

## **Chapter 23**

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**Part 1****General Provisions****§23-101. Statement of Findings.**

The Borough Council of the Borough finds that:

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

B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety, and welfare and the protection of the people of the Borough and all the people of the Commonwealth, their resources, and the environment.

*(Ord. 3/14/2005, §101)*

**§23-102. Purpose.**

The purpose of this Chapter is to promote the public health, safety, and welfare by minimizing the damages described in §23-101.A of this Part by provisions designed to:

A. Control accelerated runoff and erosion and sedimentation problems at their source by regulating activities which cause such problems.

B. Utilize and preserve the desirable existing natural drainage systems.

C. Encourage recharge of groundwaters and prevent degradation of groundwater quality.

D. Maintain the existing flows and quality of streams and water courses in the Borough and the Commonwealth.

E. Preserve and restore the flood carrying capacity of streams.

F. Provide for proper maintenance of all permanent stormwater management structures which are constructed in the Borough.

G. Provide performance standards and design criteria for watershed-wide stormwater management and planning.

*(Ord. 3/14/2005, §102)*

**§23-103. Statutory Authority.**

The Borough is empowered to regulate these activities by the authority of the Act of October 4, 1978, P.L. 864, No. 167, the Storm Water Management Act.

*(Ord. 3/14/2005, §103)*

**§23-104. Applicability.**

1. This Chapter shall apply to all areas of the Borough.
2. This Chapter shall only apply to permanent stormwater management facilities constructed as part of any of the activities listed in this Section. Stormwater management and erosion and sedimentation control during construction activities are specifically not regulated by this Chapter, but shall continue to be regulated under existing laws and ordinances.
3. The following activities, hereafter “regulated activities,” are included within the scope of this Chapter:
  - A. Land development.
  - B. Subdivision.
  - C. Earthmoving involving 1 or more acre.
  - D. Construction of new or additional impervious or semi-pervious surfaces (included, but not limited to, concrete, asphalt, stoned surfaces, surfaces using pavers).
  - E. Construction of new buildings or additions to existing buildings.
  - F. Diversion or piping of any natural or man-made stream channel.
  - G. Installation of stormwater systems or appurtenances thereto.

*(Ord. 3/14/2005, §104)*

#### **§23-105. Compatibility with Other Permit and Ordinance Requirements.**

Permits and approvals issued pursuant to this Chapter do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. If more stringent requirements concerning regulation of stormwater or erosion and sedimentation control are contained in the other code, rule, act, or ordinance, the more stringent regulation shall apply.

*(Ord. 3/14/2005, §107)*

#### **§23-106. Hardship Waiver Procedure.**

1. Waiver of this Chapter or any of its terms may be requested, in writing, to the Borough and transmitted to the Borough Engineer for their recommendation when it is alleged that any of the following circumstances exist:

- A. The land development or subdivision will result in no increased post-development stormwater runoff.
- B. That the proposed land development will result in an increase in post-development runoff so minimal that stormwater management is unnecessary.
- C. Adherence to the criteria set forth herein is not practical or possible.

2. The Borough Council will act upon the waiver taking into account the recommendations of the Borough Engineer. The granting of any such waiver shall be within the sole discretion of the Borough Council.

3. The Borough Engineer will evaluate the waiver request and make his recommendation utilizing the following general findings:

- A. The extent of the proposed site development as it relates to the site area.
- B. The magnitude of the anticipated increased stormwater runoff as a result

of the land development.

C. The adverse impacts of the anticipated increased stormwater runoff at the area of discharge from the site.

D. The physical circumstances or conditions of the site, including drainage characteristics of the soil types on the site, shape, location, topography, or other physical conditions specific to the site.

E. The history of stormwater runoff problems in the area which this land development would affect.

*(Ord. 3/14/2005, §108)*



## Part 2

### Definitions

#### §23-201. Definitions.

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.”

*Accelerated erosion*—the removal of the surface of the land through the combined action of man’s activities and natural processes at a rate greater than would occur because of the natural processes alone.

*BMP (best management practice)*—stormwater structures, facilities, and techniques used to maintain or improve the water quality of surface runoff while acting to neutralize increased runoff volume caused by development activity.

*Borough*—the Borough of Red Lion, a Borough located in York County, Pennsylvania.

*Cistern*—an underground reservoir or tank for storing rainwater.

*Conservation District*—the York County Conservation District.

*Council*—the Borough Council of Red Lion Borough.

*Culvert*—a structure with appurtenant works which carries surface water through an obstruction.

*Design storm*—the magnitude of precipitation from a storm event measured in probability of occurrence (e.g., 50-year storm) and duration (e.g., 24-hour), and used in computing stormwater management control systems.

*Detention basin*—a basin designed to retard stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate. A detention basin can be designed to drain completely after a storm event, or it can be designed to contain a permanent pool of water.

*Detention district*—those subareas in which some type of detention is required to meet the plan requirements and the goals of appropriate and approved Act 167

Plans.

*Developer*—a person, partnership, association, corporation, or other entity, or any responsible person therein or agent thereof, that undertakes any regulated activity is proposed.

*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 land owner to a grantee, allowing the use of private land for stormwater management purposes.

*Drainage permit*—a permit issued by the Borough Council after the drainage plan has been approved. Said permit is issued prior to or with the final Borough approval.

*Drainage plan*—the documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in §23-403.

*Earth disturbance*—any activity including, but not limited to, construction, mining, timber harvesting, and grubbing which alters, disturbs, and exposes the existing land surface.

*Erosion*—the removal of soil particles by the action of water, wind, ice, or other natural forces.

*Erosion and sedimentation pollution control plan*—a plan that is designed to minimize accelerated erosion and sedimentation associated with construction activity.

*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” unless the natural land cover is proven to generate lower curve numbers, 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 that are reasonably required to carry and discharge the 100-year

frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed—absent evidence to the contrary—that the floodway extends 50 feet from the top of the bank of the stream.

*Groundwater recharge*—replenishment of existing natural underground water supplies.

*Impervious surface*—a surface which prevents the percolation of water into the ground.

*Infiltration structures*—a structure designed to direct runoff into the ground, (e.g., French drains, seepage pits, seepage trench).

*Land development*—(1) the improvement of one lot or two or more contiguous lots, tracts or parcels of land for any purpose involving (a) a group of two or more 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; (2) a subdivision of land.

*Land disturbance*—any activity involving grading, filling, digging or filling of ground, or stripping of vegetation, or any other activity which causes land to be exposed to the danger of erosion.

*Municipality*—Red Lion Borough, York County, Pennsylvania.

*NRCS*—National Resource Conservation Service (previously SCS).

*Peak discharge*—the maximum rate of flow of water at a given point and time resulting from a specified storm event.

*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, once every 25 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 control-flow roof drains into building designs.

*Runoff*—that part of precipitation which flows over the land.

*SCS*—Soil Conservation Service, U. S. Department of Agriculture.

*Sediment*—solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water.

*Sediment basin*—a barrier, dam, retention or detention basin designed to retain sediment.

*Seepage pit / seepage trench*—an area of excavated earth filled with loose stone or similar materials and into which surface water is directed for infiltration into

the ground.

*Semi-pervious surface*—a surface such as stone, rock concrete, or other materials which permits some vertical transmission of water.

*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 SCS, and found in its publication “Urban Hydrology for Small Watersheds,” Technical Release No. 55, SCS, January 1975.

*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.

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

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

*Storm sewer*—a system of pipes or other conduits which carries intercepted surface runoff, street water and other wash waters, or drainage, but excludes domestic sewage and industrial wastes.

*Stormwater 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 District Watershed Map—Appendix 23-C*—Defining release rate criteria within the watershed.

*Stormwater Management Plan*—the plan for managing stormwater runoff adopted by York County.

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

*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*—the smallest drainage unit of a watershed for which stormwater management criteria have been established in the 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, transfer of ownership or building or lot development; provided, however, that the division of land for agricultural purposes into parcels of more than 10 acres, not involving any new street or easement of access, shall be exempt.

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

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

*Watercourse*—a stream of water; river, brook, creek, or a channel or ditch for water, whether natural or man-made.

*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.

*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.

(Ord. 3/14/2005, Art. II)



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

1. All regulated activities within the Borough which do not fall under the exemption criteria listed in §23-402 shall submit a drainage plan to the Borough for review. Impervious cover shall include, but not be limited to, any roof, parking or driveway, new streets, and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the exemption criteria (§23-402 and stormwater design).

2. *Maintenance of Natural Drainageways.* All natural streams, channels, swales, drainage systems, and/or areas of surface water concentration shall be maintained in their existing condition unless an alteration is approved by the Borough. All encroachment activities shall comply with the requirements of 25 Pa.Code, Chapter 105, Water Obstructions and Encroachments, rules and regulations of PA DEP.

3. *Methods of Stormwater Runoff Detention and Control.* The following is a listing of detention and control methods which may be utilized in stormwater management systems, if appropriate. The choice of control techniques is not limited to the ones appearing on this list.

- A. Retention basins.
- B. Detention basins.
- C. Roof-top storage.
- D. Parking lot and street ponding.
- E. Seepage pits, seepage trenches, or other infiltration structures.
- F. Porous pavement and concrete lattice block surfaces.
- G. Grassed channels and vegetated strips.
- H. Cisterns and underground reservoirs.
- I. Routed flow over grass.
- J. Decreased impervious area coverage.

The use of other control methods which meet the criteria in this Section will be permitted when approved by the Borough Engineer. Various combinations of methods should be tailored to suit the particular requirements of the type of development and the topographic features of the project area.

4. *Design.* The applicant is urged to consult the publications listed in the Appendix to this Chapter for aid in design of control methods.

(Ord. 3/14/2005, §301)

**§23-302. Stormwater Management Districts.**

1. The Borough has been divided into release rate areas as shown on Appendix 23-C.

2. *Description of Stormwater Management Districts.* Stormwater management

districts are broadly defined by the watershed boundaries identified in the York County Comprehensive Plan, Water Resource Section, Map 2. Further regulation within these districts is justified by the Act 167 Study for each watershed, when completed.

3. When a project or land disturbance activity is located in more than one stormwater management district, stormwater may not be transferred from a district with stricter stormwater management criteria to a district with less strict criteria, unless the need for such a transfer is identified in the County stormwater management plan, the regional water quality management plan or the State water plan. In any district, infiltration and volume regulations dictated in §§23-306 and 23-307 will be required.

District ID	Regulated Storm Frequency	Percentage of Pre-developed Peak Flow Rate to Determine Allowable Post-developed Release Rate
Codorus	2-50 year	100%
East Branch Codorus	2-50 year	100%
Susquehanna	2-50 year	100%
Muddy	2-50 year	100%

In all cases, the 100-year storm frequency will be routed to show no significant change to existing flow patterns nor any negative impact from this flow to proposed improvements.

(Ord. 3/14/2005, §302)

**§23-303. Design Criteria.**

1. Post-development rates of runoff from any regulated activity shall not exceed the peak release rates of runoff specified in §23-302, of the Chapter. If it is shown, by applications of water quality and ground water recharge requirements pursuant to §§23-306 and 23-307, that the post-development hydrographs are equal to the pre-development hydrographs to assure the rate and volume of runoff leaving the site is unchanged for 2-, 5-, 10-, 25-, 50-, and 100-year frequency storms, then the requirements of this Section will be considered met. Otherwise, the developer shall control the rate and volume for the balance of uncontrolled runoff subsequent to the credits obtained by satisfying §§23-306 and 23-307. If an extended detention or a permanent pool type facility is selected for the treatment of water quality volume, the outlet shall be designed such that 1-year 24-hour post-development runoff volume is released over a 24-hour period. This will also help channel protection. The release of water begins at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall consider and minimize the chances of clogging and sedimentation potential. Orifices smaller than 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. The developer may, subject to approval of the Borough Engineer, use the stormwater credits, described in the following table, in computing post-development hydrograph:

Stormwater Credit	Description
Natural Area Conservation	Conservation of natural areas such as forest, wetlands, or other sensitive areas in a protected easement thereby retaining their pre-development hydrologic and water quality characteristics. Using this credit, a designer may subtract conservation areas from total site area when computing the required water quality volume. Additionally, the post-development curve number (CN) for these areas may be assumed to be forest in good condition.
Disconnection of Rooftop Runoff	Credit is given when rooftop runoff is disconnected and then directed over a pervious area where it may either infiltrate into the soil or filter over it. Credit is typically obtained by grading the site to promote overland flow or by providing bioretention on single-family residential lots. If a rooftop area is adequately disconnected, the impervious area may be deducted from the total impervious cover. Additionally, the post-development CNs for disconnected rooftop areas may be assumed to be forest in good condition.
Disconnection of Non-rooftop Runoff	Credit is given for practices that disconnect surface impervious cover by directing it to pervious areas where it is either infiltrated or filtered through the soil. As with rooftop runoff, the impervious area may be deducted from the total impervious cover thereby reducing the required water quality volume.
Stream Buffer Credit	Credit is given when a stream buffer effectively treats stormwater runoff. Effective treatment constitutes capturing runoff from pervious and impervious areas adjacent to the buffer and treating the runoff through overland flow across a grass or forested area. Areas treated in this manner may be deducted from total site area in calculating and may contribute to meeting requirements for groundwater recharge.
Grass Channel (Open Section Roads)	Credit may be given when open grass channels are used to reduce the volume of runoff and pollutants during smaller storms. Use of grass channels will automatically meet the minimum groundwater recharge requirement. If designed according to appropriate criteria, these channels may meet water quality criteria for certain types of residential development.
Environmentally Sensitive Rural Development	Credit is given when a group of environmental site design techniques are applied to low density or rural residential development. This credit eliminates the need for structural practices to treat both the required recharge volume $Re_v$ and water quality volume. The designer must still address the channel protection volume, the overbank protection and overbank/extreme flood event requirements for all roadway and connected impervious surfaces.

2. Infiltration BMPs must be provided for all development to capture all volume from impervious area associated with development for a 2.4 inch, 24-hour Type II SCS rainfall distribution. See requirements specified in §23-306.

3. *Site Located in More than One District.* For a proposed development site located within two or more stormwater management district category subareas, the peak discharge rate from any subarea shall be the pre-development peak discharge for that subarea as indicated in §23-302. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea.

4. *Off-Site Areas.* Off-site areas which drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, onsite drainage facilities shall be designed to safely convey off-site flows through the development site.

5. *Site Areas.* Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area requiring stormwater management measures shall be subject to the management district criteria. Undisturbed areas shall be considered as existing conditions. In other words, unimpacted areas bypassing the stormwater management facilities would not be subject to the management district criteria.

6. *Downstream Hydraulic Capacity Analysis.* Any downstream capacity hydraulic analysis conducted in accordance with this Chapter shall use the following criteria for determining adequacy for accepting increased peak flow rates:

A. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 25-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 PA DEP *Erosion and Sediment Pollution Control Program Manual*.

B. Natural or man-made channels or swales must be able to convey increased 50-year return period runoff without creating any hazard to persons or property.

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

7. *Regional Detention Alternatives.* For certain areas within the study area, it may be more cost-effective to provide one control facility for more than one development site than to provide an individual control facility for each development site. The initiative and funding for any regional runoff control alternatives are the responsibility of prospective developers. The design of any regional control basins must incorporate reasonable development of the entire upstream watershed. The peak outflow of a regional basin would be determined on a case-by-case basis using the hydrologic model of the watershed consistent with protection of the downstream watershed areas. "Hydrologic model" refers to the calibrated model as developed for the Stormwater Management Plan.

8. *Capacity Improvements.* In certain instances, primarily within the provisional no detention areas, local drainage conditions may dictate more stringent levels of runoff control than those based upon protection of the entire watershed. In these instances, if the developer could prove that it would be feasible to provide capacity improvements to relieve the capacity deficiency in the local drainage network, then the capacity improvements could be provided by the developer in lieu of runoff controls on the development site. Any capacity improvements would be designed based upon

development of all areas tributary to the proposed improvement and the capacity criteria specified in §23-303. In addition, all new development upstream of a proposed capacity improvement shall be assumed to implement the applicable runoff controls consistent with this Chapter except that all new development within the entire subarea(s) within which the proposed development site is located shall be assumed to implement the developer's proposed discharge control, if any. Capacity improvements may also be provided as necessary to implement any regional or subregional detention alternatives.

*(Ord. 3/14/2005, §303)*

**§23-304. Regulation Governing Stormwater Management Facilities.**

1. Any stormwater facility located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PennDOT).

2. Any stormwater management facility (i.e., detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this Chapter shall be designed to provide an emergency spillway to handle flow up to and including the 100-year post-development conditions. The height of embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any stormwater management facility require a dam safety permit under 25 Pa.Code, Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety which may be required to pass storms larger than 100-year event.

3. Any stormwater management facilities regulated by this Chapter that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by PA DEP through the joint permit application process, or, where deemed appropriate by PA DEP, the general permit process. When there is a question whether wetlands may be involved, it is the responsibility of the developer or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PA DEP.

4. Any drainage conveyance facility and/or channel that does not fall under 25 Pa.Code, Chapter 105, must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm. Conveyance facilities to or exiting from stormwater management facilities (i.e., detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements.

5. Storm sewers must be able to convey post-development runoff from a 10-year design storm without surcharging inlets, where appropriate. Any post-development drainage area that does not naturally convey stormwater runoff to a management facility shall incorporate a storm sewer system capable of collecting and conveying the stormwater runoff during a 100-year storm to said facilities. A combination of aboveground and overland conveyance will be accepted without creation of hazardous conditions to any person or property.

6. All earthmoving activities must be reviewed and approved by the York County

Conservation District prior to commencing work.

7. The design of all stormwater management facilities shall incorporate good engineering principles and practices. The Borough shall reserve the right to disapprove any design that would result in the occupancy or continuation of adverse hydrologic or hydraulic conditions within the watershed.

8. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the adjacent property owner(s) and shall be subject to any applicable discharge criteria specified in this Chapter. The volume of stormwater runoff may not be increased onto downstream properties unless an analysis is completed that shows adequate facilities are in place to adequately convey post-development flows. The owner's signature must be included on the stormwater plan granting approval to alter the concentrated drainage. Adequate downstream conveyance facilities are hereby defined as existing natural conveyance channels, manmade conveyance channels or pipe conveyance systems. Discharge of stormwater to areas without existing defined conveyance facilities must be prevented. Should the owner refuse to accept the altered stormwater discharge, the developer must modify the post-development stormwater plan in a manner that will not increase the drainage area or volume of discharge.

9. Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this Chapter. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the developer 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 the concentrated discharge. The affected adjacent property owner's signature must be provided on the stormwater plan granting approval of the altered discharge. Adequate downstream conveyance facilities are hereby defined as existing natural conveyance channels, manmade conveyance channels, or pipe conveyance systems. Discharge of stormwater to areas without existing defined conveyance facilities must be prevented. Should the owner refuse to accept the altered stormwater discharge, the developer must modify the post-development stormwater plan in a manner that will not increase the drainage area or volume of discharge.

10. Where a development site is traversed by watercourses drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. Also, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.

11. When it can be shown that, due to topographic conditions, natural drainageways on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainageways. Work within natural drainageways shall be subject to approval by PA DEP through the joint permit application process, or, where deemed appropriate by PA DEP, through the general permit process.

12. Roof drains must not be connected to streets, sanitary or storm sewers, or

roadside ditches to promote overland flow and infiltration/percolation of stormwater where advantageous to do so. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case by case basis by the Borough. In no case shall roof drains be positioned in a manner that promotes drainage to adjacent structures or onto adjacent properties.

13. *Special Requirements for Areas Falling Within Defined Exceptional Value and High Quality Subwatersheds.* The temperature and quality of water and streams that have been declared as exceptional value and high quality is to be maintained as defined in 25 Pa.Code, Chapter 93, "Water Quality Standards," of Pennsylvania Department of Environmental Protection rules and regulations. Temperature sensitive BMP's and stormwater conveyance systems are to be used and designed with storage pool areas and supply outflow channels and should be shaded with trees. This will require modification of berms for permanent ponds and the relaxation of restrictions on planting vegetation within the facilities, provided that capacity for volumes and rate control is maintained. At a minimum, the southern half on pond shorelines shall be planted with shade or canopy trees within 10 feet of the pond shoreline. In conjunction with this requirement, the maximum slope allowed on the berm area to be planted is 10 to 1. This will lessen the destabilization of berm soils due to root growth. A long term maintenance schedule and management plan for the thermal control BMP's is to be established and recorded for all development sites within defined exceptional value and/or high quality subwatersheds.

14. *Outlet Control Structures.* Outlet control shall be accomplished utilizing (6 inches diameter or 6 inches width maximum) perforations arranged vertically to provide for positive control of stormwater runoff. Outlet controls shall also provide for modification of the orifice to a smaller diameter through the use of removable plates.

15. *Discharge Dispersion.* Discharges from piping outlets of management facilities shall be provided with a concrete "level spreader" to convert point discharge back to simulated sheet flow. The length of the level spreader shall be equal to 10 times the outlet pipe diameter (e.g., an 18-inch discharge pipe would require a 15-foot wide level spreader).

16. *Minimum Bottom Slope.* All detention basins shall have a minimum bottom slope of 2 percent unless infiltration facilities are provided.

17. *Maximum Depth.* The permitted depth for detention or retention basins shall be 6 feet, measured from the bottom of the emergency spillway to the lowest point in the basin.

18. *Side Slopes.* The maximum permitted side slopes for detention or retention basins shall be 4 horizontal to 1 vertical.

19. *Location.* All stormwater management facilities are considered structures and must comply with building setback requirements. No part of the discharge structure or piping shall encroach into the setback area.

20. *Fencing.* Any stormwater detention/retention facility that is designed so that it retains water at a depth of 3 feet or more on a permanent basis located in or adjacent to a residential zone shall be subject to the following fencing requirements:

A. Stormwater facility must be completely surrounded by a fence or wall of not less than 4 feet in height, which shall be so constructed as not to have openings, holes, or gaps larger than 2 inches in any dimension (including the distance

between horizontal or vertical pickets in a picket fence).

B. All gates or doors opening through such enclosure shall be equipped with a self-closing and self-latching device for keeping the gate or door securely closed at all times.

21. No stormwater management facilities shall be installed over existing utility mains or services.

22. *Easement.* Plans showing outlet control structures shall contain an easement dedication as follows: "An easement is hereby granted to Red Lion Borough to access and modify the basin outlet control device at the expense of the developer so as to function within design parameters."

23. *Inlet Placement.* In general, inlets shall be spaced such that, based upon the Rational Method, Time-of-Concentration (Tc) = 5 minutes and 10-year rainfall intensity, the area contributing to the inlet shall not produce a peak runoff of greater than 4 cubic feet per second (cfs). Also, inlets shall be spaced so that their efficiency, based upon efficiency curves published by the Pennsylvania Department of Transportation, is not less than 65 percent. Additional inlets shall be placed at the upper side of driveway/street intersections to prevent stormwater from discharging onto the roadway. Other devices such as high efficiency grates or perforated pipe may be required if conditions warrant.

24. *Culverts.* In all cases where drainage is picked up by means of a head wall, and inlet or outlet conditions control, the pipe shall be designed as a culvert. The minimum diameter of culvert shall be 18 inches. The procedure contained in Hydraulic Engineer Circulars No. 5 and No. 13, as prepared by the U. S. Department of Transportation, Federal Highway Administration, Washington, D.C., shall be used for the design of culverts. When a pipe or culvert is intended to convey the discharge from a stormwater management facility, its required capacity shall be computed by the Rational Method and compared to the peak outflow from the stormwater management facility for the 50-year storm. The greater flow shall govern the design of the pipe or culvert.

(Ord. 3/14/2005, §304)

### **§23-305. Calculation Methodology.**

Stormwater runoff from all development sites shall be calculated using either the Rational Method or a Soil Cover Complex methodology.

A. Any stormwater runoff calculations involving drainage areas greater than 200 acres, including on- and off-site areas, shall use generally accepted calculation technique that is based on the NRCS Soil Cover Complex method. 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 Borough may allow the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 200 acres.

B. All calculations consistent with this Chapter using the Soil Cover Complex method shall use the appropriate design rainfall depths for the various return period storms presented in Table 6-1. If a hydrologic computer model such as PSRM or HEC-RAS is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The SCS Rainfall Type II curve shall be used for the rainfall

distribution.

C. For the purposes of pre-development flow rate determination, undeveloped land, including disturbed areas, shall be considered as “meadow” in good condition, unless the natural ground cover generates a lower curve number or Rational “C” value (i.e., forest), as listed in Table 6-6.

D. 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 for Pennsylvania Department of Transportation Design Rainfall Curves. Region 4 curves will apply to this watershed. Peak discharge computed using the Rational Method should follow the formula,  $Q = CIA$  where:

Q = Peak discharge in cubic feet per second.

C = Runoff factor expressed as a percent of the total rainfall.

I = Rainfall intensity in inches per hour.

A = The drainage area expressed in acres.

E. 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). Time-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 Table 6-5.

G. Runoff coefficients (c) for both existing and proposed conditions for use in the Rational Method shall be obtained from Table 6-6.

H. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations such as the capacity of open channels, pipes, and storm sewers. Values for Manning’s roughness coefficient (n) shall be consistent with Table 6-7.

I. Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Chapter using any generally accepted hydraulic analysis technique or method.

J. The design of any stormwater detention facilities intended to meet the performance standards of this Chapter shall be verified by routing the design storm hydrograph through these facilities.

(Ord. 3/14/2005, §305)

### **§23-306. Groundwater Recharge (Infiltration/Recharge/Retention).**

1. Maintaining runoff volumes of pre-developed conditions requires groundwater recharge of the areas being developed. Design of the infiltration/recharge stormwater management facilities shall incorporate groundwater recharge to compensate for the reduction in the percolation that occurs when the ground surface is converted to an impervious surface. These measures are required unless the applicant can prove the development site is physically incapable of recharge. If physical limitations exist preventing groundwater recharge runoff volumes must be reduced through another

acceptable BMP proposed by the developer's engineer.

2. Infiltration BMPs shall meet the following minimum requirements:

A. Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:

(1) A minimum depth of 12 inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones). Limiting zones to be determined by probe hole excavation.

(2) An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by field tests conducted by the owner's professional designer.

B. The size of the recharge facility shall be based upon the following calculation:

**Infiltration Design Structure Worksheet**

A. Total storm rainfall	2.40	Inches
B. Weighed drainage area CN	98	
C. Potential abstraction (S)=(1000/CN)-10	0.204	
D. Drainage area in square feet	1500	— input requirements
E. Perc rate in ft/hr	0.1667	
F. Seepage bed (horz. area in square feet)	200	

(1) Storm in Hours	(2) Type II Storm Dis- tribution	(3) Rainfall in inches	(4) Runoff in inches	(5) Runoff in cubic feet	(6) Potential perc rate	(7) Actual perc rate	(8) Volume storage required	(9) Depth of Bed
0	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
1	0.012	0.029	0.000	0.00	33.34	0.00	0.00	0.00
2	0.022	0.053	0.001	0.08	33.34	0.08	0.00	0.00
3	0.035	0.084	0.008	0.94	33.42	0.94	0.00	0.00
4	0.048	0.115	0.020	2.48	34.28	2.48	0.00	0.00
5	0.065	0.156	0.042	5.19	35.82	5.19	0.00	0.00
6	0.080	0.192	0.064	8.04	38.53	8.04	0.00	0.00
7	0.100	0.240	0.098	12.30	41.38	12.30	0.00	0.00
8	0.120	0.288	0.135	16.92	45.64	16.92	0.00	0.00
9	0.148	0.355	0.191	23.83	50.26	23.83	0.00	0.00
10	0.181	0.434	0.259	32.40	57.17	32.40	0.00	0.00
11	0.235	0.564	0.376	47.05	65.74	47.05	0.00	0.00

(1) Storm in Hours	(2) Type II Storm Dis- tribution	(3) Rainfall in inches	(4) Runoff in inches	(5) Runoff in cubic feet	(6) Potential perc rate	(7) Actual perc rate	(8) Volume storage required	(9) Depth of Bed
12	0.663	1.591	1.370	171.26	80.39	80.39	90.87	1.14
13	0.772	1.853	1.629	203.57	113.73	113.73	89.84	1.12
14	0.820	1.968	1.743	217.83	147.07	147.07	70.76	0.88
15	0.855	2.052	1.826	228.24	180.41	180.41	47.83	0.60
16	0.880	2.112	1.885	235.68	213.75	213.75	21.93	0.27
17	0.903	2.167	1.940	242.52	247.09	242.52	0.00	0.00
18	0.920	2.208	1.981	247.58	275.86	247.58	0.00	0.00
19	0.940	2.256	2.028	253.54	280.92	253.54	0.00	0.00
20	0.952	2.285	2.057	257.11	286.88	257.11	0.00	0.00
21	0.968	2.323	2.095	261.88	290.45	261.88	0.00	0.00
22	0.980	2.352	2.124	265.46	295.22	265.46	0.00	0.00
23	0.990	2.376	2.148	268.44	298.80	268.44	0.00	0.00
24	1.000	2.400	2.171	271.42	301.78	271.42	0.00	0.00

*Description of Column Calculation.*

(5) Calculated by multiplying the drainage area (D) by the runoff in inches converted to feet.

(6) Calculated by multiplying the seepage area (F) by the perc rate and adding the preceding actual perc.

(7) Listing the lesser of the potential perc vs. the runoff in CF.

(8) Listing the difference between the runoff and the actual perc = amount to be stored (awaiting infiltration).

(9) Volume of storage divided by the seepage bed horizontal area = depth of bed.

**Depth of Seepage Bed Design Table**

Drainage Area to Bed	Perc Rate (in/hr)					
	1	3	5	7	9	11
500	0.9	0.4	0.0	0.0	0.0	0.0
1000	2.3	1.5	1.0	0.6	0.2	0.0
1500	3.9	2.7	2.1	1.7	1.2	0.8
2000	5.7	4.0	3.1	2.7	2.3	1.9
2500	7.6	5.3	4.4	3.7	3.3	2.9

Drainage Area to Bed	Perc Rate (in/hr)					
	1	3	5	7	9	11
3000	9.6	6.8	5.7	4.9	4.3	3.9
3500	11.7	8.3	7.1	6.2	5.4	5.0
4000	13.8	9.9	8.4	7.5	6.7	6.0
5000	18.2	13.3	11.3	10.1	9.3	8.5
6000	22.7	16.9	14.4	12.7	11.9	11.1
7000	27.2	20.7	17.6	15.8	14.5	13.7
8000	31.7	24.7	21.0	18.9	17.2	16.3

Area of seepage bed = 100 sf

Drainage Area to Bed	Perc Rate (in/hr)					
	1	3	5	7	9	11
500	0.2	0.0	0.0	0.0	0.0	0.0
1000	0.6	0.2	0.0	0.0	0.0	0.0
1500	1.2	0.6	0.2	0.0	0.0	0.0
2000	1.7	1.0	0.6	0.2	0.0	0.0
2500	2.3	1.5	1.0	0.6	0.2	0.0
3000	2.9	1.9	1.4	1.0	0.6	0.2
3500	3.5	2.4	1.9	1.4	10.0	0.6
4000	4.2	2.9	2.3	1.9	1.4	1.0
5000	5.7	4.0	3.1	2.7	2.3	1.9
6000	7.2	5.0	4.2	3.5	3.1	2.7
7000	8.8	6.2	5.2	4.4	3.9	3.5
8000	10.4	7.4	6.3	5.4	4.7	4.3

Area of seepage bed = 250 sf

Drainage Area to Bed	Perc Rate (in/hr)					
	1	3	5	7	9	11
500	0.0	0.0	0.0	0.0	0.0	0.0
1000	0.2	0.0	0.0	0.0	0.0	0.0
1500	0.4	0.0	0.0	0.0	0.0	0.0

Drainage Area to Bed	Perc Rate (in/hr)					
	1	3	5	7	9	11
2000	0.6	0.2	0.0	0.0	0.0	0.0
2500	0.9	0.4	0.0	0.0	0.0	0.0
3000	1.2	0.6	0.2	0.0	0.0	0.0
3500	1.4	0.8	0.4	0.0	0.0	0.0
4000	1.7	1.0	0.6	0.2	0.0	0.0
5000	2.3	1.5	1.0	0.6	0.2	0.0
6000	2.9	1.9	1.5	1.0	0.6	0.2
7000	3.5	2.4	1.9	1.4	1.0	0.6
8000	4.2	2.9	2.3	1.9	1.4	1.0

Area of seepage bed = 500 sf

C. The recharge volume provided at the site shall be directed to the most permeable soils available.

D. The recharge facility shall be capable of completely infiltrating the impounded water within 48 hours.

3. 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. The general process for designing the infiltration BMP shall be:

A. Site evaluation to determine general areas of suitability for infiltration practices.

B. Provide field test to determine appropriate percolation rate and/or hydraulic conductivity.

C. Design infiltration structure for required storm volume based on all available data.

4. Extreme caution shall be exercised where infiltration is proposed in geologically susceptible areas such as strip mine 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 evaluate the possibility of groundwater contamination from the proposed infiltration/recharge facility and recommend 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 shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent groundwater contamination and, where necessary, sinkhole formation. The infiltration requirement in the high quality/exceptional waters shall be subject to the Department's 25 Pa.Code, Chapter 93, and anti-degradation regulations. The Borough may require

the installation of an impermeable liner in detention basins. A detailed hydrogeologic investigations may be required by the Borough.

5. The Borough may require the developer to provide safeguards against groundwater contamination for uses which may cause groundwater contamination, should there be a mishap or spill. It shall be the developer's responsibility to verify if the site is underlain by limestone. The following note shall be attached to all drainage plans and signed and sealed by the developer's engineer/surveyor/landscape/architect/geologist:

I, \_\_\_\_\_ certify that the proposed detention basin (circle one) is/is not underlain by limestone.

6. Where previous pavement is permitted for parking lots, recreational facilities, nondedicated streets, or other areas, pavement construction specifications shall be noted on the plan.

7. Recharge/infiltration facilities may be used in conjunction with other innovative or traditional BMPs, stormwater control facilities, and nonstructural stormwater management alternatives.

(Ord. 3/14/2005, §306)

### **§23-307. Water Quality and Stream Protection.**

1. Developed areas will provide adequate storage and treatment facilities necessary to capture and treat stormwater runoff. The recharge volume computed under §23-306 may be a component of the Water Quality Volume. If the recharge volume is less than the water quality volume, the remaining water quality volume may be captured and treated by methods other than recharge/infiltration BMP's.

2. The water quality volume (WQv) is the storage capacity needed to treat stormwater runoff produced by "P" inch of rainfall (90 percent rule) from the developed areas of the site. The following calculation formula is used to determine the storage volume, WQv, in acre-feet of storage:

$$WQv = [(P.0)(Rv)(A)]/12$$

WQv = Water Quality Volume

P = Rainfall Amount (2.4")

A = Disturbed Project Area

$$Rv = 0.05 + 0.009(I)$$

$$I = (\text{Impervious Area} + \text{Total Project Area}) \times 100$$

3. WQv shall be designed as part of a stormwater management facility which incorporates water quality BMP's as a primary benefit of using that facility, in accordance with design specifications contained in *Pennsylvania Handbook of Best Management Practices for Developing Areas*. The following factors shall be considered when evaluating the suitability of BMPs used to control water quality at a given development site:

- A. Total contributing area.
- B. Permeability and infiltration rate of the site soils.
- C. Slope and depth to bedrock.

- D. Seasonal high water table.
- E. Proximity to building foundations and well heads.
- F. Erodibility of soils.
- G. Land availability and configuration of the topography.
- H. Peak discharge and required volume control.
- I. The nature of the pollutant being removed.
- J. Maintenance requirements.
- K. Creation/protection of aquatic and wildlife habitat.
- L. Recreational value.
- M. Enhancement of aesthetic and property value.

4. Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall consider and minimize the chances of clogging and sedimentation potential. Orifices smaller than 3 inches in diameter are not recommended.

5. The land developer may submit original and innovative designs to the Borough engineer for review and approval. Such designs may achieve the water quality objectives through a combination of BMPs (best management practices). Infiltration required in §23-306 should be accounted for in meeting the requirements of §23-307.1. (*Ord. 3/14/2005, §307*)

**§23-308. Erosion and Sedimentation Requirements.**

1. As required in §23-304.6, whenever the vegetation and topography are to be disturbed, such activity must be in conformance with 25 Pa.Code, Chapter 102, "Erosion Control," and in accordance with the York County Conservation District.

2. It is extremely important that strict erosion and sedimentation control measures be applied surrounding infiltration structure during installation to prevent the infiltrative surfaces from becoming clogged. 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:

A. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.

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

(*Ord. 3/14/2005, §308*)



**Part 4**

**Plan Requirements**

**§23-401. General Requirements.**

For any of the activities regulated by this Chapter, the subdivision or land development, the issuance of any building permit, or the commencement of any land disturbance activity may not proceed until the property owner or developer or his/their agent has received written approval of a stormwater management plan from the Borough.

(Ord. 3/14/2005, §401)

**§23-402. Exemptions.**

Any regulated activity that meets the following exemption criteria is exempt from the provisions of this Chapter. These criteria shall apply to the total development even if development is to take place in phases. The date of the Borough 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. Exemption shall not relieve the applicant from implementing such measures as are necessary to protect health, safety, and property. This exemption shall not relieve the applicant from meeting the requirements for water quality and groundwater recharge, special requirements for high quality (HQ) and exceptional value (EV) watersheds.

**Stormwater Management Exemption Criteria  
Impervious Area Exemption**

Total Parcel Size	Exemption (sq. ft.)
<.25 acre	1,000
0.25–< 0.5 acre	2,500
0.5–1 acre	5,000
> 1-2 acres	10,000
> 2-5 acres	15,000
> 5 acres	20,000

(Ord. 3/14/2005, §402)

**§23-403. Drainage Plan Contents.**

1. The drainage plan shall consist of all applicable calculations, maps, and plans. A note on the maps shall refer to the associated computations and erosion and sedimentation control plan by title and date. 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 Borough in a format that is

clear, concise, legible, neat, and well organized; otherwise, the drainage plan shall be disapproved and returned to the applicant.

2. 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.

B. Map(s) of the project area shall be submitted on 24-inch by 36-inch or 30-inch by 42-inch sheets. The contents of the map(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 of 2 feet. In areas of steep slopes (greater than 15 percent), 5-foot contour intervals may be used.

(3) Existing streams, lakes, ponds, 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 at 2 feet. In areas of steep slopes (greater than 15 percent), 5-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 1 inch equals no more than 50 feet; for tracts of 20 acres or more, the scale shall be 1 inch equals no more than 100 feet.

(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 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 Chapter.

(20) A statement, signed by the landowner, acknowledging the stormwater management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the Borough.

(21) The location of all erosion and sedimentation control facilities.

(22) The location of all groundwater recharge facilities.

C. *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 Chapter.

(c) Stormwater management techniques to be applied both during and after development.

(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 Chapter.

(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) Soil evaluation to justify infiltration site location and results of on-site testing to establish infiltration rates used for design.

D. *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.

(Ord. 3/14/2005, §403)

**§23-404. Plan Submission.**

For all activities regulated by this Chapter, the steps below shall be followed for submission. For any activities that require a PA DEP joint permit application and regulated under 25 Pa.Code, Chapter 105, "Dam Safety and Waterway Management," or 25 Pa.Code, Chapter 106, "Floodplain Management," of PA DEP's rules and regulations, require a PennDOT highway occupancy permit, or require any other permit

under applicable State or Federal regulations, the proof of application for that permit(s) shall be part of the plan. The plan shall be coordinated with the State and Federal permit process.

- A. The drainage plan shall be submitted by the developer or owner as part of any regulated activity defined in §23-104 of this Chapter.
- B. Three copies of the drainage plan shall be submitted.
- C. Distribution of the drainage plan will be as follows:
  - (1) One copy to the Borough.
  - (2) One copy to the Borough Engineer.
  - (3) One copy to a delegated agent of the York County Planning Commission.

*(Ord. 3/14/2005, §404)*

#### **§23-405. Drainage Plan Review.**

1. The Borough Engineer shall review the drainage plan for consistency with any adopted Watershed Act 167 Stormwater Management Plans. The Borough shall require receipt of a complete plan, as specified in this Chapter.

2. The Borough Engineer shall review the drainage plan for any submission or land development against the Borough Subdivision and Land Development Ordinance [Chapter 22] provisions not superseded by this Chapter. A written review will be provided to the Borough outlining the results of the review.

3. The borough shall not approve any subdivision or land development for regulated activities specified in §23-104 of this Chapter if the drainage plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Borough Engineer. All required permits from PA DEP must be obtained prior to approval of any subdivision or land development.

4. The Borough Building Permit Office shall not issue a building permit for any regulated activity specified in §23-104 of this Chapter if the drainage plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the Borough Engineer, or without considering the comments of the Borough Engineer. All required permits from PA DEP must be obtained prior to issuance of a building permit.

5. The developer 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 Borough Engineer for final approval. In no case shall the Borough approve the record drawings until the Borough receives a copy of the highway occupancy permit from the PennDOT District Office, and any applicable permits from PA DEP.

*(Ord. 3/14/2005, §405)*

#### **§23-406. Modification of Plans.**

1. 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 redesign 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 Borough Engineer, shall require a resubmission of the modified drainage plan consistent with §23-404 of this Chapter and be subject to review as specified in §23-405 of this Chapter.

2. A modification to an already approved or disapproved drainage plan shall be submitted to the Borough, accompanied by the applicable review. A modification to a drainage plan for which a formal action has not been taken by the Borough shall be submitted to the Borough, accompanied by the applicable Borough review fee.

*(Ord. 3/14/2005, §406)*



**Part 5****Inspections****§23-501. Schedule of Inspections.**

1. The Borough Engineer or his municipal assignee shall inspect phases of the installation of the permanent stormwater management facilities as deemed appropriate by the Borough Engineer.

2. During any stage of the work, if the Borough Engineer determines that the permanent stormwater management facilities are not being installed in accordance with the approved Stormwater Management Plan, the Borough shall revoke any existing permits until a revised drainage plan is submitted and approved, as specified in this Chapter.

*(Ord. 3/14/2005, §501)*



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**Part 6****Fees and Expenses****§23-601. General.**

The fee required by this Chapter is the Borough review fee. The Borough review fee shall be established by the Borough to defray review costs incurred by the Borough and the Borough Engineer. All fees shall be paid by the applicant.

*(Ord. 3/14/2005, §601)*

**§23-602. Borough Drainage Plan Review Fee.**

The Borough shall establish a review fee schedule by resolution of the Borough Council based on the size of the regulated activity and based on the Borough's costs for reviewing drainage plans. The Borough shall periodically update the review fee schedule to ensure that review costs are adequately reimbursed.

*(Ord. 3/14/2005, §602)*

**§23-603. Expenses Covered by Fees.**

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

- A. Administrative costs.
- B. The review of the drainage plan by the Borough and the Borough 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 Chapter, correct violations, and assure proper completion of stipulated remedial actions.

*(Ord. 3/14/2005, §603)*



**Part 7****Maintenance Responsibilities****§23-701. Performance Guarantee.**

The applicant should provide a financial guarantee to the Borough for the timely installation and proper construction of all stormwater management controls as required by the approved stormwater plan and this Chapter in accordance with the Pennsylvania Municipalities Code, 53 P.S. §10101 *et seq.*

(*Ord. 3/14/2005, §701*)

**§23-702. Maintenance Responsibilities.**

1. The drainage plan for the development site shall contain an operation and maintenance plan prepared by the developer and approved by the borough Engineer. the operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to insure proper operation of the facility(ies).

2. The drainage plan for the development site shall establish responsibilities for the continuing operation and maintenance of all proposed stormwater control facilities, consistent with the following principals:

A. 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 Borough, stormwater control facilities may also be dedicated to and maintained by the Borough.

B. 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.

3. The Borough Council, upon recommendation of the Borough Engineer, shall make the final determination on the continuing maintenance responsibility for any or all of the stormwater management controls.

(*Ord. 3/14/2005, §702*)

**§23-703. Maintenance Agreement for Privately Owned Stormwater Facilities.**

Prior to final approval of the site's stormwater management plan, the property owner shall sign and record a maintenance agreement (see Appendix 23-A) covering all stormwater control facilities which are to be privately owned. The agreement shall stipulate that:

A. The owner, successor, and assigns shall maintain all facilities in accordance with the approved maintenance schedule and shall keep all facilities in a safe and attractive manner.

B. The owner shall convey to the Borough easements and/or rights-of-way to assure access for periodic inspections by the Borough and maintenance, if required.

C. The owner shall keep in file with the Borough the name, address, and

telephone number of the person or company responsible for maintenance activities; in the event of a change, new information will be submitted to the Borough within 10 days of the change.

D. If the owner, successor, or assigns fails to maintain the stormwater control facilities following due notice by the Borough to correct the problem(s), the Borough may perform the necessary maintenance work or corrective work and the owner shall reimburse the Borough for all costs.

*(Ord. 3/14/2005, §703)*

#### **§23-704. Municipal Stormwater Maintenance Fund.**

Persons installing stormwater storage facilities shall be required to pay a specified amount to the Borough stormwater maintenance fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:

A. If the storage facility is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the Borough for a period of 10 years, as estimated by the Borough Engineer. After that period of time, inspections will be performed at the expense of the Borough.

B. If the storage facility is to be owned and maintained by the Borough, the deposit shall cover the estimated costs for maintenance and inspections for 10 years. The Borough Engineer will establish the estimated costs utilizing information submitted by the applicant.

C. The amount of the deposit to the fund shall be converted to present worth of the annual series values. The Borough Engineer shall determine the present worth equivalents which shall be subject to the approval of the Borough Council.

*(Ord. 3/14/2005, §704)*

#### **§23-705. Post-construction Maintenance Inspections.**

1. Basins shall be inspected by the land owner/developer or responsible entity (including the Borough Engineer for dedicated facilities) on the following bases:

A. Annually for 10 years.

B. During and immediately after the cessation of a significant storm event.

2. The entity conducting the inspection shall be required to submit a report to the Borough regarding the condition of the facility and recommending necessary repairs, if needed.

*(Ord. 3/14/2005, §705)*

**Part 8****Enforcement and Penalties****§23-801. Right-of-Entry.**

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

(Ord. 3/14/2005, §801)

**§23-802. Notification.**

In the event that a person fails to comply with the requirements of this Chapter, or fails to conform to the requirements of any permit issued hereunder, the Borough shall provide written notification of the violation. Such notification shall set forth the nature of the violations 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 Chapter. All such penalties shall be deemed cumulative and does not prevent the Borough 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 Chapter.

(Ord. 3/14/2005, §802)

**§23-803. Enforcement.**

The Borough Council is hereby authorized and directed to enforce all of the provisions of this Chapter. All inspections regarding compliance with the drainage plan shall be the responsibility of the Borough Engineer or other qualified persons designated by the Borough.

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

B. *Adherence to Approved Plan.* It shall be unlawful for any person, firm, or corporation to undertake any regulated activity under §23-104 on any property except as provided for in the approved drainage plan and pursuant to the requirements of this Chapter. It shall be unlawful to alter or remove any control structure required by the drainage plan pursuant to this Chapter or to allow the property to remain in a condition which does not conform to the approved drainage plan.

C. At the completion of the project, and as a prerequisite for the release of the performance 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 Borough, a final inspection shall be conducted by the Borough Council or its designee to certify compliance with this Chapter.

E. Prior to revocation or suspension of a permit, the Borough Council will schedule a hearing to discuss the noncompliance if there is no immediate danger to life, public health, or property.

F. *Suspension and Revocation of Permits.*

(1) Any permit issued under this Chapter may be suspended or revoked by the Borough Council for:

(a) Noncompliance with or failure to implement any provision of the permit.

(b) A violation of any provision of this Chapter 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 permit shall be reinstated by the Borough Council when:

(a) The Borough 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.

(b) The Borough Council is satisfied that the violation of the ordinance, law, or rule and regulation has been corrected.

(c) A permit which has been revoked by the Borough Council cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Chapter.

G. *Occupancy Permit.* An occupancy permit shall not be issued unless the certification of compliance pursuant to §23-803.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 Borough.

(Ord. 3/14/2005, §803)

#### **§23-804. Public Nuisance.**

1. The violation of any provision of this Chapter is hereby deemed a public nuisance.

2. Each day that a violation continues shall constitute a separate violation.

(Ord. 3/14/2005, §804)

#### **§23-805. Penalties.**

1. Any one violating the provisions of this Chapter, upon conviction thereof, shall be sentenced to a fine of not more than \$1,000 plus costs and, in default of payment of said fine and costs, to a term of imprisonment not to exceed 30 days. Each day that a

violation of this Chapter continues or each Section of this Chapter which shall be found to have been violated shall constitute a separate offense. [*Ord. 2009-09-02*]

2. In addition, the Borough, through its Solicitor may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Chapter. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus, or other appropriate forms of remedy or relief.

(*Ord. 3/14/2005, §805; as amended by Ord. 2009-09-02, 9/14/2009*)

**§23-806. Appeals.**

1. Any person aggrieved by any action of the Borough or its designee may appeal to the Borough Council within 30 days of that action.

2. Any person aggrieved by a decision of the Borough Council may appeal to the County Court of Common Pleas in the County where the activity has taken place within 30 days of the Borough's decision.

(*Ord. 3/14/2005, §806*)



## Appendix 23-A

### Standard Stormwater Facilities Maintenance and Monitoring Agreement

THIS AGREEMENT, made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between \_\_\_\_\_, ((hereinafter the “landowner”), and \_\_\_\_\_ County; Pennsylvania, (hereinafter “municipality”);

WITNESSETH:

WHEREAS, the landowner is the owner of certain real property as recorded by deed in the land records of \_\_\_\_\_ County, Pennsylvania, Deed Book \_\_\_\_\_ at Page \_\_\_\_\_. (hereinafter “property”).

WHEREAS, the landowner is proceeding to build and develop the property; and

WHEREAS, the subdivision/land management plan (hereinafter “plan”) for the \_\_\_\_\_ subdivision which is expressly made a part hereof, as approved or to be approved by the Municipality, provides for detention or retention of stormwater within the confines of the property; and

WHEREAS, the Municipality and the landowner, his successors and assigns agree that the health, safety, and welfare of the residents of the Municipality require that on-site stormwater management facilities be constructed and maintained on the property; and

WHEREAS, the Municipality requires, through the implementation of the \_\_\_\_\_ Watershed Stormwater Management Plan, that stormwater management facilities as shown on the plan be constructed and adequately maintained by the landowner, his 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 agree as follows:

1. The on-site stormwater management facilities shall be constructed by the landowner, his successors and assigns, in accordance with the terms, conditions, and specifications identified in the plan.
2. The landowner, his successors and assigns, shall maintain the stormwater management facilities in good working condition, acceptable to the Municipality so that they are performing their design functions.
3. The landowner, his successors and assigns, hereby grants permission to the Municipality, his authorized agents and employees, upon presentation or proper identification, to enter upon the property at reasonable times, and to inspect the stormwater management facilities whenever the Municipality 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 Municipality shall give the landowner, his successors and assigns, copies of the inspection report with findings and evaluations. At a minimum, maintenance inspections shall be performed in accordance with the following schedule:

A. Basins shall be inspected by the landowner/developer or responsible entity (including the Borough Engineer for dedicated facilities) on the following bases:

(1) Annually for 10 years.

(2) During and immediately after the cessation of a significant storm event.

4. All reasonable costs for said inspections shall be born by the landowner and payable to the Municipality.
5. The owner shall convey to the Municipality easements and/or rights-of-way to assure access for periodic inspections by the Municipality and maintenance, if required.
6. In the event the landowner, his successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the Municipality, the Municipality 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 successors and assigns. This provisions shall not be construed as to allow the Municipality to erect any structure of a permanent nature on the land of the landowner, outside of any easement belonging to the Municipality. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this agreement be construed to impose any such obligation on the Municipality.
7. The landowner, his successors and assigns, will perform maintenance in accordance with the maintenance schedule for the stormwater management facilities including sediment removal as outlined on the approved schedule and/or Subdivision/Land Management Plan.
8. In the event the Municipality, pursuant to this agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like on account of the landowner's or his successors' and assigns' failure to perform such work, the landowner, his successors and assigns, shall reimburse the Municipality upon demand, within 30 days of receipt of invoice thereof, for all costs incurred by the Municipality hereunder. If not paid within said 30-day period, the Municipality may enter a lien against the property in the amount of such costs, or may proceed to recover his costs through proceedings in equity or as law as authorized under the provisions of the \_\_\_\_\_ code.

9. The landowner, his successors and assigns, shall indemnify the Municipality and his agents and employees against any and all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against the Municipality for the construction, presence, existence, or maintenance of the stormwater management facilities by the landowner, his successors and assigns.
  
10. In the event a claim is asserted against the Municipality, his agents or employees, the Municipality shall promptly notify the landowner, his successors and assigns, and they shall defend, at their own expense, any suit based on such claim. If any judgment or claims against the Municipality, his agents or employees shall be allowed, the landowner, his successors and assigns shall pay all costs and expenses in connection therewith.
  
11. In the advent of an emergency or the occurrence of special or unusual circumstances or situations, the Municipality may enter the property, if the landowner is 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 Municipality shall notify the landowner of any inspection, maintenance, or repair undertaken within 5 days of the activity. The landowner shall reimburse the Municipality for its costs.

This agreement shall be recorded among the land records of \_\_\_\_\_ County, Pennsylvania and shall constitute a covenant running with the property and/or equitable servitude, and shall be binding on the landowner, his administrators, executors, assigns, heirs, and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL)

For the Municipality:

\_\_\_\_\_

(SEAL)

For the landowner:

\_\_\_\_\_

ATTEST:

\_\_\_\_\_ (City, Borough, Township)

County of \_\_\_\_\_, Pennsylvania

I, \_\_\_\_\_, a Notary Public in and for the County and State aforesaid, whose commission expires on the \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, do hereby certify that \_\_\_\_\_ whose name(s) is/are signed to the foregoing agreement bearing date of the \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

(SEAL)

\_\_\_\_\_  
Notary Public

**Appendix 23-B**

**Drainage Plan Proposed Schedule of Fees**

Subdivision Name \_\_\_\_\_ Submittal No. \_\_\_\_\_  
Owner \_\_\_\_\_ Date \_\_\_\_\_  
Engineer \_\_\_\_\_

	<u>Fee Schedule</u>	<u>Project Fee Calculation</u>
1. Filing fee	\$ 500.	\$ _____ 500.
2. Relative amount of earth disturbance		
2a. Residential		
Road <500 l.f.	\$ 100.	
Road 500-2,640 l.f.	\$ 1,000.	
Road >2.640 l.f.	\$ 1,500.	\$ _____.
2b. Commercial/industrial and other		
Impervious area <3,500 s.f.	\$ 1,000.	
Impervious area 3,500-43,460 s.f.	\$ 1,500.	
Impervious area >43,560 s.f.	\$ 2,000.	\$ _____.
	Total	\$ _____.

All subsequent reviews shall be one-fourth the amount of the initial review fee total unless a new application is required as per §23-406 of the Stormwater Ordinance. A new fee shall be submitted with each revision in accordance with this schedule.



**Appendix 23-C**

**Red Lion Borough Watershed Map**



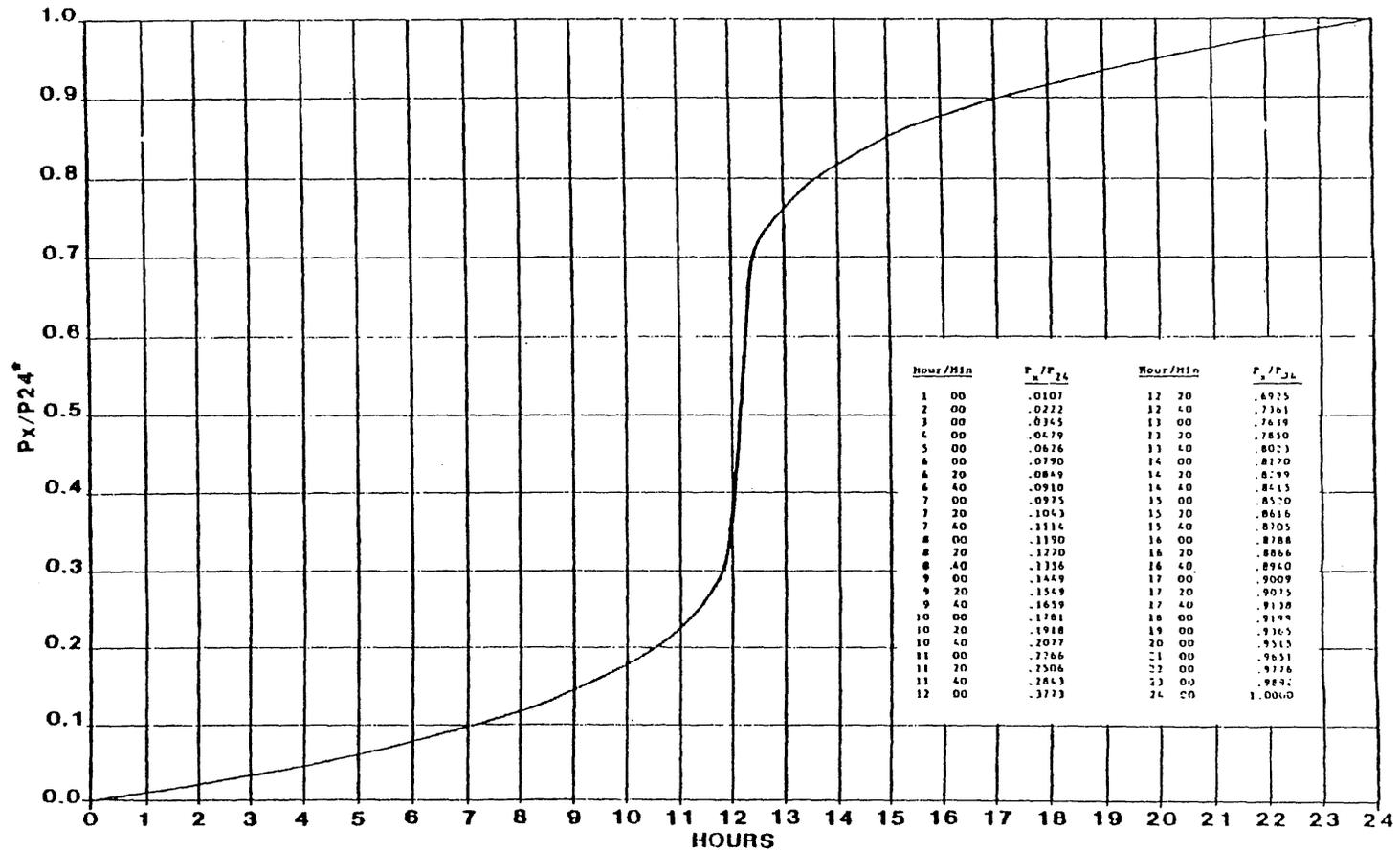
**Table 6-1**

**Design Storm Rainfall Amount (Inches)**

<b>Design Storm Frequency (years)</b>	<b>24-Hours Rainfall Amount (inches)</b>
1	2.4
2	3.1
5	3.9
10	4.9
25	5.5
50	6.2
100	6.9

Table 6-2

(SCS) Type II Rainfall Distribution



$P_x / P_{24}$  equals cumulative percentage of rainfall as a fraction of the total 24 hour rainfall.

Source: U.S. Department of Agriculture, Soil Conservation Service, Engineering Division, 1986, Urban Hydrology for Small Watersheds, Technical Release 55, Washington, DC.

**Table 6-3****NRCS (SCS) Type II Rainfall Distribution - S Curve  
Tabular Format**

<b>Time (hrs)</b>	<b>Increment</b>	<b>Time (hrs)</b>	<b>Increment</b>	<b>Time (hrs)</b>	<b>Increment</b>
0.00	0.0000	10.00	0.1810	20.00	0.9530
0.25	0.0020	10.25	0.1910	20.25	0.9560
0.50	0.0020	10.50	0.2030	20.50	0.9590
0.75	0.0080	10.75	0.2180	20.75	0.9620
1.00	0.0111	11.00	0.2360	21.00	0.9650
1.25	0.0140	11.25	0.2570	21.25	0.9680
1.50	0.0170	11.50	0.2830	21.50	0.9710
1.75	0.0200	11.75	0.3870	21.75	0.9740
2.00	0.0230	12.00	0.6630	22.00	0.9777
2.25	0.0260	12.25	0.7070	22.25	0.9800
2.50	0.0290	12.50	0.7350	22.50	0.9830
2.75	0.0320	12.75	0.7580	22.75	0.9860
3.00	0.0350	13.00	0.7760	23.00	0.9890
3.25	0.0380	13.25	0.7910	23.25	0.9920
3.50	0.0410	13.50	0.8040	23.50	0.9950
3.75	0.0440	13.75	0.8150	23.75	0.9980
4.00	0.0480	14.00	0.8250	24.00	1.0000
4.25	0.0520	14.25	0.8340		
4.50	0.0560	14.50	0.8420		
4.75	0.0600	14.75	0.8490		
5.00	0.0640	15.00	0.8560		
5.25	0.0680	15.25	0.8630		
5.50	0.0720	15.50	0.8690		
5.75	0.0760	15.75	0.8750		
6.00	0.0800	16.00	0.8810		
6.25	0.0850	16.25	0.8870		
6.50	0.0900	16.50	0.8930		
6.75	0.0950	16.75	0.8980		
7.00	0.1000	17.00	0.9030		
7.25	0.1050	17.25	0.9080		
7.50	0.1100	17.50	0.9130		
7.75	0.1150	17.75	0.9180		
8.00	0.1200	18.00	0.9220		
8.25	0.1260	18.25	0.9260		
8.50	0.1330	18.50	0.9300		
8.75	0.1400	18.75	0.9340		
9.00	0.1470	19.00	0.9380		
9.25	0.1550	19.25	0.9420		
9.50	0.1630	19.50	0.9460		
9.75	0.1720	19.75	0.9500		

Table 6-4

PennDOT Storm Intensity-Duration-Frequency Curves (Region 4)

REGION 4

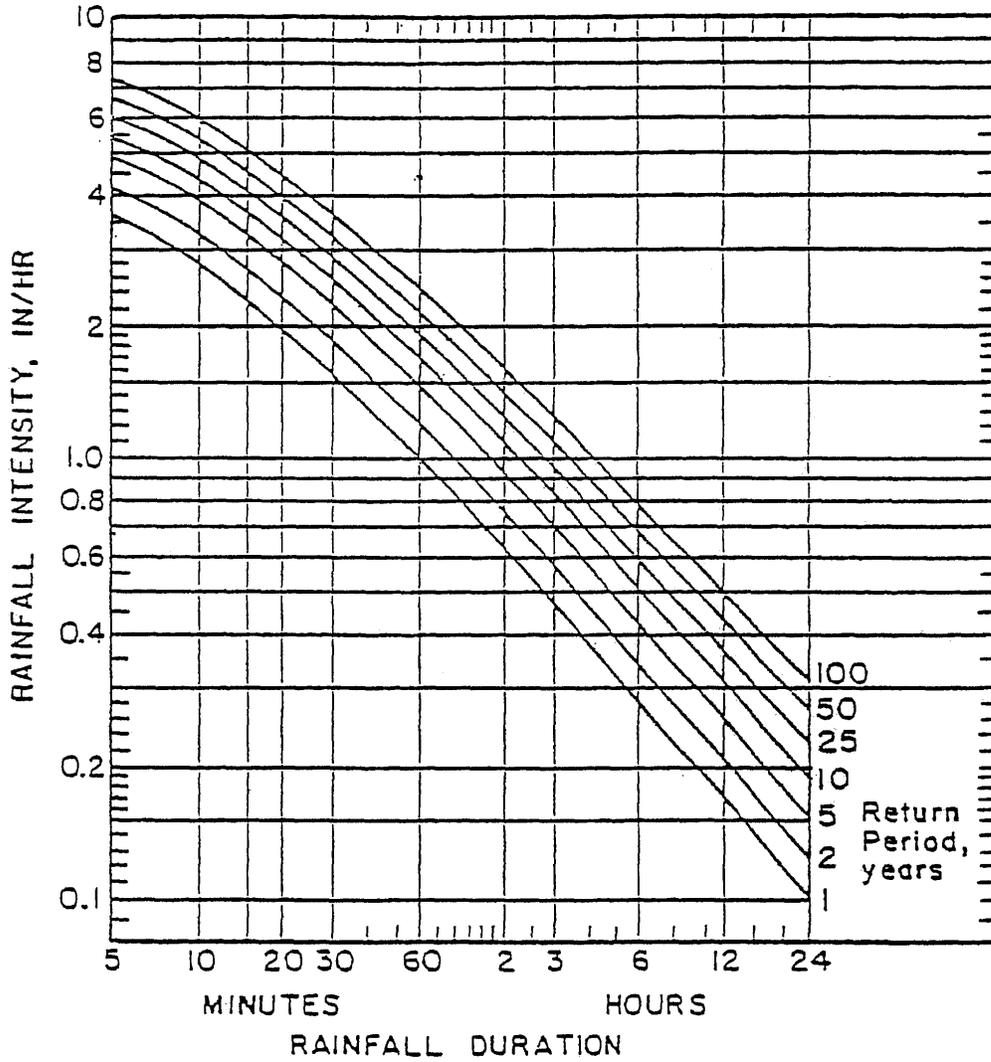


Figure 2.10.4.2(D) Storm intensity-duration-frequency curves for Region 4

**Table 6-5**

**Runoff Curve Numbers  
[From NRCS (SCS) TR-55]**

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Open Space	44	65	77	82
Meadow	30**	58	71	78
Agricultural	59	71	79	83
Forest	36**	60	73	79
Commercial (85% impervious)	89	92	94	95
Industrial (72% impervious)	81	88	91	93
Institutional (50% impervious)	71	82	88	90
<b>Residential</b>				
<b>Average Lot Size</b>	<b>% Impervious</b>			
1/8 acre or less*	65	77	85	90
1/8-1/3 acre	34	59	74	82
1/3-1 acre	23	53	69	80
1-4 acres	12	46	66	78
Farmstead	59	74	82	86
Smooth surfaces (concrete, asphalt, gravel or bare compacted soil)	98	98	98	98
Water	98	98	98	98
Mining newly graded areas (pervious areas only)	77	86	91	94

\* Includes multi-family housing unless justified lower density can be provided.

\*\* Caution - CN values under 40 may produce erroneous modeling results.

Note: Site conditions of bare earth or fallow shall be considered as meadow when choosing a CN value for existing undeveloped conditions.

**Table 6-6**

**Rational Runoff Coefficients**  
by Hydrologic Soils Group and Overland Slope (%)

Land Use	A			B			C			D		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Cultivated land	0.08 <sup>a</sup>	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
	0.14 <sup>b</sup>	0.18	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	0.20	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	0.27	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												
Lot size 1/8 acre	0.25	0.28	0.31	0.27	0.30	0.25	0.30	0.33	0.38	0.33	0.36	0.42
	0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Lot size 1/4 acre	0.22	0.26	0.31	0.27	0.30	0.25	0.30	0.33	0.38	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
Lot size 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
Lot size 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
Lot size 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	0.8	0.85	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	0.71	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	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
	0.95	0.96	0.97	0.95	0.96	0.97	0.95	0.9	0.97	0.95	0.96	0.97

<sup>a</sup> Runoff coefficients for storm recurrence intervals less than 25 years.

<sup>b</sup> Runoff coefficients for storm recurrence intervals 25 years or more.

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

**Table 6-7**

**Roughness Coefficients (Manning's "n") for Overland Flow**  
(U.S. Army Corps of Engineers, HEC-1 Users Manual)

Surface Description	n
Dense growth	0.4–0.5
Pasture	0.3–0.4
Lawns	0.2–0.03
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 ¼ inch)	0.10–0.15
-small depths (¼ inch to several inches)	0.05–0.10

**Roughness Coefficients (Manning's "n") for Sheet Flow**  
(U.S. Soil Conservation Service Technical Release 55)

Surface Description	n
Smooth Surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover less than or 20%	0.06
Residue cover greater than 20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods:	
Light underbrush	0.40
Dense underbrush	0.80

