

ACT 167 STORMWATER MANAGEMENT PLAN

DAMASCUS TOWNSHIP

WAYNE COUNTY

LACKAWAXEN RIVER WATERSHED

STORMWATER MANAGEMENT

ORDINANCE

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**DAMASCUS TOWNSHIP
LACKAWAXEN RIVER WATERSHED
STORMWATER MANAGEMENT ORDINANCE**

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DAMASCUS TOWNSHIP STORMWATER MANAGEMENT ORDINANCE

ARTICLE I - GENERAL PROVISIONS

SECTION 101. Statement of Findings

The Supervisors of Damascus Township finds that:

- A. Inadequate management of accelerated runoff of stormwater resulting from development throughout a watershed:
 - increases flood flow volumes and velocities,
 - contributes to erosion and sedimentation,
 - overtaxes the carrying capacity of streams and storm sewers,
 - greatly increases the cost of public facilities to carry and control storm water,
 - undermines floodplain management and flood control efforts in down-stream communities,
 - reduces groundwater recharge,
 - deteriorates the water quality of receiving waters, and
 - threatens public health and safety.
- B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety and welfare and the protection of the people of Damascus Township and all the people of the Commonwealth, their resources and the environment.

SECTION 102. Purpose

The purpose of this Ordinance is to promote the public health, safety, and welfare within the Lackawaxen River Watershed by minimizing the damages described in Section 101.A of this Ordinance. To accomplish this, the Ordinance establishes a comprehensive stormwater management program designed to:

- A. Control accelerated runoff and erosion and sedimentation problems at their source by regulating activities which cause such problems.
- B. Utilize and preserve the existing natural drainage systems.
- C. Encourage recharge of ground waters.
- D. Maintain the existing flows and quality of streams and water courses in Damascus Township and the Lackawaxen River Watershed.
- E. Preserve the flood carrying capacity of streams.
- F. Provide for proper design, installation and maintenance of all permanent storm water management structures which are constructed in Damascus Township.

SECTION 103. Statutory Authority

Damascus Township is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864 (Act 167), the "Stormwater Management Act" and the Second Class Township Code.

SECTION 104. Applicability

- A. This Ordinance shall apply to those areas of Damascus Township as delineated on the official maps available for examination at the Damascus Township office.
- B. This Ordinance contains only those stormwater runoff control criteria and standards which are necessary or desirable from a total watershed perspective. Additional design standards for stormwater management facilities (i.e. inlet spacing, inlet type, collection system details, etc.) may be listed in the Damascus Township Subdivision and Land Development Ordinance, or may be instituted by the Damascus Township Engineer.
- C. The following land disturbance activities are defined as Regulated Activities and shall be regulated by this Ordinance, except those individual land disturbance activities which meet the criteria to qualify for exemption, as described in Section 402 and Section 1001:
 - 1. General land disturbance activities, including clearing and excavation.
 - 2. Land development.
 - 3. Subdivision.
 - 4. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.).
 - 5. Construction of new buildings or additions to existing buildings.
 - 6. Nursery operations.
 - 7. Diversion or piping of any natural or man-made drainage channel.
 - 8. Installation of stormwater systems or appurtenances thereto.

ARTICLE II - DEFINITIONS

Unless otherwise stated, the following words shall, for the purpose of this Ordinance, have the meaning herein indicated. Words in the present tense include the future tense. Words in the singular include the plural and words in the plural include the singular. The word "shall" is mandatory and not discretionary. The word "may" is permissive. Technical definitions not included in this article can be found in Appendix C. Words not defined herein or in Appendix C shall be construed to have the meaning given by common and ordinary use.

Act - The Pennsylvania Storm Water Management Act of October 4, 1978 (P.L. 864, No. 167).

Agricultural Operations - All activities connected with farming including dairying, pasturage, agriculture, apiaries, horticulture, floriculture, forest management, viticulture, and animal and poultry husbandry.

Applicant - A landowner or developer who has filed an Application for a Zoning Permit or Subdivision and/or Land Development approval.

Best Management Practice (BMP) - A non-point source pollution control practice that is developed by a process that considers water quality impacts, as well as political, social, economic and technical feasibility.

Codes Enforcement Officer - An individual designated by Damascus Township to execute the regulations set forth in this Ordinance. The individual must be determined to be qualified for this position by the Supervisors of Damascus Township.

Conservation District - A public organization created under State enabling law as a special - purpose district to develop and carry out a program of soil, water, and related resource conservation, use and development within its boundaries, usually a subdivision of State government with a local governing body and always with limited authorities. Often called a soil conservation district or a soil and water conservation district. For this Ordinance Conservation District applies to the Wayne Conservation District.

Critical Area - An area defined by this Ordinance to require more stringent control of post-development runoff flow rates and/or pollutant loads than those specified for the general watershed area.

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.

Detention Basin - A pond, swale or other structure designed to drain completely after storing runoff for a given design storm event and release it at a predetermined rate. Also known as a dry pond.

Developer - A person or persons, partnership, association, corporation or other entity, or any responsible person therein or agent thereof, that undertakes any Regulated Activities covered by this Ordinance.

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

Drainage - The flow of stormwater or wastewater and the methods of directing such flow, whether natural or artificial.

Drainage Plan - The documentation of the proposed stormwater management controls, if any, to be used for a given development site, the contents of which are established in Section 403.

Earth Disturbance Activity - Any activity initiated by man that changes existing cover or contours of the land. This includes grading; tilling; excavating; filling of ground; removal or destruction of the topsoil, trees or other vegetative cover; or any other activity which causes land to be exposed to the effects of erosion.

Easement - An area of land owned by another that entitles its holder specific rights of access for inspection and/or access.

Erosion - The removal of soil particles or rock fragments of the land surface by the action of running water, wind, ice, or other geological agents.

FHWA - Federal Highway Administration, United States Department of Transportation (USDOT).

Flood Fringe - That part of the floodplain located between the outer limits of the floodway and the outer limits of the floodplain as shown on floodplain maps approved or promulgated by the Federal Emergency Management Agency (FEMA).

Floodplain - (Also commonly referred to as the 100-year floodplain or flood hazard area). The maximum area of land that is likely to be flooded by a 100-year flood as shown on floodplain maps approved or promulgated by FEMA. This area encompasses both the floodway and the flood fringe.

Floodway - The channel of the watercourse and those portions of the adjoining floodplains which are reasonably required to carry and discharge the 100-year flood. The boundary of the 100-year floodway is as indicated on the maps and flood insurance studies provided by FEMA. In an area where no FEMA maps nor studies have defined the boundaries of the floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the centerline stream 50 feet outward in a perpendicular direction from the top of the bank of the stream on both sides.

Forest Management Operations - All activities connected with growing and harvesting of forest products including the site preparation, cultivation and logging of trees, and the construction and maintenance of roads. The U.S. Dept. of Agriculture and the PA Department of Conservation and Natural Resources recognize forestry practices and anything associated with forest management to be considered an agricultural operation. Refer to "Agricultural Operations".

Impervious Area - A surface which prevents the infiltration and percolation of water into the ground.

Infiltration - The process of liquid permeating or penetrating a porous material.

Land Development - Any land subdivision or development. The improvement of one (1) lot or two (2) contiguous lots, tracts or parcels of land for any purpose or any alteration of land not for agricultural or conservation purposes, which includes earthmoving, filling or stripping on a tract. Land development includes, but is not limited to road construction, utility installation, public, commercial or industrial facility construction, mining and quarrying and water resource management and any activity classified as land development under the Pennsylvania Municipalities Planning Code, Act 247, as amended.

Memorandum of Understanding (MOU) - An agreement initiated by the municipality and outside agency (s) to document the responsibilities and liabilities of concerned parties for specified task(s). The document may also include provisions for enacting a fee schedule for work performed.

Municipality - Damascus Township, Wayne County, Pennsylvania.

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

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

Nursery - A tract of land on which trees and plants are raised or stored for transplanting and sale.

Obstruction - Any structure or assembly of materials including fill above or below the surface of the land or water, and any activity which might impede, retard, or change flood flows. The planting, cultivation and harvesting of field and orchard crops or the grazing of livestock, including the maintenance of necessary appurtenant agricultural fencing, shall not be considered an "obstruction" under this definition and shall not be subject to regulation under this Act.

Owner - Any person, partnership, corporation, company, or other legal entity holding a current legal title.

PA DEP - Pennsylvania Department of Environmental Protection.

PA DOT - Pennsylvania Department of Transportation.

Regulated Activity - Action or proposed action which impacts upon proper management of stormwater runoff and which is governed by this Ordinance as specified in Section 104.

Retention Basin - A pond, swale or other structure containing a permanent pool of water designed to store runoff for a given design storm event.

Right-of-Way - An area of land reserved for construction of a Public road, railroad, or Public utility.

Runoff - That part of precipitation which does not infiltrate the surface that it contacts, but instead flows over its surface (s).

SCS - Soil Conservation Service, U.S. Department of Agriculture (USDA).

Semi-Pervious Surface - A surface such as stone, rock, gravel or other material which permits some vertical transmission of water into the ground.

Stormwater - Runoff and drainage from land surfaces resulting from precipitation, including snow or ice melt.

Stormwater Conveyance Facility - Any structural control (i.e. piping, inlets, channels and swales) designed to safely collect and convey stormwater without purposely controlling its rate of flow.

Stormwater Management - A program of controls and measures (both conveyance and management facilities) designed to regulate the quantity and quality of stormwater from a development and/or land disturbance while promoting the protection and conservation of ground waters and groundwater recharge.

Stormwater Management Facility - Any structural control (i.e. detention/retention basin) specifically designed to control the rate of stormwater flow.

Stormwater Management Plan - The plan for managing stormwater runoff adopted by the Wayne County Commissioners as required by the Act.

Stormwater Structures - The basins, pipes, swales, terraces, etc. designed and installed to collect, convey, detain and/or retain stormwater.

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

Subwatershed - The smallest breakdown unit of a watershed for hydrologic modeling purposes for which the runoff control criteria have been established in the Stormwater Management Plan. These areas are identified in Section 302.

Tract - A single unit of land area defined by a closed property line. The property subject to subdivision or land development activity at the time of Plan approval.

USDA - United States Department of Agriculture.

USDI - United States Department of Interior.

USDOT - United States Department of Transportation.

USEPA - United States Environmental Protection Agency.

USFWS - United States Fish and Wildlife Service

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

ARTICLE III - STORMWATER MANAGEMENT REQUIREMENTS

SECTION 301. General Requirements

- A. Where applicable, stormwater management facilities or programs shall comply with the requirements of Chapter 92 (National Pollutant Discharge Elimination System), Chapter 102 (Erosion and Sediment Pollution Control), Chapter 105 (Dam Safety and Waterway Management), and Chapter 106 (Flood Plain Management) of the Title 25, Rules and Regulations of the PA DEP. Any inquiries on permit requirements or other concerns should be addressed to the Northeast Regional Office, Cross Valley Centre, 667 North River Street, Plains, PA 18705-1099. "Dam Permits must be obtained from the Bureau of Dams, Waterways and Wetlands, 400 Market St., Harrisburg, PA. 17105."
- B. Stormwater management facilities which involve a state highway shall be subject to the approval of PA DOT.
- C. Stormwater management facilities located within or affecting the floodplain of any watercourse shall also be subject to the requirements of any Damascus Township Ordinance "and the Floodplain Management Act," which regulates construction and development within areas which are subject to flooding.
- D. Stormwater management facilities located within or affecting designated wetland areas shall be subject to the requirements of Chapter 105 (Dam Safety and Waterway Management) of Title 25, Rules and Regulations of the PA DEP.
- E. Stormwater management facilities must be designed so that the post-development runoff rates equal the pre-development runoff rates for those areas of the watershed defined in Section 302 of this Ordinance. Exceptions to this are the Special Release Rate SWM Districts defined in Section 302. The pre-development and post-development runoff rates and volumes shall be calculated for the appropriate design storm events presented in Section 303.C.

It is the responsibility of the developer to design the SWM facilities of the site such that the pre-development discharge rates from the site at the final point of discharge are maintained during post-development conditions for the 2.33, 5, and 10-year storms.

- F. It is the responsibility of the developer to provide adequate drainage conveyance facilities. Adequate drainage conveyance facilities must have the hydraulic characteristics to accommodate the maximum expected flow of stormwaters for the watershed or portion thereof, for the required design storm event.

Adequate drainage conveyance facilities shall be designed to:

- 1. Honor natural drainage divides;
- 2. Convey stormwater to a natural outfall;
- 3. Not adversely affect the adjacent or neighboring properties.

In situations where the developer is constructing new drainage conveyance facilities (storm piping, inlets, culverts, channels and swales), the facilities shall be designed to safely convey the 10-year design storm event.

In situations where the developer's site is traversed by a natural watercourse, it is the developer's responsibility to provide calculations verifying that the pre-development discharge rates within the watercourse are maintained during post-development conditions for the storms listed above. The developer's calculations must assume existing conditions for the area of the watershed tributary to the point of discharge (outfall) of the watercourse from the site and post-development conditions for the development site. The calculations must utilize separate discharge hydrographs for both the development site area and the natural watercourse watershed areas, and a final composite hydrograph for both pre- and post-development conditions for the 2.33, 5, and 10-year design storm events.

- G. Concentration or diversion of flow by proposed development activity which does not discharge to an existing stormwater conveyance facility will not be permitted unless adequate off-site drainage improvements to safely convey peak flows from the 10-year storm are provided.
- H. A natural outfall shall have sufficient capacity to receive the ultimate runoff from the watershed without deterioration of the facility and without adversely affecting property in the watershed. This natural outfall may be a river, creek, or other drainage facility so designated by Damascus Township for the proposed system.
- I. Detention is the provision of acceptable storage area for stormwater with the use of a control structure providing a significant reduction in the peak discharge of stormwater. Detention of stormwater is desirable in many cases to alleviate existing downstream drainage problems and to preclude the development of new ones. Detention or retention is mandatory where the existing downstream drainage system is clearly inadequate and its expansion or improvement is either financially prohibitive or aesthetically unacceptable. Damascus Township reserves the right to waive the requirement for detention of stormwater where Damascus Township determines that its use is not in the public interest and where alternatives may apply.
- J. Innovative stormwater management systems may be used when approved by Damascus Township. Various combinations of stormwater management systems should be developed to suit the particular, unique requirements of the development and topographic features of the development site. Approval of a proposed stormwater management control facility using these innovative methods shall depend on the effectiveness of the facility in controlling the impacts of post-development runoff rates and volumes and the facility's ability to meet the design and construction specifications of Appendix D of this Ordinance. The following is a partial listing of control methods which can be used in stormwater management facilities where appropriate:
 - 1. Stormwater Conveyance Facilities (Storm Sewers)
 - 2. Impoundment Facilities (Detention and Retention Basins)
 - 3. Infiltration Facilities
 - 4. Cisterns

5. Rooftop Detention
6. Parking Lot Storage
7. Porous Pavement
8. Erosion & Sediment Controls

General descriptions, including the operation and maintenance of these stormwater management facilities, are provided in Appendix D of this Ordinance.

- K. Access easements to facilities shall be provided for maintenance and operation. This access shall be a cleared access that is, when possible, approximately twenty (20) feet wide. Proximity of facilities to public right-of-ways shall be encouraged in order to minimize the length of access easements. Multiple access easements shall be encouraged for major facilities.
- L. All control facility designs shall conform to the applicable standards and specifications of the following governmental and institutional agencies:
 1. American Society of Testing and Materials (ASTM).
 2. Asphalt Institute (AI).
 3. Wayne Conservation District.
 4. Federal Highway Administration (FHWA).
 5. National Crushed Stone Association (NCSA).
 6. National Sand and Gravel Association (NSGA).
 7. Pennsylvania Department of Environmental Protection (PA DEP).
 8. Pennsylvania Department of Transportation (PA DOT).
 9. U.S. Department of Agriculture-Soil Conservation Service, Pennsylvania (USDA-SCS,PA).
- M. Control facilities which receive stormwater from areas which are a potential source of oil and grease contamination shall include a baffle, skimmer, grease trap or other mechanism suitable for preventing oil and grease from leaving the facility in concentrations that would cause or contribute to violations of applicable water quality standards in the receiving waters (i.e. automotive fueling/service stations, truck stops).
- N. "No Harm" Option.

The developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove to the satisfaction of the Damascus Township Supervisors that "no harm" would be caused by discharging at a higher runoff rate than that specified by the criteria of this Ordinance. Proof of "no harm" would have to be shown from the development site through the remainder of the downstream drainage network to the downstream mouth of the Lackawaxen

River. Proof of "no harm" must be shown using the capacity criteria specified by references of Section J above and Appendix D if downstream capacity analysis is a part of the "no harm" justification and shall be governed by the following provisions:

1. Any available capacity in the downstream conveyance system as documented by a developer may be used by the developer only in proportion to the development site acreage relative to the total upstream undeveloped acreage from the identified capacity (i.e. if the site is 10% of the upstream undeveloped acreage, he may only use up to 10% of the documented downstream available capacity).
2. Developer-proposed runoff controls which would generate increased peak flow rates at documented "significant" storm drainage problem areas would, by definition, be precluded from successful attempts to prove "no harm", except in conjunction with any required capacity improvements for the problem areas. Any "no harm" justifications shall be submitted by the developer as part of the Drainage Plan submission per Article IV.

SECTION 302. Stormwater Management Subwatersheds and Zones

A. Mapping of Stormwater Management Subwatersheds:

In order to implement the provisions of the Lackawaxen River Watershed Stormwater Management Plan, Damascus Township has been divided into stormwater management subwatersheds. The boundaries of the stormwater management subwatersheds are shown on an official map which is available for inspection at the Damascus Township office.

B. Identification of Stormwater Management Districts:

Three levels of Stormwater Management can be implemented within the subwatersheds of the Lackawaxen River Watershed. They are indicated on the Watershed Stormwater Release Rate Map, which is available for inspection at the Damascus Township office. The Stormwater Management Districts are as follows:

- District 1: 100% Release Rate Stormwater Management analysis required only for new development activity creating impervious area greater than 5 percent of the tract (i.e. No control of peak flow required if less than 5 percent impervious area of the tract is created. However, adequate drainage conveyance facilities must still be provided). Activities on tracts of land less than or equal to 5 acres are exempt if they create less than 10,890 sq ft (5 percent of 5 acres) of impervious area.
- District 2: 100% Release Rate Stormwater Management analysis required for all new development activity.

District 3: Special Release Rate Stormwater Management requirements - as required by Municipal Engineer. Release Rate percentage shown on the watershed Release Rate Map.

SECTION 303. Methods of Calculation of Runoff Flow Parameters

- A. The methods of computation used to determine peak discharge and volume of runoff shall be one of the following four methods or any other method approved by Damascus Township in advance:
1. The USDA SCS Soil-Cover-Complex Method as set forth in the latest edition of "Urban Hydrology For Small Watersheds", Technical Release No. 55.
 2. The USDA SCS Soil-Cover-Complex Method as set forth in the "TR-20 Computer Program for Project Formulation Hydrology", Technical Release No. 20.
 3. The Penn State Runoff Model (PSRM) as set forth in the Penn State Runoff Model User's Manual, January 1987 Version and all updates.
 4. The "Rational Method" of $Q=CIA$, where Q is the peak discharge from the watershed in cubic feet per second (cfs), C is the coefficient of runoff, I is the intensity of rainfall in inches per hour, and A is the area of the watershed in acres.
- B. Where the drainage basin exceeds 200 acres or where a detention/retention facility is involved, a hydrographic method is to be used for design purposes. The method of computation shall be selected using the following guidelines:

Output Requirements	Drainage Area	Hydrologic Computation to be used
Peak Discharge Only	Up to 200 acres	Rational Method, TR-55, TR-20, or PSRM
	Up to 20 sq. mi.	TR-55, TR-20, or PSRM
Peak Discharge and Total Runoff Volume	Above 20 sq. mi.	TR-20 or PSRM
	Up to 20 sq. mi.	TR-55, TR-20, or PSRM
Runoff Hydrograph	Above 20 sq. mi.	TR-20, or PSRM
	Up to 20 sq. mi.	TR-55, TR-20, or PSRM

- C. Rainfall data to be used depends on the method of computation selected.

When the SCS Soil-Cover-Complex Method is used, storm runoff shall be based on the following storm volumes using the SCS Type II 24-hour rainfall distribution:

Return Period (years)	Rainfall Volume (inches) for Indicated Region			
	II	III	IV	V
2.33	2.65	2.60	3.00	3.40
5	3.05	3.10	3.60	4.20
10	3.60	3.70	4.50	5.00

The above rainfall volumes were obtained from the "Field Manual of Pennsylvania Department of Transportation (PA DOT) Storm Intensity-Duration-Frequency Charts" (PDT-IDF) published by PA DOT and the Federal Highway Administration. Reproductions of these charts and a watershed region map are provided in Appendix B.2 of this Ordinance.

When the Rational Method is used, the appropriate Regional chart from the PDT-IDF Manual shall also be used to determine the rainfall intensity in inches per hour based upon the calculated time of concentration.

- D. Runoff Curve Numbers (CN's) to be used in the Soil Cover Complex Methods shall be based upon Table 2-2 of the TR-55 manual. A reproduction of Table 2-2 has been provided in Appendix B.3 of this Ordinance, as well as a reproduction of Worksheet 2, which shall be used to calculate the composite CN's.
- E. Time of Concentration (Tc) and Travel Time (Tt) estimates for overland flows shall be based on the methods described in Chapter 3 of the TR-55 manual. A figure and the methodology provided on Worksheet 3 in Appendix B.4 of this Ordinance shall be used to determine the average flow velocities and resultant Time of Concentration or Travel Time.
- F. Runoff coefficients for use in the Rational Method shall be based upon the table presented in Appendix B.5 of this Ordinance.
- G. The Manning equation shall be used to calculate the capacity and velocity of flow in open channels and in closed drains not under pressure. Manning's Roughness Coefficient "n" values used in the calculations shall be consistent with the table presented in Appendix B.6 of this Ordinance.
- H. Runoff calculations for all permanent stormwater conveyance structures shall include both a hydrologic and hydraulic analysis indicating:
 - rate and velocities of flow;
 - grades, dimensions, and capacities of water carrying structures and impoundment structures; and
 - energy grade lines of all stormwater conveyance structures; and
 - sufficient design information to construct such stormwater management facilities.

Runoff calculations shall include both pre-development and post-development rates of peak discharge and volumes of storm runoff from the project development site. Runoff calculations for temporary stormwater conveyance structures used during the development of the site shall accurately reflect the hydrologic and hydraulic conditions of the site.

- I. When the USDA-SCS TR-20 computer program is used to estimate runoff flows and volumes, the Type II-24 -hour rainfall distribution shall be used. A reproduction of this distribution is provided in Appendix B.1 of this Ordinance.

ARTICLE IV - DRAINAGE PLAN REQUIREMENTS

SECTION 401. General Requirements

Prior to the final approval of subdivision and/or land development plans, the issuance of any permit, or the commencement of any land disturbance activity involving any of the Regulated Activities described in Section 104.C of this Ordinance, the owner, subdivider, developer or his agent shall submit a Drainage Plan to Damascus Township for approval. The plan shall meet the requirements set forth herein, and shall also meet all requirements of Title 25 Rules and Regulations PA DEP - Chapter 92 (National Pollutant Discharge Elimination System), Chapters 102 (Erosion and Sediment Pollution Control), 105 (Dam Safety and Waterway Management) and 106 (Flood Plain Management).

SECTION 402. Exemptions

This section includes activities which are exempt **from the plan preparation** provisions of this Ordinance. However, these activities must **still manage stormwater** in the manner which will adequately protect health and property from possible injury.

- A. Construction of single family residential structures, private garages and other residentially related outbuildings. Also, any land disturbance activity associated with home gardening.
- B. Any regulated activity (except those defined in Section 104.C.7 and 104.C.8) which would create 10,890 square feet or less of impervious area. This criteria shall apply to the total development even if development is to take place in phases. Activities which are exempt pursuant to this section shall be undertaken in a manner so as to manage the quantity, velocity, and direction of resulting stormwater runoff to adequately protect adjacent or downstream properties from possible injury.
- C. Agricultural Operations Exclusion

Agricultural activities such as growing crops, rotating crops, tilling of soil and grazing animals and other such activities are specifically exempt from complying with the requirements of this ordinance.
- D. Forest Management Operations Exclusion

Any land disturbance associated with forest management operations which is following the PA DEP's management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and is operating under an adequate Erosion and Sedimentation Control Plan as per the Chapter 102 rules and regulations.
- E. The following sliding scale may be used to evaluate when additional exemptions could be applied. It takes into account several factors which affect storm water runoff. These factors include the slope of the land, the

overall tract size, the contributing area draining towards the proposed development, soils, and the location of the proposed improvements on the tract with respect to downstream property lines. Several computations were made in which these factors were adjusted. These computations compared the pre-development with the post-development runoff rate for a sample tract. Areas of impervious cover were increased on the sample tract until a change in runoff rate of greater than 1.0 cfs was reached. This area of impervious surface was then accepted as the maximum impervious area that can be created without requiring a storm water management plan. This analysis was run for several varying factors as described above. The maximum limit of each computation was then plotted on a scale and trend analysis was performed to develop a best fit line through the results of the analysis. The trend lines showed that as the percentage of proposed change in impervious area on the parcel decreases and the distance of the proposed change from the downstream property line increases, a large exemption can be tolerated. A chart was then created from these lines which plots the distance of the proposed impervious area from down slope property lines versus the percent proposed impervious area in relation to total site area. The trend lines show exemptions grouped into five categories; 5,000 square feet; 10,000 square feet; 15,000 square feet; 20,000 square feet; and 40,000 square feet. This chart was developed with the property owner in mind so that the determination can be made and approved without having to consult an engineer. A table which produces similar results accompanies the chart which breaks down categories and ranges which can also be used.

Example 1.

20,000 square feet (sf) lot - 9,000 sf proposed impervious area is 200 feet from the downslope property line.

-9,000 sf/20,000 sf = 45% impervious area.

-From Figure A-2 exemption is 10,000 sf

-9,000 sf < 10,000 sf therefore exempt from the ordinance.

Example 2.

50 acre parcel - 30,000 sf proposed impervious area is 900 feet from the downslope property line

-30,000 sf/(50 ac. x 43,560 sf/ac) = 1.37% impervious area

-From Figure A-2 exemption is 40,000 sf

-30,000 sf < 40,000 sf therefore exempt from the ordinance.

Example 3.

5 acre lot - 2 acres proposed to be impervious area 100 feet from the downslope property line.

-2 ac/5 ac = 40% impervious area

-From Figure A-2 exemption is 5,000 sf

-2 acres (87,120 sf) > 5,000 sf therefore comply with the ordinance or reduce impervious area to 5,000 sf

ACT 167 STORMWATER MANAGEMENT
EXEMPTION CRITERIA

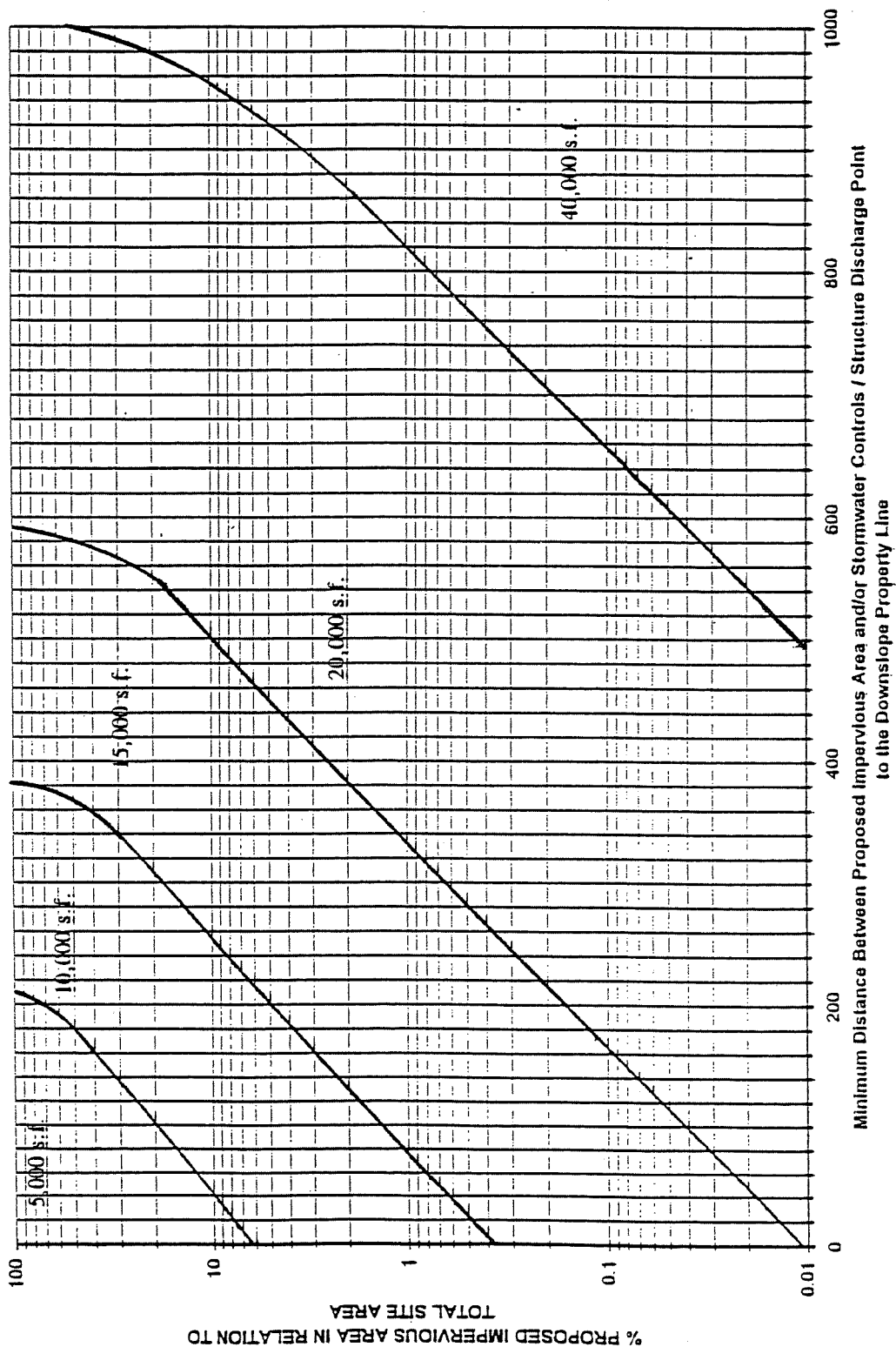


Figure A-1

ACT 167 STORMWATER MANAGEMENT
EXEMPTION CRITERIA

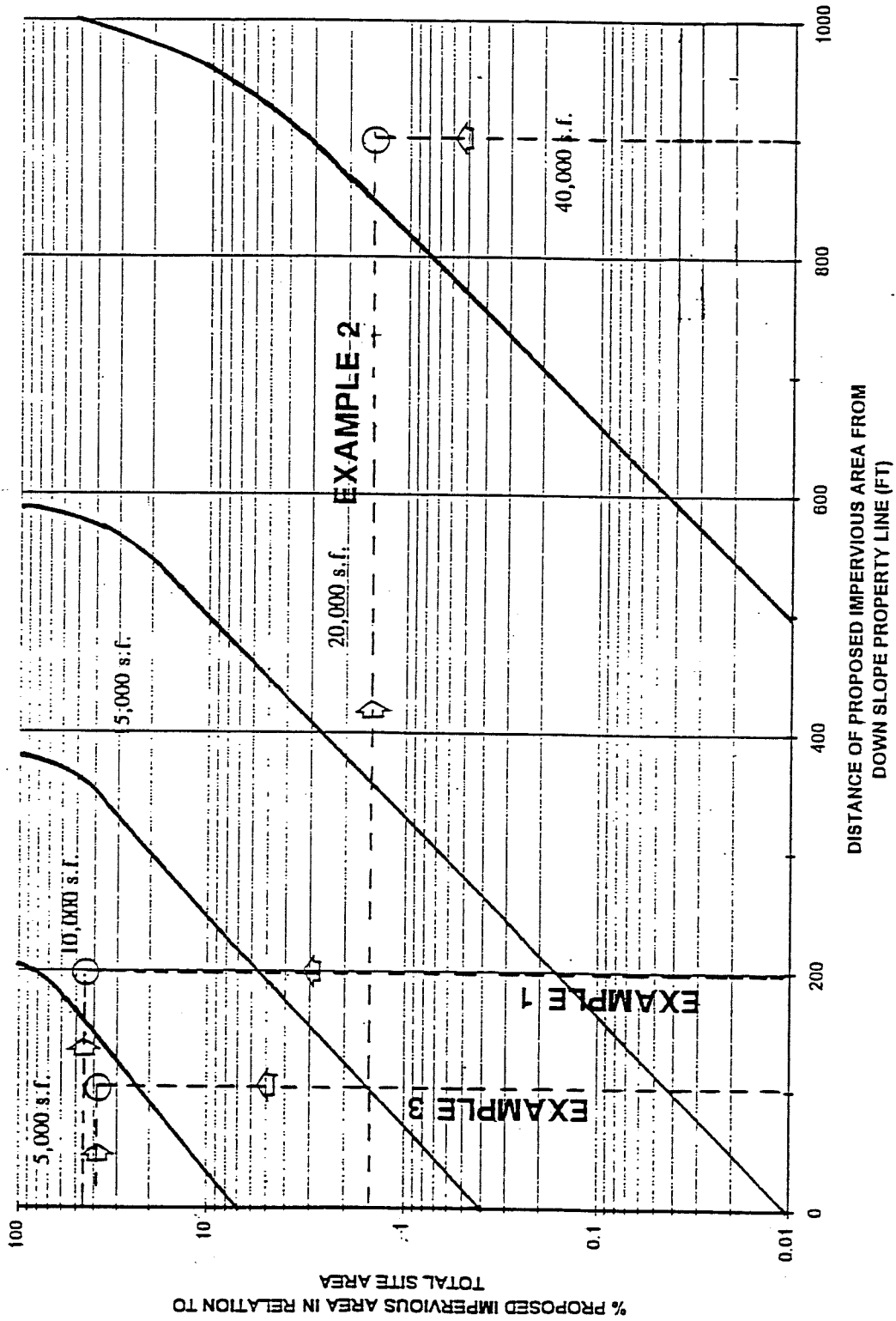


Figure A-2

**Act 167 STORMWATER MANAGEMENT
EXEMPTION CRITERIA**

Total Parcel Size	Minimum Distance* (feet)	Impervious Areas Exempt from Ordinance
< 1 acres	0	5,000 sq. ft.
1-2 acres	100	10,000 sq. ft.
2-5 acres	250	15,000 sq. ft.
> 5 acres	500	20,000 sq. ft.

* The minimum distance between the proposed impervious area and/or stormwater controls/structure discharge point to the downslope property line.

SECTION 403. Plan Contents

The following items, where appropriate, shall be included in the Drainage Plan:

- A. Written report, prepared and sealed by an individual registered in the Commonwealth of Pennsylvania and who is qualified to perform such studies and designs, including the following information:
1. General description of project.
 2. General description of proposed stormwater controls (temporary and permanent) both during and after development including the stormwater runoff calculations, assumptions and factors considered, and criteria used for both pre-development and post-development conditions.
 3. General description of the erosion and sedimentation control plan that conforms to the requirements of Chapter 102 (Erosion and Sediment Pollution Control) of Title 25 Rules and Regulations of the PA DEP.
 4. General description of an ownership and maintenance program that clearly sets forth the ownership and maintenance responsibility of all temporary and permanent stormwater management facilities and erosion and sedimentation control facilities, including:
 - a. Description of temporary and permanent maintenance requirements.
 - b. Identification of responsible individual, corporation, association or other entity for ownership and maintenance of both temporary and permanent stormwater management and erosion and sedimentation control facilities.

- c. Establishment of suitable easements for access to all stormwater management facilities.
 - d. The intent of these regulations is to provide private ownership and maintenance of stormwater management and erosion and sedimentation control facilities. Where the Drainage Plan proposes that Damascus Township own or maintain the facilities, a description of the methods, procedures, and the extent to which any facilities shall be turned over to Damascus Township shall be incorporated as an integral part of the Drainage Plan.
 - e. Where private development is involved, deed covenants and restrictions must be submitted to provide for maintenance of stormwater facilities by the property owners or owner's association.
- 5. Expected project time schedule, including anticipated start and completion date.
- 6. Training and experience of person(s) preparing the plan.
- B. Plans, prepared and sealed by an individual registered in the Commonwealth of Pennsylvania and who is qualified to perform such studies and designs, showing the following information:
 - 1. General
 - a. All plans shall be on sheet sizes consistent with the Damascus Township Subdivision and Land Development Ordinance.
 - b. Proposed name or identifying title of project.
 - c. Name and address of the landowner and developer of the project site.
 - d. Plan date and date of the latest revision to the plan, north point, graphic scale and written scale. All plans shall be at a scale of ten (10), twenty (20), thirty (30), forty (40), [or] fifty (50), to the inch.
 - e. Total acreage and boundary lines of the project site and the tract of land on which the project site is located.
 - f. A location map, for the purpose of locating the project site to be developed, at a minimum scale of two thousand (2000) feet to the inch, showing the relation of the tract to adjoining property and to all highways, streets, Damascus Township boundaries, and other identifiable landmarks existing within one thousand (1000) feet of any part of the

tract of land on which the project site is proposed to be developed.

- g. Certificate for approval by Damascus Township Board of Supervisors.
- h. Certificate for review by the Damascus Township Planning Commission.
- i. Certificate for review by the Damascus Township Engineer, if required by the Damascus Township Board of Supervisors.

2. Existing Features

- a. Tract boundaries showing distances, bearings and curve data, as located by field survey or by deed plotting.
- b. Existing contours at vertical intervals of two (2) feet for land with an average natural slope of (15%) percent or less and at vertical intervals of five (5) feet for more steeply sloping land; except that for residential and agricultural uses where a preliminary subdivision or land development plan is not required by the Damascus Township Subdivision and Land Development Ordinance, no contours shall be required; however, the plan should indicate the natural drainage patterns of the site along with the approximate grades of all slopes. Where contours are shown, the location of the benchmark and the name of the datum shall also be indicated.
- c. The names of all owners of all immediately adjacent unplatted land, the names of all proposed or existing developments immediately adjacent, and the locations and dimensions of any streets or easements shown thereon.
- d. The names, locations and dimensions of all existing structures, highways, streets, railroads, easements, rights-of-way, watercourses and bodies of water, drainage facilities, floodplains, and other significant features within two hundred (200) feet of any part of the tract proposed to be developed and the location of all structures and approximate location of all tree masses within the tract.
- e. Locations and dimensions of overhead and underground utilities.
- f. Soil types (including Soil Series and Hydrologic Soil Group) as designated by the USDA-SCS Soil Survey of Wayne County.

3. Proposed Features

- a. The proposed land use, the number of lots and dwelling units and the extent of commercial, industrial or other non-residential uses.
- b. The locations and dimensions of all proposed streets, parks, playgrounds, and other public areas; overhead and underground utilities; lot lines and building locations, and parking areas and other impervious and semi-pervious surfaces; easements and rights-of-way.
- c. The proposed changes to land surface and vegetative cover.
- d. Final contours at vertical intervals of two (2) feet for land with an average natural slope of (15%) percent or less and at vertical intervals of five (5) feet for more steeply sloping land. Where existing contours are not shown or where proposed contour lines cannot be accurately located (i.e., as in a single family detached residential development when the building location has not been determined), arrows indicating general surface runoff flow patterns shall be shown with the approximate grade of all slopes.
- e. A twenty-five (25) foot access easement around all stormwater management structures and from such structures to a public right-of-way.

4. Stormwater Conveyance and Management Facilities

- a. All stormwater conveyance facilities (piping, inlets, channels and swales) along with any proposed connections to existing facilities.
- b. Groundwater recharge methods such as seepage pits, beds or trenches. When these structures are used, the locations of septic tank infiltration areas and wells must be shown.
- c. Other control devices or methods such as roof-top storage, grass swales, parking lot ponding, vegetated strips, and detention or retention basins.
- d. Plans and profiles of all proposed stormwater management facilities including vertical and horizontal alignment, size and type of material. This information shall be of the quality required for the construction of all facilities.
- e. A certificate, signed and sealed by an individual registered in the Commonwealth of Pennsylvania and who is qualified to perform such studies and designs, indicating the compliance of the design of the stormwater management facilities with the provisions of this Ordinance.

5. Erosion and Sedimentation Controls

- a. The type, location and extent of all erosion and sedimentation control measures shall be shown on an erosion and sedimentation control plan that conforms to the requirements of Chapter 102 (Erosion and Sediment Pollution Control) of Title 25 Rules and Regulations of the PA DEP.
- C. Financial security for the completion of stormwater management facilities as set forth in Article VII of this Ordinance.
- D. Maintenance guarantee, as set forth in Article VII of this Ordinance.
- E. When a Drainage Plan is submitted in Sections, a generalized drainage plan for the entire project site shall be submitted in addition to the detailed drainage plan for the proposed Section. This generalized plan shall demonstrate how the stormwater of the proposed Section will relate to the entire development. The amount and velocity at the discharge point of the Section shall be included in the data submitted. If temporary facilities are required for construction of a Section, such facilities shall be included in the submitted Drainage Plan.

SECTION 404. Plan Submission

The following items shall be considered as a complete Drainage Plan submission package for the Regulated Activities specified in Section 104 of this Ordinance:

- 1. Five (5) copies of the Drainage Plan shall be submitted by the developer to the [municipality secretary or other appropriate person] as part of the submission of the Drainage Plan for the Regulated Activity.

Distribution of the Drainage Plan will be as follows:

- a) Two (2) copies to the Damascus Township Supervisors.
- b) One (1) copy to the Damascus Township Engineer.
- c) One (1) copy to the Damascus Township Planning Commission.
- d) One (1) copy to the Wayne Conservation District.
- e) A copy of the drainage plan shall accompany each set of subdivision and/or land development applications.

The Township reserves the right to require additional copies of plans for appropriate review.

- 2. The Drainage Plan shall be accompanied by the requisite fees, as set forth in Article VI of this Ordinance.

SECTION 405. Plan Review and Approval

Plan review and approval by agencies outside of the municipal government are contingent upon a Memorandum of Understanding with Damascus Township.

A. Damascus Township Engineer Review

The Damascus Township Engineer shall review the Drainage Plan for consistency with the adopted Lackawaxen River Watershed Stormwater Management Plan, as embodied by this Ordinance and with any additional storm drainage provisions contained in Damascus Township's applicable codes, regulations, and Ordinances. The Damascus Township Engineer shall provide written comment of his review to Damascus Township.

B. Damascus Township Planning Commission/Wayne Conservation District Review

The Damascus Township Planning Commission shall review the Drainage Plan for consistency with the Lackawaxen River Watershed Storm Water Management Plan. The Wayne Conservation District shall review the plan for its consistency with PA DEP's Chapter 102 Erosion and Sediment Control Rules and Regulations. Both the Damascus Township Planning Commission/Wayne Conservation District shall provide written comment of their review to Damascus Township.

For Regulated Activities specified in Section 104.C, the Damascus Township Planning Commission/Wayne Conservation District shall review the Drainage Plan for coordination with the PA DEP permit application process under Chapter 92 (National Pollutant Discharge Elimination System), Chapter 102 (Erosion and Sediment Pollution Control), Chapter 105 (Dam Safety and Waterway Management), or Chapter 106 (Flood Plain Management) of Title 25 of PA DEP's Rules and Regulations. The Damascus Township Planning Commission/Wayne Conservation District shall notify a regional office of the PA DEP whether the Drainage Plan is consistent with the Stormwater Management Plan and forward a copy of the review letter to Damascus Township and the developer.

C. Public Hearing

Damascus Township may require a public hearing if the Damascus Township Engineer, or the Damascus Township Planning Commission request one and the municipality deems it appropriate. Provisions for a public hearing include:

1. A minimum of a two-week public notice in a local newspaper and in a newsletter mailed to all property owners adjoining the proposed project.
2. The notice shall contain a brief summary of the Drainage Plan and a reference to the places where copies may be examined or purchased at cost.

D. Notification of Decision

The decision of Damascus Township shall be in writing and shall be communicated to the developer personally or mailed to him at his last known address no later than [ninety (90)] days from receipt of a complete Drainage Plan submission.

E. Disapproval Stipulations

When the Drainage Plan is not approved in terms as submitted, the decision shall specify the defects found in the Drainage Plan and describe the requirements which have not been met and shall, in each case, cite the provisions of the Ordinance relied upon.

F. Approval Time Limitation

Failure of Damascus Township to render a decision and communicate it to the developer within the time and in the manner required herein shall be deemed an approval of the Drainage Plan in terms as presented unless the developer has agreed in writing to an extension of time or change in the prescribed manner of presentation or communication of the decision, in which case, failure to meet the extended time or change in manner of presentation or communication shall have like effect.

G. Approval Agency

The agency who prepares the plan should not be the agency who approves the plan so as to avoid possible conflict of interest.

SECTION 406. Modification of Plans

A modification to an approved Drainage Plan which involves a change in control methods or techniques, or which involves the relocation or redesign of control measures, or which is necessary because soil or other conditions are not as stated on the approved plan application (as determined by the Damascus Township Engineer or their designee), shall require a resubmission of the modified Drainage Plan consistent with Section 404 and be subject to review per Section 405 of this Ordinance.

ARTICLE V - INSPECTIONS

SECTION 501. General Requirements

- A. Prior to approval of the constructed stormwater management facilities of the approved Drainage Plan, the developer must provide a schedule of inspections along with a final inspection and submission of "as-built" drawings to the Damascus Township Engineer. These inspection provisions pertain only to construction activities regulated by the plan preparation provisions of Article IV.

SECTION 502. Schedule of Inspections

- A. The Damascus Township Engineer or his designee shall inspect all phases of development of the site including, but not limited to:
1. Initial inspection: prior to commencement of work on the excavation or filling activity.
 2. Rough grading: when all rough grading of the site (or any major portions of the site) has been completed.
 3. Drainage facilities: at key times during installation of drainage facilities, and prior to backfilling of any underground conveyance structures.
 4. Special structures: when excavations are complete for retaining and formwork walls, and when reinforcing steel is in place prior to pouring concrete.
 5. Final inspection: when all work including installation of all drainage structures and vegetative stabilization has been completed.
- B. No work shall begin on a subsequent stage until the proceeding stage has been inspected and approved by the Damascus Township Engineer or his designee.
- C. It is the responsibility of the developer to notify the Damascus Township Engineer or his designee two (2) workdays in advance of the commencement of work or the completion of each identified phase of development.
- D. In the event the Damascus Township Engineer or his designee discovers that the work does not comply with the approved Drainage Plan or any applicable laws and Ordinances, Damascus Township shall stop work until corrections are made. Any portion of the work that does not comply with the approved plan must be corrected by a developer within ten (10) days. No work may proceed on any subsequent phase of the Drainage Plan, the subdivision or land development or building construction until the required corrections have been made.
- E. If at any stage of the work, the Damascus Township Engineer or his designee determines that the soil or other conditions are not as stated or shown in the approved Drainage Plan, he may refuse to approve further work and Damascus Township may revoke approvals until a revised Drainage Plan is submitted and

approved, as required by Section 406 of this Ordinance. If the revised Drainage Plan cannot remedy the situation then Damascus Township reserves the right to cancel the Damascus Township approval and halt all work except for that work required to "close -out" the activity and return the site to pre-construction conditions as much as is reasonably possible.

- F. If the Damascus Township Engineer or his designee discovers that the facilities or measures installed may be in violation of Chapter 102 (Erosion and Sediment Pollution Control) of the Clean Streams Law provision, the Damascus Township Engineer or his designee shall promptly refer these violations to the Wayne Conservation District.
- G. The developer must submit a certification by an individual registered in the Commonwealth of Pennsylvania and who is qualified to perform such studies and designs which certifies that all elements of the approved Drainage Plan have been constructed as designed and approved.

SECTION 503. Final Inspection

When the developer has completed all the required facilities, he shall notify Damascus Township in writing by certified or registered mail, and shall send a copy of such notice to the Damascus Township Engineer. Damascus Township shall, within ten (10) days after receipt of such notice, authorize the Damascus Township Engineer or his designee to inspect the required facilities. Following this final inspection, the Damascus Township Engineer shall promptly file a report, in writing, with Damascus Township and shall mail a copy of the report to the developer by certified or registered mail. The report shall be made and mailed within [thirty (30)] days after receipt by the Damascus Township Engineer of the aforesaid authorization by Damascus Township.

SECTION 504. As-Built

Following final inspection, the developer shall submit drawings to Damascus Township bearing the seal of an individual registered in the Commonwealth of Pennsylvania and who is qualified to perform such studies and designs indicating the "As-Built" improvements called for in the approved plan.

ARTICLE VI - FEES AND EXPENSES

SECTION 601. General

A fee covering costs to Damascus Township for Drainage Plan review and inspections shall be established by resolution of the Damascus Township Supervisors. No approval of the Drainage Plan shall be issued until the requisite fee has been paid.

A. Fee Adjustments

1. If the funds submitted as the requisite fee are not sufficient to cover the costs incurred by the municipality through the performance of their review and inspection activities, the applicant shall be required to submit additional funds to cover the resultant costs in their entirety. The municipality may withhold any required permits or approval until all fees are paid in full.
2. If the funds submitted as the requisite fee are in excess of the costs incurred by the municipality through the performance of their review and inspection activities, the remaining portion thereof shall be returned to the applicant after all final reviews and inspections have been completed.
3. If the scope of any project generates excessive fees, the governing body may adjust such fees after consultation with the Damascus Township Engineer.

SECTION 602. Modification of Plans

If it is determined that a modification to the existing Drainage Plan is required under Section 406 of this Ordinance, a revised plan shall not be approved until an additional fee which satisfies the requirements of Section 601 of this Ordinance has been paid by the applicant.

SECTION 603. Expenses Covered by Fees

The fees payable by an applicant shall, at a minimum, equal the cost of:

- A. The review of the Drainage Plan by the Damascus Township Engineer or his designee as presented in Section 405 of this Ordinance.
- B. The site inspection.
- C. The inspection of required controls and improvements during construction as presented in Section 502 of this Ordinance.
- D. The final inspection upon completion of the controls and improvements required in the plan as presented in Section 503 of this Ordinance.
- E. Any additional work required to enforce any provision regulated by this Ordinance, correct violations, and assure the completion of stipulated remedial actions.

ARTICLE VII - FINANCIAL GUARANTEES AND MAINTENANCE

SECTION 701. Performance Guarantees

- A. When requested by the developer, in order to facilitate financing, Damascus Township if designated, shall furnish the developer with a signed copy of a resolution indicating approval of the Drainage Plan contingent upon the developer obtaining a satisfactory financial security. The Drainage Plan shall not be approved until the financial improvements agreement is executed. The resolution or letter of contingent approval shall expire and be deemed to be revoked if the financial security agreement is not executed within ninety (90) days unless a written extension is granted by Damascus Township; such extension shall not be unreasonably withheld and shall be placed in writing at the request of the developer.
- B. The developer shall provide Damascus Township financial security as a performance guarantee in a form to be approved by the Damascus Township Solicitor. Documentation of the financial security is to be provided in the Drainage Plan submission as per Section 701.G of this Ordinance.
- C. Without limitation as to other types of financial security which Damascus Township may approve, which approval shall not be unreasonably withheld, Federal or Commonwealth chartered lending institution irrevocable letters of credit and restrictive or escrow accounts in such lending institutions shall be deemed acceptable financial security for the purposes of this Section.
- D. Such financial security shall be posted with a bonding company or Federal or Commonwealth chartered lending institution chosen by the party posting the financial security, provided said bonding company or lending institution is authorized to conduct such business within the Commonwealth.
- E. Such bond, or other security shall provide for, and secure to the public, completion of the installation of all stormwater management facilities on or before the date fixed on the approved Drainage Plan for the completion of such facilities.
- F. The amount of financial security to be posted shall be equal to one hundred ten per cent (110%) of the cost to install the required facilities estimated as of ninety (90) days following the date scheduled for completion by the developer. Annually, Damascus Township may adjust the amount of the financial security by comparing the actual cost of the facilities which have been installed and the estimated cost for the completion of the remaining facilities as of the expiration of the 90th day after either the original date scheduled for completion or the rescheduled date of completion. Subsequent to said adjustment, Damascus Township may require the developer to post additional security in order to assure that the financial security equals said 110%. Any additional security shall be posted by the developer in accordance with this subsection.
- G. The amount of financial security required shall be based upon an estimate of the cost of completion of the required facilities, submitted by an applicant or developer and prepared by a professional engineer licensed as such in this Commonwealth

and certified by such engineer to be a fair and reasonable estimate of such cost. Damascus Township, upon the recommendation of the Damascus Township Engineer, may refuse to accept such estimate for good cause shown. If the applicant or developer and Damascus Township are unable to agree upon an estimate, then the estimate shall be recalculated and recertified by another professional engineer licensed as such in this Commonwealth and chosen mutually by Damascus Township and the applicant or developer. The estimate certified by the third engineer shall be presumed fair and reasonable and shall be the final estimate. In the event that a third engineer is so chosen, fees for the services of said engineer shall be paid equally by Damascus Township and the applicant or developer.

- H. If the developer requires more than one (1) year from the date of posting of the financial security to complete the required facilities, the amount of financial security may be increased by an additional ten percent(10%) for each one (1) year period beyond the first anniversary date from posting of financial security or to an amount not exceeding one hundred ten percent (110 %) of the cost of completing the required facilities as re-established on or about the expiration of the preceding one (1) year period by using the above bidding procedure.
- I. Financial Security for Staged Development - In the case where development is projected over a period of years, Damascus Township may authorize submission of Drainage Plan applications by sections or stages of development so as to require or guarantee that stormwater management facilities in both current and future stages of development will provide the protection of the finally approved stage of the development.
- J. Release of Financial Security - As the work of installing the required stormwater management facilities proceeds, the developer posting the financial security may request Damascus Township to release or authorize the release, from time to time, such portions of the financial security necessary for payment to the contractor or contractors performing the work. Any such requests shall be in writing addressed to Damascus Township who shall have forty-five (45) days from receipt of such request within which to allow [the municipal] engineer to certify, in writing, to Damascus Township that such portion of the work upon the facilities has been completed in accordance with the approved plan. Upon such certification, Damascus Township shall authorize release by the bonding company or lending institution of an amount as estimated by Damascus Township Engineer fairly representing the value of the facilities completed or, if Damascus Township fails to act within said forty-five (45) day period, Damascus Township shall be deemed to have approved the release of funds as requested. Damascus Township may, prior to final release, require retention of ten percent (10%) of the estimated cost of the aforesaid facilities. The final release of the financial security provisions shall be permitted only after receipt by Damascus Township of certification and "As-Builts" as required in Sections 502, 503 and 504.
- K. Where Damascus Township accepts dedication of all or some of the required facilities following completion, Damascus Township may require the posting of financial security to secure structural integrity of said facilities as well as the functioning of said facilities in accordance with the design and specifications as depicted on the Drainage Plan for a term not to exceed eighteen (18) months from

the date of acceptance of dedication. Said financial security shall be of the same type as otherwise required in this Section with regard to installation of such facilities, and the amount of the financial security shall not exceed fifteen percent (15%) of the actual cost of installation of said facilities.

- L. Based on the report of the Damascus Township Engineer, Damascus Township shall indicate approval or rejection of the stormwater management facilities, either in whole or in part; and if not approved, state reasons for the rejection. Damascus Township shall notify the developer, within fifteen (15) days of receipt of the engineer's report, in writing by certified or registered mail, of its actions.
- M. If Damascus Township or the Damascus Township Engineer fails to comply with the time limitation provisions contained herein, all stormwater management facilities will be deemed to have been approved, and the developer shall be released from all liability, pursuant to its performance guaranty bond or other security agreement.
- N. If any portion of said improvements are not approved or are rejected by Damascus Township, the developer shall proceed to complete the same and, upon completion, the same procedure of notification, as outlined herein, shall be followed.
- O. Nothing herein, however, shall be construed in limitation of the developer's right to contest or question by legal proceedings or otherwise, any determination of Damascus Township or the Damascus Township Engineer.
- P. Where herein reference is made to the Damascus Township Engineer, he shall be as a consultant thereto.
- Q. Remedies to Effect Completion of Facilities - In the event that any stormwater management facilities which may be required have not been installed as provided in this Ordinance or in accordance with the approved final plan, Damascus Township has the power to enforce any corporate bond or other security by appropriate legal and equitable remedies. If proceeds of such bond or other security are insufficient to pay the cost of installing or making repairs or corrections to all facilities covered by said security, Damascus Township may, at its option, install part of such facilities in all or part of the development and may institute appropriate legal or equitable action to recover the monies necessary to complete the remainder of the facilities. All of the proceeds, whether resulting from the security or from any legal or equitable action brought against the developer, or both, shall be used solely for the installation of the stormwater management facilities covered by such security, and not for any other purpose.

SECTION 702. Maintenance Responsibilities

- A. The maintenance responsibilities for permanent stormwater management facilities shall be determined based upon the type of ownership of the property and/or facilities. The following priority process was established for facility ownership and maintenance responsibility:

1. As first priority, the property and facilities are owned by a private entity which shall be responsible for maintenance. A private entity shall be defined as an association, public or private corporation, partnership firm, trust, estate or any other legal entity empowered to own real estate exclusive of an individual lot owner.
 2. As second priority, the property and facilities are owned by an individual lot owner who shall be responsible for maintenance.
- B. The failure of any person, individual lot owner or private entity to properly maintain any stormwater management facility shall be construed to be a violation of this Ordinance and is declared to be a public nuisance, subject to Article VIII, Enforcement and Penalties.

SECTION 703. Maintenance Guarantees

Upon approval of any stormwater management facilities by Damascus Township, the developer shall provide a financial security, in a form approved by the Damascus Township Solicitor for maintenance guarantees, as follows:

A. **Construction Maintenance Bond**

Damascus Township may require the posting of a maintenance bond to secure the structural integrity of said facilities as well as the functioning of said facilities in accordance with the design and specifications as depicted on the approved Drainage Plan for a term not to exceed eighteen (18) months from the date of acceptance of dedication. Said financial security shall be the same type as required in Section 701 with regard to installation of such facilities, and the amount of the financial security shall not exceed fifteen percent (15%) of the actual cost of installation of said facilities.

B. **Long-term Maintenance Bond**

The long-term maintenance bond shall be in an amount equal to the present worth of maintenance of the facilities for a ten (10) year period. The estimated annual maintenance cost for the facilities shall be based on a fee schedule provided by the Damascus Township Engineer and adopted by Damascus Township.

C. **Documentation**

The terms of the maintenance guarantees shall be documented as part of the Drainage Plan as per Article VII of this Ordinance.

SECTION 704. Maintenance by Private Entity

When a private entity (such as a homeowner's association) retains ownership of any stormwater management facility, such entity shall be responsible for maintenance of the facility. The stated responsibilities of the entity in terms of owning and maintaining the facilities shall be submitted with the Drainage Plan for determination of their adequacy. Approval of the Drainage Plan shall be conditioned upon the approval of these terms.

These terms shall be in writing, shall be in recordable form, and shall, in addition to any other terms deemed necessary by Damascus Township, contain a provision permitting inspection at any reasonable time by Damascus Township or its designee of all such facilities deemed critical in the public welfare.

SECTION 705. Maintenance by Individual Lot Owners

When any stormwater management facility is located on an individual lot, and when maintenance thereof is the responsibility of that landowner, a description of the facility or systems and the terms of the required maintenance shall be incorporated as a part of the deed to the property. The deed shall be recorded with the Wayne County Recorder of Deeds within ninety (90) days following Damascus Township approval. In addition, Damascus Township may require as a condition of approval that a deed conveying any interest in such lot contain language indicating that the conveyance is subject to an express covenant by the grantor that the grantee will maintain the stormwater management facility.

ARTICLE VIII - ENFORCEMENT AND PENALTIES

SECTION 801. Enforcement

Damascus Township shall designate by resolution a qualified individual, agency, or combination thereof to act as the Damascus Township Enforcement Officer. Said Enforcement Officer will execute the regulations set forth in this Ordinance. In the event that the Damascus Township Enforcement Officer is unable to perform the required duties, or in the event of a conflict of interest, Damascus Township may appoint an alternate to fulfill those responsibilities.

SECTION 802. Right-of-Entry

Upon presentation of proper credentials, duly authorized representatives of Damascus Township may enter at reasonable times upon any property within Damascus Township to investigate or ascertain the condition of the subject property in regard to any aspect regulated by this Ordinance. This includes property housing stormwater management facilities for which Damascus Township is not directly responsible for maintenance as provided in Section 704 and 705 of this Ordinance.

SECTION 803. Violations

Any activity conducted in violation of this Ordinance is declared to be a public nuisance.

A. Notice

In the event that an owner, applicant, developer, property manager or his agent fails to comply with the Ordinance, the Damascus Township Enforcement Officer shall provide a written notice of the violation to be served upon the person. Such notice shall set forth the nature of the violation (s) and direct the person to whom it is served to comply with all terms of this Ordinance within seven (7) days, or such additional period, not to exceed thirty (30) days, as the Damascus Township Enforcement Officer shall deem reasonable, and further the Damascus Township Enforcement Officer shall give notice to the owner, applicant, developer, property manager or his agent that if the violation is not corrected, Damascus Township may correct the same and charge the landowner or other person responsible the cost thereof plus penalties as specified herein for failure to comply.

B. Service of Notice

Such notice may be delivered by the United States mail, first class, postage prepaid, or by certified or registered mail; or by personal service; or, if the property is occupied, by posting the notice at a conspicuous place upon the subject property.

SECTION 804. Penalties

- A. Any owner, applicant, developer, property manager or his agent violating the provisions of this Ordinance shall, upon being found liable therefore in a civil enforcement proceeding commenced by Damascus Township, pay a judgement of not more than five hundred dollars (\$500.00) plus all court costs, including

reasonable attorney fees incurred by Damascus Township as a result thereof. No judgement shall commence or be imposed, levied or payable until the date of the determination of a violation by the district justice. If the defendant neither pays nor timely appeals the judgement, Damascus Township may enforce the judgement pursuant to the applicable rules of civil procedure. Each day that a violation continues shall constitute a separate violation, unless the District Justice determining that there has been a violation further determines that there was a good faith basis for the owner, applicant, developer, property manager or his agent violating the Ordinance to have believed that there was no such violation, in which event there shall be deemed to have been only one such violation until the fifth day following the date of the determination of a violation by the District Justice and thereafter each day that a violation continues shall constitute a separate violation.

- B. The court of common pleas, upon petition, may grant an order of stay, upon cause shown, tolling the per diem judgment pending a final adjudication of the violation and judgement.
- C. Nothing contained in this Section shall be construed or interpreted to grant to any person or entity other than Damascus Township the right to commence any action for enforcement pursuant to this Section.

ARTICLE IX - APPEALS

SECTION 901. Appeal to Damascus Township SUpervisors

Any person, partnership corporation or organization aggrieved by any action of Damascus Township or its designee may appeal to the Damascus Township Supervisors within thirty (30) days of that action.

SECTION 902. Appeal to Court

Any person, partnership, corporation or organization aggrieved by any decision of the Damascus Township Supervisors may appeal to the Wayne County Court within thirty (30) days of that decision.

ARTICLE X - MISCELLANEOUS

SECTION 1001. Hardship Waiver Procedure

- A. The Damascus Township Supervisors may hear requests for waivers where it is alleged that the provisions of this Ordinance inflict unnecessary hardship upon the applicant. The waiver request shall be in writing using an application form promulgated by Damascus Township. A copy of the completed application form shall be provided to each of the following: the Damascus Township Supervisors, the Damascus Township Engineer, the Damascus Township Solicitor and the Damascus Township Planning Commission. The application shall state in full the grounds and facts of unreasonableness or hardship on which the request is based, the provision or provisions of the Ordinance involved and the minimum waiver necessary.
- B. Damascus Township may grant a waiver of one or more provisions of this Ordinance provided that in the opinion of Damascus Township such waiver will not be contrary to the public interest and that all of the following findings are made in a given case:
 - 1. That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this Ordinance;
 - 2. That because of such physical circumstances or conditions, there is no possibility that the property can be developed in strict conformity with the provisions of this Ordinance, including the "no harm" provision documented in Section 301.N, and that the authorization of a waiver is therefore necessary to enable the reasonable use of the property;
 - 3. That such unnecessary hardship has not been created by the applicant; and
 - 4. That the waiver, if authorized, will represent the minimum waiver that will afford relief and will represent the least modification possible of the regulation in issue.
- C. In granting any waiver, Damascus Township may attach such reasonable conditions and safeguards as it may deem necessary to implement the purposes of this Ordinance. Damascus Township shall keep a record of all action on all requests for waivers.

SECTION 1002. Repealer.

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

SECTION 1003. Compatibility with Other Permit and Ordinance Requirements

Approvals issued pursuant to this Ordinance do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act or Ordinance. If more stringent requirements concerning regulation of stormwater or erosion and sedimentation control are contained in the other code, rule, act or Ordinance, the more stringent regulation shall apply. Refer to Appendix A for a list of related regulations, codes and Ordinances.

SECTION 1004. Damascus Township Liability

The making of an administrative decision shall not constitute a representation, guarantee or warranty of any kind by Damascus Township or by any official or employee thereof, of the practicability or safety of any proposed structure or use with respect to damage from erosion sedimentation, storm water runoff or floods, and shall create no liability upon, or cause of action against Damascus Township, its officials or employees.

ARTICLE XI - ENACTMENT

SECTION 1101. Severability

If any Section, subsection, or requirement of this Ordinance shall be held to be unconstitutional or invalid by any court of competent jurisdiction, such decision shall not affect the legality of the remaining provisions of this Ordinance or of this Ordinance as a whole.

SECTION 1102. Amendments

Amendments to this Ordinance may be initiated by the Damascus Township Supervisors. The proposed amendment or amendments shall be submitted to the Damascus Township Planning Commission for review and comment at least thirty (30) days prior to a public hearing. Before enactment of a proposed amendment or amendments the Damascus Township Supervisors shall hold a public hearing thereon pursuant to public notice.

SECTION 1103. Effective Date

This Ordinance shall become effective on August 18, 1997.

Ordained and enacted this 18 day of August, 1997.

William J. Sager Chairman
Board of Supervisors of Damascus Township

Thomas D. Griffith
Board of Supervisors of Damascus Township

Elmer C. Davis
Board of Supervisors of Damascus Township

ATTEST:

Alice Reynolds
Secretary

Damascus Township Stormwater Management Ordinance

APPENDICES

APPENDIX A

**LIST OF RELATED DAMASCUS TOWNSHIP
REGULATIONS, CODES, AND ORDINANCES**

APPENDIX A

LIST OF RELATED DAMASCUS TOWNSHIP REGULATIONS, CODES, AND ORDINANCES

A.1 Subdivision/Land Development Ordinance

Damascus Twp.	May 13, 1974	Regulates land use
Subdivision Ordinance	Amended October 21, 1985	

A.2 Stormwater/Runoff Control Ordinance

Damascus Twp.	1997	Manages stormwater runoff
Lackawaxen River Watershed Stormwater Mgt Ordinance		

A.3 Floodplain Management Regulations

Floodplain Regulations	September 30, 1985	Determines flood hazard areas
------------------------	--------------------	-------------------------------

A.4 Road Ordinance

Damascus Twp.	June 6, 1970	Regulates opening/dedication of roads
Road Ordinance		

A.5 Building Permits

Building Permit Ordinance	May 5, 1975	Requires permits prior to building
------------------------------	-------------	------------------------------------

A.6 Zoning Ordinance

Damascus Twp.	August 7, 1980	Protects & promotes health, safety & general welfare of the citizens. Provides guidelines for a coordinated and practical community development. Guides land use for future development.
Zoning Ordinance		

APPENDIX B
CALCULATION PARAMETERS

**STANDARD SCS 24-HOUR, TYPE II
DISTRIBUTION CUMULATIVE
RAINFALL TABLE (REVISED MAY 1982)**

APPENDIX B.1

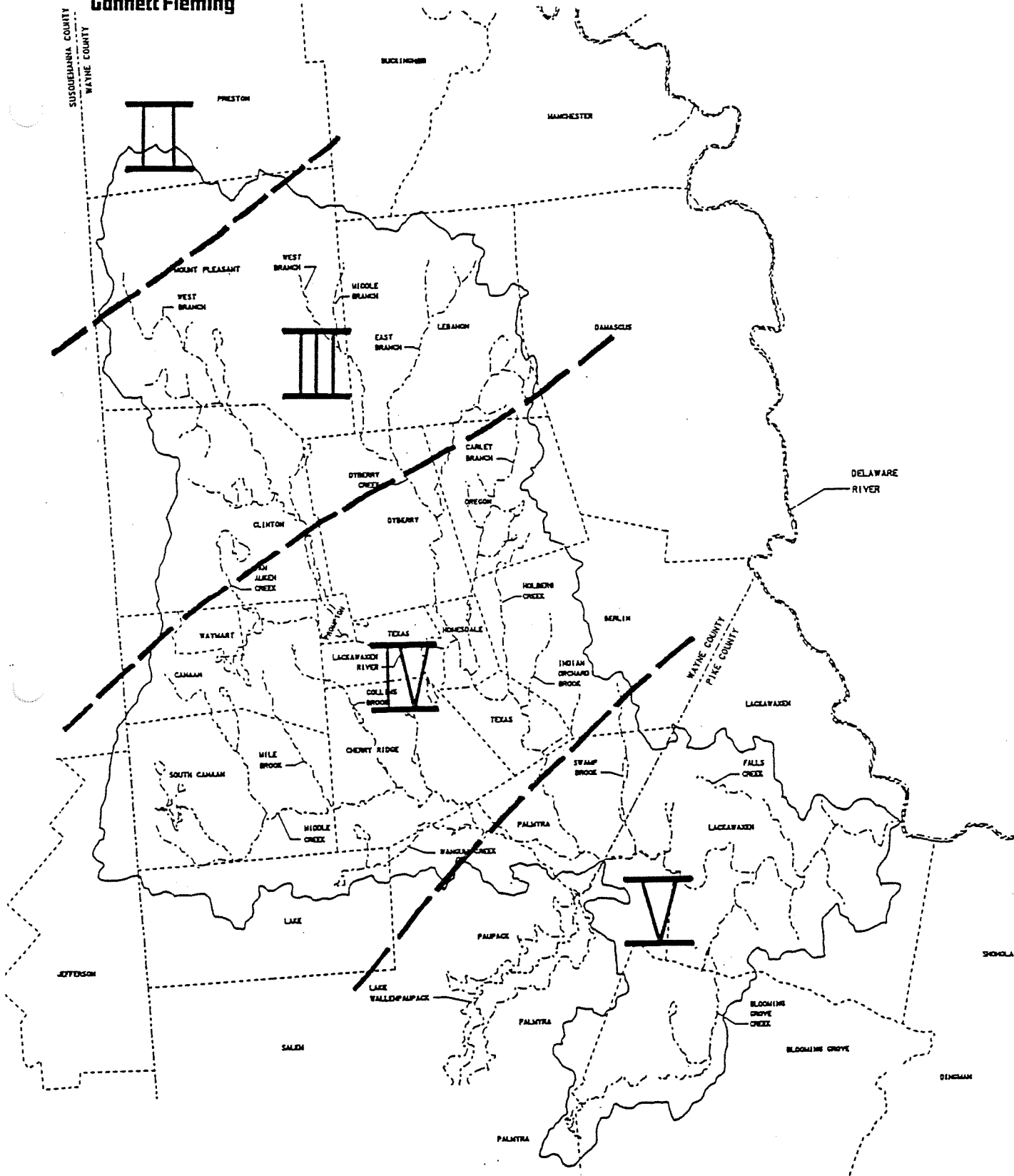
SCS Type II, 24-hour Rainfall Distribution

Time Increment = 15 minutes (0.25 hour)

0.0000	0.0020	0.0050	0.0080	0.0111
0.0140	0.0170	0.0200	0.0230	0.0260
0.0290	0.0320	0.0350	0.0380	0.0410
0.0440	0.0480	0.0520	0.0560	0.0600
0.0640	0.0680	0.0720	0.0760	0.0800
0.0850	0.0900	0.0950	0.1000	0.1050
0.1100	0.1150	0.1200	0.1260	0.1330
0.1400	0.1470	0.1550	0.1630	0.1720
0.1810	0.1910	0.2030	0.2180	0.2360
0.2570	0.2830	0.3870	0.6630	0.7070
0.7350	0.7580	0.7760	0.7910	0.8040
0.8150	0.8250	0.8340	0.8420	0.8490
0.8560	0.8630	0.8690	0.8750	0.8810
0.8870	0.8930	0.8980	0.9030	0.9080
0.9130	0.9180	0.9220	0.9260	0.9300
0.9340	0.9380	0.9420	0.9460	0.9500
0.9530	0.9560	0.9590	0.9620	0.9650
0.9680	0.9710	0.9740	0.9770	0.9800
0.9830	0.9860	0.9890	0.9920	0.9950
0.9980	1.0000	1.0000	1.0000	1.0000

**STORM INTENSITY - DURATION - FREQUENCY
LOCATION MAP AND CURVES FOR
THE LACKAWAXEN RIVER WATERSHED**

Gannett Fleming



SOURCE:

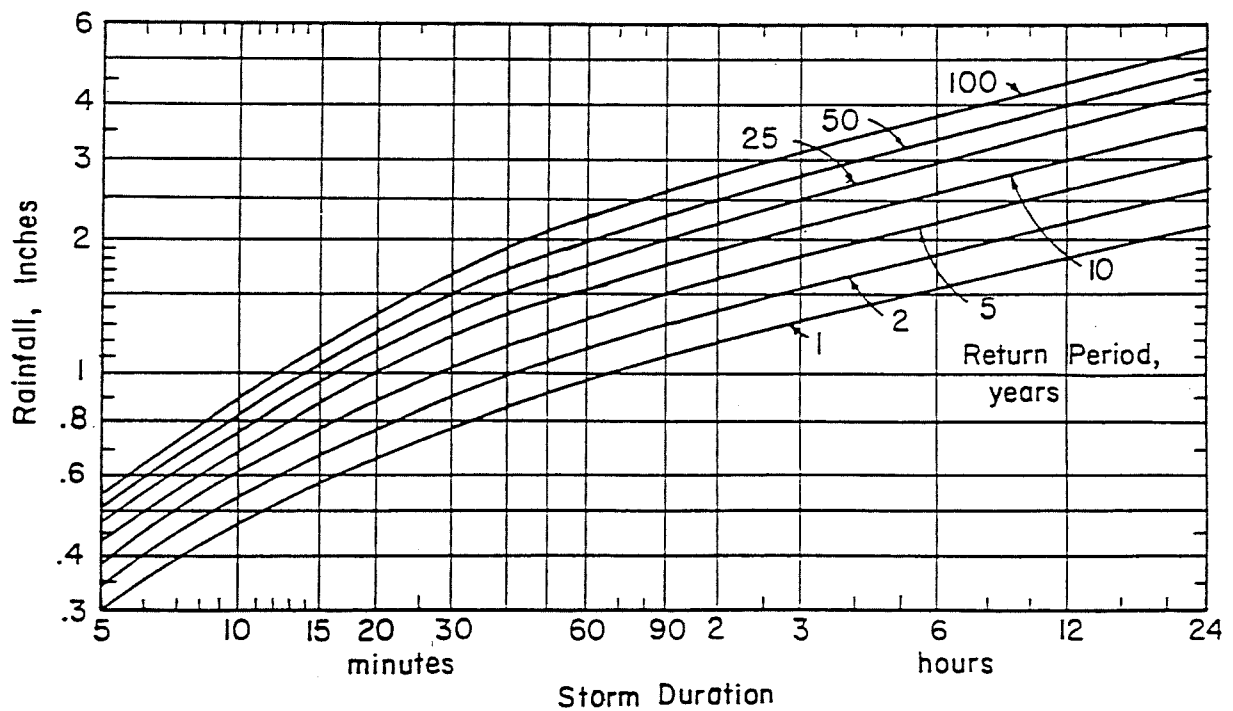
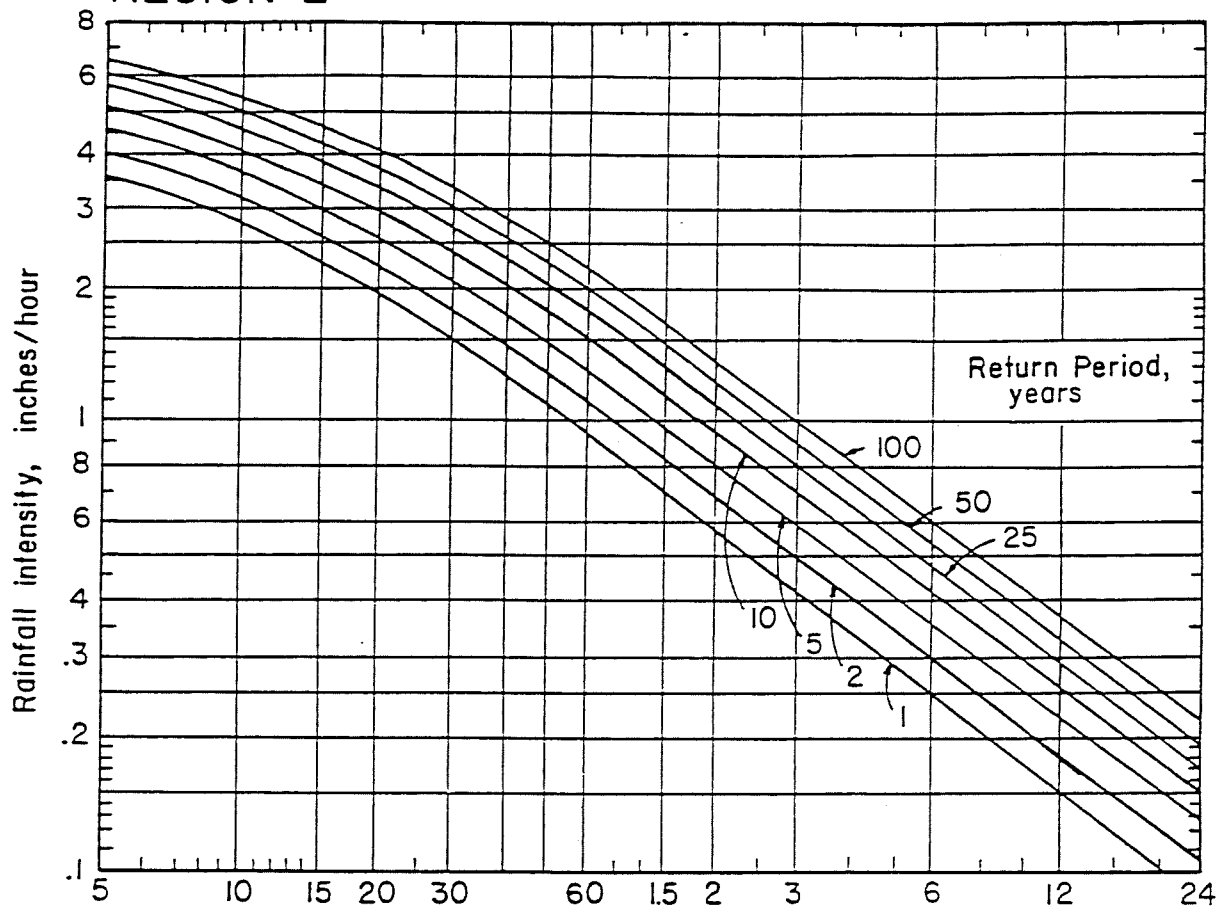
Field Manual of Pennsylvania
Department of Transportation
Storm Intensity-Duration-Frequency
(PDT-IDF) Charts published by PA DOT

APPENDIX B.2

LACKAWAXEN RIVER WATERSHED RAINFALL REGIONS

REGION 2

APPENDIX B.2

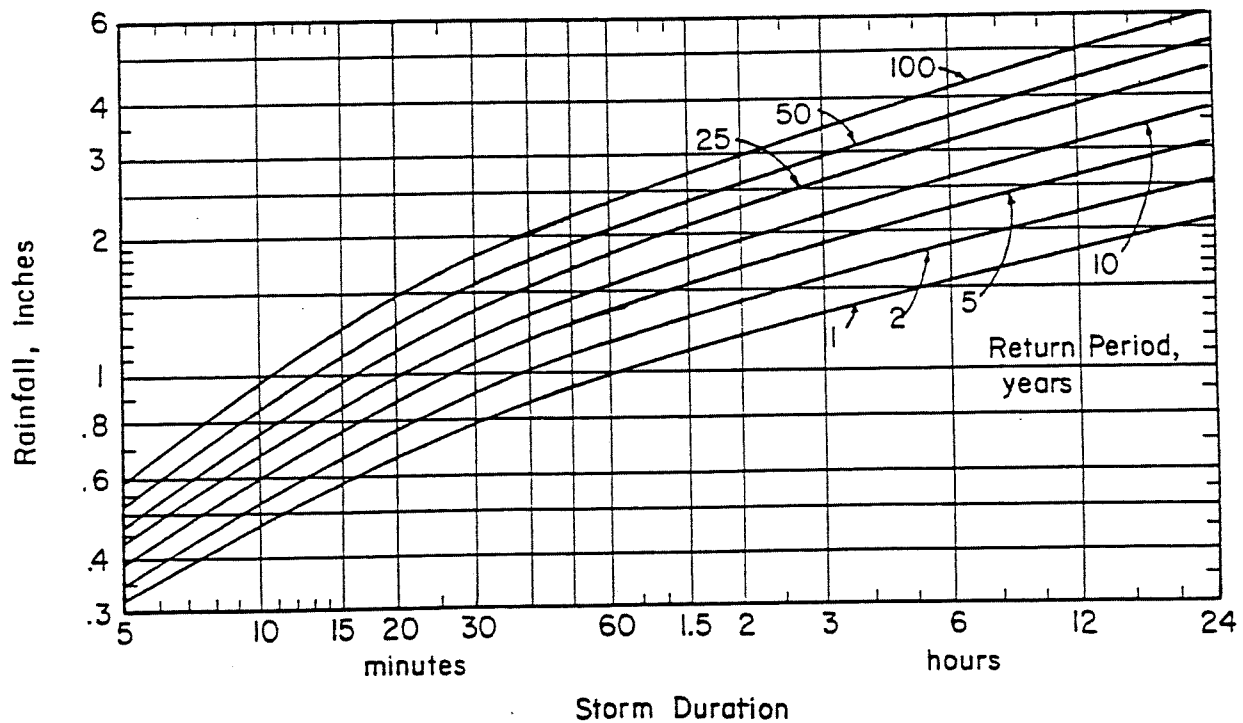
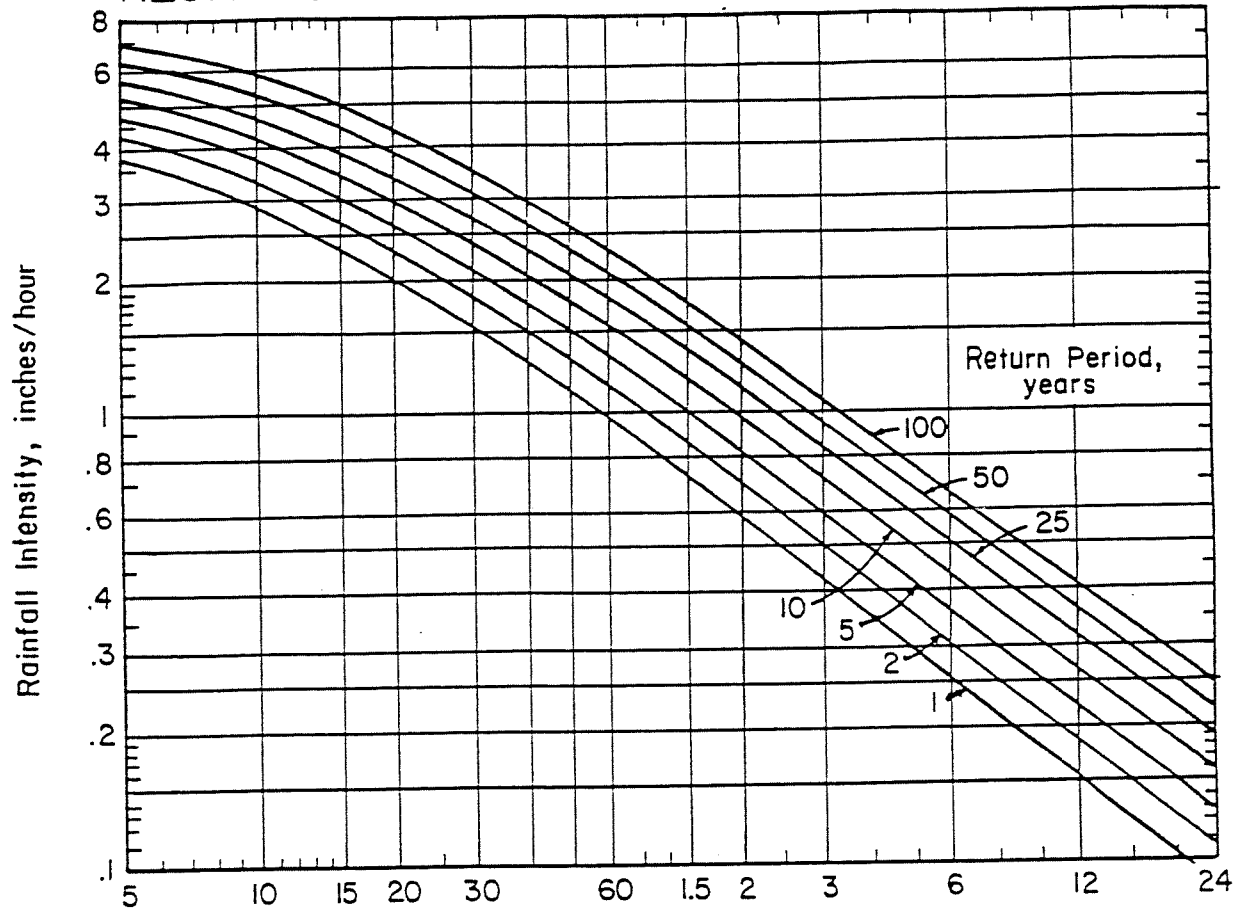


Design Storm Curves for Region 2.

SOURCE:

Field Manual of Pennsylvania
Department of Transportation
Storm Intensity-Duration-Frequency
(PDT-IDF) Charts published by PA DOT
and the Federal Highway Administration

REGION 3

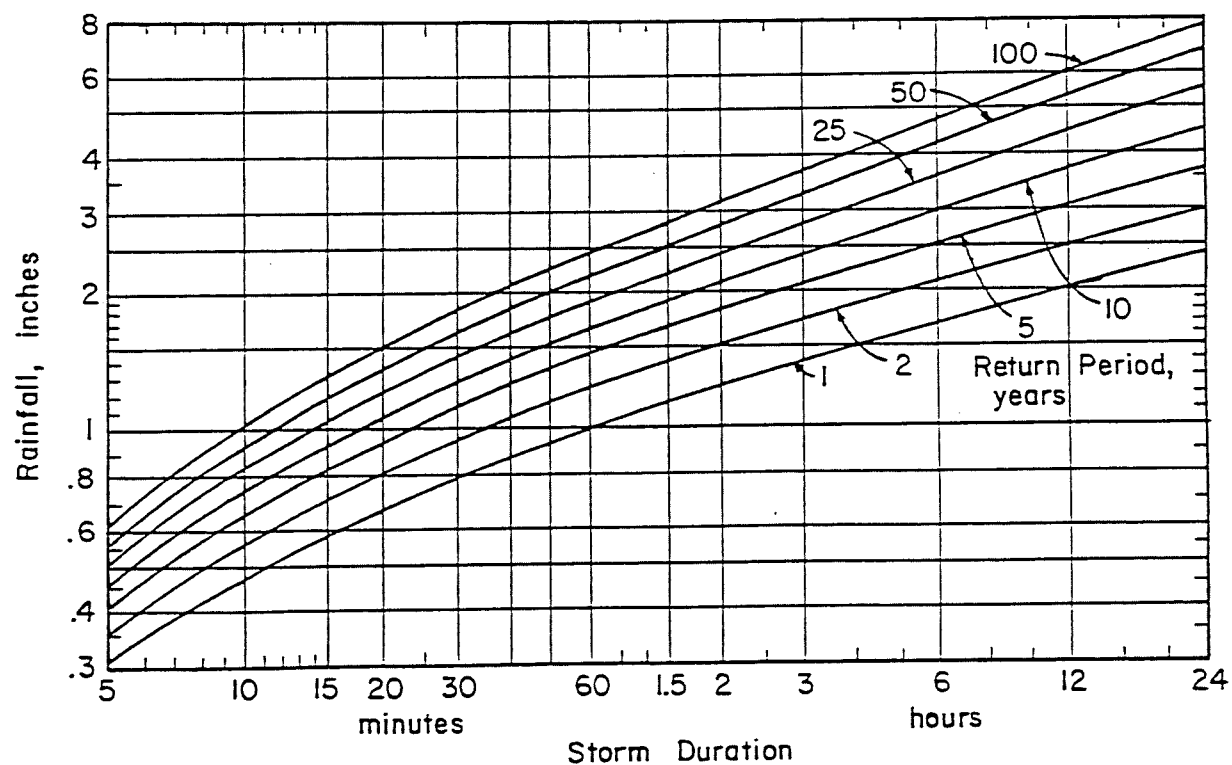
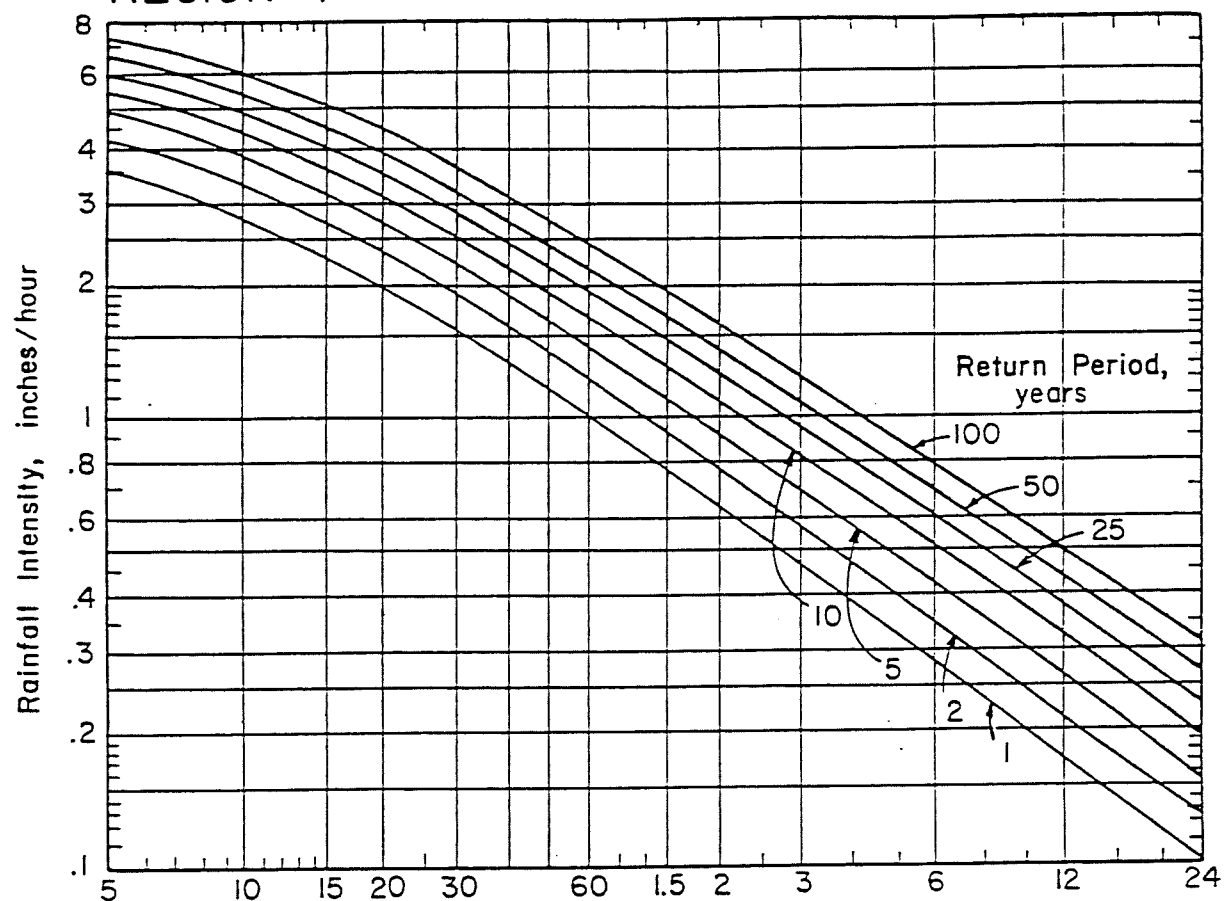


Design Storm Curves for Region 3.

SOURCE:

Field Manual of Pennsylvania
 Department of Transportation
 Storm Intensity-Duration-Frequency
 (PDT-IDF) Charts published by PA DOT
 and the Federal Highway Administration

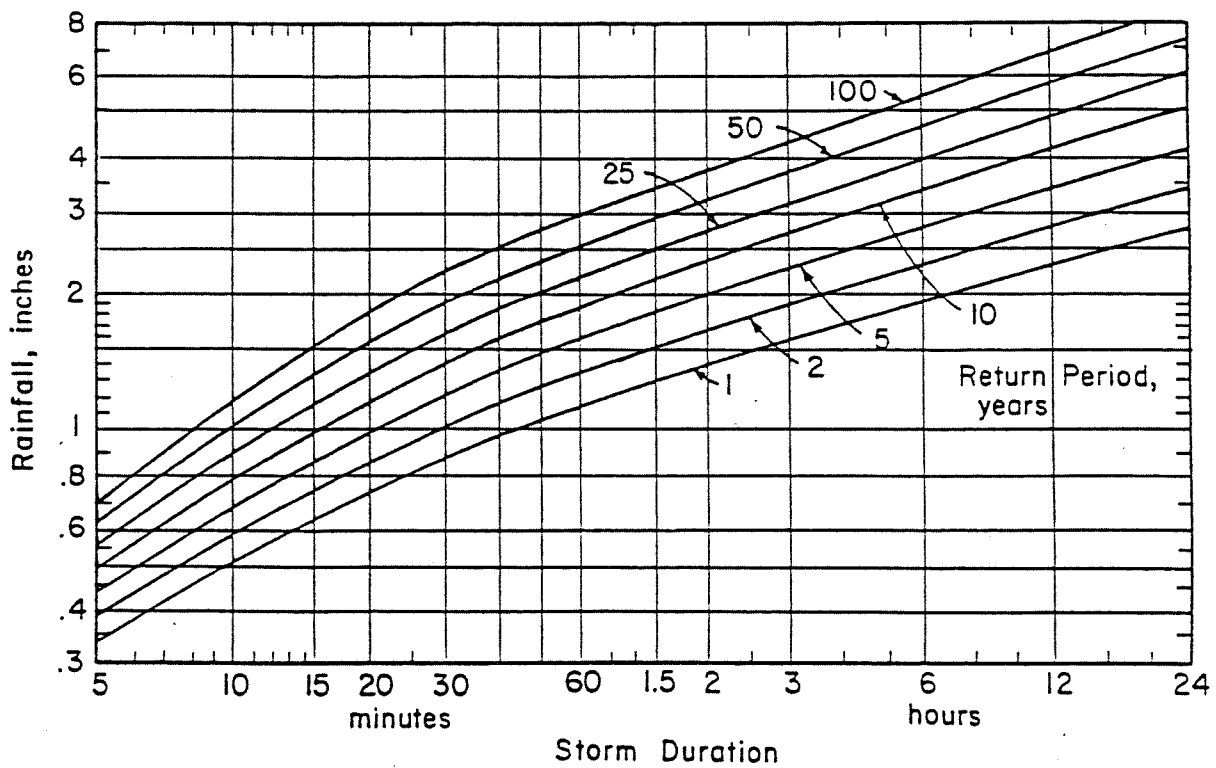
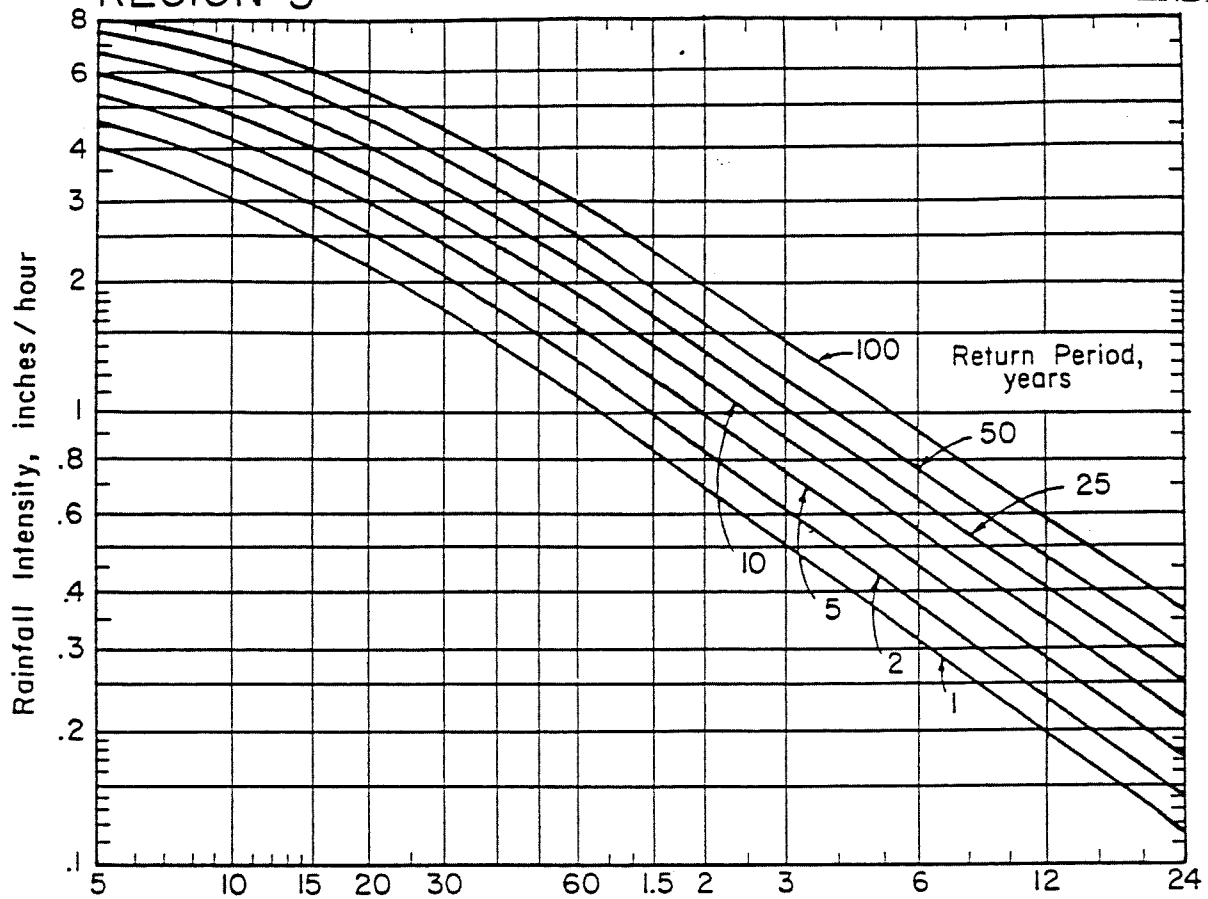
REGION 4



Design Storm Curves for Region 4.

SOURCE:

Field Manual of Pennsylvania
 Department of Transportation
 Storm Intensity-Duration-Frequency
 (PDT-IDF) Charts published by PA DOT
 and the Federal Highway Administration



Design Storm Curves for Region 5.

SOURCE:

Field Manual of Pennsylvania
Department of Transportation
Storm Intensity-Duration-Frequency
(PDT-IDF) Charts published by PA DOT
and the Federal Highway Administration

**SCS - TR55 RUNOFF CURVE NUMBERS
AND WORKSHEET FOR CALCULATING
COMPOSITE RUNOFF CURVE NUMBERS**

APPENDIX B.3

Table 2-2a.—Runoff curve numbers for urban areas¹

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

¹Average runoff condition, and $I_{a1} = 0.2S$.

²The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

³CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

⁴Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

⁵Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

APPENDIX B.3

Table 2-2b.—Runoff curve numbers for cultivated agricultural lands¹

Cover description			Curve numbers for hydrologic soil group—			
Cover type	Treatment ²	Hydrologic condition ³	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

¹Average runoff condition, and $I_n = 0.25$.

²Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

³Hydrologic condition is based on combination of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes in rotations, (d) percent of residue cover on the land surface (good $\geq 20\%$), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

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

APPENDIX B.3

Table 2-2c.—Runoff curve numbers for other agricultural lands¹

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ²	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. ³	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	⁴ 30	48	65	73
Woods—grass combination (orchard or tree farm). ⁵	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ⁶	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	⁴ 30	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

¹Average runoff condition, and $I_a = 0.2S$.

²Poor: <50% ground cover or heavily grazed with no mulch.

Fair: 50 to 75% ground cover and not heavily grazed.

Good: >75% ground cover and lightly or only occasionally grazed.

³Poor: <50% ground cover.

Fair: 50 to 75% ground cover.

Good: >75% ground cover.

⁴Actual curve number is less than 30; use CN = 30 for runoff computations.

⁵CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

⁶Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.

Fair: Woods are grazed but not burned, and some forest litter covers the soil.

Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

APPENDIX B.3

Worksheet 2: Runoff curve number and runoff

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN ^{1/}			Area <input type="checkbox"/> acres <input type="checkbox"/> mi ² <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Fig. 2-3	Fig. 2-4		
Totals =						

^{1/} Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = _____ = _____; Use CN =

2. Runoff

Frequency yr

Rainfall, P (24-hour) in

Runoff, Q in
(Use P and CN with table 2-1, fig. 2-1,
or eqs. 2-3 and 2-4.)

Storm #1	Storm #2	Storm #3

**AVERAGE VELOCITIES FOR ESTIMATING OVERLAND
FLOW AND TIME OF TRAVEL AND WORKSHEET
FOR DETERMINING TIME OF CONCENTRATION**

APPENDIX B.4

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

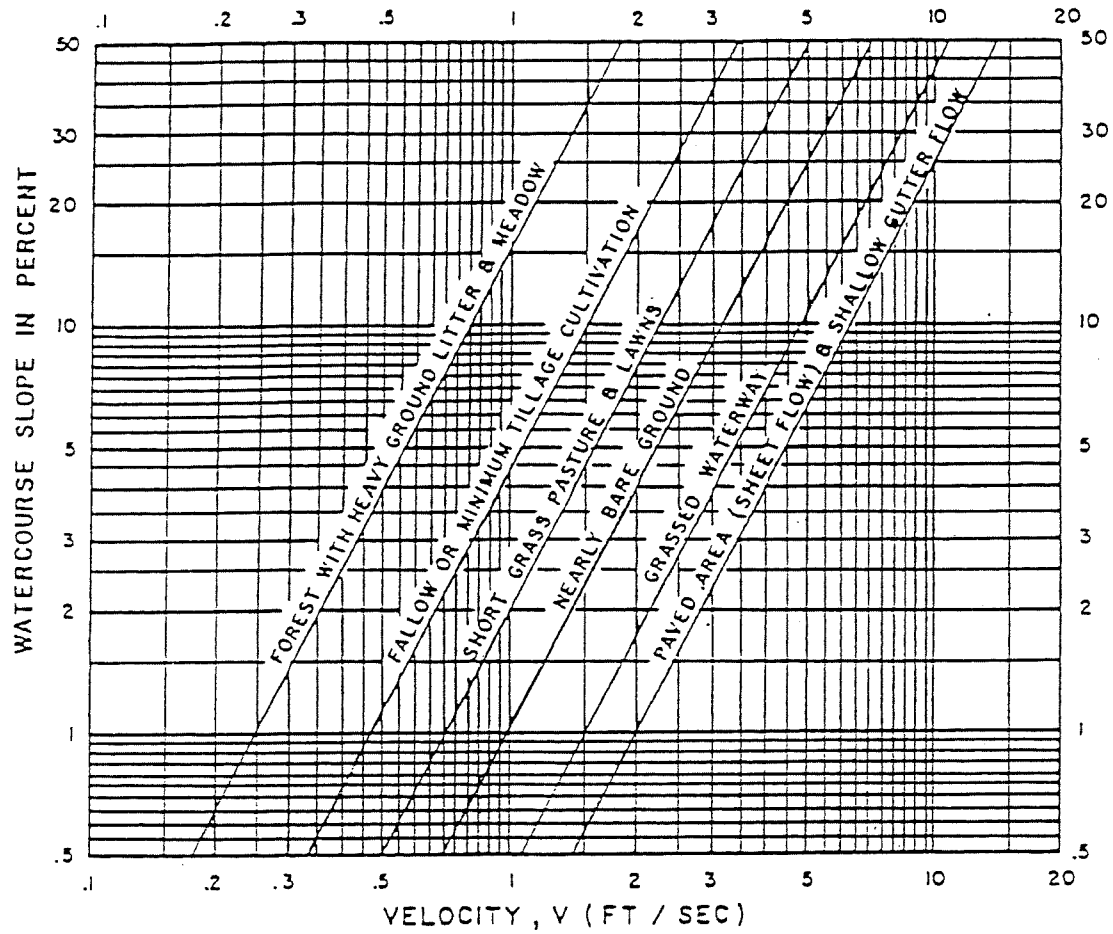
Surface description	n ¹
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses ²	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: ³	
Light underbrush	0.40
Dense underbrush	0.80

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

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

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

APPENDIX B.4



SCS, 1972 Figure Velocities for Upland Method of Estimating
Time of Concentration

APPENDIX B.4

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed

Circle one: T_c T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

Segment ID

1. Surface description (table 3-1)

2. Manning's roughness coeff., n (table 3-1) ..

3. Flow length, L (total $L \leq 300$ ft) ft

4. Two-yr 24-hr rainfall, P_2 in

5. Land slope, s ft/ft

6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t hr

Shallow concentrated flow

Segment ID

7. Surface description (paved or unpaved)

8. Flow length, L ft

9. Watercourse slope, s ft/ft

10. Average velocity, V (figure 3-1) ft/s

11. $T_t = \frac{L}{3600 V}$ Compute T_t hr

Channel flow

Segment ID

12. Cross sectional flow area, a ft²

13. Wetted perimeter, p_w ft

14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft

15. Channel slope, s ft/ft

16. Manning's roughness coeff., n

17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V ft/s

18. Flow length, L ft

19. $T_t = \frac{L}{3600 V}$ Compute T_t hr

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr

**RECOMMENDED RUNOFF COEFFICIENTS
FOR THE RATIONAL METHOD**

APPENDIX B.5

Rational Method Runoff Coefficients

<u>Type of Surface</u>	<u>"C"</u> <u>Normal Range</u>	<u>"C"</u> <u>Recommended Value</u>
Pavement:		
Concrete or Bituminous Concrete	0.75 - 0.95	0.90
Bituminous Macadam or Surface Treated Gravel	0.65 - 0.80	0.75
Gravel, Macadam, etc.	0.25 - 0.60	0.50
Brick	0.70 - 0.85	
Roofs	0.70 - 0.95	
Sandy Soil:		
Cultivated or Light Growth	0.15 - 0.30	0.20
Woods or Heavy Brush Lawns	0.14 - 0.30	0.20
Flat, less than 2%	0.05 - 0.10	
Average, 2-7%	0.10 - 0.15	
Steep, 7% or more	0.15 - 0.20	
Clay Soil:		
Bare or Light Growth	0.35 - 0.75	0.50
Woods or Heavy Growth Lawns	0.25 - 0.60	0.40
Flat, less than 2%	0.13 - 0.17	
Average, 2-7%	0.18 - 0.22	
Steep, 7% or more	0.25 - 0.35	
<u>Type of Area</u>		
Business		
Downtown	0.70 to 0.95	0.90
Neighborhood	0.50 to 0.70	
Residential		
Single Family	0.30 to 0.50	
Multi-units, detached	0.40 to 0.60	
Multi-units, attached	0.60 to 0.75	
Residential, suburban	0.25 to 0.40	
Apartment	0.50 to 0.70	
Industrial		
Light	0.50 to 0.80	
Heavy	0.60 to 0.90	
Parks, Cemeteries, Golf Courses	0.10 to 0.25	
Railroad Yard	0.20 to 0.35	
Unimproved	0.10 to 0.30	

SOURCE: Handbook of Applied Hydrology
Chow/McGraw-Hill

**RECOMMENDED MANNING “n” VALUES
FOR VARIOUS SURFACES SUBJECT TO
STORMWATER FLOW AT DEPTH**

APPENDIX B.6

Manning's Roughness Coefficients	
<u>Surface</u>	<u>n</u>
Uncoated cast-iron pipe	0.013
Coated cast-iron pipe	0.012
Commercial wrought-iron pipe, black	0.013
Commercial wrought-iron pipe, galvanized	0.014
Smooth brass and glass pipe	0.010
Smooth lockbar and welded "OD" pipe	0.011
Riveted and spiral steel pipe	0.015
Vitrified sewer pipe	0.013
Common clay drainage tile	0.012
Glazed brickwork	0.013
Brick in cement mortar; brick sewers	0.015
Neat cement surfaces	0.011
Cement mortar surfaces	0.013
Concrete pipe	0.012
Wood stave pipe	0.011
Plank flumes:	
Planed	0.012
Unplaned	0.013
With battens	0.015
Concrete-lined channels	0.014
Cement-rubble surface	0.020
Dry-rubble surface	0.030
Dressed-ashlar surface	0.014
Semicircular metal flumes, smooth	0.012
Semicircular metal flumes, corrugated	0.025
Canals and ditches:	
Earth, straight and uniform	0.025
Rock cuts, smooth and uniform	0.033
Rock cuts, jagged and irregular	0.040
Winding sluggish canals	0.025
Dredged earth channels	0.0275
Canals with rough stony beds, weeds on earth banks	0.035
Earth bottom, rubble sides	0.030
Natural stream channels:	
(1) Clean, straight bank, full stage, no rifts or deep pools	0.029
(2) Same as (1), but some weeds and stones	0.035
(3) Winding, some pools and shoals, clean	0.039
(4) Same as (3), lower stages, more ineffective slope and sections	0.047
(5) Same as (3), some weeds and stones	0.042
(6) Same as (4), stony sections	0.052
(7) Sluggish river reaches, rather weedy or with very deep pools	0.065
(8) Very weedy reaches	0.112

For additional "n" values, refer to Table 2.10.5.1 in PDT Publication B.

SOURCE: Handbook of Applied Hydrology
Chow/McGraw-Hill

APPENDIX C
TECHNICAL DEFINITIONS

APPENDIX C

TECHNICAL DEFINITIONS

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

Aggregate - Term for the stone or rock gravel needed to fill in an infiltration stormwater control facility such as a trench or porous pavement.

Agricultural Waste - Wastes that have their origin from agriculture. Most such wastes are associated with the production of food and fiber on farms, ranges, and forests. These wastes normally include animal manure, crop residues, dead animals, and agricultural chemicals.

Bank Stabilization - Includes grade stabilization structures to stabilize soils and, in some cases, provide some stormwater infiltration.

Bedrock - The more or less solid rock in place either on or beneath the surface of the earth. It may be soft, medium or hard and have a smooth or irregular surface.

Borings - Cylindrical samples of a soil profile used to determine infiltration capacity.

Channel - A natural or artificial watercourse with a definite bed and banks which confine and conduct continuously or intermittently flowing water. See "Watercourse".

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

Channelization - Any artificial reconstruction of a stream channel such as straightening, lining, or deepening.

Cistern - An underground or above ground reservoir or tank for storing rainwater.

Commercial Land Use - Any use involving in part or in whole the sale of merchandise, materials or services, but not including home occupations.

Conduit - Any channel intended for the conveyance of water, whether open or closed.

Contour - An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting points of the same elevation.

Cover Crop - A close-growing crop grown primarily for the purpose of protecting and improving soil between periods of permanent vegetation.

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

Design Storm - The magnitude of precipitation from a storm event measured in probability of occurrence (e.g., 50-yr storm) and duration (e.g., 24-hour), and used in the planning and design of stormwater management control systems.

Detention Basin - A basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. Detention basins are designed to drain completely after a storm event.

Detention Time - The amount of time a parcel of water actually is present in a stormwater control facility. Theoretical detention time for a runoff event is the average time parcels of water residue in the basin over the period of release from the facility.

Diversion - A channel with a supporting ridge on the lower side constructed to a predetermined grade across or at the bottom slope, and designed to collect and divert surface runoff from slopes which are subject to erosion.

Easement - A right granted by a land owner to a grantee, allowing the use of private land for certain public, quasi-public or private purposes such as stormwater management.

Emergent Plants - Aquatic plants that are rooted in the sediment but whose leaves are at or above the water surface. These wetland plants often have high habitat value for wildlife and waterfowl, and can aid in pollutant uptake.

Eutrophication - The process of over-enrichment of water bodies of nutrients often typified by the presence of algal blooms.

Evaporation - The process by which a liquid is changed to a vapor or gas.

Evapo-transpiration - The combined loss of water from a given area and during a specific period of time, by evaporation from the soil surface and by transpiration from plants.

Event Mean Concentration (EMC) - The average concentration of an urban pollutant measured during a storm runoff event. The EMC is calculated by flow-weighting each pollutant sample measured during a storm event.

Filter Fabric - Textile of relatively small mesh or pore size that is used to (a) allow water to pass through while keeping sediment out (permeable), or (b) prevent runoff and sediment from passing through (impermeable).

Filter Strips - Long, narrow strips of close-growing vegetation at the perimeter of disturbed or impervious areas which serve to intercept or retard sheet flows of surface runoff and/or collect sediment. Used often to protect other stormwater control facilities such as diversions, impoundments, etc.

First Flush - The delivery of a disproportionately large load of pollutants during the early part of storms due to the rapid runoff of accumulated pollutants. The first flush of runoff has been defined several ways (e.g., one-half inch per impervious acre).

Flow-Weighting - A statistical technique used to adjust a series of pollutant concentration measurements for the effect of flow.

Flume - A device constructed to convey water on steep grades lined with erosion-resistant materials.

Forebay - An extra storage area provided near an inlet of a stormwater control facility to trap incoming sediments before they accumulate in a pond facility.

Freeboard - A vertical distance between the elevation of the design highwater 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.

Frost-Heave - The upward movement of soil surface due to the expansion of ice stored between particles in the first few feet of the soil profile. May cause fracturing of asphalt or concrete.

Gabion - A large rectangular box of heavy gage wire mesh which holds large cobbles and boulders. Use in streams and ponds to change flow patterns, stabilize banks, or prevent erosion.

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

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

Grid/Modular Pavement - Involves using a strong concrete structural material, having regularly interspersed void areas that are filled with pervious materials such as sod, gravel, or sand which allows infiltration of rain.

Groundwater Recharge - Replenishment of existing natural underground water supplies.

Hydraulic Gradient - The slope of the hydraulic grade line, i.e. the line joining points whose vertical distance from the center of the cross section of the fluid flowing in a pipe are proportional to the pressure in the pipe at that point.

Hydrograph - A graph showing for a given point on a stream or for a given point in any drainage system the discharge, stage (water depth), velocity, or other property of water with respect to time.

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

Infiltration - The flow of a liquid into a substance through pores or other openings, connoting flow **into** a soil in contradistinction to the word, percolation, which connotes flow **through** a porous substance. The infiltration capacity is expressed in terms of inches per hour.

Infiltration Pits/Trenches - An excavated area filled with sand and/or graded aggregates into which stormwater surface runoff is directed for infiltration into the ground.

Infiltration Structures - A structure designed to direct runoff into the ground, e.g. french drains, pits, trenches.

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 Elevation - The vertical elevation of a pipe or orifice in a pond which defines the water level.

Low Flow Channel - An incised or paved channel from inlet to outlet in a dry basin which is designed to carry low runoff flows and/or baseflow, directly to the outlet without detention.

Manning's Equation - An equation used to predict velocity of water flow in an open channel or pipelines:

$$V = \frac{1.486r^{2/3} S^{1/2}}{n}$$

where: V = mean velocity of flow in feet per second (fps);
 r = hydraulic radius in feet (ft);
 S = slope of the energy gradient or, for assumed uniform flow, the slope of the channel in feet per foot (ft/ft); and
 n = roughness coefficient or retardance factor of the channel lining

Nitrogen - Chemical element usually available as ammonium, nitrite, and nitrate ions, and certain simple amines for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.

Nutrients - Substances necessary for growth of algae or bacteria in water, such as nitrates and phosphates.

Outfall - Point where water flows from a conduit, stream, or drain.

Outlet - Point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Overflow Rate - Detention basin release rate divided by the surface area of the basin. It can be thought of as an average flow rate through the basin.

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

Peak Discharge - The maximum instantaneous rate of flow (at a given point and time) resulting from a specified storm event.

Phosphorus - Inorganic element that is readily available for plant growth.

Porous Asphalt Pavement - Involves using a porous asphaltic paving material and a high-void aggregate base that allows infiltration of rain falling on paved surfaces.

Rational Formula - A rainfall - runoff relation used to estimate peak flow, expressed by the following formula:

$$Q = CIA$$

Where:

- Q = peak runoff rate in cubic feet per second (cfs);
- C = runoff coefficient;
- I = design rainfall intensity in inches per hour (in/hr), lasting for a critical time, T_c;
- T_c = time of concentration in hours (hrs); and
- A = drainage area (acres).

This methodology is applicable for computing small runoff volumes such as roof and driveway runoff flows required in the design of infiltration structures.

Release Rate - The rate of discharge in volume per unit time from a detention facility.

Residential Land Use - The use of land for dwelling units or rooming units, including single-family or two-family houses, multiple dwellings, boarding or rooming houses or apartments.

Retention Basin - A basin designed to retain stormwater runoff by having a controlled subsurface discharge system. Generally, its primary release of water is through ground infiltration. "Release" can also be via evaporation or, when warranted, via an emergency bypass.

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

Riparian - A relatively narrow strip of land that borders a stream or river, often coincides with the maximum water surface elevation of the 100 year storm.

Riprap - Broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves); also applied to brush or pole mattresses, or brush and stone, or other similar materials used for soil erosion control and filtering of sediment.

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

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

Sedimentation - The process by which solid material, both mineral and organic, is accumulated; transported, or deposited by moving wind, water, or gravity. Once this matter is deposited (or remains suspended in water), it is usually referred to as "sediment".

Sediment Basin - A barrier, dam, retention or detention basin designed to retain sediment.

Seepage Areas - Grass-covered areas that infiltrate stormwater runoff and allow particulate contaminants to settle.

Senescence - The annual die-back of aquatic plants at the end of the growing season.

Sheetflow - Runoff which flows over the ground surface as a thin, even layer, not concentrated in a channel.

Short Circuiting - The passage of runoff through a stormwater control facility in less than the theoretical or design treatment time.

Slope - The face of an embankment or cut section; any ground whose surface makes an angle with the plane of the horizon. Slopes are usually expressed in a percentage based upon vertical difference in feet per 100 feet of horizontal distance.

Soil-Cover Complex Method - A method of runoff computation developed by SCS, and found in its publication "Urban Hydrology for Small Watersheds", Technical Release No. 55, SCS, January 1975, revised 1986. It is based upon relating soil type and land use/cover to a runoff parameter called a Curve Number and abbreviated as RCN.

Soil Group, Hydrologic - A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

Soil Strata - The various horizontal layers of sedimentary rock (soil).

Sorption - The physical or chemical binding of pollutants to sediment or organic particles.

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

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

Storm Sewers - A system of pipes, conduits, swales, or other similar structures including appurtenant works which carries intercepted surface runoff, street water and other wash waters, or drainage, but excludes domestic sewage and industrial wastes.

Subgrade - A layer of stone or soil used as the underlying base for a stormwater control facility.

Substrate - The natural soil base underlying a stormwater control facility.

Suspended Solids - Solids either floating or suspended in water, sewage, or other liquid wastes and that are removable by filtering.

Swale - A wide shallow ditch or low-lying stretch of land characterized as a depression which gathers then temporarily stores, routes or filters surface water runoff.

Terrace - An embankment or combination of an embankment and channel across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.

Time of Concentration (T_c) - 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.

TR-20 - A SCS methodology developed for evaluating the hydrologic response of a watershed to various rainfall conditions and land use development patterns using the soil-cover complex method. This methodology has been computerized for more efficient use.

TR-55 - A simplified procedure to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. The procedure is most applicable to small watersheds especially urban watersheds. The storage-routing curves and the graphical peak discharge and tabular hydrograph methods used by TR-55 are generalizations derived from TR-20 routings. The TR-55 procedure has been computerized for more efficient use.

Transpiration - The process by which vapor escapes from living plants and enters the atmosphere.

Travel Time - (T_t) - The time it takes water to travel from one location to another in a watershed. It is a component of time of concentration and includes overland flow travel time, reach (a pipe or channel) flow travel time, etc.

Watercourse - A stream of water; river; brook; creek; or a channel or ditch for water, whether natural or manmade. See "Channel".

Water Table - The upper surface of the free groundwater in a zone of saturation (indicates the uppermost extent of groundwater); locus of points in soil water at which hydraulic pressure is equal to atmospheric pressure.

APPENDIX D

**STORMWATER MANAGEMENT FACILITIES -
DESIGN AND CONSTRUCTION SPECIFICATIONS**

APPENDIX D

STORMWATER MANAGEMENT FACILITIES DESIGN AND CONSTRUCTION SPECIFICATIONS

D.1 Stormwater Conveyance Facilities.

1. All proposed stormwater conveyance facilities including storm sewer pipes, open channels, ditches and swales shall be designed to safely convey the ten (10) year post-development storm event (utilizing either Rational Method or USDA-SCS-TR-55 methodology) unless Damascus Township requires a larger storm event because of special conditions or waivers.

2. Level of Control and Design Parameter Calculations

- a. The time of concentration is defined as the interval of time required for water from the most remote portion of the drainage area to reach the point in question. Calculations of the time of concentration include calculations of travel times for sheet flow, shallow concentrated flow, open channel flow, or some combination of these. Chapter 3 of the SCS Technical Release No. 55, Second Edition (June 1986) shall be used to determine average velocities for estimating travel times for the various flow segments. A worksheet for calculating the time of concentration is provided in Appendix B of this Ordinance.

Special Note: The USDA-SCS has recommended for the State of Pennsylvania that the maximum overland sheet flow length that should be used for unpaved areas is 150 feet with a standard length of 50 to 100 feet. The theoretical maximum length of 300 feet is achieved only in unique situations such as uniformly sloped parking lots.

- b. The capacity and velocity of flow in open channels and in closed drains not under pressure shall be determined by the Manning equations. Maximum permissible open channel velocities and design standards shall be in accordance with good engineering practice as documented in the "Engineering Field Manual for Conservation Practices", USDA-SCS or in "Design Charts for Open-Channel Flow", Hydraulic Design Series No. 3, U.S. Department of Transportation. Recommended roughness coefficients for use in the Manning Equation are provided in Appendix B of this Ordinance.
- c. Storm sewer pipes shall be installed on sufficient slopes to provide a minimum flow velocity of three (3) feet per second when flowing full to prevent clogging through sedimentation.

3. Design and Construction Specifications

- a. Width requirements for access easements shall be as follows for storm drains: $W=2d+D+2$ where W is the easement width in feet, d is the depth of pipe from

the invert to finished grade and D is the inside pipe diameter. The calculated easement width shall be rounded up to the next five (5) feet increment with the minimum required width being ten (10) feet. To provide a uniform easement width, the largest value of W shall be retained wherever practicable.

- b. For ditches, at a minimum, the easement shall be ten (10) feet wider than the top width of the ditch, with at least ten (10) feet required on one side for future access. The easement width required shall be rounded up to the next five (5) feet increment. Additional width may be required, as necessary, by Damascus Township.
- c. Storm sewer pipes and culverts, other than those used as basin outlets, which are intended to be dedicated to Damascus Township shall have a minimum diameter of fifteen (15) inches. All pipes and culverts shall be made of reinforced concrete culvert pipe (RCP), corrugated metal pipe (CMP) or corrugated plastic pipe (CPP). RCP shall be reinforced concrete satisfying ASTM Standard C 76. CMP shall be helical, 26-gage minimum, galvanized steel pipe. CPP shall be High Density Polyethylene (HDPE), with either a corrugated or smooth interior lining, as the design requires. When conditions are such that the pipe requires coating (see Table 2.10.5.6, PA DOT Publication No. 13, Design Manual, Part 2, August 1981), galvanized steel pipes and fittings shall be fully-coated, inside and out, with either polymer or asphaltic cement in accordance with PA DOT Publication No. 408 Specifications. All storm sewer pipes shall be laid to a minimum depth of one (1) foot from subgrade to the crown of the pipe.
- d. If justified by supporting calculations, pressure flow is permitted in storm sewers. The elevation of the hydraulic gradient shall be at least one (1) foot below ground level. Pressure heads between one (1) and twenty-five (25) feet are acceptable only when RCP with rubber gasketed joints are specified. Hydraulic grade line calculations shall be in accordance with the methods described in Chapter 5 of the U.S. Department of Transportation document "Design of Urban Highway Drainage, The State of The Art", FHWA-TS-79-225, August 1979 (reprinted 1983).
- e. Manholes, inlets, headwalls and endwalls proposed for dedication to Damascus Township or located along streets shall conform to the PA DOT Bureau of Design, "Standards for Roadway Construction", Publication No. 72, in effect at the time the design is submitted. The design may be modified by adopted municipal construction standards. Headwalls and endwalls shall be used where storm runoff enters or leaves the storm sewer horizontally from either a natural or manmade channel.
- f. Inlets shall be placed on both sides of the street at low points and:
 - At a maximum interval of six hundred (600) feet along any one continuous line.
 - At points of abrupt changes in either the horizontal or vertical directions of storm sewers.

- At points where the width of flow exceeds one half ($\frac{1}{2}$) the travel lane or depth of flow exceeds a height equal to one inch below the existing or design curb reveal for the ten (10) year storm frequency.

Inlets shall normally be along the curb line at or beyond the curb radius points. For inlets along a continuous grade, if analysis of Inlets using the methods described in PA DOT design manual Part 2, Section 10 assuming a collection efficiency of 100% results in inlet spacing less than 100 feet, consideration shall be given to re-spacing the inlets by allowing flow to bypass the inlets based on figures 2.10.5.1 through 2.10.5.4. Inlets shall be of the Type C, M, or S type, as discussed in PA DOT Pub. 13 and the Standards for Roadway Construction, Publication No. 72. The maximum amount of water that should be bypassed onto the next downstream inlet is ten (10) percent.

Inlet grates shall be cast iron or structural steel. A bicycle-safe grate shall be installed in areas where bicycle traffic is anticipated, such as curbed roadways or for roadways specifically established and signed as bikeways or having bike lanes.

- g. Manholes may be substituted for inlets at locations where inlets are not required to handle surface runoff. Manholes shall be located on a continuous storm sewer system at all abrupt changes of grade, at all locations where a transition in storm sewer pipe sizing is required, at all angle points exceeding fifteen (15) degrees, and at all points of convergence of two or more influent storm sewer mains. Where storm sewer pipe is designed on a radius, the pipe shall be manufactured to the design radius.

If there are two or more pipes entering an inlet or manhole and the pipe sizes differ, the elevations of the crowns of the pipes should be equal, or the smaller pipe higher. In all cases including equal size inflow and outflow pipes, a minimum drop of two inches should be provided between the lowest inflow pipe and the outflow pipe invert elevations. A storm pipe exiting an inlet or manhole must be equal in size or greater than the largest inflowing pipe.

4. Operation Specifications

- a. Wherever possible, roof drains and pipes shall discharge water into a dispersion or infiltration control facility and not into street gutters or storm sewers.
- b. All existing natural watercourses, channels, drainage systems and areas of surface water concentration shall be maintained in their existing condition unless an alteration is approved by Damascus Township.
- c. Flow velocities from any storm sewer outlet shall not result in erosion of the receiving channel. Energy dissipators shall be placed at the outlets of all storm sewer pipes where flow velocities exceed maximum permitted water carrying velocities as described in Chapter 4, Section H of the "Erosion and Sediment Pollution Control Manual", PA DEP.

D.2 Stormwater Management Facilities

1. Permanent detention basins shall be designed with a multi-stage primary outlet structure capable of reducing the post-development discharges to those that are less than or equal to the pre-development peak discharges for the 2.33, 5, and 10 year storm events while maintaining a freeboard of one foot below the invert of the emergency spillway. The basin shall have an emergency spillway capable of conveying the excess discharge (above what the principal spillway can convey) created during the 100-year design storm event while maintaining one foot of freeboard below the top of the basin embankment.
2. General Design
 - a. All basins shall be structurally sound and shall be constructed of sound and durable materials. The completed structure and foundation of all basins shall be stable under all probable conditions of operation. Where dam permits are required, the design must meet the provisions of the Dam Safety and Encroachments Act as outlined in Chapter 105, Dam Safety and Waterways Management Rules and Regulations.
 - b. The effect of embankment failure on downstream areas shall be considered in the design of all basins. Where possible, the basin shall be designed to minimize the potential damage of embankment failure.
 - c. In some cases, separate detention facilities for a number of sites may be more expensive and difficult to maintain than a joint facility. In such cases Damascus Township may consider joint detention facilities that fulfill the detention requirements.
 - d. No basin shall be located within the one hundred (100) year floodway limits of a floodplain area shown on mapping approved by the FEMA. Construction of basins within the one hundred (100) year flood fringe area of the flood plain shown on mapping approved by the FEMA shall be avoided, where possible. If construction in this area is unavoidable, the situation shall be examined for its functionality.
 - e. To facilitate drainage prior to stream flooding, impoundments may be waived by Damascus Township upon the recommendation of the Damascus Township Engineer. Such a decision depends on the proximity of the proposed impoundment to major streams, and the hydrology of the watershed.
 - f. An access easement for maintenance crew access to the pond and outlet areas shall be established around all basins requiring maintenance. The limits of such easements shall be fifteen (15) feet from the outside toe of the dams and embankments and the top of all basin side slopes. The access easement shall be connected to a public right-of-way.
 - g. A specific maintenance plan shall be formulated outlining the schedule and scope of maintenance operations. Items to be included in the

maintenance plan are sediment removal, inspection of inlets and outlets, vegetation and insect control, ponding area prevention and safety inspections.

3. Stormwater Management Basin Design

- a. A basin shall, when site dimensions allow, have a length to width ratio of 2l:1w to 3l:1w and the distance between basin inflow and outflow points shall be maximized to maximize the travel time through the pond.
- b. A riprap apron of adequate length and flare shall be provided at all surface discharge points to disperse and slow down flow to minimize erosion, promote settling, and minimize re-suspension of settled pollutants. The apron shall extend downstream from the outlet invert of the pipe and be sized according to the procedure set forth in Chapter 4, Section H of the "Erosion and Sediment Pollution Control Manual", PA DEP, or similar procedure.
- c. A cutoff trench of relatively impervious material shall be provided within all basin embankments whose side slope ratios are steeper than three 3h:1v.
- d. All culverts through basin embankments shall have properly spaced concrete cutoff collars or factory welded anti-seep collars according to the guidelines set forth in the USDA-SCS "Standards and Specifications for Ponds" (#378).
- e. Damascus Township shall make the decision to require fencing based on potential hazards at the site. Basins with water-edge slopes steeper than three (3) to (1), or depths greater than three (3) feet may require six (6) foot high fencing of a material acceptable to the municipality. A locked gate 20 feet wide shall be supplied to allow restricted access to the basin for maintenance. For impoundments subject to freezing of detained runoff, some means of "thin ice" warning shall be incorporated in the overall operations plan established for the basin.
- f. The basin shall have a minimum bottom slope of one (1) percent towards the primary outlet to assure positive drainage and prevent saturated conditions and maintenance problems. Low flow channels may be required by Damascus Township to convey small inflows to the basin outlet.
- g. Safety ledges shall be constructed on the side slopes of all detention basins having a permanent pool of water. The ledges shall be four (4) to six (6) feet in width and located approximately two and one half (2 ½) to three (3) feet below and one (1) to one and one half (1 ½) feet above the permanent water surface.

- h. The minimum top width of all dams and embankments shall be as follows:

Height (feet)	Top Width (feet)
0-5	8
5-15	10

Where the embankment height is defined as the difference in elevation between the highest elevation on the top of the embankment and the lowest elevation of the upstream toe of the embankment.

- i. The design top elevation of all dams and embankments shall be equal to or greater than the maximum water surface in the basin resulting from the routed one hundred (100) year storm, plus twelve (12) inches of freeboard. The design height of the dam shall be increased by the amount needed to insure that the design top elevation will be maintained following settlement. This increase shall not be less than five (5) percent of the design height.

4. Inlet and Outlet Design

- a. Dry detention basins shall have an outlet structure designed to completely drain the basin within 24 hours. All outlet structures and emergency spillways shall include a satisfactory means of dissipating the energy of discharge at its outlet to assure conveyance of the discharge without endangering both the safety and integrity of either the basin, the embankment or the downstream drainage channel and drainage area. If riprap is used to dissipate energy, the design criteria presented in Section D.2.3.b shall govern.

D.3 Infiltration Facilities

1. Infiltration pits and trenches shall be designed to provide control for the ten (10) year storm event, seepage areas and filter strips shall be designed to provide control for the five (5) year storm event.
2. Level of Control and Design Parameter Calculations
 - a. A seepage analysis must be made for infiltration pits and trenches to determine any adverse affects of seepage on nearby building foundations, roads, and parking lots. Pits and trenches must never be located next to foundation walls.
 - b. A soil analysis shall be submitted with the design plans of infiltration facilities. Surrounding soils shall have a percolation rate of at least 0.6 inch per hour. A groundwater quality analysis shall also be made and shall include depth of water table (with seasonal variations), probable runoff pollutants, and the uses of the local groundwater.

3. Design and Construction Specifications

- a. Infiltration facilities shall not be considered in fill areas due to the lack of infiltration capacity in areas of controlled fill and the potential slope slippage problems in areas of uncontrolled fill.
- b. Seepage areas shall not allow ponding to exceed eighteen (18) inches of depth. Soil percolation rates for these areas shall be at least 0.6 inches per hour. Areas shall be graded to allow positive drainage but slopes shall be as slight as possible to minimize velocities. Seepage areas should also include overflow systems such as flanking grass diversion swales graded to catch and transport excess water without subjecting nearby structures to flood waters.
- c. Filter strips widths shall be at least twenty-five (25) feet and should be designed with the following parameters:
 - Land use and treatment above the strip,
 - Slope of land above and in the strip,
 - Length of slope above strip,
 - Erodibility of soil above strip,
 - Type of vegetation in strip, and
 - Degree of maintenance the strip will receive.
- d. Infiltration trenches shall have a side area to bottom area ratio less than or equal to 4l:1w. Wheel stops or segmented curbs shall be used to keep vehicular traffic off the trenches when they are not protected by grating.
- e. Volume storage calculations for pits and trenches depends on the intended purpose of the facility. A pit or trench designed to store all site runoff would be sized for the maximum runoff volume. A second option is to design the facility to store only the flow generated in excess of the pre-development condition. In this option some method of diverting flow into the facility is needed. This could be a weir device incorporated into base flow channels sized only to carry the pre-development runoff rates.
- f. The aggregate filler of trenches and pits shall be stone with a size range of one (1) to two (2) inches. These stones shall be poorly graded to include a few stones smaller than the selected size. Rounded stone is preferable to crushed stone because it provides a higher potential void ratio. All stone shall be washed prior to installation to remove excess dust and soil particles. The side walls of the facility shall be lined with a filter cloth or other permeable material to prevent soil from creeping into the void space.

4. Operation Specifications

- a. Maintenance tasks shall include maintenance of a dense grass buffer strip for surface facilities, removal of accumulated sediments within the pre-treatment devices of underground facilities, and partial or total reconstruction of the facility

in the event of clogging.

D.4 Cistern Facilities

1. The design of the cistern storage volume and release rate is dependent upon the purpose of the structure. For reducing peak runoff rates, the facility shall be designed to detain the post-development 2.33-year storm event and release it at the pre-development peak rate and velocity. For controlling non-point source pollution, additional storage is needed to capture a predetermined initial volume of runoff which is to be released at a very slow rate.
2. For underground cisterns, more than one access point for ventilation and cleaning shall be provided. Access manholes or drop boxes shall be sufficiently large to allow maintenance equipment to reach the facility. At least one access opening shall be a minimum of sixty (60) inches in diameter.
3. To ensure complete drainage of the facility, the minimum slope of the tank floor shall be one (1) percent. If a pumping system is included, provisions shall be made to prevent pump clogging and standby pumping capability shall be provided.
4. The outlet pipe shall not be less than five (5) inches in diameter to lessen the possibility of it becoming clogged. When low release rates are designed for the outlet to enhance the water quality obtained through sedimentation, special maintenance considerations must be made for removing the accumulated sediments.

D.5 Rooftop Detention

1. The rooftop detention storage volume shall be designed to detain the post-development 2.33-year storm event and release it at the pre-development peak rate and velocity.
2. Roof design shall meet all Building and Occupational Code Act (B.O.C.A.) building code standards. Depths of rooftop ponding shall not exceed three (3) inches. Rooftops shall be capable of supporting a "live" load equal to thirty (30) pounds per square foot. These requirements allow for a reasonable safety factor because thirty (30) pounds allow for the accumulation of 5.8 inches of water. Roof drain requirements are as follows:

Roof Area (Square Feet)	Minimum Number of Drains
≤10,000	2
>10,000 and ≤40,000	4
>40,000	1/10,000 SF

3. Maintenance shall consist of inspecting and cleaning roof drain inlets and of removing accumulated debris, ice, and fallen leaves.

D.6 Parking Lot Storage

1. The parking lot storage volume shall be designed to detain the post-development 2.33-year storm event and release it at the pre-development peak rate and velocity.
2. The storage area shall have a minimum one (1) percent slope to the control outlet to ensure positive drainage following a storm. The maximum depth of ponded water within the storage area shall not exceed six (6) inches for pedestrian safety and to avoid wet brakes and other vehicle maintenance problems. The storage system shall be designed so that an overflow resulting from either clogging of the principle release structure or runoff in excess of the design storm does not result in flooding of nearby buildings or thoroughfares. The control orifice at the discharge control structure shall not be less than four (4) inches in diameter.

D.7 Porous Pavement.

1. Porous pavement designs shall be based on the pre-development ten (10) year storm event.
2. The following standards shall apply to the porous asphalt and grid/modular pavement installations:
 - a. Porous pavement designs shall be based on the 10-year storm event.
 - b. Test borings shall be taken to determine the character and permeability of the soil. The ability of the soil to transmit the water passing through the pavement shall determine the thickness of the base reservoir required.
 - c. Subgrade soil coefficient of permeability shall be greater than 0.01 foot per day.
 - d. Subgrade soil clay and silt contents shall total less than forty (40) percent by weight to resist frost heaving as defined by the Asphalt Institute Publication MS-15 (1966).
 - e. Slopes of pavement shall not exceed five (5) percent to avoid excessive downslope surfacing of water.
 - f. The combined surface and base thickness shall exceed the anticipated frost penetration depth.
 - g. The aggregates selected for porous asphalt pavement construction shall meet requirements of the standard specification for "Crushed Stone, Crushed Slag, and Crushed Gravel for Bituminous Macadam Base and Surface Courses of Pavements," ASTM C-693-71, with one exception and one addition. The exception requires the gradation to be of the "open" graded type. The addition is a requirement for a soundness test as specified in ASTM D-694-61, "Crushed Stone, Crushed Slag, and Crushed Gravel for Dry-Bound or Water-Bound Macadam Base Courses." This is

required to determine if the aggregate is susceptible to disintegration by water.

- h. Asphalt mixing temperatures shall range from 230°-260° degrees Fahrenheit, with the recommended temperatures at the lower end of that range (230°-240°F).
- i. Asphalt content shall be determined according to the testing procedure recommended in the FHWA Report No. FHWA-RD-74-2, "Design of Open-Grade Asphalt Friction Courses". The Marshall Design method for determining mix content is not permitted under this Ordinance. Using a five and one-half percent (5 ½%) asphalt content and the Asphalt Institute's recommended 4-inch minimum surface course, a 0.6-inch rainfall reservoir capacity is obtained with a seepage rate of 176 inches per hour.
- j. Design of porous asphalt pavement shall be based on the specifications of the Asphalt Institute. Asphalt pavement structures must be designed and built to support the heaviest traffic volumes and loads for a particular application. By increasing the depth of the base course, loads are spread conically over large areas, thus reducing the loading intensity until the subgrade will support the load without undue deformation. A porous asphalt pavement structure must not only carry the loads without damage but must also:

- (1) Imbibe all or most of the rainfall as well as water from melted snow.
- (2) Survive freeze-thaw and weathering.

The base course depth not only carries vehicular loads but also acts as a water reservoir. The ultimate storage capacity of this reservoir will depend on the material used, and the void area within it.

- 3. Maintenance shall include annual inspection of the porous pavement during wet weather; surface vacuuming at least four (4) times per year followed by high pressure jet hosing; patching of potholes, cracks, and other pavement defects; and replacement of structure when clogging occurs in the stone reservoir or subsoil.

D.8 Erosion and Sediment Control.

- 1. All earth moving activities must comply with the requirements of the PA DEP's regulations of Act 25 PA Code, Sections 92.81-92.83 regarding NPDES Permitting of discharges of stormwater associated with construction activity.
- 2. All earth moving activities shall be conducted in such a way as to minimize accelerated erosion and resulting sedimentations. Measures to control erosion and resulting sedimentation shall, at a minimum, meet the standards of Chapter 102 (Erosion and Sediment Pollution Control) of Title 25, Rules and Regulations of the PA DEP and the standards of the Wayne Conservation District. An erosion and sediment control plan must be prepared and submitted to the Wayne Conservation District for their review and approval before any development activity begins.

3. The erosion and sedimentation control plan must be available at the development site. When required, all permits allowing earth moving activity shall be obtained by the developer before any construction on the development site shall begin.
4. Approval of an erosion and sedimentation control plan by the municipality shall not be construed as an indication that the plan complies with the standards of any agency of the Commonwealth of Pennsylvania. Final approval of an erosion and sedimentation control plan must be issued by the appropriate state government agency, whether it be the Wayne Conservation District office, or the regional district of the Department of Environmental Protection.

