submitted to Northampton Township and the Bucks County Conservation District.

(5) The SWM site plan shall include an operations & maintenance (O&M) plan for all existing and proposed stormwater management facilities.

C. *Calculations.* The following information should be included in the stormwater report and calculations:

(1) A general description of the proposed development.

(2) A general description of temporary and permanent accelerated erosion control.

(3) A general description of temporary and permanent sediment control.

(4) A general description of stormwater management both during and after development.

(5) A study of the watershed including plans in which the site is located to assess the impact the proposal will have on downstream conditions.

(6) Computations of the stormwater runoff for all points of runoff concentration before and after development, including:

(a) The design computations for the stormwater drainage systems, including storm drain pipes and inlets, runoff control measures, volume control measures, BMPs and culverts and drainage channels.

(b) Computations of the stormwater runoff before, during and after construction, including all supporting material.

(c) The flood routing and/or storage requirement calculations.

(d) A stage-storage curve for the detention/retention/wet basin.

(7) The estimate development schedule for the site, including:

(a) Stripping and/or clearing.

(b) Rough grading and installation of erosion and sediment control facilities and practices.

(c) Installation of improvements, including streets, underground utilities, buildings, driveways, parking areas, stormwater BMPs and other

structures and facilities.

(d) Final grading and vegetative establishment, including program of operations for conversion of erosion and sediment controls to permanent stormwater management facilities.

(8) A statement describing temporary control measures and facilities to be used during earthmoving.

(9) A permanent stormwater management program.

(a) A statement regarding conformance with requirements of this Chapter, including BMPs.

(b) Types, locations, dimensioned details and specifications of stormwater management facilities and BMPs, including detailed plans of all required off-site improvements.

(c) Design considerations and calculations supporting the stormwater management program.

(d) Establishment of permanent vegetation or other soil stabilization measures, including:

- 1) All landscape and vegetative BMP measures.
- 2) Seeding mixes and rates.
- 3) Mowing rates, if applicable.

(e) The location and legal descriptions of rights-of-way, easements or land offered for dedication related to the management of stormwater.

(10) Maintenance procedures and ownership arrangements for temporary and permanent stormwater management facilities, including BMPs.

(11) For detention basins, the following information shall be submitted:

(a) General description of proposed facilities and the operation of the runoff control measures.

(b) A sketch of the berm embankment and outlet structure, indicating the embankment top elevation, embankment side slopes, top width of embankment, slope of basin floor, emergency spillway elevation, outlet structure dimensions and elevations, outlet pipe size and length, cut-off trench location and dimensions, dimensions and spacing of anti-seep collars and if required, temporary riser location and dimensions.

(c) Design computations of the outlet pipe and outlet structure.

(d) A plot of the stage/storage (acre/feet versus elevation) and all supporting computations.

(e) Flood routing computations and hydrographs for all required storms.

(f) Time of concentration and curve number computations.

(g) A detailed plan of the trash rack and anti-vortex device, if required.

(Ord. 559, 7/27/2011, §113-19)

§23-403. Plan Submission.

The Township requires submission of a complete SWM site plan, as specified in this Chapter.

A. Proof of application or documentation of required permit(s) or approvals for the programs listed below shall be part of the plan:

- (1) NPDES permit for stormwater discharges from construction activities.
- (2) DEP joint permit application.
- (3) PennDOT highway occupancy permit.
- (4) Chapter 105 (Dam Safety and Waterway Management).
- (5) Chapter 106 (Floodplain Management).
- (6) Any other permit under applicable State or Federal regulations.

B. The plan shall be coordinated with the State and Federal permit process and the Northampton Township SALDO review process. For regulated activities requiring permits from Pennsylvania DEP or the U.S. Army Corps of Engineers, the applicant shall make all submittals directly to the agency with all required submittal documents and fees. Proof of application or documentation of required permit(s) and approvals must be submitted as part of the plan.

C. For regulated activities the stormwater management site plan shall be submitted by the developer to the Zoning/Code Enforcement Officer either as part of the preliminary plan submission for the subdivision or land development or as a SWM site plan application for any other regulated activity.

D. Five copies of the stormwater management site plan shall be submitted. Distribution of the stormwater management site plan shall be made by the Zoning/Code Enforcement Officer, as follows:

- (1) Four copies to the Township Engineer.
- (2) One copy to the Zoning/Code Enforcement Officer accompanied by the requisite Township review fee and escrow specified in this Chapter.

E. Additional copies shall be submitted as requested by the Township, County or DEP. All stormwater management site plans submitted as part of a subdivision or land development shall follow the submission requirements of the SALDO [Chapter 22].

F. The applicant shall make submissions to the Bucks County Planning Commission and/or the Bucks County Conservation District, as required.

G. Any submissions to the agencies listed above that are found to be incomplete shall not be accepted for review and shall be returned to the applicant with a notification in writing of the specific manner in which the submission is incomplete.

(Ord. 559, 7/27/2011, §113-20)

§23-404. Stormwater Management (SWM) Site Plan Review.

1. The Township Engineer shall review the stormwater management site plan for consistency with this Chapter. Any found incomplete shall not be accepted for review and shall be returned to the applicant.

2. The Township Engineer shall review the stormwater management site plan for any subdivision or land provisions not otherwise superseded by this Part.

3. The Conservation District, in accordance with established criteria and procedures, shall review the stormwater management site plan, when required, for consistency with stormwater management and erosion and sediment pollution control requirements and provide comments to Northampton Township. Such comments shall be considered by the Township prior to final approval of the stormwater management site plan.

4. For activities regulated by this Chapter, the Township Engineer shall notify Northampton Township in writing, within 45 calendar days, whether the stormwater management site plan is consistent with the provisions of this Chapter.

A. If the Township Engineer determines that the stormwater management site plan is consistent with the provisions of this Chapter, the Township Engineer shall forward two copies of the plan stamped “approved” along with a letter of consistency to the Township Zoning/Code Enforcement Officer who will then forward a copy to the applicant.

B. If the Township Engineer determines that the stormwater management site plan is inconsistent or noncompliant with the stormwater management plan, the Township Engineer shall forward a letter to the Township Zoning/Code Enforcement Officer with a copy to the applicant citing the reason(s) and specific Sections of this Chapter for the inconsistency or noncompliance. Inconsistency or noncompliance may be due to inadequate information to make a reasonable judgment as to compliance with the stormwater management plan. Any stormwater management site plans that are inconsistent or noncompliant may be revised by the applicant and resubmitted when consistent with this Chapter. Any inconsistent or noncompliant stormwater management site plans may be revised by the applicant and resubmitted consistent with this Part.

5. For regulated activities specified in §23-105 of this Chapter which require a building permit, the Township Engineer shall notify the Township Zoning/Code Enforcement Officer in writing, within a time frame consistent with the Township Building Code [Chapter 5, Part 1] and/or Township SALDO [Chapter 22], whether the stormwater management site plan is consistent with this Chapter. The Township Zoning/Code Enforcement Officer shall forward a copy of the consistency/inconsistency letter to the applicant. Any stormwater management site plan deemed inconsistent may be revised by the applicant and resubmitted consistent with this Part.

6. For regulated activities under this Part that require an NPDES permit application, the applicant shall forward all review comments from the reviewing agency to Northampton Township. Such comments shall be considered by the Township prior to final approval of the stormwater management site plan.

7. No building permits for any regulated activity specified in §23-105 of this Chapter shall be approved by Northampton Township if the stormwater management site plan has been found to be inconsistent, as determined by the Township Engineer and Bucks County Conservation District, or without considering the comments of the Township Engineer and Conservation District. All required permits from DEP must be obtained prior to issuance of a building permit.

8. Northampton Township’s approval of a stormwater management site plan shall

be valid for a period not to exceed 2 years commencing on the date that Northampton Township approves the stormwater management site plan. Northampton Township may specify a term of validity shorter than 2 years for the approval for any specific stormwater management site plan. If stormwater management facilities included in the approved stormwater management site plan have not been constructed, or if constructed, and as-built drawings of these facilities, if required, have not been approved within this 2-year time period, then Northampton Township may consider the stormwater management site plan inconsistent or noncompliant and may revoke any and all permits. Stormwater management site plans that are determined to be inconsistent or noncompliant by Northampton Township shall be resubmitted in accordance with §23-405 of this Chapter.

(Ord. 559, 7/27/2011, §113-21)

§23-405. Modification of Plans.

1. A modification to a submitted stormwater management site plan under review by Northampton Township for a development site that involves the following shall require a resubmission to Northampton Township of a modified stormwater management site plan consistent with §23-402 of this Part and be subject to review as specified in §23-404 of this Part.

A. Change in stormwater management facilities or techniques.

B. Relocation or re-design of stormwater management facilities.

C. Is necessary because soil or other conditions are not as stated on the stormwater management site plan as determined by the Township Engineer.

2. A modification to an already approved stormwater management site plan shall be submitted to Northampton Township, accompanied by the applicable Township review and inspection fee and escrow. A modification to a stormwater management site plan for which a formal action has not been taken by Northampton Township shall be submitted to the Township, accompanied by the applicable Township review and inspection fee and escrow.

(Ord. 559, 7/27/2011, §113-22)

§23-406. Resubmission of Disapproved SWM Site Plans.

An inconsistent, noncompliant or disapproved stormwater management site plan may be resubmitted, with the revisions addressing the Township Engineer's concerns documented in writing and addressed to the Township Zoning/Code Enforcement Officer in accordance with §23-403 of this Chapter and distributed accordingly and be subject to review as specified in §23-404 of this Chapter. The applicable Township fee must accompany a resubmission of an inconsistent, noncompliant or disapproved stormwater management site plan.

(Ord. 559, 7/27/2011, §113-23)

Part 5**Design Criteria and Requirements****§23-501. Design Criteria.****1. General.**

A. All land areas shall be graded to secure proper drainage away from buildings and to prevent the collection of stormwater pools. Drainage provisions shall be of such design as to carry surface waters to the nearest practical adequate street, storm drain or natural watercourse. The developer shall construct and/or install such drainage structures and/or pipes as are determined by the Township Engineer to prevent erosion, damage and siltation and to satisfactorily carry off surface waters.

B. Stormwater discharge shall be carried by conduit to prevent excessive surface flow on or across streets, sidewalks, drives, parking areas and any other paved surface or traveled way, where infiltration practices would not be feasible. Culverts or bridges shall be required at all stream crossings of any street or roadway, using design criteria for a 100-year peak flow rate. Natural swales or open drains of any type may be used only where there is no danger to structures or abutting property.

C. Identified natural watercourses (streams or creeks) which have continuous flow shall remain open and shall not be piped or covered unless required by the Township and as approved by the Township Engineer and if required by PADEP.

D. The SWM site plan for each regulated activity shall take into account and provide for upstream areas within the entire watershed in computing discharge quantities, sizing of pipes, inlets and other structures. The runoff from any proposed development shall be subject to evaluation which includes the anticipated runoff from other existing or proposed developments within the same watershed. Stormwater management facilities designed to serve more than one property, or development in the same watershed are encouraged, in which case consultation with the Township is required prior to design.

E. The Board of Supervisors may require, based upon the advice of the Township Engineer, stormwater retention or detention devices, basins, subsurface recharge facilities or other delayed-release devices or designs to contain the excess storm discharge and prevent downstream flow increases and/or encourage groundwater recharge.

F. *Storm Drainage Required.* Overland or sheet flow is encouraged over concentrated flow. A storm sewer system and all appurtenances shall be required to be constructed by the applicant in any area from which the surface or subsurface drainage could impair public safety or cause physical damage to adjacent lands or public property. The system shall be designed to collect water at any point where 3 to 5 cubic feet per second is accumulated, at the bottom of all vertical grades and immediately upgrade from all street intersections. The system shall discharge to the nearest practical natural drainage channel or storm system.

G. *Off-site Improvements.* Any increase in runoff may require necessary

corrective measures, including deeds of easement, deemed appropriate by the Township to alleviate any off-site drainage problem affected by the regulated activity. The costs for such measures will be borne entirely by the developer or subdivider.

H. *Total Watershed Evaluation.* The future use of undeveloped areas upstream, as shown on the approved Township Comprehensive Plan, shall be taken into account in the design of all storm sewer systems. The capacity and maximum anticipated present flow of the body or system receiving the proposed system(s) discharge shall be calculated to verify its capability of receiving any additional flow caused by the development or subdivision. The runoff from any proposed development shall be subject to an evaluation which includes the anticipated runoff from other existing or proposed developments within the same watershed. Stormwater management facilities designed to serve more than one property or development in the same watershed are encouraged. Consultation with the Township is required prior to the design of such facilities.

I. In addition to any other requirement of this Chapter, the developer may be required to participate in off-site storm drainage improvements in the drainage basin within which the proposed development is located. The specific off-site drainage improvements required shall be those specified by the Township Board of Supervisors.

J. *General Note for All Stormwater Management Systems.* The following note shall be placed on all plans which propose a stormwater BMP: "The stormwater facilities shown on these plans are a basic and perpetual part of the stormwater management system of the proposed site located in Northampton Township, Bucks County, Commonwealth of Pennsylvania, and as such are to be protected and preserved in accordance with the approved final plans by the owners, their successors and assigns of these lands. Northampton Township and/or its agents reserve the right and privilege to enter upon these lands from time to time for the inspection of said facilities in order to determine that proper operation and maintenance and that the structural and design integrity is being maintained by the owner."

2. *Storm Sewer and Inlets.*

A. Storm sewer within all road rights-of-way and all Township-owned easements (pipes or other structures) shall be reinforced concrete pipe. All storm sewer (pipes or other structures) shall have a minimum grade of ½ percent and a minimum inside diameter of 18 inches or a cross-sectional area of 254 square inches, except that pipes under a fill of 25 feet or greater shall not be less than 24 inches in diameter (inside) or have a cross-sectional area of less than 453 square inches.

B. Roof drains or yard drains shall not connect to any sanitary sewer and shall not discharge water directly over any sidewalk. Storm drainage facilities should be located within the paved areas of roadways. Where storm sewers discharge into existing drainage channels at an angle greater than 30 degrees from parallel to the downstream channel flow, the far side bank shall be stabilized by the use of riprap, masonry, or concrete walls. The stabilization shall be designed to prevent erosion and frost heave under and behind the stabilizing media.

C. Storm sewer systems shall be constructed in accordance with Township specifications, which are approved by resolution of the Board of Supervisors. If a particular design or device is not specifically approved within the Township specifications, the Township Engineer must review the particular design or device for conformance with the objectives of this Section.

D. All pipe and inlets shall meet material capacity and construction specifications as outlined in the latest revisions of the Penn DOT Form 408 and the Penn DOT Design Manual or as outlined in the Township specification as approved by resolution of the Board of Supervisors.

E. *Design Flow Rate.* The storm drain system shall be designed to carry a 100-year peak flow rate. The design 100-year peak flow rate into each inlet shall be indicated on the stormwater drainage plan. The 100-year flow rate shall be determined by the rational formula as follows:

$$Q=ciA$$

Where:

Q=Peak runoff rate in cubic feet per second (cfs)

c=Runoff coefficient equal to the ratio of the peak runoff rate to the average rate of rainfall over a time period equal to the time of concentration.

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

A=Drainage area in acres.

NOTE: Appropriate values for the runoff coefficient and rainfall intensity can be found in Appendix 23-B-7.

F. *Overflow System.* An overflow system shall be provided to carry flow to the detention basin when the capacity of the storm drain pipe system is exceeded.

G. *Inlet Capacity.* All inlets must be designed to accommodate the 100-year peak flow rate. The capacity of all C-type, M-type or S-type inlets shall be determined from the Commonwealth of Pennsylvania Department of Transportation Design Manual, Part 2, Highway Design.

H. *Straight Pipe Sections.* Wherever possible, all storm drain pipes shall be designed to follow straight courses. No angular deflections of storm sewer pipe sections in excess of 50 shall be permitted. A manhole or inlet shall be provided at all horizontal deflections in the storm pipe system exceeding 5 degrees. No vertical curves shall be permitted in the storm drain pipe system.

I. *Pipe Capacity.* The capacity of all pipe culverts shall, as a minimum, provide the required carrying capacity as determined by, this Chapter or if approved by the Township, the following sources:

US Department of Transportation

Federal Highway Administration

Hydraulic Design Series No. 5

Hydraulic Design of Highway Culverts, Second Edition

J. *Pipe Arches.* Where headroom is restricted, equivalent pipe arches may be

used in lieu of circular pipe.

K. *Allowable Headwater Depth.* At all inlets or manholes, the maximum allowable headwater depth shall be 1 foot below the top of the inlet grate or the manhole cover.

L. *Minimum and Maximum Cover.* A minimum of 2 feet of cover shall be maintained over all reinforced concrete pipe. All other storm pipes shall have a minimum of 3 feet of cover. The top of storm drain pipes shall be at least ½ foot below subgrade elevation. The maximum cover over storm drain pipes shall be 10 feet unless special structural design calculations are submitted or approved.

M. *Match Crowns.* The crowns of all pipes tying into an inlet or manhole shall be set at equal elevations.

N. *Diversions of Runoff.* All storm drain pipes shall be designed to carry the runoff into a detention basin or similar facility utilized to control the rate of runoff.

O. *Structural Backfill.* All storm drainage structures shall be backfilled in 12-inch layers with 2A stone to a dimension at the base of the structure 12 inches outside of all faces of the structure tapering to a width of 24 inches outside all faces of the structure at the top of the structure.

3. *Erosion and Sedimentation Control.* Prior to the commencement of any regulated earth disturbance activity, the following criteria shall be met:

A. No changes shall be made in the contour of the land and no grading, excavating, removal or destruction of the topsoil, trees or other vegetative cover of the land shall be commenced until such time as a plan for minimizing: soil erosion and sedimentation has been submitted and approved.

B. Measures used to control erosion and reduce sedimentation shall, as a minimum, meet the standards and specifications of the Bucks County Conservation District and the PADEP. The Township Engineer shall ensure compliance with the appropriate specifications, copies of which are available from the district.

C. Plans shall preserve salient natural features, keep cut/fill operations to a minimum and ensure conformity with natural topography so as to create the least erosion potential and adequately handle the volume and velocity of surface water runoff. Whenever feasible, natural vegetation shall be retained, protected and supplemented. The disturbed area and the duration of exposure shall be kept to a practical minimum. Disturbed soils shall be stabilized as quickly as practicable. Temporary vegetation and/or mulching shall be used to protect critical areas during development.

D. The permanent (final) vegetation, erosion control and drainage shall be installed as soon as practical in the development. Provisions shall be made to effectively accommodate the increased runoff caused by changed soil and surface conditions during and after development. Sediment in all runoff water shall be trapped by the use of filters, sediment basins, silt traps or similar measures until the disturbed area is fully stabilized. Such devices shall be periodically cleaned of all silt and debris to ensure proper operation.

E. During grading operations, necessary measures for dust control must be exercised.

F. Grading equipment will not be allowed to cross-flowing streams. Provision

shall be made for the installation of temporary culverts or bridges which are subject to PADEP approval.

G. Permanent retention or detention basins shall be provided when required by the Board. The location of such basins shall be approved by the Board upon advice from the Township Engineer and when required, by the PADEP.

H. No person, corporation or other entity shall block, impede the flow of, alter, construct any structure or deposit any material or thing or commit any act which will affect normal or flood flow in any swale, stream or watercourse without having obtained prior approval from the Township and/or the Pennsylvania Department of Environmental Protection, whichever is applicable. It is the responsibility of any person, corporation or other entity doing any act on or across a stream, watercourse or swale or upon the floodplain or right-of-way during the period of the activity to return it to its original or equal condition after such activity is completed.

I. Whenever sedimentation is caused by stripping vegetation, regrading or other development, it shall be the responsibility of the person, corporation or other entity causing such sedimentation to remove it from all adjoining surfaces; drainage systems and watercourses and to repair any damage at their expense as quickly as possible.

J. Maintenance of all drainage facilities and watercourses, both existing and proposed, within the proposed site shall be the responsibility of the developer until such time as one of the following is accomplished:

(1) A right-of-way for these facilities is offered for dedication by the developer and is accepted by the Township, at which time it shall then be the responsibility of the Township.

(2) An easement acceptable to the Township is established. In the case of a subdivision, the maintenance shall then be the responsibility of the individual lot owners over whose property the easement passes. For land developments, the maintenance shall thereafter be the responsibility of the owner.

(3) A homeowner's association, approved by the Township, assumes responsibility for the maintenance of the development, including the maintenance of the watercourses and/or drainage facilities, provided that the Township Engineer approves the assumption of maintenance of such facilities.

K. The installation and design of the required erosion and sediment control measures, listed below, shall be in accordance with standards and specification found in PADEP's *Erosion and Sediment Pollution Control Program Manual* dated April 15, 2000, or latest edition, or the *Pennsylvania Handbook of Best Management Practices for Developing Areas*.

L. Detailed designs for all the appurtenances related to temporary basins and all stormwater and erosion and sedimentation control facilities must be supplied.

M. Criteria contained in this Chapter shall not remove or alter the requirement for the developer to submit plans and specifications to the Pennsylvania Department of Environmental Protection under the Clean Streams Act of 1972, 35 P.S. §691.1 *et seq.*, where Department of Environmental Protection's permits are required.

N. Three days prior to the commencement of any operation in the construction or installation of any drainage facilities or erosion and sedimentation control facility, the applicant shall notify the Township Engineer, who shall inspect the work, materials, construction and installation for compliance with Township requirements. The Township Engineer shall be authorized to have such tests of materials made as are provided in the Northampton Township specification and design standards in order to have proper control of materials. Such fees for tests of materials as provided above shall be in accordance with the fee schedule as established by resolution of the Board of Supervisors.

O. Sediment basins, retention basins, wet basins and detention basins shall neither be located within nor discharge into a tree protection zone where no established water course exists.

4. *Underdrains.*

A. All building foundations, grade slabs and cellar floors located in soils that have a community development limitation degree of moderate to severe seasonal high water table, as defined by an on-site soils test witnessed by the Township Engineer, shall be provided with an underdrain system. This system shall provide for drainage of the enclosed volume above the slab and relief of subsurface water to a depth of not less than 6 inches below the slab or foundation bottom. The system shall consist of a perforated pipe field of the herringbone or gridiron configuration in coarse, gravel-filled trenches that are in direct contact with the slab or foundation subbase. The excavation shall provide a minimum of 0.05-foot/foot slope to the gravel-filled trenches.

B. All proposed roadways shall be constructed with an underdrain system consisting of 6-inch perforated pipe wrapped in a Class 1 geotextile material. The underdrain shall be bedded with a minimum of 6 inches of 2B stone. The bedding material shall extend to the bottom of the base course. The underdrain shall discharge into an inlet, manhole or other approved stormwater device.

5. *Detention Basins/Stormwater Rate Management Facilities.*

A. *Basin Design Criteria.* The following design criteria shall be used in the design of all detention basins and/or other stormwater management facilities in the Township. The basins shall be designed to detain the quantity of water resulting from a 100-year, 24-hour storm under full development conditions. This criteria shall be met for all frequency storms and must be analyzed of the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year and 100-year storms. All flows in excess of the above-mentioned standard shall flow over an emergency spillway.

B. *Maximum Depth of Detention Basins.* The maximum depth of water in a detention basin shall not exceed 5 feet.

C. *Emergency Spillway.* Whenever possible, the emergency spillway for detention basins shall be constructed on undisturbed ground. Emergency spillways shall be constructed of reinforced concrete, vegetated earth, or other approved material. All emergency spillways shall be constructed so that the detention basin berm is protected against erosion. The minimum capacity of all emergency spillways shall be equal to the peak flow rate from the post-development 100-year design storm. Emergency spillways shall extend along the upstream and downstream berm embankment slopes. The upstream edge of the emergency

spillway shall be a minimum of 3 feet below the spillway crest elevation. The downstream slope of the spillway shall, as a minimum, extend to the top of the berm embankment. The emergency spillway shall not discharge over earthen fill and/or easily erodible material.

D. *Anti-seep Collars.* Anti-seep collars shall be poured-in-place concrete and installed around the principal pipe barrel within the normal saturation zone of the detention basin berms. The collars shall be poured against the pipe bell. The anti-seep collars and their connections to the pipe barrel shall be watertight. The anti-seep collars shall extend a minimum of 2 feet beyond the outside of the principal pipe barrel. The spacing between collars shall be 16 feet. The use of an O-ring pipe would be required for all detention discharge pipes.

E. *Freeboard.* Freeboard is the difference between the design flow elevation in the emergency spillway and the top of the settled detention basin embankment. The minimum freeboard shall be 1 foot and the maximum freeboard shall be 2 feet.

F. *Slope of Detention Basin Embankment.* The maximum slope of earthen detention basin embankments shall be 3 to 1. The top or toe of any slope shall be located a minimum of 5 feet from any property line. Whenever possible, the side slopes and basin shape shall be amenable to the natural topography. Straight side slopes and rectangular basins shall be avoided whenever possible.

G. *Width of Berm.* The minimum top width of detention basin berms shall be 10 feet.

H. *Slope of Basin Bottom.* In order to ensure proper drainage of the detention basin, a minimum grade of 2 percent shall be maintained for all sheet flow.

I. *Energy Dissipaters.* Energy dissipating devices (riprap, end sills, etc.) shall be placed at all basin inlets and outlets. Forebays or split flow controls are encouraged at the inlet to all basins. When a forebay or split flow control is not used, an energy-dissipating device shall be used and extend to the bottom of the basin.

J. *Key Trench.* All basin berms in fill areas are to have a key trench. The minimum depth shall be 1 foot and increased to a depth of 3 feet at the maximum point of fill. The minimum width of the key trench shall be 8 feet.

K. The distance from the highest free water surface of any detention basin or drainage facility to a dwelling unit shall be a minimum of 100 feet.

L. All detention basin outlet structures with invert orifices of 12 inches or less shall be protected with a trash rack. The surface area of the trash rack shall be three times the area of the opening. The trash rack shall be welded aluminum with stainless steel anchors.

M. A sketch of the berm embankment and outlet structure, indicating the embankment top elevation, embankment side slopes, top width of embankment, emergency spillway elevation, perforated riser dimensions, pipe barrel dimensions and dimensions and spacing of anti-seep collars shall be provided.

6. *Culverts and Drainage Channels.*

A. *Design Flow Standard.* All culverts and drainage channels shall be designed to carry a flow rate equal to a 100-year, 24-hour storm (Soil Conservation Service, Technical Release No. 55).

B. *Erosion Prevention.* All drainage channels shall be designed to prevent the erosion of the bed and bank areas. The flow velocity in all vegetated drainage channels shall not exceed the maximum permissible velocity to prevent erosion. Suitable bank stabilization shall be provided where required to prevent erosion of the drainage channels. The stabilization shall be designed to prevent erosion and frost heave under and behind the stabilizing media.

C. *Maximum Side Slope.* Any vegetated drainage channel requiring mowing of the vegetation shall have a maximum grade of 3 horizontal to 1 vertical.

D. *Design Standard.* Because of the critical nature of vegetated drainage channels, the design of all vegetated channels shall, as a minimum, conform to the design procedures outlined in the *Erosion and Sediment Pollution Control Program Manual*. Several acceptable sources outline procedures for non-vegetated drainage channels, including the following:

US Department of Transportation

Federal Highway Administration

Hydraulic Design Series No. 5

Hydraulic Design of Highway Culverts, Second Edition

7. *Subsurface Recharge System.*

A. In selecting the appropriate subsurface recharge BMPs, the applicant shall consider the following:

- (1) Permeability and infiltration rate of the site soils.
- (2) Slope and depth to bedrock.
- (3) Seasonal high water table.
- (4) Proximity to building foundations and well heads.
- (5) Erodibility of soils.
- (6) Land availability and topography.

B. *Soil Investigation.* In designing a subsurface stormwater system, a key element is an analysis of the soil. The Township Engineer shall require and witness the soil testing which shall include the following:

- (1) The locations and results of all test borings, test pits or auger holes, in order to determine the type of soil.
- (2) The seasonal high water level.
- (3) The slope and depth to bedrock.

C. *Infiltration Capacity.* Infiltration rates may be determined from permeability testing, percolation testing or hydraulic conductivity testing.

D. *Infiltration Rate.* Percolation tests shall be accepted as a means of determining the infiltration rate of a soil. The tests must be completed at the location and depth of the proposed infiltration area.

E. *Soil Characteristics.*

- (1) Infiltration BMPs are particular appropriate in hydrologic soil groups A and B.
- (2) Low erodibility factors ("k" factors) are preferred for the construction

of basins.

(3) There, must be a minimum depth of 24 inches between the bottom of any subsurface recharge BMP and the seasonal high water table and/or bedrock (limiting zones).

(4) There must be an infiltration and or percolation rate sufficient to accept the additional storm water load, and to drain completely as determined by field tests.

(5) Infiltration BMPS shall be located a minimum of 10 feet away from the building foundation wall.

(6) The infiltration system shall positive overflow controls to prevent storage within 1 foot of the finished surface or grade.

(7) Infiltration rates shall not be used in computing the storage volume or when routing the respective design storm through the infiltration system.

(8) *Sediment and Debris.* Various measures shall be taken to guarantee that the subsurface recharge system does not become filled with sediment during and after construction and that the system is kept free of debris (leaves, twigs, etc.) to prevent clogging. These measures include, but are not limited to, temporary siltation berms and other erosion controls and gutter screens for direct piping from roofs to the system. Surface inflows shall be designed to prevent direct discharge of sediment into the infiltration system.

F. During the period of land disturbance, runoff shall be controlled prior to entering any proposed infiltration area, areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.

G. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMPs has received final stabilization.

H. *Aggregate/Filter Material.* Aggregate fill shall be clean stone between 2 inches and 4 inches in diameter. Larger stone shall be placed near the bottom of the system and smaller stone near the top. An appropriate geotextile fabric shall line the bottom, top and sides, with sufficient excess material left at the top to fold over the aggregate fill when placed, prior to the placement of the topsoil layer.

I. *Prefabricated Systems.* When prefabricated systems are proposed, the applicant shall adhere to all recommended manufacturer's specifications, in addition to the requirements of this Section.

J. *Emergency Overflow.* Each subsurface recharge system shall be designed with an emergency overflow/surcharge system to protect the system in the event of a storm of higher intensity.

(Ord. 559, 7/27/2011, §113-24)

§23-502. Grading and Landscaping.

1. *Grassed Areas or Grass/Ground Cover Combinations.* All such areas specified on proposed or approved plans shall be prepared, installed and maintained in accordance with the Pennsylvania Department of Transportation Form 408

Specifications, as amended.

2. *Drainage Channels and Retention Areas.* All storm drainage channels, detention and retention areas, whether existing or proposed, shall be graded and planted to effectively naturalize area(s) so as to become an integral and harmonious part of the landscape by contour and type of plant materials used.

3. All detention basins side slopes and bottom shall be seeded with an appropriate seed mixture specifically suited to the levels or periodic inundation for which the system is designed. No-mow basins shall only be allowed as approved by the Township.

4. A suitable naturalized, native plant screening shall be provided around all detention basins. Fences may be required at the discretion of the Board of Supervisors. Native plants acceptable for use are listed as part of the Recommended Native Plants for Landscaping in Pennsylvania, as issued by the PA Department of Conservation and Natural Resources. The uses of native plants and grasses and wetland tolerant plants, acceptable for use is highly encouraged.

5. Trees and shrubs shall be placed so as to provide a suitable visual barrier at the time of planting. Trees shall not be placed on the top of the detention basin. Trees may be placed in the basin bottom, subject to the approval of the Township Engineer. Whatever materials are used, they shall be placed sufficiently far back from the cut or fill slope so as to allow ease in mowing.

6. Native deciduous trees shall be a minimum of 2½ inches in caliper, native shrubs shall be a minimum of 24 to 36 inches in height, and native evergreen trees shall be a minimum of 6 to 8 feet in height at the time of installation. Trees and shrubs shall be spaced in accordance with the characteristic spread of each specific species at maturity.

7. The screening requirement shall be waived only with the expressed consent of the Board of Supervisors.

8. *Topsoil.* A minimum of 6 inches of topsoil material shall be placed on all areas affected by the basin construction (bottom of basin, side slopes, top of berm, etc.). The material must meet the requirements of the Pennsylvania Department of Transportation, Form 408 specifications, as amended.

9. *Subsurface recharge system.* In order to preserve the integrity of the system, at no time shall any trees be planted in or around a subsurface recharge system. As a general rule, the dripline of a mature tree should not be located within 5 feet of a subsurface recharge system.

10. *Grading Design Criteria.*

A. *Cuts.* No excavation shall be made with a cut face steeper than 3 to 1, horizontal to vertical, except under the condition in which the material in which the excavation is made is sufficiently stable to sustain a slope of steeper than 3 horizontal to 1 vertical. A written statement to that effect is required from a licensed civil engineer having experience in soils engineering and shall be submitted to the Township Engineer and approved by him. The statement shall affirm that the site has been inspected and that the deviation from the slope will not result in injury to persons or damage to property. Retaining walls will be required if a stable slope cannot be maintained. Any retaining walls design must be approved by the Township Engineer. The toe of the slope or headwall of any cut

must be located a minimum of 5 feet from property lines. No excavation shall endanger adjoining properties.

B. *Fills*. No fills shall be made which creates any exposed surface steeper in slope than 3 horizontal to 1 vertical, except where the fill is located so that settlement, sliding or erosion will not result in property damage or be a hazard to adjoining property, streets or buildings. A written statement from a licensed civil engineer licensed by the commonwealth of Pennsylvania and having experience in soils engineering, certifying that he has inspected the site and that any proposed deviation from the slope specified above will not endanger any property or result in property damage, must be submitted to and approved by the Township Engineer.

(1) A concrete or stone masonry wall constructed in accordance with Township specifications may be required to support the face of the fill where above slopes are exceeded.

(2) The top of any fill or toe of the slope of any fill shall be located 5 feet from any property line.

(3) *Fill Placement and Compaction*. All fill shall be placed mechanically and shall be free of any debris or organic material, roots and stumps. Fill shall be placed in consecutive, maximum eight-inch layers: and compressed or compacted mechanically with equipment weighing not less than 10 tons or with similar sheeps-foot roller or compactors having equivalent compression capability. The Township shall require, at the owner's expense, a test certifying the adequate compaction of fill materials as required above or in accordance with the requirements of the Township Engineer. All detention basin fill shall be compacted to 95 percent Modified Proctor Density (ASTM 1557).

C. *Retaining Walls*. All plans that require retaining walls shall provide shop drawings and design calculations, sealed by a professional engineer registered in the State of Pennsylvania, to be submitted to the Township Engineer for review and approval prior to construction. Top and bottom of wall elevations must be shown on the grading plans to the satisfaction of the Township Engineer.

11. Permanent removal of topsoil shall be prohibited in all developments. The only exception to this prohibition shall be under the circumstance where design of a large-scale development permits the removal of excess topsoil in locations of large parking areas or large buildings where the topsoil removed may be more appropriately used elsewhere on the site or on a nearby site. A special permit for such topsoil removal is required, as issued by the Board of Supervisors.

12. *Tree Protection Standards*.

A. General requirements shall be as follows:

(1) Grade changes and excavation on any location within the site shall not:

(a) Encroach upon a tree protection zone.

(b) Result in an alteration to soil or drainage conditions which would adversely affect existing vegetation to be retained following site disturbance, unless adequate provisions are made to protect such vegetation and its root systems.

(2) No toxic materials shall be stored within 100 feet of a tree protection

zone including petroleum-based and/or derived products.

(3) The area within a tree protection zone shall not be built upon or covered by impervious materials, either temporarily or permanently.

(4) The storage of equipment, materials, debris or fill and the parking of vehicles shall be prohibited within a tree protection zone.

B. Tree protection zone construction requirements shall be as follows:

(1) Prior to construction, any tree protection zone shall be identified on the site in conformance with the approved subdivision or land development plan and in the following manner:

(a) All trees scheduled to remain shall be clearly marked. Only trees on the outer edge of tree groups or forests are required to be marked.

(b) A 4-foot high wooden snow fence mounted on steel posts located 8 feet on center, or similar fencing materials or barrier approved by the Township Arborist, shall be placed along the boundary of the tree protection zone. Immediately following the installation of said fencing, the Township shall inspect and approve the same prior to the commencement of any development activity on the site. The fencing shall be properly maintained until all development activity has ceased, and damaged fencing shall be repaired or replaced before any development may recommence.

(c) In addition to such fencing, trees outside the tree protection zone may be temporarily retained to the limits of grading and utilized as an additional buffer area during construction. Such trees shall be removed prior to the completion of development.

(2) The operation of heavy equipment shall not occur within a tree protection zone.

(3) Trees being removed shall not be felled, pushed or pulled into a tree protection zone or into any other trees which are required to be retained.

(4) Any tree stumps located within 10 feet of a tree protection zone shall be removed by means of a stump grinder to minimize their effect on surrounding root systems.

(5) Tree roots which must be severed shall be:

(a) Cut by a backhoe or similar equipment, aligned radially to the tree, in such a manner so as to reduce the lateral movement of roots during excavation.

(b) Trimmed cleanly so that their edges are smooth and are cut back to a lateral root, if exposed.

(c) Covered temporarily with peat moss, moist burlap or other moist biodegradable material within 4 hours of any severance in order to avoid their drying out.

(6) Damaged areas shall be treated promptly, and as may be required by the Township Arborist.

(a) Damaged bark shall be cut back to a point where the bark is intact and tight to the tree.

- (b) Exposed roots shall be cleaned up and covered with topsoil.
- (c) Tree limbs shall be cut back in proportion to root area loss.
- (d) Liquid or dry fertilizer shall be applied to trees with disturbed root zones to compensate for any loss of roots.
- (e) All pruning shall be undertaken in accordance with the standards of the National Arborist Association as noted in the National Arborist Association Book of Standards, as amended.
- (f) Trees shall not be used for roping, cables, signs, fencing or lighting. Nails and spikes shall not be driven into trees.

(7) *Fertilization.*

- (a) All trees which have been disturbed or have tree roots which have been damaged as a result of development shall be fertilized.
- (b) Such trees shall be fertilized during the months of September through October or April through May.
- (c) Fertilizer having approximately three parts nitrogen to one part phosphorus and one part potassium (3 to 1 to 1 ratio) shall be broadcast over the soil surface in an area twice the size of the tree protection zone at a rate equivalent to 1 pound nitrogen per 1,000 square feet. A minimum of 1,000 square feet per tree shall receive fertilization.

(8) *Retaining Walls.*

- (a) Any re-grading which causes a change in the original grade at the tree protection zone line shall require the installation of a retaining wall outside of the tree protection zone, designed to comply with Township standards.
- (b) The top of such retaining wall shall be 4 inches above the finished grade line.
- (c) The retaining wall shall be constructed of large stones, brick, building tile, concrete blocks or treated wood beams not less than 6 inches by 6 inches.
- (d) A means for drainage through the wall shall be provided, as approved by the Township Engineer.
- (e) A layer of clean stone, sized $\frac{3}{4}$ to 1 inch shall be placed 1 foot out from the retaining wall to aid in drainage.

(9) *Trenching and Tunneling.*

- (a) Utility lines shall be located outside tree protection zones.
- (b) Tunneling shall be used for the installation of any utility line approved by the Board of Supervisors for location within a tree protection zone. Trenching may only be used where, in the opinion of the Township, the survival of a tree or trees would not be affected.
- (c) Upon the completion of the installation of any utility line, the trench shall be filled immediately and tamped lightly to avoid air spaces.

(Ord. 559, 7/27/2011, §113-25)

§23-503. Township Stormwater BMP Operation and Maintenance Fund.

1. If stormwater facilities and BMPS are accepted by the Township for dedication, the Township may require persons installing stormwater BMPS to pay a specified amount to the Township stormwater BMP operation and maintenance fund, to help defray costs of operations and maintenance activities. The amount may be determined as follows:

A. If the stormwater facility or BMP is to be owned and maintained by the Township, the amount shall cover the estimated costs for operations and maintenance for 10 years as determined by the Township.

B. The amount shall then be converted to present worth of the annual series values.

2. If a BMP is proposed that also serves as a recreation facility (e.g., ball field, lake), the Township may adjust the amount accordingly.

3. The off-site stormwater drainage contribution shall be in addition to the obligation of the developer to construct and install at its sole expense the on-site and off-site drainage improvements required as a condition to subdivision or land development approval.

4. When, in the discretion of the Board of Supervisors, circumstances surrounding the development of a site warrant special consideration, these contributions may be reduced or waived.

(Ord. 559, 7/27/2011, §113-26)

Part 6**Inspections and Right of Entry****§23-601. Inspections.**

1. The Township or its designee shall inspect all phases of the construction, operations, maintenance and any other implementation of the best management practices (BMPs) and/or stormwater management (SWM) facilities as deemed appropriate by the Township.

2. During any stage of the work, if the Township or its designee determines that the BMPs and/or stormwater management facilities are not being implemented or installed in accordance with the approved SWM site plan, the Township may suspend or revoke any existing permits or other approvals and issue a cease and desist order until a revised SWM site plan is submitted and approved, as specified in this Chapter and until the deficiencies are corrected.

3. A final inspection of all BMPs and/or stormwater management facilities shall be conducted by the Township to confirm compliance with the approved SWM site plan prior to the issuance of any occupancy permit.

(Ord. 559, 7/27/2011, §113-27)

§23-602. Right of Entry.

1. Upon presentation of proper credentials, duly authorized representatives of the Township may enter at reasonable times upon any property within the Township to inspect the implementation, condition, or operation and maintenance of the stormwater facilities or best management practices (BMPs) in regard to any aspect governed by this Chapter.

2. Landowners, with stormwater facilities and BMPs on their property, shall allow persons working on behalf of the Township ready access to all parts of the premises for the purposes of determining compliance with this Chapter.

3. Persons working on behalf of the Township shall have the right to temporarily locate on any stormwater facility or BMP in the Township such devices as are necessary to conduct monitoring and/or sampling of the discharges from such stormwater facilities or BMP.

4. Unreasonable delays in allowing the Township access to a stormwater management facility or BMP is a violation of this Chapter.

(Ord. 559, 7/27/2011, §113-28)

Part 7**Fees and Expenses****§23-701. Stormwater Management (SWM) Site Plan Review and Inspection Fee.**

Fees shall be established by the Township to cover plan review and construction inspection costs incurred by the Township. All fees shall be paid by the applicant at the time of SWM site plan submission. A review and inspection fee schedule shall be established by resolution of the Board of Supervisors. The Township shall periodically update the review and inspection fee schedule to ensure that review costs are adequately reimbursed. No permit to begin any work on the project shall be issued until the requested fees have been paid.

(Ord. 559, 7/27/2011, §113-29)

§23-702. Expenses Covered by Fees.

The fees required by this Chapter shall, at a minimum, cover:

- A. Administrative costs.
- B. The review of the stormwater (SWM) site plan and as-built plan by the Township and the Township Engineer. Review shall mean all technical reviews, meetings and discussions relative to the plans.
- C. The site inspections including, but not limited, to pre-construction meetings, inspections during construction of stormwater facilities and BMP's and final inspection upon completion of the stormwater facilities and BMP's.
- D. Any additional work required to enforce any permit provisions regulated by this Chapter, correct violations, and assure proper completion of stipulated remedial actions.
- E. Stormwater permit issuance.

(Ord. 559, 7/27/2011, §113-30)

Part 8**Maintenance Responsibilities****§23-801. Performance Guarantee and Maintenance.**

1. For subdivisions and land developments, the applicant shall provide a financial guarantee to the Northampton Township for the timely installation and proper construction of all stormwater management (SWM) facilities as:

A. Required by the approved SWM site plan equal to or greater than the full construction cost of the required controls.

B. The amount and method of payment provided for in the Subdivision and Land Development Ordinance [Chapter 22].

2. For other regulated activities, Northampton Township may require a financial guarantee from the applicant.

3. Unless and until the permitted earth disturbance activity and stormwater management facilities have been completed and are accepted by the Township or other legal entity approved by the Township, the maintenance of said stormwater management facilities shall be the responsibility of the applicant.

4. Whenever sedimentation is caused by an earth disturbance activity, it shall be the responsibility of the person causing such sedimentation to remove it from all affected surfaces, drainage systems and watercourses on and off site and to repair any damage at his expense as quickly as possible following a storm event.

5. Persons doing any earth disturbance on or across a watercourse, swale, floodplain or right-of-way shall return such areas to their original or equal condition after such activity is completed.

6. Upon the issuance of an approved earth disturbance permit, unless maintenance responsibilities lie with the Township or a legal entity approved by the Township, the owner of any property on which an excavation or fill has been made shall maintain in good condition and repair all retaining walls, cribbing, drainage structures, fences, landscaping and any other protective devices.

(Ord. 559, 7/27/2011, §113-31)

§23-802. Responsibilities for Operations and Maintenance (O&M) of Stormwater Facilities and BMPs.

1. No regulated activities within Northampton Township shall commence until approval by Northampton Township of a SWM site plan that describes how the permanent stormwater controls and BMPs will be properly operated and maintained.

2. The owner of any land upon which stormwater facilities and BMPs will be placed, constructed, or implemented, as described in the stormwater management site plan, shall record the following documents in the Office of the Recorder of Deeds for Bucks County, within 10 days of approval of the stormwater management site plan by the Township:

A. The O&M agreements.

B. Easements.

3. The Township may suspend or revoke any approvals granted for the project site upon discovery of failure on the part of the owner to comply with this Section.

4. The stormwater management site plan for the project site shall establish responsibilities for the continuing O&M of all stormwater facilities and BMPs, as follows:

A. If a plan includes structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Township, stormwater facilities and BMPs may also be offered for dedication to and maintained by the Township. If the Township does not accept dedication of the BMP's, the owner, homeowners association, or private management entity shall be responsible for the continued operation and maintenance of the BMP's.

5. The Township shall make the final determination on the continuing O&M responsibilities. The Township reserves the right to accept or reject the O&M responsibility for any or all of the stormwater facilities and BMPs.

6. Facilities, areas, or structures used as BMPs shall be enumerated as permanent real estate appurtenances and recorded as deed restrictions or conservation easements that run with the land.

7. The O&M plan shall be recorded as a restrictive deed covenant that runs with the land.

8. The Township may take enforcement actions against an owner for any failure to satisfy the provisions of this Part and this Chapter.

9. The O&M agreement shall be transferred with transfer of ownership. The agreement shall be substantially the same as the agreement in Appendix 23-A.

10. Other items may be included in the O&M agreement where determined necessary to guarantee the satisfactory O&M of all stormwater controls and BMPs. The O&M agreement shall be subject to the review and approval of the Township.

11. The owner is responsible for the O&M of the SWM BMPs. If the owner fails to adhere to the O&M agreement, the Township may perform the services required and charge the owner appropriate fees. Nonpayment of fees may result in a lien against the property.

(Ord. 559, 7/27/2011, §113-32)

§23-803. As-Built Plan.

The applicant and/or developer shall be responsible for providing as-built plans of all stormwater management BMPs included in the approved stormwater management site plan required by a subdivision or land development, or as deemed necessary by the Township. The as-built plans and an explanation of any discrepancies from the approved SWM site plan which received approval by Northampton Township, shall be submitted to Northampton Township. The as-built plans shall be submitted in paper and digital (.dwg) formats.

(Ord. 559, 7/27/2011, §113-33)

§23-804. Stormwater Management Easements.

1. Where stormwater or surface water will be gathered, discharged, or drained over lands within or beyond the boundaries of the subdivision or land development, or within a proposed regulated activity site, the applicant or owner shall reserve or obtain easements over all lands affected thereby, provided that no easement or right-of-way for drainage purposes exists on such affected land. Such easements shall be adequate for such discharge of drainage and for the carrying off of such water and for the maintenance, repair and reconstruction of the same, including the right of passage over and upon the same by vehicles, machinery and other equipment for such purposes, and which shall be of sufficient width for such passage and work and that would provide ingress to and egress from a public right-of-way. The width of the easement shall be determined by the Township Engineer, but in no case be less than 20 feet in width. The owner shall convey, free of charge or cost, such easement to the Township upon demand.

2. Stormwater management easements shall be provided by the property owner, if necessary, for:

A. Access for inspections and maintenance.

B. Preservation of stormwater runoff conveyance, infiltration and detention areas and other BMPs, by persons other than the property owner. The purpose of the easement shall be specified in any agreement.

3. All easements shall be fully described with metes ad bounds on the BMP operations and maintenance plan.

(Ord. 559, 7/27/2011, §113-34)

Part 9**Prohibitions****§23-901. Prohibited Discharges.**

1. Any stormwater drain or stormwater conveyance, whether on the surface or subsurface, that allows any nonstormwater discharge, including sewage, process wastewater, and wash water to enter the waters of the Commonwealth is prohibited.

2. No person shall allow, or cause to allow, stormwater discharges into surface waters of this Commonwealth or Northampton Township separate storm sewer system which are not composed entirely of stormwater, except (A) as provided in subsection .3 below, and (B) discharges allowed under a State or Federal permit.

3. The following discharges are authorized unless they are determined to be significant contributors to pollution to the waters of the Commonwealth:

- A. Discharges from firefighting activities.
- B. Potable water sources including water line flushing and fire hydrant flushing.
- C. Irrigation drainage.
- D. Air conditioning condensate.
- E. Springs.
- F. Water from crawl space pumps.
- G. Flows from riparian habitats and wetlands.
- H. Uncontaminated water from foundations or from footing drains.
- I. Lawn watering.
- J. De-chlorinated swimming pool discharges (per Department of Environmental Protection (PADEP) requirements).
- K. Uncontaminated groundwater.
- L. Water from individual residential car washing.
- M. Routine external building wash down (which does not use detergents or other compounds).
- N. Pavement washwater 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.

4. In the event that the Township or PADEP determines that any of the discharges identified in subsection .3 significantly contribute to pollution of the waters of this Commonwealth, the Township or PADEP will notify the responsible person(s) to cease the discharge.

5. Upon notice provided by the Township, the discharger will have a reasonable time, as determined by the Township to cease the discharge consistent with the degree of pollution caused by the discharge.

(Ord. 559, 7/27/2011, §113-35)

§23-902. Roof Drains.

1. Roof drains shall not be connected to streets, sanitary or storm sewers, or roadside ditches; except as provided in §23-901.2.

2. 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 the Township.

3. Roof drains and sump pumps shall discharge to infiltration or vegetative BMPs and to the maximum extent practicable satisfy the criteria for disconnected impervious areas (DIAs); provided, however, that roof drains may be connected to streets, road side ditches, or storm drains upon determination by the Borough Engineer that such connection is the only practical alternative or will provide other offsetting advantages. (*Ord. 559, 7/27/2011, §113-36*)

§23-903. Alteration of SWM BMPs.

1. No person shall modify, remove, fill, landscape, or alter any stormwater management (SWM) best management practices (BMPs), facilities, areas, or structures unless it is part of an approved maintenance program and written approval of the Township has been obtained.

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

(*Ord. 559, 7/27/2011, §113-37*)

Part 10**Enforcement and Penalties****§23-1001. Enforcement.**

1. The Board of Supervisors of Northampton Township or its designee is hereby authorized and directed to enforce all of the provisions of this Chapter. All inspections regarding compliance with the stormwater management (SWM) site plan and this Chapter shall be the responsibility of the Township Engineer or other qualified persons designated by Northampton Township.

2. It shall be unlawful for any person, firm or corporation to undertake any regulated activity on any property except as provided for in the approved SWM site plan and pursuant to the requirements of this Chapter. It shall be unlawful to alter or remove any structure required by the SWM site plan pursuant to this Chapter or to allow the property to remain in a condition which does not conform to the approved SWM site plan without written approval from the Township.

3. Whenever the Township finds that a person has violated a prohibition or failed to meet a requirement of this Chapter, the Township may order compliance by written notice to the responsible person. Such notice may, without limitation, require the following remedies:

- A. Performance of monitoring, analyses, and reporting.
- B. Elimination of prohibited connections or discharges.
- C. Cessation of any violating discharges, practices, or operations.
- D. Abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property.
- E. Payment of a fine to cover administrative and remediation costs.
- F. Implementation of stormwater facilities and best management practices (BMPs).
- G. Operation and maintenance (O&M) of stormwater facilities and BMPs.

D. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Said notice may further advise that, if applicable, should the violator fail to take the required action within the established deadline, the work will be done by the Township or designee and the expense may be charged to the violator.

E. Failure to comply within the time specified may subject a violator to the penalty provisions of this Chapter. All such penalties shall be deemed cumulative and shall not prevent the Township from pursuing any and all other remedies available in law or equity.

(Ord. 559, 7/27/2011, §131-38)

§23-1002. Suspension and Revocation of Permits and Approvals.

1. Any building, land development, or other permit or approval issued by the Township may be suspended or revoked, in whole or in part, by the Township for:

- A. Noncompliance with or failure to implement any provision of the permit.
 - B. A violation of any provision of this Chapter.
 - C. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life, health, or property of others.
2. A suspended permit may be reinstated by the Township when:
- A. The Township or designee has inspected and approved the corrections to the stormwater facilities, BMPs and the erosion and sedimentation control facilities or the elimination of the hazard or nuisance.
 - B. The Township is satisfied that all applicable violations in this Chapter have been corrected.
3. Any permit or approval that has been revoked by the Township cannot be reinstated. The applicant may apply for a new permit under the procedures outlined of this Chapter.

(Ord. 559, 7/27/2011, §113-39)

§23-1003. Penalties.

1. Any person violating the provisions of this Chapter guilty of a misdemeanor and upon conviction, shall be subject to a fine of not more than \$1,000 for each violation, recoverable with costs. Each day that the violation continues shall constitute a separate offense and the applicable fines are cumulative.
2. In addition, the Township through its Solicitor may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Chapter. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

(Ord. 559, 7/27/2011, §113-40)

§23-1004. Appeals.

1. Any person aggrieved by any action of Northampton Township or its designee may appeal to the Board of Supervisors of Northampton Township within 30 days of that action. The Board of Supervisors of Northampton Township shall, within 30 days of receipt of an appeal, schedule a hearing to consider the appeal. The proceeding shall be governed by the Pennsylvania Local Agency Law, 2 Pa.C.S.A. §751 *et seq.*
2. Any person aggrieved by any decision of the Board of Supervisors of Northampton Township may appeal to the County Court of Common Pleas of Bucks County within 30 days of the Township's decision.

(Ord. 559, 7/27/2011, §113-41)

APPENDIX 23-A
STORMWATER CONTROLS AND BEST MANAGEMENT
PRACTICES OPERATIONS AND MAINTENANCE
AGREEMENT (Example)

THIS AGREEMENT, made and entered into this _____ day of _____,
20____, 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 Controls and 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 (BMPs); 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.

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.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the BMP(s) by the Landowner; provided, however, that this Agreement shall not be deemed to create or affect 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, shall release 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) at a minimum of once every three years 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
_____, 20__, do hereby certify that

_____ whose name(s) is/are signed to the
foregoing Agreement bearing date of the _____ day of _____,
20__, has acknowledged the same before me in my said County and State.

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

NOTARY PUBLIC

(SEAL)

APPENDIX 23-B

STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE 23-B-1

DESIGN STORM RAINFALL AMOUNT

Source: NOAA Atlas 14 website, Doylestown Gage (36-2221)
http://hdsc.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html.

FIGURE 23-B-1

ATLAS 14 TYPE II S-CURVES FOR ALL FREQUENCY STORMS – DOYLESTOWN GAGE (36-2221)

Source: NOAA Atlas 14 website, Doylestown Gage (36-2221)
http://hdsc.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html.

TABLE 23-B-2

NATURAL RESOURCE PROTECTION STORMWATER MANAGEMENT CONTROLS

Source: PA BMP Manual Chapter 8, pg 33

TABLE 23-B-3

GUIDANCE TO CALCULATE THE 2-YEAR, 24-HOUR VOLUME INCREASE FROM PRE-DEVELOPMENT TO POST-DEVELOPMENT CONDITIONS

Source: PA BMP Manual Chapter 8, pg 37

TABLE 23-B-4

RUNOFF CURVE NUMBERS

Source: NRCS (SCS) TR-55

TABLE 23-B-5

VOLUME CONTROL CALCULATION GUIDANCE FOR NONSTRUCTURAL BMPS

Source: PA BMP Manual Chapter 8, pg 34

TABLE 23-B-6

VOLUME CONTROL CALCULATION GUIDANCE FOR STRUCTURAL BMPS

Source: PA BMP Manual Chapter 8, pg 38

TABLE 23-B-7

RATIONAL RUNOFF COEFFICIENTS

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

TABLE 23-B-8

MANNING ROUGHNESS COEFFICIENTS

TABLE 23-B-1
DESIGN STORM RAINFALL AMOUNT (INCHES)

The design storm rainfall amount chosen for design should be obtained from the National Oceanic and Atmospheric Administration Atlas 14 interactive website:
http://hdsc.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html

Source: NOAA Atlas 14 website, Doylestown Gage (36-2221)
http://hdsc.nws.noaa.gov/hdsc/pfds/orb/pa_pfds.html

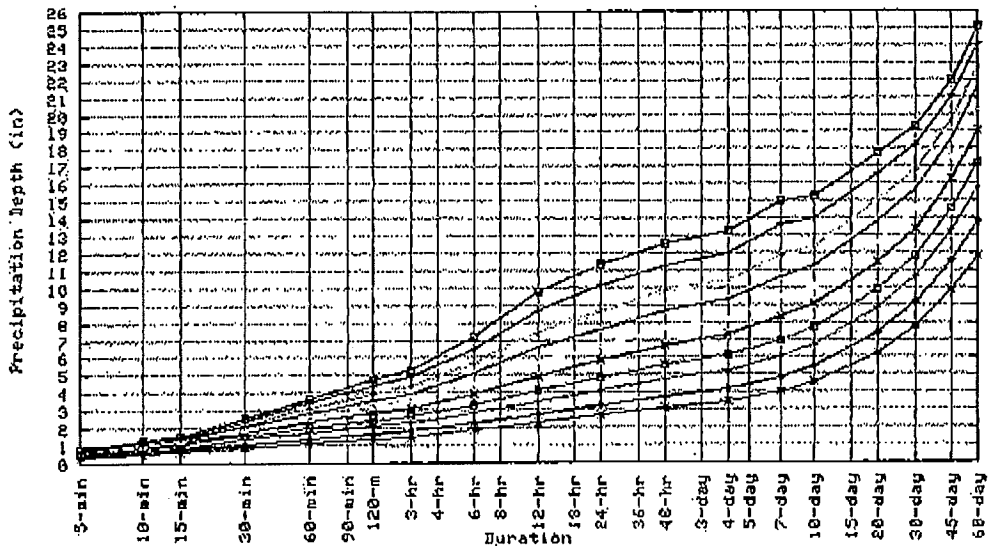
Precipitation Frequency Estimates (inches)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.34	0.54	0.68	0.93	1.15	1.38	1.51	1.89	2.30	2.71	3.13	3.48	4.07	4.61	6.23	7.76	9.85	11.81
2	0.40	0.64	0.81	1.12	1.40	1.67	1.83	2.28	2.78	3.26	3.78	4.19	4.87	5.51	7.39	9.14	11.57	13.83
5	0.47	0.76	0.96	1.36	1.75	2.10	2.30	2.86	3.50	4.11	4.76	5.24	6.02	6.71	8.81	10.65	13.30	15.78
10	0.53	0.84	1.06	1.54	2.01	2.42	2.66	3.32	4.11	4.81	5.57	6.09	6.96	7.68	9.93	11.83	14.60	17.23
25	0.59	0.94	1.19	1.76	2.34	2.86	3.15	3.98	4.99	5.83	6.71	7.30	8.30	9.03	11.44	13.36	16.25	19.04
50	0.63	1.00	1.27	1.92	2.60	3.21	3.54	4.52	5.74	6.70	7.66	8.29	9.41	10.11	12.61	14.52	17.46	20.35
100	0.67	1.07	1.35	2.07	2.85	3.56	3.94	5.09	6.55	7.63	8.67	9.33	10.59	11.23	13.79	15.66	18.61	21.57
200	0.71	1.13	1.42	2.21	3.11	3.92	4.35	5.69	7.43	8.64	9.75	10.44	11.83	12.39	14.98	16.79	19.69	22.70
500	0.76	1.20	1.51	2.40	3.44	4.41	4.90	6.54	8.73	10.12	11.30	12.01	13.60	14.00	16.58	18.23	21.02	24.08
1000	0.79	1.24	1.56	2.53	3.69	4.78	5.34	7.23	9.82	11.35	12.57	13.29	15.04	15.28	17.80	19.31	21.96	25.04

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

FIGURE 23-B-1

Atlas 14 Type II S-Curves for All Frequency Storms - Doylestown Gage (36-2221)

Partial duration based Point Precipitation Frequency Estimates - Version: 3
48.3 N 75.1333 W 385 ft



Wed Mar 11 12:14:13 2009

Average Recurrence Interval (years)	
1	↑
2	↑
5	↑
10	↑
25	↑
100	↑
200	↑
500	↑
1000	↑

**TABLE 23-B-2: NATURAL RESOURCE PROTECTION
STORMWATER MANAGEMENT CONTROLS**

Existing Natural Sensitive Resource	Mapped in the ERSAM? Yes/No/n/a	Total Area (Ac.)	Area to be Protected (Ac.)
Waterbodies			
Floodplains			
Riparian Areas / Buffers			
Wetlands			
Vernal Pools			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15%-25%			
Steep Slopes, over 25%			
Other:			
Other:			
Total Existing:			

TABLE 23-B-3: GUIDANCE TO CALCULATE THE 2-YEAR, 24-HOUR VOLUME INCREASE FROM PRE-DEVELOPMENT TO POST-DEVELOPMENT CONDITIONS

Existing Conditions: Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft3)
Woodland								
Meadow								
Impervious								
Total:								

Developed Conditions: Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff (in)	Runoff Volume (ft3)
Total:								

2-year Volume Increase (ft3):

TABLE 23-B-4. Runoff Curve Numbers (from NRCS (SCS) TR-55)

LAND USE DESCRIPTION	Hydrologic Condition	HYDROLOGIC SOIL GROUP			
		A	B	C	D
Open Space					
Grass cover < 50%	Poor	68	79	86	89
Grass cover 50% to 75%	Fair	69	79	84	
Grass cover > 75%	Good	39	61	74	80
Meadow		30	58	71	78
Agricultural					
Pasture, grassland, or range – Continuous forage for grazing	Poor	68	79	86	89
Pasture, grassland, or range – Continuous forage for grazing.	Fair	49	69	79	84
Pasture, grassland, or range – Continuous forage for grazing	Good	39	61	74	80
Brush-weed-grass mixture with brush the major element.	Poor	48	67	77	83
Brush-weed-grass mixture with brush the major element.	Fair	35	56	70	77
Brush-weed-grass mixture with brush the major element.	Good	30	48	65	73
Fallow Bare soil	-----	77	86	91	94
Crop residue cover (CR)	Poor	76	85	90	93
	Good	74	83	88	90
Woods – grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Commercial (85% Impervious)		92	94	95	
Industrial (72% Impervious)		88	91	93	
Institutional (50% Impervious)		82	88	90	
Residential districts by average lot size:					
	% Impervious				
1/8 acre or less * (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Farmstead		59	74	82	86
Smooth Surfaces (Concrete, Asphalt, Gravel or Bare Compacted Soil)	98	98	98	98	
Water	98	98	98	98	
Mining/Newly Graded Areas (Pervious Areas Only)	77	86	91	94	

* Includes Multi-Family Housing unless justified lower density can be provided.

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

**TABLE 23-B-5: VOLUME CONTROL CALCULATION GUIDANCE FOR
NONSTRUCTURAL BMPs**

Type of Nonstructural BMP

	AREA (sq ft)	* Runoff Volume (in)	* 1/12 =	Volume Reduction(ft ³)
Use of Natural Drainage Feature				
<i>Utilize natural flow pathways</i>	_____sq ft	* 1/4"	* 1/12 =	_____cu ft
Minimum Soil Compaction				
<i>Lawn</i>	_____sq ft	* 1/3"	* 1/12 =	_____cu ft
<i>Meadow</i>	_____sq ft	* 1/3"	* 1/12 =	_____cu ft
Protecting existing trees (not located in protected area)				
For trees within 20 feet of impervious cover:				
<i>Tree Canopy</i>	_____sq ft	* 1"	* 1/12 =	_____cu ft
For trees within 20-100 feet of impervious cover:				
<i>Tree Canopy</i>	_____sq ft	* 1/2"	* 1/12 =	_____cu ft
Rooftop Disconnection				
For runoff directed to pervious and/or vegetative areas where infiltration occurs				
<i>Roof Area</i>	_____sq ft	* 1/4"	* 1/12 =	_____cu ft
Impervious Disconnection				
For runoff from impervious surfaces such as streets and concrete directed to pervious and/or vegetative areas where infiltration occurs				
<i>Impervious Area</i>	_____sq ft	* 1/4"	* 1/12 =	_____cu ft
Total Volume Reduction				_____cu ft

* represents multiply

TABLE 23-B-6: VOLUME CONTROL CALCULATION GUIDANCE FOR STRUCTURAL BMPS

$$\begin{array}{ccc} \text{Required} & \text{Nonstructural} & \text{Structural Volume} \\ \text{Volume Control (ft}^3\text{)} & \text{Volume Control (ft}^3\text{)} & \text{Requirement (ft}^3\text{)} \\ \text{Table B-3} & \text{Table B-5} & \end{array} =$$

Type	Proposed Structural BMP	Section in BMP Manual	Area (sq ft)	Storage Volume (cu ft)
Infiltration and / or Evapotranspiration	Porous Pavement	6.4.1		
	Infiltration Basin	6.4.2		
	Infiltration Bed	6.4.3		
	Infiltration Trench	6.4.4		
	Rain Garden/Bioretention	6.4.5		
	Dry Well/Seepage Pit	6.4.6		
	Constructed Filter	6.4.7		
	Vegetative Swale	6.4.8		
	Vegetative Filter Strip	6.4.9		
	Infiltration Berm	6.4.10		
Evaporation and / or Reuse	Vegetative Roof	6.5.1		
	Capture and Re-use	6.5.2		
Runoff Quality	Constructed Wetlands	6.6.1		
	Wet Pond / Retention Basin	6.6.2		
	Dry Extended Detention Basin	6.6.3		
	Water Quality Filters	6.6.4		
Restoration	Riparian Buffer Restoration	6.7.1		
	Landscape Restoration / Reforestation	6.7.2		
	Soil Amendment	6.7.3		
Other	Level Spreader	6.8.1		
	Special Storage Areas	6.8.2		
	other			

Total Volume Control from Structural BMPs: _____

TABLE 23-B-7. RATIONAL RUNOFF COEFFICIENTS
By Hydrologic Soils Group and Overland Slope (%)

Land Use	A			B			C			D		
	0-2%	2-6%	6%-	0-2%	2-6%	6%-	0-2%	2-6%	6%-	0-2%	2-6%	6%-
Cultivated Land	0.08 ^a 0.14 ^b	0.13 0.18	0.16 0.22	0.11 0.16	0.15 0.21	0.21 0.28	0.14 0.20	0.19 0.25	0.26 0.34	0.18 0.24	0.25 0.29	0.31 0.41
Pasture	0.12 0.15	0.20 0.25	0.30 0.37	0.18 0.23	0.28 0.34	0.37 0.45	0.24 0.30	0.34 0.42	0.44 0.52	0.50 0.57	0.40 0.50	0.58 0.62
Meadow	0.10 0.14	0.16 0.22	0.25 0.30	0.14 0.20	0.22 0.28	0.30 0.37	0.20 0.26	0.28 0.35	0.36 0.44	0.24 0.30	0.30 0.40	0.40 0.50
Forest	0.05 0.08	0.08 0.11	0.11 0.14	0.08 0.10	0.11 0.14	0.14 0.18	0.10 0.12	0.13 0.16	0.16 0.20	0.12 0.15	0.16 0.20	0.20 0.25
Residential												
Lot Size 1/8 Acre	0.25 0.33	0.28 0.37	0.31 0.40	0.27 0.33	0.30 0.39	0.35 0.44	0.30 0.38	0.33 0.42	0.38 0.49	0.33 0.41	0.36 0.45	0.42 0.54
Lot Size 1/4 Acre	0.22 0.30	0.26 0.34	0.29 0.37	0.24 0.33	0.29 0.37	0.33 0.42	0.27 0.36	0.31 0.40	0.36 0.47	0.30 0.38	0.34 0.42	0.40 0.51
Lot Size 1/3 Acre	0.19 0.28	0.23 0.31	0.26 0.35	0.22 0.30	0.26 0.35	0.30 0.39	0.25 0.33	0.29 0.38	0.34 0.45	0.28 0.36	0.32 0.40	0.39 0.50
Lot Size 1/2 Acre	0.16 0.25	0.20 0.29	0.24 0.32	0.19 0.28	0.23 0.32	0.28 0.36	0.22 0.31	0.27 0.35	0.32 0.42	0.26 0.34	0.30 0.38	0.37 0.48
Lot Size 3/4 Acre	0.14 0.22	0.19 0.26	0.23 0.29	0.17 0.24	0.21 0.28	0.26 0.34	0.20 0.28	0.25 0.32	0.31 0.40	0.24 0.31	0.29 0.35	0.35 0.46
Industrial	0.67 0.85	0.68 0.85	0.68 0.85	0.68 0.85	0.68 0.86	0.69 0.86	0.68 0.86	0.69 0.86	0.69 0.87	0.69 0.86	0.69 0.86	0.70 0.88
Commercial	0.71 0.88	0.71 0.88	0.72 0.89	0.71 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.90	0.72 0.89	0.72 0.89	0.72 0.90
Streets	0.70 0.76	0.71 0.77	0.71 0.79	0.71 0.80	0.72 0.81	0.74 0.84	0.72 0.84	0.73 0.83	0.76 0.89	0.73 0.89	0.73 0.91	0.78 0.95
Open Space	0.05 0.11	0.10 0.16	0.14 0.20	0.08 0.14	0.13 0.19	0.19 0.26	0.12 0.18	0.17 0.23	0.24 0.32	0.16 0.22	0.21 0.27	0.28 0.39
Parking	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	0.85 0.95	0.86 0.96	0.87 0.97

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

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

Source: Rawls, W.J., S.L. Wong and R.H. McCuen, 1981, "Comparison of Urban Flood Frequency Procedures", Preliminary Draft, U.S. Department

TABLE 23-B-8. MANNING'S ROUGHNESS COEFFICIENTS

DESCRIPTION	Manning's n-value
Smooth-wall Plastic Pipe	0.011
Concrete Pipe	0.012
Smooth-lined Corrugated Metal Pipe	0.012
Corrugated Plastic Pipe	0.024
Annular Corrugated Steel And Aluminum Alloy Pipe (Plain or polymer coated)	
68 mm × 13 mm (2 2/3 in × 1/2 in) Corrugations	0.024
75 mm × 25 mm (3 in × 1 in) Corrugations	0.027
125 mm × 25 mm (5 in × 1 in) Corrugations	0.025
150 mm × 50 mm (6 in × 2 in) Corrugations	0.033
Helically Corrugated Steel And Aluminum Alloy Pipe (Plain or polymer coated)	
75 mm × 25 mm (3 in × 1 in), 125 mm × 25 mm (5 in × 1 in), or 150 mm × 50 mm (6 in × 2 in) Corrugations	0.024
Helically Corrugated Steel And Aluminum Alloy Pipe (Plain or polymer coated)	
68 mm × 13 mm (2 2/3 in × 1/2 in) Corrugations	
a. Lower Coefficients*	
450 mm (18 in) Diameter	0.014
600 mm (24 in) Diameter	0.016
900 mm (36 in) Diameter	0.019
1200 mm (48 in) Diameter	0.020
1500 mm (60 in) Diameter or larger	0.021
b. Higher Coefficients**	0.024
Annular or Helically Corrugated Steel or Aluminum Alloy Pipe Arches or Other Non-Circular Metal Conduit (Plain or Polymer coated)	0.024
Vitrified Clay Pipe	0.012
Ductile Iron Pipe	0.013
Asphalt Pavement	0.015
Concrete Pavement	0.014
Grass Medians	0.050
Grass – Residential	0.30
Earth	0.020
Gravel	0.030
Rock	0.035
Cultivated Areas	0.030 - 0.050
Dense Brush	0.070 - 0.140
Heavy Timber (Little undergrowth)	0.100 - 0.150
Heavy Timber (w/underbrush)	0.40
Streams:	
a. Some Grass And Weeds (Little or no brush)	0.030 - 0.035
b. Dense Growth of Weeds	0.035 - 0.050
c. Some Weeds (Heavy brush on banks)	0.050 - 0.070

Notes:

* Use the lower coefficient if any one of the following conditions apply:

- A storm pipe longer than 20 diameters, which directly or indirectly connects to an inlet or manhole, located in swales adjacent to shoulders in cut areas or depressed medians.
- A storm pipe which is specially designed to perform under pressure.

**Use the higher coefficient if any one of the following conditions apply:

- A storm pipe which directly or indirectly connects to an inlet or manhole located in highway pavement sections or adjacent to curb or concrete median barrier.
- A storm pipe which is shorter than 20 diameters long.
- A storm pipe which is partly lined helically corrugated metal pipe.

APPENDIX 23-C

SWM SITE PLAN CHECKLIST

TMP No: _____
Project Name: _____
Engineer: _____
Date: _____
Project ID: _____ (for Municipal use ONLY)

SECTION I: REGULATED ACTIVITIES

Reference: §23-105

1. Does the Proposed Project meet the definition of a "Regulated Activity"? ☐ Yes ☐ No

STOP – If you have checked NO for the above question, you are not required to submit a Grading Permit.

SECTION II: EXEMPTION

Reference: §23-106

1. Does the regulated activity create an Impervious Surface greater than 1,000 square feet but less than 5,000 square feet? ☐ Yes ☐ No
2. Does the regulated activity involve an Agricultural Activity? ☐ Yes ☐ No
3. Does the regulated activity involve Forest Management or Timber Operations? ☐ Yes ☐ No

Parcel IS Exempt from the SWM Site Plan and Peak Rate Control ☐

Parcel IS Exempt from Peak Rate Control ☐

Parcel IS NOT Exempt ☐

SECTION III: VOLUME CONTROLS

Reference: §23-304

A. Site Disturbance Minimization

1. Has an Existing Resource and Site Analysis Map (ERSAM) been prepared?

☐ Yes ☐ No, Explain _____

2. Are any of the following environmentally sensitive areas identified on site?

Steep Slopes	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Ponds / Lakes / Vernal Pools	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Streams	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Wetlands	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Hydric Soils	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Flood plains	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Stream Buffer Zones	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Hydrologic Soil Groups A or B	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Recharge Areas	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown
Others: _____	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Unknown

3. Does the site layout plan avoid environmentally sensitive areas identified on site?

☐ Yes ☐ No, Explain _____

B. Post-development Runoff Volume Control

1. What method is used to calculate the required volume control?

☐ Design-storm method ☐ Simplified method

2. What is the level of runoff volume (ft³) required to be controlled from the post-development site?
_____ (ft³)

C. Stormwater runoff control measures

1. What is the level of runoff volume (ft³) controlled through nonstructural BMPs? _____ (ft³)

2. What is the level of runoff volume (ft³) controlled through structural BMPs? _____ (ft³)

3. Have provisions been installed to promote infiltration on site?

☐ Yes ☐ No, Explain _____

4. Have provisions been installed to promote evapotranspiration, capture or reuse on site?

☐ Yes ☐ No, Explain _____

SECTION V: PEAK RATES

Reference: §23-305

1. Does the Proposed Conditions Runoff meet the Criteria established in Table 23-305.1?

☐ Yes ☐ No, if you answered Yes proceed to Section VI.

SECTION VI: CALCULATION METHODOLOGY

Reference: §23-306 and Appendix 23-B

1. Which method(s) are utilized in the site stormwater management plan for computing stormwater runoff rates and volumes?

<input type="checkbox"/> TR-20	<input type="checkbox"/> PSRM
<input type="checkbox"/> TR-55	<input type="checkbox"/> Rational Method
<input type="checkbox"/> HEC-1 / HEC-HMS	<input type="checkbox"/> Other: _____

2. Was Table 23-B-1 or Figure 23-B-1 utilized in rainfall determination?

☐ Yes ☐ No, Explain _____

3. Was Table 23-B-4 (Runoff Curve Numbers) or Table 23-B-7 (Rational Runoff Coefficients) utilized in calculations for runoff?

☐ Yes ☐ No, Explain _____

SECTION IX: FACILITY OPERATION AND MAINTENANCE PLAN

Reference: §23-803

1. Has a Stormwater Control and BMP Operations and Maintenance Plan been approved by the Municipality?

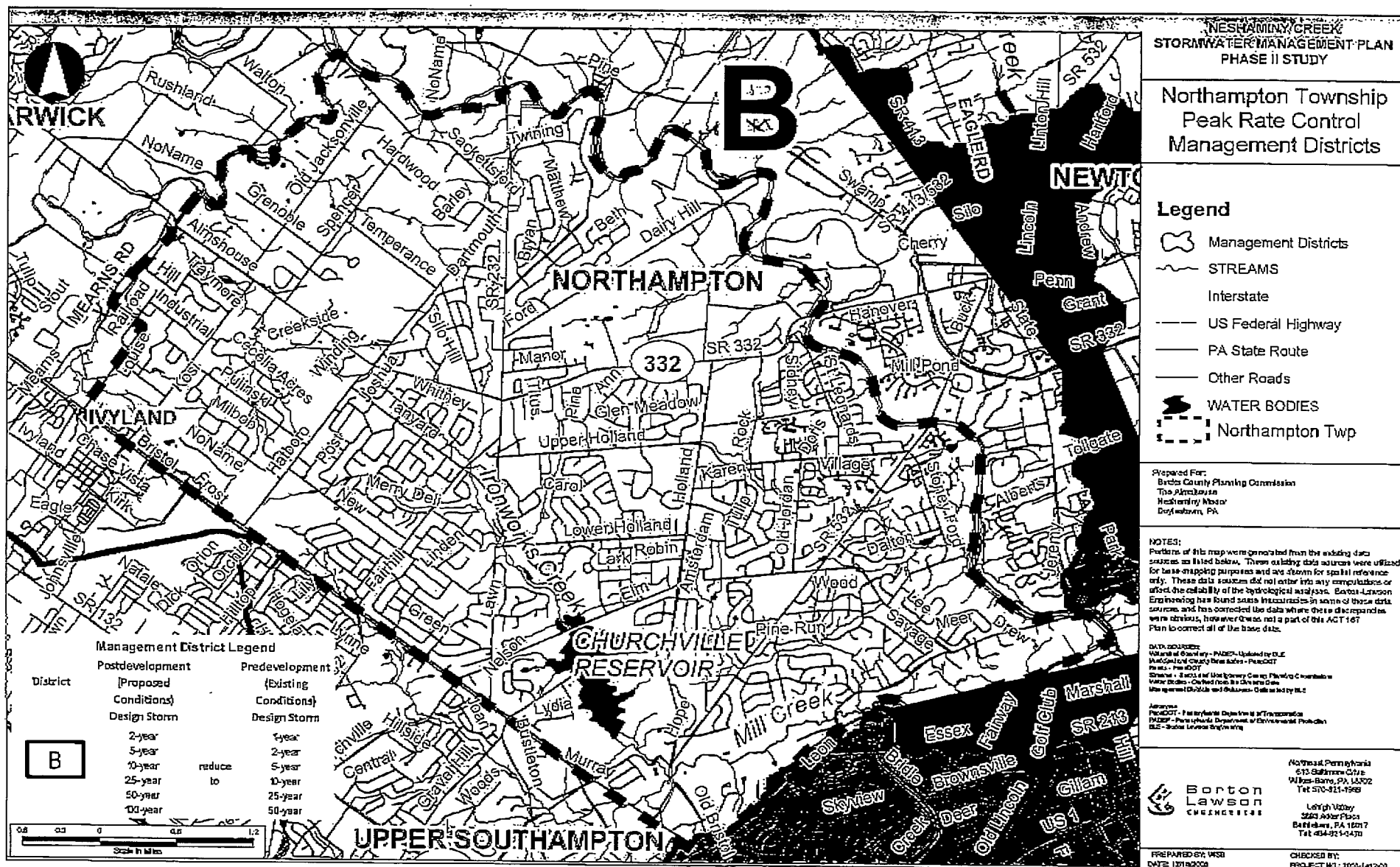
☐ Yes ☐ No, Explain _____

2. Who shall assume responsibility for implementing the Stormwater Control and BMP Operations and Maintenance Plan?

<input type="checkbox"/> Municipality	<input type="checkbox"/> Homeowner Association
<input type="checkbox"/> Private Owner	<input type="checkbox"/> Other _____

APPENDIX 23-D

MAPS OF MANAGEMENT DISTRICTS



APPENDIX 23-E

LOW IMPACT DEVELOPMENT (LID) PRACTICES

ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

Natural hydrologic conditions can be altered radically by poorly planned development practices, such as 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 leads 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 and will minimize needs for artificial conveyance and storage facilities. To simulate predevelopment hydrologic conditions, infiltration is often necessary to offset the loss of infiltration by the creation of impervious surfaces. Preserving natural hydrologic conditions requires careful alternative site design considerations. Site design practices include preserving natural drainage features, 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 LID techniques that may be used:

1. **Protect Sensitive and Special Value Resources:** See Section 5.4 of the *Pennsylvania Stormwater Best Management Practices Manual*, Pennsylvania Department of Environmental Protection (PADEP) No. 363-0300-002 (2006).
 - a. **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 are typically 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.
 - b. **Protecting Natural Depression Storage Areas.** Depressional storage areas either 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.

2. Disconnect/Distribute/Decentralize: See Section 5.8 of the *Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) No. 363-0300-002 (2006)*.

- a. **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.
- b. **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.

In summary, a careful consideration of the existing topography and implementation of a combination of the above-mentioned techniques may avoid construction of costly stormwater control measures. Benefits include reduced potential of downstream flooding, water quality improvement of receiving streams/water bodies and enhancement of aesthetics and reduction of development costs. Other benefits include more stable baseflows in receiving streams, improved groundwater recharge, reduced flood flows, reduced pollutant loads, and reduced costs for conveyance and storage.

APPENDIX 23-F

DISCONNECTED IMPERVIOUS AREA (DIA)

ROOFTOP DISCONNECTION

When rooftop downspouts are directed to a pervious area that allows for infiltration, filtration, and increased time of concentration, the rooftop may qualify as completely or partially DIA and a portion of the impervious rooftop area may be excluded from the calculation of total impervious area.

A rooftop is considered to be completely or partially disconnected if it meets the requirements listed below:

- The contributing area of a rooftop to each disconnected discharge is 500 square feet or less, and
- The soil, in proximity of the roof water discharge area, is not designated as hydrologic soil group "D" or equivalent, and
- The overland flow path from roof water discharge area has a positive slope of 5% or less.

For designs that meet these requirements, the portion of the roof that may be considered disconnected depends on the length of the overland path as designated in Table F.1.

Table F.1: Partial Rooftop Disconnection

Length of Pervious Flow Path *	Roof Area Treated as Disconnected
(ft)	(% of contributing area)
0 – 14	0
15 – 29	20
30 – 44	40
45 – 59	60
60 – 74	80
75 or more	100

* Flow path cannot include impervious surfaces and must be at least 15 feet from any impervious surfaces.

If the discharge is concentrated at one or more discrete points, no more than 1,000 square feet may discharge to any one point. In addition, a gravel strip or other spreading device is required for concentrated discharges. For non-concentrated discharges along the edge of the pavement, this requirement is waived; however, there must be a provision for the establishment of vegetation along the pavement edge and temporary stabilization of the area until vegetation becomes stabilized.

REFERENCE

Philadelphia Water Department. 2006. *Stormwater Management Guidance Manual*. Section 4.2.2: Integrated Site Design. Philadelphia, PA.

APPENDIX 23-G

SMALL PROJECT STORMWATER MANAGEMENT (SWM) SITE PLAN

Small Project Stormwater Management Site Plan

This small project stormwater site plan has been developed to assist those proposing residential projects to meet the requirements of the *Neshaminy Creek Watershed Stormwater Management Act 167 Plan Model Ordinance* without having to hire professional services to draft a formal stormwater management plan. This small project site plan is only permitted for residential projects proposing less than or equal to 5,000 square feet of impervious surface and less than 1 acre of earth disturbance.

A. What is an applicant required to submit?

A brief description of the proposed stormwater facilities, including types of materials to be used, total square footage of proposed impervious areas, volume calculations, and a simple sketch plan showing the following information:

- Location of proposed structures, driveways, or other paved areas with approximate surface area in square feet.
- Location of any existing or proposed on-site septic system and/or potable water wells showing proximity to infiltration facilities.
- Bucks County Conservation District erosion and sediment control "Adequacy" letter.

B. Determination of Required Volume Control and Sizing Stormwater Facilities

By following the simple steps outlined below in the provided example, an applicant can determine the runoff volume that is required to be controlled and how to choose the appropriate stormwater facility to permanently remove the runoff volume from the site. Impervious area calculations must include all areas on the lot proposed to be covered by roof area or pavement which would prevent rain from naturally percolating into the ground, including impervious surfaces such as sidewalks, driveways, parking areas, patios or swimming pools. Pervious areas that are designed and constructed to allow for infiltration are not included in this calculation.

Site Plan Example: Controlling runoff volume from a proposed home site

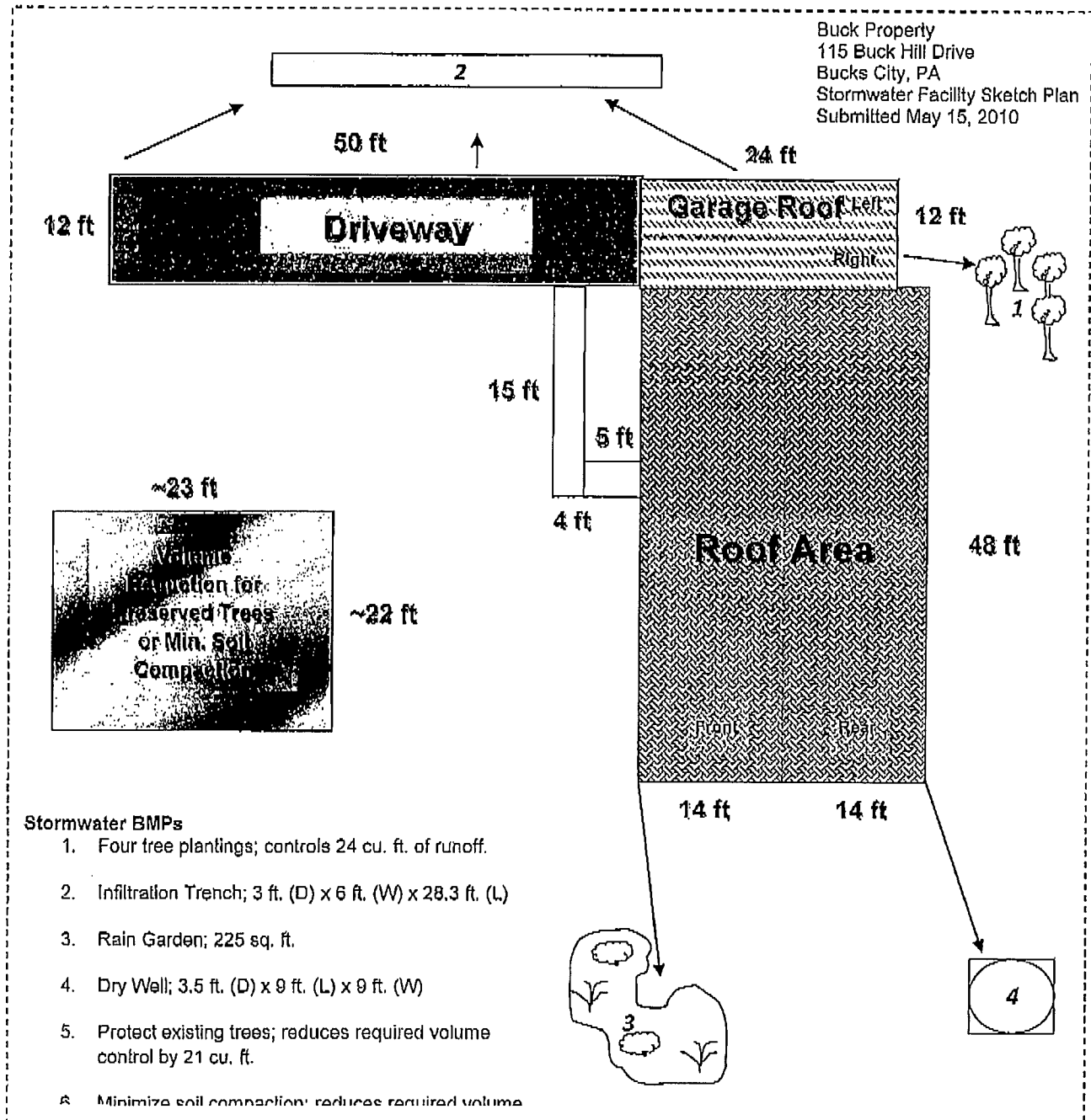
Step 1: Determine Total Impervious Surfaces

Impervious Surface			Area (sq. ft.)
House Roof (Front)	14 ft. x 48 ft.	=	672 sq. ft.
House Roof (Rear)	14 ft. x 48 ft.	=	672 sq. ft.
Garage Roof (Left)	6ft. x 24 ft.	=	144 sq. ft.

Garage Roof (Right)	6 ft. x 24 ft.	=	144 sq. ft.
Driveway	12 ft. x 50 ft.	=	1000 sq. ft.
Walkway	4 ft. x 20 ft.	=	80 sq. ft.

	Total Impervious		3000 sq ft

Figure 1: Sample Site Sketch Plan



Step 2: Determine Required Volume Control (cubic feet) using the following equation:

Volume (cu. ft.) = (Total impervious area in square feet x 2 inches of runoff) /12 inches

$$(3,000 \text{ sq. ft.} \times 2 \text{ inches of runoff}) /12 \text{ inches} = 500 \text{ cu. ft.}$$

Step 3: Sizing the Selected Volume Control BMP

Several Best Management Practices (BMPs), as described below, are suitable for small stormwater management projects. However, their application depends on the volume required to be controlled, how much land is available, and the site constraints. Proposed residential development activities can apply both nonstructural and structural BMPs to control the volume of runoff from the site. A number of different volume control BMPs are described below. Note that Figure 1 is an example of how these BMPs can be utilized in conjunction to control the total required volume on one site.

Structural BMPs

1. Infiltration Trench

An Infiltration Trench is a linear stormwater BMP consisting of a continuously perforated pipe at a minimum slope in a stone-filled trench. During small storm events, infiltration trenches can significantly reduce volume and serve in the removal of fine sediments and pollutants. Runoff is stored between the stones and infiltrates through the bottom of the facility and into the soil matrix. Runoff should be pretreated using vegetative buffer strips or swales to limit the amount of coarse sediment entering the trench which can clog and render the trench ineffective. In all cases, an infiltration trench should be designed with a positive overflow.

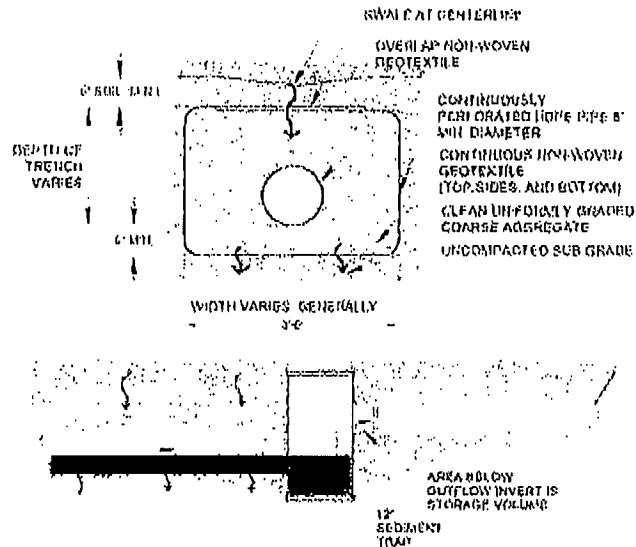
Design Considerations:

- Although the width and depth can vary, it is recommended that Infiltration Trenches be limited in depth to not more than six (6) feet of stone.
- Trench is wrapped in nonwoven geotextile (top, sides, and bottom).
- Trench needs to be placed on uncompacted soils.
- Slope of the Trench bottom should be level or with a slope no greater than 1%.
- A minimum of 6 inches of topsoil is placed over trench and vegetated.
- The discharge or overflow from the Infiltration Trench should be properly designed for anticipated flows.
- Cleanouts or inlets should be installed at both ends of the Infiltration Trench and at appropriate intervals to allow access to the perforated pipe.
- Volume of facility = Depth x Width x Length x Void Space of the gravel bed (assume 40%).

Maintenance:

- Catch basins and inlets should be inspected and cleaned at least two times a year.
- The vegetation along the surface of the infiltration trench should be maintained in good condition and any bare spots should be re-vegetated as soon as possible.
- Vehicles should not be parked or driven on the trench and care should be taken to avoid soil compaction by lawn mowers.

Figure 3: Infiltration Trench Diagram



Source: PA BMP Guidance Manual, Chapter 6, page 42.

Figure 4: Example of Infiltration Trench Installation



Source: PA BMP Guidance Manual, Chapter 6, Page 46.

Sizing Example for Infiltration Trench

1. Determine Total Impervious Surface to drain to Infiltration Trench:

Garage Roof (Left)	6 ft. x 24 ft.	=	144 sq ft
Driveway	12 ft. x 50 ft.	=	1000 sq ft
Walkway	4 ft. x 20 ft.	=	80 sq ft

2. Determine the required infiltration volume:

$$(1224 \text{ sq. ft.} \times 2 \text{ inches of runoff}) / 12 \text{ ft.} = 204 \text{ cu. ft.} / 0.4^* = 510 \text{ cu. ft.}$$

(*0.4 assumes 40% void ratio in gravel bed)

3. Sizing the infiltration trench facility:

$$\text{Volume of Facility} = \text{Depth} \times \text{Width} \times \text{Length}$$

Set Depth to 3 feet and determine required surface area of trench.

$$510 \text{ cu. ft.} / 3 \text{ ft} = 170 \text{ sq ft.}$$

The width of the trench should be greater than 2 times its depth (2 x D); therefore, in this example, the trench width of 6 feet is selected.

$$\text{Determine trench length: } L = 170 \text{ sq. ft.} / 6 \text{ ft.} = 28.3 \text{ ft.}$$

Final infiltration trench dimensions: 3 ft. (D) x 6 ft. (W) x 28.3 ft. (L)

2. Rain Garden

A Rain Garden is a planted shallow depression designed to catch and filter rainfall runoff. The garden captures rain from a downspout or a paved surface. The water sinks into the ground, aided by deep rooted plants that like both wet and dry conditions. The ideal location for a rain garden is between the source of runoff (roofs and driveways) and the runoff destination (drains, stream, low spots, etc).

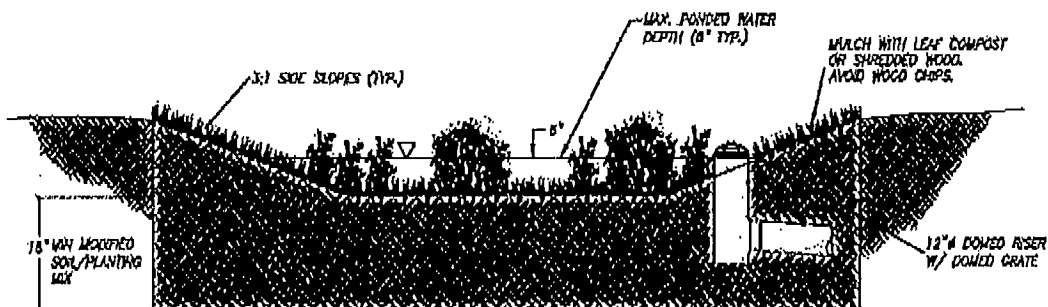
Design Considerations:

- A maximum of 3:1 side slope is recommended.
- The depth of a rain garden can range from 6 - 8 inches. Pondered water should not exceed 6 inches.
- The rain garden should drain within 72 hours.
- The garden should be at least 10-20 feet from a building's foundation and 25 feet from septic system drainfields and wellheads.
- If the site has clay soils, soil should be amended with compost or organic material.
- Choose native plants. See http://pa.audubon.org/habitat/PDFs/RGBrochure_complete.pdf for a native plant list. To find native plant sources go to www.pawildflower.org.
- At the rain garden location, the water table should be at least 2 feet below the soil level. If water stands in an area for more than one day after a heavy rain, you can assume it has a higher water table and is not a good choice for a rain garden.

Maintenance:

- Water plants regularly until they become established.
- Inspect twice a year for sediment buildup, erosion and vegetative conditions.
- Mulch with hardwood when erosion is evident and replenish annually.
- Prune and remove dead vegetation in the spring season.
- Weed as you would any garden.
- Move plants around if some plants would grow better in the drier or wetter parts of the garden.

Figure 5: Rain Garden Diagram



Source: PA BMP Guidance Manual, Chapter 6 Page 50

Sizing Example for Rain Garden

1. Pick a site for the rain garden between the source of runoff and between a low lying area, a.k.a., a drainage area.
2. Perform an infiltration test to determine the depth of the rain garden:
 - Dig a hole 8" x 8"
 - Fill with water and put a popsicle stick at the top of the water level.
 - Measure how far it drains down after a few hours (ideally 4).
 - Calculate the depth of water that will drain out over 24 hours.
3. Determine total impervious surface area to drain to rain garden:

House Roof (Front)	14 ft. x 48 ft.	=	672 sq ft
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4. Sizing the rain garden:

For this example, the infiltration test determined 6 inches of water drained out of a hole in 24 hours. The depth of the rain garden should be set to the results of the infiltration test so 6 inches is the depth of the rain garden. The sizing calculation below is based on controlling 1 inch of runoff. First divide the impervious surface by the depth of the rain garden.

$$(672 \text{ sq ft} / 6 \text{ ft.}) = 112 \text{ sq. ft.}$$

In order to control 2 inches of runoff volume, the rain garden area needs to be multiplied by 2.

$$112 \text{ sq. ft.} * 2 = 224 \text{ sq. ft.}$$

The rain garden should be about 225 sq. ft. in size and 6 inches deep.

3. Dry Well (a.k.a. Seepage Pit)

A Dry Well, sometimes called a Seepage Pit, is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff from the roofs of structures. By capturing runoff at the source, Dry Wells can dramatically reduce the increased volume of stormwater generated by the roofs of structures. Roof leaders connect directly into the Dry Well, which may be either an excavated pit filled with uniformly graded aggregate wrapped in geotextile, or a prefabricated storage chamber or pipe segment. Dry Wells discharge the stored runoff via infiltration into the surrounding soils. In the event that the Dry Well is overwhelmed in an intense storm event, an overflow mechanism (surcharge pipe, connection to a larger infiltration area, etc.) will ensure that additional runoff is safely conveyed downstream.

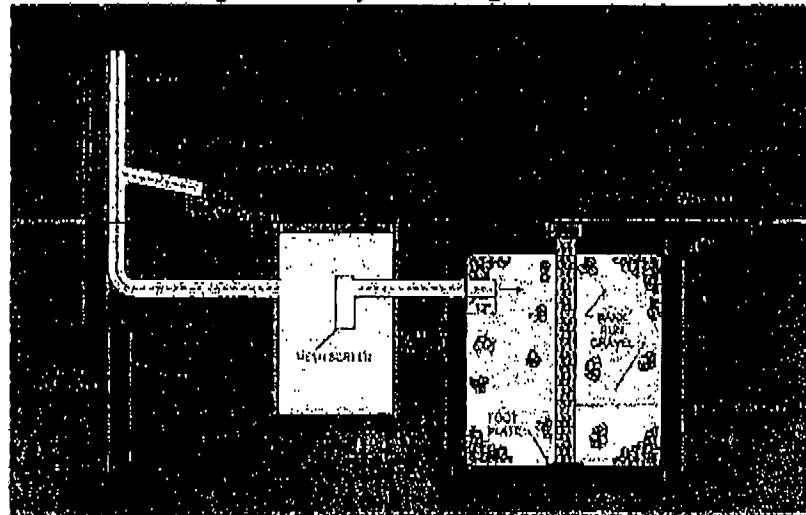
Design Considerations:

- Dry Wells typically consist of 18 to 48 inches of clean washed, uniformly graded aggregate with 40% void capacity (AASHTO No. 3, or similar). "Clean" gravel fill should average one and one-half to three (1.5 – 3.0) inches in diameter.
- Dry Wells are not recommended when their installation would create a significant risk for basement seepage or flooding. In general, 10-20 feet of separation is recommended between Dry Wells and building foundations.
- The facility may be either a structural prefabricated chamber or an excavated pit filled with aggregate.
- Depth of dry wells in excess of three-and-a-half (3.5) feet should be avoided unless warranted by soil conditions.
- Stormwater dry wells must never be combined with existing, rehabilitated, or new septic system seepage pits. Discharge of sewage to stormwater dry wells is strictly prohibited.

Maintenance:

- Dry wells should be inspected at least four (4) times annually, as well as after large storm events.
- Remove sediment, debris/trash, and any other waste material from a dry well.
- Regularly clean out gutters and ensure proper connections to the dry well.
- Replace the filter screen that intercepts the roof runoff as necessary.

Figure 6: Dry Well Diagram



Source: PA BMP Guidance Manual, Chapter 6, Page 65.

Sizing Example for Dry Wells:

1. Determine contributing impervious surface area:

House Roof (Rear)	14 ft. x 48 ft.	=	672 sq. ft.
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2. Determine required volume control:

$$(672 \text{ sq. ft.} \times 2 \text{ inches of runoff}) / 12 \text{ inches} = 112 \text{ cu. ft.}$$

$$112 \text{ cu. ft.} / 0.4 = 280 \text{ cu. ft. (assuming the 40\% void ratio in the gravel bed)}$$

3. Sizing the dry well:

Set depth to 3.5 ft; Set width equal to length for a square chamber.

$$280 \text{ cu. ft.} = 3.5 \text{ ft.} \times L \times L; L = 9 \text{ ft.}$$

$$\text{Dimensions} = 3.5 \text{ ft. (D)} \times 9 \text{ ft. (L)} \times 9 \text{ ft. (W)}$$

Non-Structural BMPs

1. Tree Plantings and Preservation

Trees and forests reduce stormwater runoff by capturing and storing rainfall in the canopy and releasing water into the atmosphere through evapotranspiration. Tree roots and leaf litter also create soil conditions that promote the infiltration of rainwater into the soil. In addition, trees and forests reduce pollutants by taking up nutrients and other pollutants from soils and water through their root systems. A development site can reduce runoff volume by planting new trees or by preserving trees which existed on the site prior to development. The volume reduction calculations either determine the cubic feet to be directed to the area under the tree canopy for infiltration or determine a volume reduction credit which can be used to reduce the size of any one of the planned structural BMPs on the site.

Tree Considerations:

- Existing trees must have at least a 4 inches trunk caliper or larger.
- Existing tree canopy must be within 100 ft. of impervious surfaces.
- A tree canopy is classified as the continuous cover of branches and foliage formed by a single tree or collectively by the crowns of adjacent trees.
- New tree plantings must be at least 6 ft. in height and have a 2-inch trunk caliper.
- All existing and newly planted trees must be native to Pennsylvania. See <http://www.dcnr.state.pa.us/forestry/commontr/commontrees.pdf> for a guide book titled *Common Trees of Pennsylvania* for a native tree list.
- When using trees as volume control BMPs, runoff from impervious areas should be directed to drain under the tree canopy.

Determining the required number of planted trees to reduce the runoff volume:

1. Determine contributing impervious surface area:

Garage Roof (Right)	6 ft. x 24 ft.	=	144	ft
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2. Calculate the required control volume:

$$(144 \text{ sq. ft.} \times 2 \text{ inches of runoff}) / 12 \text{ inches} = 24 \text{ cu. ft.}$$

3. Determine the number of tree plantings:

- A newly planted deciduous tree can reduce runoff volume by 6 cu. ft.
- A newly planted evergreen tree can reduce runoff volume by 10 cu. ft.

$$24 \text{ cu. ft.} / 6 \text{ cu. ft.} = 4 \text{ Deciduous Trees}$$

Determining the volume reduction for preserving existing trees:

1. Calculate approximate area of the existing tree canopy:

$$\sim 22 \text{ sq. ft.} \times \sim 23 \text{ sq. ft.} = 500 \text{ sq. ft.}$$

2. Measure distance from impervious surface to tree canopy: 35 ft.

3. Calculate the volume reduction credit by preserving existing trees:

- For Trees within 20 feet of impervious cover:
Volume Reduction cu. ft. = (Existing Tree Canopy sq. ft. \times 1 inch) / 12
- For Trees beyond 20 feet but not farther than 100 feet from impervious cover:
Volume Reduction cu. ft. = (Existing Tree Canopy sq. ft. \times 0.5 inch) / 12

$$(500 \text{ sq. ft.} \times 0.5 \text{ inches}) / 12 = 21 \text{ cu. ft.}$$

This volume credit can be utilized in reducing the size of any one of the structural BMPs planned on the site. For example, the 21 cu. ft. could be subtracted from the required infiltration volume when sizing the infiltration trench:

$$510 \text{ cu. ft.} - 21 \text{ cu. ft.} = 489 \text{ cu. ft.}$$

$$489 \text{ cu. ft.} / 3 \text{ ft (Depth)} = 163 / 6 \text{ ft. (Width)} = 27.1 \text{ ft (Length)}$$

Using the existing trees for a volume credit would decrease the length of the infiltration trench to 27.1 ft. instead of 28.3 ft.

2. Minimize Soil Compaction and Replant with Lawn or Meadow

When soil is overly compacted during construction, it can cause a drastic reduction in the permeability of the soil and rarely is the soil profile completely restored. Runoff from vegetative areas with highly compacted soils similarly resembles runoff from an impervious surface. Minimizing soil compaction and re-planting with a vegetative cover like meadow or lawn, not only increases the infiltration on the site, but also creates a friendly habitat for a variety of wildlife species.

Design Considerations:

- Area shall not be stripped of topsoil.
- Vehicle movement, storage, or equipment/material lay down shall not be permitted in areas preserved for minimum soil compaction.
- The use of soil amendments and additional topsoil is permitted.
- Meadow should be planted with native grasses. Refer to *Meadows and Prairies: Wildlife-Friendly Alternatives to Lawn* at <http://pubs.cas.psu.edu/FreePubs/pdfs/UH128.pdf> for reference on how to properly plant the meadow and for a list of native species.

Determining the volume reduction by minimizing soil compaction and planting a meadow:

1. Calculate approximate area of preserved meadow:
 $\sim 22 \text{ sq. ft.} \times \sim 23 \text{ sq. ft.} = 500 \text{ sq. ft.}$
2. Calculate the volume reduction credit by minimizing the soil compaction and planting a lawn/meadow:
 - For Meadow Areas: Volume Reduction (cu. ft.) = (Area of Min. Soil Compaction (sq. ft.) \times 1/3 inch of runoff) / 12
 $(500 \text{ sq. ft.} \times 1/3 \text{ inch of runoff}) / 12 = 13.8 \text{ cu. ft.}$
 - For Lawn Areas: Volume Reduction (cu. ft.) = (Area of Min. Soil Compaction (sq. ft.) \times 1/4 inch of runoff) / 12
 $(500 \text{ sq. ft.} \times 1/4 \text{ inch of runoff}) / 12 = 10.4 \text{ cu. ft.}$

This volume credit can be used to reduce the size of any one of the structural BMPs on the site. See explanation under the volume credit for preserving existing trees for details.

REFERENCES:

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