

GREGG TOWNSHIP

STORMWATER MANAGEMENT ORDINANCE

Ordinance No. 01 of 2009

Gregg Township, Union County, Pennsylvania

Adopted at a Public Meeting Held on February 9, 2009.

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ARTICLE I
GENERAL PROVISIONS

100 LONG TITLE

An Ordinance establishing rules, regulations, and standards for regulating land use activities and associated stormwater runoff within Gregg Township, County of Union, Commonwealth of Pennsylvania; setting forth the powers, duties and procedures to be followed by the Township in administering this Ordinance; and setting forth the penalties for violation thereof.

101 SHORT TITLE

This Ordinance shall be known as and may be referenced and cited as the Gregg Township Stormwater Management Ordinance.

102 AUTHORITY

The Township is empowered to regulate land use activities that affect runoff by the authority of the Act of October 4, 1978, 32 P.S., P.L. 864 (Act 167) Section 680.1 et seq.; as amended, the Stormwater Management Act. Stormwater Management is also authorized by the Pennsylvania Municipalities Planning Code, Act 247 of 1968, P.L. 805; P.S. 10101 and by the Second Class Township Code, Act 69 of 1933, P.L. 103; 53 P.S. 65101.

103 STATEMENT OF FINDINGS

The Gregg Township Board of Supervisors finds that:

- A. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.
- B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety, welfare, and the protection of the people of the Township and all the people of the Commonwealth, their resources, and the environment.

104 PURPOSE

The purpose of this Ordinance is to promote health, safety and welfare within Gregg Township by minimizing the damages described in Section 103 of this Ordinance through provisions designed to:

- A. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.
- B. Promote the utilization and preservation of existing natural drainage systems.
- C. Encourage groundwater recharge where appropriate and prevent degradation of groundwater quality.

- D. Maintain existing natural flows of streams including quantity, peak flows, flow type and quality.
- E. Preserve and restore flood carrying capacity of streams.
- F. Provide for proper maintenance of all permanent stormwater management facilities constructed in the Township.
- G. Provide for the protection of wellhead areas and community water supplies and protection of downstream properties from impacts resulting from increased development.
- H. Provide performance standards and design criteria for watershed wide stormwater management and planning.

105 APPLICABILITY

This Ordinance shall apply in all watersheds within Gregg Township and shall only apply to permanent stormwater management facilities constructed as part of any regulated activities listed in this Section. This Ordinance contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective.

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

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

106 EXEMPTIONS

- A. Any Regulated Activity on parcels generating less than 5,000 square feet of total impervious area may be granted an exemption from the provisions of this Ordinance. This criterion shall apply to the total development even if development is to take place in phases. The date of this Ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered. Exemptions shall be at discretion of Municipal Engineer upon review of site conditions, topography, soils and other factors as deemed appropriate.
- B. Prior to the granting of an exemption, the Applicant must provide documentation that the increased flows from the site leaves the site in the same manner as the pre-development condition, and that there will be no adverse affects to properties along the path of flow(s), or that the increased flow(s) will reach a natural watercourse or an existing stormwater management structure before adversely affecting any property along the path of the flow(s). This documentation must include a signed statement by the landowner indicating the total impervious area constructed since the date of adoption of this Ordinance.
- C. No exemption shall be provided for Regulated Activities as defined in Section 105.E. and 105.F. of this Ordinance nor where the exemption would contribute to worsening an existing stormwater

problem area.

107 COMPATIBILITY WITH OTHER ORDINANCES

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 act, code, law, ordinance, plan, policy, rule, regulation, or statute.

108 REPEALER

All previous Township stormwater management ordinances are hereby repealed. All other ordinances or sections thereof and resolutions, which are inconsistent with any of the provisions herein, are hereby repealed to the extent of the inconsistency only. Repeal of said Ordinances or resolutions shall not be construed to affect any suit or proceeding now pending in any court or any rights accrued or liability incurred or any cause or causes of action accrued or existing under any Ordinance repealed hereby; nor shall any right or remedy be lost, impaired, or affected by this Ordinance.

109 SEVERABILITY

Should a court of competent jurisdiction declare any section, subsection, or provision of this Ordinance invalid, such decision shall not affect the validity of this Ordinance as a whole, or any other part of the remaining provisions of the Ordinance. The Gregg Township Supervisors hereby declare that it would have enacted the remainder of this Ordinance even without any such part, provision, or application.

110 LIABILITY DISCLAIMER

The granting of approval of a stormwater drainage plan, stormwater management design, or any improvement installed as a condition thereof, shall not constitute a representation, guarantee, or warranty of any kind by Gregg Township, or by any official, employee, or appointee thereof, of the practicality or safety of the proposed use or improvement, and shall create no liability upon or cause of action against the Township, its officials, employees, or appointees for any damage that may result pursuant thereto. The applicant is responsible for ensuring that any development and activities regulated by this Ordinance will not cause injury or damage to other persons or property.

111 REFERENCES

Specific methods and publications referenced in this Ordinance shall, in all cases, refer to the latest available edition and shall include revisions, amendments, and/or replacements thereto.

112 AMENDMENTS

The Gregg Township Supervisors may, from time to time, revise, modify, and amend this Ordinance pursuant to the provisions of the Pennsylvania Stormwater Management Act, Act 167 of October 4, 1978 32 P.S., P.L. 864; the Pennsylvania Municipalities Planning Code, Act 247 of 1968, P.L. 805; P.S. 10101 and by the Second Class Township Code, Act 69 of 1933, P.L. 103; 53 P.S. as from time to time reenacted and amended or other applicable law in effect at the time of said amendment.

113 EFFECTIVE DATE

This Ordinance shall become effective immediately upon being duly enacted and ordained by the Gregg Township Board of Supervisors.

ARTICLE II
DEFINITIONS

200 GENERAL

Unless otherwise expressly stated, the following terms and words used herein shall, for the purposes of this Ordinance, have the meaning indicated in this Section.

201 GENERAL TERMS

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

- A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.
- B. The word "includes" or "including" shall not limit the term to the specific example, but is intended to extend its meaning to all other instances of like kind and character.
- C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, or any other similar entity.
- D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.
- E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained."

202 SPECIFIC TERMS

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

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

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

Applicant - A landowner or developer who has filed an application for approval to engage in any Regulated Activities as defined in Section 106 of this Ordinance.

BMP (Best Management Practice) - Stormwater structures, facilities and techniques to control, maintain or improve the quantity and quality of surface runoff.

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

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Union County Conservation District.

Culvert - Structure with appurtenant works that carries a stream under or through an embankment or fill.

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

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

Designee - The agent of Gregg Township involved with the administration, review or enforcement of any provisions of this Ordinance by contract or memorandum of understanding.

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

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

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

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

Downslope Property Line - That portion of the property line of the lot, tract, or parcels of land being developed located such that all overland or pipe flow from the site would be directed towards it.

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

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

Drainage Permit - A permit issued by the municipal governing body after the drainage plan has been approved. Said permit is issued prior to or with the final municipal approval.

Drainage Plan - The plan and documentation prepared by the developer or his representative indicating how stormwater runoff will be managed and the stormwater management system, if any, to be used for a given development site, the contents of which are established in this Ordinance.

Earth Disturbance - Any activity including, but not limited to, construction, mining, timber harvesting and grubbing which alters, disturbs, and exposes the existing land surface.

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

Erosion - The movement of soil particles by the action of water, wind, ice, or other natural forces.

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

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

Flood - A general but temporary condition of partial or complete inundation of normally dry land areas

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

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

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

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

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

Grade - 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.

Groundwater Recharge - Replenishment of existing natural underground water supplies.

HEC-HMS (Hydrologic Engineering Center Hydrologic Modeling System) - The computer-based hydrologic modeling technique adapted to a particular watershed as part of an official Act 167 Watershed Plan and calibrated to reflect actual recorded flow values by adjoining key model input parameters. West Branch of the Susquehanna Act 167 Plan has a calibrated HEC-HMS model.

Impervious Surface - A surface that prevents the percolation of water into the ground. For the purposes of this Ordinance impervious surface may include, but not be limited to, the following: concrete, asphalt, building coverage, water impoundments, gravel and crushed stone areas, highly compacted soil, etc.

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

Infiltration Structures - A structure designed to direct runoff into the ground (e.g., French drains, seepage pits, seepage trench).

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

Karst - A type of topography that is formed over limestone, dolomite, or gypsum by bedrock solution, and that is characterized by closed depressions or sinkholes, caves and underground drainage (from AGI, Glossary of Geology, 1972.).

Land Development - (i) the improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving (a) a group of two or more buildings, or (b) the division or allocation of land or space between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features; (ii) any subdivision of land; (iii) development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

Land Earth Disturbance - Any activity involving grading, tilling, digging, or filling of ground or stripping of vegetation or any other activity that causes an alteration to the natural condition of the land.

Limestone - A rock that is chiefly formed by the accumulation of organic remains, consisting mainly of calcium carbonate.

Main Stem (Main Channel) - Any stream segment or other runoff conveyance facility used as a reach in any Act 167 Watershed Plan hydrologic model runs.

Manning Equation in (Manning formula) - A method for calculation of velocity of flow (e.g., feet per second) and flow rate (e.g., cubic feet per second) in open channels based upon channel shape, roughness, depth of flow and slope. "Open channels" may include closed conduits so long as the flow is not under pressure.

Municipality - Gregg Township, Union County, Pennsylvania.

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

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

Non-Structural BMP's - Stormwater runoff treatment techniques which use natural measures to reduce pollution levels, do not require extensive construction efforts and/or promote pollutant reduction by eliminating the pollutant source. Acceptable non-structural BMPs are identified in Appendix B.

NRCS - Natural Resource Conservation Service (previously SCS).

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

Overbank and Extreme Event Flood Protection Volume - See Release Rates.

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

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

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

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

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

Planning Commission - Gregg Township Planning Commission.

PMF - Probable Maximum Flood - The flood that may be expected from the most severe combination

of critical meteorological and hydrological conditions that is reasonably possible in any area. The PMF is derived from the probable maximum precipitation (PMP) as determined based on data obtained from the National Oceanographic and Atmospheric Administration (NOAA).

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

Recharge Volume (Re_v) - The volume of stormwater runoff from a site that must be infiltrated into the soil to promote the maintenance of groundwater recharge rates that existed prior to development.

Regulated Activities - Actions or proposed actions that have an impact on stormwater runoff and that are specified in Section 106 of this Ordinance.

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

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

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

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.

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

Sediment Basin - A barrier, dam, retention or detention basin located and designed to retain rock, sand, gravel, silt, or other material transported by water.

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

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

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

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

Soil-Cover Complex Method - A method of runoff computation developed by the NRCS that is based on relating soil type and land use/cover to a runoff parameter called Curve Number (CN).

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

Storage Indication Method - A reservoir routing procedure based on solution of the continuity equation

(inflow minus outflow equals the change in storage) with outflow defined as a function of storage volume and depth.

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

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

Stormwater Management Credits - Incentive based non-structural stormwater management applications that can be incorporated into the site design process to promote water quality, groundwater recharge, volume control, and other stormwater objectives. These include conservation of natural areas, disconnection of rooftop runoff, disconnection of non-rooftop runoff, sheet flow to buffers, grass channels and environmentally sensitive or low impact development.

Stormwater - The total amount of precipitation reaching the ground surface.

Stormwater Hotspot - A land use or activity that generates higher concentrations of hydrocarbons, trace metals, or toxicants than are found in typical stormwater runoff, based on monitoring studies. Typical stormwater hotspots are listed in Section 302 of this Ordinance.

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

Stormwater Management Plan - The plans for managing stormwater runoff in designated watersheds adopted by Union County and approved by the PA DEP as required by the Act of October 4, 1978, P.L. 864, (Act 167), the Stormwater Management Act.

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

Subarea (sub-watershed) - The smallest drainage unit of a watershed for which stormwater management criteria have been established in an Act 167 Stormwater Management Plan.

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 acres, not involving any new street or easement of access or any residential dwellings, shall be exempt.

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

Technical Release 20 (TR-20) - Project Formulation-Hydrology, Computer Program. NRCS.

Technical Release 55 (TR-55) - Urban Unit Hydrology for Small Watersheds. NRCS.

Timber Operations - See Forest Management.

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.

Township Engineer- See Municipal Engineer

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

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

Water Quality Volume (WQ_v) - The storage needed to capture and treat the runoff from 90% of the average annual rainfall. For Union County the depth of rain associated with 90% of the total of all rainfall events is 1.2 inches.

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

ARTICLE III

STORMWATER MANAGEMENT

300 STORMWATER MANAGEMENT AREAS

The Gregg Township Stormwater Management Areas are as follows and appear on a map in Appendix A of this Ordinance.

- A. West Branch Susquehanna River Stormwater Area - Activities occurring within the West Branch Susquehanna River Watershed shall comply with the requirements of this Ordinance and the *West Branch Susquehanna River Act 167 Stormwater Management Plan*, adopted by the County of Union and approved by the Pennsylvania Department of Environmental Protection.
- B. White Deer Hole Creek - Activities occurring within the White Deer Hole Creek Watershed shall comply with the requirements of this Ordinance and the *White Deer Hole Creek Act 167 Stormwater Management Plan*, adopted by the County of Union and approved by the Pennsylvania Department of Environmental Protection.
- C. Black Run Creek - Activities occurring within the Black Run Creek Watershed shall comply with the requirements of this Ordinance and with the applicable Act 167 stormwater management plan, adopted by the County of Union and approved by the Pennsylvania Department of Environmental Protection.

301 GENERAL REQUIREMENTS

- A. The management of stormwater on the site, both during and upon the completion of construction, and the design of any temporary or permanent facilities or structures and the utilization of a natural drainage system shall be in full compliance with this section.
- B. Site designs shall minimize impervious surfaces and shall promote the infiltration of runoff through seepage beds, infiltration trenches, etc. where soil conditions permit to reduce the size or eliminate the need for detention facilities.
- C. Stormwater runoff generated from development discharged directly into a wetland or other waters of the Commonwealth shall be done in accordance with Federal and State regulatory requirements and shall be adequately treated to prevent degradation.
- D. Annual groundwater recharge rates shall be maintained by promoting infiltration. At a minimum annual recharge from the post development site shall mimic the annual recharge from the pre-development site conditions.
- E. Applicants may select runoff control techniques, or a combination of techniques, which are most suitable to control stormwater runoff from the development site. Gregg Township encourages applicants to consider alternative solutions, including Best Management Practices (BMP's) for stormwater management. Applicants are urged to consult the Pennsylvania Handbook of Best Management Practices for Developing Areas, the Pennsylvania Best Management Practices Manual and with the Municipal Engineer and the County Conservation District. All stormwater designs are subject to the approval of the Municipal Engineer. The Township may request specific information on design and/or operating features of the proposed stormwater controls in order to determine their suitability and adequacy in terms of the standards of this Ordinance.
- F. All stormwater management facilities including detention basins, BMP's, sewers, and culverts shall be designed by an individual qualified and/or experienced in their design. These qualifications should be listed on the front cover of the plan narrative.

- G. The anticipated peak rate of stormwater runoff from the site during and after full development shall not exceed the peak rate of runoff from the site prior to development activities, measured in accordance with the standards and criteria of this Ordinance.
- H. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches but shall be allowed to drain to the land surface to promote overland flow and infiltration of stormwater.
- I. Existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.
- J. If existing diffused stormwater flow is proposed to be concentrated the applicant must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from concentrated discharge.
- K. Storm sewers, swales, culverts, bridges, and related facilities shall be provided to:
1. Permit the unimpeded flow of natural watercourses;
 2. Insure the drainage of all points along the line of streets;
 3. Intercept stormwater runoff along streets at reasonable intervals related to the extent and grade of the area drained, and to prevent the flooding of intersections and the undue concentration of storm water; and
 4. Insure unrestricted flow of stormwater under driveways, and at natural watercourses or drainage swales.
- Consideration should be given to anticipated up slope development.
- L. All natural streams, channels, swales, drainage systems and/or areas of surface water concentration shall be maintained in their existing conditions unless an alteration is approved by the Township due to topographic conditions.
- M. Easements shall be provided conforming to the line of all natural streams, channels, swales, and drainage systems and other stormwater infrastructure installed to comply with this Ordinance. The terms of such easements shall prohibit excavation, the placement of fill or structures and any other alterations, including the growth of stiff or woody vegetation that may adversely affect the flow of stormwater.
- N. All stream encroachment activities, including work in and adjacent to waters of the Commonwealth or wetlands, shall comply with applicable PA DEP requirements.
- O. Any stormwater facility located on a state highway right-of-way shall be subject to the approval of the Pennsylvania Department of Transportation and any facility located on a Township road or street right-of-way shall be subject to the approval of Gregg Township.
- P. Applicants are encouraged to incorporate designs to take advantage of the stormwater credits presented in Appendix B of this Ordinance.
- Q. Off-site areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates; however, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.

- R. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Township shall reserve the right to disapprove any design that would result in the occupancy or continuation of an adverse hydrologic or hydraulic condition.

302 WATER QUALITY REQUIREMENTS

- A. For water quality, the objective is to provide adequate storage to capture and treat the runoff from 90% of the average annual rainfall in accordance with the following where P represents the depth of rain associated with 90% of the total rainfall events over 0.11 inches.

1. The size of the water quality facility shall be based upon the following equation:

$$WQ_v = \frac{(1.2)(R_v)(A)}{12} \qquad P = 1.2 \text{ inches of rainfall}$$

Where: WQ_v = water quality volume (in ac-ft)
 R_v = $0.05 + 0.009(I)$ where I is percent impervious cover
 A = area in acres*

*Treatment of the Water Quality Volume (WQ_v) for offsite areas and areas not disturbed is not required.

2. Treatment of the WQ_v shall be provided at all developments where stormwater management is required. A minimum WQ_v of 0.2 inches per acre shall be met at sites or in drainage areas that have less than 15% impervious cover.
 3. The WQ_v shall be based on the impervious cover for the proposed site. Offsite existing impervious areas may be excluded from the calculation of the water quality volume requirements.
 4. When a project contains or is divided by multiple drainage areas, the WQ_v shall be addressed for each drainage area.
 5. Drainage areas having no impervious cover and no proposed disturbance during development may be excluded from the WQ_v calculations. Designers are encouraged to use these areas as non-structural practices for WQ_v treatment.
 6. Where structural practices for treating the Recharge Volume (Re_v) are employed upstream of a BMP, the Re_v may be subtracted from the WQ_v used for design.
 7. Where non-structural practices are employed in the site design, the WQ_v can be reduced in accordance with the conditions outlined in Appendix B of this Ordinance.
 8. The design of the facility shall consider and minimize the chances of clogging and sedimentation potential. Orifices smaller than three (3) inches diameter are not recommended. However, if the Design Engineer can provide proof that the smaller orifices are protected from clogging by use of trash racks, etc. smaller orifices may be permitted.
 9. When designing flow splitters for off-line practices, consult the small storm hydrology method provided in Appendix K of this Ordinance.
- B. To accomplish adequate water quality treatment the final WQ_v shall be treated by an acceptable BMP from the list presented in Appendix L or an equivalent practice approved by the Municipal Engineer. The applicant may submit original and innovative designs to the Municipal Engineer

for review and approval. Such designs may achieve the water quality objectives through a combination of BMPs.

- C. The water quality requirement can be met by providing a 24-hour draw down of a portion of the WQ_v in conjunction with a stormwater pond or wetland system. Referred to as extended detention (ED), this is different than providing the extended detention of the one-year storm for the Channel Protection Volume (Cp_v). The ED portion of the WQ_v may be included when routing the Cp_v .
- D. In selecting the appropriate BMPs or combinations thereof, the applicant shall consider the following:
1. Total contributing area.
 2. Permeability and infiltration rate of the site soils.
 3. Slope and topography.
 4. Seasonal high water table.
 5. Depth to bedrock.
 6. Proximity to building foundations and wellheads.
 7. Erodibility of soils.
 8. Subgrade stability and susceptibility to sinkhole formation.
 9. Land availability and configuration of the topography.
 10. Peak discharge and required volume control.
 11. Stream bank erosion.
 12. Efficiency of the BMPs to mitigate potential water quality problems.
 13. The volume of runoff that will be effectively treated.
 14. The nature of pollutants being removed.
 15. Creation and protection of wildlife habitat.
 16. Enhancement of aesthetic and property value.
 17. Maintenance requirements.
- E. Stormwater Hotspots - If a site is designated as a stormwater hotspot as per Table 302-1 it has important implications for how stormwater is managed.
1. A greater level of stormwater treatment is required at hotspot sites to prevent pollutant wash off after construction.
 2. For areas designated as hotspots a Stormwater Pollution Prevention Plan may be required to be designed and implemented that contains operation practices at the site to reduce the generation of pollutants by preventing contact with rainfall.
 3. Stormwater Pollution Prevention Plans shall follow the requirements of the U.S. EPA NPDES stormwater program.
 4. The following land uses and activities are not normally considered hotspots:
Residential streets and rural highways, residential development, institutional development, commercial and office developments, non-industrial rooftops, pervious areas except for golf courses and nurseries. Large highways and retail gasoline outlet facilities are not designated as hotspots although it is important to ensure that stormwater plans for these facilities adequately protect groundwater.

Table 302-1: Stormwater Hotspots

Vehicle Salvage Yards and Recycling Facilities*
Vehicle Service and Maintenance Facilities
Vehicle and Equipment Cleaning Facilities*
Fleet Storage Areas (bus, truck, etc)*
Industrial Sites
Marinas (service and maintenance)*
Outdoor Liquid Container Storage
Outdoor Loading/Unloading Facilities
Public Works Storage Areas
Facilities that Generate or Store Hazardous Materials*
Commercial Container Nursery
Golf Courses
Other land uses and activities as designated

*Stormwater Pollution Plan implementation may be required for these land uses or activities under the U.S. EPA NPDES stormwater program.

303 GROUNDWATER RECHARGE REQUIREMENTS

- A. Design of the infiltration/recharge stormwater management facilities shall give consideration to providing groundwater recharge to compensate for the reduction in the percolation that occurs when the ground surface is paved and roofed over. These measures are encouraged, particularly in hydrologic soil groups A and B and shall be utilized wherever feasible.
- B. The criteria for maintaining recharge is based on the USDA average annual recharge volume per soil type divided by the annual rainfall in Union County (40 inches per year) and multiplied by 90%. This keeps the recharge calculation consistent with the WQ_v methodology. Thus, an annual Recharge Volume (Re_v) requirement shall be specified for a site as follows:

1. Percent Volume Method

$$Re_v = [(S)(R_v)(A)]/12$$

Where: $R_v = 0.05 + 0.009(I)$ where I is percent impervious cover
 A = site area in acres

2. Percent Area Method

$$Re_v = (S)(A_i)$$

Where: A_i = the measured impervious cover

<u>Hydrologic Soil Group</u>	<u>Soil Specific Recharge Factor (S)</u>
A	0.40
B	0.27
C	0.14
D	0.07

- 3. The recharge volume is considered part of the total WQ_v that must be provided at a site and can be achieved either by a structural practice (e.g., infiltration, bioretention), a non-structural practice (e.g., buffers, disconnection of rooftops), or a combination of both.
- 4. Drainage areas having no impervious cover and no proposed disturbance during development may be excluded from the Re_v calculations. Designers are encouraged to use these areas as non-structural practices for Re_v treatment.

5. The Re_v and WQ_v are inclusive. When treated separately, the Re_v may be subtracted from the WQ_v when sizing the water quality BMP.
6. Recharge/infiltration facilities may be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives.

C. Basis for Determining Recharge Volume

1. If more than one Hydrologic Soil Group (HSG) is present at a site, a composite soil specific recharge factor shall be computed based on the proportion of total site area within each HSG. **The recharge volume provided at the site shall be directed to the most permeable HSG available.**
2. **The “percent volume” method is used to determine the Re_v treatment requirement when structural practices are used to provide recharge.** These practices must provide seepage into the ground and may include infiltration and exfiltration structures (e.g., infiltration, bioretention, dry swales or sand filters with storage below the under drain). Structures that require impermeable liners, intercept groundwater, or are designed for trapping sediment (e.g., forbays) may not be used. In this method, the volume of runoff treated by structural practices shall meet or exceed the computed recharge volume.
3. **The “percent area” method is used to determine the Re_v treatment requirements when non-structural practices are used.** Under this method, the recharge requirements are evaluated by mapping the percent of impervious area that is effectively treated by an acceptable non-structural practice and comparing it to the minimum recharge requirements.
4. Acceptable non-structural practices are those identified in Appendix B and include filter strips that treat rooftop or parking lot runoff, sheet flow discharge to stream buffers, grass channels that treat roadway runoff, and conservation design.
5. The recharge volume criterion does not apply to any portion of a site designated as a stormwater hotspot or any project considered as redevelopment. In addition, the Municipal Engineer may alter or eliminate the recharge volume requirement if the site is situated on unsuitable soils (e.g. marine clays), karst or in an urban redevelopment area. In this situation, non-structural practices (percent area method) shall be implemented to the maximum extent practicable and the remaining or untreated Re_v included in the WQ_v treatment.
6. If Re_v is treated by structural or non-structural practices separate and upstream of the WQ_v treatment, the WQ_v is adjusted accordingly.

D. Soils Evaluation

1. **A detailed soils evaluation of the project site shall be performed to determine the suitability of recharge facilities.** The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and subgrade stability. Advanced testing methods such as the double-ring test are encouraged. The municipal engineer reserves the right to require additional soils evaluation when it is believed that test results are not reasonable.
2. **Extreme caution shall be exercised where infiltration is proposed in geologically susceptible areas such as strip mines or limestone areas.** Extreme caution shall also be exercised where salt or chloride would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. It is also extremely important that the design professional evaluates the possibility of groundwater contamination from the proposed infiltration/recharge facility and recommends a hydrogeologic justification study

be performed if necessary. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location may be required to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation.

3. The Township may require the installation of an impermeable liner in detention basins underlain by limestone or in areas of karst topography. The Township may require a detailed hydrogeologic investigation. The developer may also be required to provide safeguards against groundwater contamination for uses that may cause groundwater contamination, should there be an accident or spill.
- E. All recharge/infiltration facilities shall be designed to completely drain within 72 hours of reaching maximum capacity.

304 **CHANNEL PROTECTION STORAGE VOLUME (STREAM BANK EROSION)**

- A. Stream Channel Protection shall be considered in implementing the standards of Section 305 of this Ordinance. If a stormwater storage facility needs to be constructed then, to protect channels from erosion, the outflow structure shall be designed to provide **24 hour extended detention of the one-year; 24-hour storm event**. The method for determining the C_{pv} requirement is detailed in Appendix O of this Ordinance.
- B. For discharges to streams having verified naturally reproducing wild trout or that are stocked with trout (based upon the most recent resource classification or other appropriate documentation of the Pennsylvania Fish and Boat Commission or other appropriate agency), only 12 hours of extended detention shall be provided. The rationale for this criterion is that runoff will be stored and released in such a gradual manner that critical erosive velocities during bankfull and near-bankfull events will seldom be exceeded in downstream channels.
- C. Basis for Determining Channel Protection Storage Volume
1. The models HEC-HMS, TR-55 and TR-20 (or an equivalent approved by the Municipal Engineer) shall be used for determining peak discharge rates.
 2. The rainfall depth for the one-year 24-hour storm event in Union County is 2.2 inches.
 3. Off-site areas shall be modeled as present land use in good condition for the one (1) year storm event.
 4. The length of overland flow used in time of concentration (t_c) calculations is limited to no more than 150 feet.
 5. The C_{pv} storage volume shall be computed using the detention lag time between hydrograph procedures outlined in Appendix M of this Ordinance. The detention lag time (T) for a one-year (1) storm is defined as the interval between the center of mass of the inflow hydrograph and the center of mass of the outflow hydrograph.
 6. C_{pv} is not required at sites where the one-year post development peak discharge (q_i) is less than or equal to 2.0 cfs. A C_{pv} orifice diameter (d_o) of less than 3.0 inches is subject to approval by the Municipal Engineer and is not recommended unless an internal control for orifice protection is used.
 7. C_{pv} shall be addressed for the entire site. If a site consists of multiple drainage areas, C_{pv} may be distributed proportionately to each drainage area.

8. Extended detention storage provided for the Cp_v does not meet the WQ_v requirement (i.e. Cp_v and WQ_v shall be treated separately).
9. The stormwater storage needed for the Cp_v may be provided above the WQ_v storage in stormwater ponds and wetlands; thereby meeting all storage criteria except Re_v in a single facility with appropriate hydraulic control structures for each storage requirement.
10. Infiltration is not recommended for Cp_v control because of large storage requirements.

305 OVERBANK AND EXTREME EVENT FLOOD PROTECTION REQUIREMENTS

For a site located within two or more districts the peak discharge rate from any sub-area shall be the pre-development peak discharge for that sub-area. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by sub-area. Pre-development and post-development runoff for specific sites shall be computed using an approved method as per Table 307-1 for the 2-, 10-, 25-, and 100-year storm. Procedures for applying the Release Rate Percentage are contained in Appendix J.

- A. West Branch Susquehanna Watershed - The West Branch Susquehanna Watershed Subareas Map in Appendix I of this Ordinance illustrates the release rate subareas. The release rate percentage of pre-development peak rate of runoff that can be discharged from an outfall on the site after development is 100% for all subwatersheds. For sites that discharge directly to the Susquehanna River the Township may waive the requirements of Section 306, with the concurrence of the Municipal Engineer.
- B. Reserved for performance standards to be determined by a White Deer Hole Creek Act 167 Plan. Until such time as an Act 167 Plan is duly adopted the post-development rate of runoff shall not exceed the pre-development rate of runoff for the 2-, 10-, 25-, and 100-year storm events.
- C. Reserved for performance standards to be determined by an Act 167 Plan governing the Black Run Creek Watershed. Until such time as an Act 167 Plan is duly adopted the post-development rate of runoff shall not exceed the pre-development rate of runoff for the 2-, 10-, 25-, and 100-year storm events.

306 DESIGN CONSIDERATIONS

- A. All storm sewers and manmade channels (i.e. swales) shall be able to convey the post-development runoff from a 10-year design storm without surcharging inlets and shall be constructed using Penn DOT Form 408 Specifications, Standard Details unless otherwise directed by the Municipal Engineer.
- B. Stormwater roof drains shall not discharge into any municipal sanitary sewer line or over a sidewalk.
- C. Inlets shall be placed at the curb line where a curbed section is installed. Inlets required for parallel or cross drainage without a curbed section shall be set at the centerline of the ditch.
- D. Structures shall be Penn DOT Type M pre-cast concrete or cast-in-place Class A concrete. Brick or block structures shall not be permitted. Solid concrete block or brick may be incorporated into a structure only for grade adjustment of the casting.
- E. All water obstructions (bridges, culverts, outfalls or stream enclosures) shall have ample waterway opening to carry expected flows, based on a minimum post development peak storm frequency of twenty-five (25) years without damage to the drainage structure or roadway.

- F. Construction of water obstructions shall be in accordance with the Pennsylvania Department of Transportation specifications and shall meet the requirements of the Pennsylvania Department of Environmental Protection (PA DEP). Any work involving wetlands shall be designed in accordance with the specification of the PA DEP and United States Army Corps of Engineers.
- G. Roadway crossings located within designated floodplain areas shall be able to convey runoff from a 100-year design storm.
- H. Whenever the vegetation and topography are to be disturbed, such activity must be in conformance with Chapter 102, Title 25, Rules and Regulations, Part I, Commonwealth of Pennsylvania, Department of Environmental Protection, Subpart C, Protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control," and in accordance with the Union County Conservation District.
- I. Any stormwater management facility designed to store runoff and requiring an earthen berm or embankment shall be designed to provide an emergency spillway to handle flow up to and including the 100-year post-development conditions. The height of the embankment must be set as to provide a minimum of one (1) foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow.
- J. Stormwater management facilities that require a dam safety permit under PA DEP Chapter 105 shall meet the applicable dam safety requirements that may require the facility to pass storms larger than the 100-year event.
- K. Adequate erosion protection shall be provided along all open channels and at all points of discharge.
- L. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to be applied where infiltration BMPs are proposed shall include the following:
1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.
 2. Constructed infiltration BMPs shall be protected from receiving sediment-laden runoff.
- M. Detention basins for stormwater peak discharge storage shall comply with the following criteria:
1. Basins shall be installed prior to any earthmoving or land disturbance that they will serve. The phasing of their construction shall be noted in a narrative and on the plan.
 2. Basins located in an area underlain by limestone may require a geologic evaluation of the proposed location to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation. The Township may require basins located over limestone to have an impermeable liner.
 3. Soils used for the construction of basins shall have low erodability factors ("K factors").
 4. Energy dissipators and/or level spreaders shall be installed at points where pipes or drainage ways discharge to or from basins. Discharge from basins shall be into a natural waterway or drainage way.

5. Exterior slopes of compacted soil shall not exceed one foot (1') vertical per three feet (3') horizontal and may be further reduced in soils of unstable characteristics.
6. Interior slopes of the basin shall not exceed one foot (1') vertical per three feet (3') horizontal except with the approval of the Municipal Engineer. Where concrete, stone, or brick walls are used for steeper interior slopes, the basin shall be fenced with a permanent wire fence at least forty-two inches (42") in height and a ramp of durable, non-slip materials for maintenance vehicles shall be provided for basin access.
7. Outlet structures within basins which will control peak discharge flows and distribute the flows by pipes to discharge areas shall be constructed of concrete, polymer-coated steel or aluminum and shall have childproof, non-clogging trash racks over all design openings exceeding twelve (12") inches in diameter, except those openings used to carry perennial stream flows. Small outlet structures may be constructed of Schedule 40 PVC.
8. Where spillways will be used to control peak discharges in excess of the ten (10) year storm, control weirs shall be constructed of concrete of sufficient mass and structural stability to withstand the pressures of impounded waters and outlet velocities.
9. Concrete outlet aprons shall be designed as level spreaders and shall extend at a minimum to the toe of the basin slope. The incorporation of any large stone found on the site into the concrete apron to provide a more natural appearance is encouraged.
10. Inlet and outlet structures shall be located at maximum distance from each other. The Township may require a rock filter berm or rock-filled gabions between inlet and outlet areas when the distance is deemed insufficient for sediment trappings.
11. Temporary and permanent grasses or stabilization measures shall be established on the sides of all earthen basins within fifteen (15) days of initial construction.

307 CALCULATION METHODOLOGY

- A. Stormwater calculations to determine runoff, peak flow rates, peak discharge, hydrographs and to design stormwater runoff rate reduction facilities shall use a generally accepted calculation technique that is based on the Natural Resource Conservation Service (NRCS) Soil-Cover Complex method. Table 307-1 summarizes acceptable methods.
- B. It is assumed that all methods will be selected by the design professional based on the individual limitations and suitability of each method for a particular site. The Township may allow the use of the Rational Method to estimate **peak discharges** from drainage areas that contain 200 acres or less; however, the Rational Method shall not be used to generate **pseudo-hydrographs** for drainage areas greater than 10 acres.
- C. For predevelopment flow rate determination it shall be assumed that all undeveloped and pervious land shall be considered as "meadow" in good condition, unless the natural ground cover generates a lower curve number or Rational "C" value (i.e. forest) as listed in Appendix C or Appendix D of this Ordinance.
- D. All calculations using the Soil Cover Complex method shall use the appropriate design rainfall depths for the various return period storms as presented in the table in Appendix E of this Ordinance. If a hydrologic computer model such as PSRM or HEC-HMS is used for stormwater

runoff calculations then the duration of rainfall shall be 24 hours. The SCS "S" curve shown in Appendix F of this Ordinance shall be used for the rainfall distribution.

- E. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the Design Storm Curves from PA Department of Transportation Design Rainfall Curves (1986) shown in Appendix G of this Ordinance. Times of concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times of concentration for channel and pipe flow shall be computed using Manning's Equation.
- F. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the Soil Cover Complex method shall be obtained from the table in Appendix C of this Ordinance.
- G. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational Method shall be obtained from the table in Appendix D of this Ordinance.
- H. Where uniform flow is anticipated the Manning Equation shall be used for hydraulic computations and to determine the capacity of open channels, pipes, and storm sewers. Manning's Equation should not be used for analysis of pipes under pressure flow or for culvert analysis. Values for Manning's roughness coefficient (n) shall be consistent with Appendix H of this Ordinance.
- I. When existing storm sewers, streets, roadside ditches or drainage swales are accessible; the applicant shall not connect the stormwater drainage system to the existing facilities without the approval of the Municipal Engineer and the facility owner.
- J. Routing of hydrographs through detention/retention facilities for the purposes of designing those facilities shall be accomplished using the Storage-Indication method or other recognized routing method subject to approval of the Municipal Engineer. For drainage areas greater than 200 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Municipal Engineer may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.
- K. Any method approved by the Pennsylvania Department of Transportation or the Pennsylvania Department of Environmental Protection may be used to design the waterway areas of bridges.

Table 307-1: Acceptable Stormwater Management Computation Methodologies

Method	Method Developer	Applicability
TR-20 (or commercial Package based on TR-20)	USDA NRCS	Where use of full hydrologic computer model is desirable or necessary.
TR-55 (or commercial Package based on TR-55)	USDA NRCS	For plans within limitations described in TR-55.
HEC-1, HEC-HMS	US Army Corps of Engineers	Where use of full hydrologic computer model is desirable or necessary.
PSRM	Penn State University	Where use of full hydrologic computer model is desirable or necessary.
Rational Method	Emil Kuichling (1889)	For sites less than 10 acres, or as approved by the Municipal Engineer.
Other Methods	Varies	Other computations approved by Municipal Engineer.

SECTION 308

NO HARM OPTION

- A. For any proposed development site the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no harm" option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no harm" would have to be shown based upon the following "Downstream Impact Evaluation" which shall include a "downstream hydraulic capacity analysis" consistent with Section 308.B of this Ordinance to determine if adequate hydraulic capacity exists. The land developer shall submit to the Municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.
1. The "Downstream Impact Evaluation" shall include hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications due to the proposed development upon a dam, highway, structure, natural point of restricted streamflow or any stream channel section, established with the concurrence of the Municipal Engineer.
 2. The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.
 3. The peak flow values to be used for downstream areas for the design return period storms (1, 2-, 5-, 10-, 25-, 50-, and 100-year) shall be the values from the calibrated model used for the analysis and preparation of the particular Act 167 Stormwater Management Plan. These flow values can be obtained from the applicable watershed plan.
 4. Developer-proposed runoff controls that would generate increased peak flow rates at storm drainage problem areas would, by definition, be precluded from successful attempts to prove "no-harm," except in conjunction with proposed capacity improvements for the problem areas consistent with Section 308.B.
 5. A financial distress shall not constitute grounds for granting a "no-harm" exemption.
 6. Capacity improvements may be provided by the developer as necessary to implement the "no harm" option which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.
 7. Any "no harm" justifications shall be submitted by the developer as part of the Drainage Plan submission per Article IV of this Ordinance.
 8. Qualification of no harm does not relieve the applicant of the other provisions of this Ordinance, including but not limited to the water quality, groundwater recharge and channel protection volume requirements of Sections 302, 303 and 304 of this Ordinance.
- B. "Downstream Hydraulic Capacity Analysis" - Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:
1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Acceptable velocities shall be based upon criteria included in the DEP *Erosion and Sediment Pollution Control Program Manual*.
 2. Natural or man-made channels or swales must be able to convey increased 25-year return

period runoff without creating any hazard to persons or property.

3. Culverts, bridges, storm sewers or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP Chapter 105 regulations (if applicable) and, at minimum, pass the increased 25-year return period runoff.

ARTICLE IV

DRAINAGE PLAN REQUIREMENTS

400 GENERAL REQUIREMENTS

The Drainage Plan shall consist of all applicable calculations, drawings, maps, and plans. The cover sheet of the computations and erosion and sedimentation control plan shall refer to the associated maps by title and date. All Drainage Plan materials shall be submitted to the Township in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant. The following items shall be included in the Drainage Plan:

- A. General
 - 1. General description of project.
 - 2. General description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.
 - 3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.
 - 4. Drainage Plans shall be prepared by a professional with demonstrated competency in stormwater management and design.
 - 5. Drainage Plans and related documentation shall contain the seal and signature of the professional that prepared the plans.
- B. Drawings(s), maps and plans of the project area shall be submitted on 24-inch x 36-inch sheets and shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of Union County. The contents of the maps(s) shall include, but not be limited to:
 - 1. The location of the project relative to highways, municipalities or other identifiable landmarks.
 - 2. Existing contours at intervals no greater than two foot. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.
 - 3. Existing streams, lakes, ponds, field delineated wetlands, or other bodies of water within the project area.
 - 4. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.
 - 5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines.
 - 6. An overlay showing soil names and boundaries.
 - 7. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.

8. Proposed structures, roads, paved areas, and buildings.
9. Final contours at intervals of no greater than two foot. In areas of steep slopes (greater than 15 percent), five- foot contour intervals may be used.
10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.
11. The date of submission.
12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.
13. A North arrow.
14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.
15. Existing and proposed land use(s).
16. A key map showing all existing man-made features beyond the property boundary that would be affected by the project.
17. Horizontal and vertical profiles of all open channels, including hydraulic capacity.
18. Overland drainage paths.
19. A minimum fifteen-foot wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way. The fifteen feet shall extend from the top of bank of any channel or berm of any basin.
20. A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located off-site. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.
21. A construction detail of any improvements made to sinkholes.
22. A statement, signed by the landowner, acknowledging the stormwater management system to be a permanent fixture that can be altered or removed only after municipal approval of a revised plan.
23. The location of all erosion and sedimentation control facilities.
24. Where pervious pavement is permitted for parking lots, recreational facilities, non-dedicated streets or other areas, pavement construction specifications shall be noted on the plan.
25. It shall be the applicant's responsibility to verify if the site is underlain by limestone. The following note shall be affixed to all drainage plans and signed and sealed by the engineer, surveyor, landscape architect or geologist:

I, _____, certify that this site and any detention basins located thereon are/are not underlain by limestone.

B. Supplemental Information

1. A written description of the following information shall be submitted.
 - a. The overall stormwater management concept for the project.
 - b. Stormwater runoff computations as specified in this Ordinance.
 - c. Existing and proposed drainage area maps.
 - d. Stormwater management techniques to be applied both during and after development.
 - e. Expected project time schedule.
2. A soil erosion and sedimentation control plan, where applicable, including all reviews and approvals, as required by PA DEP.
3. A geologic assessment of the effects of runoff on sinkholes as specified in this Ordinance.
4. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.
5. A Declaration of Adequacy and Highway Occupancy Permit from the PENNDOT District Office when utilization of a PENNDOT storm drainage system is proposed.

C. Stormwater Management Facilities

1. All stormwater management facilities must be located on a plan and described in detail.
2. When groundwater recharge methods such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.
3. All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.

401 PLAN SUBMISSION

- A. The Drainage Plan shall be submitted by the developer as part of a Preliminary and/or Final Plan application for subdivision and land development activity or separately if the activity regulated by this Ordinance is not being conducted in conjunction with a subdivision or land development.
- B. Four (4) copies of the Drainage Plan and all supplemental material shall be submitted to the Township.

402 DRAINAGE PLAN REVIEW

- A. The Municipal Engineer shall review the Drainage Plan for consistency with this Ordinance and applicable Act 167 Stormwater Management Plans. The Township shall require receipt of a complete plan, as specified in this Ordinance.
- B. For activities regulated by this Ordinance, the Municipal Engineer shall notify the Township in writing, whether the Drainage Plan is consistent with this Ordinance. Should the Drainage Plan be determined to be consistent with this Ordinance, the Municipal Engineer will forward an approval letter to the Township Secretary.
- C. Should the Drainage Plan be determined to be inconsistent with this Ordinance the Municipal

Engineer will forward a disapproval letter to the Municipal Secretary citing the specific sections of the Ordinance and reason(s) for the disapproval.

- D. The Municipal Secretary shall forward a copy of the Municipal Engineer's review of the Drainage Plan to the applicant and the Township Building Permit Officer, Zoning Officer, and Township Planning Commission.
- E. For Regulated Activities requiring a PA DEP Joint Permit Application, the Municipal Engineer shall notify PA DEP whether the Drainage Plan is or is not consistent with this Ordinance and the Act 167 Stormwater Management Plan and forward a copy of the review letter to the Municipality and the developer. PA DEP may consider the Municipal Engineer's review comments in determining whether to issue a permit.
- F. The Township shall not approve any subdivision or land development for Regulated Activities specified in Section 106 of this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance or the Act 167 Stormwater Management Plan, as determined by the Municipal Engineer.
- G. The Municipal Building Permit and Zoning Officers shall not issue building and/or zoning permits for any Regulated Activity specified in this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance as determined by the Municipal Engineer.
- H. The applicant shall be responsible for completing record drawings of all stormwater management facilities included in the approved Drainage Plan. The record drawings and an explanation of any discrepancies with the design plans shall be submitted to the Municipal Engineer for final approval. In no case shall the Township approve the record drawings until a copy of an approved Declaration of Adequacy; Highway Occupancy Permit is received from the PENNDOT District Office, and any applicable permits from PA DEP.
- I. The approval of a Drainage Plan shall be valid for a period not to exceed five (5) years. This 5-year time period shall commence on the date that the Township signs the approved Drainage Plan. If stormwater management facilities included in the approved Drainage Plan have not been constructed, or if constructed, and record drawings of these facilities have not been approved within this 5-year time period, then the Township may consider the Drainage plan disapproved and may revoke any and all approvals and/or permits. Drainage Plans that are considered disapproved by the Township shall be resubmitted in accordance with this Ordinance.

403 MODIFICATION OF PLANS

A modification to a submitted Drainage Plan for a development site that involves a change in stormwater management facilities or techniques, or that involves the relocation or re-design of stormwater management facilities, or that is necessary because soil or other conditions are not as stated on the Drainage Plan as determined by the Municipal Engineer, shall require a resubmission of the modified Drainage Plan and a review consistent with this Ordinance.

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

404 RESUBMISSION OF DISAPPROVED DRAINAGE PLANS

A disapproved Drainage Plan may be resubmitted, with the revisions addressing the Municipal Engineer's concerns documented in writing, to the Township Secretary in accordance with this Ordinance and distributed accordingly and is subject to review as specified in this Ordinance.

ARTICLE V

FEES AND EXPENSES

500 GENERAL

Applicants are responsible for paying all applicable costs incurred by the Township in reviewing Drainage Plans.

501 MUNICIPALITY DRAINAGE PLAN REVIEW FEE

The Township shall establish a Review Fee Schedule by resolution of the Township Board of Supervisors.

502 EXPENSES COVERED BY FEES

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

- A. Administrative costs.
- B. The review of the Drainage Plan by the Municipality and the Municipal Engineer.
- C. The site inspections.
- D. The inspection of stormwater management facilities and drainage improvements during construction.
- E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the Drainage Plan.
- F. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VI

FINANCIAL GUARANTEE & MAINTENANCE RESPONSIBILITIES

600 IMPROVEMENT GUARANTEE

The applicant shall provide a financial guarantee to the Municipality for the timely installation and proper construction of all stormwater management controls as required by the approved drainage plan and this Ordinance equal to 110% of the construction cost of the required stormwater controls estimated as of 90 days following the date scheduled for completion by the developer. The improvement guarantee shall follow the procedures and requirements specified for financial guarantees in the Township Subdivision and Land Development Ordinance and the Pennsylvania Municipalities Planning Code, Act 247 of 1968, P.L. 805, 53 P.S. 10101.

601 SCHEDULE OF INSPECTIONS

- A. The Municipal Engineer shall inspect all phases of the installation of the permanent stormwater management facilities as deemed appropriate by the Municipal Engineer.
- B. During any stage of the work, if the Municipal Engineer determines that the permanent stormwater management facilities are not being installed in accordance with the approved Drainage Plan, the Municipality shall revoke any existing approvals and/or permits and issue a cease and desist stop work order until the problem is corrected by the applicant or until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.
- C. At the completion of the project, and as a prerequisite for the release of the improvement guarantee, the owner or his representatives shall:
 - 1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.
 - 2. Provide a set of as-built (record) drawings.
- D. After receipt of the certification by the Township, a final inspection shall be conducted by the Municipal Engineer or designated representative to certify compliance with this Ordinance.

602 MAINTENANCE RESPONSIBILITIES

- A. The Drainage Plan for the development site shall contain an operation and maintenance plan prepared by the developer and approved by the Municipal Engineer. The operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to insure proper operation of the facility(ies).
- B. The Drainage Plan for the development site shall establish responsibilities for the continued operation and maintenance of all proposed stormwater control facilities, consistent with the following principals:
 - 1. If a development consists of structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Township, stormwater control facilities may also be offered for dedication to the Township (the Township is not obligated to accept ownership).
 - 2. If a development site is to be maintained in a single ownership or if sewers and other public improvements are to be privately owned and maintained, then the ownership and

maintenance of stormwater control facilities shall be the responsibility of the owner or private management entity.

- C. The governing body, upon recommendation of the Municipal Engineer, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the drainage plan. The governing body reserves the right to accept or reject the ownership and operating responsibility for any or all of the stormwater management controls.

603 MAINTENANCE AGREEMENT FOR STORMWATER FACILITIES

- A. Prior to final approval of the site's drainage plan, the property owner shall execute a maintenance agreement suitable for recording in the Union County Recorder of Deeds Office, an example of which is contained in Appendix N, covering all stormwater control facilities that are to be privately owned.
- B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance agreement shall be subject to the review and approval of the Township.

604 MUNICIPAL STORMWATER MAINTENANCE FUND

- A. Persons installing stormwater storage facilities shall be required to pay a specified amount to the Municipal Stormwater Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined in accordance with this Section.
- B. If the storage facility is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the Township for a period of ten (10) years, as estimated by the Municipal Engineer. After that period of time, inspections will be performed at the expense of the Municipality.
- C. If the storage facility is to be owned and maintained by the Township, the deposit shall cover the estimated costs for maintenance and inspections for ten (10) years. The Municipal Engineer will establish the estimated costs utilizing information submitted by the applicant.
- D. If a storage facility is proposed that also serves as a recreation facility (e.g., ballfield, lake), the Township may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.
- E. If at some future time a storage facility (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.

ARTICLE VII

ENFORCEMENT AND PENALTIES

700 RIGHT-OF-ENTRY

Upon presentation of proper credentials, duly authorized representatives of the Township may enter at reasonable times upon any property within the Township to inspect the condition of the stormwater structures and facilities in regard to any aspect regulated by this Ordinance.

701 NOTIFICATION

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any approvals issued hereunder, the Township shall provide written notification of the violation. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violation(s). Failure to comply within the time specified shall subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and resort by the Township from pursuing any and all remedies. It shall be the responsibility of the owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

702 ENFORCEMENT

The Township Board of Supervisors is hereby authorized and directed to enforce all of the provisions of this Ordinance. All inspections regarding compliance with the drainage plan shall be the responsibility of the Municipal Engineer or other qualified persons designated by the Township.

- A. A set of design plans approved by the Township shall be on file at the site throughout the duration of the construction activity. Periodic inspections may be made during construction.
- B. It shall be unlawful for any person, firm or corporation to undertake any regulated activity under Section 105 on any property except as provided for in the approved Drainage Plan and pursuant to the requirements of this Ordinance. It shall be unlawful to alter or remove any control structure required by the Drainage Plan pursuant to this Ordinance or to allow the property to remain in a condition that does not conform to the approved Drainage Plan.
- C. Suspension and Revocation of Approvals and/or Permits
 1. Any approval or permit issued under this Ordinance may be suspended or revoked by the governing body for:
 - a. Non-compliance with or failure to implement any provision of the permit.
 - b. A violation of any provision of this Ordinance or any other applicable law, ordinance, rule or regulation relating to the project.
 - c. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others.
 2. A suspended approval or permit shall be reinstated by the governing body when:
 - a. The Municipal Engineer or his designee has inspected and approved the corrections to the stormwater management and erosion and sediment pollution

control measure(s), or the elimination of the hazard or nuisance, and/or;

- b. The governing body is satisfied that the violation of the Ordinance, law, or rule and regulation has been corrected.
- c. A permit that has been revoked by the governing body cannot be reinstated. The Applicant may apply for a new permit under the procedures outlined in this Ordinance.

D. Occupancy Permits

An occupancy permit shall not be issued unless the certification of completion pursuant to Sections 601.C and 601.D has been secured. The occupancy permit shall be required for each lot owner and/or developer for all subdivisions and land development in the Municipality.

703 PUBLIC NUISANCE

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

704 PENALTIES

- A. Anyone violating the provisions of this Ordinance shall be guilty of a summary offense and upon conviction shall be subject to a fine of not more than \$ 500.00 for each violation, recoverable with costs. Each day that the violation continues shall be a separate offense.
- B. In addition, the Township, through its solicitor may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief.

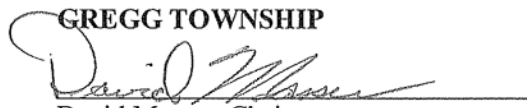
705 APPEALS

- A. Any person aggrieved by any action of the Township or its designee may appeal to the Township Board of Supervisors or Zoning Hearing Board within thirty (30) days of that action.
- B. Any person aggrieved by any decision of the Township Board of Supervisors or the Zoning Hearing Board may appeal to the Union County Court of Common Pleas within thirty (30) days of the municipal decision.

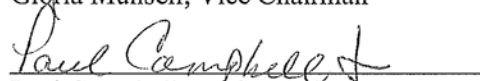
This Ordinance shall take effect as of February 9, 2009. Ordained and enacted this 9 day of February, 2009.

[SEAL]

GREGG TOWNSHIP


David Masser, Chairman


Gloria Munsell, Vice Chairman


Paul Campbell, Jr., Supervisor

APPENDICES

APPENDIX A - Stormwater Management Areas Map

APPENDIX B - Stormwater Management Credits

APPENDIX C - Runoff Curve Numbers

Source: NRCS (SCS) TR-55

APPENDIX D - Runoff Coefficients for the Rational Method

Source: Rawls, W.J., S.L. Long, and R.H. McCuen, 1981. Comparison of Urban Flood Frequency Procedures. Preliminary Draft Report prepared for the Soil Conservation Service, Beltsville, Maryland.

APPENDIX E - Design Storm Rainfall Amount (Inches)

Source: NRCS (SCS) TR-55

APPENDIX F - NRCS (SCS) Type II Rainfall Distribution

APPENDIX G - Penn DOT Storm Intensity-Duration-Frequency Curve Region 3

Source: "Field Manual of Pennsylvania Department of Transportation" Storm Intensity-Duration-Frequency Charts P D T - I D F" May 1986.

APPENDIX H - Manning Roughness Coefficients

Roughness Coefficients (Manning's "n") For Overland / Sheet Flow (From U.S. Army Corps of Engineers & NRCS TR-55)

APPENDIX I - Watershed Release Rate Maps

APPENDIX J - Release Rate Percentage Application Procedures

APPENDIX K - Method for Computing Peak Discharge for Water Quality Storm

Adapted from Claytor and Schueler, 1996.

APPENDIX L - Acceptable Stormwater BMP's

APPENDIX M - C_p Determination Method

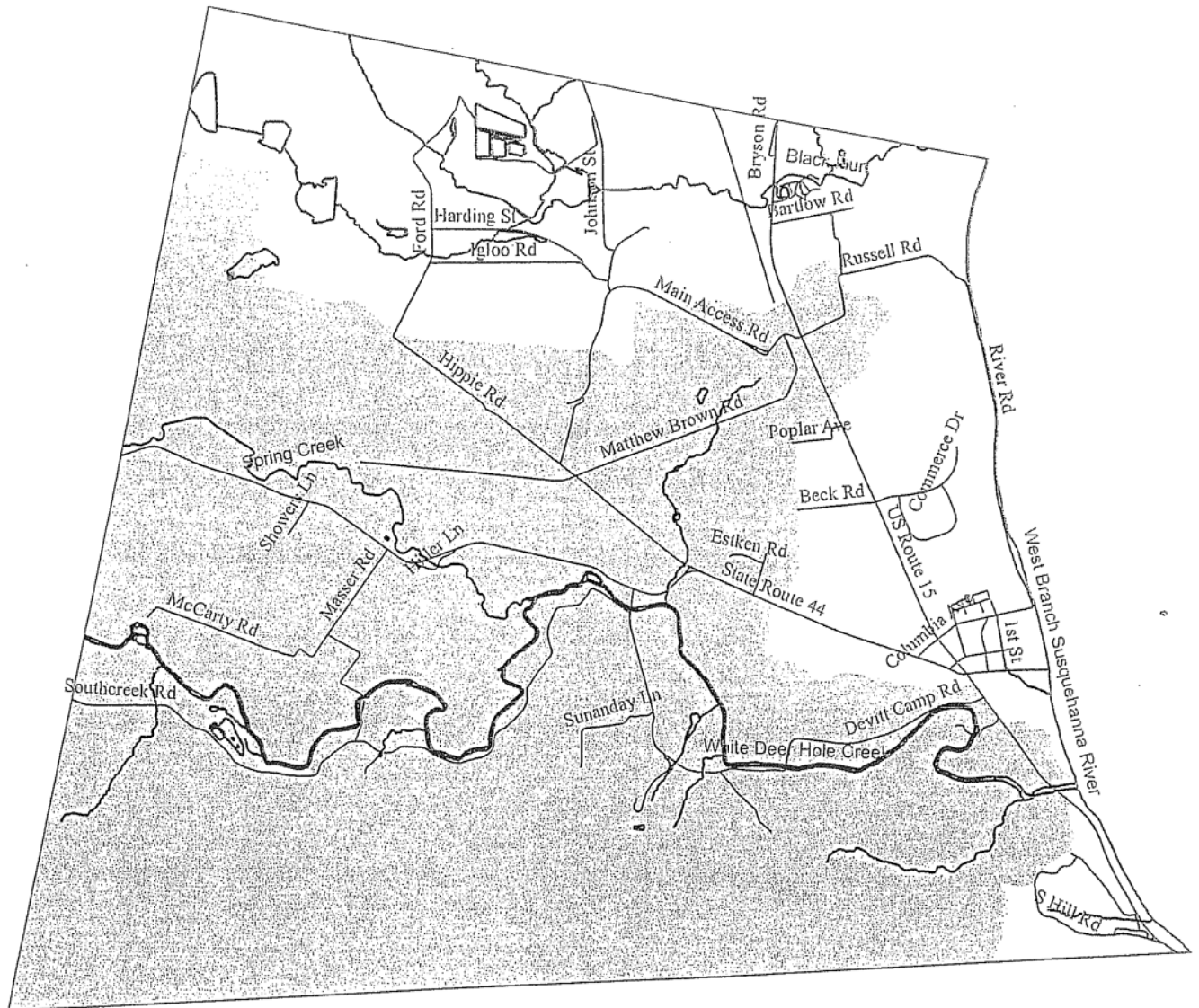
APPENDIX N - Stormwater Facilities Maintenance Agreement

APPENDIX A

Stormwater Areas Map

APPENDIX A

Gregg Township Stormwater Areas Map



Legend

- Streams
- Roads
- Black Run Watershed
- West Branch Susquehanna River
- White Deer Hole Creek



APPENDIX B

Stormwater Management Credits

APPENDIX B

APPENDIX B

Stormwater Credits For Effective Site Planning

B.1 Stormwater Credits

In Pennsylvania, there are many programs at both the State and local level that seek to minimize the impact of land development. Critical areas, forest conservation, and local stream buffer requirements are designed to reduce nonpoint source pollution. Non-structural practices can play a significant role in reducing water quality impacts and are increasingly recognized as a critical feature of every stormwater BMP plan, particularly with respect to site design. In most cases, non-structural practices must be combined with structural practices to meet stormwater requirements. The key benefit of non-structural practices is that they can reduce the generation of stormwater from the site; thereby reducing the size and cost of stormwater storage. In addition, they can provide partial removal of many pollutants. Non-structural practices have been classified into six broad groups and are designed to mesh with existing state and local programs (e.g., forest conservation, stream buffers, etc.). To promote greater use, a series of six stormwater credits are provided for designers that use these site planning techniques.

- Credit 1. Natural Area Conservation
- Credit 2. Disconnection of Rooftop Runoff
- Credit 3. Disconnection of Non-Rooftop Runoff
- Credit 4. Sheet Flow to Buffers
- Credit 5. Grass Channel
- Credit 6. Environmentally Sensitive Development

This Appendix describes each of the credits for the six groups of non-structural practices, specifies minimum criteria to be eligible for the credit, and provides an example of how the credit is calculated. Designers should check with the Municipal Engineer to ensure that the credit is applicable to their jurisdiction.

In general, the stormwater sizing criteria provide a strong incentive to reduce impervious cover at development sites. Storage requirements for all five stormwater sizing criteria are directly related to impervious cover. Thus, significant reductions in impervious cover result in smaller required storage volumes and, consequently, lower BMP construction costs.

These and other site design techniques can help to reduce impervious cover, and consequently, the stormwater treatment volume needed at a site. The techniques presented in this Chapter are considered options to be used by the designer to help reduce the need for stormwater BMP storage capacity. Due to local safety codes, soil conditions, and topography, some of these site design features will be restricted. Designers are encouraged to consult with the Municipal Engineer to determine restrictions on non-structural strategies.

NOTE: In this chapter, *italics* indicate mandatory performance criteria, whereas suggested design criteria are shown in normal typeface.

These credits are an integral part of a project's overall stormwater management plan and BMP storage volume calculation. Therefore, use of these credits shall be documented at the initial (concept) design stage, documented with submission of final grading plans, and verified with "as-built" plans. If a planned credit is not implemented, then BMP volumes shall be increased appropriately to stormwater sizing criteria.

Table B.1 Summary of Stormwater Credits

Stormwater Credit	WQ _v	Re _v	Cp _v or Q _p
Natural Area Conservation	Reduce Site Area	No credit. Use as receiving area w/Percent Area Method.	Forest/meadow CN for natural areas.
Disconnection of Rooftop Runoff	Reduced R _v	No credit. Use with Percent Area Method.	Longer tc (increased flow path). CN credit.
Disconnection of Non-Rooftop Runoff	Reduced R _v	No credit. Use with Percent Area Method.	Longer tc (increased flow path). CN credit
Sheet Flow to Buffers	Subtract contributing site area to BMP	Reduced Re _v	CN credit.
Open Channel Use	May meet WQ _v	Meets Re _v	Longer tc (increased flow path). No CN credit
Environmentally Sensitive Development	Meets WQ _v	Meets Re _v	No CN credit. tc may increase.

B.2 Natural Area Conservation Credit

A stormwater credit is given when natural areas are conserved at development sites, thereby retaining pre development hydrologic and water quality characteristics. A simple WQ_v credit is granted for all conservation areas permanently protected under conservation easements or other locally acceptable means. Examples of natural area conservation include:

- forest retention areas
- non-tidal wetlands and associated buffers
- other lands in protective easement (floodplains, open space, steep slopes)
- stream systems

Under the credit, a designer can subtract conservation areas from total site area when computing the water quality volume. The volumetric runoff coefficient, R_v, is still calculated based on the percent impervious cover for the entire site.

As an additional incentive, the post development curve number (CN) used to compute the Cp_v or Qp2, and Qp10 for all natural areas protected by conservation easements can be assumed to be woods in good condition when calculating the total site CN.

As an example, the required WQ_v for a ten acre site with three acres of impervious area and three acres of protected conservation area before the credit would be:

$$WQ_v = [(P)(R_v)(A)]/12; \text{ where } P= 1.2'', R_v= 0.05+0.009(30\%)$$

$$WQ_v = [(1.2'') (0.32)(10 \text{ acres})]/12 = 0.320 \text{ ac-ft}$$

Under the credit, three acres of conservation are subtracted from total site area, which yields a smaller storage volume:

$$WQ_v = [(P)(R_v)(A)]/12; \text{ where } P=1.2'', R_v=0.05+0.009(30\%)$$

$$WQ_v = [(1.2'')(0.32)(10-3 \text{ acres})]/12 = 0.224 \text{ ac-ft}$$

The recharge requirement ($R_{e,v}$) is not reduced using this credit.

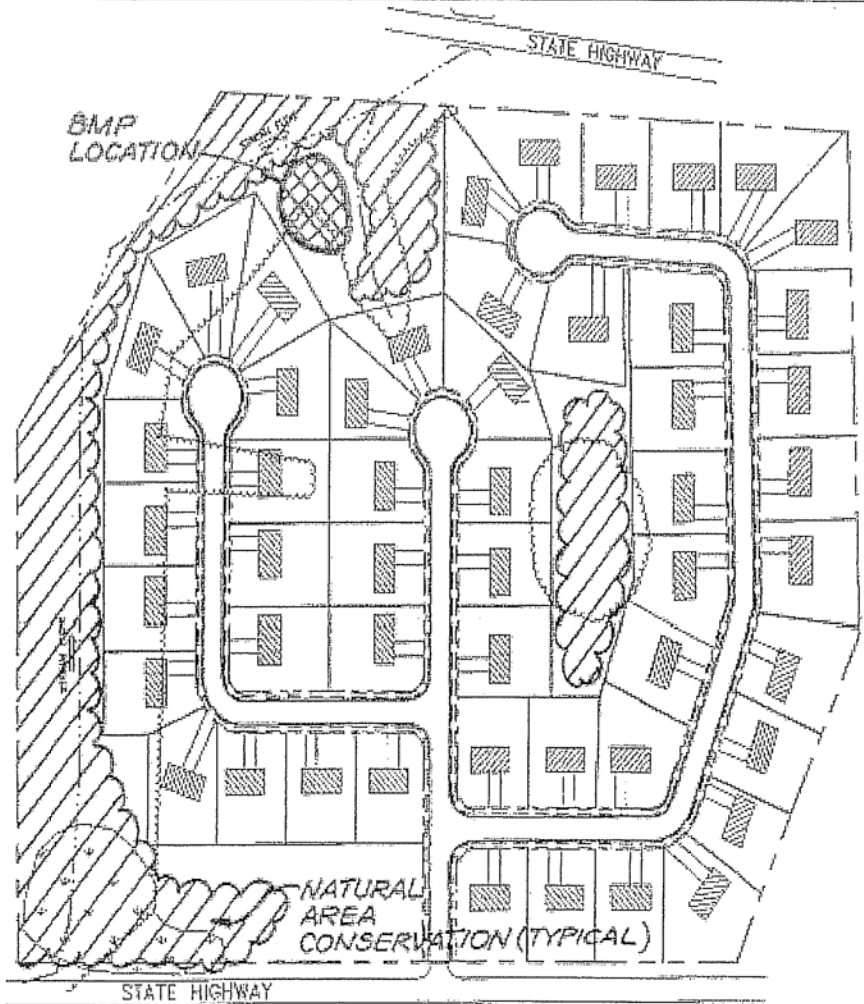
Criteria for Natural Area Credit

To receive the credit, the proposed conservation area:

- *Shall not be disturbed during project construction (e.g., cleared or graded) except for temporary impacts associated with incidental utility construction or mitigation and afforestation projects.*
- *Shall be protected by having the limits of disturbance clearly shown on all construction drawings and delimited in the field except as provided for above.*
- *Shall be located within an acceptable conservation easement or other enforceable instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management], and shall be located within the project site.*

Example of Calculating Natural Area Credit

Site Data - 51 Single Family
Lots
Area = 38 ac
Conservation Area = 7.0 ac
Impervious Area = 13.8 ac
 $R_v = .38, P = 1.2''$
Post dev. CN = 78
Original $WQ_v = 1.44$ ac-ft
Original $Re_v = 0.25$ ac-ft
Original $Cp_v = 1.65$ ac-ft



Computation of Stormwater Credits

$$\begin{aligned} WQ_v &= [(P)(R_v)(A)]/12 \\ &= [(1.2)(.38)(38.0 - 7.0 \text{ ac})]/12 \\ &= 1.18 \text{ ac-ft} \end{aligned}$$

Re_v = Same as original

(However, area draining to Natural Area may be used with the Percent Area Method)

CN reduced from 78 to 75

B.3 Disconnection of Rooftop Runoff Credit

A credit is given when rooftop runoff is disconnected and then directed to a pervious area where it can either infiltrate into the soil or filter over it. The credit is typically obtained by grading the site to promote overland filtering or by providing bioretention areas on single family residential lots.

If a rooftop is adequately disconnected, the disconnected impervious area may be deducted from total impervious cover (therefore reducing WQ_v). In addition, disconnected rooftops can be used to meet the Re_v requirement as a non-structural practice using the percent area method.

Post development CN's for disconnected rooftop areas used to compute Cp_v and Q_p can be assumed to be woods in good condition.

Criteria for Disconnection of Rooftop Runoff Credit

The credit is subject to the following restrictions:

- *Rooftop cannot be within a designated hotspot.*
- *Disconnection shall cause no basement seepage.*
- *The contributing area of rooftop to each disconnected discharge shall be 500 square feet or less.*
- *The length of the "disconnection" shall be 75 feet or greater, or compensated using Table B.1*
- *Dry wells, french drains, raingardens, or other similar storage devices may be utilized to compensate for areas with disconnection lengths less than 75 feet. (See Table B.1 and Figure B.1, dry wells are prohibited in "D" soils)*
- *In residential development applications, disconnections will only be credited for lot sizes greater than 6000 sq. ft.*
- *The entire vegetative "disconnection" shall be on an average slope of 5% or less.*
- *The disconnection must drain continuously through a vegetated channel, swale, or through a filter strip to the property line or BMP.*
- *Downspouts must be at least 10 feet away from the nearest impervious surface to discourage "re-connections".*
- *For those rooftops draining directly to a buffer, only the rooftop disconnection credit or the buffer credit may be used, not both.*

Figure B.1 Schematic of Dry Well

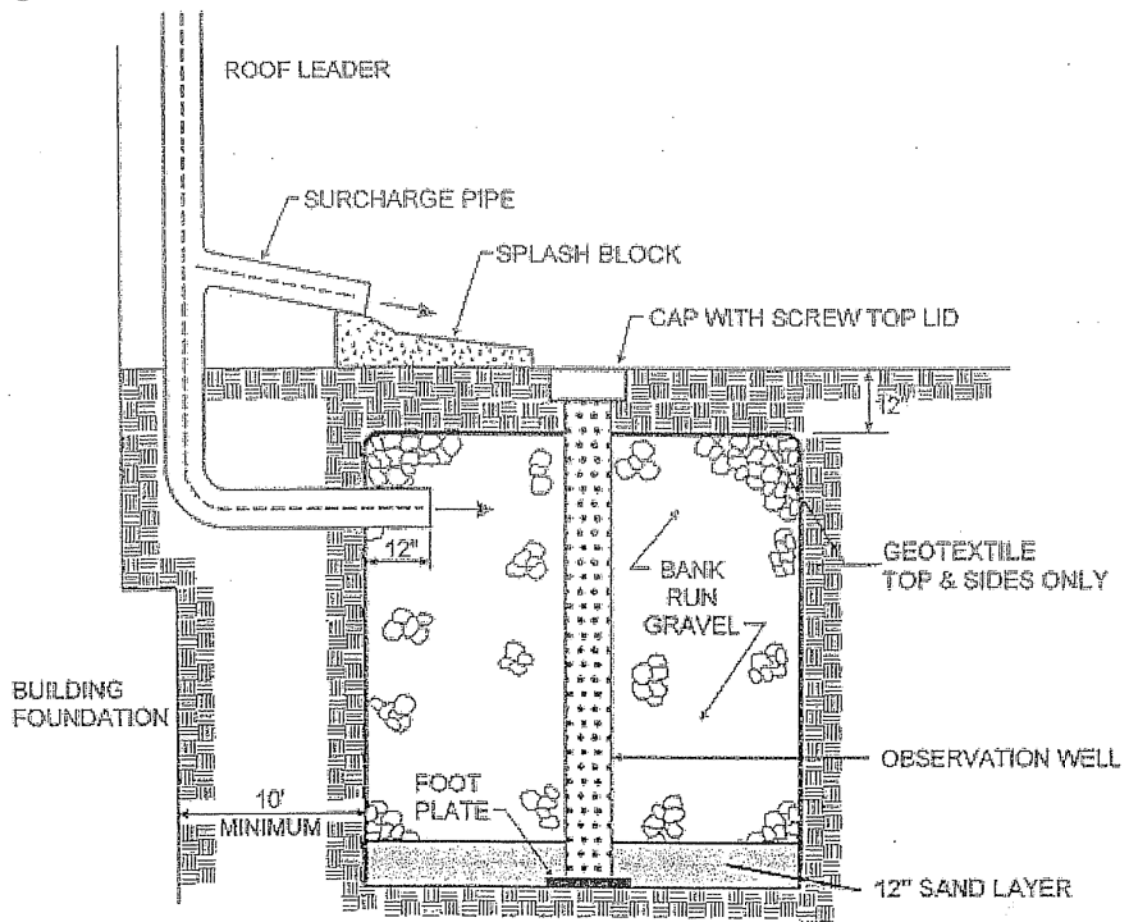


Table B.1 Rooftop Disconnection Compensation Storage Volume Requirements (Per Disconnection Using Drywells, Raingardens, etc.)

Disconnection Length Provided	0 - 14 ft.	15 - 29 ft.	30 - 44 ft.	45 - 59 ft.	60 - 74 ft.	≥75 ft.
% WQ _v Treated by Disconnect	0%	20%	40%	60%	80%	100%
% WQ _v Treated by Storage	100%	80%	60%	40%	20%	0%
Max. Storage Volume*	48 cu-ft.	39 cu-ft.	30 cu-ft.	21 cu-ft.	12 cu-ft.	0 cu-ft.

*Assuming 500 square feet roof area to each downspout.

Example of Using the Rooftop Disconnection Credit

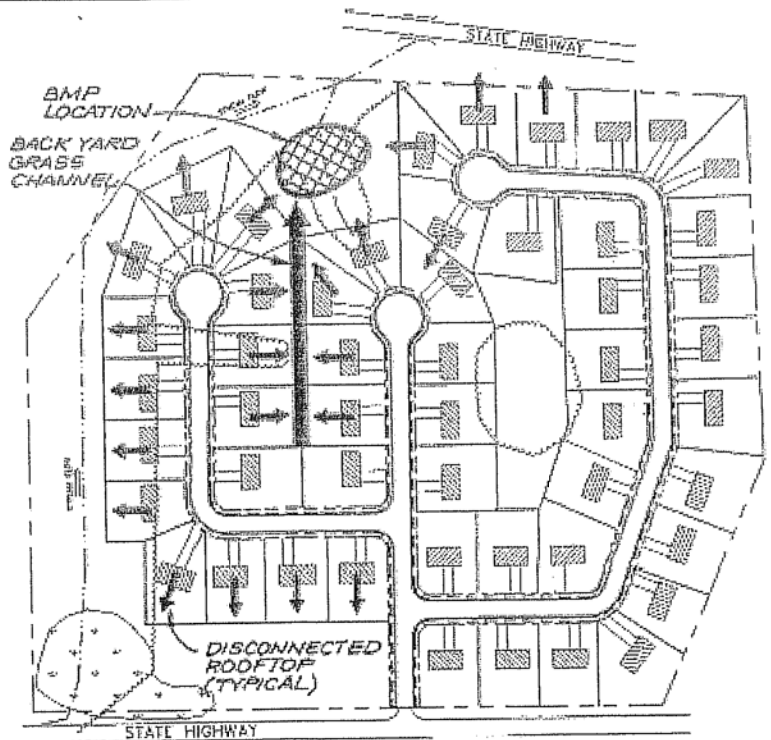
Site Data - 51 Single Family Lots
 Area = 38 ac, ½ ac lots
 Original Impervious Area = 13.80 ac
 Original $R_v = 0.38$
 Post dev. CN = 78
 # of Disconnected Rooftops = 22
 Original $WQ_v = 1.44$ ac-ft
 Original $Re_v = 0.25$ ac-ft
 Original $Cp_v = 1.65$ ac-ft

60% B Soils
 40% C Soils
 Composite $S=0.218$ (21.8%)

22 Lots Disconnected w/5
 Downspouts each
 2500 sf. each lot

Net impervious area reduction =
 $(22)(2500)/43560 = 1.3$ ac

Net Impervious Area =
 $13.8 - 1.3 = 12.5$ ac



Computation of Stormwater Credit:

New $R_v = 0.05 + 0.009 (12.5 \text{ ac}/38 \text{ ac}) = 0.35$
 $WQ_v = [(1.2)(.35)(38 \text{ ac})]/ 12 = 1.33$ ac-ft

Required Re_v (Percent Area Method)

$Re_v = 21.8\% \times 13.8 \text{ ac.} = 3.01$ ac

Re_v treated by disconnection = 1.3 ac

Re_v remaining for treatment = 1.71 acres non structurally or 0.14 ac-ft structurally

CN reduced from 78 to 76

B.4 Disconnection of Non-Rooftop Runoff Credit

Credit is given for practices that disconnect surface impervious cover runoff by directing it to pervious areas where it is either infiltrated into the soil or filtered (by overland flow). This credit can be obtained by grading the site to promote overland vegetative filtering or providing bioretention areas on single family residential lots.

These "disconnected" areas can be subtracted from the impervious area when computing WQ_v . In addition, disconnected surface impervious cover can be used to meet the Re_v requirement as a non-structural practice using the percent area method.

Criteria for Disconnection of Non-Rooftop Runoff Credit

The credit is subject to the following restrictions:

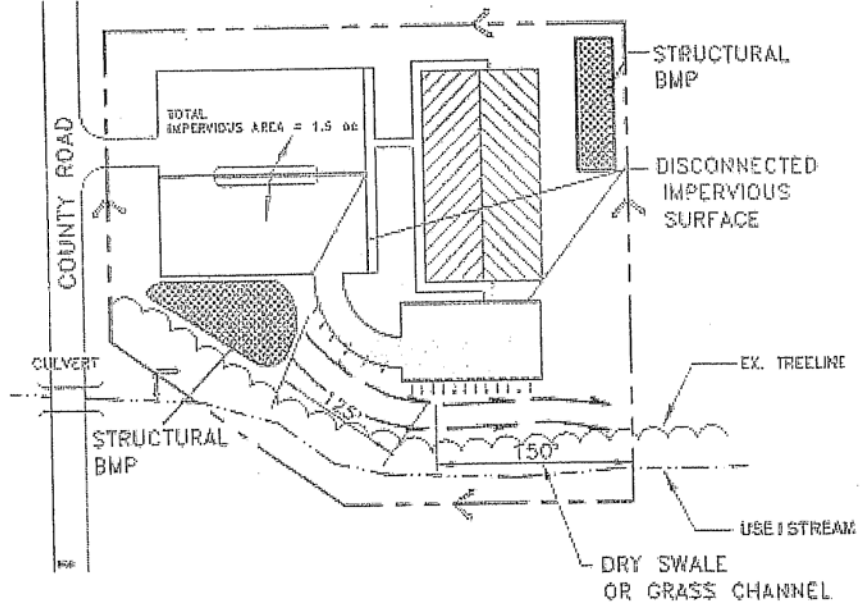
- *Runoff cannot come from a designated hotspot.*
- *The maximum contributing impervious flow path length shall be 75 feet.*
- *The disconnection shall drain continuously through a vegetated channel, swale, or filter strip to the property line or BMP.*
- *The length of the "disconnection" must be equal to or greater than the contributing length.*
- *The entire vegetative "disconnection" shall be on an average slope of 5% or less.*
- *The surface impervious area to any one discharge location cannot exceed 1,000 ft².*
- *Disconnections are encouraged on relatively permeable soils (HSG's A and B).*
- *If the site cannot meet the required disconnect length, a spreading device, such as a french drain, gravel trench or other storage device may be needed for compensation.*
- *For those areas draining directly to a buffer, only the non rooftop disconnection credit or the stream buffer credit can be used, not both.*

Example of Calculating the Non-Rooftop Disconnection Credit

Site Data -Community Center
 Area = 3.0 ac
 Original Impervious Area =
 1.9 ac = 63.3%
 Original $R_v = .62$
 Post dev. CN = 83
 B Soils, $S = 0.27$
 Original $WQ_v = 8102 \text{ ft}^3$
 Original $Re_v = 1688 \text{ ft}^3$
 Original $Cp_v = \text{N/A}$

0.33 ac of surface imperviousness
 disconnected

Net impervious area reduction
 $1.9 - 0.33 = 1.57 \text{ ac}$



Computation of Stormwater Credit:

$$\text{New } R_v = 0.05 + 0.009 (1.57 \text{ ac} / 3.0 \text{ ac}) = .52$$

$$WQ_v = [(1.2)(0.52)(3.0 \text{ ac})] 12 = 0.16 \text{ ac-ft (6795 ft}^3\text{)}$$

Required Re_v (Percent area method)

$$Re_v = (S)(Ai) = (0.27)(1.9 \text{ ac}) = 0.51 \text{ ac}$$

Re_v treated by disconnection = 0.33 ac

Re_v remaining for treatment = 0.18 ac non structurally or 595.8 cf structurally

Post developed CN may be reduced

B.5 Sheetflow to Buffers Credit

This credit is given when stormwater runoff is effectively treated by a natural buffer to a stream or forested area. Effective treatment is achieved when pervious and impervious area runoff is discharged to a grass or forested buffer through overland flow. The use of a filter strip is also recommended to treat overland flow in the green space of a development site.

The credits include:

1. The area draining by sheet flow to a buffer is subtracted from the total site area in the WQ_v calculation.
2. The area draining to the buffer contributes to the recharge requirement, Re_v .
3. A wooded CN can be used for the contributing area if it drains to a forested buffer.

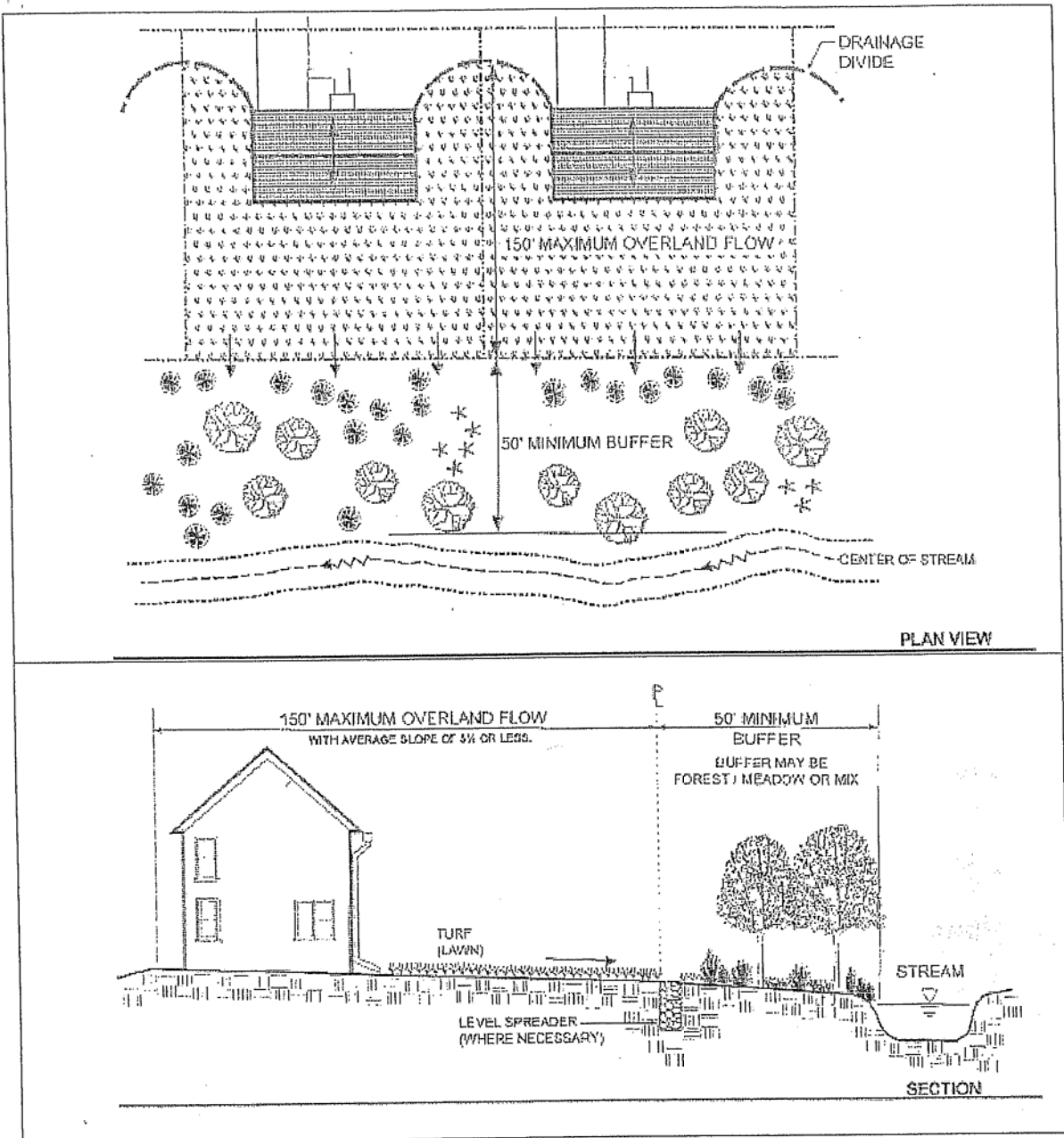
Criteria for Sheetflow to Buffers Credit

The credit is subject to the following conditions:

- *The minimum buffer width shall be 50 feet as measured from bankfull elevation or centerline of the buffer.*
- *The maximum contributing length shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces.*
- *Runoff shall enter the buffer as sheet flow. Either the average contributing overland slope shall be 5.0% or less, or a concrete level spreading device shall be used where sheet flow can no longer be maintained.*
- *Not applicable if rooftop or non rooftop disconnection is already provided.*
- *Buffers shall remain unmanaged other than routine debris removal.*
- *Shall be located within an acceptable conservation easement or other enforceable instrument that ensures perpetual protection of the proposed area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked [Note: managed turf (e.g., playgrounds, regularly maintained open areas) is not an acceptable form of vegetation management].*
- The Rev credit for sheetflow to buffer is not applicable in HSG's C and D.

Figure B.2 illustrates how a buffer or filter strip can be used to treat stormwater from adjacent pervious and impervious areas.

Figure B.2 Example of Sheetflow to Buffers Credit



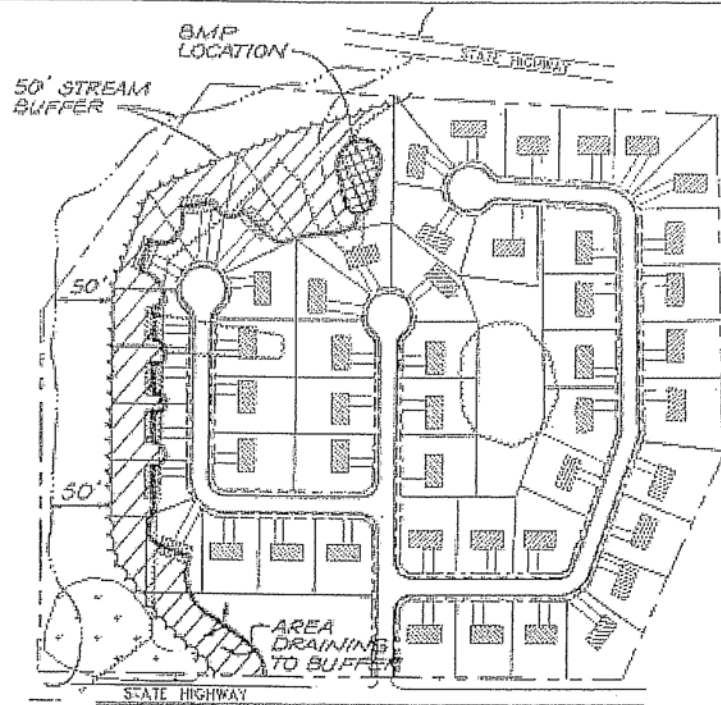
Example of Using the Sheetflow to Buffers Credit

Site Data - 51 Single Family
 Area = 38.0 ac
 Original Impervious Area =
 13.8 ac = 36.3%
 Original $R_v = .38$
 Post-dev. CN = 78

Original $WQ_v = 1.44$ ac-ft
 Original $Re_v = 0.24$ ac-ft
 Original $Cp_v = 1.65$ ac-ft

Credit

5.0 ac draining to buffer/filter strip
 Rooftops represent 3% of site
 imperviousness = 0.41 ac



Computation of Stormwater Credits

New drainage area = 38 ac - 5 ac = 33.0 ac
 R_v remains unchanged to BMP; $R_v = 0.05 + 0.009(36.3) = 0.38$

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

$$= [(1.2)(0.38)(33.0 \text{ ac.})]/12$$

$$= 1.25 \text{ ac-ft}$$

Required Re_v (Percent Area Method)

$Re_v = 21.8\% \times 13.8 \text{ ac.} = 3.01 \text{ acres}$
 Re_v treated by disconnection = 0.41 acres
 Re_v remaining for treatment = 2.60 acres non structurally or 0.207 ac-ft structurally

CN is reduced slightly

B.6 Grass Channel Credit (in lieu of Curb and Gutter)

Credit may be given when open grass channels are used to reduce the volume of runoff and pollutants during smaller storms (e.g., < 1 inch). The schematic of the grass channel is provided in Figure B.3.

Use of a grass channel will automatically meet the Re_v for impervious areas draining into the channel. However, Re_v for impervious areas not draining to grass channels must still be addressed. If designed according to the following criteria, the grass channel will meet the WQ_v as well.

CNs for channel protection or peak flow control (Cp_v or Q_p) will not change.

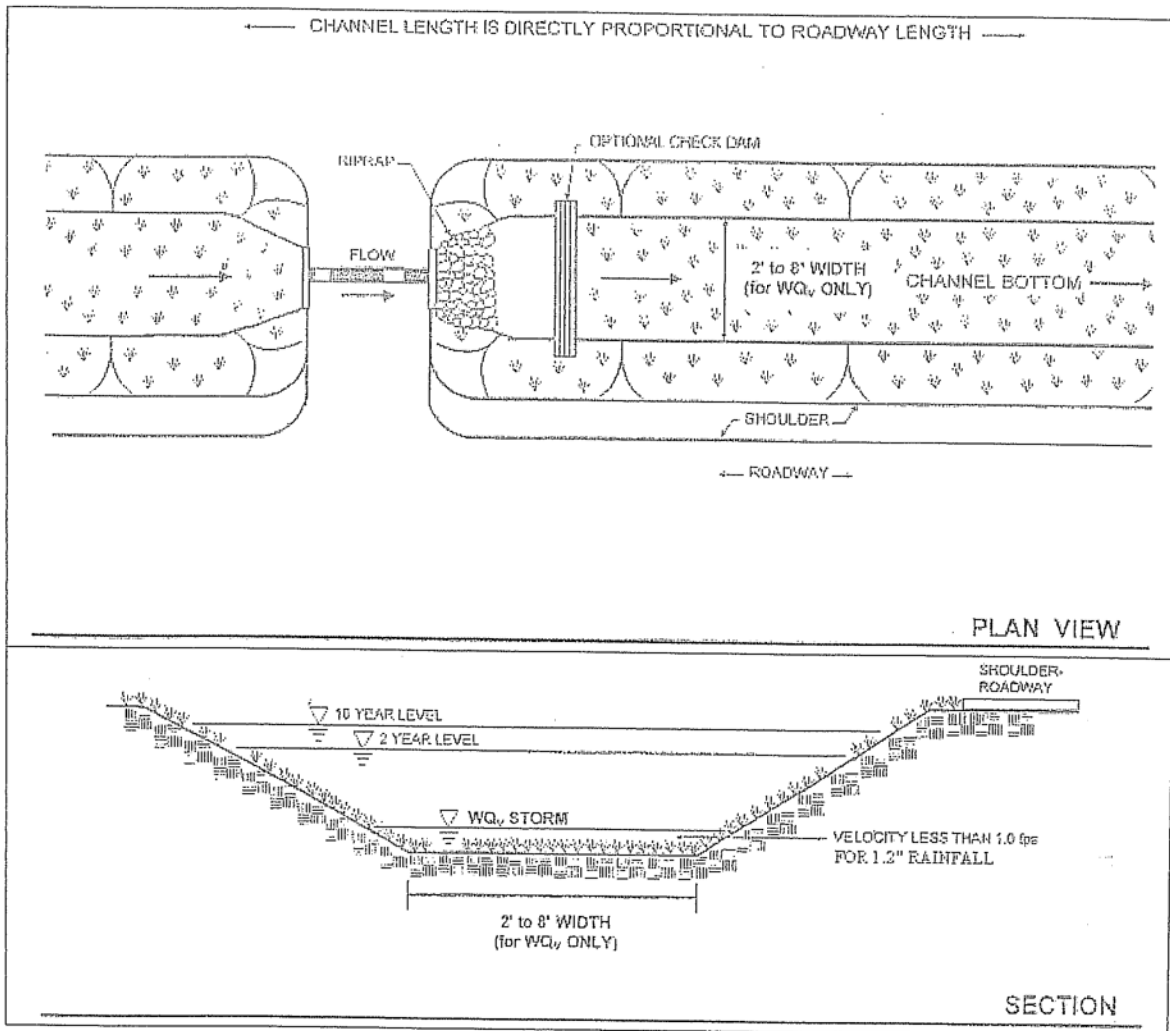
Criteria for the Grass Channel Credit

The WQ_v credit is obtained if a grass channel meets the following criteria:

- *The maximum flow velocity for runoff from the 1.2 inch rainfall shall be less than or equal to 1.0 fps.*
- *The maximum flow velocity for runoff from the 10-year design event shall be non-erosive.*
- *The bottom width shall be 2 feet minimum and 8 feet maximum.*
- *The side slopes shall be 3:1 or flatter.*
- *The channel slope shall be less than or equal to 4.0%.*
- *Not applicable if rooftop disconnection is already provided (see Credit B.2).*
- *Credit for use of grass channels is not applicable in HSG's C and D.*

An example of a grass channel is provided in Figure B.3.

Figure B.3 Example of Grass Channel



Example of Grass Channel Credit

Site Data - 51 Single Family

Residences

Area = 38.0 ac

Original Impervious Area =

13.8 = 36.3%

$R_v = 0.38$

CN = 78

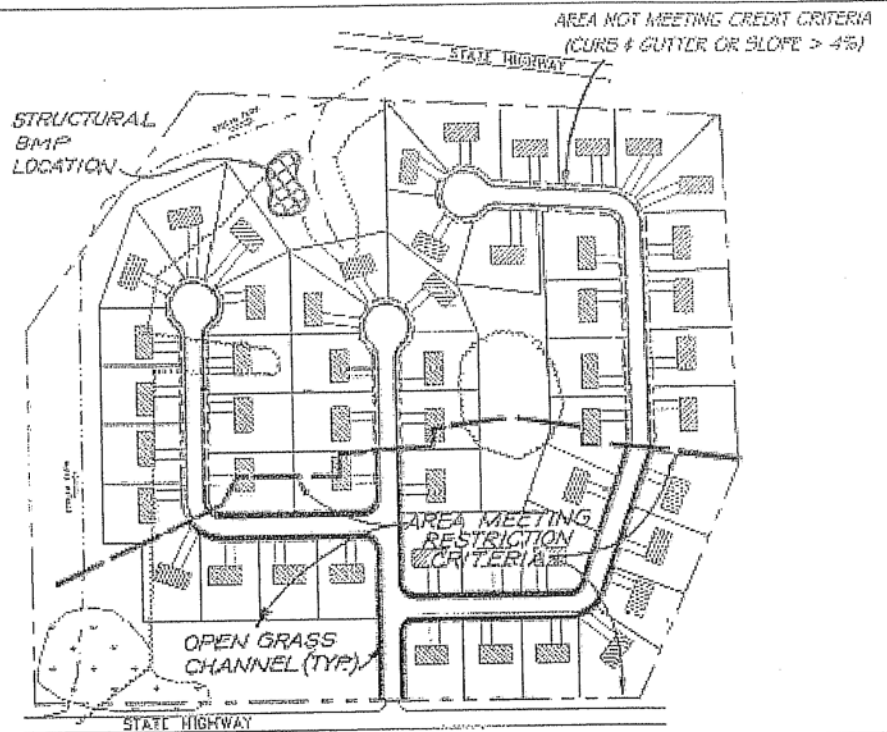
Original $WQ_v = 1.44$ ac-ft

Original $Re_v = 0.25$ ac-ft

Original $Cp_v = 1.65$ ac-ft

Credit

12.5 ac meet grass channel criteria



Computation of Stormwater Credits

New WQ_v Area = 38 ac - 12.5 ac = 25.5 ac

$WQ_v = [(1.2)(0.38)(25.5 \text{ ac})]/12$

= 0.97 ac-ft

Required Re_v (Percent Area Method)

$Re_v = 21.8\% \times 13.8 \text{ ac} = 3.01 \text{ ac}$

4.5 ac of imperviousness lie within area drained by grass channels, and

4.5 ac > 3.01 ac

Re_v requirement is met

Cp_v and Q_p : No change

B.7 Environmentally Sensitive Development Credit

Credit is given when a group of environmental site design techniques are applied to low density or residential development. The credit eliminates the need for structural practices to treat both the Re_v and WQ_v and is intended for use on large lots.

Criteria for Environmentally Sensitive Development Credit

These criteria can be met without the use of structural practices in certain low density residential developments when the following conditions are met:

For Single Lot Development:

- *Total site impervious cover is less than 15%.*
- *Lot size shall be at least two acres.*
- *Rooftop runoff is disconnected in accordance with the criteria outlined in Section B.3.*
- *Grass channels are used to convey runoff versus curb and gutter.*

For Multiple Lot Development:

- *Total site impervious cover is less than 15%.*
- *Lot size shall be at least two acres if clustering techniques are not used.*
- *If clustering techniques are used, the average lot size shall not be greater than 50% of the minimum lot size as identified in the appropriate local zoning ordinance and shall be at least one half acre.*
- *Rooftop runoff is disconnected in accordance with the criteria outlined in Section B.3.*
- *Grass channels are used to convey runoff versus curb and gutter.*
- *A minimum of 25% of the site is protected in natural conservation areas (by permanent easement or other similar measure).*
- *The design shall address stormwater (Re_v , WQ_v , Cp_v , and extreme events) for all roadway and connected impervious surfaces.*

Example of Environmentally Sensitive Development Credit

Site Data - 1 Single Family Lot

Area = 2.5 ac

Conservation Area = 0.6 ac

Impervious Area = .35 ac (includes adjacent road surface) = 14%

B soils

$R_v = 0.05 + 0.009(14) = 0.18$

CN = 65

WQ_v : Use $P=0.2$ as $I < 15\%$

$$WQ_v = [(0.2)(A)]/12$$

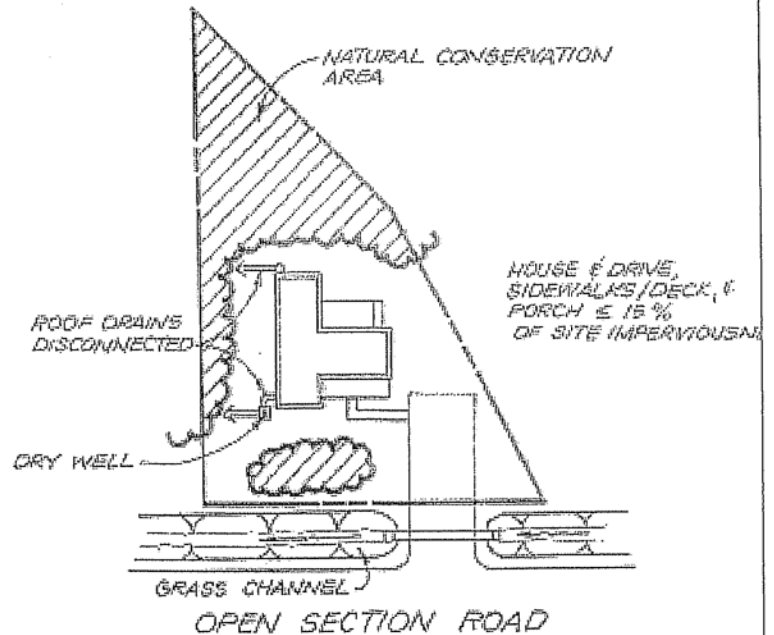
$$= [(0.2)(2.5)]/12 \times (43560 \text{ ft}^2/\text{ac})$$

$$= 1,815 \text{ ft}^3$$

$$Re_v = [(S)(R_v)(A)]/12$$

$$= [(0.27)(0.18)(2.5)]/12 \times (43,560 \text{ ft}^2/\text{ac})$$

$$= 441.0 \text{ ft}^3$$



Computation of Stormwater Credits:

WQ_v is met by site design

Re_v is met by site design

Cp_v : No change in CN, tc may be longer which would reduce Q_p requirements

APPENDIX C

Runoff Curve Numbers

APPENDIX C

APPENDIX C

Runoff Curve Numbers
Source: NRCS (SCS) TR-55

Runoff Curve Numbers for Urban Areas					
Cover Description		Curve Numbers for Hydrologic Soil Groups			
<i>Cover Type and Hydrologic Condition</i>	<i>Average % Impervious Area</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>Fully Developed Urban Areas (Vegetation Established)</i>					
Open Space (lawns, parks, golf courses, etc)					
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.		98	98	98	98
Streets and Roads					
Paved: Curbed and Storm Sewers		98	98	98	98
Paved: Open Ditches		83	89	92	93
Gravel		76	85	89	91
Dirt		72	82	87	89
Western Desert Urban Areas					
Natural Desert Landscaping (pervious area only)		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	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

APPENDIX C (Cont'd.)

Runoff Curve Numbers
Source: NRCS (SCS) TR-55

Runoff Curve Numbers for Cultivated Agricultural Lands						
Cover Description			Curve Numbers for Hydrologic Soil Groups			
<i>Cover Type</i>	<i>Treatment</i>	<i>Hydrologic Condition</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
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

APPENDIX C (Cont'd.)

RUNOFF CURVE NUMBERS

Source: NRCS (SCS) TR-55

Runoff Curve Numbers for Other Agricultural Lands					
Cover Description		Curve Numbers for Hydrologic Soil Groups			
Cover Type	Hydrologic Condition	A	B	C	D
Pasture, Grassland, or Range - Continuous Forage for Grazing	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	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30	48	65	73
Woods - Grass Combination (Orchard or Tree Farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Farmsteads - Buildings, Lanes, Driveways, and Surrounding Lots	--	59	74	82	86

APPENDIX C (Cont'd.)

Runoff Curve Numbers
Source: NRCS (SCS) TR-55

Runoff Curve Numbers For Cultivated Agricultural Lands					
Cover Description		Curve Numbers for Hydrologic Soil Groups			
Cover Type	Hydrologic Condition	A	B	C	D
Herbaceous - Mixture of Grass, Weeds, and Low-Growing Brush, With Brush the Minor Element	Poor	--	80	87	93
	Fair	--	71	81	89
	Good	--	62	74	85
Oak-Aspen - Mountain Brush Mixture of Oak Brush, Aspen, Mountain Mahogany, Bitter Brush, Maple, and Other Brush	Poor	--	66	74	79
	Fair	--	48	57	63
	Good	--	30	41	48
Pinyon-Juniper - Pinyon, Juniper, or Both; Grass Understory	Poor	--	75	85	89
	Fair	--	58	73	80
	Good	--	41	61	71
Sagebrush With Grass Understory	Poor	--	67	80	85
	Fair	--	51	63	70
	Good	--	35	47	55
Desert Shrub - Major Plants Include Saltbrush, Greasewood, Creosotebush, Blackbrush, Bursage, Palo Verde, Mesquite, and Cactus	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

APPENDIX D

Runoff Coefficients for the Rational Method

APPENDIX D

APPENDIX D

Runoff Coefficients For The Rational Method

Source: Rawls, W.J., S.L. Long, and R.H. McCuen, 1981. Comparison of Urban Flood Frequency Procedures. Preliminary Draft Report prepared for the Soil Conservation Service, Beltsville, Maryland.

Land Use	A			B			C			D		
	0-2%	2-6%	6+%	0-2%	2-6%	6+%	0-2%	2-6%	6+%	0-2%	2-6%	6+%
Cultivated	0.08 ^a	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
Land	0.14 ^b	0.08	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
	0.15	0.25	0.37	0.23	0.34	0.45	0.30	0.42	0.52	0.37	0.50	0.62
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
	0.14	0.22	0.30	0.20	0.28	0.37	0.26	0.35	0.44	0.30	0.40	0.50
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20
	0.08	0.11	0.14	0.10	0.14	0.18	0.12	0.16	0.20	0.15	0.20	0.25
Residential	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
1/8 Acre	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
1/4 Acre	0.22	0.26	0.29	0.24	0.29	0.33	0.27	0.31	0.36	0.30	0.34	0.40
	0.30	0.34	0.37	0.33	0.37	0.42	0.36	0.40	0.47	0.38	0.42	0.52
1/3 Acre	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
	0.28	0.32	0.35	0.30	0.35	0.39	0.33	0.38	0.45	0.36	0.40	0.50
1/2 Acre	0.16	0.20	0.24	0.19	0.23	0.28	0.22	0.27	0.32	0.26	0.30	0.37
	0.25	0.29	0.32	0.28	0.32	0.36	0.31	0.35	0.42	0.34	0.38	0.48
1 Acre	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
	0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
	0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
	0.76	0.77	0.79	0.80	0.82	0.84	0.84	0.85	0.89	0.89	0.91	0.95
Open Space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
	0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Parking or	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
Impervious	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.96	0.97

a = Runoff coefficients for storm recurrence intervals less than 25 years

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

APPENDIX E

Design Storm Rainfall Amount

APPENDIX E

APPENDIX E

DESIGN STORM RAINFALL AMOUNT (INCHES)

The design storm rainfall amount chosen for design shall be obtained from the PENNDOT Region III Storm Intensity-Duration-Frequency Curve according to Appendix G.

Source: NRCS (SCS) TR-55

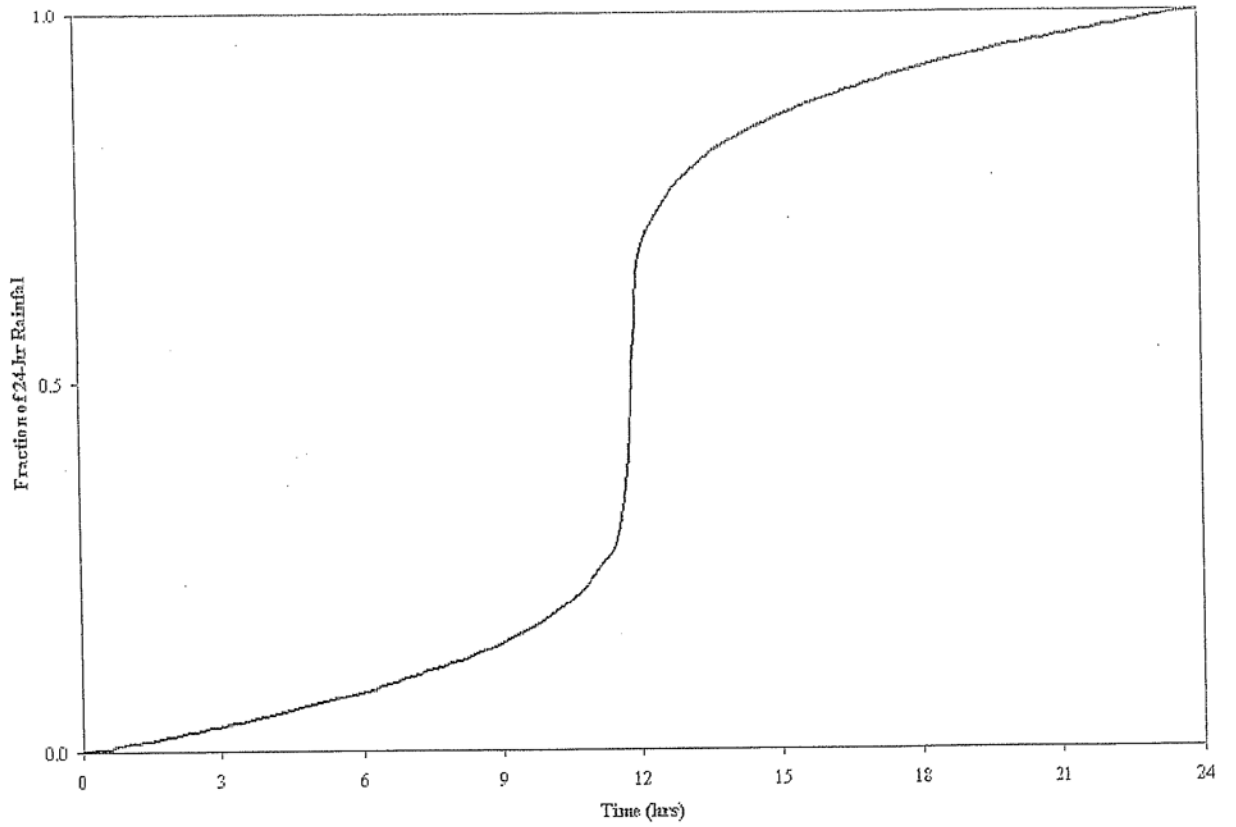
Design Storm Frequency (years)	24 Hours Rainfall Amount (inches)
1	2.2
2	2.6
5	3.1
10	3.8
25	4.6
50	5.3
100	6.0

APPENDIX F
NRCS Type II Rainfall
Distribution

APPENDIX F

APPENDIX F

NRCS (SCS) Type II Rainfall Distribution



APPENDIX G

PennDOT Storm Intensity- Duration-Frequency Curve Region III

APPENDIX G

APPENDIX G

PENN DOT Storm Intensity-Duration-Frequency Curve Region 3

Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
P D T - I D F" May 1986

REGION 3

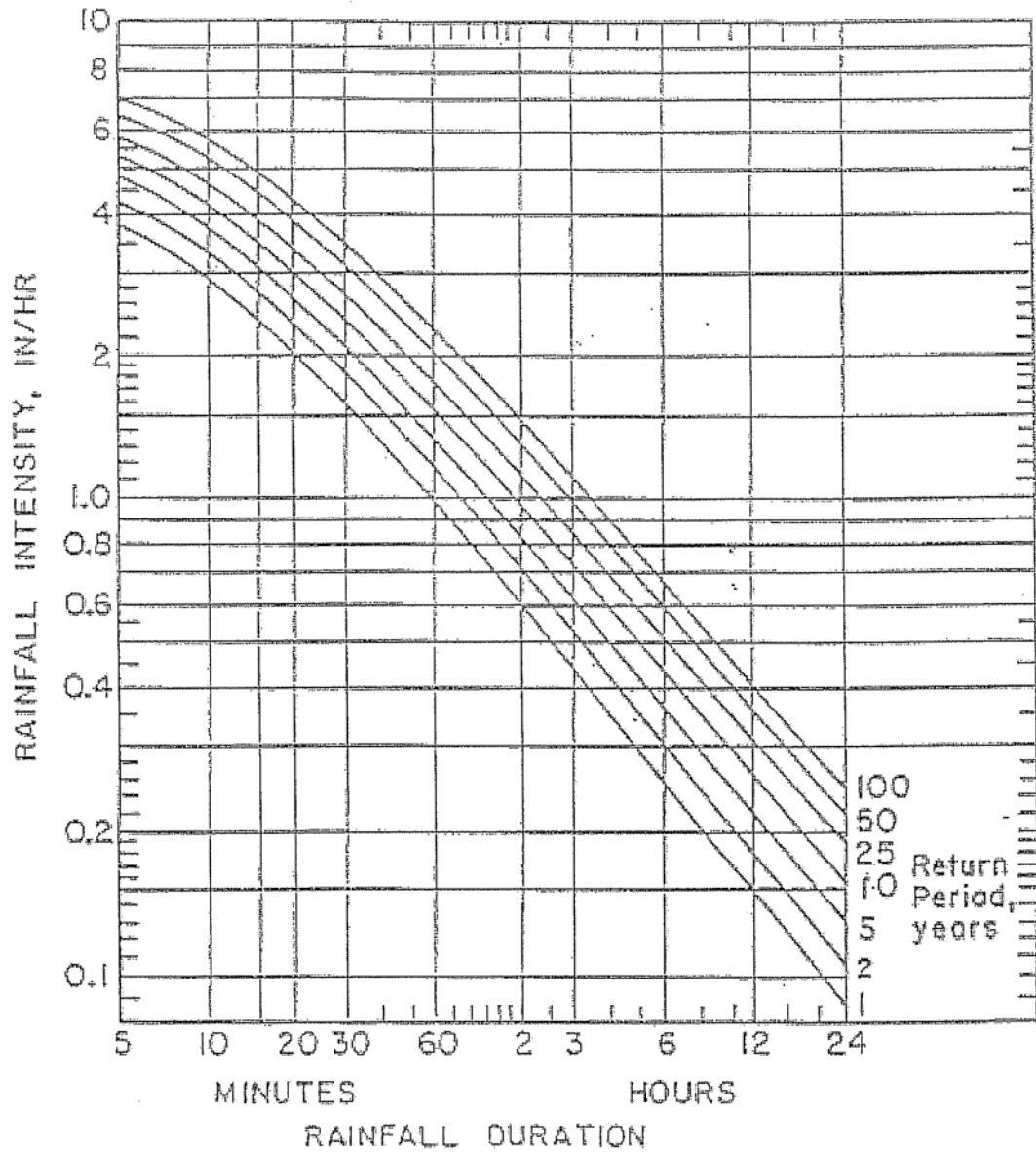


Figure 4. Storm intensity-duration-frequency curves for Region 3.

APPENDIX H
Manning Roughness
Coefficients

APPENDIX H

APPENDIX H

Manning Roughness Coefficients

Roughness Coefficients (Manning's "n") For Overland/Sheet Flow
(From U.S. Army Corps of Engineers & NRCS TR-55)

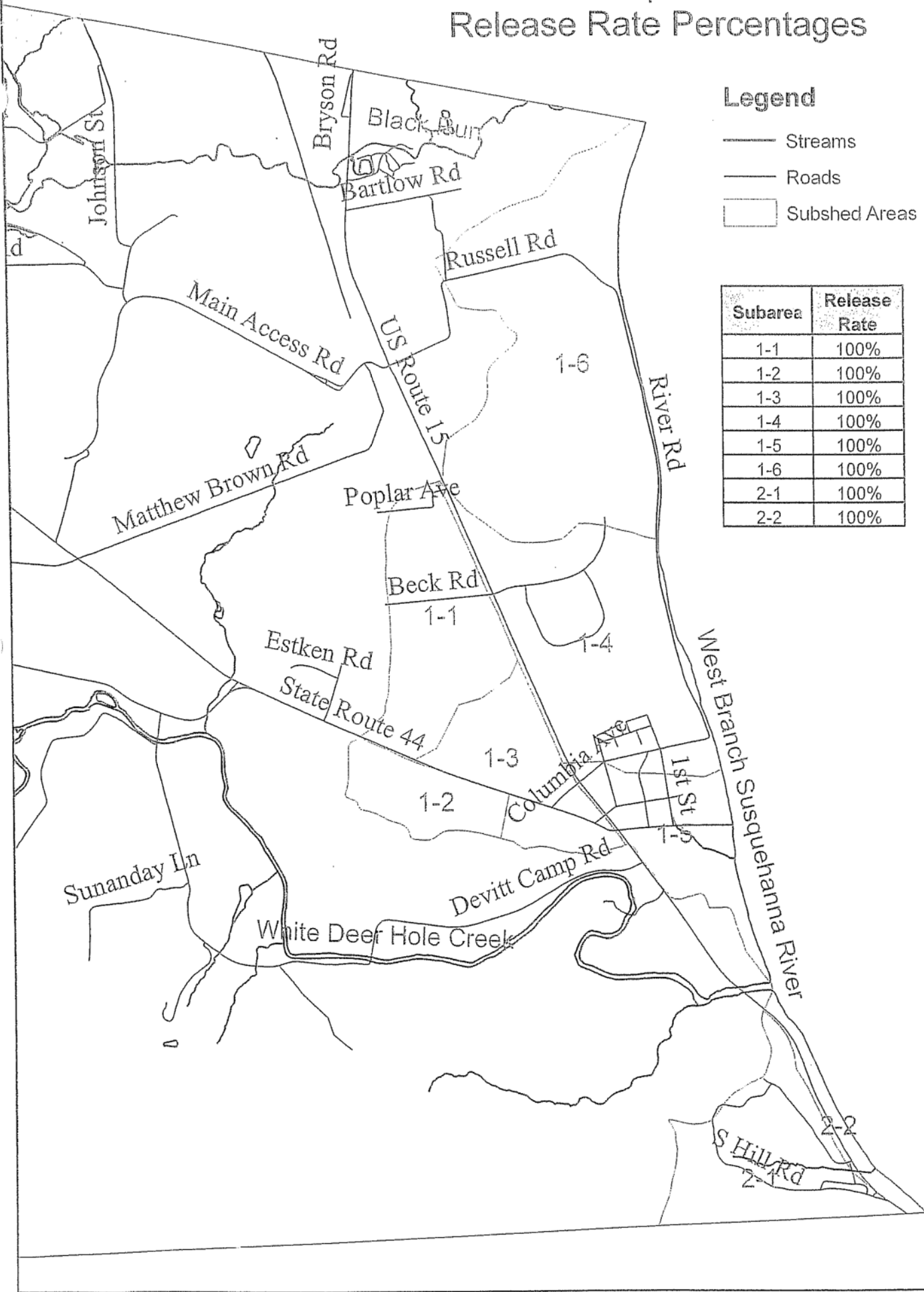
Surface Description	n
Dense Growth	0.4 - 0.5
Pasture	0.3 - 0.4
Lawns	0.2 - 0.3
Bluegrass Sod	0.2 - 0.5
Short Grass Prairie	0.1 - 0.2
Sparse Vegetation	0.05 - 0.13
Bare Clay - Loam Soil (eroded)	0.01 - 0.03
Concrete/Asphalt - very shallow depths	
(less than 1/4 inch)	0.10 - 0.15
- small depths	
(1/4 inch to several inches)	0.05 - 0.10
Fallow (no residue)	0.05
Cultivated Soils	
Residue Cover Less Than or = 20%	0.06
Residue Cover Greater Than 20%	0.17
Grass	
Dense Grasses	0.24
Bermuda Grass	0.41
Range (natural)	0.13
Woods (Light Underbrush)	0.40

APPENDIX I

Watershed Release Rate Maps

APPENDIX I

West Branch Susquehanna Subareas Release Rate Percentages



Legend

- Streams
- Roads
- Subshed Areas

Subarea	Release Rate
1-1	100%
1-2	100%
1-3	100%
1-4	100%
1-5	100%
1-6	100%
2-1	100%
2-2	100%

APPENDIX J

Release Rate Percentage Application Procedures

APPENDIX J

APPENDIX J

Release Rate Percentage Procedures

To utilize the Release Rate for a particular site in one of the delineated Release Rate Percentage areas, the applicant shall follow the following general sequence of actions.

1. Compute the pre-development and post-development runoff for the specific site using an approved method for the 2-, 10-, 25-, and 100-year storms, using **no stormwater management techniques**. If the post-development peak rate is less than or equal to the pre-development rate and time of peak of post and pre-development rates are identical, the requirements of Act 167 and the Plan have been met. If the post-development runoff rate exceeds the pre-development rate, proceed to Step 2.
2. Apply on-site stormwater management techniques to increase infiltration and reduce impervious surfaces. Recompute the post-development runoff rate for the 2-, 10-, 25-, and 100 year storms; and if the resulting post-development rate is less than or equal to the pre-development rate multiplied by the applicable release rate, the requirements of the Act 167 Plan have been met. Otherwise, stormwater detention or retention will be required and the applicant should proceed to Step 3.
3. Multiply the assigned release rate percentage for the area by the pre-development peak runoff rate to determine the allowable total peak runoff rate from the development. Design the necessary detention/retention facilities to meet the allowable peak runoff rate standard.

APPENDIX K

Method for Computing Peak Discharge for Water Quality Storm

APPENDIX K

APPENDIX K

Method for Computing Peak Discharge for Water Quality Storm (Adapted from Claytor and Schueler, 1996)

The peak rate of discharge is needed for the sizing of off-line diversion structures and to design grass channels. Conventional SCS methods underestimate the volume and rate of runoff for rainfall events less than 2 inches. This discrepancy in estimating runoff and discharge rates can lead to situations where a significant amount of runoff by-passes the filtering treatment practice due to an inadequately sized diversion structure or leads to the design of undersized grass channels.

The following procedure can be used to estimate peak discharges for small storm events. It relies on the volume of runoff computed using the Small Storm Hydrology Method (Pitt, 1994) and utilizes the NRCS, TR-55 Graphical Peak Discharge Method (USDA, 1986).

Using the WQv methodology, a corresponding Curve Number (CN) is computed utilizing the following equation:

$$CN = \frac{1000}{[10+5P+10Q_a - 10(Q_a^2 + 1.25 Q_a P)^{1/2}]}$$

Where: P = rainfall, in inches (use 1.2" for the Water Quality Storm)

Q_a = runoff volume, in inches (equal to P x R_v)

Note: The above equation is derived from the SCS Runoff Curve Number method described in detail in NEH-4, Hydrology (SCS 1985) and SCS TR-55 Chapter 2: Estimating Runoff. The CN can also be obtained graphically using Figure 1 of this Appendix from TR-55.

Once a CN is computed the time of concentration (t_c) is computed (based on the methods identified in TR-55, Chapter 3: "Time of Concentration and Travel Time").

Using the computed CN, t_c and drainage area (A), in acres; the peak discharge (Q_p) for the Water Quality Storm is computed (based upon the procedures identified in TR-55, Chapter 4: "Graphical Peak Discharge Method"). Use Rainfall distribution type II.

- Read initial abstraction (I_a), compute I_a/P
- Read the unit peak discharge (q_u) from Exhibit 4-II for appropriate t_c
- Using the runoff volume (Q_a), compute the peak discharge (Q_p); $Q_p = q_u \times A \times Q_a$

Where: Q_p = the peak discharge, in cfs

q_u = the unit peak discharge, in cfs/mi²/inch

A = drainage area, in square miles

Q_a = runoff volume, in watershed inches

Example Calculation of Peak Discharge for Water Quality Storm

Using a 3.0 acre small shopping center having a 1.0 acre flat roof, 1.6 acres of parking, and 0.4 acres of open space, and using P = 1.2"; the weighted volumetric runoff coefficient (R_v) is:

$$\begin{aligned} R_v &= 0.05 + 0.009(I); I = 2.6 \text{ acres} / 3.0 \text{ acres} = 0.867 \text{ (86.7\%)} \\ &= 0.05 + 0.009(86.7\%) \\ &= 0.83 \end{aligned}$$

The runoff volume, Q_a is:

$$\begin{aligned} Q_a &= P \times R_v \\ &= 1.2'' \times 0.83 \\ &= 1.0 \text{ watershed inches} \end{aligned}$$

and WQ_v is:

$$WQ_v = \frac{[(1.2'')(1.0)(3.0 \text{ acres})]}{12} \times \frac{43,560 \text{ ft}^2}{\text{acre}} = 13,016 \text{ ft}^3$$

Using $Q_a = 1.0$ watershed inches and $P = 1.2''$; CN for the water quality storm is:

$$CN = \frac{1000}{[10 + (5)(1.2'') + (10)(1.0) - 10((1.0)^2 + 1.25(1.0)(1.2''))^{1/2}]} = 98$$

Using: $t_c = 10$ minutes (0.17 hour);

$$I_a = (200/CN)^2 = 0.041;$$

$$I_a/P = (0.041/1.2'') = 0.049; \text{ (Use } I_a/P = 0.10, \text{ Ref: TR-55 Limitations)}$$

$$q_u = 850 \text{ csm/in. (from TR-55 Exhibit 4-II); and}$$

$$A = 3.0 \text{ acres} \times 1/640 \text{ mi}^2 \text{ per acre} = 0.0047 \text{ mi}^2$$

$$Q_p = (850 \text{ csm/in.})(0.0047 \text{ mi}^2)(1.0'') = 4.0 \text{ cfs}$$

For computing runoff volume and peak rate for storms larger than the Water Quality Storm (i.e. 2-, 10-, 25-, and 100-year storms) use the published CN's from TR-55 and follow the prescribed procedure in TR-55.

In some cases the Rational Formula may be used to compute peak discharges associated with Water Quality Storm. The designer must have available reliable intensity, duration, frequency (IDF) tables or curves for the storm and region of interest. This information may not be available for many locations and therefore the TR-55 method described above is recommended.

APPENDIX L

Acceptable Stormwater BMP's

APPENDIX L

Acceptable Stormwater Best Management Practices (BMP's)**BMP Group 1 - Stormwater Ponds**

Stormwater Ponds - Practices that have a combination of permanent pool, extended detention or shallow wetland equivalent to the entire WQ_v include:

- Micropool Extended Detention
- Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- Pocket Pond

BMP Group 2 - Stormwater Wetlands

Stormwater Wetlands - Practices that include significant shallow wetland areas to treat stormwater runoff but often may also incorporate small permanent pools and/or extended detention storage to achieve the full WQ_v include:

- Shallow Wetland
- Extended Detention Shallow Wetland
- Pond/Wetland System
- Pocket Wetland

BMP Group 3 - Infiltration Practices

Infiltration Practices - Practices that capture and temporarily store the WQ_v before allowing it to infiltrate into the soil over a two-day period include:

- Infiltration Trench
- Infiltration Basin

BMP Group 4 - Filtering Practices

Filtering Practices - Practices that capture and temporarily store the WQ_v and pass it through a filter bed of sand, organic matter, soil or other media are considered to be filtering practices. Filtered runoff may be collected and returned to the conveyance system. Design variants include:

- Surface Sand Filter
- Underground Sand Filter
- Perimeter Sand Filter
- Organic Filter
- Pocket Sand Filter
- Bioretention*

* May also be used for infiltration

BMP Group 5 - Open Channel Practices

Open Channel Practices - Vegetated open channels that are explicitly designed to capture and treat the full WQ_v within dry or wet cells formed by checkdams or other means include:

- Dry Swale
- Wet Swale

BMP Group 6 - Non-Structural BMP's

Non-structural BMP's - These are increasingly recognized as a critical feature of stormwater BMP plans, particularly with respect to site design. In most cases, non-structural BMP's shall be combined with structural BMP's to meet all stormwater requirements. The key benefit of non-structural BMP's is that they can reduce the generation of stormwater from the site; thereby reducing the size and cost of structural BMP's. In addition, they can provide partial removal of many pollutants. The non-structural BMP's have been classified into seven broad categories. To promote greater use of non-structural BMP's, a series of credits and incentives are provided for developments that use these progressive site-planning techniques in Appendix O of this Ordinance.

- Natural Area Conservation
- Disconnection of Rooftop Runoff
- Disconnection of Non-Rooftop Impervious Area
- Sheet Flow to Buffers
- Grass Channel
- Environmentally Sensitive Development

There are numerous sources of information available related to BMP's. This brief list has been provided for your convenience:

United States Environmental Protection Agency - www.epa.gov
PA Department of Environmental Protection - www.dep.state.pa.us
The Center for Watershed Protection - www.cwp.org
The Pennsylvania Handbook of Best Management Practices for Developing Areas*
2000 Maryland Stormwater Design Manual*
New York Stormwater Management Design Manual*

* - Available for review at the Union County Planning Office.

APPENDIX M

Cpv Determination Method

APPENDIX M

APPENDIX M

Computation Of The Channel Protection Storage Volume (C_{pv})

The following procedure shall be used to design the channel protection storage volume (C_{pv}). The method is based on the Design Procedures for Stormwater Management Extended Detention Structures (MDE, 1987) and utilizes the NRCS, TR-55 Graphical Peak Discharge Method (USDA, 1986).

- Compute the time of concentration (t_c) and the one-year post-development runoff depth (Q_a) in inches.

$$Q_a = \frac{(2.4 - I_a)^2}{(2.4 - I_a) + S} \quad \text{where } S = (1000/CN) - 10, I_a = (200/CN) - 2$$

- Compute the ratio $I_a/2.4$ where 2.4 is the one-year rainfall depth (Source: NRCS (SCS) TR-55).
- With t_c and I_a/P , find the unit peak factor (q_u) from Figure 1 and compute the one year post-development peak discharge $q_i = q_u A Q_a$ where A is the drainage in square miles.
- **If $q_i \leq 2.0$ cfs, C_{pv} is not required.** Provide for water quality (WQv) and groundwater recharge (Re_v) as necessary.

- With q_u , find the ratio of outflow to inflow (q_o/q_i) for $T = 12$ or 24 hours from Figure 2.

- Compute the peak outflow discharge $q_o = (q_o/q_i) \times q_i$

- With q_o/q_i , compute the ratio of storage to runoff volume (V_s/V_r).

$$\square \quad V_s/V_r = 0.683 - 1.43(q_o/q_i) + 1.64(q_o/q_i)^2 - 0.804(q_o/q_i)^3$$

- Compute the extended detention storage volume $V_s = (V_s/V_r) \times V_r$ (note: $V_r = Q_a$);

- Convert V_s to acre-feet by $(V_s/12) \times A$, where V_s is in inches and A is in acres.

- Compute the required orifice area (A_o) for extended detention design:

$$\square \quad A_o = \frac{q_o}{C(2gh_o)^{0.5}} = \frac{q_o}{4.18(h_o)^{0.5}}$$

- Where h_o is the maximum storage depth associated with V_s .

- Determine the required maximum orifice diameter (d_o) $d_o = (4A_o/\pi)^{0.5}$

- A d_o of less than 3.0 inches is subject to local jurisdictional approval, and is not recommended unless an internal control for orifice protection is used.

Figure 1 SCS Graphical Method of Determining Peak Discharge (q_u) in csm/in
For 24-Hour Type II Storm Distribution

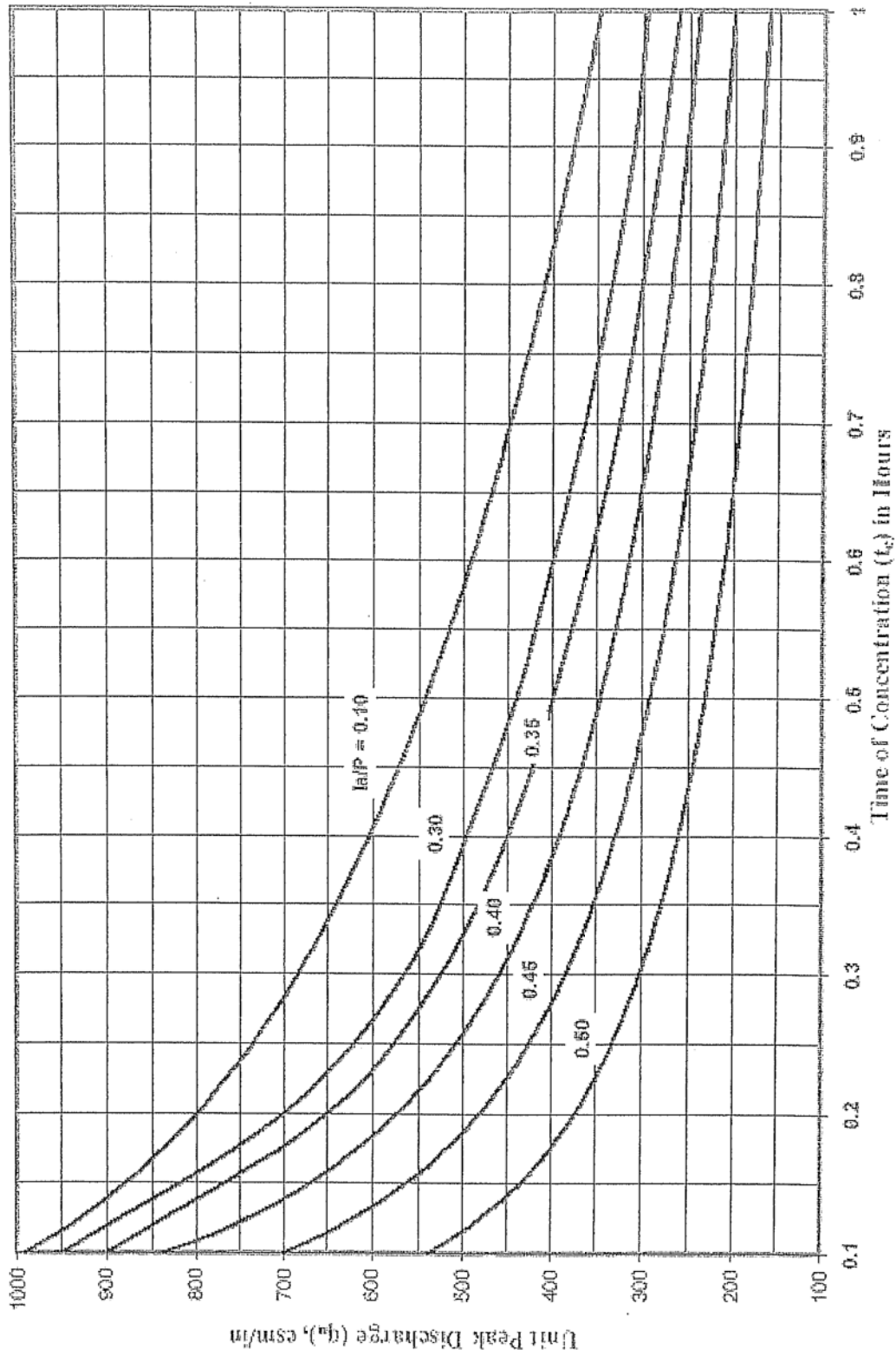
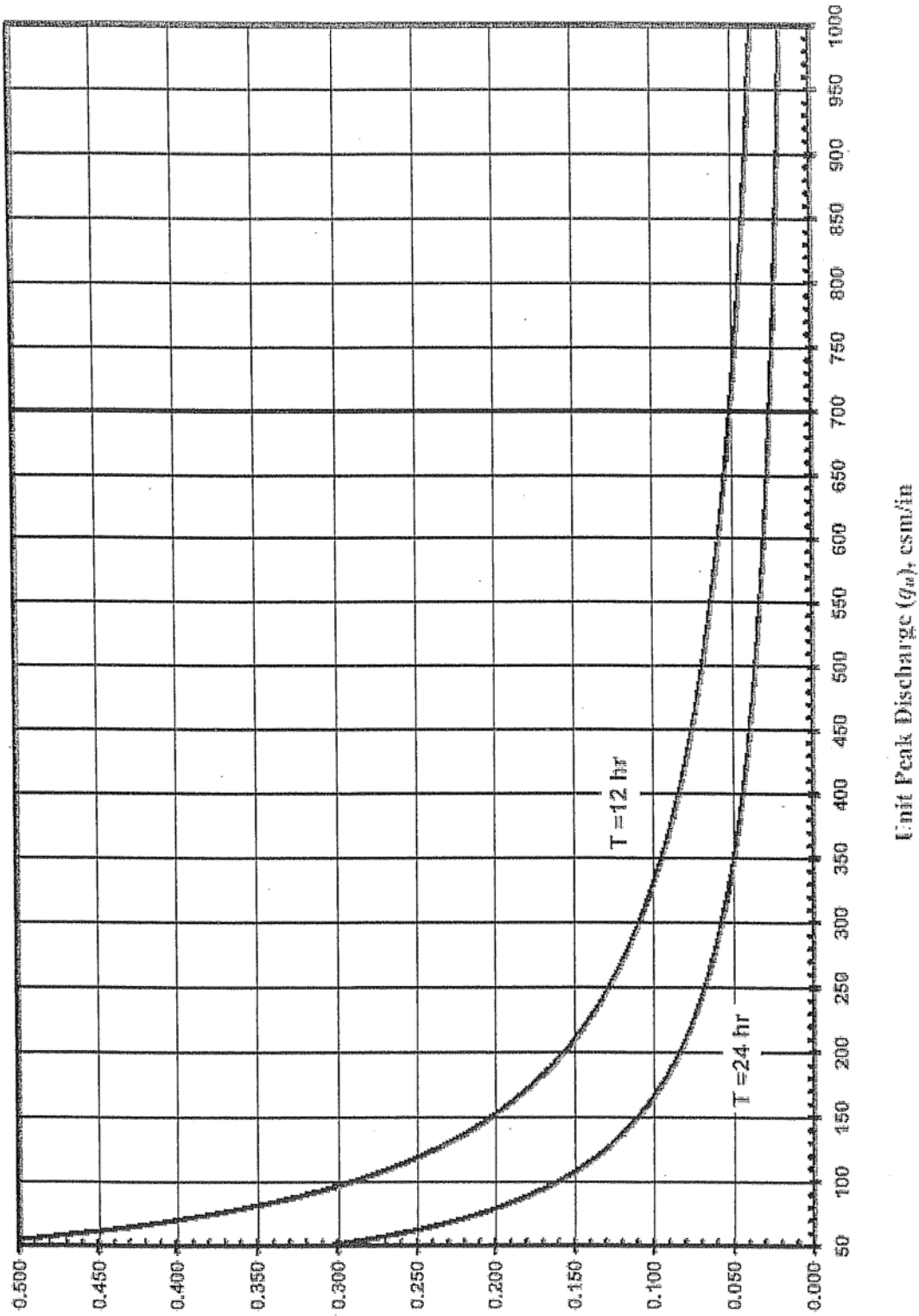


Figure 2 Detention Time Versus Discharge Ratios (q_0/q_1)



APPENDIX N

Stormwater Facilities Maintenance Agreement

APPENDIX N

APPENDIX N

STORMWATER MANAGEMENT FACILITIES MAINTENANCE AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20____, by and between _____ (hereinafter the "Landowner"), RR 1 Box 20; Allenwood, Union County, Pennsylvania, 17810;

AND

Gregg Township (hereinafter the "Township"), P.O. Box 215, Allenwood, Union County, Pennsylvania, 17810.

WITNESSETH

WHEREAS, the Landowner is the fee simple owner of a certain tract of real property as recorded and vested by deed in the land records of Union County, Pennsylvania, Recorder of Deeds Office Deed Book ____ at Page ____, and identified by Tax Parcel Identification Number(s) _____ (hereinafter "Property");

WHEREAS, the Landowner intends to build and develop this Property by constructing permanent improvements as more fully shown upon a plan prepared by _____ entitled "Final Subdivision/Land Development Plan of _____" (hereinafter "Plan") dated _____ 200____, which is expressly made a part hereof as approved by the Gregg Township Planning Commission;

WHEREAS, the "Plan" for _____ provides for the detention, retention, infiltration, and/or conveyance of stormwater within the confines of the Property; and

WHEREAS, the Township and the Landowner and his heirs, successors and assigns, including a homeowners or other association of owners, agree that the health, safety, and welfare of the residents of the Township require that on-site stormwater management facilities be constructed and maintained on the Property; and

WHEREAS, Gregg Township Planning requires, through the implementation of the Gregg Township Stormwater Management Ordinance and the Subdivision and Land Development Ordinance, that

APPENDIX N

stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, his heirs, successors and assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto, intended to be legally bound hereby, agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, his heirs, successors and assigns, in accordance with the terms, conditions and specifications identified on the Plan.
2. The Landowner, his heirs, successors, and assigns do hereby establish a permanent easement for stormwater management facilities and access to said facilities as more fully shown upon the Plan. The stormwater management facility easement shall run with and bind the land and fee simple owners, their heirs, executors, administrators, successors and assigns.
3. The Landowner, his heirs, successors and assigns, shall maintain the stormwater management facilities in good working condition, acceptable to the Township so that they are performing their design functions. This includes maintenance of all pipes, channels, swales and other structures built to convey stormwater to the facility as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. The Landowner, his heirs, successors and assigns shall notify the Gregg Township Supervisors and Union County Conservation District prior to initiating any major repair activities.
4. The Landowner, his heirs, successors and assigns shall inspect the stormwater management facilities and submit an inspection report annually. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection report shall cover the entire facility including berms, outlet structure, pond areas, access roads, etc. Deficiencies shall be noted in the inspection report. At a minimum, maintenance inspections shall be performed in accordance with the following schedule:
 - Annually for the first 5 years after the construction of the stormwater facilities,
 - Once every 2 years thereafter, or
 - During or immediately upon the cessation of a 100 year or greater precipitation event.

At a minimum the inspection should include the following:

- (1) An examination of the stormwater collection, conveyance, detention and infiltration facilities for debris deposition (such debris may include, but is not limited to, aggregate material, leaves, grass clippings, and soil material); and
 - (2) An examination of the stormwater facilities for settlement, sinkholes, structural cracking, excessive vegetation, erosion, etc.
5. The Landowner, his heirs, successors and assigns, hereby grant permission to the Township, its authorized agents and employees upon presentation of proper identification, to enter upon the Property at reasonable times, and to inspect the stormwater management facilities whenever the Township deems necessary. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structures, pond areas, access roads, etc. When inspections are conducted, the Township shall give the Landowner, his heirs, successors and assigns copies of the inspection report with findings and evaluations.
6. All reasonable costs for said inspections shall be born by the Landowner, his heirs, successors and assigns and payable to the Township.
7. In the event the Landowner, his heirs, successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the Township, the Township may enter upon the Property and take such necessary and prudent action to maintain said stormwater management facilities and to charge the costs of the maintenance and/or repairs to the Landowner, his heirs, successors and assigns. This provision shall not be construed as to allow the Township to erect any structure of a permanent nature on the land of the Landowner, outside of any easement belonging to the Township. It is expressly understood and agreed that the Township is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Township.
8. The Landowner, his heirs, successors and assigns, will perform maintenance in accordance with the maintenance schedule for the stormwater management facilities including sediment removal as outlined on the Maintenance Plan and schedule described in Exhibit A, attached hereto.

9. In the event the Township, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like on account of the Landowner, his heirs, successors and assigns failure to perform such work, the Landowner, his heirs, successors and assigns, shall reimburse the Township upon demand, within 30 days of receipt of invoice thereof, for all costs incurred by the Township hereunder. If not paid within said 30-day period, the Township may enter a lien against the Property in the amount of such costs, or may proceed to recover its costs through proceedings in equity or at law as authorized under the provisions of the Municipal Lien Law.
10. The Landowner, his heirs, successors and assigns, shall indemnify the Township and its agents and employees against any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the Township for the construction, presence, existence or maintenance of the stormwater management facilities by the Landowner, his heirs, successors and assigns.
11. In the event a claim is asserted against the Township, its agents or employees, the Township shall promptly notify the Landowner, his heirs, successors and assigns, and they shall defend, at their own expense, any suit based on such claim. If any judgment or claims against the Township, its agents or employees shall be allowed, the Landowner, his heirs, successors and assigns shall pay all costs and expenses in connection therewith.
12. In the advent of an emergency or the occurrence of special or unusual circumstances or situations, the Township may enter the Property, if the Landowner, his heirs, successors and assigns are not immediately available, without notification or identification, to inspect and perform necessary maintenance and repairs, if needed, when the health, safety or welfare of the citizens is at jeopardy. However, the Township shall notify the landowner, his heirs, successors and assigns of any inspection, maintenance, or repair undertaken within 5 business days of the activity. The Landowner, his heirs, successors and assigns shall reimburse the Township for its costs.
13. No structures may be placed within or on the Stormwater Management Facilities and easement and no landscaping or grading is permitted within said easement which would impede stormwater flow or

alter the course of the flow within said easement, nor impede the functioning of stormwater inlets, outlet structures, infiltration beds, or any other element of the stormwater management facility.

IN WITNESS WHEREOF, intending to be legally bound hereby, the parties hereto have set their hands and seals the day and year first above written

ATTEST:

GREGG TOWNSHIP

Chairman

Vice Chairman

Secretary

ATTEST:

LANDOWNER

STATE OF PENNSYLVANIA

)

)SS:

COUNTY OF UNION

)

Gregg Township, County of Union, Pennsylvania. I, _____, a Notary Public in the Commonwealth of Pennsylvania, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____, the landowner whose name is signed to the foregoing Agreement bearing the date of the _____ day of _____, 20__, personally appeared before me (known to me or satisfactorily proven) and acknowledges that he executed the same for the purpose therein contained.

GIVEN UNDER MY HAND THIS _____ day of _____, 20__.

NOTARY PUBLIC

This Agreement shall be recorded among the land records of Union County, Pennsylvania and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the

APPENDIX N

Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

RECORDED in the Office of the Recorder of Deeds in and for Union County, in Record Book _____,
Page _____.

WITNESS my hand and official seal this _____ day of _____, 20____.

RECORDER OF DEEDS