

Ordinance No. 239

**BEDMINSTER TOWNSHIP
STORMWATER MANAGEMENT
ORDINANCE**

**Bedminster Township
Bucks County, Pennsylvania**

Adopted: October 14, 2020

Effective: October 19, 2020

Table of Contents**Page**

Article I.	General Provisions	
	Section 101	Short Title.....1
	Section 102	Statement of Findings1
	Section 103	Purpose2
	Section 104	Statutory Authority2
	Section 105	Applicability3
	Section 106	Exemptions3
	Section 107	Waivers7
	Section 108	Repealer.....7
	Section 109	Severability.....7
	Section 110	Compatibility with Other Ordinance Requirements.....7
Article II	Definitions	
	Section 201	Interpretations8
	Section 202	Definitions8
Article III	Stormwater Management	
	Section 301	General Requirements.....17
	Section 302	Stormwater Management Peak Rate Control19
	Section 303	Volume Controls20
	Section 304	Riparian Buffers22
	Section 305	Non-structure Project Design.....22
	Section 306	Additional Requirements Applicable to Infiltration Oriented Stormwater Management Systems.....23
	Section 307	Stream Bank Erosion Requirements26
	Section 308	Design Criteria for Stormwater Management Facilities and Best Management Practices27
	Section 309	Calculation Methodology.....35
	Section 310	Standards During Land Disturbance.....36
	Section 311	Water Quality Requirements After Regulated Earth Disturbance Activities Are Complete.....38
Article IV	Stormwater Management (SWM) Site Plan Requirements	
	Section 401	General Requirements.....39
	Section 402	SWM Site Plan Preparation40
	Section 403	Plan Submission41
	Section 404	SWM Site Plan Review42
	Section 405	Erroneous Permit42
	Section 406	Retention of Plans at Project Site42
	Section 407	Adherence to Approved Plan42
	Section 408	Modification of Plans43
	Section 409	Resubmission of Disapproved SWM Site Plans43
	Section 410	Authorization to Construct and Term of Validity43
	Section 411	As-Built Plans, Completion Certificate, and Final Inspection.....43
	Section 412	Occupancy Permit.....43
Article V	Inspections	
	Section 501	Schedule of Inspections.....44
	Section 502	Right of Entry44

Article VI	Fees and Expenses	
	Section 601	SWM Site Plan Review Fee..... 44
	Section 602	Expenses Covered by Fees..... 45
	Section 603	Itemization of Costs 45
Article VII	Maintenance Responsibilities	
	Section 701	Performance Guarantee 45
	Section 702	Maintenance Responsibilities 45
	Section 703	Operation and Maintenance Agreements 46
	Section 704	Stormwater Management Easements 46
	Section 705	Municipal Stormwater Maintenance Fund 47
Article VIII	Prohibitions	
	Section 801	Prohibited Discharges and Connections..... 47
	Section 802	Roof Drains and Sump Pumps 48
	Section 803	Waste Disposal Prohibitions 48
	Section 804	Alteration of SWM BMPs 49
Article IX	Enforcements and Penalties	
	Section 901	Right-of-Entry 49
	Section 902	Inspection..... 49
	Section 903	Enforcement..... 49
	Section 904	Suspension and Revocation 50
	Section 905	Penalties 50
	Section 906	Public Nuisance 50
	Section 907	Appeals 51
Appendix A	Operation and Maintenance Agreement (O&M)	
Appendix B	Stormwater Management Design Criteria	
Appendix C	Stormwater Runoff Peak Rate District Map	
Appendix D	Chapter 93 Designated Use Map	
Appendix E	Preliminary Site Investigation and Testing Requirements	
Appendix F	Low Impact Development (LID) Practices	
Appendix G	Nonstructural Stormwater Management BMPs	
Appendix H	Hotspots	
Appendix I	Simplified Stormwater Management Procedures for Existing Single-Family Dwellings	
Appendix J	Pervious Hardscaping Design and Credit Criteria	
Appendix K	Stormsewer Bedding/Backfill Requirements	
Appendix L	References	

ARTICLE I. GENERAL PROVISIONS

Section 101. Short Title

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

Section 102. Statement of Findings

The Board of Supervisors of Bedminster Township finds that:

- A. Inadequate management of accelerated stormwater runoff resulting from development and redevelopment throughout a watershed increases runoff volumes, flows, and velocities; contributes to erosion and sedimentation; overtaxes the carrying capacity of existing streams and storm sewers; greatly increases the cost of public facilities to carry and control stormwater; undermines floodplain management and flood reduction efforts in upstream and downstream communities; reduces groundwater recharge; threatens public health and safety; and increases nonpoint source pollution of water resources.
- 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 stream-beds and stream-banks thereby elevating sedimentation); destroying aquatic habitat; and elevating aquatic pollutant concentrations and loadings such as sediments, nutrients, heavy metals and pathogens. Groundwater resources are also impacted through loss of recharge.
- C. Through project design, impacts from stormwater runoff can be minimized to maintain the natural hydrologic regime and sustain high water quality, groundwater recharge, stream base flow, and aquatic ecosystems. The most cost effective and environmentally advantageous way to manage stormwater runoff is through nonstructural project design, minimizing impervious surfaces and sprawl, avoiding sensitive areas (i.e. stream buffers, floodplains, steep slopes), and designing to topography and soils to maintain the natural hydrologic regime.
- D. These impacts happen mainly through a decrease in natural infiltration of stormwater.
- E. A comprehensive program of stormwater management (“SWM”), including reasonable regulation of development and activities causing accelerated runoff, is fundamental to the public health, safety, and welfare and critical for the protection of people of the Commonwealth and Bedminster Township, their respective resources, and the environment.
- F. Stormwater is an important water resource that provides groundwater recharge for water supplies and supports the base flow of streams.
- G. The use of green infrastructure and low impact development (“LID”) is intended to address the root cause of water quality impairment by using systems and practices which use or mimic natural processes to: 1) infiltrate and recharge, 2) evapotranspire, and/or 3) harvest and use precipitation near where it falls to earth. Green infrastructure practices and LID contribute to the restoration or maintenance of pre-development hydrology.
- H. Federal and state regulations require certain municipalities such as Bedminster Township to implement a program of stormwater controls. These municipalities are required to obtain a federal permit for stormwater discharges from their separate storm sewer systems under the National Pollutant Discharge Elimination System (“NPDES”).

- I. Public education on the control of pollution from stormwater is an essential component in successfully addressing stormwater.
- J. Non-stormwater discharges to municipal separate storm sewer systems can contribute to pollution of Waters of the Commonwealth by the Township.

Section 103. Purpose

The purpose of this Ordinance is to promote health, safety, and welfare within the Township and its watershed by minimizing the harms and maximizing the benefits described in Section 102 of this Ordinance, through provisions designed to:

- A. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code 93 to protect, maintain, reclaim, and restore the existing and designated uses of the waters of this Commonwealth.
- B. Preserve natural drainage systems.
- C. Manage stormwater runoff close to the source, reduce runoff volumes, and mimic predevelopment hydrology.
- D. Provide procedures and performance standards for stormwater planning and management.
- E. Maintain groundwater recharge to prevent degradation of surface and groundwater quality and to otherwise protect water resources.
- F. Maintain existing flows and quality of streams and watercourses in the Township and the Commonwealth.
- G. Prevent scour and erosion of stream banks and streambeds.
- H. Manage stormwater impacts close to the runoff source, requiring a minimum of structures, and relying on natural processes.
- I. Meet legal water quality requirements under state law, including regulations at 25 Pa. Code, Chapter 93.4.a requiring protection and maintenance of "existing uses," maintenance of the level of water quality to support those uses in all streams, and the protection and maintenance of water quality in "special protection" streams.
- J. Provide proper operation and maintenance of all stormwater best management practices ("BMPs") that are implemented within the Township.
- K. Provide standards to meet NPDES permit requirements.

Section 104. Statutory Authority

The Township is empowered to regulate land use activities that affect runoff by the authority of the Act of October 4, 1978 32 P.S., P.L. 864 (Act 167) Section 680.1 *et seq.*, as amended, the 'Storm Water Management Act,'; and by the Authority of Pennsylvania Municipalities Planning Code, Act 247 of 1968, as amended by Act 170 of 1988, as further amended by Act 209 of 1990 and Act 131 of 1992, 53 P.S. Section 10101.

Section 105. Applicability

- A. All Regulated Activities and all activities that may affect stormwater runoff, including land development and earth disturbance activity, are subject to regulation by this Ordinance; and this Ordinance shall apply to all areas of the Township including, but not limited to, the Tohickon Creek Watershed and the East Branch Perkiomen Creek Watershed.
- B. This Ordinance shall apply to temporary and permanent stormwater management facilities constructed as part of any of the Regulated Activities listed in this Section. Stormwater management and erosion and sedimentation control during construction activities that are specifically not regulated by this Ordinance, shall continue to be regulated under existing laws and ordinances.
- C. This Ordinance contains stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Stormwater management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall also be regulated by applicable existing laws and ordinances.
- D. The following activities are defined as “Regulated Activities” and shall be regulated by this Ordinance except as exempted by Section 106 of this Ordinance:
 - 1. Subdivision and Land Development.
 - 2. Prohibited or polluted discharges.
 - 3. Alteration of the natural hydrologic regime.
 - 4. Construction of additional impervious surfaces (e.g. driveways, parking lots, etc.) and/or construction of new buildings or additions to existing buildings which cumulatively (refer Section 106.B) exceed 1,000 square feet in area and which result in additional impervious surface since October 19, 2020 (the effective date of this Ordinance).
 - 5. Diversion or piping of any natural stream channel.
 - 6. Installation of BMPs and stormwater management facilities or appurtenances thereto.
 - 7. Temporary storage of impervious or pervious material (rock, soil, etc.) where ground contact exceeds five (5) percent of the lot area or 5,000 square feet (whichever is less), and where the material is placed on slopes exceeding eight (8) percent. (Based on Pennsylvania Department of Environmental Protection (“DEP”) stock piling regulations, maximum stockpile height is 35 feet with maximum side slopes of 2 to 1).

Section 106. Exemptions

- A. General Exemptions: The following land use activities are exempt from stormwater management requirements of Article III of this Ordinance.
 - 1. Use of land for gardening for occupant’s home consumption.
 - 2. Agriculture when operated in accordance with a conservation plan, nutrient management plan, or erosion and sedimentation control plan, approved by the Bucks County Conservation District, including activities such as growing crops, rotating crops, tilling of soil, and grazing animals. Installation of new, or expansion of existing, farmsteads, animal housing, waste storage, and production areas having impervious surfaces shall be subject to the provisions of this Ordinance unless exempt pursuant to Section 106 B.

3. Forest Management operations following the DEP's management practices contained in its publication Soil Erosion and Sedimentation Control Guidelines for Forestry and operating under an E&S Plan approved by the Bucks County Conservation District which have a Zoning Permit approval by Bedminster Township.
 4. Public road replacement, replacement paving, repaving, and/or maintenance.
- B. All Regulated Activities as described in Section 105 of this Ordinance shall comply with the Stormwater Management requirements set forth herein, except those activities listed in "Stormwater Management Exemption Criteria" tables provided below. Those activities listed in "Stormwater Management Exemption Criteria" Tables 106.1, 106.2, and 106.3 are, to the extent stated herein, exempt from peak rate control requirements of Section 302 of this Ordinance. An exemption, however, shall not relieve an applicant from meeting runoff volume requirements of Section 303 of this Ordinance for watersheds draining to High Quality (HQ) or Exceptional Value (EV) waters.
- C. Any Regulated Activity that meets the exemption criteria established in this section is exempt from Stormwater Management Site Plan submission requirements of Article IV of this Ordinance (refer requirements of Section 106.E. of this Ordinance). Exemption criteria shall apply to the total development even if development is to take place in phases. The starting point from which to consider tracts as "parent tracts" is the effective date of this Ordinance. All impervious surface area constructed on or after the effective date of this Ordinance shall be considered cumulatively. Impervious surface existing on the "parent tract" prior to the date of this Ordinance shall not be considered in cumulative impervious area calculations for exemption purposes. An exemption shall not relieve the applicant from implementing such stormwater control measures and erosion control measures as are necessary to protect health, safety, and property.

Table 106.1 & Table 106.2 Stormwater Management Exemption Criteria

1. Regulated Activities included within Section 105.D are exempt where the amount of impervious surface conforms to Table 106.1 below and the proposed location of this impervious surface on a parcel conforms to table 106.2 below:

Table 106.1 Stormwater Management Exemption Criteria

Total Parcel Area (acres)	Maximum Impervious Surface Area (square feet)
<0.5	1,200
0.5 to 1.0	2,500
>1.0 to 2.0	4,000
>2.0 to 5.0	5,000
>5.0	7,500

Any impervious surface area meeting the exemption criteria listed under Table 106.1 above that is located within a setback (excluding driveway access) measured from the downslope property boundary shall conform to the following table:

Table 106.2 Stormwater Management Exemption Criteria

Setback* (feet)	Maximum Impervious Surface Area permitted within the setback (square feet)
10	None permitted

20	1,000
50	2,500
100	4,000
200	5,000
500	7,500

* The minimum setback distance is measured between the proposed impervious area (excluding driveway access) and/or stormwater control/structure discharge point to the downslope property boundary. The maximum allowable impervious surface area is the amount of impervious surface area permitted within the setback distance. For example: a total of 4,000 square feet of impervious surface is permitted within the 100 feet setback, of which none is permitted within the 10 feet setback, not more than 1,000 square feet is permitted within the 20 feet setback, and not more than 2,500 square feet is permitted within the 50 feet setback.

2. In lieu of meeting the minimum distance criteria set forth in Table 106.2 above, an applicant may provide documentation from a Professional Engineer registered in the Commonwealth of Pennsylvania that the increased flows from the site leave the site in the same manner as the pre-development condition, and that there will be no adverse effects to properties along the path of flow(s). The Township may require the above referenced documentation on any site including a site meeting the minimum distance or parcel size criteria when deemed necessary at the sole discretion of the Township.
3. Regulated Activities included within Section 105.D proposed on a parcel used for agricultural activity, deed restricted from further subdivision, or containing a conservation easement restricting future development to not more than two (2) dwellings which conform to the exemption criteria listed under Table 106.1 above or the exemption criteria listed under following Table 106.3 are exempt:

Table 106.3 Stormwater Management Exemption Criteria

Total Parcel Area (acres)	Maximum Impervious Surface Area* (square feet)
>5.0 to 10.0	7,500
>10.0 to 20.0	10,000
>20.0 to 50.0	15,000
>50.0	25,000

* Location of impervious surface must conform to Table 106.2

4. If an applicant receives an exemption for Agricultural Activity pursuant to Section 106.3 C.3 and the property is subdivided in the future for non-agricultural purposes, stormwater design for the subdivision must consider all impervious surface constructed after October 14, 2020 as meadow in good condition.
5. Construction or reconstruction of buildings or additions to existing buildings or other impervious surface (activities regulated pursuant to Section 105.D) are exempt where the following conditions are met:
 - a. An area of impervious surface is removed within the same sub-watershed on the project site equal to, or in excess of, the proposed impervious surface area.

- b. The area where existing impervious surface is removed pursuant to Subsection 4.a. above must be restored with a minimum of eight (8) inches of topsoil and stabilized groundcover.
6. Lot line adjustment subdivisions are exempt when no increase in impervious surface is proposed.

D. Simplified Procedure for Single Family Dwelling Lots

Individual home construction projects and accessory structures on existing single-family lots which result in less than two thousand five hundred (2,500) square feet of new impervious area (including the building footprint, driveway, sidewalks, and parking areas) and less than five thousand (5,000) square feet of earth disturbance but do not meet exemption criteria of Section 106.B or are subject to the additional criteria of Section 106.D may utilize the simplified procedure within Appendix I to this Ordinance to meet requirements of this Ordinance and are not required to submit formal SWM Site plans to the Township. This procedure may **not** be utilized for a proposed subdivision or land development.

E. Additional Exemption Criteria.

1. Exemption responsibilities – An exemption shall not relieve an applicant from implementing such measures as are necessary to protect the public health, safety, and property.
 2. HQ and EV streams – An exemption shall not relieve an applicant from meeting the special requirements for watersheds draining to high quality (HQ) or exceptional value (EV) waters contained in Sections 303 and 306 of this Ordinance.
 3. Drainage problems - Where drainage problems are documented or known to exist downstream of, or are expected from, the proposed activity, the Township may deny an exemption, at its sole discretion.
- E. All applicants seeking an exemption from the stormwater management requirements of this Ordinance based upon criteria contained in this Section 106 shall be required, at a minimum, to submit to the Township the following documentation for review:
1. Three (3) copies of the completed Township Stormwater Management Application form.
 2. Stormwater Management Exemption review fee and escrow, as established by separate resolution of the Board of Supervisors.
 3. Three (3) copies of a plot plan for the parcel, which is the subject of the exemption application, containing, at a minimum, the following information:
 - a. Property boundaries and area of the site, based on deed information, or field survey.
 - b. Location map identifying the site relative to streets and other parcels in the vicinity of the site.
 - c. Location of significant natural and existing manmade features, including wetlands, watercourses, woodlands, steep slopes, structures, parking areas, driveways, utilities, wells, and septic systems within 200 feet of proposed impervious surface, regardless of the location of the property boundary.
 - d. Location and dimensions of existing and proposed impervious surface and other improvements, with setbacks drawn to relate the location of same to property lines, streets, and existing features.
 - e. North Arrow.

- f. Plan scale, as applicable.
- g. Information regarding existing/proposed topography and drainage patterns, within two hundred (200) feet of proposed impervious surface based on field survey, LIDAR, and/or field observation.
- h. Other information deemed necessary by the Township Engineer to determine compliance with exemption criteria contained in this Section 106.

Section 107. Waivers

- A. If the Township determines that any requirement under this Ordinance cannot be achieved for a particular Regulated Activity, the Township may, after an evaluation of alternatives, approve measures other than those required by this Ordinance, subject to this Section 107.
- B. Waivers or modifications of the requirements of this Ordinance may be approved by the Township Board of Supervisors if enforcement will exact undue hardship because of peculiar conditions pertaining to the land in question, provided that the modifications will not be contrary to the public interest and that the purpose of this Ordinance is preserved. Cost or financial burden shall **not** be considered a hardship. Modification may be considered if an alternative standard or approach will provide equal or better achievement of the purpose of this Ordinance. A request for modification shall be in writing and accompany the Stormwater Management Site Plan submission. The request shall provide the facts on which the request is based, the provision(s) of the Ordinance involved, and the proposed modification.
- C. No waiver or modification of any regulated stormwater activity involving earth disturbance greater than or equal to one (1) acre may be granted by the Township unless that action is approved in advance by the DEP or the Bucks County Conservation District.

Section 108. Repealer

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

Section 109. Severability

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

Section 110. Compatibility with Other Ordinance Requirements

Approvals issued and actions taken under this Ordinance do not relieve an applicant of the responsibility to secure required permits or approvals for activities regulated by any other statute, code, law, rule, regulation, or ordinance. To the extent that this Ordinance imposes more rigorous requirements for stormwater management than any other statute, law, code, ordinance, rule, or regulation, the specific requirements contained in this Ordinance shall be followed.

ARTICLE II. DEFINITIONS

Section 201. Interpretations

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

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.
- C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, 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. Any provision referencing or incorporating a Federal, State, or County rule or regulation shall be interpreted to mean the most recent and/or up to date version of that rule or regulation (i.e. that rule or regulation as amended or replaced from time to time by regulating authority).

Section 202. Definitions

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

Accelerated Erosion – The removal of the surface of the land through the combined action of man's 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; or earth disturbance. Alteration includes removal of trees and vegetation in a manner, or to an extent, to increase the rate or volume of stormwater runoff.

Applicant – A landowner, developer, or other person who has filed an application for approval to engage in any Regulated Activities as defined in Section 105 of this Ordinance.

As-Built Plan – Plans that are maintained during construction of the project and which document the actual locations of the site improvements. As-built plan must be prepared by a professional landscape architect, professional land surveyor, or professional engineer licensed in the Commonwealth of Pennsylvania.

Bankfull – The point where water begins to overflow the channel onto a floodplain.

Base Flow – The portion of stream flow that is sustained by groundwater discharge.

Best Management Practice (BMP) – Activities, facilities, designs, measures, or procedures used to manage stormwater impacts from Regulated Activities, to meet state water quality requirements, to promote groundwater recharge, and to otherwise meet the purposes of this Ordinance. Stormwater BMPs are commonly grouped into one of two broad categories or measures: “structural” or “non-structural.” In this Ordinance, non-structural BMPs or measures refer to operational and/or behavior-related practices that attempt to minimize the contact of pollutants with stormwater runoff, whereas structural BMPs or measures are those that consist of a physical device or practice that is installed to capture 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.

BMP Manual – The “Pennsylvania Stormwater Best Management Practices Manual”, December 30 2006 edition, as amended.

Conservation District – Bucks County Conservation District.

Culvert – A pipe, conduit, or similar structure, including appurtenant works, which conveys surface water underground and/or under or through an embankment or fill.

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

DEP – Pennsylvania Department of Environmental Protection.

Design Professional – A professional engineer, landscape architect, or land surveyor licensed in the Commonwealth of Pennsylvania and trained to develop stormwater management plans.

Design Storm – The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g. 50-year storm) and duration (e.g. 24-hours), used in the design and evaluation of stormwater management facilities. Also see Return Period.

Designee – The agent of the Board of Supervisors involved with the administration, review, or enforcement of any provisions of this Ordinance by contract or memorandum of understanding.

Detention Basin – An impoundment structure designed to manage stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

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

Developer – A person, partnership, association, corporation, or other entity, or any responsible person therein or agent thereof, that undertakes a development project and/or any Regulated Activity.

Development – Any man-made change to improved or unimproved real estate including, but not limited to, the construction or placement of buildings or other structures, mobile homes, streets and other paving, utilities, mining, dredging, filling, grading, excavation, or drilling operations, and the subdivision of land.

Development Plan – The provisions for development including a planned residential development, a plat of subdivision, all covenants relating to use, location and bulk of buildings and other structures, intensity of use or density of development, streets, ways and parking facilities, common open space and public

facilities. The phrase “provisions of development plan” when used in this Ordinance shall mean the written and graphic materials referred to in this definition.

Development Site – See Project Site.

Disconnected Impervious Area (DIA) – Rooftop or other impervious surface, the drainage of which is directed to a pervious area that allows for infiltration, filtration, and increased time of concentration.

Disturbed Area – Unstabilized land area where an earth disturbance activity is occurring or has occurred.

Downslope Property Boundary – That portion of the property line of the site which is located such that overland or pipe flow from the site would be directed toward it.

Drainage Conveyance Facility – A stormwater management facility designed to transmit stormwater runoff, including streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

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

Drainageway - Any natural or artificial watercourse, trench, ditch, swale, channel, or similar depression into which surface water flows.

E&S Manual – Pennsylvania Department of Environmental Protection Erosion and Sediment Pollution Control Program Manual, No. 363-2134-008 (March 31, 2012), as amended and updated.

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

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

Engineer – A licensed professional civil engineer registered by the Commonwealth of Pennsylvania.

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

Erosion and Sediment Control Plan – A site-specific plan identifying the BMPs to minimize accelerated erosion and sedimentation, pursuant to 25 Pa Code Chapter 102.

Exceptional Value Waters - Surface waters of high quality which satisfy the requirements currently set forth in Pennsylvania Code Title 25 Environmental Protection, Chapter 93 Water Quality Standards, §93.4b(b) (relating to antidegradation), as amended or replaced from time to time by DEP.

Existing Conditions – The dominant land cover during the 5-year period immediately preceding a proposed Regulated Activity. Farm field, disturbed earth, or undeveloped cover conditions of a site or portions of a site used for modeling purposes, shall be considered “meadow” unless the natural groundcover generates lower curve numbers or Rational “C” value, such as forested land. Existing man-made impervious surfaces shall be considered as “meadow” when developing “cover complex” calculations.

FEMA – Federal Emergency Management Agency.

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

Floodplain – Any land area susceptible to inundation by water from any natural source or delineated by applicable FEMA maps and studies as being a special flood hazard area. Also includes areas that comprise Group 13 Soils, as listed in Appendix A of the “Pennsylvania DEP Technical Manual for Sewage Enforcement Officers” (as amended or replaced from time to time by DEP).

Floodway – The channel of the watercourse and those portions of the adjoining floodplains that are reasonably required to carry and discharge the 100-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed-absent evidence to the contrary, that the floodway extends from the streambank to 50 feet from the top of the bank of the stream.

Forest Management – Planning and activities necessary for the management of forestland. These include conducting a timber inventory, preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation, and reforestation.

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

Grade – The slope of a street, other public way, land area, drainage facility, or pipe specified in percent.

Grassed Swale – A natural or constructed swale, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water.

Green Infrastructure – Systems and practices that use or mimic natural processes to infiltrate, evapotranspire, or reuse stormwater on the site where it is generated.

Groundwater Recharge – Replenishment of natural underground water supplies.

HEC-HMS – The US Army Corps of Engineers, Hydrologic Engineering Center (HEC) – Hydrologic Modeling System (HMS).

High Quality Waters - Surface waters having quality which exceeds levels necessary to support propagation of fish, shellfish, and wildlife and support recreation in and on the water as defined by the requirements currently set forth in Pennsylvania Code Title 25 Environmental Protection, Chapter 93, Water Quality Standards, §93.4b(a), as amended or replaced from time to time by DEP.

Hydric Soil – A soil that is saturated, flooded, or ponded long enough during the growing season to develop an anaerobic condition in the upper part.

Hydrologic Regime (Natural) – The hydrologic cycle or balance that sustains quality and quantity of stormwater, stream baseflow, stormwater storage, and groundwater supplies under the natural conditions.

Hydrologic Soil Group (HSG) – Infiltration rates of soils vary widely and are affected by subsurface permeability, as well as surface intake rates. Soils are classified into four HSGs (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. The NRCS defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of the development site may be identified from a soil survey report that can be obtained from local NRCS offices or conservation district offices. Soils become less pervious as the HSG varies from A to D. (NRCS^{1, 2})

Impervious Surface (Impervious Area) – A surface that prevents the infiltration of water into the ground. Impervious surfaces (or areas) shall include, but not be limited to roofs; additional indoor living spaces,

patios, garages, storage sheds, pools, and similar structures; and any new streets or sidewalks. Decks, parking areas, and driveway areas are not counted as impervious areas if they are designed and constructed as a BMP so that they promote infiltration.

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

Infiltration - The passing of stormwater through the soil from the surface.

Infiltration Structure - A structure designed to direct runoff into the ground (e.g. French drains, seepage pits, seepage trench, biofiltration swale, infiltration basins, etc.)

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

Invert – The inside bottom of a culvert or other conduit.

Land Development – Inclusive of any or all of the following meanings:

1. The improvement of one (1) or two (2) or more contiguous lots, tracts or parcels of land for any purpose involving:
 - a. a group of two (2) or more residential or nonresidential buildings, whether purposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure; or
 - b. the division or allocation of land or space, whether initially or cumulatively, between or among two (2) or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features.
2. A subdivision of land.
3. Development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.
4. "Land development" does not include development which involves the following:
 - a. the conversion of an existing single-family detached dwelling or single-family semi-detached dwelling into not more than three (3) residential units, unless such units are intended to be a condominium;
 - b. the addition of a residential accessory building, including farm building, on a lot or lots subordinate to an existing principal building; or
 - c. the addition or conversion of buildings or rides within the confines of an enterprise which would be considered an amusement park. For the purposes of this subsection, an amusement park is defined as a tract or area used principally as a location for permanent amusement structures or rides. This exclusion shall not apply to newly acquired acreage by an amusement park until initial plans for the expanded area have been approved by the proper authorities.

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

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

2. A rock with open joints, fracture or solution channels, or masses of loose rock fragments, including gravel, with insufficient fine soil to fill the voids between the fragments.
3. A rock formation, other than stratum or soil condition which is so slowly permeable that it effectively limits downward passage of effluent.

Low Impact Development (LID) – Site design approaches and small-scale stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. LID can be applied to new development, urban and suburban retrofits, and revitalization projects. LID utilizes design techniques that infiltrate, filter, evaporate, and store runoff close to its source. Rather than rely on costly large-scale conveyance and treatment systems, LID addresses stormwater through a variety of small, cost-effective landscape features located on-site.

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 when the flow is not under pressure.

Municipal Separate Storm Sewer System (MS4) – A system of conveyances owned by a state, city, town, or other public entity that include catch basins, curbs, gutters, ditches, man-made channels, pipes, tunnels, or storm drains that discharge into Waters of the United States.

National Pollutant Discharge Elimination System (NPDES) – A provision of the Clean Water Act that prohibits discharge of pollutants into Waters of the U.S. unless a special permit is issued by the U.S. Environmental Protection Agency ("EPA"), a state, or a tribal government.

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

NRCS – USDA Natural Resource Conservation Service (previously SCS).

Open Channel – A drainage element in which stormwater flows with an open surface. Open channels include, but shall not be limited to, natural and man-made drainageways, swales, streams, ditches, canals, and pipes flowing partly full.

Outfall – An outfall is defined as any point where a separate storm sewer system discharges to either Waters of the United States or to another MS4. Outfalls include discharges from pipes, ditches swales, and other points of concentrated flow.

Parent Tract – The parcel of land from which a land development or subdivision originates as of the date of adoption of this Ordinance.

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

PennDOT - The Pennsylvania Department of Transportation.

Person – An individual, partnership, association, corporation, or other entity.

Pervious Area – Any area not defined as impervious.

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

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.

Pretreatment – Techniques employed in stormwater BMPs to provide storage or filtering to trap coarse materials and other pollutants before they enter the stormwater management system.

Project Site – The specific tract of land where any regulated activity in the Township is 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 Ordinance.

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

Recharge Area – Undisturbed surface area or depression where stormwater collects, a portion of which infiltrates and replenishes groundwater.

Regulated Activity – Any activity to which this Ordinance is applicable pursuant to Section 105 of this Ordinance.

Regulated Earth Disturbance Activity – Activity subject to regulation under 25 Pa. Code 92, 25 Pa. Code 102, or the PA Clean Streams Law.

Recharge Volume – A calculated volume of stormwater runoff from impervious areas which is required to be infiltrated at a site and may be achieved through use of structural or non-structural BMPs.

Release Rate – The percentage of predevelopment peak rate of runoff from a site or subarea to which the post development peak rate of runoff must be reduced to protect downstream areas.

Removed Runoff – The volume of runoff that is captured and not released directly into the surface waters of this Commonwealth during or after a storm event.

Retention Basin – A basin designed to collect and hold and/or infiltrate stormwater runoff so that a permanent pool is established.

Retention Volume/Removed Runoff – The volume of runoff that is captured and not released directly into the surface waters of this Commonwealth during or after a storm event.

Return Period – The average interval, in years, within which a storm event of a given magnitude can be expected to recur. For example, the 25-year return period rainfall would be expected to recur on the average once every 25 years; or stated another way, the probability of a 25-year storm occurring in any one year is 0.04 (i.e., a 4% chance)

Riparian Buffer – A permanent area of trees and shrubs located adjacent to intermittent and perennial streams, lakes, ponds, or wetlands.

Riparian Corridor – A vegetated ecosystem along a waterbody that serves to buffer the waterbody from the effects of runoff by providing water quality filtering, bank stability, recharge, rate attenuation and volume reduction, and shading of the waterbody by vegetation. Riparian corridors also provide habitat and may include streambanks, riparian buffers, wetlands, floodplains, and transitional areas.

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

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

Sediment – Soils or other materials transported by surface water as a product of erosion.

Sediment Basin – A barrier, dam, or 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.

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

Separate Storm Sewer System – A system of pipes, open channels, streets, and other conveyances intended to carry stormwater runoff.

Sheet Flow – Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.

Site – The specific tract(s) of land where any Regulated Activity is planned, proposed, conducted, or maintained.

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 a Curve Number (CN).

State Water Quality Requirements – The regulatory requirements to protect, maintain, reclaim, and restore water quality under Title 25 of the Pennsylvania Code and the PA Clean Streams Law.

Storm Frequency – The number of times that a given storm event occurs or is exceeded on the average in a stated period of years. Refer "Return Period."

Storm Sewer – A system of pipes and/or open channels that convey intercepted runoff and stormwater from other sources, but excludes domestic sewage and industrial wastes.

Stormwater – Drainage runoff from the surface of the land resulting from precipitation or snow or ice melt.

Stormwater Management Facility – Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff. Typical stormwater management facilities include, but are not limited to, detention and retention basins, open channels, storm sewers, pipes, infiltration structures, and other BMPs.

Stormwater Management Permit – A permit issued by Bedminster Township after the SWM Site Plan has been approved. Said permit is issued prior to or with the final Township approval of the proposed development activity.

Stormwater Management Plan – The plan for managing stormwater runoff within the Township adopted as required by the Act of October 4, 1978, P.L. 864, (Act 167), as amended and known as the "Stormwater Management Act".

Stormwater Management Site Plan ("SWM Site Plan") – The plan prepared by a developer or its engineer indicating how stormwater runoff will be managed at the development site in accordance with this Ordinance. Stormwater Management Site Plan will be designated as SWM Site Plan throughout this Ordinance.

Stream or Watercourse – Rivers, creeks, springs, and other perennial or intermittent watercourses containing water at least on a seasonal basis during an average water year. The term "stream" shall include all of the following:

1. Springs or Seeps – The point where groundwater discharges to become surface water.

2. **Stream, Ephemeral** – A reach of stream that flows only during and for short periods following precipitation, and flows in low areas that may or may not be a well-defined channel. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Some commonly used names for ephemeral streams include stormwater channel, drain, swale, gully, dry stream channel, hollow, or saddle.
3. **Stream, Headwater** – The beginning reach of a stream, which collects water from springs and seeps and provides a hydrologic connection to a perennial stream. These channels may be ill defined and may move from year to year depending upon groundwater input, snowmelt, and runoff, but are typified by hydric soils and hydric vegetation.
4. **Stream, Intermittent** – A reach of stream that flows only during wet periods of the year and flows in a continuous well-defined channel. During dry periods, when the water table is depressed by seasonal aridity or drought, intermittent streams may go down to a trickle of water and appear dry, when in fact there is water flowing within the stream bottom or “substrate”.
5. **Stream, Perennial** – A body of water in a channel that flows throughout a majority of the year in a defined channel and is capable, in the absence of pollution, drought, or manmade stream disturbances, of supporting a benthic macroinvertebrate community that is composed of two or more recognizable taxonomic groups of organisms, large enough to be seen by the unaided eye and can be retained by a U.S. Standard No. 30 sieve (28 meshes per inch, 0.595 mm openings) and live at least part of their life cycles within or upon available substrates in a body of water or water transport system. A perennial stream can have Q7-10 flow of zero. For the purposes of this Ordinance, a perennial stream includes rivers, lakes, and ponds and other permanent surface water bodies.

Stream Enclosure – A bridge, culvert, or other structure in excess of one hundred (100) feet in length upstream to downstream which encloses a regulated water of this Commonwealth.

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

Subdivision – As defined in the Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247.

Surveyor – A licensed professional land surveyor registered by the Commonwealth of Pennsylvania.

Swale – A low-lying stretch of land which gathers or carries surface water runoff.

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

Township – Bedminster Township, Bucks County, Pennsylvania.

Township Engineer – A professional engineer licensed in the Commonwealth of Pennsylvania and appointed by the Township pursuant to Article V of the Second-Class Township Code.

Tributary Area – The portion of a watershed that contributes runoff to a particular point in that watershed.

USDA – United States Department of Agriculture.

Volumetric Runoff Coefficient – A variable indicative of stormwater runoff volume and dependent on the impervious coverage for a site.

Water Quality Requirements – As defined under Pennsylvania regulations – protection of designated and existing uses (Refer 25 Pa Code Chapters 93 and 96):

1. Each stream segment in Pennsylvania has a “designated use”, such as “cold water fishery” or “potable water supply”, which are listed in Chapter 93. These uses must be protected and maintained, under state regulations.
2. “Existing uses” are those attained as of November 1975, regardless whether they have been designated in Chapter 93. Land development must be designed to protect and maintain existing uses and maintain the level of water quality necessary to protect those uses in all streams, and to protect and maintain water quality in special protection streams.
3. Water quality involves the chemical, biological, and physical characteristics of surface water bodies. After land development, these characteristics can be impacted by addition of pollutants such as sediment, and changes in habitat through increased flow volumes and/or rates. Therefore, discharge to surface waters must be designed and managed to protect the streambank, streambed, and structural integrity of the waterway, to prevent these impacts.

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

Watershed – Region or area bounded peripherally by water parting and draining to a particular watercourse or body of water.

Wetland – 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, including swamps, marshes, bogs, fens, and similar areas.

ARTICLE III. STORMWATER MANAGEMENT

Section 301. General Requirements

- A. All Regulated Activities within the Township which do not fall under the exemption criteria contained within Section 106 of this Ordinance shall submit a SWM Site Plan consistent with this Ordinance to the Township for review. These criteria shall apply to the total proposed development even if development is to take place in stages.
- B. Regulated Activities shall be designed, implemented, operated, and maintained to meet the purposes of this Ordinance, through these two elements:
 1. Erosion and sediment control prevention during land development (i.e. earth disturbance during construction), and
 2. Water quality protection measures after completion of land development (i.e. post-construction).
- C. No approval of any subdivision or land development plan, or issuance of any building, Erosion and Sedimentation Control Permit, occupancy permit, or the commencement of any earth disturbance at a project site within the Township, shall proceed until the requirements of this Ordinance are met, including approval of a SWM Site Plan in accordance with Section 401 and a permit has been issued under DEP regulations, where applicable.

- D. Erosion and sediment control during land development shall be addressed as required by Section 310.
- E. Water quality protection and infiltration shall be addressed as required by Sections 303 and 306.
- F. All Best Management Practices (BMPs) shall conform to the design criteria of this Ordinance and the BMP Manual.
- G. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities designed to encourage infiltration, groundwater recharge, and improved water quality.
- H. Stormwater flows onto adjacent property shall not be created, increased, decreased, relocated, or otherwise altered without written notification to the adjacent property owner(s). Such stormwater flows shall be subject to the requirements of this Ordinance.
- I. Existing points of concentrated drainage that discharge onto adjacent property shall not be altered without written approval of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.
- J. For all subdivision and land development applications, the tributary area discharging drainage to any location along the site property boundary shall not increase by more than twenty-five percent (25%) over the predevelopment condition without written approval from the adjacent affected property owner(s) and the Township.
- K. Where a subdivision or land development site is traversed by watercourses, drainage easements shall be provided conforming to the line of such watercourses. The width of the easement shall be adequate to provide for the unimpeded flow of stormwater runoff from the 100-year storm event. However, in no case shall the easement be less than thirty (30) feet in width. Terms of the easement shall be subject to approval by the Township and prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. The easement shall also require periodic maintenance of the easement area by the landowner to ensure proper runoff conveyance.
- L. When it can be shown that, due to topographic conditions, drainageways on the project site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such drainageway. Work within stream shall be subject to approval by the Township and DEP through the Joint Permit Application process, or, where deemed appropriate by DEP, through the General Permit process.
- M. Any stormwater management facility regulated by this Ordinance that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by DEP through the Joint Permit Application process, or, where deemed appropriate by DEP, the General Permit process. When there is a question whether wetlands may be involved, it is the responsibility of the applicant or his agent to show that the land in question cannot be classified as wetlands; otherwise approval to work in the area must be obtained from DEP and the Township.
- N. Any stormwater management facilities regulated by this Ordinance that would be located on state highway rights-of-way or would discharge stormwater to facilities located within a state highway right-of-way, shall be subject to approval by PennDOT and the Township.
- O. Site disturbance and impervious surface shall be minimized. Infiltrating stormwater runoff through seepage beds, infiltration trenches, etc. shall be required, where soil conditions permit, to reduce the size or eliminate the need for retention/detention facilities.

- P. Infiltration BMPs shall be spread out, made as shallow as practicable, and located to maximize use of natural on-site infiltration features while still meeting the other requirements of this Ordinance.
- Q. Normally dry, open top, storage facilities shall completely drain both the volume control and rate control capacities over a period of time not less than 24 hours and not more than 72 hours from the end of the design storm.
- R. Design storm volumes to be used in the analysis of peak rates of discharge shall be obtained from the latest version of the Precipitation-Frequency Atlas of the United States, National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Silver Spring, Maryland.
- S. If methods other than green infrastructure and LID methods are proposed to achieve the volume and rate controls required under this Ordinance, the SWM Site Plan must include a detailed justification demonstrating that the use of LID and green infrastructure is not practicable.
- T. All collected stormwater runoff shall be pretreated for water quality prior to discharge to surface or groundwater as required by Section 303 of this Ordinance
- U. Completed stormwater management facilities, including detention/retention basins, shall be surveyed by a Surveyor or Engineer to verify compliance with the character of stormwater management facilities as depicted on the approved final plan (or subsequently approved revision, thereof). As-constructed plans shall be submitted to Bedminster Township for review and approval, upon completion of construction of all facilities and prior to the offer of dedication of any public facilities and/or submission of financial security for the required maintenance period. Public facilities will not be accepted by Bedminster Township until such time the as-constructed plans have been reviewed and approved by the Township Engineer.
- V. The record plan and development agreement for an approved subdivision or land development shall define the ownership and maintenance responsibilities, as well as, access rights for all drainage related easements. Specifically, the record plan shall contain a provision permitting access to such easement(s), at any reasonable time, for inspection and/or emergency repair/maintenance, by Bedminster Township or its designee, of all facilities. In the event the property owner fails to honor its maintenance responsibilities set forth herein, in any manner, Bedminster Township shall have the right of entry upon and within the area of the easement to undertake any required corrective or maintenance effort. The total cost of such, including administrative, engineering, and legal costs for enforcement, may be imposed upon the responsible party as determined by Bedminster Township.

Section 302. Stormwater Management Districts – Peak Rate Control

- A. Mapping of Stormwater Runoff Peak Rate Districts. In order to implement the provisions of this Ordinance and the Perkiomen Creek Watershed and Tohickon Creek Watershed Stormwater Management Plans, Bedminster Township is hereby divided into stormwater runoff peak rate districts consistent with the plans. The boundaries of the districts are indicated on the Stormwater Runoff Peak Rate District Map that is available for inspection at the Township building. A copy of this Stormwater Runoff Peak Rate District Map attached hereto and incorporated herein as Appendix B.
- B. Exact location of the Stormwater Runoff Peak Rate District boundary as it applies to a given development site shall be determined by mapping the boundaries using the two (2) feet or five (5) feet topographic contours provided as part of the stormwater management plan developed for the site in accordance with the Township's Subdivision and Land Development Ordinance. The District boundaries, as originally drawn, coincide with topographic divides or, in certain instances, are drawn from the intersection of the watercourse or a potential flow obstruction to the topographic divide consistent with topography. The locations determined on the stormwater management plan shall be reviewed and verified by the Township Engineer.

C. Description of Tohickon Creek Watershed Stormwater Runoff Hydrologic Peak Rate Districts:

1. 100 Percent Release Rate District. Subareas included in this District are 11 - 16, 22 - 28, 31 - 34, 41, 44 - 48, 50, 51, 54 and 56 - 59. These subareas are not expected to incur a great deal of development growth due to location, topography, soils, or a combination of all three factors. Also, the location of these subareas in the watershed is of minor importance in supporting the overall watershed level runoff control. Therefore, these subareas are allowed to release post-development runoff at a rate that does not exceed the existing rates of runoff.
2. 90 Percent Release Rate District. Subareas included in this District are 29, 30, and 35-40. Certain subareas require the control of stormwater runoff to a portion of the existing runoff equal to ninety percent (90%). These subareas are located in upper reaches of the watershed. In order to ensure uniform watershed-level runoff control, the assignment of this release rate on a widespread basis will uniformly restrict the future runoff in a fashion that favors no particular subarea.
3. Conditional No Detention Districts (Direct Discharge). Subareas included in this District are 18, 20, 21, 42, 43, 49, 52, 62, 70, 72, 76, and 77. These subareas may discharge post-development runoff without the use of detention facilities without adversely affecting the total watershed peak flow. These subareas are located adjacent to Tohickon Creek or Lake Nockamixon, which waterbodies are capable of absorbing undetained runoff without affecting the watershed level control. In certain instances, the conveyance capabilities of the local receiving facilities may not be adequate to safely transport the increased peak flows from undetained runoff. In these cases, the developer shall ensure that one hundred percent (100%) release rate control is applied to the particular receiving stream(s), and/or the developer may provide increased capacity of those receiving facilities in order to ensure safe passage of any undetained runoff.

D. Description of East Branch Perkiomen Creek Watershed Stormwater Runoff Hydrologic Peak Rate Districts.

1. 100 Percent Release Rate District. Subareas included in this district are 1-10, 17, and 19. These subareas are not expected to incur a great deal of development growth due to location, topography, soils, SUBAREA. or a combination of all three factors. Also, the location of these subareas in the watershed is of minor importance in supporting the overall watershed level runoff control. Therefore, these subareas are allowed to release post-development runoff at a rate that does not exceed the existing rates of runoff.

E. Sites Located in More Than One District. For a proposed development site located within two or more subareas located in more than one release rate district, the peak discharge rate from any subarea shall be the pre-development peak discharge for that subarea multiplied by the applicable release rate. The calculated peak discharges shall apply regardless of whether the proposed grading changes the drainage areas by subarea.

F. Off-Site Areas. Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates or volume reduction. However, on-site drainage facilities shall be designed to safely convey off-site flows through or around the development site to existing points of discharge from the property.

G. Where the area of a site being impacted by a proposed development activity differs significantly from the total site area, only the proposed disturbed area utilizing stormwater management measures shall be subject to the management district criteria. Unimpacted or undisturbed areas that do not flow into, or bypass, the stormwater management facilities shall not be subject to the requirements of this Section.

- H. "Downstream Hydraulic Capacity Analysis". – Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates.
1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Acceptable velocities shall be based upon criteria included in the E&S Manual.
 2. Natural or man-made channels or swales must be able to convey the increased 25-year return period runoff without creating any hazard to persons or property, or wildlife and aquatic habitat. Habitat impact shall be minimized or avoided.
 3. Culverts, bridges, storm sewers, or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP, Chapter 105 regulations (if applicable) and, at a minimum, pass the increased 25-year return period runoff.

Section 303. Volume Controls

The green infrastructure and low impact development practices provided in the BMP Manual shall be utilized for all Regulated Activities wherever possible. Water volume controls shall be implemented using the Design Storm Method in Subsection 303.A or the Simplified Method in Subsection 303.B below. This Ordinance establishes no preference for either methodology concerning Regulated Activities covering an area equal to or less than one (1) acre that do not require hydrologic routing to design the stormwater facilities, and, therefore in such a situation, the applicant may select either methodology on the basis of economic considerations, the intrinsic limitations on applicability of the analytical procedures associated with each methodology, and other factors.

- A. The *Design Storm Method* (CG-1 in the BMP Manual) is applicable to any size of Regulated Activity. This method requires detailed modeling based on site conditions.
1. Do not increase the post-development total runoff volume for all storms equal to or less than the 2-year 24-hour duration precipitation.
 2. For modeling purposes:
 - a. Existing (predevelopment) non-forested pervious areas must be considered meadow in good condition.
 - b. One hundred percent (100%) of existing impervious area, when present, shall be considered meadow in good condition in the model for existing conditions.
- B. The *Simplified Method* (CG-2 in the BMP Manual) provided below is independent of site conditions and shall be used if the *Design Storm Method* is not followed. This method is not applicable to Regulated Activities with earth disturbance greater than one (1) acre, or for projects that require design of stormwater storage facilities. For new impervious surfaces:
1. Stormwater facilities shall capture at least the first two (2) inches of runoff from all new impervious surfaces.
 2. At least the first one (1) inch of runoff from new impervious surfaces shall be permanently removed from the runoff flow, i.e., it shall not be released into the surface waters of this Commonwealth. Removal options include reuse, evaporation, transpiration, and infiltration.

3. Wherever possible, infiltration facilities shall be designed to accommodate infiltration of the entire permanently removed runoff; however, in all cases at least the first 0.5 inch of the permanently removed runoff shall be infiltrated.

This method is exempt from the requirements of Section 302, Peak Rate Control.

Section 304. Riparian Buffers

- A. In order to protect and improve water quality, a riparian buffer easement shall be created and recorded as part of any subdivision or land development that encompasses a riparian buffer.
- B. Except as required by Title 25 of the PA Code, Chapter 102, the riparian buffer easement shall be measured to be the greater of the limit of the 100-year floodplain or, as required by the Township Zoning Ordinance, a minimum of 37.5 feet from the center of the bed of a perennial or intermittent stream or watercourse (on each side).
- C. Minimum Management Requirements for Riparian Buffers.
 1. Existing native vegetation shall be protected and maintained within the riparian buffer easement.
 2. Whenever practicable, invasive vegetation shall be actively removed, and the riparian buffer easement shall be planted with native trees, native shrubs, and other native vegetation to create a diverse native plant community appropriate to the intended ecological context of the site.
- D. The riparian buffer easement shall be granted to and enforceable by the Township and shall be recorded in the Bucks County Recorder of Deeds Office, so that it shall run with the land and shall limit the use of the property located therein. The easement shall allow for the continued private ownership.
- E. Any permitted use within the riparian buffer easement shall be conducted in a manner that will maintain the extent of the existing 100-year floodplain, improve or maintain the stream stability, and preserve and protect the ecological function of the floodplain.
- F. The following conditions shall apply when public and/or private recreation trails are permitted within riparian buffers:
 1. Trails shall be for non-motorized use only.
 2. Trails shall be designed to have the least impact on native plant species and other sensitive environmental features.
- G. Septic drain fields and sewage disposal systems shall not be permitted within the riparian buffer easement and shall comply with setback requirements established under 25 Pa.Code, Chapter 73 to the riparian buffer easement boundary line.

Section 305. Nonstructural Project Design (Sequencing to Minimize Stormwater Impacts)

- A. For design and applicability of non-structural BMPs refer to Chapter 5 of the BMP Manual. For the non-structural BMPs proposed, the applicant shall utilize and submit appropriate checklists included in Chapter 8, Section 8.8 of the BMP Manual to demonstrate that the BMPs are applicable to the project and to determine the amount of volume or peak rate credit is applicable.

- B. An applicant for major subdivision or land development approval shall demonstrate that stormwater management is designed in the following sequence to minimize the increase in stormwater runoff and degradation of water quality:
1. Prepare an Existing Resource and Site Analysis Plan (ERSAP), showing environmentally sensitive areas including, but not limited to, steep slopes, ponds, lakes, streams, wetlands, hydric soils, vernal pools, floodplains, riparian corridors, hydrologic soil groups A, B, C, and D, "prime agricultural soils" (prime farmland and farmland of statewide importance as designated in the soil survey of Bucks County), woodlands, surface waters regulated by the Commonwealth or Federal Government, any existing recharge areas, and any other requirements outlined in the Subdivision and Land Development Ordinance. The Plan shall also show and establish riparian buffers according to Section 304 of this Ordinance.
 2. Prepare a draft project layout avoiding sensitive areas identified in the ERSAP and minimizing earth disturbance for the site. The ratio of disturbed area to the entire site area and measures taken to minimize earth disturbance shall be included in the ERSAP.
 3. Identify site specific existing conditions, drainage areas, discharge points (points of interest), recharge areas, and hydrologic soil groups A and B.
 4. Evaluate Nonstructural Stormwater Management Alternatives. (Refer to Appendix G of this Ordinance)
 - a. Minimize earth disturbance.
 - b. Minimize impervious surfaces.
 - c. Break up large impervious surfaces.
 5. Satisfy volume control objective (Section 303).
 6. Satisfy recharge requirements (Section 306)
 6. Satisfy stream bank erosion protection objective (Section 307).
 7. Determine the Stormwater Management (Release Rate) District within which the project site is located (refer to Appendix C of this Ordinance) and conduct a predevelopment runoff analysis.
 8. Prepare final project design to maintain predevelopment drainage areas and discharge points, to minimize earth disturbance and impervious surfaces, to reduce runoff to the maximum extent possible, and to minimize the use of surface or point discharges.
 9. Conduct a proposed conditions runoff analysis based on the final design and to meet the release rate.
 10. Manage any remaining runoff through treatment prior to discharge, as part of detention, bioretention, direct discharge, or other structural control.
 11. Prepare an Operation and Maintenance Plan consistent with requirements of Section 702 that ensures the long-term viability of the stormwater control facilities.

Section 306. Additional Requirements Applicable to Infiltration Oriented Stormwater Management Systems

- A. Prevention of stormwater runoff is the key objective of Chapter 93 of the DEP regulations, because runoff can change the physical, chemical, and biological integrity of waterbodies thereby impacting water quality.
- B. The SWM Site Plan shall describe how water quality protection requirements will be met. Infiltration BMPs shall be evaluated and utilized to the maximum extent possible to manage the net change in stormwater runoff generated so that post construction discharges do not degrade the physical, chemical, or biological characteristics of the receiving waters.
- C. Post construction stormwater infiltration of runoff shall replicate preconstruction infiltration of runoff to the maximum extent possible.
- D. In calculating the volume of runoff that can be infiltrated at a site, the following methodology shall be used:

1. Methodology:

$Re_v = [(S)(R_v)(A)]/12$ (inches/foot), where:

Re_v = Recharge Volume (acre-feet)

S = Soil specific recharge factor (inches)

A = Site area contributing to the recharge facility (acres)

R_v = Volumetric runoff coefficient, $R_v = 0.05 + 0.009 (I)$, where:

I = Percent impervious area, and S shall be obtained based upon hydrologic soil group from the following table:

<u>Hydrologic Soil Group (HSG)</u>	<u>Soil Specific Recharge Factor (S)</u>
A	0.38
B	0.25
C	0.13
D	0.06

If more than one HSG is present at a site, a composite recharge volume shall be computed based upon the proportion of total site area within each HSG.

- E. In selecting the appropriate infiltration BMPs, the applicant shall consider the following:
 1. Permeability and infiltration rate of the site soils.
 2. Topographic slope and depth to bedrock.
 3. Seasonal high-water table.
 4. Proximity and elevation relative to building foundations, basements, and well heads. (Infiltration BMPs shall be located downgrade of these structures).
 5. Erodibility of soils.
 6. Land availability, configuration, and topography.
 7. Peak discharge and required volume control.

8. Streambank erosion.
 9. Efficiency of the BMPs to mitigate potential water quality problems.
 10. Volume of runoff that will be effectively treated.
 11. Nature of the pollutant to be removed.
 12. Maintenance requirements.
 13. Creation/protection of aquatic and wildlife habitat.
 14. Recreational value.
 15. Enhancement of aesthetic and property value.
- F. A detailed soils evaluation of the project site shall be performed to determine the suitability of infiltration BMPs. The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and subgrade stability. The site testing shall include adequate sampling of all portions of the site, except those areas containing natural resources with total protection as defined by the Township Zoning Ordinance, to determine areas of the property which are suitable for infiltration BMPs. The general process for designing the infiltration BMP shall be:
1. Analyze hydrologic soil groups as well as natural and manmade features within the site to determine general areas of suitability for infiltration BMPs.
 2. Provide field testing data at the elevation of the proposed infiltration zone (bottom surface of infiltration facilities) to determine appropriate percolation rate and/or hydraulic conductivity.
 3. Design infiltration BMPs for required stormwater volume based on field-determined capacity at the level of the proposed infiltration surface.
 4. Soil characteristics:
 - a. Infiltration BMPs are particularly appropriate in hydrologic soil groups A and B, as described in the Natural Resources Conservation Service Manual TR-55.
 - b. Low-erodibility factors ("K" factors) are preferred for the construction of basins.
 - c. There must be a minimum depth of eighteen (18) inches between the bottom of any facility and the seasonal high water table and/or bedrock (limiting zones), except for infiltration BMPs receiving only roof runoff which shall be placed in soils having a minimum depth of twelve (12) inches between the bottom of the facility and the limiting zone. The minimum required separation between the limiting zone may be increased, if required by the Township, should project specific conditions exist (such as anticipated increased contaminants) which dictate greater prevention of groundwater contamination.
 - d. There must be an infiltration and/or percolation rate sufficient to accept the additional stormwater load, and to drain completely as determined by field tests.
 - e. A minimum of thirty (30) feet of undisturbed fill shall separate the foundation wall of any building and an infiltration BMP.

- f. The infiltration system shall have positive overflow controls to prevent storage within one foot of the finished surface of grade.
 - g. Infiltration rates shall not be used in computing the storage volume of the infiltration system.
 - h. Surface inflows shall be designed to prevent direct discharge of sediment into the infiltration system.
- G. The recharge volume provided at the site shall be directed to the most permeable Hydrologic Soil Group ("HSG") available, except where other considerations apply such as in limestone geology.
- H. Any infiltration BMP shall be capable of completely infiltrating the impounded water within forty-eight (48) hours from the end of the storm.
- I. Special attention shall be paid to proper installation of infiltration-oriented stormwater management facilities during construction and to careful avoidance of soil compaction during site development.
- J. Caution shall be exercised where salt or chloride would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. Extreme caution shall be exercised where infiltration is proposed in source water protection areas. The qualified design professional shall evaluate the possibility of groundwater contamination from the proposed infiltration/recharge facility and perform a hydrogeologic justification study if necessary. The infiltration requirement in High Quality/Exceptional Value waters shall be subject to DEP's Antidegradation Regulations (25 Pa.Code, Chapter 93). The Township may require the installation of an impermeable liner in BMP and/or detention basins where the possibility of groundwater contamination exists. A detailed hydrogeologic investigation may be required by the Township where the proposed management system is proposed to be located within a source water protection area or when groundwater contamination from the proposed management system is possible.
- K. The SWM Site Plan must include safeguards against groundwater contamination for uses which may cause groundwater contamination, should there be a mishap or spill.
- L. 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.
- M. Infiltration BMPs shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has achieved final stabilization.
- N. The requirements for volume control and infiltration are applied to all disturbed areas, even if they are ultimately to be a pervious or permeable land use such as lawn or other landscaped area, given the extent to which development-related disturbance leads to compaction of the soils and reduces their infiltrative capacity.

Section 307. Stream Bank Erosion Requirements

- A. In addition to the water quality volume, to minimize the impact of stormwater runoff on downstream stream bank erosion, a BMP must be designed to detain the proposed conditions 2-year, 24-hour design storm to the existing conditions 1-year flow using the SCS Type II distribution. Additionally, provisions shall be made (such as adding a small orifice at the bottom of the outlet structure) so that the proposed conditions 1-year storm takes a minimum of 24 -hours to drain from the facility from a point where the maximum volume of water from the 1-year storm is captured (e.g. the maximum water surface elevation is achieved in the facility).

- B. Release of water may begin at the start of the storm (e.g. the invert of the water quality orifice is at the invert of the facility). The design of the facility shall minimize clogging and sedimentation. Orifices smaller than four (4) inches in diameter are not allowed unless the design engineer can verify that the smaller orifice is protected from clogging by use of trash racks, etc. In that case, smaller orifices may be permitted, at the Township Engineer's discretion. Trash racks are required for any primary orifice.
- C. Whenever a watercourse is located within a site, it shall remain open; in its natural state and location; and shall not be piped, impeded, or altered (except for road crossings). It is the responsibility of the developer to restore existing eroded stream/channel banks within a subdivision or land site and obtain all permits necessary from DEP, to do so. The developer must submit pictorial documentation of existing stream/channel banks to the Township so that the Township can determine whether the existing banks must be stabilized as part of the project.

Section 308. Design Criteria for Stormwater Management Facilities and Best Management Practices

- A. Stormwater runoff which may result from Regulated Activities shall be controlled by permanent stormwater BMPs that will meet the required standards within this Article III. The methods of stormwater control or BMPs which may be used to meet the required standards are described in this Ordinance and the BMP Manual. While the choice of BMPs is not limited to the ones appearing in this Ordinance and the Manual; any selected BMP must meet or exceed the runoff peak rate requirements of this Ordinance for the applicable Stormwater Management District.
- B. Any stormwater facility located on state highway rights-of-way shall be subject to approval by PennDOT.
- C. Collection System Standards.
 - 1. Curb Inlets. Curb inlets shall be located at curb tangents on the uphill side of street intersections, and at intervals along the curb line to control the maximum amount of encroachment of runoff on the roadway pavement so that same does not exceed a width of four (4) feet during the design storm event. Design and location of curb inlets shall be approved by the Township.
 - 2. Pipe Materials. All storm sewer piping to be dedicated to the Township shall be Class III reinforced concrete pipe, except when pipe class and strength is required to be increased in accordance with PennDOT Specifications. Piping shall be saw-cut at ends, as needed, and not hammered or broken. All pipe joints and lift holes must be mortared except where designed for infiltration.
 - 3. Minimum Pipe Size. Minimum pipe diameter shall be eighteen (18) inches (or an equivalent flow area of 1.76 square feet).
 - 4. Inlet and Manhole Construction. Inlet and manhole castings and concrete construction shall be equivalent to PennDOT Design Standards. Manhole castings and grated covers shall have the word "STORM" cast in two (2) inch high letters on the top of the cover. All inlet grates shall be "bicycle safe" heavy duty structural steel.
 - 5. Storm Drain Notification Marking. All storm sewer inlets must be identified with a storm drain marker. Storm drain markers shall be cast in the inlet hood, or a stainless steel marker affixed to the inlet hood with adhesive, rivets, or bolts. (Marker may be bolted to the grate in off road locations). Marker shall have a minimum diameter of 3½ inches and include "No Dumping – Drains to Waterway" and a fish symbol. Alternate designs/sizes may be used as approved by DEP.

6. Open end pipes must be fitted with concrete endwalls or wing walls in accordance with PennDOT Standards.
7. Flow velocity. Stormwater collection systems shall be designed to produce a minimum velocity of three (3.0) feet per second when flowing full. The maximum permissible velocity shall be fifteen (15.0) feet per second. Pipe slopes shall not be less than 0.5%.
8. Inlets and manholes shall be spaced at intervals not exceeding three hundred (300) feet, and shall be located wherever branches are connected or pipe sizes are changed, and wherever there is a change in alignment or grade. For drainage lines of at least thirty-six (36) inches diameter, inlets and manholes may be spaced at intervals of four hundred (400) feet. Manholes shall be equipped with open grate lids.
9. Storm sewer bedding/backfill requirements shall conform to the construction details set forth in Appendix L of this Ordinance.
10. Inlets shall be located to intercept concentrated runoff prior to discharge over public/private rights-of-way, sidewalks, streets, and driveways.
11. The capacity of all Type 'C' inlets shall be based on a maximum surface flow to the inlets of four (4.0) cubic feet per second (cfs), calculated based on the 100-year frequency design storm event. The maximum flow to Type 'C' inlets located in low points (i.e. sag vertical curves) shall include the overland flow directed to the inlet, as well as, all bypass runoff from upstream inlets. The bypass flow from upstream inlets shall be calculated using inlet efficiency curves included in PennDOT Design Manual Part 2, latest edition. If the surface flow to an inlet exceeds four (4.0) cfs, additional inlets shall be provided upstream of the inlet to intercept the excessive surface flow. A Type 'C' inlet at a low point of a paved area may be designed to accept a maximum of six (6.0) cfs. Type 'M' inlets shall be designed to accept a maximum surface flow of six (6.0) cfs based on the 100-year frequency design storm event, unless otherwise approved by the Township. Double inlets will not be permitted where additional pipe and inlets can be placed upstream to intercept excessive surface flow. A maximum of twelve (12) cfs shall be permitted to be collected by a Type 'M' inlet located in an isolated pervious area, provided the design professional can verify that such an inlet would not cause stormwater to accumulate on any adjacent public or private property or outside of an associated storm sewer easement, and that the depth of the accumulated stormwater would not exceed twelve (12) inches.
12. A minimum drop of two (2) inches shall be provided between the inlet and outlet pipe invert elevations within all inlets and manholes. When varying pipe sizes enter an inlet or manhole, the elevation of crown of all pipes shall be matched.
13. Stormwater pipes shall have a minimum depth of cover of twelve (12) inches (including over the bell) or as designated by the American Concrete Pipe Association (whichever is greater), and in no case shall any part of the pipe project into the road subbase or curb. Where cover is restricted, equivalent pipe arches may be specified in lieu of circular pipe.
14. The capacity of all stormwater pipes shall be calculated utilizing the Manning Equation for open channel flow as applied to closed conduit flow. The Manning's roughness coefficient shall be 0.13 for all concrete pipe. In cases where pressure flow may occur, the hydraulic grade line shall be calculated throughout the storm sewer system to verify that at least one (1) foot of freeboard will be provided in all inlets and manholes for the design storm event.
15. Culverts shall be designed based on procedures contained in Hydraulic Design of Highway Culverts, HDS #5, U.S. Department of Transportation, Federal Highway Administration. Where pressure flow is anticipated in storm sewer pipes (non-open channel flow), the elevation of the hydraulic grade line shall be calculated through the storm sewer system. Wherever the hydraulic

grade line elevation exceeds the pipe crown elevation for the design flow, pipes with watertight joints must be specified.

16. Storm sewer structures (e.g. endwalls, inlets, and sections, etc.) may not be located on top of, or within ten (10) feet of electric, communication, water, sanitary sewer, or gas services and/or mains, unless approval is received from the Township and the Authority or utility having jurisdiction over same.
 17. Stormwater pipes must be oriented at right angles to electric, water, sanitary sewer, and gas utilities when crossing above or beneath same. Crossing angles of less than 90 degrees will only be permitted at the discretion of the Township. When skewed crossings are permitted, interior angles between alignment of the storm sewer pipe and utility may not be less than 45 degrees. Vertical and horizontal design of storm sewer must be linear.
 18. Roadway underdrain is required along both sides of all proposed roadways, existing roadways proposed to be widened, and within existing or proposed roadside swales as directed by the Township.
 19. Where a public storm sewer system is not located within a right-of-way, or dedicated public property, a twenty (20) feet wide utility easement shall be established to encompass the storm sewer system. For multiple pipes or utilities, the width of the easement shall be a minimum of thirty (30) feet.
 20. A minimum of one (1) foot of freeboard, between the inlet grate and the design flow elevation, shall be provided in all storm sewer systems (inlets and manholes) for the 100-year frequency design storm event.
- D. Open Swales and Gutters – Open swales shall be designed on the basis of Manning's Formula as indicated for collection systems with the following considerations:
1. Roughness Coefficient. The roughness coefficient shall be 0.040 for earth swales.
 2. Bank Slopes. Slopes for swale banks shall not be steeper than one (1) vertical to four (4) horizontal.
 3. Flow Velocity. The maximum velocity of flow as determined by Manning's Formula shall not exceed the allowable velocities as shown in the following table for the specific type of material, unless otherwise approved by the Township and the Conservation District.

Note: Source of the following design criteria is the DEP, Bureau of Soil and Water Conservation Publication, Erosion and Sediment Control Program Manual.

ALLOWABLE VELOCITY

<u>Material</u>	<u>Velocity in feet per second (fps)</u>
Well established grass on good soil:	
Short Pliant bladed grass	4.0 to 5.0
Bunch grass – soil exposed	2.0 to 3.0
Stiff stemmed grass	3.0 to 4.0
Earth without vegetation:	
Fine sand or silt	1.0
Ordinary firm loam	2.0 to 3.0
Stiff clay	3.0 to 5.0
Clay and gravel	4.0 to 5.0
Coarse gravel	4.0 to 5.0

Soft shale	5.0 to 6.0
Shoulders:	
Earth	(as defined above)
Stabilized	6.0
Paved	10.0 to 15.0

4. Swales shall be stabilized with bio-degradable erosion control matting to permit establishment of permanent vegetation (or sodded). Swales shall be of such shape and size to effectively contain the one hundred (100) year, Rational Method design storm, or greater, and to conform to all other specifications of the Township.
 5. To minimize sheet flow of stormwater across lots located on the lower side of roads or streets, and to divert flow away from building areas, the cross-section of the street as constructed shall provide for parallel ditches or swales or curb on the lower side which shall discharge only at drainage easements, unless otherwise approved by the Township.
 6. Gutters and swales adjacent to road paving shall be permitted to carry a maximum flow of four (4) cubic feet per second prior to discharge away from the street surface, unless it is proven to the satisfaction of the Township by engineering calculations that the road slopes or other factors would allow higher gutter or swale capacity.
 7. Flows larger than those permitted in gutters and roadside swales may be conveyed in swales outside the required road right-of-way in separate drainage easements, or may be conveyed in pipes or culverts inside or outside the required road right-of-way.
 8. Existing and proposed swales shall be provided with underdrains as deemed necessary by the Township should overland seepage result in potential maintenance problems. Underdrains must discharge into a natural drainage channel or stormwater management system.
 9. Where drainage swales are used to divert surface waters away from buildings, they shall be sodded, landscaped, or otherwise protected as required and shall be of a slope, shape, and size conforming with the requirements of the Township. Concentration of surface water runoff shall be permitted only in swales, watercourses, retention or detention basins, bioretention areas, or other areas designed to meet the objectives of this Ordinance.
- E. Bridge and Culvert Design. Any proposed bridge or culvert proposed to convey the flow of a perennial or intermittent stream shall be designed in accordance with the following principals:
1. Culverts and bridges shall be designed with an open bottom to maintain natural sediment transport and bed roughness, avoiding acceleration of water velocity above the natural (preexisting) condition. Rock (rip rap) lining (native material if possible) shall be installed within the culvert as needed to prevent erosion within the structure. Approximate top of rock lining must be at the level of the existing stream bottom so as to maintain normal water level and unimpeded movement of native animal species.
 2. Bottom of opening of a culvert shall, at a minimum, be designed to match the bankfull channel condition in terms of width and depth. The cross-sectional area of the bankfull channel (measured at a reference location upstream of the structure) shall be matched with area in the crossing structure.
 3. All bridges and culverts, and drainage channels shall be designed to convey a flow rate equal to a one hundred (100) year, twenty-four (24) hour storm as defined by the U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55. All bridges and culverts shall be designed to convey the 100-year design storm without increasing the extent and depth of the 100-year flood plain.

F. Storm Sewer Design.

1. Design flow rate: The storm sewer system shall be designed to carry the one-hundred-year frequency design storm peak flow rate. The drainage area and runoff coefficient to each inlet shall be indicated on the stormwater management plan. The 100-year flow rate shall be determined by the "Rational" method formula:

$Q = CIA$ where:

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

C = Runoff coefficient - The coefficient of stormwater runoff includes many variables, such as ground slope, ground cover, shape of drainage area, etc.

I = Intensity – Average Rainfall Intensity in inches per hour for a time equal to the time of concentration (in./hr.). Use 6.20 inches for the 100-year event (Pennsylvania State Climatologist <https://climate.met.psu.edu/links/>)

A = Area – Drainage area in acres (ac).

2. Consideration shall be given to future land use changes in the drainage area in selecting the Rational ("C") coefficient. For drainage areas containing several different types of ground cover, a weighted value of "C" shall be used.
3. In determining the peak flow rate to individual storm sewer inlets (or other collection structures) the time of concentration method (as referenced in Section 309) shall be used for inlet drainage areas greater than one (1.0) acre, unless otherwise approved by the Township. For inlet drainage areas less than one (1.0) acre, a five (5) minute time of concentration shall be used unless otherwise approved by the Township.
4. In determining the required design flow rate through a storm sewer piping system, if a five (5) minute time of concentration (storm duration) results in a pipe size exceeding a thirty (30) inch diameter pipe (or equivalent flow area of 4.9 square feet), the time of concentration approach method (as referenced in Section 309) shall be used in determining storm duration.
5. Overflow System: An overflow system shall be provided to carry all bypass flow and/or flow in excess of storm sewer design capacity, to the detention basin (or other approved outlet point) when the capacity of the storm sewer system is exceeded. Stormwater runoff will not be permitted to surcharge from storm sewer structures.

G. Grading and Drainage

1. After completion of rough grading, a minimum of eight (8) inches of topsoil shall be returned to disturbed areas prior to final grading and seeding.
2. Lots shall be graded to secure proper drainage away from buildings and to prevent the collection of storm water in pools. Minimum two percent (2%) slopes shall be maintained away from and around all structures. Separation between the top of foundation wall (or slab) shall comply with Township Building Code requirements.
3. Construction: The developer shall construct and/or install such drainage facilities which are necessary to prevent erosion damage and to satisfactorily carry off such surface waters to the nearest infiltration structure, street, storm drain, or natural watercourse.
4. Excavation: No excavation shall be made with a cut face steeper in slope than four (4) horizontal to one (1) vertical (4:1 = 25 percent), except under one or more of the following conditions:

- a. The material in which the excavation is made is sufficiently stable to sustain a slope of steeper than 4:1 and a written statement (certification) from an engineer, experienced in erosion control, to this effect is submitted for review by the Township Engineer. This statement shall indicate the site has been inspected and that the deviation from the slope specified herein will not result in injury to persons or damage to property.
 - b. A concrete, segmental block, or stone masonry wall, constructed in accordance with requirements of the Township Zoning Ordinance and Construction Codes, is provided to support the face of the excavation.
5. Fill: No fill shall be made which creates any exposed surface steeper in slope than four (4) horizontal to one (1) vertical (4:1 = 25 percent) except under one or more of the following conditions:
 - a. The fill is located so that settlement, sliding, or erosion will not result in property damage or be a hazard to adjoining property, streets, alleys, or buildings.
 - b. A written statement (certification) from an engineer, experienced in erosion control, certifying the site has been inspected and that the proposed deviation from the slope specified above will not endanger any property or result in property damage, is submitted to for review by the Township Engineer.
 - c. A concrete, segmental block, or stone masonry wall, constructed in accordance with requirements of the Township Zoning Ordinance and Construction Codes, is provided to support the face of the excavation.
6. Slopes and Fences: The top or bottom edge of slopes shall be a minimum of five (5) feet from property lines or right-of-way lines of streets or alleys in order to permit the normal rounding of the edge without encroaching on the abutting property. Where walls or slopes (steeper than two (2) horizontal to one (1) vertical) are approved under the criteria in this Ordinance, and are five (5) feet or more in height, a protective fence conforming to Township Construction Codes shall be required at the top of the wall (or bank).
7. Cut and fill operations shall be kept to a minimum. Wherever feasible, natural vegetation shall be retained, protected, and supplemented. Cut and fills shall not endanger or otherwise adversely impact adjoining property.
8. Design of energy dissipation for high volume and/or high velocity discharge from storm sewer pipes and channels shall be in accordance with Hydraulic Engineering Circular No. 14, "Hydraulic Design of Energy Dissipaters for Culverts and Channels" as published by Department of Transportation, FHA, when deemed necessary by the Township, and as approved by the Conservation District.
9. Adequate provision shall be made to prevent surface water from damaging the cut face of excavation and the sloping surfaces of fills.

H. Stormwater Management Basins

1. When basins are provided, they shall be designed to utilize the natural contours of the land whenever possible. When such design is not practical, the construction of the basin shall utilize slopes as flat as possible to blend the structure into the terrain.
2. Stormwater management basins shall not be permitted within the ultimate right-of-way of public streets, riparian buffers, or conservation easements.

3. Landscaping and planting in and around the perimeter of basins shall be provided. It shall be aesthetically pleasing and compatible with surrounding land uses, and require minimum maintenance. Proposed planting shall also be in accordance with the provisions of this Ordinance, Township Subdivision and Land Development Ordinance, and Township Zoning Ordinance.
4. If a stormwater management basin will serve as a temporary sediment control device, the temporary sediment control measures shall be shown including perforated riser pipes or standboxes, filter berms, clean-out stakes, and other measures as may be required by Pennsylvania Department of Environmental Protection, Chapter 102 Regulations. Plans for such facilities shall require the Conservation District approval prior to implementation. Sedimentation basins shall be in place prior to any earthmoving activities within their tributary drainage areas. A note identifying the above criteria shall be required on the Record Plan of subdivisions and land developments, as well as, in the development agreement with the Township.
5. Stormwater management basins shall be in place before construction of any new impervious surfaces on the site.
6. Runoff shall not be directed to any infiltration structure until all tributary drainage areas are stabilized.
7. Where permanent retention facilities (ponds) are proposed, there shall be a safety ledge, ten (10) feet wide, no greater than fifteen (15) inches and no less than twelve (12) inches below the permanent water surface level.
8. All basins shall have slopes of four (4) horizontal to one (1) vertical (4:1 = 25 percent), or flatter on the basin's outer berm and three (3) horizontal to one (1) vertical or flatter on the basin's inner berm. The top or toe of any slope shall be located a minimum of five (5) feet from any property line or ultimate right-of way line. The maximum difference between the top of berm elevation and the invert elevation of the outlet structure shall be seven (7) feet.
9. All portions of a dry detention basin bottom (non-wetland) shall have a minimum slope of two (2) percent.
10. All basin embankments shall be placed in lifts not to exceed one (1) foot in thickness and each lift shall be compacted to a minimum of 95% of Modified Proctor Density as established by A.S.T.M. D-1557. Prior to proceeding to the next lift, the compaction shall be checked by a Soils Engineer employed by the applicant/developer. Compaction tests shall be run on the leading and trailing edge of the berm along with the top of the berm. Verification of required compaction shall be submitted to the Township prior to utilization of any basin for stormwater management.
11. Emergency overflow facilities/spillway shall be provided with basins in order to convey basin inflow in excess of design flows, out of the basin, or in the event the outlet structure becomes blocked and is unable to convey flow. Emergency spillways discharging over embankments shall be constructed of reinforced concrete checker-blocks to protect the berm against erosion. The checker-blocks shall be backfilled with topsoil and seeded. Checker-block lining shall extend to the toe of the embankment on the outside of the berm, and shall extend to an elevation of three (3) feet below the spillway crest on the inside of the berm. Vegetated spillways may be utilized for spillways constructed entirely on undisturbed ground (i.e., not discharging over fill material). A dense cover of vegetation shall be rapidly established in spillways by sodding or seeding with a geotextile anchor. The minimum capacity of all emergency spillways shall be equivalent to the peak flow rate of the 100-year, post-development design storm (entering to the basin).
12. In all cases, the discharge end of the basin shall be provided with a properly designed outlet control structure (headwall, orifice structure or other approved flow control structure), culvert pipe,

and endwall. Perforated riser pipes alone, without provision for permanent outlet control structure and culvert pipe are not permitted for permanent basins.

13. Minimum top of basin berm width (at the design elevation) shall be ten (10) feet unless otherwise approved by the Township. A cut-off trench (keyway) of impervious material shall be provided under all embankments that require fill material. The cut-off trench shall be a minimum of eight (8) feet wide, three (3) feet deep and have side slopes of one (1) horizontal to one (1) vertical.
14. Minimum freeboard through the emergency spillway shall be one (1) foot. Freeboard is defined as the difference between the design flow elevation through the spillway and the elevation of the top of the settled basin berm.
15. Anti-seep collars shall be installed around the outfall pipe barrel and shall be centered within the normal saturation zone of the berm. The anti-seep collars and their connections to the pipe barrel shall be watertight. The anti-seep collars shall be cast-in-place and extend a minimum of two (2) feet beyond the outside of the principal pipe barrel. Precast collars shall be permitted if approved by the Township. A minimum of two (2) collars shall be installed on each basin outlet pipe.
16. All basin outlet pipes shall be watertight reinforced concrete having "O-Ring" joints. All joints shall be mortared.
17. A minimum of six (6) inches is required between the top of outlet structure box and the emergency spillway elevation. Six (6) inches, minimum, is also required between the 100-year water surface elevation and the top of outlet structure box.
18. Energy dissipating devices (rock lining/rip rap, or other approved materials) shall be provided at all basin outlets and shall be sized in accordance with DEP, Bureau of Soil and Water Conservation Publication, Erosion and Sediment Control Program Manual, latest revision.
19. Stone gabion baskets shall not be permitted for use in construction of detention/retention basins.
20. An access easement and stabilized drive shall be provided to every stormwater detention facility for maintenance and operation. This access easement shall be cleared and, when possible, be at least twenty (20) feet in width. Multiple accesses shall be encouraged for major facilities. The developer shall provide access easements and drives of reinforced concrete checker-block (back-filled with topsoil and seeded) or other similar paver acceptable to the Township Engineer, over a six (6) inch bed of compacted PennDOT type 3A coarse aggregate (or approved equivalent). Accessways to basins shall be a minimum of ten (10) feet wide and be no steeper in slope than ten (10) feet horizontal to one (1) foot vertical (10:1). In addition, depressed curb and concrete apron shall be provided where the accessways enters a street/driveway and the stabilized driveway shall extend from the bottom of the interior basin berm embankment to the point of access to the basin. Access easement shall be owned and maintained by the individual lot owner(s) or homeowner's association but shall be established to permit access by the Township or its designee, for inspection, maintenance, repair, renovation, rehabilitation, and/or replacement, at any reasonable time.
21. To minimize the visual impact of detention basins, the basin shall be designed to avoid the need for safety fencing.

I. General Design Requirements

1. Prior to finish grading of a site and final overlay of streets, roads, and driveways, temporary measures, acceptable to the Township, shall be taken to ensure that all runoff intended to be intercepted and collected by an inlet or other facility, will be collected. The plan shall include such details, notes, or specifications such as bituminous "eyebrows" at inlets, diversion berms, etc.

2. Water originating from man-made sources, such as air conditioning units, sump pumps, or other dry weather flow, wherever practical and possible, shall discharge to infiltration areas or vegetative BMPs, or at the approval of the Township, shall be connected to a storm sewer, street drainage structure, or other approved drainage conveyance facility designed as part of a stormwater management BMP.
3. When subdivisions or land developments are submitted to the Township for approval in phases, a complete storm sewer design for the entire proposed subdivision/land development shall be submitted. The proposed design must include the entire tract and not a phase or a portion.

Section 309. Calculation Methodology

- A. Stormwater runoff from all sites shall be calculated using either the Rational Method or Soil Cover Complex method.
- B. Any stormwater runoff calculations shall use generally accepted calculation technique that is based on the NRCS Soil-Cover Complex method. Table 309-1 summarizes acceptable computation methods. The appropriate method must be selected by the applicant based on the individual limitations and suitability of each method for a particular site. The Rational Method may be used to estimate peak discharges from drainage areas that contain less than seventy-five (75) acres and shall be used for drainage areas under twenty-five (25) acres.
- C. All calculations using the Soil-Cover Complex method shall use the appropriate design rainfall depths for the various return period storms according to the region for which they are located as presented in Table B-1 in Appendix B of this Ordinance. If a hydrologic computer model such as HEC-1 or HEC-HMS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The 'S' curve shown in Figure B-1, Appendix B shall be used for the rainfall distribution.
- D. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the Soil-Cover Complex method shall be obtained from Table B-4 in Appendix B. For the purposes of existing conditions flow rate determination for all subdivisions and land developments, all undeveloped land and twenty percent (20%) of existing impervious surface shall be considered as "meadow" in good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e., forest), as listed in Table B-4 in Appendix B.

Table 309-1. 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	US 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)	Applicable for sites less than 75 acres, or as approved by the Township Engineer.

Other methods	Varies	Other computation methodologies approved by the Township Engineer
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- C. Where uniform flow is anticipated, the Manning Equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. (Refer Table B-8 of Appendix B)
- D. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Ordinance using any hydraulic analysis technique or method accepted by the Township.
- E. The design of stormwater management facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage Indication Method. For drainage areas greater than twenty (20) acres, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph.
- G. The Township has the authority to require that computed existing runoff rates be reconciled with field observations and conditions. If the design professional engineer can substantiate through actual physical calibration that more appropriate runoff and time-of-concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the Township Engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.
- H. The time of concentration (T_c) is the time required for water to flow from the hydraulically most remote point of the drainage area to the point of interest (design point). Use of the Rational Method requires calculation of a T_c for each design point within the drainage basin. Travel Time Estimation for the Rational Method shall be based on NRCS Technical Release No. 55 (2nd Edition). For design purposes the time of concentration may not be less than five (5) minutes. Travel time (T_t) is the time it takes runoff to travel from one location to another in a watershed (sub reach) and is a component of time of concentration. T_c is computed by summing all the travel times for consecutive components of the stormwater management conveyance system.
- I. Water moves through a watershed as sheet flow, shallow concentrated flow, open channel flow, or some combination of these. Sheet flow rates shall be calculated using the NRCS TR-55 (1986) variation of the kinematic wave equation. Sheet flow length may not exceed fifty (50) feet over paved surfaces and one hundred and fifty (150) feet over unpaved surfaces. Maximum permitted sheet flow length shall be one hundred and fifty (150) feet unless site specific conditions exist (that can be demonstrated) that warrant an increase of the sheet flow length. Under no circumstances shall sheet flow length exceed three hundred (300) feet. Shallow concentrated flow time and open channel flow time shall be calculated using standard engineering methodologies.

Section 310. Standards During Land Disturbance

- A. For all Regulated Earth Disturbance activities, erosion and sediment control BMPs shall be designed, implemented, operated, and maintained during the regulated earth disturbance activities (i.e., during construction) to meet the purposes and requirements of this Ordinance and to meet all requirements under Title 25 of the Pennsylvania Code and the Pennsylvania Clean Streams Law. Various BMPs and their design standards are listed in the E&S Manual.
- B. Regulated Earth Disturbance activities that do not qualify for exemption pursuant to Section 106 of this Ordinance shall not commence until approval by the Township of an Erosion and Sediment Control Plan for construction activities.

- C. DEP regulations that require an Erosion and Sediment Control Plan for any earth disturbance activity of 5,000 square feet or more, under 25 Pa.Code §102.4(b); a “NPDES Construction Activities” permit is required for Regulated Earth Disturbance activities exceeding one (1) acre.
- D. Evidence of any necessary permit(s) for Regulated Earth Disturbance activities from the appropriate DEP regional office or Conservation District must be submitted to the Township.
- E. A copy of the Erosion and Sediment Control Plan and any required permit, as required by DEP regulations shall be available at the project site at all times.
- F. Additional erosion and sedimentation control design standards and criteria:
 - 1. Clean up: All lots must be kept free of any debris or nuisances whatsoever during construction.
 - 2. Design of erosion and sedimentation control facilities (particularly stormwater/sediment basins) shall incorporate Best Management Practices as defined herein.
 - 3. No grading equipment shall be permitted to be loaded and/or unloaded on a public street, and no grading equipment shall be permitted to travel on or across a public street unless licensed for operation on public thoroughfares.
 - 4. Grading equipment shall not be permitted to cross intermittent and perennial streams. Temporary crossing shall only be permitted where application is made, and approval is received, from DEP (where applicable), the Conservation District, and Bedminster Township.
 - 5. To control the dissemination of mud and dirt on to public roads and driveways, tire cleaning areas constructed of AASHTO #1 stone (underlain by geotextile structural fabric), at least fifty (50) feet in length shall be installed at each point of access to the site and individual lots (upon construction of internal streets in a binder condition). When deemed necessary by the Township, washing stations shall also be set-up at every construction entrance in order to wash mud and dirt from exiting vehicles. Appropriate measures must be taken to control runoff from such locations. The developer shall be responsible for the placement of appropriate signage identifying construction entrances and washing stations. Construction entrances shall be maintained by the developer during construction, as determined by the Township.
 - 6. During construction activities, necessary measures for dust control shall be exercised, including the application of water to higher traffic areas of the site.
 - 7. In the event any mud and/or debris is transported from the site onto a public roadway, the debris shall be removed immediately, and the roadway swept and/or washed as deemed necessary by the Township at the developer’s expense.
 - 8. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity. Thirty-three (33) inches Super Filter Fabric Fence, silt sock, or other approved protection mechanism must be installed around proposed infiltration areas to prevent encroachment and compaction by construction equipment.
- G. Peak discharges and discharge volumes from the site shall comply with the appropriate sections above, with the following additions:
 - 1. For purposes of calculating required detention storage volume during land disturbance, peak discharge rates and volumes shall be calculated based upon runoff coefficients for bare soils during the maximum extent of disturbance from clearing, grading, and impervious surface installation, shown on the development plan. Controls shall insure that the difference in volume and rate of peak discharges before disturbance and during shall not exceed those peak

discharges and volumes required in Section 302 and 303 of this Ordinance. Detention storage during the period of land disturbance and prior to establishment of permanent cover may require additional facilities on a temporary basis. Such measures shall be located so as to preserve the natural soil infiltration capacities of the planned infiltration areas. Calculations based on the above parameters must be submitted to verify "during construction" runoff rate does not exceed predevelopment runoff rate for the 1-year frequency through 100-year frequency design storm events.

2. Wherever soils, topography, cut and fill, or grading requirements, or other conditions suggest substantial erosion potential during land disturbance, the Township may require that the entire volume of all storms up to a 2-year storm from the disturbed areas be retained on site and that special sediment trapping facilities (such as check dams, etc.) be installed.
- H. Areas of the site to remain undisturbed shall be protected against encroachment from construction equipment/vehicles to maintain the existing infiltration characteristics of the soil. Four feet high orange safety fence or other similar protection fence approved by the Township must be installed around the entire limit of disturbance/clearing prior to commencement of earthmoving activities, and maintained until completion of all construction activity.

Section 311. Water Quality Requirements After Regulated Earth Disturbance Activities Are Complete

- A. No Regulated Earth Disturbance activities within the Township shall commence until approval by the Township of a plan which demonstrates compliance with State Water Quality Requirements after construction is complete.
- B. BMPs shall be designed, implemented, and maintained to meet State Water Quality Requirements and any other more stringent requirements as determined by the Township.
- C. To control post-construction stormwater impacts from Regulated Earth Disturbance activities, State Water Quality Requirements may be met by BMPs, including site design, which provide for replication of preconstruction stormwater infiltration and runoff conditions, so that post-construction stormwater discharges do not degrade the physical, chemical, or biological characteristics of receiving waters. As described in the DEP Comprehensive Stormwater Management Policy (#392-0300-002, September 28, 2002), this may be achieved by the following:
 1. Infiltration: Replication of preconstruction stormwater infiltration conditions;
 2. Treatment: Use of water quality treatment BMPs to filter out the chemical and physical pollutants from the stormwater runoff; and
 3. Streambank and Streambed Protection: Management of volume and rate of post-construction stormwater discharges to prevent physical degradation of receiving waters (e.g. from scouring).
- D. In accordance with DEP regulations, the developer shall prove to the Township that it has fully undertaken the proper design, implementation, installation, and maintenance of Best Management Practices (BMPs) to control runoff from the site upon completion of the Regulated Earth Disturbance activities. These requirements include the need to implement post-construction stormwater BMPs with assurance of long-term operations and maintenance of those BMPs.
- E. Evidence of any necessary permit(s) for Regulated Earth Disturbance activities from the Conservation District and/or the appropriate DEP regional office must be submitted to the Township.
- F. BMP operations and maintenance requirements are described in Article VII of this Ordinance.

ARTICLE IV. STORMWATER MANAGEMENT (SWM) SITE PLAN REQUIREMENTS

Section 401. General Requirements

For any Regulated Activities, the preliminary or final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any land disturbance activity may not proceed until the applicant has received written approval of a SWM Site Plan from the Township and the corresponding issuance of a Stormwater Management Permit.

- A. Appropriate sections from the Township Subdivision and Land Development Ordinance, and other applicable Township Ordinances, shall be followed in preparing the SWM Site Plan.
- B. The Township shall not approve any SWM Site Plan that is deficient in meeting the requirements of this Ordinance. At its sole discretion and in accordance with this Article, when a SWM Site Plan is found to be deficient, the Township may either disapprove the submission and require a resubmission, or in the case of minor deficiencies, the Township may accept submission with modifications.
- C. Provision for permanent access or maintenance easements for all SWM facilities, such as ponds and infiltration structures, as necessary to implement the Operation and Maintenance (O&M) Plan.
- D. The following signature block for the Township:

(Township official or designee), on this date (Signature date), has reviewed and hereby certifies that the SWM Site Plan meets all design standards and criteria of the Township Ordinance No. *(number assigned to this Ordinance)*.

- E. The SWM Site Plan shall provide the following information:
 - 1. The overall stormwater management concept for the project.
 - 2. A determination of site conditions in accordance with the BMP Manual.
 - 3. Stormwater runoff design computations and documentation as specified in this Ordinance, including the recommendations and general requirements in Section 301.
 - 4. When infiltration methods such as seepage pits, beds, or trenches are proposed between any septic system and any facility used for stormwater management, an analysis shall be submitted to verify that stormwater infiltration shall not affect groundwater elevation at the septic drain field site.
 - 5. Expected project time schedule.
 - 6. A soil erosion and sediment control plan, where applicable, as prepared for and submitted to the Conservation District.
 - 7. 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.
 - 8. Plan and profile drawings of all SWM BMPs, including drainage structures, pipes, open channels, and swales.
 - 9. SWM Site Plan shall show the locations of existing and proposed on-lot wastewater facilities and water supply wells.

10. SWM Site Plan shall include an O&M Plan for all existing and proposed physical stormwater management facilities. This plan shall address long-term ownership and responsibilities for the operation and maintenance of these facilities, as well as, schedules and costs for such operation and maintenance activities.
11. All SWM Site Plans shall note that stormwater management facilities are a permanent part of the development and shall not be removed, altered, or modified without approval from the Township.
12. A justification must be included in the SWM Site Plan if BMPs other than green infrastructure methods and LID practices are proposed to achieve the volume, rate, and water quality controls under this Ordinance.

Section 402. SWM Site Plan Preparation

The plan for the project area shall be submitted on twenty-four (24) inch x thirty-six (36) inch sheets and shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Bucks County. The contents of the map(s) shall include but not be limited to:

1. Location of the project relative to highways, municipalities, or other identifiable landmarks. Location map shall be at a scale of 1" = 800'.
2. Watershed within which the project is located (e.g. Lower Perkiomen Creek, Tohickon Creek).
3. Existing contours at intervals of two (2) feet (Datum NAV 1988). In areas of steep slopes (greater than twenty-five (25) percent), five (5) foot contours may be used.
4. Existing streams, lakes, ponds, or other bodies of water within the project site.
5. Other physical features including special flood hazard boundaries, sinkholes, intermittent and perennial streams, existing drainage courses, wetlands, areas of natural vegetation to be preserved, and total extent of the upstream area draining through the project site.
6. Locations of all existing and proposed utilities, sanitary sewers, and water lines located on the site and/or within fifty (50) feet of the project site.
7. An overlay showing soil names and boundaries. The overlay shall include a table on the map showing the recharge capabilities of each soil represented onsite in inches per hour and describe their recharge or infiltration capabilities.
8. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.
9. All existing and proposed stormwater management BMPs.
10. Proposed structures, buildings, roads, paved areas, and other impervious surfaces. Where pervious pavement is proposed for parking lots, recreational facilities, non-dedicated streets, or other areas, pavement construction specifications and maintenance requirements shall be noted on the plan.
11. Final contours at intervals at two (2) feet. In areas of steep slopes (greater than twenty-five (25) percent), five (5) foot contour intervals may be used.
12. Name of the development, name and address of the applicant and owner of the project site, and name of the individual or firm preparing the plan.

13. Date of submission.
14. A graphic and written scale of one (1) inch equals no more than fifty (50) feet. For tracts of twenty (20) acres or more, the scale may be one (1) inch equals no more than one hundred (100) feet.
15. A North arrow.
16. Total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
17. Existing and proposed land use(s).
18. A key map showing all existing man-made features beyond the project site that may be affected by the project.
19. Horizontal and vertical profiles of all open channels, including hydraulic capacity.
20. Overland drainage paths.
21. A minimum twenty (20) feet wide access easement to and around all stormwater BMPs and management facilities providing ingress to and egress from a public right-of-way.
22. A note on the plan indicating the location and responsibility for maintenance of any stormwater management facility that would be located off-site. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.
23. A statement on the plan, signed by the applicant, acknowledging the stormwater BMPs and management facilities to be permanent fixtures that can be altered or removed only after approval of a revised plan by the Township. This statement shall be recorded with the record plan and shall be applicable to all future landowners.
24. Location of all erosion and sedimentation control facilities.
25. The following signature block for the design engineer:

(Qualified Professional), on this date (date of signature), has reviewed and hereby certifies that this stormwater management site plan meets all design standards and criteria of the Bedminster Township Stormwater Management Ordinance.

Section 403. Plan Submission

For all Regulated Earth Disturbance Activities, the steps below shall be followed for submission. For any activities that require a DEP joint permit application and regulated under PA Code Title 25, Chapter 102 (Erosion and Sediment Control), Chapter 105 (Dam Safety and Waterway Management), and/or Chapter 106 (Floodplain Management) of DEP's Rules and Regulations; require a PennDOT highway occupancy permit; or require any other permit under applicable local, state, or federal regulations, those permit(s) shall be part of the SWM Site Plan submission.

- A. The SWM Site Plan shall be submitted by the applicant as part of the preliminary plan submission for the Regulated Activity and in conjunction with the submission of an application for a Stormwater Management Permit.

- B. The number of copies and digital data formats of the SWM Site Plan required to be submitted to the Township, shall be determined by the Township.
- C. Distribution of the SWM Site Plan shall be determined by the Township. The distribution list shall include the Township Engineer and any other agencies or entities designated by the Board of Supervisors.

Section 404. SWM Site Plan Review

- A. The applicant shall submit a complete SWM Site Plan, as specified in this Ordinance, prior to the Township reviewing any aspect of this plan. SWM Site Plans shall be reviewed by the Township for consistency with the provisions of this Ordinance.
- B. After reviewing the SWM Site Plan, the Township shall notify the applicant in writing whether the SWM Site Plan is approved or disapproved. If the SWM Site Plan involves a subdivision plan or land development plan, the notification shall occur within the time period required for that subdivision or land development.
- C. For any SWM Site Plan that proposes to use any BMPs other than green infrastructure and LID practices to achieve the volume and rate controls required under this Ordinance, the Township will not approve the SWM Site Plan unless it determines that green infrastructure and LID practices are not practicable for that aspect of the project or area of the site.
- D. If the Township disapproves the SWM Site Plan, the Township will state the reasons for the disapproval in writing. The Township also may approve the SWM Site Plan with conditions and, if so, shall provide the acceptable conditions for approval in writing.
- E. Upon approval of the SWM Site Plan, the Township shall issue the Stormwater Management Permit. The Township may attach conditions to the approval of this Permit and, if so, shall provide these conditions to the applicant in writing.

Section 405. Erroneous Permit

Any Stormwater Management Permit or other authorization/approval issued or approved based on false, misleading, or erroneous information provided by an applicant is void without the necessity of any proceedings for revocation. Any work undertaken or use established pursuant to such Permit or other authorization is unlawful. No action may be taken by a board, agency, or employee of the Township purporting to validate such a violation.

Section 406. Retention of Plans at Project Site

A set of design plans approved by the Township shall be on file at the site throughout the duration of the development activity. Periodic inspections may be made by the Township or designee during development activities.

Section 407. Adherence to Approved Plan

It shall be unlawful for any person 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 Ordinance. It shall be unlawful to alter or remove any BMP required by the SWM Site Plan pursuant to this Ordinance or to allow the property to remain in a condition which does not conform to the approved SWM Site Plan.

Section 408. Modification of Plans

A modification to a submitted SWM Site Plan that involves a change in SWM BMPs or techniques, or that involves the relocation or redesign of SWM BMPs, or that is necessary because soil or other conditions are not as stated on the SWM Site Plan as determined by the Township shall require a resubmission of the modified SWM Site Plan in accordance with this Ordinance.

Section 409. Resubmission of Disapproved SWM Site Plans

A disapproved SWM Site Plan may be resubmitted with the revisions addressing the Township's concerns, to the Township in accordance with this Ordinance. The applicable review fee and escrow must accompany a resubmission of a disapproved SWM Site Plan.

Section 410. Authorization to Construct and Term of Validity

The Township's approval of an SWM Site Plan authorizes the installation/construction of the Regulated Activities described in the approved SWM Site Plan for five (5) years following the date of approval ("Term of Validity"). The Township may specify a term of validity shorter than five (5) years in the approval for any specific SWM Site Plan. Terms of validity shall commence on the date the Township issues the approval for an SWM Site Plan. If an approved SWM Site Plan is not completed according to Section 406 within the term of validity, then the Township may consider the SWM Site Plan abandoned and may revoke any and all permits issued under or in conjunction with the Plan's approval. SWM Site Plans that are considered abandoned by the Township shall be resubmitted in accordance with Section 408 of this Ordinance.

Section 411. As-Built Plans, Completion of Certificate, and Final Inspections

- A. The developer shall be responsible for providing as-built plans of all SWM BMPs included the approved SWM Site Plan. The as-built plans and an explanation of any discrepancies with the construction plans shall be submitted to the Township.
- B. The as-built submission shall include a certification of completion signed by a qualified professional verifying that all permanent SWM BMPs have been constructed according to the approved plans and specifications. The latitude and longitude coordinates for all permanent SWM BMPs must also be submitted, at the central location of each BMP. If any qualified professionals contributed to the construction plans, then a qualified professional must sign the completion certificate.
- C. After receipt of the completion certification by the Township, the Township will conduct a final inspection of the site and all the installed/constructed stormwater management facilities.

Section 412. Occupancy Permit

An occupancy permit for an individual lot shall not be issued unless the stormwater management facilities approved for and/or serving that lot have been installed and an as-built plan has been received and found satisfactory by the Township.

ARTICLE V. INSPECTIONS

Section 501. Schedule of Inspections

- A. The Township Engineer or his/her assignee shall inspect all phases of the construction/installation of the stormwater management facilities.
- B. During any stage of the work, if the Township Engineer determines that temporary or permanent erosion and sedimentation control or stormwater management facilities/BMPs are not being implemented in accordance with the approved SWM Site Plan and this Ordinance, the Township shall issue a Stop Work Order until all defects have been corrected.
- C. A final inspection of all BMPs and/or stormwater management facilities shall be conducted by the Township Engineer or his/her designee and to confirm compliance with the approved SWM Site Plan prior to the issuance of any Occupancy Permit for a lot or structure served by such facilities.

Section 502. Right of Entry During Construction

- A. During construction, 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 SWM BMPs and to investigate whether construction activity is in compliance with this Ordinance. Unless extraordinary circumstances dictate otherwise, entry should be limited to the hours between 7:00 AM and 7:00 PM.
- B. BMP owners and operators 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 Ordinance.
- C. Persons working on behalf of the Township shall have the right to temporarily locate on any BMP in the Township such devices as are necessary to conduct monitoring and/or sampling of the facility's storm water discharge.
- D. Delaying or denying entry to the Township for the purposes stated herein shall be a violation of this Ordinance.

ARTICLE VI. FEES AND EXPENSES

Section 601. SWM Site Plan Review Fee

The applicant shall pay all fees and the costs incurred by the Township for any legal, geological, engineering, or other outside consultants or agencies.

- A. The Township shall establish a Stormwater Management Permit review fee by Resolution of the Board of Supervisors, which fee may be amended from time to time. The permit fee is non-refundable.
- B. The Township shall establish a refundable escrow amount by Resolution of the Board of Supervisors. The received escrow shall be used to pay costs incurred by the Township's legal, engineering, and other consulting experts. The Township has the authority to demand replenishment of the escrow in the event the remaining balance falls to twenty-five percent (25%) or less of the initial amount, and to notify Township consultants to stop work on the application/project until such time as the escrow is brought current and all past due bills are paid.

Section 602. Expenses Covered by Fees

- A. The fees required by this Ordinance shall cover the following:
1. Administrative/clerical costs.
 2. Review of the SWM Site Plan by the Township staff.
 3. Site inspections by the Township staff.
 4. Inspection of stormwater management facilities and stormwater management improvements during construction by the Township staff.
 5. Final inspection upon completion of the stormwater management facilities and stormwater management improvements shown on the SWM Site Plan by the Township Staff.
- B. The escrow required by this Ordinance shall, at a minimum, cover the following:
1. Review of the SWM Site Plan by the Township Solicitor, Township Engineer, and other Township consultants.
 2. Site inspections by the Township Engineer.
 3. Inspection of stormwater management facilities and stormwater management improvements during construction by the Township Engineer.
 4. Final inspection upon completion of the stormwater management facilities and stormwater management improvements shown on the SWM Site Plan by the Township Engineer.
 5. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and ensure proper completion of stipulated remedial actions.

Section 603. Itemization of Costs

Expenses incurred by the Township and charged to the applicant pursuant to Section 602 of this Ordinance shall be itemized. A copy of the itemized costs will be provided by the Township to the applicant if requested.

ARTICLE VII. MAINTENANCE RESPONSIBILITIES

Section 701. Performance Guarantee

For SWM Site Plans that involve subdivision and land development, the applicant shall provide a financial guarantee to the Township for the timely installation and proper construction of all erosion and sediment control measures, stormwater management controls, stormwater management facilities, and BMPs, as required by the approved SWM Site Plan and this Ordinance.

Section 702. Maintenance Responsibilities

- A. The SWM Site Plan for a site shall contain an Operation and Maintenance Plan prepared by the applicant and approved by the Township. The Operation and Maintenance Plan shall describe how the permanent stormwater management facilities will be properly operated and maintained and shall outline required routine maintenance actions and schedules necessary to ensure proper operation of

the BMPs. No Regulated Activities shall commence until the Township approves the Operation and Maintenance Plan.

- B. The SWM Site Plan for the site shall set forth the ownership of the stormwater management system and its components and establish responsibilities for the continuing operating and maintenance of all proposed stormwater management facilities. Any of the following ownership arrangements may be used concerning the stormwater management system and its components:
 - 1. Dedication. The stormwater management system may be dedicated to and maintained by the Township, although the Township is not obligated to accept such dedication.
 - 2. Association. The stormwater management system may be owned and maintained by an appropriately established homeowner's association or condominium association in lieu of Township ownership/maintenance. The applicant must show that the association will be created in compliance with Pennsylvania law and will have the financial wherewithal to properly operate and maintain the system. The Township may require the applicant to post an appropriate amount of financial security, as determined by the Township (generally ten percent (10%) of the construction/installation costs of the system), to guarantee the proper operation and maintenance of the system by the association.
 - 3. Private Ownership. If a site is to be maintained in a single ownership or if the stormwater management system is to be privately owned and maintained, then the system may be owned and maintained by the owner of the completed development. The Township may require the applicant to post an appropriate amount of financial security, as determined by the Township to guarantee the proper operation and maintenance of the system by this private owner.
- C. The Township, upon recommendation of the Township Engineer, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the SWM Site Plan. The Township reserves the right anytime to accept the ownership and operating responsibility for all or part of the stormwater management system or any of its components. The right of the Township to accept ownership in the future shall be stated in the operation and maintenance agreement.

Section 703. Operation and Maintenance Agreements

- A. Prior to final approval of the SWM Site Plan, the applicant shall sign an operation and maintenance agreement with the Township covering all stormwater management facilities that are to be privately owned and/or maintained. This agreement shall be prepared by the Township Solicitor and recorded in the Bucks County Recorder of Deeds. This agreement shall be transferred to any new owner of the property containing the stormwater management system.
- B. The operation and maintenance agreement shall contain any and all provisions determined necessary to guarantee the satisfactory maintenance of the stormwater management system and its component facilities proposed to be built on the site and/or in conjunction with the project.
- C. The owner of the property containing the stormwater management system is responsible for operation and maintenance (O&M) of the SWM BMPs. If the owner fails to adhere to the operation and maintenance agreement, the Township may perform the services required and recover all incurred costs and expenses for such service and work from the owner. The Township may file a municipal lien against the property for the non-payment of these costs and expenses by the owner.

Section 704. Stormwater Management Easements

- A. Fully executed stormwater management easements shall be provided by the owner of the site if necessary to provide access for inspection, maintenance, rehabilitation, repair, and replacement of

stormwater management facilities and/or preservation of the stormwater management system, including, but not limited to, stormwater runoff conveyance, infiltration, and detention areas and facilities, as well as, flood routes for the 100-year storm event. These easement shall be in a form approved by the Township Solicitor and may be part of the operation and agreement or set forth in a separate document.

- B. Stormwater management easements are required for all areas used for off-site stormwater control unless a waiver is granted by the Township.
- C. All documents containing a stormwater management easement shall be recorded with the Bucks County Recorder of Deeds prior to issuance of a building permit or recordation of a subdivision or land development plan.

Section 705. Municipal Stormwater Maintenance Fund

- A. All applicants for subdivision or land development approval shall be required to pay a specified amount to the Township Stormwater Maintenance Fund to help defray costs of periodic inspections and/or maintenance expenses. The amount of the deposit shall be determined as follows:
 - 1. If the stormwater management system or component thereof is to be owned and maintained by any person or entity other than the Township, the deposit shall cover the cost of periodic inspections performed by the Township for a period of twenty (20) years, as estimated by the applicant and approved by the Township.
 - 2. If the stormwater management system or component thereof is to be owned and maintained by the Township, the deposit shall cover the estimated costs for maintenance and inspections for twenty (20) years, as estimated by the applicant and approved by the Township.
- B. If a stormwater management facility is proposed that also serves as a public recreation facility (e.g. ballfield, pond), the Township may, but is not required to, reduce or waive the amount of the maintenance fund deposit based upon the value of this provided stormwater management.
- C. The Township shall require applicants to pay a fee to the Township Stormwater Maintenance Fund to cover unforeseen stormwater related problems which may arise from the land development and earth disturbance of the site.
- D. If at some future time a stormwater management facility (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other facilities, the unused portion of the Township Stormwater Maintenance Fund deposit related to the maintenance or inspection of this eliminated facility will be used for the maintenance or inspection of these newly installed storm sewers or other facilities.

ARTICLE VIII – PROHIBITIONS

Section 801. Prohibited Discharges and Connections

- A. Any drain or conveyance, whether on the surface or subsurface, that allows any non-stormwater discharge, including, but not limited to, sewage, process wastewater, or wash water, to enter a regulated small MS4 or the surface waters of this Commonwealth is prohibited.
- B. No person shall allow, or cause to allow, discharges into a regulated small MS4, or discharges into Waters of this Commonwealth, which are not composed entirely of stormwater, except as provided in paragraph C below. Discharges authorized under a state or federal permit do not fall under this prohibition.

- C. The following discharges are authorized unless they are determined by the Township to be significant contributors to pollution of a regulated small MS4 or to the waters of this Commonwealth.
1. Discharges or flows from firefighting activities.
 2. Discharges from potable water sources including water line flushing and fire hydrant flushing, if such discharges do not contain detectable concentrations of Total Residual Chlorine (TRC).
 3. Non-contaminated irrigation water, water from lawn maintenance, landscape drainage, and flows from riparian habitats and wetlands.
 4. Diverted stream flows and springs.
 5. Non-contaminated pumped ground water and water from foundation and footing drains and crawl space pumps.
 6. Non-contaminated HVAC condensation and water from geothermal systems.
 7. Residential (i.e. not commercial) vehicle wash water where cleaning agents are not utilized.
 8. Non-contaminated hydrostatic test water discharges, if such discharges do not contain detectable concentrations of TRC.
- D. In the event that the Township or DEP determines that any of the discharges identified in Subsection C significantly contribute pollutants to a regulated small MS4 or to the Waters of this Commonwealth, the Township or DEP will notify the responsible person(s) to cease the discharge.

Section 802. Roof Drains and Sump Pumps

- A. Roof drains and sump pumps shall discharge to infiltration areas or vegetative BMPs and to the maximum extent practicable satisfy the criteria for disconnected impervious areas (DIAs), except as described in the other provisions of this Section.
- B. Roof drains and sump pumps shall not be connected to streets through the curb or to sanitary sewers; and shall only be connected to storm sewer or swales (located within an easement) when designed as part of a stormwater BMP.
- C. On lots greater than twenty thousand square feet (20,000 sq. ft.) in area, all plans wherein a sump pump or basement drain is proposed to be installed, shall provide for discharge of the sump pump/drain to a natural watercourse, drainage swale, or storm sewer system. On lots smaller than twenty thousand square feet (20,000 sq. ft.) in area, all such pumps and drains shall discharge directly into an enclosed storm sewer for conveyance to a stormwater management facility and shall not discharge onto the ground or into a swale.

Section 803 Waste Disposal Prohibitions

No person shall throw, deposit, leave, maintain, keep, or permit to be thrown, deposited, left, or maintained, in or upon any public or private property, driveway, parking area, street, alley, sidewalk, or component of a stormwater management system, any refuse, rubbish, garbage, litter, or other discarded or abandoned objects, articles, and accumulations, so that the same may cause, constitute, or contribute to pollution. Refuse, rubbish, garbage, litter, or other discards deposited in proper waste receptacles for the purpose of collection are exempted from this prohibition.

Section 804. Alteration of SWM BMPs

No person shall modify, remove, fill, landscape, or alter any SWM BMPs, facilities, areas, or structures that were installed as a requirement of this Ordinance without the prior written approval of the Township.

ARTICLE IX – ENFORCEMENT AND PENALTIES

Section 901. Right-of-Entry

Upon presentation of proper credentials, the Township or its designated agent may enter, at reasonable times, upon any property within the Township to inspect the condition and maintenance of stormwater structures and facilities in regard to any aspect regulated by this Ordinance. Unless extraordinary circumstances dictate otherwise, entry shall be limited to the hours between 7:00AM and 7:00PM.

Section 902. Inspection

- A. Any owner of land containing stormwater management facilities or its designee (including the Township for dedicated and owned facilities) shall inspect SWM BMPs, facilities and/or structures installed or established under this Ordinance according to the following frequencies, at a minimum to ensure the facilities and/or BMPs continue to function as intended:
 - 1. Annually for the first 5 years.
 - 2. Once every 3 years thereafter.
 - 3. During or immediately after the cessation of a 10-year or greater storm.
- B. These required inspections should be conducted during or immediately following precipitation events.
- C. Where the facility/BMP being inspected was installed as a part of a project which required an NPDES Permit (earth disturbance of one (1) acre or greater), a written inspection report shall be created to document the inspection. The inspection report shall contain the date and time of the inspection, the individual(s) who completed the inspection, the location of the inspected BMP/facility, observations on performance, and recommendations for improving performance, if applicable. Inspection reports shall be submitted to the Township within thirty (30) days following completion of the inspection.

Section 903. Enforcement

- A. It shall be unlawful for a person to undertake any Regulated Activity except as provided in an approved SWM Site Plan and except as provided in this Ordinance, unless specifically exempted in Section 106.
- B. It shall be unlawful to violate Section 803 of this Ordinance.
- C. Inspections regarding compliance with the SWM Site Plan are the responsibility of the Township.
- D. An applicant shall comply with all applicable requirements of this Ordinance and shall undertake its activities in compliance with this Ordinance and its approved SWM Site Plan.

Section 904. Suspension and Revocation

- A. Any approval or permit issued by the Township pursuant to this Ordinance may be suspended or revoked for:
 - 1. Non-compliance with or failure to implement any provision of the approved SWM Site Plan or operation and maintenance agreement.
 - 2. A violation of any provision of this Ordinance or any other applicable law, ordinance, rule, or regulation relating to the Regulated Activity.
 - 3. The creation of any condition or the commission of any act during the Regulated Activity which constitutes or creates a hazard, nuisance, pollution, or endangers the life or property of others.
 - 4. Lack of project completion within the permit period.
- B. A suspended approval may be reinstated by the Township when:
 - 1. The Township has inspected and approved the corrections to the violation that caused the suspension.
 - 2. The Township is satisfied that the violation has been corrected.
- C. An approval that has been revoked by the Township cannot be reinstated. The applicant may apply for a new approval under the provisions of this Ordinance.
- D. If a violation causes no immediate danger to life, public health, or property, at its sole discretion, the Township may provide a limited time period for the violator to correct the violation. In these cases, the Township will provide the violator or its designee, with a written notice of the violation and the time period allowed for the violator to correct the violation. If the violator does not correct the violation within the allowed time period, the Township may revoke or suspend any or all applicable approvals and permits pertaining to any provision of this Ordinance, along with seeking other penalties for the violation in accordance with this Ordinance.

Section 905. Penalties

- A. Anyone violating a provision of this Ordinance shall be guilty of a summary offense, and upon conviction, shall be subject to a fine of not more than Six Hundred Dollars (\$600.00) nor less than Two Hundred Dollars (\$200.00), for each violation, plus any and all costs incurred by the Township in prosecuting this action, including but not limited to, consultant fees, attorney's fees, and expert witness fees. . Each provision of the Ordinance being violated constitutes a separate offense and each day each violation continues shall be a separate offense. All penalties shall be cumulative.
- B. In addition, the Township may institute injunctive, mandamus, or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance and/or to restrain, prevent, or abate a violation of this Ordinance. Any court of competent jurisdiction shall have the right to hearing such actions and issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief. The expense of such proceedings shall be recoverable from the violator in any manner as may now or hereafter be provided by law.

Section 906. Public Nuisance

- A. The violation of any provision of this Ordinance is hereby deemed a public nuisance.

- B. Any person engaged in the implementation, construction, installation, inspection, maintenance, repair, rehabilitation, replacement, or removal of a stormwater management system, stormwater management facility, or BMP shall undertake such activities consistent with the Stormwater Management Permit, the SWM Site Plan, and this Ordinance. Any such activity conducted in violation of the issued Permit, approved Plan, or this Ordinance is hereby declared a public nuisance.

Section 907. Appeals

- A. Appeals from the determination of the Township Zoning Officer, Township Engineer, or Township designee in the administration of this Ordinance that relate to applications for land development under Article V and VII of the Municipalities Planning Code shall be made to the Township Zoning Hearing Board within thirty (30) days of that determination or decision, pursuant to Section 909.1(b)(6) of the Municipalities Planning Code.
- B. Appeals from the determination of the Township Zoning Officer, Township Engineer, or Township designee in the administration of this Ordinance that do not relate to applications for land development under Article V and VII of the Municipalities Planning Code shall be made to the Township Zoning Hearing Board within thirty (30) days of that determination or decision, pursuant to Section 909.1(a)(9) of the Municipalities Planning Code.
- C. Any person aggrieved by a decision of the Township Zoning Hearing Board may appeal to the Bucks County Court of Common Pleas within thirty (30) days of the decision of the Zoning Hearing Board.

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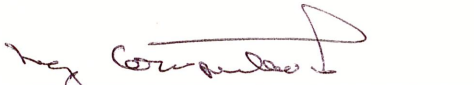
BEDMINSTER TOWNSHIP STORMWATER MANAGEMENT ORDINANCE

Ordinance No. 239

ENACTED and ORDAINED at a regular meeting of the Bedminster Township Board of Supervisors on the 14th day of October 2020. This Ordinance shall take effect five days after enactment.


Glenn Wismer, Chair



Mark Schmidt, Vice Chair


Morgan Cowperthwaite, Member

ATTEST:


Richard H. Schilling, Manager

I hereby certify that the foregoing Ordinance was advertised in the Intelligence on September 28, 2020 and October 6, 2020, a newspaper of general circulation in the Township and was duly enacted and approved as set forth at a regular meeting of the Bedminster Township Board of Supervisors held on October 14, 2020.


Richard H. Schilling, Township Manager
Bedminster Township, Bucks County, Pennsylvania

APPENDIX A

OPERATION AND MAINTENANCE AGREEMENT (O&M)

**BEDMINSTER TOWNSHIP
STORMWATER OPERATION AND MAINTENANCE AGREEMENT**

Prepared By:

Return To:

TMP #

**STORMWATER FACILITIES
OPERATION AND MAINTENANCE AGREEMENT**

THIS AGREEMENT, made and entered into this _____ day of _____, 20____, by and between _____ a Pennsylvania corporation with an registered office at _____ (hereinafter the “***Landowner***”), and **BEDMINSTER TOWNSHIP**, Bucks County, Pennsylvania (hereinafter “***Township***”);

WITNESSETH

WHEREAS, Landowner is the owner of a tract of land in Bedminster Township, Bucks County, Pennsylvania located at _____, otherwise known as Bucks County TMPs _____ and recorded by deed in the land records of Bucks County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter referred to as the “***Property***”); and

WHEREAS, on _____, Landowner obtained final plan approval from the Township for a _____ of the Property pursuant to plans prepared by _____, consisting of _____ (____) sheets, numbered 1 through ____, dated _____, last revised _____; said plans being made a part hereof and incorporated herein by reference although not physically attached hereto (hereinafter referred to as the “***Final Plans***”); and

WHEREAS, the Final Plans include the Operations and Maintenance Plan approved by the Township (hereinafter referred to as the “***Plan***”) for the Property, which is attached hereto as Exhibit A and made part hereof, as approved by the Township, provides for management of stormwater within the confines of the Property; and

WHEREAS, Landowner is proceeding to build and develop the Property in accordance with the Final Plans; and

WHEREAS, the Township requires, though the implementation of stormwater management regulations that Stormwater Management Facilities as shown on the Plan be constructed and adequately maintained by Landowner, his heirs, successors and assigns; and

WHEREAS, the Township and Landowner agree that the health, safety, and welfare of the residents of the Township require that onsite Stormwater Management Facilities be constructed and maintained on the Property; and

WHEREAS, Landowner proposes to locate, construct, install and maintain certain Stormwater Management Facilities on the Property, as shown on the Plan; and

WHEREAS, as a condition of obtaining final approval of the Plan from the Township, the Township required that Landowner execute and record this Agreement in the Office of the Recorder of Deeds of Bucks County, Pennsylvania for the purpose of ensuring that: (1) the Stormwater Management Facilities are located, constructed, installed, operated and maintained by Landowner in accordance with the Plan; (2) following the completion of the duties of Landowner pursuant to the Plan, the Stormwater Management Facilities are continually and perpetually maintained, repaired, refurbished, reconstructed, and replaced by owner(s) of the land on which the facilities are located; and (3) in the event of default of this Agreement by Landowner or its successor and assigns, the Township shall have the right to enter upon the Property to cure such default; and

WHEREAS, the Township requires, through the implementation of the Plan, that Stormwater Management Facilities as required by said Plan and the Bedminster Township Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, his successors and assigns.

NOW THEREFORE, in consideration of the foregoing statements, the Township's approval of the Final Plans and the Plan, and the following terms and conditions, the parties hereto agree as follows:

1. 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 Township's Stormwater Management Ordinance, including but not limited to infiltration trenches, seepage pits, filter strips, bioretention, wet ponds, permeable paving, rain gardens, grassed swales, forested buffers, sand filters and detention basins.

Infiltration Trench - A BMP surface structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or

groundwater aquifer.

Rain Garden - A BMP overlain with appropriate mulch and suitable vegetation designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or underground aquifer.

Seepage Pit - An underground BMP structure designed, constructed, and maintained for the purpose of providing infiltration or recharge of stormwater into the soil and/or groundwater aquifer.

Stormwater Management Facility – Any structure, device, construct, or improvement, including, but not limited to, BMPs designed, installed, constructed, and maintained for the purpose controlling stormwater.

2. All Stormwater Management Facilities shall be constructed by Landowner in accordance with the terms, conditions, and specifications identified in the Plan.
3. The Landowner shall operate and maintain the Stormwater Management Facilities as shown on the Plan in good working order acceptable to the Township and in accordance with the specific maintenance requirements noted on the Plan.
4. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite Stormwater Management Facilities 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.
5. Landowner shall keep and maintain the Stormwater Management Facilities in good working condition. Landowner shall continually and perpetually perform such maintenance, repair, refurbishment, reconstruction, and replacement of said facilities shown on the Plan and located on the Property, including but not limited to BMPs, drainage swales, detention and retention basins, stormwater piping systems, headwalls, inlet and outlet structures, and all structures and facilities appurtenant to the foregoing, as may be necessary or advisable in the opinion of the Township to ensure the structural integrity and the proper functioning thereof and to ensure compliance with all federal, state and local laws, rules, and regulations pertaining thereto. At no time shall the Stormwater Management Facilities be removed or altered in any manner without the prior written approval of the Township. In particular, Landowner agrees to the following:
 - a. Landowner shall regularly perform all inspection and maintenance of the Stormwater Management Facilities as is necessary and desirable to insure the property functioning of the Facilities.
 - b. Landowner shall not alter the area of the Stormwater Management Facilities in a manner which would cause the Facilities to differ from what is shown on the Plan without written approval of the Township.

- c. Landowner shall remove debris and silt from the facilities to insure that the Stormwater Management Facilities remain in good working order.
 - d. Landowner shall make all repairs necessary to insure the continued proper operation of the Stormwater Management Facilities.
- 6. All Stormwater Management Facilities that have been damaged or fail to function properly, for any reason, shall be stabilized and reconstructed by Landowner to approved design grades and specifications as shown on the Plan and approved by the Township.
- 7. All drainage, detention, and/or retention basin easements shown on the Plan shall be maintained in a grassed or otherwise improved condition, in accordance with the grades and designs shown on the Plan. All these easements shall be kept free of all obstructions, including but not limited to, fill, temporary or permanent structures, and plants (other than what is approved on the Plan).
- 8. Whenever sedimentation is caused by stripping vegetation, grading, or other earth moving activities, it shall be the responsibility of Landowner to remove the sedimentation from all adjoining surfaces, drainage systems, and watercourses, and to correct and repair any damage caused by such sedimentation at its sole expense.
- 9. For all Stormwater Management Facilities approved for the Property which include underground stormwater retention, detention or disbursement structures, Landowner hereby agrees to retain a reputable service company to inspect these stormwater structures on an annual basis and, if required, clean such structures by removing any debris or other material from them. The material removed must be disposed of at a DEP-permitted landfill or some other facility approved by DEP for the handling of such material. Landowner is specifically prohibited from flushing any debris or other material out of the stormwater structures.
- 10. Every three (3) years, Landowner shall provide Township with an inspection report issued by a professional engineer registered to practice within the Commonwealth of Pennsylvania. This report must certify that the Stormwater Management Facilities are functioning as designed or, if not functioning as designed, the report shall include recommendations regarding remedial measures or repairs required to correct the deficiencies. All necessary remedial measures and repairs shall be completed by Landowner within thirty (30) days of the identification of deficiencies, unless some other period is authorized by Township. A subsequent report shall be filed within 60 days of the remedial measures and repairs being finished and shall include an engineer's certification that the corrective work has been acceptably completed.
- 11. Landowner hereby grants permission to the Township, its authorized agents and employees, upon presentation of proper identification, to enter upon the Property at reasonable times to inspect the Stormwater Management Facilities whenever the Township deems necessary. The purpose of the inspection is to ensure safe and proper functioning of the facilities. The inspection shall cover the entire Facilities, including

BMPs, berms, outlet structures, pond areas, access roads, etc. When inspections are conducted, the Township shall give Landowner copies of any inspection report which may have been prepared, with findings and evaluations. Maintenance inspections shall be performed at the discretion of the Township. All reasonable costs for said inspections shall be borne by the Landowner and payable to the Township.

12. Landowner hereby grants and conveys to the Township, its authorized agents and employees, a non-exclusive access easement over the Property for the sole purposes of: inspecting the Stormwater Management Facilities; maintaining, when necessary, these Facilities; curing any default by Landowner; and exercising the rights granted to the Township under this Agreement.
13. In the event of an emergency or the occurrence of special or unusual circumstances or situations, the Township may enter the Property, even if the Landowner is not immediately available, without notification or identification, to inspect the Stormwater Management Facilities and to perform any necessary maintenance and repairs to the facilities, if the health, safety or welfare of the citizens is at jeopardy. Under such circumstances, the Township shall notify the Landowner of any inspection, maintenance or repair undertaken within five days of the activity. Landowner shall reimburse the Township for its costs.
14. It is expressly understood and agreed that the Township is under no obligation to maintain or repair any of the Stormwater Management Facilities on the Property, and, in no event shall this document be construed to impose any such obligation upon the Township.
15. In the event the Township, pursuant to this Agreement, performs work of any nature on the Stormwater Management Facilities on the Property or expends any funds in performance of said work on account of Landowner's failure to perform such work, Landowner shall reimburse the Township within thirty (30) days of receipt of an invoice for all costs and expenses (direct and indirect) incurred by the Township related to such work. If this invoice is not paid within said thirty-day period, the Township may enter a lien against the Property in the amount of such costs, or may proceed to recover its costs through proceedings in equity or at law as authorized under provisions of the Second Class Township Code.
16. Landowner releases Bedminster Township, its engineer, solicitor, and all other agents, servants, or employees from all damages, accidents, casualties, occurrences, claims, losses, liabilities, or any other demand for money or damages whatsoever, including, without limitation, all attorney's fees, arising out of or related in any way to the construction, presence, existence or maintenance of the Stormwater Management Facilities on the Property; the grant of this Agreement; Landowner's compliance with this Agreement or the exercise of the rights granted to the Township by this Agreement. Furthermore, Landowner warrants and shall forever defend against any such claims. In the event a claim is asserted against the Township, its engineer, solicitor, and all other agents, servants, or employees, the Township shall promptly notify Landowner, and

Landowner shall defend, at its own expense, any suit based on such claim. If any judgment or claims against the Township, its engineer, solicitor, and all other agents, servants, or employees, shall be allowed, Landowner shall pay all costs and expenses in connection therewith.

17. If Township determines that a violation of the terms of this Agreement has occurred or is threatened, it shall give written notice to Landowner of such violation, along with a list of responsibilities which have not been properly performed by Landowner, and demand corrective action sufficient to cure the violation. Landowner shall have twenty (20) days to accomplish, to the Township's satisfaction, the responsibilities on the list. If Landowner fails to cure the violations within these twenty (20) days after receipt of notice thereof from Township, Township may bring an action at law or in equity in a court of competent jurisdiction to enforce the terms of this Agreement and to enjoin the violation, ex parte as necessary, by temporary or permanent injunction. Township's remedies described in this Agreement shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity.

Landowner agrees that Township's remedies at law for any violation of the terms of this Agreement are inadequate and that Township shall be entitled to the injunctive relief described above, both prohibitive and mandatory, in addition to such other relief to which Township may be entitled, including specific performance of the terms of this Agreement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies.

All reasonable costs incurred by Township in enforcing the terms of this Agreement against Landowner, including, without limitation, costs and expenses of suit, and reasonable attorney's fees, shall be borne by Landowner, if Township prevails.

Forbearance by Township to exercise its rights under this Agreement in the event of any breach of any term of this Agreement by Landowner shall not be deemed or construed to be a waiver by Township of such terms, or of any subsequent breach of the same, or any other term of this Agreement, or of any of Township's rights under this Agreement. No delay or omission by Township in the exercise of any right or remedy upon any breach by Landowner shall impair such right or remedy or be construed as a waiver. Landowner hereby waives any defense of laches, estoppel, or prescription.

In addition, upon failure of Landowner to fulfill any of its obligations under this Agreement, after notice to do so is provided as required above, the Township may enter upon the Property and take such necessary and prudent work needed, in its sole and absolute discretion, to bring Landowner into compliance with this Agreement. All such work shall be conducted at Landowner's expense, and Landowner hereby agrees to assume and pay all costs incurred by the Township in completing this work, including a twenty percent (20%) surcharge for the Township's administrative expenses, all professional fees and costs, and any costs associated with the filing of a municipal lien or lawsuit. In the event that Landowner fails to pay all sums due to Township for this work within thirty (30) days of demand therefor, the Township is expressly authorized to collect these sums in the manner prescribed by law for the collection of municipal claims and liens, and, in so doing, may claim all legal fees, costs, and expenses associated therewith, as authorized by Act 1996-1.

18. This Agreement shall be recorded with the Bucks County Recorder of Deeds. This Agreement is appurtenant to Property and shall be construed to be covenants running with the land binding upon the Landowner, its heirs, successors and assigns.
19. This Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective heirs, successors and assigns, and the terms “Landowner”, “Bedminster Township”, and “Township” herein shall include their respective heirs, successors and assigns.
20. The parties agree that this Agreement contains all of the agreements between the parties regarding the operation and maintenance of the Stormwater Management Facilities and that there are no other agreements or representations made by either of them. This Agreement sets forth the entire understanding between the parties and any representations, oral or written, not contained therein, are without effect.
21. Landowner shall not assign this Agreement, in whole or any part, to any person or other entity without the prior written consent of Township. Any attempt at assignment without the prior written consent of Township shall be null and void, not binding on Township, and the same shall constitute a default under this Agreement.
22. This Agreement may not be modified except by written agreement of the parties.
23. It is expressly understood and agreed that no third party beneficiaries are created by this Agreement.
24. This Agreement shall be governed by and construed under the laws of the Commonwealth of Pennsylvania and Ordinances of Bedminster Township. All the parties to this Agreement hereby consent to the exclusive jurisdiction of the Court of Common Pleas of Bucks County, Pennsylvania regarding any dispute arising out of or in connection with this Agreement. All the easement rights and responsibilities shall be exercised in compliance with all applicable laws, ordinances, rules, and regulations along with all approvals granted by all governmental authorities having jurisdiction over the Property and/or the Project, including, without limitation, Bedminster Township.
25. If any ambiguity or ambiguities in this Agreement should be claimed by either Landowner or Township, or if any court of competent jurisdiction should determine that any ambiguity exists in this Agreement, any such ambiguity shall be resolved in favor of Township and against Landowner.
26. If any provision of this Agreement is determined by a court of competent jurisdiction to be illegal, invalid, unenforceable, unconstitutional, or void, for any reason, only such provision shall be illegal, invalid, unenforceable, unconstitutional, or void and the remainder of this Agreement shall be in full force and effect.

27. In the event that any of the provisions of this Agreement should, for any reason whatsoever, not be noted or recited in any subsequent deed for the Property or any portion thereof, such terms, conditions and restrictions shall attach to the Property or any portion thereof under and pursuant to this Agreement notwithstanding the absence of such provisions in said deed.

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BEDMINSTER TOWNSHIP
STORMWATER FACILITIES OPERATION AND MAINTENANCE AGREEMENT

Subdivision
(Signatures)

IN WITNESS WHEREOF, and intending to be legally bound, the parties hereby cause this Agreement to be executed the day and year first above written.

LANDOWNER

Witness: _____

By: _____

Name:

Title:

TOWNSHIP

BEDMINSTER TOWNSHIP
BOARD OF SUPERVISORS

Approved by the proper action of the Board of Supervisors of Bedminster Township on the _____ day of _____, A.D., 20____, at an official public meeting of the Township with a quorum present and voting, with the proper officers of the Township being directed to execute this Agreement and the Township Secretary or Assistant Secretary, being directed to note this action upon the minutes of said meeting.

Chair

Vice- Chair

Member

BEDMINSTER TOWNSHIP
STORMWATER FACILITIES OPERATION AND MAINTENANCE AGREEMENT
_____**Subdivision**
(Acknowledgments)

COMMONWEALTH OF PENNSYLVANIA :
: *ss.*
COUNTY OF _____ :

ON THIS _____ day of _____, A.D., 20____, before me, a Notary Public, personally appeared _____, known to me (or satisfactorily proven) to be the person whose name is subscribed to the within instrument, and acknowledged that he executed the same for the purposes therein contained.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

_____(SEAL)
Notary Public

COMMONWEALTH OF PENNSYLVANIA :
: *SS.*
COUNTY OF BUCKS :

ON THIS _____ day of _____, A.D., 20____, before me, a Notary Public, _____ personally _____ appeared _____, who acknowledged that they are the Supervisors of Bedminster Township, and as such, being authorized to do so, executed the foregoing instrument on its behalf for the uses and purposes therein set forth.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

_____(SEAL)
Notary Public

APPENDIX B:

STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE 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 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 B-2

NATURAL RESOURCE PROTECTION STORMWATER MANAGEMENT CONTROLS

Source: PA BMP Manual Chapter 8, pg. 33

TABLE 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 B-4

RUNOFF CURVE NUMBERS

Source: NRCS (SCS) TR-55

TABLE B-5

VOLUME CONTROL CALCULATION GUIDANCE FOR NONSTRUCTURAL BMPS

Source: PA BMP Manual Chapter 8, pg. 34

TABLE B-6

VOLUME CONTROL CALCULATION GUIDANCE FOR STRUCTURAL BMPS

Source: PA BMP Manual Chapter 8, pg. 38

TABLE B-7

RATIONAL RUNOFF COEFFICIENTS

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

TABLE B-8

MANNING ROUGHNESS COEFFICIENTS

TABLE 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	6 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 B-1

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

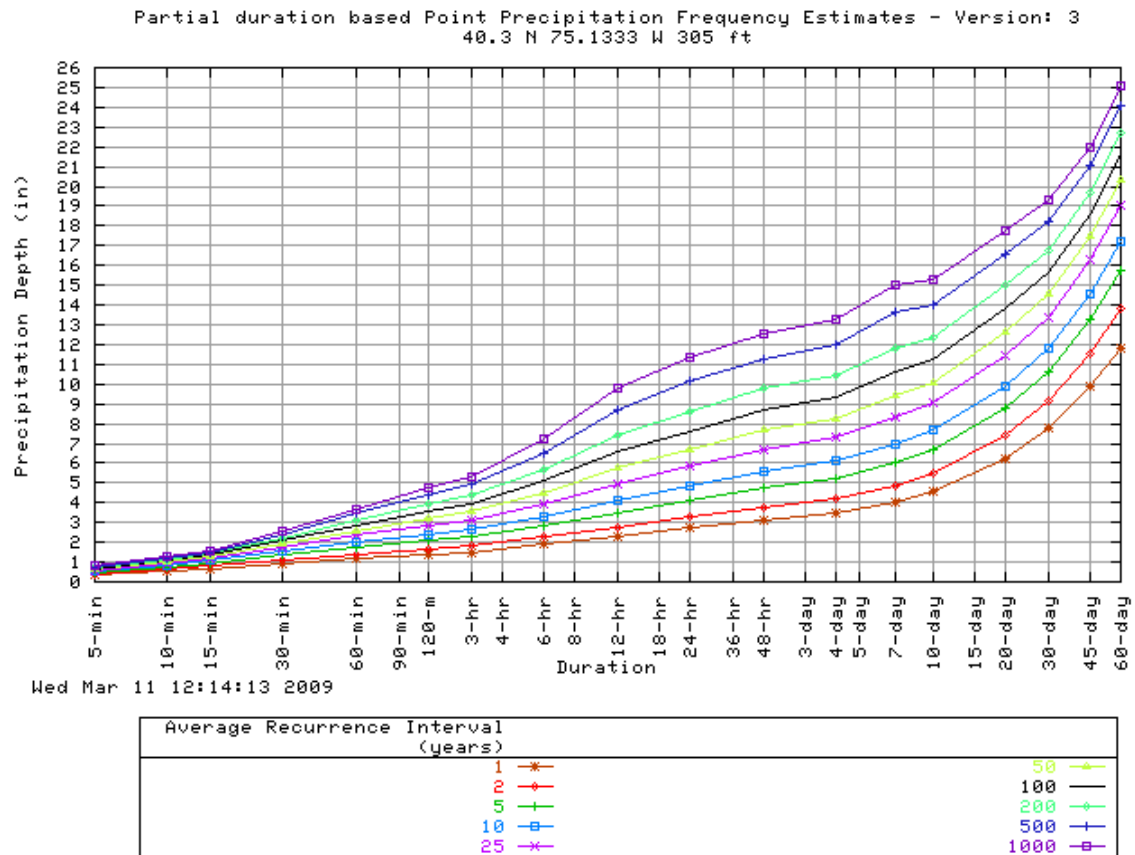


TABLE B-2

**NATURAL RESOURCE PROTECTION
STORMWATER MANAGEMENT CONTROLS**

Existing Natural Sensitive Resource	Mapped in the ERSAP? 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 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 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	49	69	79	84
Grass cover > 75%	Good	39	61	74	80
Meadow		30	58	71	78
Agricultural					
Pasture, grassland, or range – Continuous forage for grazing	Poor	68	79	86	89
Pasture, grassland, or range – Continuous forage for grazing.	Fair	49	69	79	84
Pasture, grassland, or range – Continuous forage for grazing	Good	39	61	74	80
Brush-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)	89	92	94	95
Industrial	(72% Impervious)	81	88	91	93
Institutional	(50% Impervious)	71	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 B-5

VOLUME CONTROL CALCULATION GUIDANCE FOR NONSTRUCTURAL BMPS

Type of Nonstructural BMP

AREA (sq ft) * Runoff * 1/12 = Volume Reduction(ft³)
Volume (in)

Use of Natural Drainage Feature

Utilize natural flow pathways _____sq ft * 1/4" * 1/12 = _____cu ft

Minimum Soil Compaction

Lawn _____sq ft * 1/3" * 1/12 = _____cu ft
Meadow _____sq ft * 1/3" * 1/12 = _____cu ft

Protecting existing trees (not located in protected area)

For trees within 20 feet of impervious cover:

Tree Canopy _____sq ft * 1" * 1/12 = _____cu ft

For trees within 20-100 feet of impervious cover:

Tree Canopy _____sq ft * 1/2" * 1/12 = _____cu ft

Rooftop Disconnection

For runoff directed to pervious and/or vegetative areas where infiltration occurs

Roof Area _____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

Impervious Area _____sq ft * 1/4" * 1/12 = _____cu ft

Total Volume Reduction

_____cu ft

* represents multiply

TABLE 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/Bioretenention	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 B-7 - RATIONAL RUNOFF COEFFICIENTS [S]
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 _a	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	0.23 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	0.30 0.37	0.40 0.50	0.50 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 0.35	0.30 0.39	0.25 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 0.52
Lot Size 1/3 Acre	0.19 0.28	0.23 0.32	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 1 Acre	0.14 0.22	0.19 0.26	0.22 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 0.86	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 0.82	0.74 0.84	0.72 0.84	0.73 0.85	0.76 0.89	0.73 0.89	0.75 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 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 x 13 mm (2 2/3 in x 1/2 in) Corrugations	0.024
75 mm x 25 mm (3 in x 1 in) Corrugations	0.027
125 mm x 25 mm (5 in x 1 in) Corrugations	0.025
150 mm x 50 mm (6 in x 2 in) Corrugations	0.033
Helically Corrugated Steel And Aluminum Alloy Pipe (Plain or polymer coated)	
75 mm x 25 mm (3 in x 1 in), 125 mm x 25 mm (5 in x 1 in), or 150 mm x 50 mm (6 in x 2 in) Corrugations	0.024
Helically Corrugated Steel And Aluminum Alloy Pipe (Plain or polymer coated)	
68 mm x 13 mm (2 2/3 in x 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:

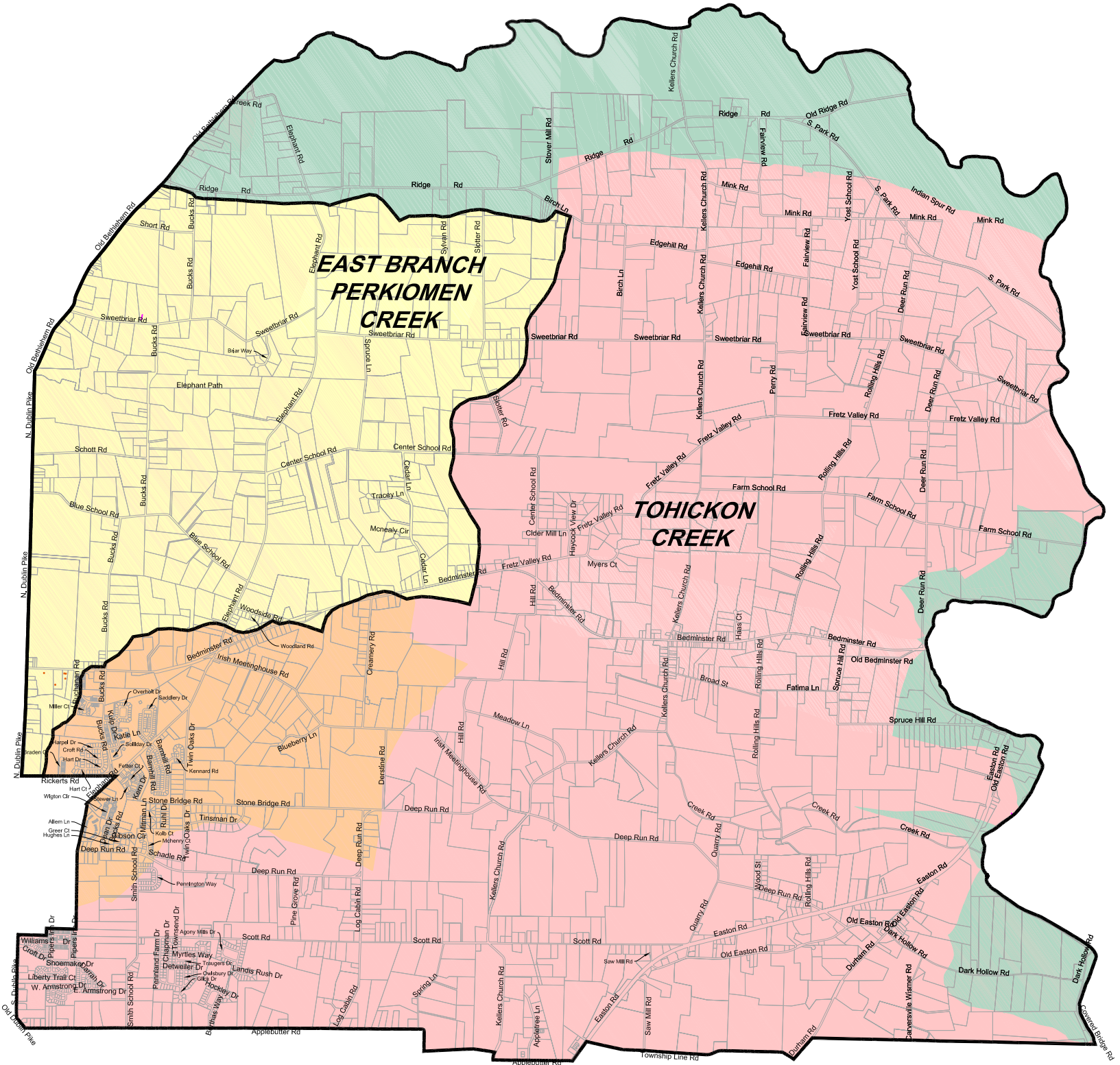
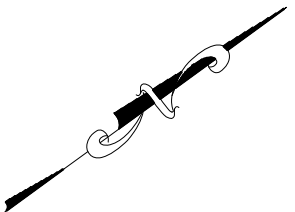
- A storm pipe longer than 20 diameters, which directly or indirectly connects to an inlet or manhole, located in swales adjacent to shoulders in cut areas or depressed medians.
- A storm pipe which is specially designed to perform under pressure.

**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 C

STORMWATER RUNOFF PEAK RATE **DISTRICT MAP**

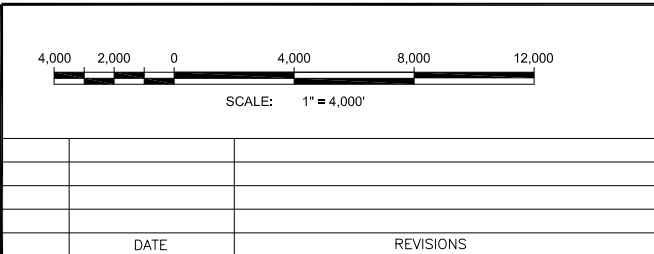


- Watershed Management Districts**
 - District A- East Branch Perkiomen Creek
 - 100% Release Rate- Tohickon Creek
 - 90% Release Rate- Tohickon Creek
 - Direct Discharge- Tohickon Creek
- Watersheds**
 - Tohickon Creek
 - East Branch Perkiomen Creek

Release Rate Requirements for District A of East Branch Perkiomen Creek

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

Source: Pennsylvania Spatial Data Access- Chapter 93 Streams, Designated Use & Pennsylvania Small Sheds. Map is not intended to replicate site specific investigations.



BEDMINSTER TOWNSHIP

STORMWATER RUNOFF PEAK RATE DISTRICT MAP

C. ROBERT WYNN ASSOCIATES, INC.

MUNICIPAL & CIVIL ENGINEERING

211 W. Broad Street, Quakertown, PA 18951 Phone 215-536-7336 Fax 215-536-5361

DWN BYEAS

CKD BYCJG

DATE: NOVEMBER 11, 2019

SCALE 1"= 4,000'

JOB NO.: 123-004

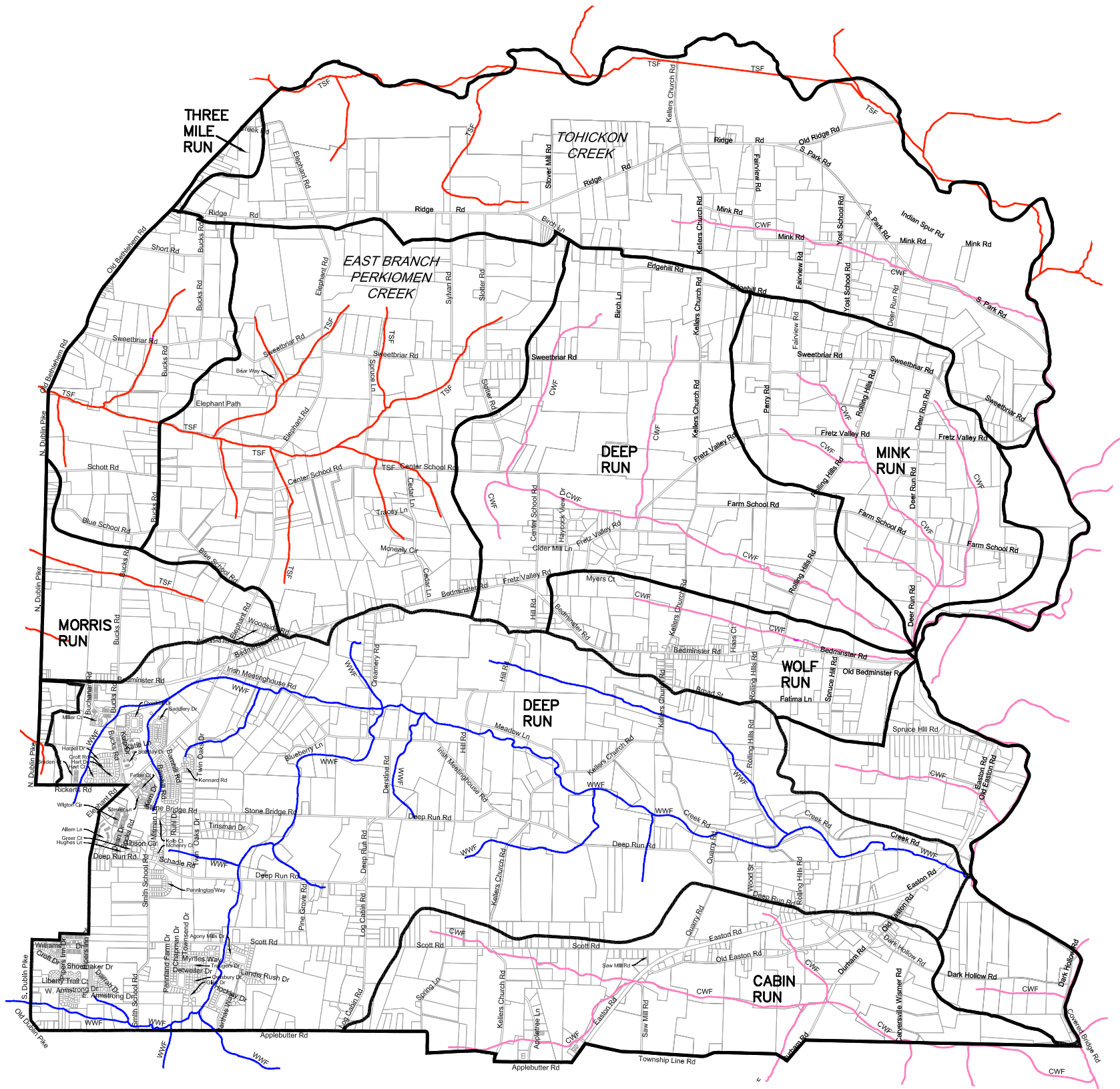
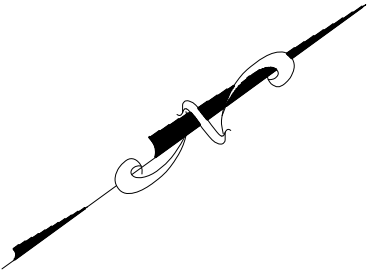
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OF 1

APPENDIX D

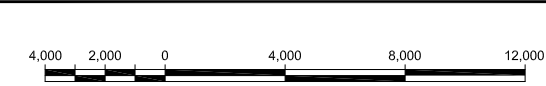
CHAPTER 93 DESIGNATED USE MAP



- Subwatersheds**
- Morris Run, TSF
 - Three Mile Run
 - Deep Run, WWF
 - Cabin Run, CWF
 - Wolf Run, CWF
 - Mink Run, CWF
 - Tohickon Creek, CWF & TSF
 - East Branch Perkiomen Creek, TSF

- Chapter 93 Designated Use**
- CWF (Cold Water Fisheries)
 - TSF (Trout Stocking)
 - WWF (Warm Water Fisheries)

Source: Pennsylvania Spatial Data Access- Chapter 93 Streams, Designated Use & Pennsylvania Small Sheds. Map is not intended to replicate site specific investigations.



DATE	REVISIONS

BEDMINSTER TOWNSHIP
CHAPTER 93 DESIGNATED USE MAP

C. ROBERT WYNN ASSOCIATES, INC.
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211 W. Broad Street, Quakertown, PA 18951 Phone 215-536-7336 Fax 215-536-5361

DWN BY: EAS	CKD BY: CJG	DATE: NOVEMBER 11, 2019	SCALE: 1"= 4,000'	JOB NO.: 123-004	DRAWING NO.: 1 OF 1
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APPENDIX E

SITE EVALUATION AND SOIL INFILTRATION TESTING

SITE EVALUATION AND SOIL INFILTRATION TESTING PROTOCOL

A. Purpose of this Protocol

The purpose of the *Site Evaluation and Soil Infiltration Testing Protocol* is to describe evaluation and field testing procedures to:

1. Determine if infiltration BMPs are suitable at a site, and at what locations.
2. Obtain the required data for infiltration BMP design.

B. When to Conduct Testing

The site development process outlined in Chapters 4 and 5 of the Pennsylvania Stormwater Management Best Management Practices Manual, December 2006, as amended ("Manual") describe a process for site development and BMPs. Soil Evaluation and Investigation shall be conducted early in the preliminary design of the project so that information developed in the testing process can be incorporated into the design. The Soil Evaluation and Investigation shall be conducted prior to development of the preliminary plan. The design engineer should possess a preliminary understanding of potential BMP locations prior to testing. Prescreening test may be carried out in advance of site potential BMP locations.

C. Who Should Conduct Testing

Qualified professionals who can substantiate by qualifications/experience their ability to carry out the evaluation shall conduct the test pit soil evaluations. A professional, experienced in observing and evaluating soils conditions is necessary to ascertain conditions that might affect BMP performance, which cannot be thoroughly assessed with the testing procedures. Such professionals must conduct these evaluations in risk areas, and areas indicated in the Manual as non-preferred locations for testing or BMP implementation.

D. Importance of Stormwater BMP Areas

Sites are often defined as unsuitable for infiltration BMPs and soil based BMPs due to proposed grade changes (excessive cut or fill) or lack of suitable areas. Many sites will be constrained and unsuitable for infiltration BMPs. However, if suitable areas exist, these areas must be identified early in the design process and not be subject to a building program that precludes infiltration BMPs. An exemption will not be permitted for development of suitable soils that may be necessary for stormwater infiltration.

E. Safety

As with all field work and testing, attention must be given to all applicable OSHA regulations related to earthwork and excavation. Digging and excavation shall not be conducted without adequate notification through the Pennsylvania One Call system (**PA One Call** 1-800-242-1776 or www.paonecall.org). Excavations shall not be left unsecured and unmarked, and all applicable authorities must be notified prior to any work.

F. Infiltration Testing: A Multi-Step Process

Infiltration Testing is a four-step process to obtain the necessary data for design of the stormwater management plan. The four steps include:

1. Background Evaluation

- Based on available published and site specific data
- Includes consideration of proposed development plan
- Used to identify potential BMP locations and testing locations
- Prior to field work (desktop)
- On-site screening test

2. Test Pit (Deep Hole) Observation

- Includes Multiple Testing Locations
- Provides an understanding of sub-surface conditions
- Identifies limiting conditions

3. Infiltration Testing

- Must be conducted onsite
- Different testing methods available
- Alternate methods for – additional – Screening and Verification testing

4. Design Considerations

- Determination of suitable infiltration rate for design calculations
- Consideration of BMP drawdown
- Consideration of peak rate attenuation

Step 1. Background Evaluation

Prior to performing testing and developing a detailed site plan, existing conditions at the site must be inventoried and mapped including, but not limited to:

- Existing mapped individual soils and USDA Hydrologic Soil Group classifications.
- Existing geology, including the location of any dikes, faults, fracture traces, solution cavities, landslide prone strata, or other features of note.
- Existing streams (perennial and intermittent, including intermittent swales) water bodies, wetlands, hydric soils, floodplains, alluvial soils, stream classifications, headwaters and 1st order streams.
- Existing topography, slope, and drainage patterns.
- Existing and previous land uses.
- Other natural or man-made features or conditions that may impact design, such as past uses of site, existing nearby structures (building, walls), etc.

In Step 1, the designer should determine the potential location of infiltration BMPs. The approximate location of these BMPs should be identified on the proposed development plan and serve as the basis for the location and number of tests to be performed onsite. A sketch plan or preliminary layout plan for development should be evaluated, including:

- Preliminary grading plan and areas of cut and fill.
- Location and water surface elevation of all existing and location of proposed water supply sources and wells.
- Location of all existing and proposed onsite wastewater systems.
- Location of other features of note such as utility right-of-ways, water and sewer lines, etc.
- Existing data such as structural borings, drillings, and geophysical testing.
- Proposed location of development features (buildings, roads, utilities, walls, etc.).

Important: If the proposed development program is located on areas that may otherwise be suitable for BMP location, or if the proposed grading plan is such that potential BMP locations are eliminated, the designer must revisit the proposed layout and grading plan and adjust the development plan as necessary. Development on areas suitable for infiltration BMPs may *not* preclude the use of BMPs for volume reduction and groundwater recharge.

Step 2. Test Pits (Deep Holes)

A Test Pit (Deep Hole) allows visual observation of the soil horizons and overall soil conditions both horizontally and vertically in that portion of the site. An extensive number of Test Pit observations can be made across a site at a relatively low cost and in a short time period. The use of soil borings as a substitute for Test Pits is not permitted as visual observation is narrowly limited in a soil boring and the soil horizons cannot be observed in-situ, but must be observed from the extracted borings. Borings and other procedures, however, might be suitable for initial screening to develop a plan for testing, or verification testing.

A Test Pit consists of a backhoe-excavated trench, two and one half (2½) to three (3) feet wide, to a depth of between seventy two (72) inches and ninety (90) inches, or until bedrock or fully saturated conditions are encountered. The trench should be benched at a depth of two (2) to three (3) feet for access and/or infiltration testing.

At each Test Pit, the following conditions shall be noted and described. Depth measurements shall be described as depth below the ground surface:

- ___ Soil horizons (upper and lower boundary)
- ___ Soil texture and color for each horizon
- ___ Color patterns
- ___ Depth to water table
- ___ Depth to bedrock
- ___ Observance of pores or roots (size, depth)
- ___ Estimated type and percent coarse fragments
- ___ Hardpan or limiting layers
- ___ Strike and dip of horizons (especially lateral direction of flow at limiting layers)
- ___ Additional comments or observations

The Sample Soil Log Form at the end of this protocol may be used for documentation of each Test Pit. (Refer Appendix C of the Pennsylvania Stormwater Best Management Practices Manual)

At the designer's discretion, soil samples may be collected at various horizons for additional analysis. Following testing, the test pits must be refilled with the original soil and the surface replaced with the original topsoil. A Test Pit should *never* be accessed if soil conditions are unsuitable for safe entry, or if site constraints preclude entry.

It is important that the Test Pit provide information related to conditions at the bottom of the proposed infiltration BMP. If the BMP depth will be greater than ninety (90) inches below existing grade, deeper excavation will be required. However, *such depths are discouraged*. Except for surface discharge BMPs (filter strips, etc.) the designer is cautioned regarding the proposal of systems that are significantly lower than the existing topography. The suitability for infiltration may decrease, and risk factors are likely to increase. *Locations that are not preferred* for testing and subsurface infiltration BMPs include swales, the toe of slopes for most sites, and soil mantels of less than three feet.

The designer and contractors shall limit proposed grading and earthwork to reduce site disturbance and compaction so that a greater opportunity exists for testing and stormwater management.

The number of Test Pits varies depending on site conditions and the proposed development plan. General guidelines are as follows:

- For single-family residential subdivisions with on-lot BMPs, one test pit per lot is recommended, preferably within twenty five (25) feet of the proposed BMP area. Verification testing should take place when BMPs are sited at greater distances.
- For multi-family and high density residential developments, one test pit per BMP area or acre is recommended.
- For large infiltration areas (basins, commercial, institutional, industrial, and other proposed land uses), multiple test pits should be evenly distributed at the rate of four (4) to six (6) tests per acre of BMP area.

The recommendations above are guidelines. Additional tests will be required if local conditions indicate significant variability in soil types, geology, water table levels, bedrock, topography, etc. Similarly, uniform site conditions may indicate that fewer test pits are necessary. Excessive testing and disturbance of the site prior to construction is not recommended.

Step 3. Infiltration Tests/Permeability Tests

A variety of field tests exist for determining the infiltration capacity of a soil. Laboratory tests are not permitted, as a homogeneous laboratory sample does not represent field conditions. Infiltration tests shall be conducted in the field. Tests should not be conducted in the rain or within twenty four (24) hours of a significant rainfall event (>0.5 inches), or when the temperature is below freezing. However, the preferred testing is between January and June, the wet season. This is the period when infiltration is likely to be diminished by saturated conditions. Percolation tests carried out between June 1 and December 31 shall use a twenty four (24) hour presoaking before the testing. This procedure is not required for infiltrometer testing, or permeometer testing.

At least one test shall be conducted at the proposed bottom elevation of an infiltration BMP, and a minimum of two tests per Test Pit is recommended. More tests may be warranted if the results for first two tests are substantially different. The highest rate (inches/hour) for test results should be discarded when more than two are employed for design purposes. The geometric mean should be used to determine the average rate following multiple tests.

Based on observed field conditions, the proposed bottom elevation of BMP may be revised. Infiltration testing should be proposed to adjust locations and depths depending upon observed conditions.

Methodologies discussed in this protocol include:

- Double-ring infiltrometer tests.
- Percolation tests (such as for onsite wastewater systems and described in PA Code Chapter 73).

There are differences between the two methods. A double-ring infiltrometer test estimates the vertical movement of water through the bottom of the test area. The outer ring helps to reduce the lateral movement of water in the soil. A percolation test allows water movement through both the bottom and sides of the test area. For this reason, the measured rate of water level drop in a percolation test must be adjusted to represent the discharge that is occurring on both the bottom and sides of the percolation test hole.

For *infiltration basins*, an infiltration test should be completed with an infiltrometer (not percolation test) to determine the saturated hydraulic conductivity rate. This precaution is taken to account for the fact that only the surface of the basin functions to infiltrate, as measured by the test. Alternatively, permeability test procedures that yield a saturated hydraulic conductivity rate can be used (see formulas developed by Elirick and Reynolds (1992), or others for computation of hydraulic conductivity and saturated hydraulic conductivity).

Other testing methodologies and standards that are available but not discussed in detail in this protocol include (but are not limited to):

- Constant head double-ring infiltrometer.
- Testing as described in the Maryland Stormwater Manual Appendix D.1 using five (5) inch diameter casing.
- ASTM 2003 Volume 4.08, Soil and Rock (I): Designation D3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using a Double-Ring Infiltrrometer.
- ASTM 2002 Volume 4.09, Soil and Rock (II): Designation D 5093.90, Standard Test Method for Field Measurement of Infiltration Rate Using a Double-Ring Infiltrrometer with a Sealed-Inner Ring.
- Guelph Permeameter.
- Constant Head Permeameter (Amoozemeter).

a. Methodology for Double-Ring Infiltrrometer Field Test

A Double-ring Infiltrrometer consists of two concentric metal rings. The rings are driven into the ground and filled with water. The outer ring helps to prevent divergent

flow. The drop in water level or volume in the inner ring is used to calculate an infiltration rate. The infiltration rate is determined as the amount of water per surface area and time unit that penetrates the soils. The diameter of the inner ring should be approximately fifty (50) percent to seventy (70) percent of the diameter of the outer ring, with a minimum inner ring size of four (4) inches, preferably much larger. (Bouwer, 1986).

Equipment for Double-Ring Infiltrometer Test:

- ___ Two concentric cylinder rings six (6) inches or greater in height. Inner ring diameter equal to fifty (50) percent – seventy (70) percent of outer ring diameter (e.g. an eight (8) inch ring and a twelve (12) inch ring).
- ___ Water supply.
- ___ Stopwatch or timer.
- ___ Ruler or metal measuring tape.
- ___ Flat wooden board for driving cylinders uniformly into soil.
- ___ Rubber mallet.
- ___ Log sheets for recording data.

Procedure for Double-Ring Infiltrometer Test:

- ___ Prepare level testing area.
- ___ Place outer ring in place; place flat board on ring and drive ring into soil to a minimum depth of two (2) inches.
- ___ Place inner ring in center of outer ring; place flat board on ring and drive ring into soil a minimum of two (2) inches. The bottom rim of both rings should be at the same level.
- ___ The test area should be presoaked immediately prior to testing. Fill both rings with water to water level indicator mark or rim at thirty (30) minute intervals for one (1) hour. The minimum water depth should be four (4) inches. The drop in water level during the last thirty (30) minutes of the presoaking period should be applied to the following standard to determine the time interval between readings.
 - If water level drop is two (2) inches or more, use ten (10) minute measurement intervals.
 - If water level drop is less than two (2) inches, use thirty (30) minute measurement intervals.
- ___ Obtain a reading of the drop in water level in the center ring at appropriate time intervals. After each reading, refill both rings to water level indicator mark or rim. Measurement to the water level in the center ring shall be made from a fixed reference point and shall continue at the interval determined until a minimum of eight readings are completed or until a stabilized rate of drop is obtained, whichever occurs first. A stabilized rate of drop means a difference of one quarter ($\frac{1}{4}$) inch or less of drop between the highest and lowest readings of four consecutive readings.

- ___ The drop that occurs in the center ring during the final period or the average stabilized rate, expressed as inches per hour, shall represent the infiltration rate for that test location.

b. Methodology for Percolation Test

Equipment for Percolation Test:

- ___ Post hole digger or auger.
- ___ Water supply.
- ___ Stopwatch or timer.
- ___ Ruler or metal measuring tape.
- ___ Log sheets for recording data.
- ___ Knife blade or sharp pointed instrument (for soil scarification).
- ___ Course sand or fine gravel.
- ___ Object for fixed reference point during measurement (nail, toothpick, etc.).

Procedure for Percolation Test

This percolation test methodology is based largely on the Pennsylvania Department of Environmental Protection (PADEP) criteria for onsite sewage investigation of soils (as described in Chapter 73 of the Pennsylvania Code). This must include the twenty four (24) hour presoak procedure. The presoak is done primarily to simulate saturated conditions in the environment and to minimize the influence of unsaturated flow.

Prepare level testing area.

- ___ Prepare hole having a uniform diameter of six (6) to ten (10) inches and depth of eight (8) to twelve (12) inches. The bottom and sides of the hole should be scarified with a knife blade or sharp pointed instrument to completely remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Loose material should be removed from the hole.
- ___ (Optional) two (2) inches of coarse sand or fine gravel may be placed in the bottom of the hole to protect the soil from scouring and clogging of the pores.
- ___ Test holes should be presoaked immediately prior to testing. Water should be placed in the hole to a minimum depth of six (6) inches over the bottom and readjusted every thirty (30) minutes to one (1) hour.
- ___ The drop in the water level during the last thirty (30) minutes of the final presoaking period should be applied to the following standard to determine the time interval between readings for each percolation hole:
 - If water remains in the hole, the interval for readings during the percolation test should be thirty (30) minutes.
 - If no water remains in the hole, the interval for readings during the percolation test may be reduced to ten (10) minutes.

- After the final presoaking period, water in the hole should again be adjusted to a minimum depth of six (6) inches and readjusted when necessary after each reading. A nail or marker should be placed at a fixed reference point to indicate the water refill level. The water level depth and hole diameter should be recorded.
- Measurement to the water level in the individual percolation holes should be made from a fixed reference point and should continue at the interval determined from the previous step for each individual percolation hole until a minimum of eight readings are completed or until a stabilized rate of drop means a difference of one quarter (¼) inch or less of drop between the highest and lowest readings of four consecutive readings.
- The drop that occurs in the percolation hole during the final period, expressed as inches per hour, shall represent the percolation rate for that test location.
- The average measured rate must be adjusted to account for the discharge of water from both the sides and bottom of the hole to develop a representative infiltration rate. The average/final percolation rate should be adjusted for each percolation test according to the following formula:

Infiltration Rate = (Percolation Rate) / (Reduction Factor)

Where the Reduction Factor is given**:

$$R_f = \frac{2d_i - \Delta d + 1}{DIA}$$

With:

d_i = Initial Water Depth (in.)
 Δd = Average/Final Water Level Drop (in.)
 DIA = Diameter of the Percolation Hole (in.)

The Percolation Rate is simply divided by the Reduction Factor as calculated above or shown in the table below to yield the representative Infiltration Rate. In most cases, the Reduction Factor varies from about two (2) to four (4) depending on the percolation hole dimensions and water level drop – wider and shallower tests have lower Reduction Factors because proportionately less water exfiltrates through the sides. For design purposes additional safety factors are employed (see Protocol 2, Infiltration Systems Design and Construction Guidelines).

*** The area Reduction Factor accounts for the exfiltration occurring through the sides of percolation hole. It assumes that the percolation rate is affected by the depth of water in the hole and that the percolating surface of the hole is in uniform soil. If there are significant problems with either of these assumptions then other adjustments may be necessary.*

Source: Pennsylvania Stormwater Best Management Practice Manual, December 2006.

APPENDIX F

LOW IMPACT DEVELOPMENT TECHNIQUES

LOW IMPACT DEVELOPMENT PRACTICES

ALTERNATIVE APPROACH FOR MANAGING STORMWATER RUNOFF

Natural hydrologic conditions may be altered radically by poorly planned development practices. Deleterious activities include introducing unneeded impervious surfaces, destroying existing drainage swales, constructing unnecessary storm sewers, and changing local topography. A traditional drainage approach of development has been to remove runoff from a site as quickly as possible and capture in a detention basin in accordance with the local regulations. This approach leads ultimately to the expenditure of additional resources for detaining and managing concentrated runoff at some downstream locations.

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

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

- A. Protect Sensitive and Special Value Resources:** (Refer Section 5.4 of the Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006))
 - 1. 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 modern developments. In fact, commonly held drainage philosophy encourages just the opposite pattern. Streets and adjacent storm sewers typically are located in the natural headwater valleys and swales, thereby replacing natural drainage functions with a completely impervious system. 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 onsite.
 - 2. Protecting Natural Depression Storage Areas.** Depressional storage areas have not 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 the 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.

B. Reduce Impervious Coverage: (Refer Section 5.7 of the Pennsylvania Stormwater Best Management Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006))

1. **Avoiding Introduction of Impervious Areas.** A careful site planning should consider reducing impervious coverage to the maximum extent possible. Building footprints, sidewalks, driveways, and other features producing impervious surfaces should be evaluated to minimize impacts on runoff.
2. **Disconnecting Impervious Surfaces (DIAs).** Impervious surfaces are significantly less of a problem if they are not directly connected to an impervious conveyance system (such as storm sewer). Two basic ways to reduce hydraulic connectivity are routing of roof runoff over lawns and reducing the use of storm sewers. Site grading should promote increasing travel time of stormwater runoff, and should help reduce concentration of runoff to a single point in the development.

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

1. **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.
2. **Reducing the Use of Storm Sewers.** By reducing use of storm sewers for draining streets, parking lots, and backyards, 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.
3. **Reducing Street Widths.** Street widths can be reduced by either eliminating on-street parking or by reducing roadway widths. Municipal planners and traffic designers should encourage narrower neighborhood streets which ultimately could lower maintenance.
4. **Limiting Sidewalks to One Side of the Street.** A sidewalk on one side of the street may suffice in low-traffic neighborhoods. The lost sidewalk could be replaced with bicycle/recreational trails that follow back-of-lot lines. Where appropriate, backyard trails should be constructed using pervious materials.
5. **Using Permeable Paving Materials.** These materials include permeable interlocking concrete paving blocks or porous bituminous concrete. Such materials should be considered as alternatives to conventional pavement surfaces, especially for low use surfaces such as driveways, overflow parking lots, and emergency access roads.
6. **Reducing Building Setbacks.** Reducing building setbacks reduces driveway and entry walks and is most readily accomplished along low traffic streets where traffic noise is not a problem.

- D. Constructing and Concentrate:** (Refer Section 5.5 of the Pennsylvania Stormwater Best Practices Manual, Pennsylvania Department of Environmental Protection (PADEP) no. 363-0300-002 (2006). Cluster developments can also reduce the amount of impervious area for a given number of lots. The biggest savings is in street length, which also will reduce costs of the development. Cluster development clusters the construction activity onto less-sensitive areas without substantially affecting the gross density of development.

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 included reduced potential of downstream flooding, water quality degradation 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 G

NONSTRUCTURAL STORMWATER MANAGEMENT BMPs

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" 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" 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 sq. ft. x 2 inches of runoff) / 12 inches = 24 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. x 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. x 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.

Alternative BMP to Capture and Reuse Stormwater

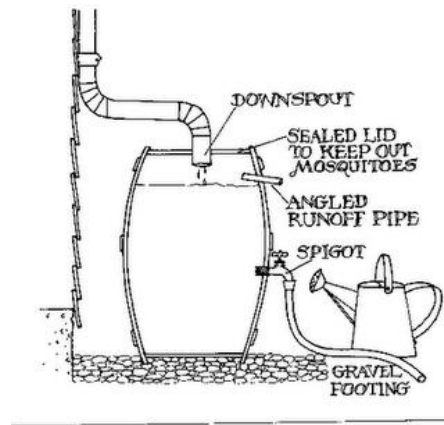
Rain Barrels

Rain barrels are large containers that collect drainage from roof leaders and temporarily store water to be released to lawns, gardens, and other landscaped areas after the rainfall has ended. Rain barrels are typically between 50 and 200 gallons in size. It is not recommended for rain barrels to be used as a volume control BMP because infiltration is not guaranteed after each storm event. For this reason, a rain barrel is not utilized in the site plan example. However, the information is included to provide an alternative for a homeowner to utilize when considering capture and reuse stormwater methods.

Design Considerations:

- Rain barrels should be directly connected to the roof gutter/spout.
- There must be a means to release the water stored between storm events to provide the necessary storage volume for the next storm.
- When calculating rain barrel size, rain barrels are typically assumed to be 25% full because they are not always emptied before the next storm.
- Use screens to filter debris and cover lids to prevent mosquitoes.
- An overflow outlet should be placed a few inches below the top with an overflow pipe to divert flow away from structures.
- It is possible to use a number of rain barrels jointly for an area.

Figure 2: Rain Barrel Diagram and Examples



Sources: (top picture) <http://www.citywindsor.ca/DisplayAttach.asp?AttachID=12348>
 (bottom picture on left) <http://repurposinglife.blogspot.com/2009/05/rainwater-harvesting.html>
 (bottom picture on right) <http://www.floridata.com/tracks/transplantedgardener/Rainbarrels.cfm>

Sizing Example for a Rain Barrel

1. Determine contributing impervious surface area:

Garage Roof (Right)	6 ft. x 24 ft.	=	144 sq ft
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2. Determine the amount of rainfall to be captured by the Rain Barrel. A smaller storm, no more than 2", is recommended to calculate the runoff to be captured. This example chose the 1" storm event.
3. Calculate the volume to be captured and reused:
 $(144 \text{ sq. ft.} \times 1 \text{ inch of runoff}) / 12 \text{ inches} = 12 \text{ cu. ft.}$
4. Size the rain barrel:

$$1 \text{ cu. ft.} = 7.48 \text{ gallons}$$

12 cu. ft. x 7.48 = 90 gallons

90 gallons x (0.25*) = 22.5 gallons (*assuming that the rain barrel is always at least 25% full)

90 gallons + 22.5 gallons = 112 gallons

The rain barrel or barrels should be large enough hold at least 112 gallons of water.

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APPENDIX H

HOT SPOTS

HOT SPOTS

Hot spots are sites where the land use or activity produces a higher concentration of trace metals, hydrocarbons, or priority pollutants than normally found in urban runoff.

1. EXAMPLES OF STORMWATER HOT SPOTS

- vehicle salvage yards and recycling facilities
- vehicle fueling stations
- vehicle service and maintenance facilities
- vehicle and equipment cleaning facilities
- fleet storage areas (bus, truck, etc.)
- industrial sites (based on Standard Industrial Codes defined by the U.S. Department of Labor)
- marinas (service and maintenance)
- outdoor liquid container storage
- outdoor loading/unloading facilities
- public works storage areas
- facilities that generate or store hazardous materials
- commercial container nursery
- other land uses and activities as designated by an appropriate review authority

2. LAND USE AND ACTIVITIES NOT NORMALLY CONSIDERED HOT SPOTS

- residential streets and rural highways
- residential development
- institutional development
- office developments
- nonindustrial rooftops
- pervious areas, except golf courses and nurseries (which may need an Integrated Pest Management (IPM) Plan).

- 3. LIST OF ACCEPTABLE BMPs for Hot Spot Treatment:** The following BMPs listed under the Best Management Practice column are BMPs appropriate for application on hot spot sites. BMPs which facilitate infiltration are prohibited by this ordinance. In many design manuals the BMPs with a * designation are designed with infiltration, however it is possible to design these without infiltration.

The numbers listed under the Design Reference Number column correlate with the Reference Table which lists materials that can be used for design guidance.

Best Management Practice	Design Reference Number
Bioretention*	4, 5, 11, 16
Capture/Reuse	4, 14
Constructed Wetlands	4, 5, 8, 10, 16
Dry Extended Detention Ponds	4, 5, 8, 12, 18

Best Management Practice	Design Reference Number
Minimum Disturbance/ Minimum Maintenance Practices	1, 9
Significant Reduction of Existing Impervious Cover	N/A
Stormwater Filters* (Sand, Peat, Compost, etc.)	4, 5, 10, 16
Vegetated Buffers/Filter Strips	2, 3, 5, 11, 16, 17
Vegetated Roofs	4, 13
Vegetated Swales*	2, 3, 5, 11, 16, 17
Water Quality Inlets (Oil/Water Separators, Sediment Traps/Catch Basin Sumps, and Trash/Debris Collectors in Catch Basins)	4, 7, 15, 16, 19
Wet Detention Ponds	4, 5, 6, 8

Reference Table

Number	Design Reference Title
1	"Conservation Design For Stormwater Management – A Design Approach to Reduce Stormwater Impacts From Land Development and Achieve Multiple Objectives Related to Land Use", Delaware Department of Natural Resources and Environmental Control, The Environmental Management Center of the Brandywine Conservancy, September 1997
2	"A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zone", Schueler, T. R., Kumble, P. and Heraty, M., Metropolitan Washington Council of Governments, 1992.
3	"Design of Roadside Channels with Flexible Linings", Federal Highway Administration, Chen, Y. H. and Cotton, G. K., Hydraulic Engineering Circular 15, FHWA-IP-87-7, McLean, Virginia, 1988.
4	"Draft Stormwater Best Management Practices Manual", Pennsylvania Department of Environmental Protection, January 2005.
5	"Evaluation and Management of Highway Runoff Water Quality", Federal Highway Administration, FHWA-PD-96-032, Washington, D.C., 1996.
6	"Evaporation Maps of the United States", U.S. Weather Bureau (now NOAA/National Weather Service) Technical Paper 37, Published by Department of Commerce, Washington D.C., 1959.
7	"Georgia Stormwater Manual", AMEC Earth and Environmental, Center for Watershed Protection, Debo and Associates, Jordan Jones and Goulding, Atlanta Regional Commission, Atlanta, Georgia, 2001.
8	"Hydraulic Design of Highway Culverts", Federal Highway Administration, FHWA HDS 5, Washington, D.C., 1985 (revised May 2005).
9	"Low Impact Development Design Strategies An Integrated Design Approach, Prince Georges County, Maryland Department of Environmental Resources, June 1999.

Number	Design Reference Title
10	"Maryland Stormwater Design Manual", Maryland Department of the Environment, Baltimore, Maryland, 2000.
11	"Pennsylvania Handbook of Best Management Practices for Developing Areas", Pennsylvania Department of Environmental Protection, 1998.
12	"Recommended Procedures for Act 167 Drainage Plan Design", LVPC, Revised 1997.
13	"Roof Gardens History, Design, and Construction", Osmundson, Theodore. New York: W.W. Norton & Company, 1999.
14	"The Texas Manual on Rainwater Harvesting", Texas Water Development Board, Austin, Texas, Third Edition, 2005.
15	"VDOT Manual of Practice for Stormwater Management", Virginia Transportation Research Council, Charlottesville, Virginia, 2004.
16	"Virginia Stormwater Management Handbook", Virginia Department of Conservation and Recreation, Richmond, Virginia, 1999.
17	"Water Resources Engineering", Mays, L. W., John Wiley & Sons, Inc., 2005.
18	"Urban Hydrology for Small Watersheds", Technical Report 55, US Department of Agriculture, Natural Resources Conservation Service, 1986.
19	US EPA, Region 1 New England web site (as of August 2005) http://www.epa.gov/NE/assistance/ceitts/stormwater/techs/html .

4. RECOMMENDED PRE-TREATMENT METHODS FOR "HOT SPOT" LAND USES:

The following table recommends what is considered the best pre-treatment option for the listed land use. These methods are either a BMP or can be applied in conjunction with BMPs.

Hot Spot Land Use	Pre-treatment Method(s)
Vehicle Maintenance and Repair Facilities including Auto Parts Stores	-Water Quality Inlets -Use of Drip Pans and/or Dry Sweep Material Under Vehicles/Equipment -Use of Absorbent Devices to Reduce Liquid Releases -Spill Prevention and Response Program
Vehicle Fueling Stations	-Water Quality Inlets -Spill Prevention and Response Program
Storage Areas for Public Works	-Water Quality Inlets -Use of Drip Pans and/or Dry Sweep Material Under Vehicles/Equipment -Use of Absorbent Devices to Reduce Liquid Releases -Spill Prevention and Response Program -Diversion of Stormwater away from Potential Contamination Areas
Outdoor Storage of Liquids	-Spill Prevention and Response Program
Commercial Nursery Operations	-Vegetated Swales/Filter Strips -Constructed Wetlands -Stormwater Collection and Reuse
Hot Spot Land Use	Pre-treatment Method(s)

Salvage Yards and Recycling Facilities*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Fleet Storage Yards and Vehicle Cleaning Facilities*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Facilities that Store or Generate Regulated Substances*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Marinas*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit
Certain Industrial Uses (listed under NPDES)*	-BMPs that are a part of a Stormwater Pollution Prevention Plan under an NPDES Permit

*Regulated under the NPDES Stormwater Program

APPENDIX I

SIMPLIFIED STORMWATER MANAGEMENT PROCEDURES FOR EXISTING SINGLE FAMILY DWELLING LOTS

SIMPLIFIED STORMWATER MANAGEMENT PROCEDURES FOR EXISTING SINGLE FAMILY DWELLING LOTS

Projects eligible for this procedure

Individual home construction projects on single family lots which result in less than two thousand five hundred (2,500) square feet of new impervious area (including the building footprint, driveway, sidewalks, and parking areas) and less than five thousand (5,000) square feet of earth disturbance may utilize the simplified procedure contained in this Appendix to meet volume requirements of this Part and are not required to submit detailed stormwater management plans as required by Article IV to the Township. This procedure may not be utilized for proposed subdivisions or land developments.

Are professional services necessary to meet these requirements?

This Appendix has been developed to assist the individual homeowner in meeting the water quality and groundwater recharge goals of the Stormwater Management Ordinance. If the guidelines are followed, the homeowner will not require professional services to comply with these water quality and groundwater recharge goals.

What do I need to submit to Bedminster Township?

Even though a formal stormwater management plan is not required for individual lot owners, a brief description of the proposed infiltration facilities, including types of material to be used, total impervious areas and volume calculations, and a simple sketch plan showing the following information shall be submitted to the Township prior to construction:

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

Determination of Recharge Volume

The amount of recharge volume that must be provided is determined by following the simple steps below. 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 sidewalks, driveways or parking areas. Sidewalks, driveways or patios that are constructed with turf pavers and are not included in this calculation.

Example Recharge Volume:

STEP 1 – Determine Total Impervious Surfaces:

House Roof (Front)	12 ft. x 48 ft.	=	576 sq. ft.
House Roof (Rear)	12 ft. x 48 ft.	=	576 sq. ft.
Driveway	12 ft. x 50 ft.	=	600 sq. ft.
Parking Pad	12 ft. x 12 ft.	=	144 sq. ft.
Walkway	4 ft. x 20 ft.	=	80 sq. ft.

			1,976 sq. ft.

STEP 2 – Determine Required Infiltration Volume (Rv) Using the Following Equation

$$Rv = \frac{3.26 \text{ inches} \times (\text{total impervious area in square feet})}{12} = \text{_____ cubic feet of recharge}$$

$$Rv = \frac{3.26 \times 1,976 \text{ sq. ft.}}{12} = 537 \text{ cu. ft.}$$

Note: This example is located within the Neshaminy Creek Watershed. Use 2.0 inches in other watersheds.

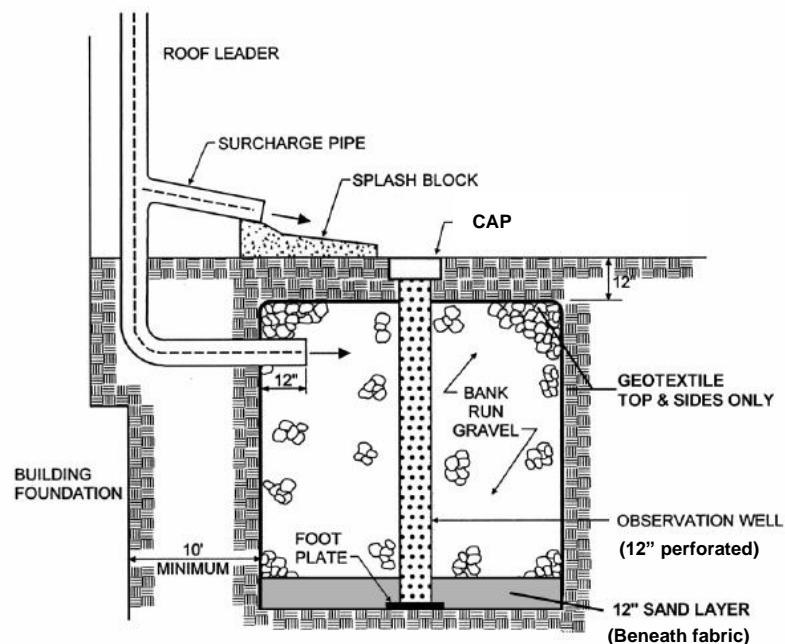
STEP 3 – Sizing of Selected Infiltration Method

The following pages identify several methods to infiltrate stormwater runoff. Their appropriateness depends on the amount of required infiltration volume and amount of available land. More than one method may be implemented on a site, depending on site constraints. Dry wells may be used only for receiving runoff from roof drains. Infiltration trenches are appropriate for receiving runoff from driveways, sidewalk or parking areas. Other methods may be appropriate, but these must be reviewed with the Township Engineer prior to installation.

Dry Wells

Dry wells are effective methods to infiltrate runoff from roof leaders. These facilities must be located based upon a determination by the design professional to reduce potential basement seepage problems but not less than a minimum of twenty (20) feet from the building foundation. A dry well may be either a structural prefabricated chamber or an excavated pit filled with aggregate. Dry well shall not be constructed until all other areas of the site are stabilized, to avoid clogging. During construction, compaction of the subgrade soil shall be avoided, and construction may be performed with only light machinery. Depth of dry wells in excess of three and one-half (3 ½) feet should be avoided unless warranted by soil conditions. "Clean" gravel fill should average one and one half to three (1.5 – 3.0) inches in diameter. Dry wells should be inspected at least four (4) times annually as well as after large storm events.

FIGURE 1 - TYPICAL DRY WELL CONFIGURATION



Source: Maryland Stormwater Design Manual

Example Sizing For Drywells:

STEP 1 – Determine Total Impervious Surfaces

House Roof Area: 12 ft. x 48 ft. = 576 sq. ft.

STEP 2 – Determine Required Infiltration Volume using Equation

$$\frac{3.26 \text{ in.} \times 576 \text{ sq. ft.}}{12} = 156 \text{ cu. ft.}$$

$$\frac{156 \text{ cu. ft.}}{0.4^*} = 390 \text{ cu. ft.} \text{ (*assumes 40\% void ratio in gravel)}$$

STEP 3 – Sizing of Selected Infiltration Method

Volume of facility = Depth x Width x Length

Set D = 3.5 ft; Set W = L for a square chamber

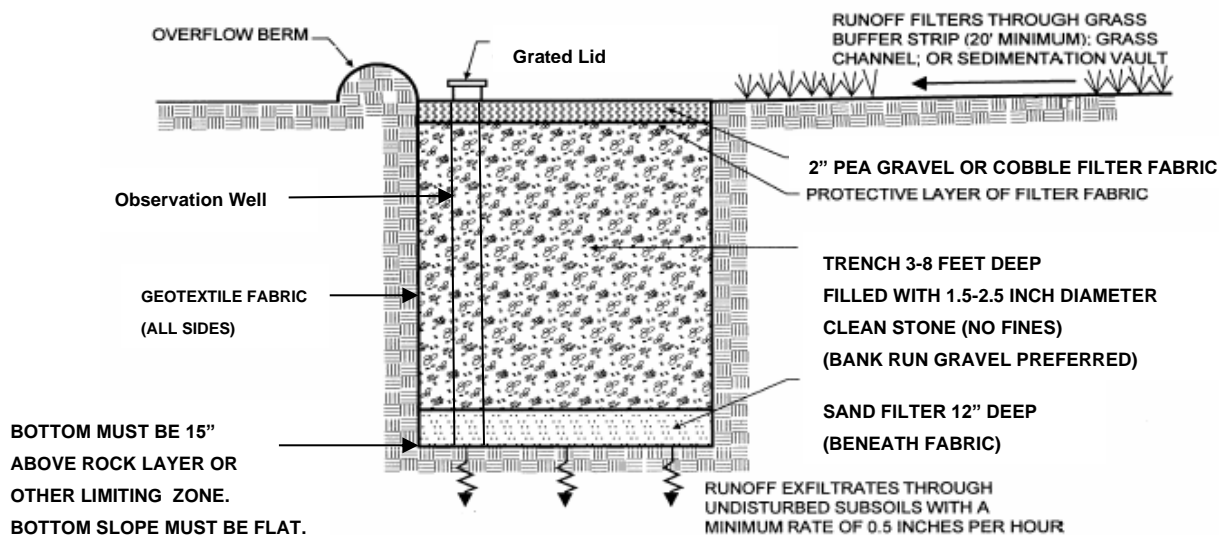
$$390 \text{ cu. ft.} = 3.5 \times L \times L ; L = 10.5 \text{ ft.}$$

Final Facility Dimensions: 3.5 ft. (D) x 10.5 ft. (W) x 10.5 ft. (L)

Infiltration Trenches

An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

FIGURE 2 - TYPICAL INFILTRATION TRENCH CONFIGURATION



Source: Maryland Stormwater Design Manual, 2000

Example Sizing For Infiltration Trenches:

STEP 1 – Determine Total Impervious Surfaces

Driveway	12 ft. x 50 ft.	=	600 sq. ft.
Parking Pad	12 ft. x 12 ft.	=	144 sq. ft.
Walkway	4 ft. x 20 ft.	=	80 sq. ft.

			824 sq. ft.

STEP 2 – Determine Required Infiltration Volume using Equation

$$\frac{3.26 \text{ in.} \times 824 \text{ sq. ft.}}{12} = 224 \text{ cu. ft.}$$

$$\frac{224 \text{ cu. ft.}}{0.4^*} = 560 \text{ cu. ft. (*assumes 40\% void ratio in gravel bed)}$$

Note: This example is located within the Neshaminy Creek Watershed. Use 2.0 inches in other watersheds.

STEP 3 – Sizing of Selected Infiltration Method

Volume of facility = Depth x Width x Length

Set D = 3 ft; determine required surface area of trench

$$560 \text{ cu. ft.} / 3 \text{ ft.} = 187 \text{ sq. ft.}$$

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

$$\text{Determine trench length: } L = 187 \text{ sq. ft.} / 6 \text{ ft.} = 31 \text{ ft.}$$

Final trench dimensions: 3 ft. (D) x 6 ft. (W) x 31 ft. (L)

Rain Gardens

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. Ponded 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 drain fields and wellheads.
- If the site has clay soils, soil should be amended with compost or organic material.
- Choose native plants.

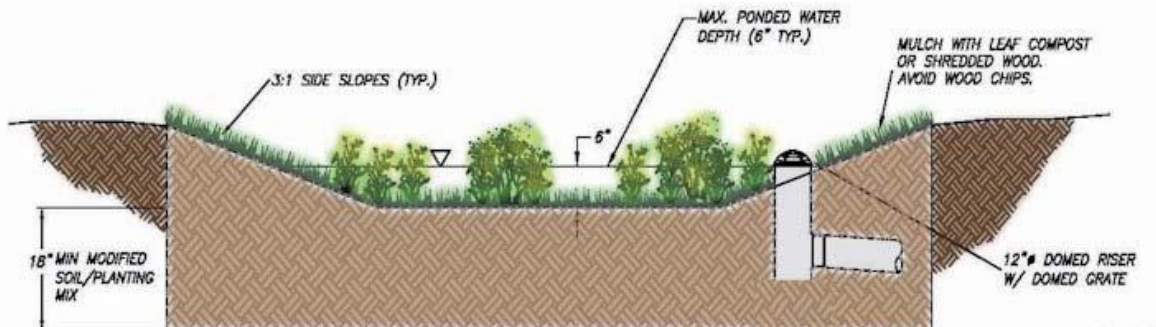
See http://pa.audubon.org/habitat/PDFs/RGBrochure_complete.pdf for a native plant list.
To find native plant sources go to www.pawildflower.org.

- At the rain garden location, the water table should be at least 2' 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 3: Rain Garden Diagram



Source: PA BMP Guidance Manual, Chapter 6 Page 50

Sizing Example for Rain Garden

- Pick a site for the rain garden between the source of runoff and between a low lying area, a.k.a., a drainage area.
- 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.
- 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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- Sizing the rain garden:

For this example, the infiltration test determined 6" 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" is the depth of the rain garden. The sizing calculation below is based on controlling 1" of runoff. First divide the impervious surface by the depth of the rain garden.

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

APPENDIX J

PERVIOUS HARDSCAPING DESIGN AND CREDIT CRITERIA

PERVIOUS HARDSCAPING SYSTEM DESIGN & IMPERVIOUS SURFACE AREA CREDIT CRITERIA

An impervious surface area credit for construction of pervious hardscaping systems may be approved provided they comply with the design guidelines herein and approval is received from Bedminster Township.

An impervious surface credit shall only be considered by the Township for driveways, parking areas, and other hardscaping surfaces that are constructed at a slope greater than 1%, but less than 5%.

Numbers shown in the following table are the percentage of hardscaping surface area (proposed) that must be considered "IMPERVIOUS" based on factors such as paver block open void area and the material installed in the voids/openings of these surfaces.

**TABLE 1.0
HARDSCAPING SURFACE AREA THAT MUST BE CONSIDERED IMPERVIOUS SURFACE:**

FILL MATERIAL IN PAVER BLOCK VOIDS	HARDSCAPING MATERIAL				
	PAVER/ BLOCK	→	→	CLEAN STONE OR STRUCTURAL "GEOWEB"(1)	
	SURFACE OPEN AREA PERCENTAGE (%)				
	50-59.99	60-69.99	70-79.99	80-89.99	90-100
SOIL/GRASS	67%	60%	54%	48%	NOT PERMITTED
CLEAN STONE (no fines) or other CLEAN, NON-ERODIBLE FILL	52%	43%	33%	24%	14%

TABLE FOOTNOTE:

- (1) Driveways and parking areas must either be bituminous paving, stone (residential driveways, only), or some other combination of load bearing paver block backfilled with stone or soil. Geoweb, alone, with earth backfill may not be used for driveways and parking areas; therefore, is not eligible for an impervious surface area credit.

NOTES:

1. An impervious surface area credit, if approved by the Township, will only be valid if a proper sub-base is used and when filter fabric is installed to separate all soil/stone interfaces and clean stone/sand leveling bed surfaces, as more particularly shown on the attached conceptual installation detail.
2. Pervious hardscaping systems with less than 50% open surface void percentage is not eligible for an impervious surface credit and the entire surface of such hardscaping will be considered 100% impervious for the purpose of calculating on-site impervious surface area and stormwater runoff. However, such systems may be considered a "Best Management Practice" if constructed in compliance with the criteria herein.

3. The hardscaping surface area which is intended and approved for impervious credit must be fully protected (by super silt fence) during the entire construction process to prevent compaction of the underlying soils by construction equipment and vehicles. A note must be added to the plan indicating this requirement.
4. The sequence of construction must specify the area of pervious hardscaping may only be constructed upon stabilization of the remainder of the site to prevent sediment from contaminating the surface.
5. General design and construction of these surfaces must conform to the attached construction detail and installation and maintenance procedures for the designated pervious hardscaping system must be identified on the plan.
6. Each request for impervious credit must include the manufacturer, style/product number, surface open area percentage (as identified by the manufacturer), and product data sheets. This information must also be shown on the plan including a notation that hardscaping system may only be modified with the written approval of the Township. No other "paver" block or stone may be substituted for that approved.
7. If the impervious surface credit is approved by the Township, the resulting ("net") total of impervious surface area from the "paver" must be included in the impervious surface tabulation which must also identify the total area of "paver" block and percentage of hardscaping area that must be considered impervious (refer Table 1.0). The calculation of impervious surface area (refer sample herein) must be shown on the plan.
8. All applications for impervious surface area credit shall be reviewed by the Township Engineer for completeness and technical content to satisfy the above requirements and any other applicable ordinance requirements. Design and installation must be permanent and will be evaluated based on criteria herein, feasibility, effectiveness, and longevity. The Township retains the right to require infiltration testing at pervious paver locations, as well as the right to deny any application due to unforeseen circumstances unique to the site or application. Finally, Construction of the pervious hardscaping system must be inspected by the Township Engineer with advance notice of 48-hours to schedule required inspections.

CALCULATION OF HARDSCAPING SURFACE THAT MUST BE CONSIDERED IMPERVIOUS SURFACE AREA:

Proposed Pervious Hardscaping Surface Area = PHSA

Percentage of (Hardscaping) surface that must be considered Impervious (from **Table 1.0**)= PI

Total Area of Hardscaping Surface that must be considered Impervious = TI

$TI = PHSA \times (PI \div 100)$

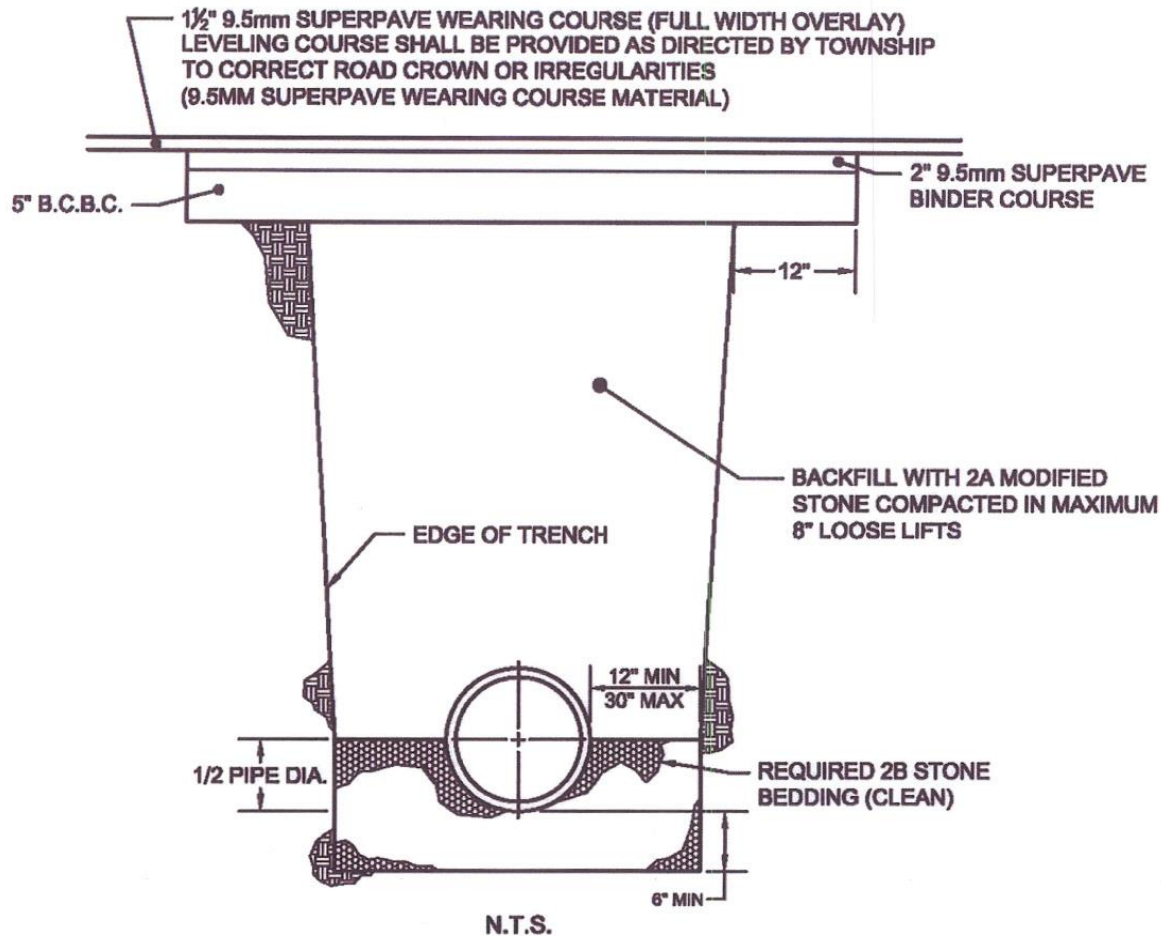
SAMPLE CALCULATIONS:

1. If 1,250 SF of lot area is covered with "Hastings Checkerblock" (70% open area) with voids backfilled with clean stone, the quantity of hardscaping area that must be considered impervious surface area is:

$1,250 \text{ SF} \times (33\% \div 100)$ (from **Table 1.0**) = 413 SF = TI; therefore the "impervious surface credit" would be: $1,250 \text{ SF} - 413 \text{ SF} = 837 \text{ SF}$

APPENDIX K

STORMSEWER BEDDING/BACKFILL REQUIREMENTS

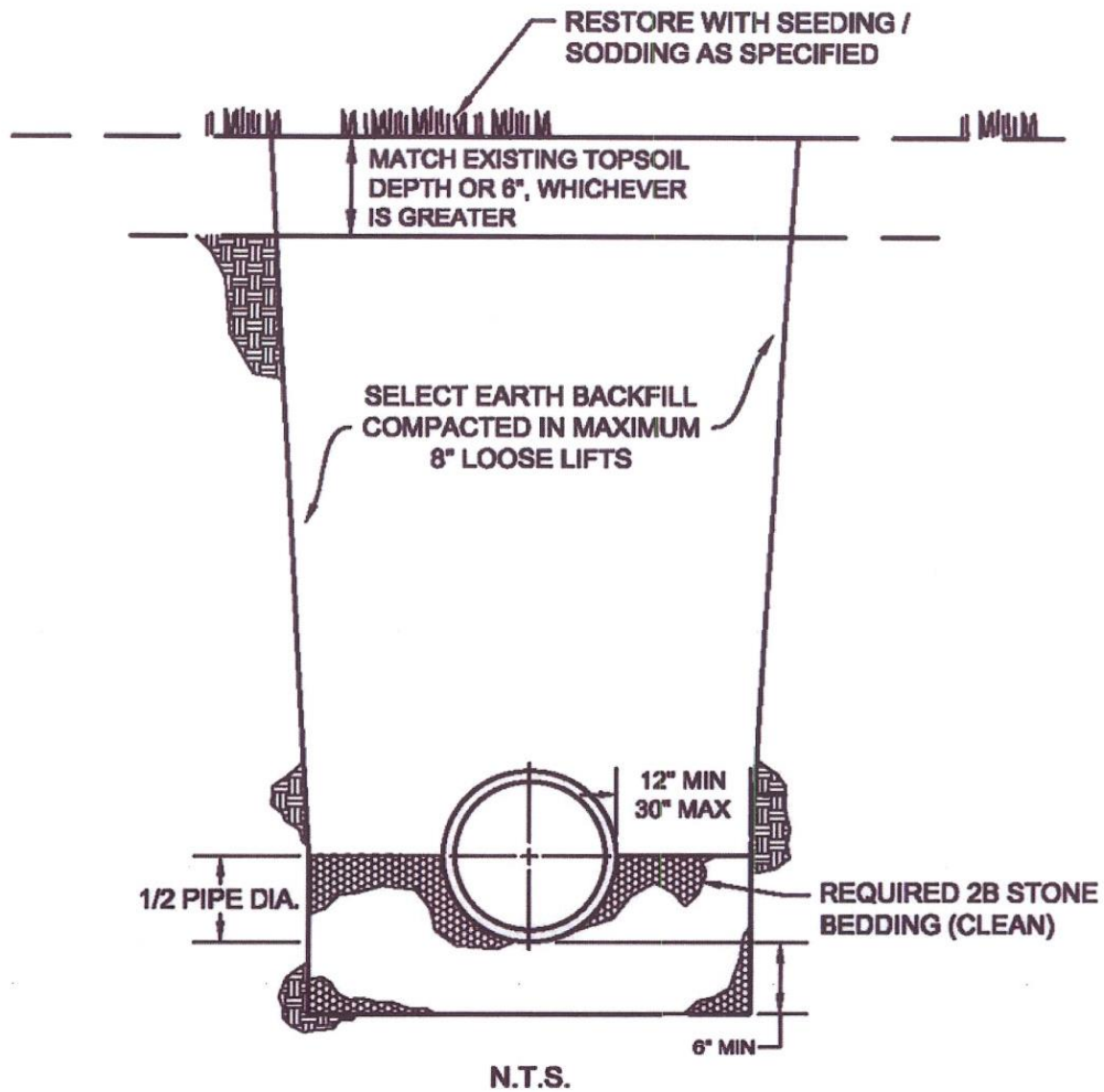


NOTES:

1. Developer/Contractor shall be responsible for proper implementation of safety requirements in conformance to all Federal and State Department of Labor and Occupational Safety and Hazard Administrative Regulations.
2. Backfill for new road construction may be select earth backfill when suitable material is available as determined by the Township.
3. Full depth 2A stone backfill shall be required for all storm sewer, sanitary sewer and utility trenching when edge of trench is within 15 feet of existing roadway edge of paving; and for all trenching within area of roadway widening.
4. Roadway crown shall be 3/8 inch per foot.
5. 3 inch temporary patch of BCBC shall be provided and maintained for less than 30 days prior to final restoration of existing roadway or driveway. Temporary patch shall be removed with final restoration performed no more than 90 days from date of sewer installation providing testing has been satisfactorily accomplished and no settlement has occurred.
6. All work and materials shall conform to PennDot Publication 408, latest edition.

STORM SEWER BEDDING DETAIL

(WITHIN RIGHT-OF-WAY, BENEATH ALL EXISTING ROADWAYS AND
DRIVEWAYS, PUBLIC OR PRIVATE)



STORM SEWER BEDDING DETAIL

(EARTHEN AREA)

APPENDIX L

REFERENCES

1. U.S. Department of Agriculture, National Resources Conservation Service (NRCS). *National Engineering Handbook*. Part 630: Hydrology, 1969-2001. Originally published as the *National Engineering Handbook*, Section 4: Hydrology. Available from the NRCS online at <http://www.nrcs.usda.gov/>.
2. U.S. Department of Agriculture, Natural Resources Conservation Service. 1986. *Technical Release 55: Urban Hydrology for Small Watersheds*, 2nd Edition. Washington, DC.
3. Pennsylvania Department of Environmental Protection. No. 363-0300-002 (December 2006), as amended and updated. *Pennsylvania Stormwater Best Management Practices Manual*. Harrisburg, PA.
4. Pennsylvania Department of Environmental Protection. No. 363-21234-008 (March 31, 2012), as amended and updated. *Erosion and Sediment Pollution Control Program Manual*. Harrisburg, PA.
5. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Hydrometeorological Design Studies Center. 2004-2006. *Precipitation-Frequency Atlas of the United States, Atlas 14*, Volume 2, Version 3.0, Silver Spring, MD. Internet address: <http://hdsc.nws.noaa.gov/hdsc/pfds>.