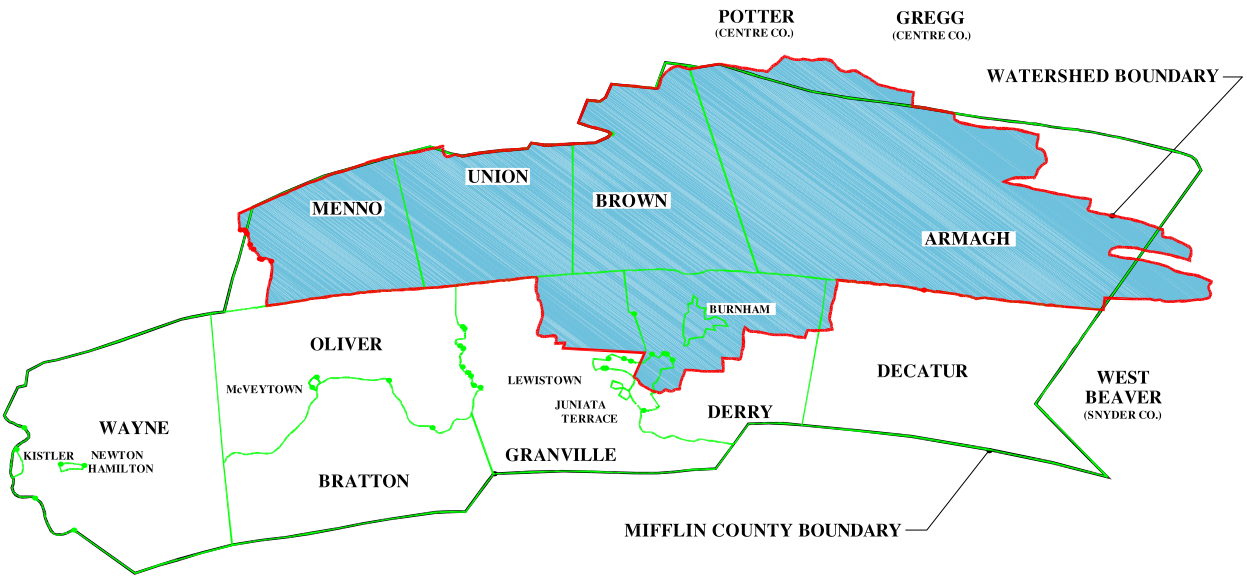
# ACT 167
# STORM WATER MANAGEMENT PLAN
# PHASE II

## MIFFLIN COUNTY
## PLANNING COMMISSION

# KISHACOQUILLAS CREEK WATERSHED




# FINAL REPORT

NOVEMBER, 2003

# KISHACOQUILLAS CREEK WATERSHED

## ACT 167 STORM WATER MANAGEMENT STUDY

## FINAL REPORT

NOVEMBER, 2003

MIFFLIN COUNTY PLANNING COMMISSION
20 NORTH WAYNE STREET
LEWISTOWN, PENNSYLVANIA 17044
(717) 242-0887

# KISHACOQUILLAS CREEK WATERSHED
# ACT 167
# STORMWATER MANAGEMENT PLAN

**Mifflin County, Pennsylvania**

*Plan Prepared For:*


## Mifflin County Board of Commissioners
Charles E. "Yogi" Laub, Chairman
Susan M. McCartney
James L. Hilderbrandt

## Mifflin County Planning Commission
Otis Riden, Jr., Chairman
Dan Dunmire
John Pannizzo
John Morris
Donald Kauffman
James Spendiff
Marshall Hartman
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## Staff Participation
Mifflin County Planning and Development Department
William A. Gomes, AICP, Director of Planning
Mark N. Donohue, Associate Planner
Millie J. Sunderland, Planning Secretary
Donna P. Baer, Fiscal Assistant

## Project Consultant
Gannett Fleming, Inc.
P.O. Box 67100
Harrisburg, PA 17106-7100



PLAN ADOPTION BY MIFFLIN COUNTY: December 4, 2003

PLAN APPROVAL BY PA DEP: December 18, 2003

*Funding for this plan was provided through the Pennsylvania Department of Environmental Protection, as well as local funding provided by the Mifflin County Board of Commissioners.*

**RESOLUTION NO. 2003-21**

**RESOLUTION OF THE MIFFLIN COUNTY BOARD OF COMMISSIONERS FOR THE ADOPTION OF THE KISHACOQUILLAS CREEK WATERSHED STORMWATER MANAGEMENT PLAN**

WHEREAS, the General Assembly of Pennsylvania enacted the "Stormwater Management Act" (No. 167, 1978);

WHEREAS; the Stormwater Management Act provides for the regulation of land and water use for flood control and stormwater management purposes, and imposes duties and confers powers on the Department of Environmental Protection, municipalities and counties;

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

WHEREAS, the County of Mifflin understands that a comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety, welfare and the protection of the people of Mifflin County and all people of the Commonwealth, their resources and the environment;

WHEREAS, Mifflin County has been designated by the Pennsylvania Department of Environmental Protection as the lead agency in the preparation of the Kishacoquillas Creek Watershed Stormwater Management Plan;

WHEREAS, the County of Mifflin seeks to fully comply with ACT 167 of 1978, the Pennsylvania Stormwater Management Act, which requires counties to prepare and adopt a watershed stormwater management plan for each designated watershed within its jurisdiction;

WHEREAS, Mifflin County has prepared a Stormwater Management Plan for the Kishacoquillas Creek Watershed under the guidance of the Mifflin County Planning Commission, municipal officials from impacted communities, the Kishacoquillas Creek Watershed Advisory Committee and the consultant for the project, Gannett Fleming, Inc.;

WHEREAS, a public hearing was held on April 24, 2003 to present the contents of the plan and seek public comments, a follow up meeting of municipal representatives was held on October 15, 2003 to seek additional input and the applicable public comments and concerns have been adequately addressed.

NOW, THEREFORE, BE IT RESOLVED that the Mifflin County Commissioners hereby adopt the Kishacoquillas Creek Stormwater Management Plan, prepared by the Mifflin County Planning Commission, the Kishacoquillas Creek Watershed Plan Advisory Committee, municipal representatives and the consultant, Gannett Fleming, Inc., this fourth day of December, 2003.

ATTEST:

Peggy A. Finkenbiner

Peggy Finkenbiner, Chief Clerk

MIFFLIN COUNTY BOARD OF COMMISSIONERS

Charles E. Laub, Chairman

Susan M. McCartney, Vice Chairman

James L. Hilderbrandt, Secretary

KISHACOQUILLAS CREEK ACT 167 STUDY

FINAL REPORT

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FINAL REPORT

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## FINAL REPORT

## I. PURPOSE OF THE REPORT

The purpose of this report is to summarize the findings and recommendations of the Kishacoquillas Creek Watershed Act 167 Study. The goal of producing and distributing this report is to keep interested parties informed so the final management plan can best meet the needs of the area.

Comments regarding this report are welcome and should be addressed to:

Mr. William Gomes
Mifflin County Planning Commission
20 North Wayne Street
Lewistown, PA 17044
(717) 242-0887

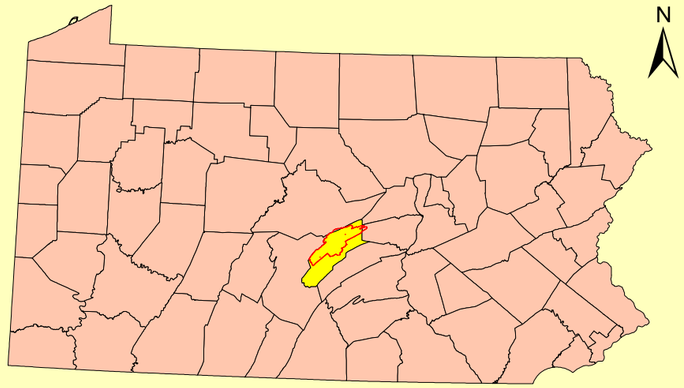
## II. WATERSHED LOCATION AND DESCRIPTION

The Kishacoquillas Creek watershed is located in the northern portion of Mifflin County, PA as illustrated on Plate 1. The watershed encompasses approximately 196 square miles (125,178 acres) and includes all or portions of 12 municipalities as shown in Table 1 and illustrated on Plate 2. Kishacoquillas Creek flows in a generally north to south direction where the main stem discharges into the Juniata River. There are several medium-sized unnamed tributary streams that flow into the main stem and numerous small creeks.

The highest point in the watershed is approximately 2,300 feet MSL and the elevation at the mouth is about 450 feet MSL. The average watershed slope is 17 percent. Much of the watershed is underlain by limestone, which has led to the development of numerous sinkholes. The stream has a good baseflow, which is typical for streams in the karst terrain of central Pennsylvania where many springs occur. Surface and ground water quality appear to be generally good, although no testing was done as part of this study.

Floodplain areas for some of the streams in the watershed have been mapped by the Federal Emergency Management Agency (FEMA). Those areas are shown on Plate 2.

There are a number of storm drain systems in the watershed. Plate 2 highlights the areas that are currently served by storm drains. New residential, commercial, and industrial development is projected for the watershed. It is likely that these developments will incorporate storm sewers and stormwater management systems consistent with existing ordinances.




KISHACOQUILLAS CREEK WATERSHED
LOCATION MAP

ARMAGH TOWNSHIP

BROWN TOWNSHIP

DECATUR TOWNSHIP

UNION TOWNSHIP

MENNO TOWNSHIP

GRANVILLE TOWNSHIP

OLIVER TOWNSHIP

322

655

522

103

Burnham

Lewistown

Juniata Terrace

**Legend**

- Mifflin County
- Watershed Study Area
- Township Boundary
- Rivers
- Roads

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 1: WATERSHED LOCATION MAP

ARMAGH

WEST BEAVER

DECATUR

BROWN

UNION

DERRY

MENNO

GRANVILLE

OLIVER

## Legend

- Major Roads
- Rivers
- FEMA Floodplain Delineation
- Township Boundary
- Existing Storm Drain Systems
- Kishacoquillas Creek Watershed

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 2: DETAILED WATERSHED MAP

**TABLE 1**
**MUNICIPALITIES IN THE WATERSHED**

| MUNICIPALITY | COUNTY | PORTION OF WATERSHED IN THE MUNICIPALITY (Acres) | PORTION OF THE MUNICIPALITY IN THE WATERSHED (%) |
|---|---|---|---|
| Armagh Township | Mifflin | 50,506 | 85 |
| Brown Township | Mifflin | 20,905 | 99 |
| Decatur Township | Mifflin | 379 | 1 |
| Derry Township | Mifflin | 10,904 | 54 |
| Granville Township | Mifflin | 5,242 | 20 |
| Menno Township | Mifflin | 13,797 | 90 |
| Union Township | Mifflin | 16,329 | 100 |
| Lewistown Borough | Mifflin | 575 | 42 |
| Burnham Borough | Mifflin | 664 | 100 |
| Gregg Township | Centre | 359 | 1 |
| Potter Township | Centre | 2,386 | 6 |
| West Beaver Township | Snyder | 2,626 | 13 |

## III. EXISTING LAND USE

Existing land use in the watershed includes all major types: residential, commercial, industrial, institutional, agricultural, forest, and open space. Plate 3 shows the major land use categories and Table 2 provides a summary of the acreages associated with each land use.

**TABLE 2**
**EXISTING LAND USE**

| LAND USE CATEGORY | PERCENTAGE | ACREAGE |
|---|---|---|
| Residential - Single Family | 3.2 | 4,041 |
| Residential - Multiple Family | 0.9 | 1,168 |
| Commercial | 0.5 | 638 |
| Industrial | 0.9 | 1,176 |
| Institutional | 0.3 | 319 |
| Forest | 61.6 | 77,116 |
| Open Space/Agricultural | 32.5 | 40,720 |
| TOTALS | 100.0 | 125,178 |

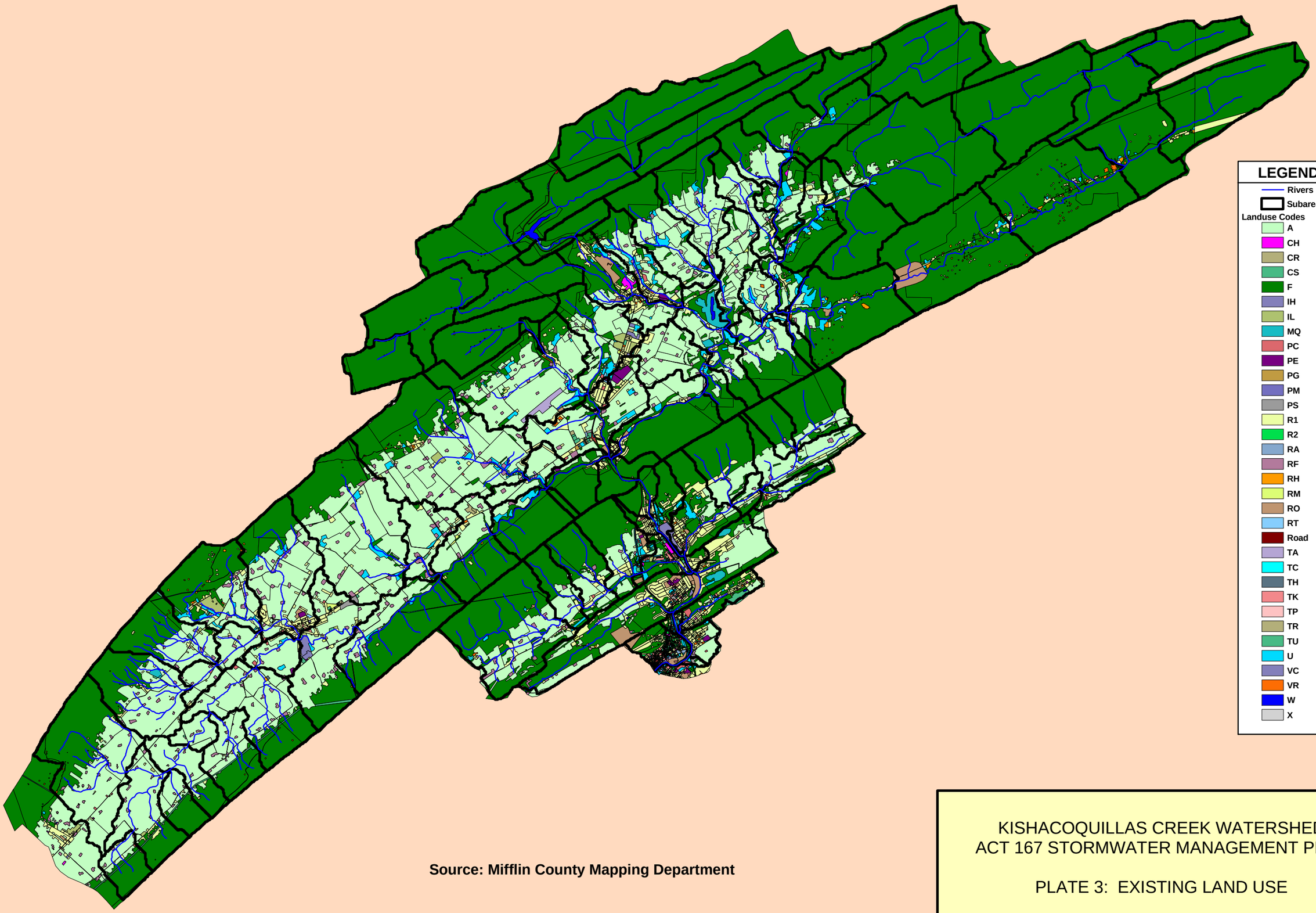
## IV. PROJECTED LAND USE

Portions of the watershed are undergoing development, with residential growth being the predominant sector. For this project, future land use was based on the Mifflin County Comprehensive Plan which was adopted in 1990 and updated in 2002.

Plate 4 shows the future land use categories in the watershed associated with each zoning type.

## V. EXISTING STORMWATER MANAGEMENT REGULATIONS

There are a variety of laws and regulations that impose requirements on development to manage their stormwater discharges in order to protect downstream properties. Act 167 (Public Law 864, October, 1978), provides for the regulation of land and water use for flood control and stormwater management purposes on a watershed basis. The Act requires counties to prepare and adopt stormwater management plans for each watershed in the county. Following adoption of the plans, each municipality in the watershed must adopt the provisions of the model ordinance developed as part of the watershed plan. The goal of the Act is to foster the development of a consistent set of local rules and regulations to protect and improve the capacity of natural stream channels throughout the state. The rules and regulations formulated in the model ordinance are intended to work in concert with other state and federal laws. Those laws include:




**Source: Mifflin County Mapping Department**

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 3: EXISTING LAND USE

## LEGEND

- Township Boundary
- Main Roads
- Main Streams
- Village Center
- Limited Growth Area
- Publicly Developed Land
- Presently Developed
- Natural Resource Area
- Zoned High Growth Area (Commercial & Industrial)
- Zoned High Growth Area (Residential)
- Unzoned High Growth (Industrial & Commercial)
- Unzoned High Growth Residential
- Rural Development Area

Armagh

Brown

Decatur

Union

Derry

Menno

Granville

Oliver

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 4: FUTURE LAND USE

Pennsylvania Municipal Planning Code as amended (Act 170)
Pennsylvania Floodplain Management Act of 1968 (Act 166)
Pennsylvania Dam Safety and Encroachment Act of 1978 (Act 325)
Pennsylvania Clean Streams Law as amended (Act 394)
Pennsylvania Scenic River Act as amended (Act 110)
Federal Clean Water Act (CWA)
National Flood Insurance Act (FIA)
Flood Disaster Protection Act (FDPA)

Some of the municipalities in the watershed have comprehensive plans, zoning ordinances and maps, subdivision ordinances, and floodplain maps. However, some municipalities rely on the County to review land development plans. Table 4 summarizes the stormwater management provisions of the municipal ordinances. As the table shows, most of the municipalities require some level of peak flow control for new development.

## VI. STORMWATER PROBLEMS

A number of stormwater related problems were identified by the municipalities in the Kishacoquillas Creek watershed. Plate 5 shows the locations of the problems and Table 5 provides some descriptive information obtained from the Municipal Questionnaire.

## VII. MODELING RESULTS

A computer model of the watershed was developed using the Soil Conservation Service=s (SCS) TR-20 program. The model database was created using mapping data and aerial photos obtained from the County and from field reconnaissance information.

The watershed was divided into 89 subwatersheds, as shown in Plate 6, for purposes of characterizing runoff conditions. Each subwatershed was analyzed to determine the types of soils and land use for existing conditions and this information was used to derive the SCS Curve Number (CN - an indicator of the runoff potential of an area). The Mifflin County Comprehensive Plan was used to develop the land use for projected development conditions and the subwatersheds were analyzed to derive a future condition CN. Table 6 summarizes the characteristics of the subwatersheds for existing and projected development conditions.

Modeling results were presented in an interim report during the project. The SCS TR-20 model reports the resulting stream flow rates by stream cross section. Each of the 89 subareas was associated with a stream cross section and the model accumulated the runoff and routed the flows down through the stream channel. Plate 7 shows the location of the stream cross sections in the watershed, and Table 7 summarizes the results of the modeling by presenting the peak discharges at selected stream locations for existing and projected development conditions for the range of storms that were analyzed.

**TABLE 3**
**SUMMARY OF ORDINANCE PROVISIONS**

| MUNICIPALITY NAME | SEPARATE ORDINANCE OR COUNTY (S/C) | PEAK FLOW CONTROL REQUIRED (Y/N) | DESIGN STORMS RETURN FREQUENCY (YEARS/DURATION) | REQUIRED METHODOLOGY | COMMENTS |
|---|---|---|---|---|---|
| Armagh Township | S | Y | N/S | N/S | Post back to pre |
| Brown Township | C | Y | 2-, 5-, 10-, 25-, 50- | > 320 ac. - SCS < 320 ac. - Rational | Post back to pre |
| Decautur Township | S | Y | N/S | N/S | Post back to pre |
| Derry Township | S | Y | 2-, 5-, 10-, 25-, 50- | > 320 ac. - SCS < 320 ac. - Rational | Post back to pre |
| Granville Township | S | Y | N/S | N/S | Post back to pre |
| Menno Township | S | Y | 10- | > 320 ac. - SCS < 320 ac. - Rational | Post back to pre |
| Union Township | S | N/S | N/S | N/S | |
| Lewistown Borough | S | N | 10-, 25- | Rational | Evaluate capacity of downstream system |
| Burnham Borough | S | Y | 2-. 10- | TR-55, Rational | Post back to pre |
| Gregg Township | C | Y | N/S | N/S | Post back to pre |
| Potter Township | C | Y | N/S | N/S | Post back to pre |
| West Beaver Township | C | Y | N/S | N/S | Post back to pre |

N/S = Not specified in ordinance.

**TABLE 4**
**STORMWATER PROBLEMS**

| PROBLEM NUMBER | MUNICIPALITY | LOCATION | DESCRIPTION |
|---|---|---|---|
| 1 | Armagh | Naginey | Private property flooding |
| 2 | Armagh | Siglerville | Channel/stream/street flooding |
| 3 | Armagh | Milroy, Lower End | Channel/stream flooding, erosion |
| 4 | Armagh | Lingle Valley | Channel/stream/street flooding, erosion |
| 5 | Brown | Willow Lane in Honey Brook | Channel/stream/street flooding |
| 6 | Derry | Meadowfield Playground | Channel/stream flooding, erosion |
| 7 | Derry | N. Derry Avenue | Channel/stream flooding |
| 8 | Derry | Derry Community Park | Channel/stream flooding, erosion |
| 9 | Lewistown | Rec. Park | Channel/stream flooding |
| 10 | Lewistown | Trinity H.C.C. | Private property flooding |
| 11 | Union Township | Main Street | Channel/stream/street flooding |
| 12 | Mifflin County Emergency Services provided a detailed map of the watershed identifying numerous locations where stream and street flooding, erosion, and sedimentation occur frequently. The problem areas are too numerous to list individually. The map will be kept on file for future reference. | | |

ARMAGH

WEST BEAVER

DECATUR

BROWN

UNION

DERRY

MENNO

GRANVILLE

OLIVER

1
2
3
4
5
6
7
8
9
10
11

## LEGEND

- Stormwater Problem Areas
- Major Roads
- Rivers
- Township Boundary
- Kishacoquillas Creek Watershed

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 5: STORMWATER PROBLEM AREA MAP

Another component of the modeling effort involved development of Release Rates. The Release Rate concept was developed because it had been observed that controlling peak discharges after development to rates experienced before development occurred was not sufficient to ensure that downstream areas would not experience increased flooding conditions. The cause of the flooding was found to be related to the duration of the controlled peak flow from the new development.

The Release Rate defines what percentage of the predevelopment peak discharge can be released as a peak discharge after development. For example, a 100 percent Release Rate implies that the development can discharge runoff at a rate equal to predevelopment conditions, while a 50 percent Release Rate indicates that the peak discharge after development cannot exceed 50 percent of the predevelopment peak discharge.

Another modeling tool, STREMTUL, was use to determine the Release Rates for the watershed. This tool, developed by the Lancaster County Planning Commission, analyzes the results of the TR-20 model and determines the appropriate release rate for each subarea. The Release Rate analysis as applied by STREMTUL makes some generalizing assumptions, so the results have to be reviewed and adjustments are made manually. The results of the Release Rate analyses were summarized in a report published in June, 2000. Plate 8 shows the final Release Rate percentages that incorporate comments from the WPAC and several municipalities that reviewed the draft report.

## VIII. MODEL ORDINANCE

A Model Stormwater Management Ordinance was prepared and presented to the Watershed Plan Advisory Committee at the October and November, 2000 meetings. Comments were received from the municipal engineers and solicitors and changes were made to the Model Ordinance. The revised Model Ordinance is presented in Attachment A. The Model Ordinance includes performance standards and specifications for managing storm runoff in the watershed. It includes acceptable criteria for determining existing and projected runoff rates, designing stormwater collection systems, and reducing peak discharge rates.

## IX. BEST MANAGEMENT PRACTICES

The Model Ordinance requires developers to implement water quantity and quality controls to minimize the impact of development on the natural drainage system. To achieve the most cost-effective results, it is strongly recommended that the developer consider implementation of Best Management Practices (BMP=s). The Pennsylvania Department of Environmental Protection has published AThe Pennsylvania Handbook of Best Management Practices for Developing Areas@ (1998) to assist developers and municipalities in the selection and implementation of these management practices.

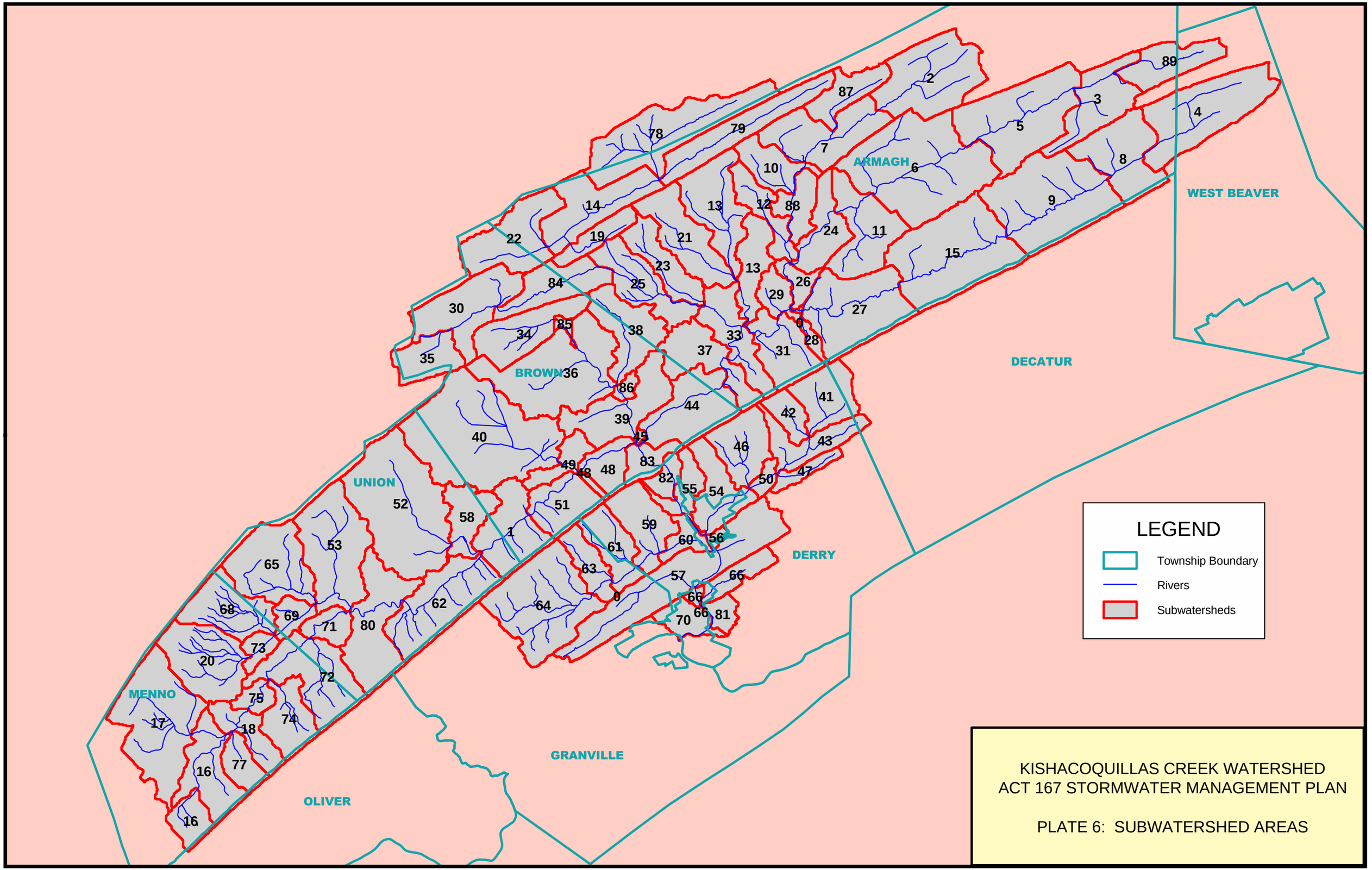

ARMAGH
WEST BEAVER
DECATUR
BROWN
UNION
DERRY
MENNO
GRANVILLE
OLIVER
LEGEND
Township Boundary
Rivers
Subwatersheds
KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN
PLATE 6: SUBWATERSHED AREAS

**TABLE 5**
**SUBWATERSHED MODELING CHARACTERISTICS**

| SUBWATERSHED NUMBER | AREA (SQ. MI.) | CURVE NUMBER | | TIME OF CONCENTRATION (HOURS) |
|---|---|---|---|---|
| | | EXISTING | PROJECTED | |
| 1 | 2.46 | 68 | 68 | 1.39 |
| 2 | 3.71 | 65 | 65 | 1.76 |
| 3 | 2.35 | 67 | 67 | 1.24 |
| 4 | 3.96 | 65 | 65 | 2.08 |
| 5 | 4.46 | 65 | 65 | 1.91 |
| 6 | 6.44 | 65 | 65 | 2.07 |
| 7 | 2.90 | 65 | 65 | 1.42 |
| 8 | 2.76 | 67 | 67 | 1.27 |
| 9 | 5.17 | 67 | 67 | 1.94 |
| 10 | 1.36 | 72 | 72 | 1.19 |
| 11 | 2.69 | 65 | 65 | 1.86 |
| 12 | 1.35 | 76 | 76 | 1.79 |
| 13 | 2.65 | 74 | 74 | 1.69 |
| 14 | 2.74 | 66 | 66 | 1.50 |
| 15 | 5.28 | 66 | 66 | 2.03 |
| 16 | 0.95 | 70 | 70 | 1.14 |
| 17 | 4.65 | 69 | 69 | 1.98 |
| 18 | 1.29 | 70 | 70 | 1.49 |
| 19 | 0.97 | 65 | 67 | 0.83 |
| 20 | 2.93 | 70 | 70 | 1.94 |
| 21 | 2.49 | 75 | 75 | 1.70 |
| 22 | 2.80 | 66 | 66 | 1.49 |

**TABLE 5**
**SUBWATERSHED MODELING CHARACTERISTICS**

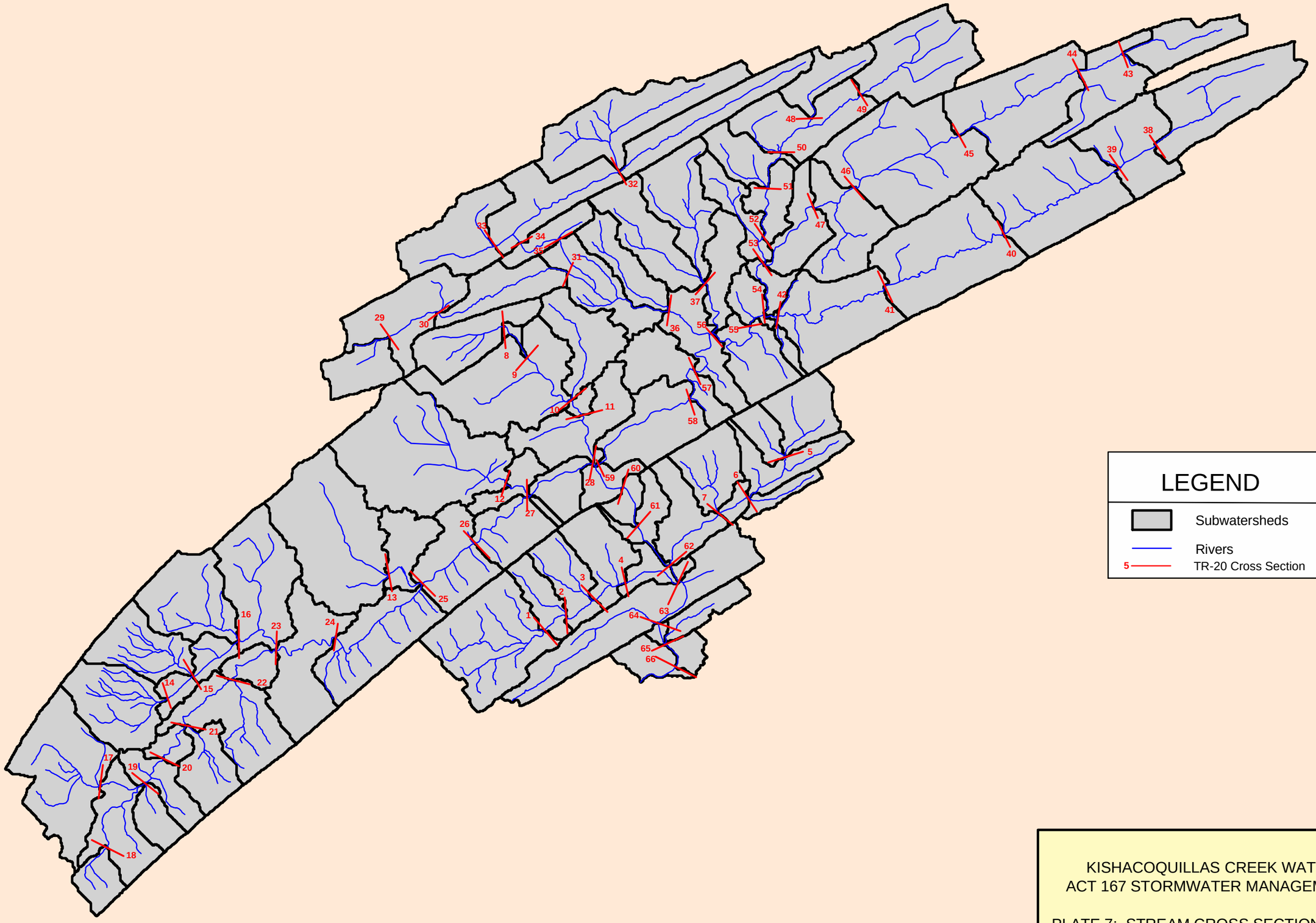
| SUBWATERSHED NUMBER | AREA (SQ. MI.) | CURVE NUMBER | | TIME OF CONCENTRATION (HOURS) |
|---|---|---|---|---|
| | | EXISTING | PROJECTED | |
| 23 | 1.65 | 76 | 77 | 1.71 |
| 24 | 1.65 | 69 | 69 | 1.43 |
| 25 | 2.17 | 75 | 77 | 1.96 |
| 26 | 0.59 | 79 | 79 | 0.84 |
| 27 | 3.82 | 69 | 69 | 1.68 |
| 28 | 0.31 | 70 | 70 | 1.08 |
| 29 | 0.79 | 79 | 79 | 1.13 |
| 30 | 2.87 | 67 | 67 | 1.50 |
| 31 | 2.02 | 69 | 69 | 1.59 |
| 32 | 1.56 | 76 | 76 | 1.20 |
| 33 | 2.03 | 67 | 67 | 2.10 |
| 34 | 2.22 | 65 | 65 | 1.79 |
| 35 | 1.43 | 69 | 69 | 1.25 |
| 36 | 4.93 | 72 | 72 | 2.55 |
| 37 | 2.12 | 70 | 70 | 2.02 |
| 38 | 2.25 | 73 | 75 | 1.79 |
| 39 | 2.61 | 73 | 75 | 2.16 |
| 40 | 7.12 | 69 | 69 | 2.83 |
| 41 | 1.81 | 65 | 65 | 1.53 |
| 42 | 0.82 | 65 | 65 | 1.19 |
| 43 | 1.55 | 69 | 69 | 1.74 |
| 44 | 2.78 | 68 | 68 | 1.69 |
| 45 | 0.06 | 72 | 75 | 0.67 |

**TABLE 5**
**SUBWATERSHED MODELING CHARACTERISTICS**

| SUBWATERSHED NUMBER | AREA (SQ. MI.) | CURVE NUMBER | | TIME OF CONCENTRATION (HOURS) |
|---|---|---|---|---|
| | | EXISTING | PROJECTED | |
| 46 | 1.89 | 65 | 65 | 1.48 |
| 47 | 0.56 | 68 | 68 | 1.30 |
| 48 | 1.07 | 68 | 68 | 1.27 |
| 49 | 1.01 | 71 | 71 | 1.27 |
| 50 | 0.35 | 69 | 69 | 0.83 |
| 51 | 1.76 | 65 | 65 | 1.45 |
| 52 | 5.94 | 68 | 68 | 2.52 |
| 53 | 3.79 | 70 | 72 | 2.63 |
| 54 | 1.84 | 71 | 75 | 1.49 |
| 55 | 1.00 | 72 | 75 | 1.50 |
| 56 | 0.15 | 72 | 75 | 0.57 |
| 57 | 4.93 | 70 | 75 | 2.24 |
| 58 | 1.47 | 72 | 72 | 2.32 |
| 59 | 1.93 | 70 | 72 | 1.26 |
| 60 | 0.67 | 80 | 80 | 0.81 |
| 61 | 1.61 | 66 | 70 | 1.31 |
| 62 | 3.39 | 67 | 67 | 2.06 |
| 63 | 1.13 | 68 | 70 | 1.13 |
| 64 | 4.63 | 68 | 68 | 1.86 |
| 65 | 3.02 | 71 | 73 | 1.82 |
| 66 | 0.92 | 73 | 75 | 1.26 |
| 67 | 0.89 | 80 | 80 | 0.25 |
| 68 | 2.24 | 70 | 70 | 1.58 |

**TABLE 5**
**SUBWATERSHED MODELING CHARACTERISTICS**

| SUBWATERSHED NUMBER | AREA (SQ. MI.) | CURVE NUMBER | | TIME OF CONCENTRATION (HOURS) |
|---|---|---|---|---|
| | | EXISTING | PROJECTED | |
| 69 | 0.68 | 75 | 75 | 1.18 |
| 70 | 0.94 | 77 | 80 | 1.19 |
| 71 | 0.81 | 73 | 73 | 1.47 |
| 72 | 3.23 | 70 | 70 | 1.83 |
| 73 | 0.54 | 71 | 71 | 1.33 |
| 74 | 1.66 | 69 | 69 | 1.61 |
| 75 | 0.57 | 73 | 73 | 1.24 |
| 76 | 2.38 | 70 | 70 | 1.05 |
| 77 | 0.92 | 68 | 68 | 1.16 |
| 78 | 4.25 | 65 | 65 | 3.09 |
| 79 | 2.60 | 68 | 68 | 2.58 |
| 80 | 3.23 | 72 | 72 | 2.09 |
| 81 | 0.51 | 76 | 80 | 0.87 |
| 82 | 0.57 | 65 | 67 | 0.90 |
| 83 | 0.84 | 65 | 67 | 1.14 |
| 84 | 1.96 | 65 | 65 | 1.64 |
| 85 | 0.15 | 66 | 66 | 0.54 |
| 86 | 0.27 | 71 | 75 | 0.89 |
| 87 | 1.35 | 65 | 65 | 1.46 |
| 88 | 1.12 | 75 | 75 | 1.28 |
| 89 | 1.70 | 65 | 65 | 1.81 |




## LEGEND

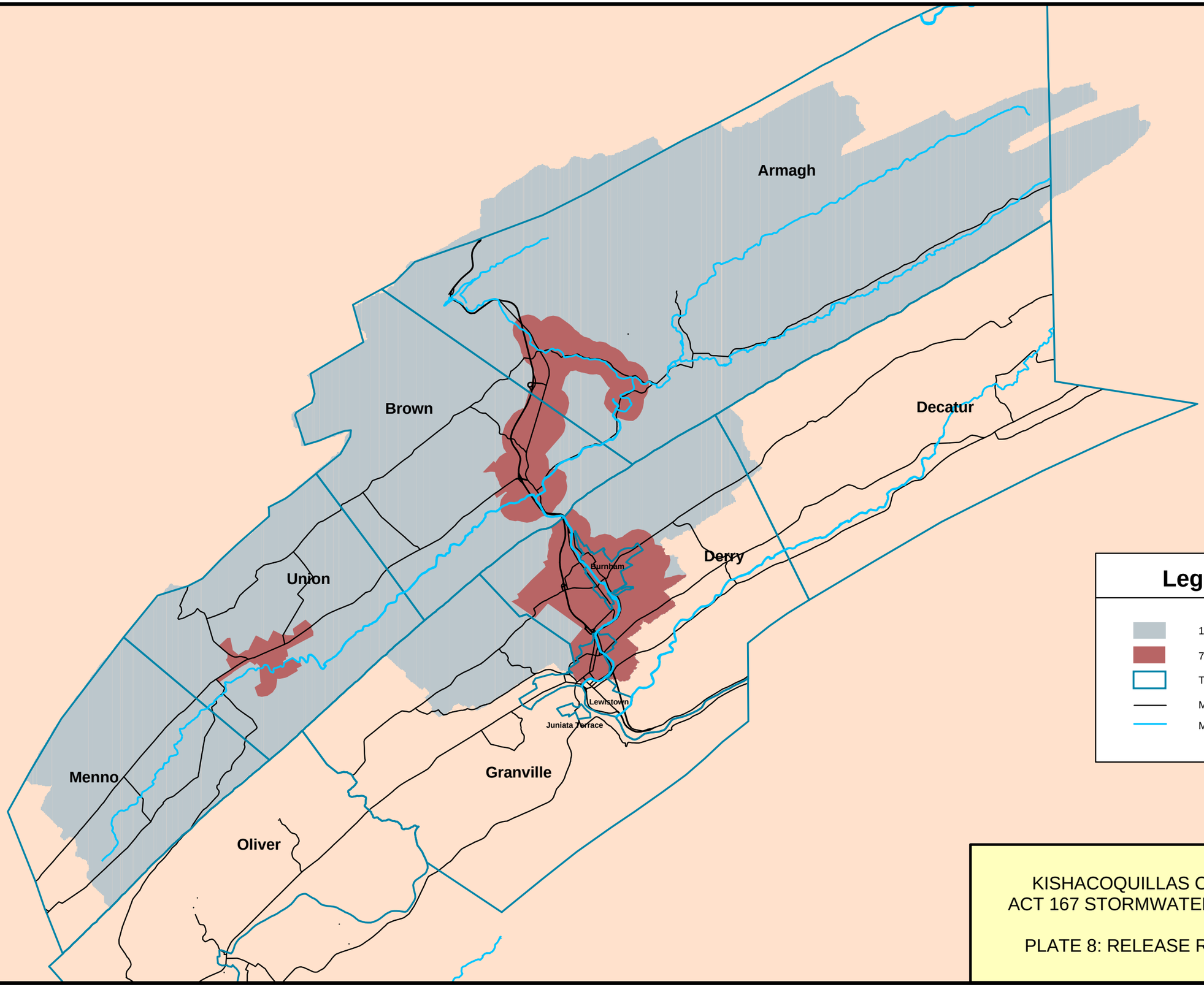
- Subwatersheds
- Rivers
- 5 — TR-20 Cross Section

KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 7: STREAM CROSS SECTION LOCATIONS

**TABLE 6**
**SUMMARY OF MODELING RESULTS**

| STREAM SECTION | EXISTING CONDITIONS PEAK DISCHARGES FOR INDICATED RETURN FREQUENCY STORM (CFS) | | | | | | PROJECTED CONDITIONS PEAK DISCHARGES FOR INDICATED RETURN FREQUENCY STORM (CFS) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 -Year Storm | 5 -Year Storm | 10 -Year Storm | 25 -Year Storm | 50 -Year Storm | 100- Year Storm | 2 -Year Storm | 5 -Year Storm | 10 -Year Storm | 25 -Year Storm | 50 -Year Storm | 100- Year Storm |
| 10 | 35 | 65 | 115 | 258 | 363 | 540 | 39 | 70 | 122 | 278 | 394 | 583 |
| 23 | 96 | 193 | 346 | 770 | 1087 | 1528 | 103 | 203 | 360 | 807 | 1137 | 1586 |
| 27 | 141 | 320 | 596 | 1285 | 1808 | 2517 | 151 | 332 | 612 | 1324 | 1864 | 2585 |
| 31 | 7 | 23 | 48 | 103 | 151 | 224 | 7 | 23 | 48 | 103 | 151 | 224 |
| 36 | 33 | 95 | 194 | 405 | 560 | 815 | 38 | 98 | 201 | 416 | 579 | 842 |
| 52 | 14 | 37 | 80 | 170 | 245 | 371 | 14 | 37 | 80 | 170 | 245 | 371 |
| 58 | 145 | 360 | 752 | 1575 | 2171 | 3188 | 150 | 363 | 760 | 1587 | 2197 | 3222 |
| 60 | 327 | 763 | 1522 | 3211 | 4499 | 6396 | 351 | 789 | 1561 | 3291 | 4621 | 6554 |
| 66 | 370 | 896 | 1792 | 3770 | 5283 | 7484 | 432 | 963 | 1890 | 3952 | 5571 | 7846 |




KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

PLATE 8: RELEASE RATE PERCENTAGES

## X. PLAN IMPLEMENTATION

The regulatory approach for implementing this Watershed Plan utilizes the powers granted by Act 247, the Municipalities Planning Code (MPC). The MPC enables counties and municipalities to adopt zoning, subdivision and land development, and planned residential development ordinances and to address storm drainage concerns in these ordinances. Implementation of this Plan requires that it first be reviewed by the municipal, County, and regional planning commissions. Comments received from these agencies will be incorporated into the Plan, and then it will be presented to the County Board or Commissioners for adoption. The adoption process includes conducting Public Hearing at which the Plan will be presented, comments will be received, and appropriate changes will be made. Then the County will enact an Adoption Resolution.

Once this Watershed Plan has been adopted by the Mifflin County Board of Commissioners it will be submitted to the PA Department of Environmental Protection for approval. Once approved, the municipalities within the watershed will be required to adopt the Model Ordinance as a stand-alone ordinance or incorporate it into their existing subdivision and land development ordinances. The ordinance provisions adopted by the municipalities must be at least as restrictive as the provisions stated in the Model Ordinance. In addition to adopting the stormwater provisions, the municipalities must amend existing zoning and building codes to provide correct references. If the municipalities do not adopt the Model Ordinance, the County's ordinance will prevail and the County Planning Commission will review development plans for conformance with the ordinance requirements.

Some municipalities in the Kishacoquillas Creek watershed encompass multiple subwatersheds. These different subwatersheds may require varying levels of control based on the Release Rate percentages. Each municipality has the option of adopting the varying levels of control or setting the required control level to the most restrictive rate for all subwatersheds in their boundaries.

## XI. PLAN UPDATE

Section 5(b) of the Stormwater Management Act requires that approved plans incorporate Aprovisions for periodically reviewing, revising and updating the plan@. Section 5(a) requires that plan updates be conducted at least every five (5) years to account for changes in land use, development pressures, and water quantity and quality provisions. The Mifflin County Planning Commission will compile and maintain information as necessary to facilitate the subsequent updating of the plan and will initiate the process whenever it is deemed appropriate. Information to be compiled includes updates and revisions to municipal ordinances, new development plans, and documentation on any stormwater or flood management facilities that are constructed. If a plan update is initiated, the County will reconvene the Watershed Plan Advisory Committee to provide local input into the process.

# KISHACOQUILLAS CREEK WATERSHED
# Storm Water Management Ordinance

**PLEASE HAVE YOUR SOLICITOR REVIEW THE ENCLOSED ORDINANCE AND CHECK THE APPLICABILITY OF ALL SECTIONS TO YOUR MUNICIPALITY**

NOVEMBER, 2003

If you have any questions, please call
William Gomes
Mifflin County Planning Commission
20 North Wayne Street
Lewistown, Pennsylvania 17044
(717) 242-0887

## ORDINANCE REQUIREMENTS

The following ordinance provisions **must be retained** when a municipality either elects to create a single-purpose storm water ordinance or amends existing subdivision or zoning ordinances to implement the storm water management plan.

- Article I - General Provisions
- Article II - Definitions
- Article III - Storm Water Management
- Article VIII - Enforcement and Penalties (only when enacting a single-purpose ordinance)

The following ordinance provisions are **optional, but recommended to be retained.**

- Article IV – Drainage Plan Requirements
- Article V - Inspections
- Article VI - Fees and Expenses
- Article VII – Maintenance Responsibilities

**NOTE: If a municipality chooses to use the sample ordinance to implement the storm water management plan, it is recommended that the ordinance be submitted to the municipal solicitor, engineer, and DEP for review prior to enactment.**

STORM WATER MANAGEMENT ORDINANCE

Implementing the Requirements of the

Kishacoquillas Creek Watershed Storm Water Management Plan

ORDINANCE NO. _____ OF

_____, MIFFLIN COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on
_____, 20__

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## ARTICLE I - GENERAL PROVISIONS

### *Section 101. Statement of Findings*

The governing body of the Municipality finds that:

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

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

### *Section 102. Purpose*

The purpose of this Ordinance is to promote health, safety, and welfare within the Kishacoquillas Creek Watershed by minimizing the damages described in Section 101.A of this Ordinance through provisions designed to:

A. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.

B. Utilize and preserve the existing natural drainage systems.

C. Encourage recharge of groundwater where appropriate and prevent degradation of groundwater quality.

D. Maintain existing flows and quality of streams and watercourses in the municipality and the Commonwealth.

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

F. Provide proper maintenance of all permanent storm water management facilities that are constructed in the Municipality.

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

### *Section 103. Statutory Authority*

The Municipality is empowered to regulate land use activities that affect runoff by the authority of the Act of October 4, 1978 32 P.S., P.L. 864 (Act 167) Section 680.1 et seq., as amended, the "Storm Water Management Act", [and the applicable Municipal Code].

### *Section 104. Applicability*

This Ordinance shall apply to those areas of the Municipality that are located within the Kishacoquillas Creek Watershed, as delineated in Appendix D which is hereby adopted as part of this Ordinance.

This Ordinance is intended to control storm water related quantity and quality during and after construction as part of any of the Regulated Activities listed in this Section. Storm water management and erosion and sedimentation control during construction activities shall be regulated by both this Ordinance and under existing laws and ordinances related to erosion and sediment control.

This Ordinance contains only the storm water management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Local storm water management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable Municipal Ordinances or at the municipal engineer's discretion.

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

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

### *Section 105. Exemptions*

A. Any Regulated Activity that meets the following criteria shall not be required to implement the storm water controls prescribed in Sections 301, 304, and 305 of this Ordinance. These criteria shall apply to the total development even if development is to take place in phases. The date of the Municipal 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. Developers that seek relief under this exemption criteria are

responsible for any damages to downstream properties caused by the failure to install sufficient controls to protect said properties from an increase in the volume or rate of runoff from the developed property and may be required to install additional controls at their own expense if damage to downstream property does occur.

## Storm Water Management Exemption Criteria

### Impervious Area Exemption

- **Proposed impervious area must be less than 20 percent of total parcel area and less than 5,000 square feet.**

"Proposed impervious area" as used in the above exemption criteria is defined as the total impervious area added to the parcel since the adoption of this ordinance.

B. Any regulated activity that meets the above stated criteria must satisfy water quality and groundwater recharge criteria. However, they can meet the criteria of Sections 302 and 303 of this Ordinance if it can be shown that all new impervious surfaces are disconnected from direct conveyance into curb/gutter, storm sewer, or open channel systems and said impervious surfaces are constructed to allow for the filtration, either naturally or mechanically, of runoff to address water quality concerns and potentially to improve infiltration. Examples include but are not limited to:

- controlling runoff through a "sheet flow" system of vegetative or similar buffers having a minimum flow length equal to or greater than 25 feet, or the average width of impervious area, whichever is greater, and the square footage of the pervious area is equal to or greater than 50 percent of the new impervious area;
- disconnecting roof downspouts from direct discharge to curb/gutter or storm sewer systems and allowing the downspout discharge to flow over plant, lawn or woodland areas in such a manner as to avoid rill or gully erosion;
- passing concentrated runoff through grease and oil separators before discharge to storm sewers or open channels;
- using infiltration basins or trenches to promote infiltration and filtration of runoff from impervious surfaces;
- use of cisterns or French drains to promote infiltration of runoff from impervious areas; and
- discharge of concentrated runoff to constructed wetlands that are designed to filter pollutants from the runoff.

Other Best Management Practice approaches (bioinfiltration swale, bioretention basin, etc.) can also be used. The Municipal Engineer shall have authority to review, approve, reject, or recommend alternative methods for meeting the requirements of Sections 302 and 303.

C. No exemption shall be provided for Regulated Activities as defined in Section 104.E and 104.F of this Ordinance.

***Section 106. Repealer***

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

***Section 107. Severability***

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

***Section 108. Compatibility with Other Ordinance Requirements***

Approvals issued pursuant to this Ordinance do not relieve the Applicant of the responsibility to comply with or to secure required permits or approvals for activities regulated by any other applicable codes, rules, statutes, or ordinances.

## ARTICLE II - 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 activity and the natural processes of a rate greater than would occur because of the natural process alone.

**Accessory Structure** – A structure detached from a principal building located on the same lot and customarily incidental and subordinate to the principal building or use.

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

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

**Applicant** - A landowner or developer who has submitted a drainage plan or filed an application for approval to engage in any Regulated Activities as defined in Section 104 of this Ordinance.

**As-built Drawings** – A set of engineering or site drawings that delineate the specific permitted storm water management facility as actually constructed.

**BMP (Best Management Practice)** - Storm water structures, facilities and techniques to maintain or improve the water quality of surface runoff. *Pennsylvania Handbook of Best Management Practices for Developing Areas*, Spring, 1998.

**Buffer** – See Stream Buffer.

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

**Cistern** - An underground reservoir or tank for storing rainwater.

**Conservation District** - The Mifflin County Conservation District.

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

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

**Deed Restriction** – See Restrictive Covenant.

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

**Designee** - The agent of the Mifflin County Planning Commission and/or agent of the municipality involved with the administration, review or enforcement of any provisions of this ordinance by contract or memorandum of understanding.

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

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

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

**Development** – See Land Development.

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

**Discharge Easement** – The grant of a property right to allow runoff in excess of the previous quantity and/or rate of flow.

**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 Storm Water Management Facility designed to transmit storm water runoff and shall include streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

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

**Drainage Permit** - A permit issued by the municipality after the drainage plan has been approved. Said permit is issued prior to or with the final Township approval.

**Drainage Plan** - The documentation of the storm water management system, if any, to be used for a given development site, the contents of which are established in Section 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.

**Easement** – A right-of-way granted for limited use of private land for a public or quasi-public purpose (e.g., utility lines, discharge easement, drainage easement), and within which the owner of the property shall not erect any permanent structures.

**Ephemeral Streams (also ephemeral flow)** – Streams that carry only surface runoff and are dry except during precipitation events. The groundwater table is generally located below the bottom of ephemeral streams.

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

**Erosion and Sediment Pollution Control Plan** - A plan that is designed to minimize accelerated erosion and sedimentation. Said plan must be submitted to and approved by the Mifflin County Conservation District before construction can proceed.

**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" on “B” soils unless the natural land cover is proven to generate lower curve numbers or Rational "C" value, such as forested lands.

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

**Floodplain** - Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal

Insurance Administration Flood Hazard Boundary - Mapped as being a special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PADEP) Technical Manual for Sewage Enforcement Officers (as amended or replaced from time to time by PADEP).

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

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

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

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

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

**Groundwater Recharge** - Replenishment of existing natural underground water supplies.

**Impervious Surface** – A surface that has been compacted or covered with material to the extent that it is highly resistant to infiltration by water, including, but not limited to, conventional impervious surfaces such as paved streets, roofs, compacted stone, and sidewalks. In addition, the following shall be considered impervious surfaces when used by motor vehicles: graveled areas, paver blocks, bricks, and cobblestone.

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

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

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

**Intermittent Streams (also intermittent flow)** – Streams that flow only during wet seasons. The groundwater table generally is at or above the bottom of intermittent streams during wet seasons, but drops below the stream bottom during dry seasons. Stream flow in intermittent streams is primarily due to precipitation, but does have some groundwater contribution during wet seasons.

**Land Development** – As now defined or as may be defined in the Pennsylvania Municipalities Planning Code (MPD), the term Land Development means any of the following activities: (1) the improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving (a) a group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure, or (b) the division or allocation of land or space, whether initially or cumulatively, between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features; (2) any subdivision of land; (3) development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

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

**Main Stem (Main Channel)** - Any stream segment or other runoff conveyance facility used as a reach in the Kishacoquillas Creek hydrologic model.

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

**Municipality** - [municipal name], Mifflin County, Pennsylvania.

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

**NPDES** – National Pollutant Discharge Elimination System – a permit issued by the PA Department of Environmental Protection regulating the discharge of wastewater or storm water from a facility. NPDES Permits are issued under the authority of the Clean Water Act (PL 92-500).

**NRCS** - Natural Resource Conservation Service (previously SCS).

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

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

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

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

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

**Penn State Runoff Model** (calibrated) - A computer-based hydrologic modeling technique.

**Perennial Streams (also perennial flow)** – Streams that flow year round. Perennial streams derive their flow from both groundwater and runoff and the groundwater table never drops below the streambed.

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

**Planning Commission** - The Mifflin County planning commission, unless otherwise specified.

**PMF - Probable Maximum Flood** - The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in any area. The PMF is derived from the probable maximum precipitation (PMP) as determined on the basis of data obtained from the National Oceanographic and Atmospheric Administration (NOAA).

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

**Redevelopment** – Reconstruction of an existing improved, developed property, as of the date of adoption of this Ordinance.

**Regulated Activities** - Actions or proposed actions that have an impact on storm water runoff and that are specified in Section 104 of this Ordinance.

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

**Restrictive Covenant** – A restriction on the use of land usually set forth in the deed. Restrictive covenants (a.k.a. Deed Restrictions) usually run with the land and are binding upon subsequent owners of the property.

**Retention Basin** - An impoundment in which storm water is stored and not released. Stored water may be released from the basin at some time after the end of the storm (temporary retention), or else it leaves the basin through infiltration or evaporation.

**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 twenty-five years.

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

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

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

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

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

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

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

**Semi-Pervious Surfaces** – Material that allows rainfall to seep through to the underlying strata. Examples include gravel, porous asphalt pavement, and paving blocks not used for motor vehicles. If these materials are used for vehicular pathways, parking, and material storage they are generally considered to be impervious. Use of these materials in development sites must be supported by published information concerning infiltration rates if credit is to be taken for the infiltration volume.

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

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

**Soil Group, Hydrologic** - A classification of soils by the 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 that is used to pass peak discharge greater than the maximum design storm controlled by the pond.

**Storage Indication Method** - A reservoir routing procedure based on solution of the continuity equation (inflow minus outflow equals the change in storage) with outflow defined as a function of storage volume and depth.

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

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

**Storm Water** - The total amount of precipitation reaching the ground surface.

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

**Storm Water Management Plan** - The plan for managing storm water runoff in the Kishacoquillas Creek Watershed adopted by Mifflin County as required by the Act of October 4, 1978, P.L. 864, (Act 167), and known as the "Kishacoquillas Creek Watershed Act 167 Storm Water Management Plan.

**Storm Water Management Site Plan** - The plan prepared by the Applicant or his representative indicating how storm water runoff will be managed at the particular site of interest according to this Ordinance.

**Stream** – A natural or man-made channel that conveys water in a concentrated manner. See also ephemeral stream, intermittent stream and perennial stream.

**Stream Buffer** – A vegetative strip paralleling the banks of a perennial or intermittent stream. The buffer shall contain appropriate vegetation through its width with the exception of a minimum five-feet wide strip of land maintained in meadow grass or forbs at its outer boundary.

**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 storm water management criteria have been established in the Storm Water 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 subdivision by lease of land for agricultural purposes into parcels of more than ten acres, not involving any new street or easement of access or any residential dwellings, shall be exempt.

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

**Timber Operations** - See Forest Management.

**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.

**TR-20** - The computer-based hydrologic modeling technique adapted to the Kishacoquillas Creek watershed for the Act 167 Plan. The model has been "calibrated" to reflect actual recorded flow values by adjusting key model input parameters.

**TR-55** - A method for determining runoff volumes and rates developed by the NRCS.

**Watercourse** – A channel or conveyance of surface water having defined bed and banks, whether natural or artificial with perennial or intermittent flow.

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

## ARTICLE III - STORM WATER MANAGEMENT

### *Section 301. General Requirements*

A. All regulated activities in the Kishacoquillas Creek Watershed that do not fall under the exemption criteria shown in Section 105 shall submit a Drainage Plan consistent with the Kishacoquillas Creek Watershed Storm Water Management Plan to the Municipality for review. These criteria shall apply to the total proposed development even if development is to take place in stages. Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks.

B. Storm water drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by storm water management facilities or open channels consistent with this Ordinance.

C. 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 Ordinance.

D. 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 Ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property (see Section 301.C), the Applicant must demonstrate to the Municipality in accordance with Section 306 that adequate downstream drainage conveyance facilities exist to safely transport the concentrated discharge, or the Applicant must obtain drainage easements from affected downstream property owners and provide the facilities to safely convey the flow.

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

    1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Acceptable velocities shall be based upon criteria included in the DEP Erosion and Sediment Control Program Manual.

    2. Natural or man-made channels or swales shall be designed to convey the increased 25-year return period runoff without creating any hazard to persons or property.

    3. Culverts, bridges, storm sewers or any other facilities which must pass or convey flows from the upstream (i.e., offsite) area that contributes flow to that

structure shall be designed in accordance with DEP, Chapter 105 regulations (if applicable) and, at a minimum, pass the increased 25-year return period runoff.

F. Where a development site is traversed by watercourse(s), stream buffers (see definition section) shall be provided conforming to the line of such watercourses. The width of the buffers shall be determined as set forth in Section 302.A.3. It shall be prohibited to excavate, place fill, build structures, or make any alterations that may adversely affect the flow of storm water within any portion of the stream buffer unless the proposed work is associated with a regulated wetlands mitigation program. The buffer shall be defined through a deed covenant or shown on an approved subdivision or land development plan that has been recorded.

G. 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 PADEP through the Joint Permit Application process, or, where deemed appropriate by PADEP, through the General Permit process.

H. Any storm water management facilities regulated by this Ordinance 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 Applicant or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PA DEP.

I. Any storm water management facilities regulated by this Ordinance that would be located on or discharging into State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PADOT).

J. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc. are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.

K. Roof drains must not be connected to sanitary sewers. Roof drains must not be connected to streets, storm sewers, or roadside ditches to promote overland flow and infiltration/percolation of storm water. However, when it is more advantageous to connect directly to streets, storm sewers or roadside ditches, it shall be permitted on a case by case basis as determined by the Municipal Engineer.

### *Section 302. Water Quality Requirements*

A. Applicant shall comply with the following water quality requirements unless otherwise exempted by provisions of this ordinance.

1. Applicants will provide adequate storage and treatment facilities necessary to capture and treat a volume of storm water runoff termed as the “Water Quality Volume” which is calculated in accordance with the following:

   The Water Quality Volume (WQv) is the storage capacity needed to treat storm water runoff equivalent to a minimum of the first 1.5 inches of runoff (from Appendix F, “*Pennsylvania Handbook of BMPs for Developing Areas*”, page F-2 for Region 2, value of 1.48” is rounded to 1.50”) from the developed areas of the site. The following calculation is used to determine the storage volume, WQv in acre-feet of storage:

   $$WQv = [(1.50)(Rv)(A)]/12$$

   Where: WQv = Water Quality Volume in acre-feet
   A = Area in acres
   Rv = 0.05 + 0.009(I)
   I = Impervious cover in percent (e.g., I=50 for 50% impervious cover)

   WQv shall be designed as part of a storm water management facility which incorporates water quality BMPs as a primary benefit of using that facility, in accordance with design specifications contained in “*Pennsylvania Handbook of BMPs for Developing Areas*”, 1998.

2. The Applicant shall first provide infiltration facilities in areas where soils are suitable for infiltration and shall direct the runoff from impervious surfaces into those infiltration facilities. A qualified soil scientist, geologist, or hydrogeologist shall characterize the infiltration characteristics of the site by conducting infiltration tests and developing a soil profile through test pitting in the proposed infiltration area. If the soils are not suitable for infiltration, Applicant shall submit documentation from a registered soil scientist, geologist, or hydrogeologist documenting the soil characteristics and receive a waiver from the Municipal Engineer. See Section 303 for the groundwater recharge requirements.

3. If a perennial or intermittent stream passes through the development site, the Applicant shall create a stream buffer conforming to the line of such watercourses and extending a minimum of 50 feet to either side of the top of the bank of the channel. The buffer area shall be maintained with appropriate vegetation as referenced in Appendix E of this Ordinance. The Municipality may select a smaller buffer width if desired, but never less than 10 feet. If the applicable rear or side yard setback is less than 50 feet, the buffer width may be reduced to 25 percent of the setback to a minimum of 10 feet. If an existing buffer is legally prescribed (e.g., deed covenant, easement, etc.) and it exceeds the requirement of this Ordinance, the existing buffer shall be maintained.

4. Detain the 1-year, 24-hour post-development design storm runoff based on using the SCS Type II distribution from the contributing watershed (after development). Provisions shall be made so that the detained runoff takes a minimum of 24 hours to drain from the facility from a point where the maximum

volume of water is captured, (i.e., the maximum water surface elevation is achieved in the facility). 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. The Applicant may also utilize infiltration facilities in lieu of extended detention. The volume of infiltration provided for the contributing area may be deducted from the volume requirement for extended detention.

B. The Applicant shall submit designs for water quality facilities to the Municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of BMPs.

C. In selecting the appropriate BMPs or combinations thereof, the Applicant shall consider the following:

1. Total contributing area
2. Permeability and infiltration rate of the site soils
3. Slope and depth to bedrock
4. Seasonal high water table
5. Proximity to building foundations and well heads
6. Erodibility of soils
7. Land availability and configuration of the topography
8. Consistency with approved watershed and storm water management plans or regulations

D. The following additional factors shall be considered when evaluating the suitability of BMPs used to control water quality at a given development site:

1. Peak discharge and required volume control
2. Streambank erosion
3. Efficiency of the BMPs to mitigate potential water quality problems
4. The volume of runoff that will be effectively treated
5. The nature of the pollutant being removed
6. Maintenance requirements
7. Creation/protection of aquatic and wildlife habitat
8. Recreational value
9. Enhancement of aesthetic and property value

E. It is prohibited to discharge concentrated runoff (i.e., in channels, culverts, or storm sewers) into sinkholes unless prior approval is granted by the Municipal Engineer. If sinkholes develop during construction, the Applicant shall seal and backfill the sinkhole in a manner acceptable to the Municipal Engineer. If existing sinkholes are to be sealed during construction, the Applicant shall submit a sinkhole repair plan for approval by the Municipal Engineer.

***Section 303. Groundwater Recharge Requirements***

A. Applicant shall maintain annual groundwater recharge consistent with pre-development conditions, by infiltrating an amount of runoff equal to the “Recharge

Volume" (based on the average annual infiltration rate based on the prevailing hydrologic soil groups present at a site). The Recharge Volume (Rev) may be part of the Water Quality Volume. The groundwater recharge is calculated in accordance with the following formula, but shall not be less than the net increase in runoff from the 2-year storm event:

$$Rev = [(S)(Rv)(A)]/12$$

Where:

Rev = Recharge Volume in acre-feet
S = Soil Specific Recharge factor
A = Area in acres
Rv = 0.05+0.009(I)
I = Impervious cover in percent (e.g., I=50 for 50% impervious cover)

The Soil Specific Recharge factor varies according to soil type. For the Kishacoquillas Creek watershed, the following factors should be used:

| Hydrologic Soil Group | Soil Specific Recharge Factor (S) |
|---|---|
| A | 0.41 |
| B | 0.27 |
| C | 0.14 |
| D | 0.07 |

### *Section 304. Storm Water Management Districts*

A. The Kishacoquillas Creek Watershed has been divided into two (2) storm water management districts as shown on the Watershed Map in Appendix D.

B. Standards for managing runoff from each subarea in the Kishacoquillas Creek Watershed for the 2, 10, 25, 50, and 100-year design storms are shown below. Development sites located in each of the districts must control post-development runoff rates to pre-development runoff rates for the design storms as follows:

| DISTRICT | CONTROL CRITERIA |
|---|---|
| 100% | Post-development peak discharge for all design storms must be no greater than pre-development peak discharges. |
| 75% | Post-development peak discharge for all design storms must be no greater than 75 percent of the pre-development peak discharges. |

C. If a proposed development located in a 75% Release Rate District incorporates infiltration facilities that achieve the Groundwater Recharge Requirements

specified in Section 303, then the Release Rate for the development shall be increased to 100%.

***Section 305. Storm Water Management District Implementation Provisions (Performance Standards)***

A. General - Post-development rates of runoff from any regulated activity shall not exceed the peak release rates of runoff prior to development for the design storms specified on the Storm Water Runoff Peak Rate Districts Map, Ordinance Appendix D and Section 302, of the Ordinance.

B. District Boundaries - The boundaries of the Storm Water Management Districts are shown on an official map, which is available for inspection at the municipal office. A copy of the official map at a reduced scale is included in Appendix D of this Ordinance. The exact location of the Storm Water Management District boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two- foot topographic contours (or most accurate data required) provided as part of the Drainage Plan.

C. Sites Located in More Than 1 District - for a proposed development site located within two or more release category subareas, the peak discharge rate from any subarea shall be the pre-development peak discharge for each subarea multiplied by the applicable release rate. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by subarea. An exception to the above may be granted if discharges from multiple subareas re-combine in proximity to the site. In this case, peak discharge in any direction may be a 100% release rate provided that the overall site discharge meets the weighted average release rate.

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

E. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, as determined by the Municipal Engineer, only the proposed development area and areas contributory to the proposed storm water management facilities shall be subject to the release rate criteria.

F. 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 Applicants. 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 Storm Water Management Plan.

***Section 306. Design Criteria for Storm Water Management Facilities***

A. Any storm water management facility (i.e. detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this Ordinance shall be designed to provide an emergency spillway to handle flow up to and including the 100-year post-development conditions. The height of the embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any storm water management facility require a dam safety permit under PADEP 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.

B. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), and any work involving wetlands as directed in PA DEP Chapter 105 regulations (as amended or replaced from time to time by PA DEP), shall be designed in accordance with Chapter 105 and will require a permit from PA DEP. Any other drainage conveyance facility that doesn't fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm. [Municipalities may require design based on a larger storm event]. Open channels shall be designed with a minimum of 1.0 foot of freeboard. Any facility that constitutes a dam as defined in PA DEP Chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PA DOT right of way must meet PA DOT minimum design standards and permit submission requirements. If the primary drainage facilities do not have capacity for future flows, then a safe drainage path shall be provided to convey up to the 100-year design storm without impacting structures.

C. Storm sewers must be able to convey post-development runoff from a 10-year design storm without surcharging inlets. Road culverts must be designed in accordance with Penn DOT standards.

D. Storm inlets, storm sewers, culverts, and open channels shall be designed without consideration of the impact of karst terrain on runoff rates.

E. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.

F. The design of all storm water management facilities shall incorporate sound engineering principles and practices. The Municipal Engineer shall reserve the right to disapprove any design that would result in the occurrence or continuation of an adverse hydrologic or hydraulic condition within the watershed.

G. Storm drain conveyance system stability (swales, open channels, and pipe discharge aprons) shall be computed using a 10-year period peak runoff rate.

H. Storm sewers, where required by zoning and land use densities, shall be placed under or immediately adjacent to the roadway side of the curb, or as directed by the Municipal Engineer, when parallel to the street within the right-of-way.

### *Section 307. Calculation Methodology*

Storm water runoff from all development sites shall be calculated using either the rational method or a soil-cover-complex methodology.

A. Any storm water runoff calculations involving drainage areas greater than 200 acres, including on- and off-site areas, shall use a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table 307-1 summarizes acceptable computation methods. 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.

B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms presented in Table A-1 in Appendix A of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1 is used for storm water runoff calculations, then the duration of rainfall shall be 24 hours. The NRCS curve shown in Figure A-1, Appendix A of this Ordinance shall be used for the rainfall distribution.

C. For the purposes of predevelopment flow rate determination, undeveloped land shall be considered as "meadow" good condition, type “B” soil (RCN=58, Rational “C” = 0.12), unless the natural ground cover generates a lower curve number or Rational 'C' value (e.g. forest).

TABLE 307-1

ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORM WATER MANAGEMENT PLANS

| METHOD | METHOD DEVELOPED BY | APPLICABILITY |
|---|---|---|
| TR-20 or commercial Package Based on TR-20 | USDA – NRCS | When use of full model is desirable or necessary |
| Tr-55 or Commercial Package Based on TR-55 | USDA - NRCS | Applicable for plans within the models limitations |
| HEC-HMS | U.S. Army Corps of Eng. | When use of full model is desirable or necessary |
| PSRM | Penn State Univ. | When use of full model is desirable or necessary |
| Rational Method or commercial package based on Rational Method* | Emil Kuiching (1889) | For sites less than 200 acres |
| Other Methods | Various | As approved by the Municipal Engineer |

* Use of the Rational Method to estimate peak discharges from drainage areas that contain more than 100 acres must be approved by the Municipal Engineer.

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 from PA Department of Transportation Design Rainfall Curves (1986) (Figure A-2). Times of concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55 (as amended or replaced from time to time by NRCS). Times of concentration for channel and pipe flow shall be computed using Manning's equation.

E. Runoff Curve Numbers (RCN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table A-2 in Appendix A of this Ordinance.

F. Runoff characteristics of off-site areas that drain through a proposed development shall be based on actual existing conditions, not RCN=58 or C=0.12, and shall be assumed to not have any controls implemented on future development (i.e., no release rate restrictions).

G. Runoff coefficients (C) for both existing and proposed conditions for use in the Rational method shall be obtained from Table A-3 in Appendix A of this Ordinance.

H. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table A-4 in Appendix A of the Ordinance.

I. Outlet structures for storm water management facilities shall be designed to meet the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method. Acceptable methods are presented in “Handbook of Hydraulics”, by King and Brater (McGraw Hill). In addition, application of computer programs such as HY-8 (Federal Highway Administration) or FlowMaster (Haested Methods) will also be accepted.

J. The design of any storm water detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For drainage areas greater than 20 acres in size, the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Municipality may approve the use of any generally accepted full hydrograph approximation technique that shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

K. The Municipality has the authority to require that computed existing runoff rates be reconciled with field observations and conditions. If the designer can substantiate through actual physical calibration that more appropriate runoff and time-of-

concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the Municipal Engineer. Calibration shall require detailed gage and rainfall data for the particular site in question.

### *Section 308. Erosion and Sedimentation Requirements*

A. Whenever the vegetation and topography are to be disturbed, such activity must be in conformance with Chapter 102, Title 25, Rules and Regulations, Part I, Commonwealth of Pennsylvania, Department of Environmental Protection, Subpart C, protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control," and in accordance with the Mifflin County Conservation District and the standards and specifications of the Municipality.

B. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to be applied where infiltration BMPs are proposed and include the following:

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

2. In order to insure compliance with Chapter 102, the timing of the installation and operation of the infiltration BMP shall be at the discretion of the Municipal Engineer.

## ARTICLE IV - DRAINAGE PLAN REQUIREMENTS

### *Section 401. General Requirements*

For any of the activities regulated by this Ordinance, the final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any land disturbance activity may not proceed until the Applicant or his/her agent has received written approval of a Drainage Plan from the Municipality.

### *Section 402. Drainage Plan Contents*

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 Municipality in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant.

The following items shall be included in the Drainage Plan:

A. General

1. General description of project.

2. General description of permanent storm water management techniques, including construction specifications of the materials to be used for storm water management facilities.

3. Complete hydrologic, hydraulic, and structural computations for all storm water management facilities.

B. Map(s) of the project area shall be submitted on __-inch x __-inch sheets and shall be prepared in a form that meets the requirements of the [County's or Municipality's] subdivision and land development ordinances and for recording at the offices of the Recorder of Deeds of Mifflin County. The contents of the maps(s) shall include, but not be limited to:

1. The location of the project relative to highways, municipalities or other identifiable landmarks.

2. Existing contours at intervals of two (2) feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.

3. Existing streams, lakes, ponds, or other bodies of water and wetlands 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 structures and utilities 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 two (2) feet. In areas of steep slopes (greater than 15 percent), five-foot contour intervals may be used.

10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.

11. The date of the plan, including revisions.

12. A graphic and written scale of a minimum one (1) inch equals no more than fifty (50) 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. Vertical profiles of all proposed open channels and storm sewers, including hydraulic capacity.

17. Overland drainage paths of proposed swales or channels to convey water.

18. A construction detail of any improvements made to sinkholes and the location of all notes to be posted, as specified in this Ordinance.

19. A statement, signed by the landowner, acknowledging the storm water management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the Municipality.

20. The following signature block for the Design Engineer:

"(Design Engineer), on this date (date of signature), has reviewed and hereby certifies that the Drainage Plan meets all design standards and

criteria of the Kishacoquillas Creek Watershed Act 167 Storm Water Management Ordinance."

C. Supplemental Information

1. A written description of the following information shall be submitted.

   a) The overall storm water management concept for the project.
   b) Storm water runoff computations as specified in this Ordinance.
   c) Storm water management techniques to be applied both during and after development.
   d) Expected project time schedule.

2. A soil erosion and sedimentation control plan, where applicable, including all reviews and approvals, as required by PADEP.

3. A geologic assessment of the effects of runoff on sinkholes as specified in this Ordinance.

4. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal storm water collection system that may receive runoff from the project site.

5. A Declaration of Adequacy and Highway Occupancy Permit from the PADOT District Office when utilization of a PADOT storm drainage system is proposed.

D. Storm Water Management Facilities

1. All storm water 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 storm water management facilities must be shown.

### *Section 403. Plan Submission*

For all activities regulated by this Ordinance, the steps below shall be followed for submission. For any activities that require a PADEP Joint Permit Application and regulated under Chapter 105 (Dam Safety and Waterway Management) or Chapter 106 (Floodplain Management) of PADEP's Rules and Regulations, require a PADOT Highway Occupancy Permit, or require any other permit under applicable state or federal regulations, the permit(s) shall be part of the plan.

A. The Drainage Plan shall be submitted by the Applicant as part of the Preliminary Plan submission for the Regulated Activity.

B. Four (4) copies of the Drainage Plan shall be submitted.

C. Distribution of the Drainage Plan will be as follows:

1. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee, as specified in this Ordinance.

2. One (1) copy to the Municipal Engineer.

3. One (1) copy to the County Planning Commission/Department

***Section 404. Drainage Plan Review***

A. The Municipal Engineer shall review the Drainage Plan for consistency with the adopted Kishacoquillas Creek Watershed Act 167 Storm Water Management Plan. The Municipality shall require receipt of a complete plan, as specified in this Ordinance.

B. The Municipal Engineer shall review the Drainage Plan for any submission or land development against the municipal subdivision and land development ordinance provisions not superseded by this Ordinance.

C. For activities regulated by this Ordinance, the Municipal Engineer shall notify the Municipality in writing whether the Drainage Plan is consistent with the Storm Water Management Plan. Should the Drainage Plan be determined to be consistent with the Storm Water Management Plan, the Municipal Engineer will forward an approval letter to the Developer with a copy to the Municipal Secretary.

D. Should the Drainage Plan be determined to be inconsistent with the Storm Water Management Plan, the Municipal Engineer will forward a disapproval letter to the Applicant with a copy to the Municipal Secretary citing the reason(s) for the disapproval. Any disapproved Drainage Plans may be revised by the Applicant and resubmitted consistent with this Ordinance.

E. For Regulated Activities specified in Sections 104.C and 104.D of this Ordinance, the Municipal Engineer shall notify the Municipal Building Permit Officer in writing, within a time frame consistent with the Municipal Building Code and/or Municipal Subdivision Ordinance, whether the Drainage Plan is consistent with the Storm Water Management Plan and forward a copy of the approval/disapproval letter to the Applicant. Any disapproved drainage plan may be revised by the Applicant and resubmitted consistent with this Ordinance.

F. For Regulated Activities requiring a PADEP Joint Permit Application, the Municipal Engineer shall notify PADEP whether the Drainage Plan is consistent

with the Storm Water Management Plan and forward a copy of the review letter to the Municipality and the Applicant. PADEP may consider the Municipal Engineer's review comments in determining whether to issue a permit.

G. The Municipality shall not approve any subdivision or land development for Regulated Activities specified in Sections 104.A and 104.B of this Ordinance if the Drainage Plan has been found to be inconsistent with the Storm Water Management Plan, as determined by the Municipal Engineer. All required permits from PADEP must be obtained prior to approval.

H. The Municipal Building Permit Office shall not issue a building permit for any Regulated Activity specified in Section 104 of this Ordinance if the Drainage Plan has been found to be inconsistent with the Storm Water Management Plan, as determined by the Municipal Engineer, or without considering the comments of the Municipal Engineer. All required permits from PADEP must be obtained prior to issuance of a building permit.

I. The Developer shall be responsible for completing an "As-Built Survey" of all storm water management facilities included in the approved Drainage Plan. The As-Built Survey and an explanation of any discrepancies with the design plans shall be submitted to the Municipal Engineer for final approval. In no case shall the Municipality approve the As-Built Survey until the Municipality receives a copy of an approved Declaration of Adequacy, Highway Occupancy Permit from the PADOT District Office, and any applicable permits from PADEP.

J. The Municipality's approval of a Drainage Plan shall be valid for a period not to exceed one (1 ) year. This one-year time period shall commence on the date that the Municipality signs the approved Drainage Plan. If storm water management facilities included in the approved Drainage plan have not been constructed, or if an As-Built Survey of these facilities has not been approved within this one-year time period, then the Municipality may consider the Drainage plan disapproved and may revoke any and all permits. Drainage Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 406 of this Ordinance.

### *Section 405. Modification of Plans*

A modification to a submitted Drainage Plan for a development site that involves a change in storm water management facilities or techniques, or that involves the relocation or re-design of storm water management facilities, or that is necessary because soil or other conditions are not as stated on the Drainage Plan as determined by the Municipal Engineer, shall require a resubmission of the modified Drainage Plan consistent with Section 403 of this Ordinance and be subject to review as specified in Section 404 of this Ordinance.

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

### *Section 406. Resubmission of Disapproved Drainage Plans*

A disapproved Drainage Plan may be resubmitted, with the revisions addressing the Municipal Engineer's concerns documented in writing, to the Municipal Engineer in accordance with Section 403 of this Ordinance and be subject to review as specified in Section 404 of this Ordinance. The applicable Municipality Review Fee must accompany a resubmission of a disapproved Drainage Plan.

## ARTICLE V - INSPECTIONS

### *Section 501. Schedule of Inspections*

A. The Municipal Engineer or his municipal assignee shall inspect all phases of the installation of the permanent storm water management facilities.

B. During any stage of the work, if the Municipal Engineer determines that the permanent storm water management facilities are not being installed in accordance with the approved Storm Water Management Plan, the Municipality shall revoke any existing municipal permits or issue a stop work order until the work is corrected or a revised Drainage Plan is submitted and approved, as specified in this Ordinance.

## ARTICLE VI - FEES AND EXPENSES

### *Section 601. General*

The fee required by this Ordinance is the Municipal Review Fee. The Municipal Review fee shall be established by the Municipality to defray review costs incurred by the Municipality and the Municipal Engineer. All fees shall be paid by the Applicant.

### *Section 602. Municipality Drainage Plan Review Fee*

The Municipality shall establish a Review Fee Schedule by separate resolution of the municipal governing body based on the size of the Regulated Activity and based on the Municipality's costs for reviewing Drainage Plans. The Municipality shall periodically update the Review Fee Schedule to ensure that review costs are adequately reimbursed.

### *Section 603. Expenses Covered by Fees*

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

A. Administrative Costs.

B. The review of the Drainage Plan by the Municipality and the Municipal Engineer.

C. The site inspections.

D. The inspection of storm water management facilities and drainage improvements during construction.

E. The final inspection upon completion of the storm water management facilities and drainage improvements presented in the Drainage Plan.

### *Section 604. Additional Costs*

Developer will be invoiced for any additional costs incurred by the Municipality in the course of reviewing the development plan. These costs may include, but are not limited to, special studies by qualified engineers or surveyors, field reconnaissance, and testing.

## ARTICLE VII - MAINTENANCE RESPONSIBILITIES

### *Section 701. Performance Guarantee*

The applicant shall provide a financial guarantee to the Municipality for the timely installation and proper construction of all storm water management controls as required by the approved storm water plan and this Ordinance equal to the full construction cost of the required controls.

### *Section 702. Maintenance Responsibilities*

A. The Drainage Plan for the development site shall contain an operation and maintenance plan prepared by the Applicant and approved by the Municipal Engineer. The operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to insure proper operation of the facility(ies).

B. The Drainage Plan for the development site shall establish responsibilities for the continuing operating and maintenance of all proposed storm water control facilities, consistent with the following principals:

   1. If a development consists of structures or lots that are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Municipality, storm water control facilities may also be dedicated to and maintained by the Municipality.

   2. If a development site is to be maintained in a single ownership or if sewers and other public improvements are to be privately owned and maintained, then the ownership and maintenance of storm water control facilities shall be the responsibility of the owner or private management entity.

C. The governing body, upon recommendation of the Municipal Engineer, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the Drainage Plan. The Municipality reserves the right to accept the ownership and operating responsibility for any or all of the storm water management controls.

### *Section 703. Maintenance Agreement for Privately Owned Storm Water Facilities*

A. Prior to final approval of the site's storm water management plan, the property owner shall sign and record a maintenance agreement covering all storm water control facilities that are to be privately owned. Said agreement shall be substantially in the form of the Agreement, designated as Appendix C, that is attached and made part hereto.

B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance

agreement shall be subject to the review and approval of the Municipal Solicitor and governing body.

### *Section 704. Municipal Storm Water Maintenance Fund*

A. If storm water facilities are accepted by the municipality for dedication, persons installing storm water storage facilities shall be required to pay a specified amount to the Municipal Storm Water Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. Payment can be in the form of an irrevocable letter of credit, a restricted escrow account, or a corporate security bond. The amount of the deposit shall be determined as follows:

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

2. The amount of the deposit to the fund shall be converted to present worth of the annual series values. The Municipal Engineer shall determine the present worth equivalents, which shall be subject to the approval of the municipal governing body.

B. If a storage facility is proposed that also serves as a recreation facility (e.g. ballfield, pond), the Municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.

C. If at some future time a storage facility (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.

### *Section 705. Post-Construction Maintenance Inspections*

A. Storm water detention and retention basins or facilities shall be inspected by, or under the direction of a registered professional engineer on behalf of the land owner/Applicant or responsible entity (including the Municipal Engineer for dedicated facilities) on the following basis:

1. Annually for the first 5 years.
2. Once every 3 years thereafter,
3. During or immediately after the cessation of a 100-year or greater storm event.

B. The entity conducting the inspection shall be required to submit a report to the Municipality within one (1) month following completion of the inspection. The

report will present documentation regarding the condition of the facility and recommending necessary repairs, if needed. Any needed repairs shall be implemented by the Owner within 1 month of the report issuance date.

## ARTICLE VIII - ENFORCEMENT AND PENALTIES

### *Section 801. Right-of-Entry*

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

### *Section 802. Notification*

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any permit issued hereunder, the Municipality shall provide written notification of the violation. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Failure to comply within the time specified shall subject such person to the penalty provision of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies. It shall be the responsibility of the owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

### *Section 803. Enforcement*

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

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

B. It shall be unlawful for any person, firm or corporation to undertake any regulated activity under Section 104 on any property except as provided for in the approved drainage plan and pursuant to the requirements of this Ordinance. It shall be unlawful to alter or remove any control structure required by the Drainage Plan pursuant to this Ordinance or to allow the property to remain in a condition 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 Applicant 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 printed set of as-built drawings to the Municipality.

D. After receipt of the certification by the Municipality, a final inspection shall be conducted by the Municipality or its designee to certify compliance with this Ordinance.

E. Suspension and Revocation of Permits

1. Any Municipal permit issued under this Ordinance may be suspended or revoked or a stop work order may be issued by the governing body for:

a) Non-compliance with or failure to implement any provision of the permit.

b) A violation of any provision of this Ordinance or any other applicable law, ordinance, rule or regulation relating to the project.

c) The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others, or as outlined in Article IX of this Ordinance.

2. A suspended permit shall be reinstated by the Municipality when:

a) The Municipal Engineer or his designee has inspected and approved the corrections to the storm water management and erosion and sediment pollution control measure(s), or the elimination of the hazard or nuisance, and/or;

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

c) A permit that has been revoked by the Municipality cannot be reinstated. The Applicant may apply for a new permit under the procedures outlined in this Ordinance.

F. Occupancy Permit

An occupancy permit shall not be issued by the Municipality unless all requirements of this Ordinance have been met. The occupancy permit shall be required for each lot owner and/or Applicant for all subdivisions and land development in the Municipality.

### *Section 804. Public Nuisance*

A. The violation of any provision of this Ordinance is hereby deemed a Public Nuisance.

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

***Section 805. Enforcement Remedies***

A. Anyone violating the provisions of this Ordinance shall be guilty of a misdemeanor, and upon conviction shall be subject to a fine of not more than $_____ for each violation plus court costs or imprisonment of not more than _____ days, or both. Each day that the violation continues shall be a separate offense.

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

***Section 806. Appeals***

A. Any person aggrieved by any action of the Municipality or its designee, relevant the provisions of this ordinance, may appeal to the Municipality within thirty (30) days of that action.

B. Any person aggrieved by any decision of the Municipality, relevant to the provisions of this Ordinance, may appeal to the County Court of Common Pleas in the county where the activity has taken place within thirty (30) days of the Municipality's decision.

**ENACTED and ORDAINED** at a regular meeting of the [Name of the municipal governing body] on the _____th day of _____, 20__. This Ordinance shall take effect immediately.

_____
[Name],[Title]

_____
[Name],[Title]

_____
[Name],[Title]

ATTEST:

_____
[name], Secretary ( type or print )

I hereby certify that the foregoing Ordinance was advertised in the [name of newspaper] on [date], a newspaper of general circulation in the municipality and was duly enacted and approved as set forth at a regular meeting of the [name of municipal governing body] held on [date].

_____
[name], Secretary

## APPENDIX A - STORM WATER MANAGEMENT DESIGN CRITERIA

Note: The attached Appendix A tables and graphs present suggested values, only. Data specific to your municipality should be incorporated when the Model Ordinance is adopted.

### TABLE A-1

### DESIGN STORM RAINFALL AMOUNT (INCHES) FOR 24-HOUR STORM EVENT

| RETURN FREQUENCY (YEARS) | PRECIPITATION (INCHES) |
|---|---|
| 1 | 2.2 |
| 2 | 2.6 |
| 5 | 3.0 |
| 10 | 3.5 |
| 25 | 4.3 |
| 50 | 4.7 |
| 100 | 5.2 |

Source: Pennsylvania Department of Transportation “Storm Intensity-Duration-Frequency Charts”, May 1986.

## TABLE A-2
## RUNOFF CURVE NUMBERS
## (FROM NRCS (SCS) TR-55)

| LAND USE | HYDROLOGIC CONDITION | RUNOFF CURVE NUMBER FOR INDICATED HYDROLOGIC SOIL GROUP | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Open Space: | | | | | |
| Poor Condition (grass cover < 50%) | | 68 | 79 | 86 | 89 |
| Fair Condition (grass cover 50% to 75%) | | 49 | 69 | 79 | 84 |
| Good Condition (grass cover > 75%) | | 39 | 61 | 74 | 80 |
| Impervious Areas | | | | | |
| Paved parking lots, roof, driveways | | 98 | 98 | 98 | 98 |
| Streets and roads: | | | | | |
| Paved; w/ curbs and storm sewers | | 98 | 98 | 98 | 98 |
| Paved; w/ open ditches | | 83 | 89 | 92 | 93 |
| Gravel | | 76 | 85 | 89 | 91 |
| Dirt | | 72 | 82 | 87 | 89 |
| Urban Districts: | | | | | |
| Commercial and Business | | 89 | 92 | 94 | 95 |
| | | 81 | 88 | 91 | 93 |
| Residential Districts by average lot size: | | | | | |
| 1/8 acre or less (town houses) | | 77 | 85 | 90 | 92 |
| ¼ acre | | 61 | 75 | 83 | 87 |
| 1/3 acre | | 57 | 72 | 81 | 86 |
| ½ acre | | 54 | 70 | 80 | 85 |
| 1 acre | | 51 | 68 | 79 | 84 |
| 2 acres | | 47 | 66 | 77 | 82 |
| Newly graded areas (pervious area, no vegetation) | | 81 | 89 | 93 | 95 |
| Agricultural Lands: | | | | | |
| Fallow: | | | | | |
| Bare soil | | 77 | 86 | 91 | 94 |
| Crop residue cover | Poor | 76 | 85 | 90 | 93 |
| Crop residue cover | Good | 74 | 83 | 88 | 90 |
| Pasture, grassland, or range | Poor | 68 | 79 | 86 | 89 |
| Pasture, grassland, or range | Fair | 49 | 69 | 79 | 84 |
| Pasture, grassland, or range | Good | 39 | 61 | 74 | 80 |
| Agricultural Lands (continued): | | | | | |
| Row Crops: | | | | | |
| Straight row | Poor | 72 | 81 | 88 | 91 |
| Straight row | Good | 67 | 78 | 85 | 89 |
| Straight row and crop residue cover | Poor | 71 | 80 | 87 | 90 |
| Straight row and crop residue cover | Good | 64 | 75 | 82 | 85 |
| Contoured | Poor | 70 | 79 | 84 | 88 |
| Contoured | Good | 65 | 75 | 82 | 86 |

| LAND USE | HYDROLOGIC CONDITION | RUNOFF CURVE NUMBER FOR INDICATED HYDROLOGIC SOIL GROUP | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Contoured and crop residue cover | Poor | 69 | 78 | 83 | 87 |
| Contoured and crop residue cover | Good | 64 | 74 | 81 | 85 |
| Contoured and terraced | Poor | 66 | 74 | 80 | 82 |
| Contoured and terraced | Good | 62 | 71 | 78 | 81 |
| Contoured, terraced & crop residue | Poor | 65 | 73 | 79 | 81 |
| Contoured, terraced & crop residue | Good | 61 | 70 | 77 | 80 |
| Small Grain: | | | | | |
| Straight row | Poor | 65 | 76 | 84 | 88 |
| Straight row | Good | 63 | 75 | 83 | 87 |
| Straight row and crop residue | Poor | 64 | 75 | 83 | 86 |
| Straight row and crop residue | Good | 60 | 72 | 80 | 84 |
| Contoured | Poor | 63 | 74 | 80 | 85 |
| Contoured | Good | 61 | 73 | 81 | 84 |
| Contoured and crop residue | Poor | 62 | 73 | 81 | 84 |
| Contoured and crop residue | Good | 60 | 72 | 80 | 83 |
| Contoured and terraced | Poor | 61 | 72 | 79 | 82 |
| Contoured and terraced | Good | 59 | 70 | 78 | 81 |
| Contoured, terraced & crop residue | Poor | 60 | 71 | 78 | 81 |
| Contoured, terraced & crop residue | Good | 58 | 69 | 77 | 80 |
| Meadow or Legumes: | | | | | |
| Straight row | Poor | 66 | 77 | 85 | 89 |
| Straight row | Good | 58 | 72 | 81 | 85 |
| Contoured | Poor | 64 | 75 | 83 | 85 |
| Contoured | Good | 55 | 69 | 78 | 83 |
| Contoured and terraced | Poor | 63 | 73 | 80 | 83 |
| Contoured and terraced | Good | 51 | 67 | 76 | 80 |
| Meadow, continuous grass, protected from grazing and mowed for hay | | 30 | 58 | 71 | 78 |
| Brush – brush/weed mixture | Poor | 48 | 67 | 77 | 83 |
| | Fair | 35 | 56 | 70 | 77 |
| | Good | 30 | 48 | 65 | 73 |
| Woods and grass combination (orchard) | Poor | 57 | 73 | 82 | 86 |
| | Fair | 43 | 65 | 76 | 82 |
| | Good | 32 | 58 | 72 | 79 |
| Woods | Poor | 45 | 66 | 77 | 83 |
| | Fair | 36 | 60 | 73 | 79 |
| | Good | 30 | 55 | 70 | 77 |
| Farmsteads – buildings, lanes, driveways, and surrounding lots | | 59 | 74 | 82 | 86 |

## TABLE A-3
## RATIONAL FORMULA RUNOFF COEFFICIENTS

| TYPE OF DRAINAGE AREA | RUNOFF COEFFICIENT |
|---|---|
| Lawns: | |
| Sandy soil, flat, <2% | 0.05-0.10 |
| Sandy soil, average, 2-7% | 0.10-0.15 |
| Sandy soil, steep, >7% | 0.15-0.20 |
| Heavy soil, flat, <2% | 0.13-0.17 |
| Heavy soil, average, 2-7% | 0.18-0.22 |
| Heavy soil, steep, >7% | 0.25-0.35 |
| Business: | |
| Downtown areas | 0.70-0.95 |
| Neighborhood areas | 0.50-0.70 |
| Residential: | |
| Single-family areas | 0.30-0.50 |
| Multi units, detached | 0.40-0.60 |
| Multi units, attached | 0.60-0.75 |
| Suburban | 0.25-0.40 |
| Apartment dwelling areas | 0.50-0.70 |
| Industrial: | |
| Light areas | 0.50-0.80 |
| Heavy areas | 0.60-0.90 |
| Parks, Cemeteries | 0.10-0.25 |
| Playgrounds | 0.20-0.35 |
| Railroad Yard Areas | 0.20-0.40 |
| Unimproved Areas | 0.10-0.30 |
| Streets: | |
| Asphaltic | 0.70-0.95 |
| Concrete | 0.80-0.95 |
| Brick | 0.70-0.85 |
| Drives and Walks | 0.75-0.85 |
| Roofs | 0.75-0.95 |

## TABLE A-4
## MANNING ROUGHNESS COEFFICIENTS

| PIPE MATERIAL OR CHANNEL LINING | ROUGHNESS COEFFICIENT |
|---|---|
| Cast Iron Pipe | 0.013 |
| Concrete Pipe | 0.012 |
| Corrugated Metal Pipe | 0.024 |
| Corrugated Metal Pipe – Paved Invert | 0.019 |
| High Density Polyethylene Pipe (HDPE) – Smooth Lined | 0.012 |
| High Density Polyethylene Pipe (HDPE) – Corrugated | 0.018 |
| Plastic Pipe (PVC, SDR, S&D) | 0.011 |
| Earth-lined Channel (few rocks) | 0.020 |
| Earth-bottomed Channel with Rock Sides | 0.030 |
| Grass-lined Channel | 0.050 |

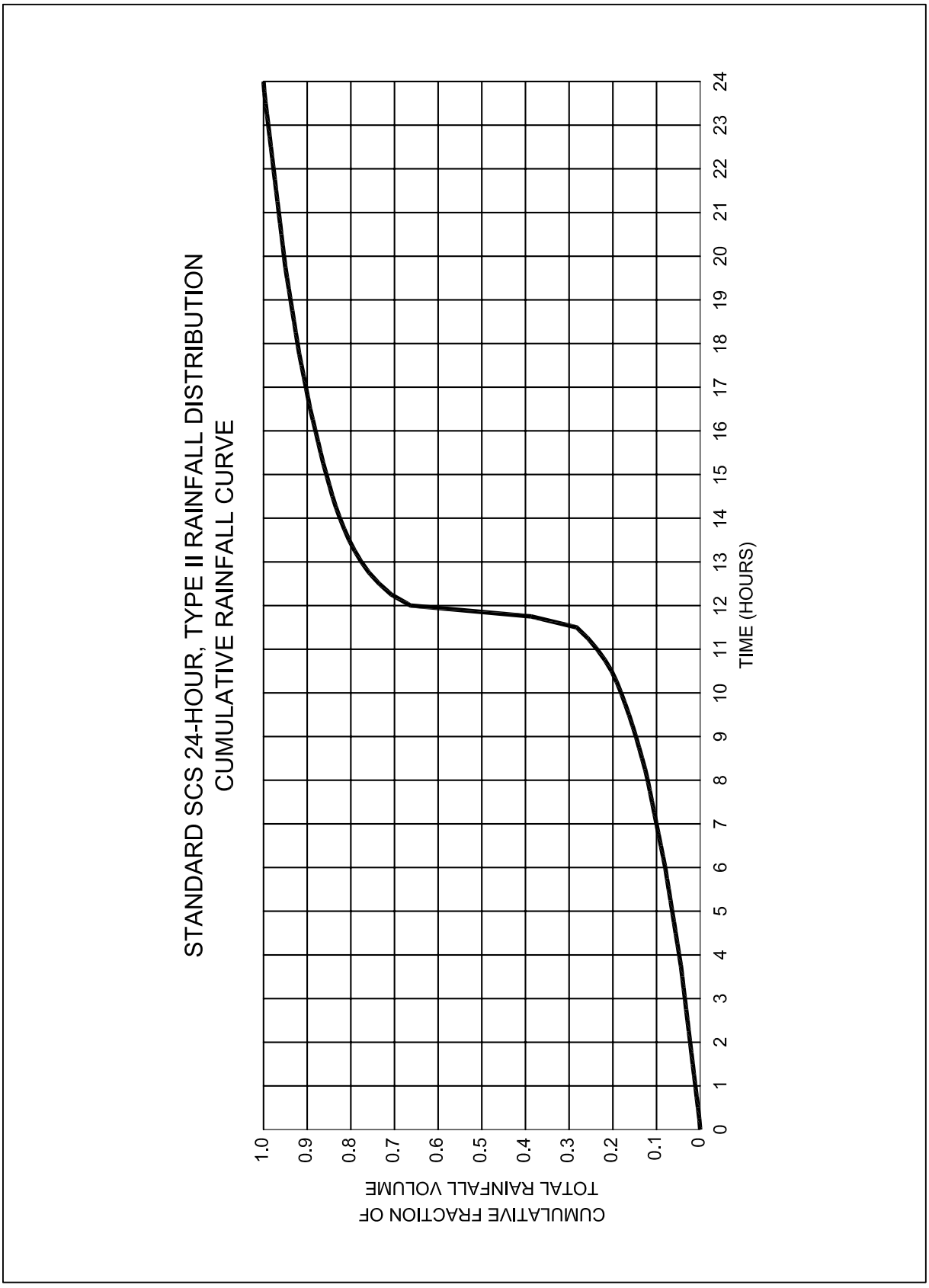
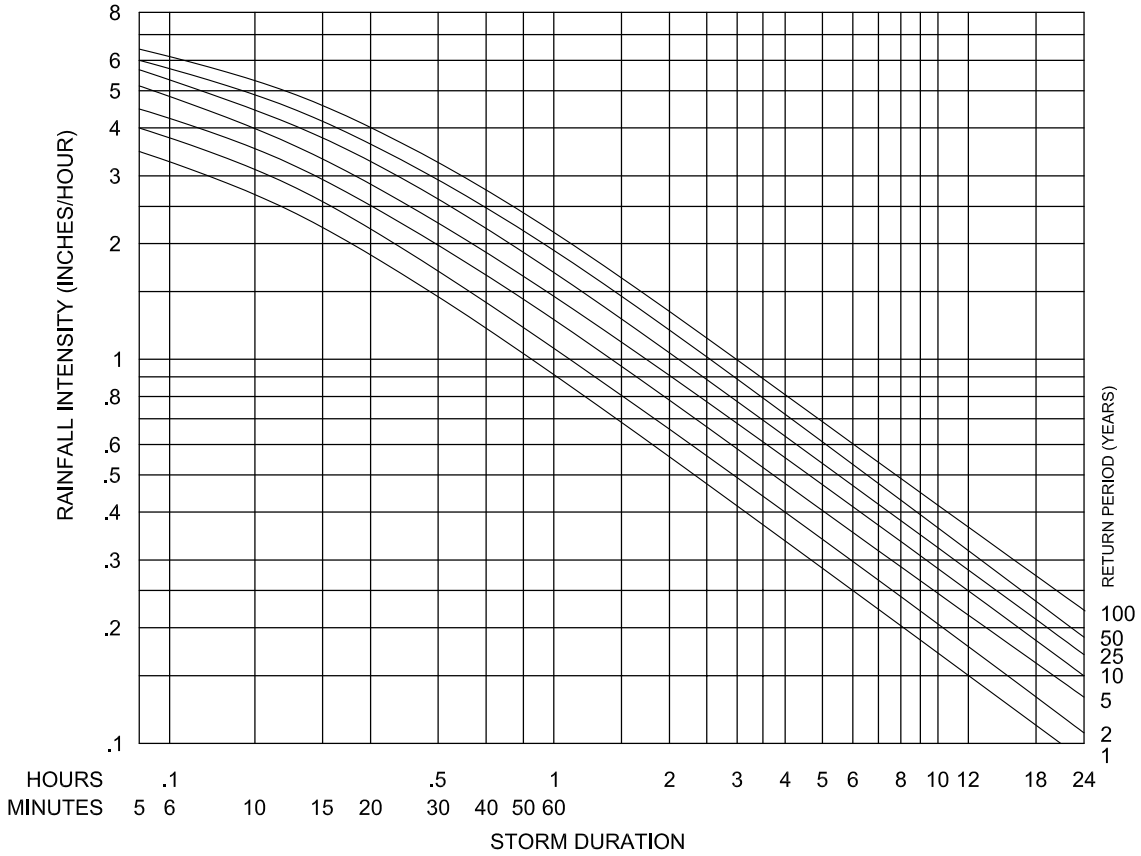

STANDARD SCS 24-HOUR, TYPE II RAINFALL DISTRIBUTION
CUMULATIVE RAINFALL CURVE
CUMULATIVE FRACTION OF
TOTAL RAINFALL VOLUME
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
TIME (HOURS)

FIGURE A-1

# Penn DOT RAINFALL CURVES FOR REGION 2

## RAINFALL DURATION-INTENSITY-FREQUENCY




## RAINFALL DURATION-VOLUME-FREQUENCY

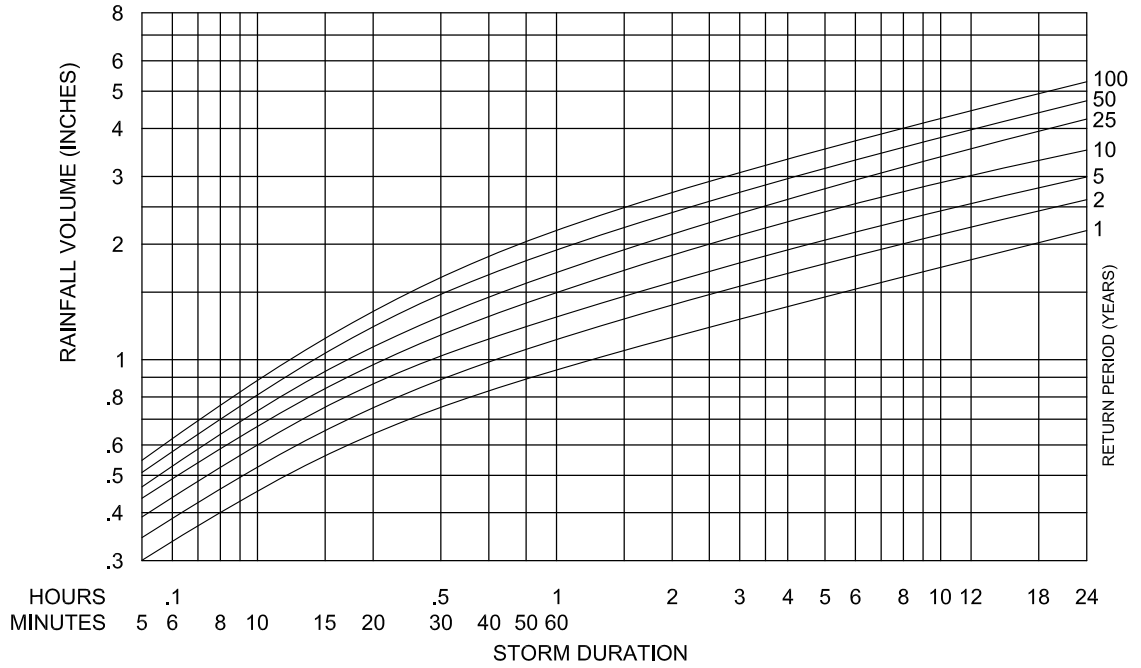



FIGURE A-2

## APPENDIX B - SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE

### DRAINAGE PLAN APPLICATION

(To be attached to the "land subdivision plan or development plan review application Or "minor land subdivision plan review application")

Application is hereby made for review of the storm water management and erosion and Sedimentation control plan and related data as submitted herewith in accordance with The _____ township storm water management and earth disturbance Ordinance.

_____ final plan _____ preliminary plan _____ sketch plan

Date of submission: _____ Submission no:._____

1. Name of subdivision or development
   _____

2. Name of applicant _____ telephone no._____

   (if corporation, list the corporation's name and the names of two officers of the corporation)

   Address _____

   City _____ Zip Code_____

   Applicants interest in subdivision or development
   _____
   (if other than property owner give owners name and address)

3. Name of property owner _____ Telephone No._____
   Address _____ City _____
   Zip Code _____

   Name of engineer or surveyor _____

   Telephone no. _____Address _____

   City _____ Zip Code _____

4. Type of subdivision or development proposed:

| | | |
|---|---|---|
| _____Single Family lots | _____Townhouses | ____ Commercial (multi lot) |
| _____ Two Family lots | _____ Garden Apartments | ____ Commercial (one lot) |
| _____Cluster lots | _____ Campground | ____ Industrial (one lot) |
| _____ Planned Residential | _____ Other | |

If other, describe type of development _____

5. Lineal feet of new road proposed? _____l.f.

6. Area of proposed and existing impervious area on entire tract.

a. Existing (to remain)_____ s.f. _____% of property
b. Proposed _____ s.f. _____% of property

7. Storm water

a. Does the peak rate of runoff from proposed conditions exceed that flow which occurred for predevelopment conditions for the designated design storm?

_____

b. Design storm utilized (on-site conveyance systems) (24 hr.) (check one)

- no. of subareas _____
- watershed name_____
- If other, explain:

_____
_____

c. Does the submission meet the release rate and/or district criteria for the applicable subarea?

_____

d. Number of subareas from Release Rate Map of the Kishacoquillas Creek Watershed Storm Water Management Plan.

e. Does the submission meet the requirements for infiltration and extended detention?

f. Type of proposed runoff control _____

g. Does the proposed storm water control criteria meet the requirement/guidelines of the storm water ordinance? _____

h. Does the plan meet the requirements of Article III of the storm water ordinance?
_____

i. Was TR-55, June 1986 utilized in determining the time of concentration?
_____

j. What hydrologic method was used in the storm water computations?
_____

k. Is a hydraulic routing through the storm water control structure submitted?
_____

l. Is a construction schedule or staging attached? _____

m. Is a recommended maintenance program attached? _____

8. Has an Erosion and sediment pollution control (e&s) been submitted to the County Conservation District?

a. Total area of earth disturbance _____ s.f.

9. Wetlands

a. Have the wetlands been delineated by someone trained in wetland delineation?
_____

b. Have the wetland lines been verified by a state or federal permitting authority?
_____

c. Have the wetland lines been surveyed?
_____

d. Total acreage of wetland within the property _____

e. Total acreage of wetland disturbed
_____

f. Supporting documentation
_____

10. Filing

a. Has the required fee been submitted? _____

Amount $_____

b. Has the proposed schedule of construction inspection to be performed by the applicant's engineer been submitted?
_____

c. Name of individual who will be making the inspections_____

_____

d. General comments about storm water management at development site

_____

_____

_____

_____

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:
COMMONWEALTH OF PENNSYLVANIA COUNTY OF MIFFLIN

On this the _____ day of _____, 20_____, before me, the undersigned officer, personally appeared _____ who being duly sworn, according to law, desposes and says that _____ owners of the property described in this application and that the application was made with_____ knowledge and/or direction and does hereby agree with the said application and to the submission of the same.

---

Property Owner(s)

My Commission Expires _____, 20_____

_____Notary Public

THE UNDERSIGNED HEREBY CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE AND BELIEF THE INFORMATION AND STATEMENTS GIVEN ABOVE ARE TRUE AND CORRECT.
SIGNATURE OF APPLICANT_____

**This Information To Be Completed By The Municipality**

_____ Township official submission receipt

Date complete application received _____ Plan number_____

Fees _____ Date fees paid _____ Received by _____

Official submission receipt date
_____

Received by _____

## FEE SCHEDULE

_____ Township

Drainage Plan
Schedule of Fees

Subdivision name _____Submittal no._____

Owner _____ Date _____

Engineer _____

1. Filing fee $ _____
2. Land use
   - 2a. Subdivision, campgrounds, mobile home parks, and multi-family dwelling where the units are located in the same local watershed $ _____
   - 2b. Multi-family dwelling where the designated open space is located in a different local watershed from the proposed units. $ _____
   - 2c. Commercial/industrial $ _____

3. Relative amount of earth disturbance
   - 3a. Residential
     - road <500 l.f. $ _____
     - road 500-2,640 l.f. $ _____
     - road >2,640 l.f. $ _____
   - 3b. Commercial/industrial and other
     - impervious area <3,500 s.f. $ _____
     - impervious area 3,500-43,460 s.f. $ _____
     - impervious area >43,560 s.f. $ _____

4. Relative size of project
   - 4a. Total tract area <1 ac $ _____
     - 1-5 ac $ _____
     - 5-25 ac $ _____
     - 25-100 ac $ _____
     - 100-200 ac $ _____
     - >200 ac $ _____

5. Storm water control measures

| | | |
|---|---|---|
| 5a. | Detention basins & other controls which require a review of hydraulic routings ($ per control) | $ _____ |
| 5b. | Other control facilities which require storage volume calculations but no hydraulic routings. ( $ per control) | $ _____ |
| 6. | Site inspection ($ per inspection) | $ _____ |
| | total | $ _____ |

All subsequent reviews shall be 1/4 the amount of the initial review fee unless a new application is required as per section 406 of the storm water ordinance. A new fee shall be submitted with each revision in accordance with this schedule.

# Appendix C

## STANDARD STORM WATER FACILITIES MAINTENANCE AND MONITORING AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20__, by and between _____, (hereinafter the "Landowner"), and _____, Mifflin County, Pennsylvania, (hereinafter "Municipality");

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of Mifflin 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 storm water 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 storm water management facilities be constructed and maintained on the Property: and

WHEREAS, the Municipality requires, through the implementation of the _____ Watershed Storm Water Management Plan, that storm water 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 storm water 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 storm water 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 of proper identification, to enter upon the Property at reasonable times, and to inspect the storm water 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:
    - Annually for the first 5 years after the construction of the storm water facilities,
    - Once every 2 years thereafter, or
    - During or immediately upon the cessation of a 100 year or greater precipitation 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 storm water 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 storm water management facilities and to charge the costs of the maintenance and/or repairs to the Landowner, his successors and assigns. This provision 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 storm water 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 file a Municipal Claim and enter a Municipal Lien against the property in the amount of such costs, or may proceed to recover his costs through proceedings in equity or at 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 storm water 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 his costs.

**This Agreement shall be recorded among the land records of Mifflin 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 Mifflin, Pennsylvania

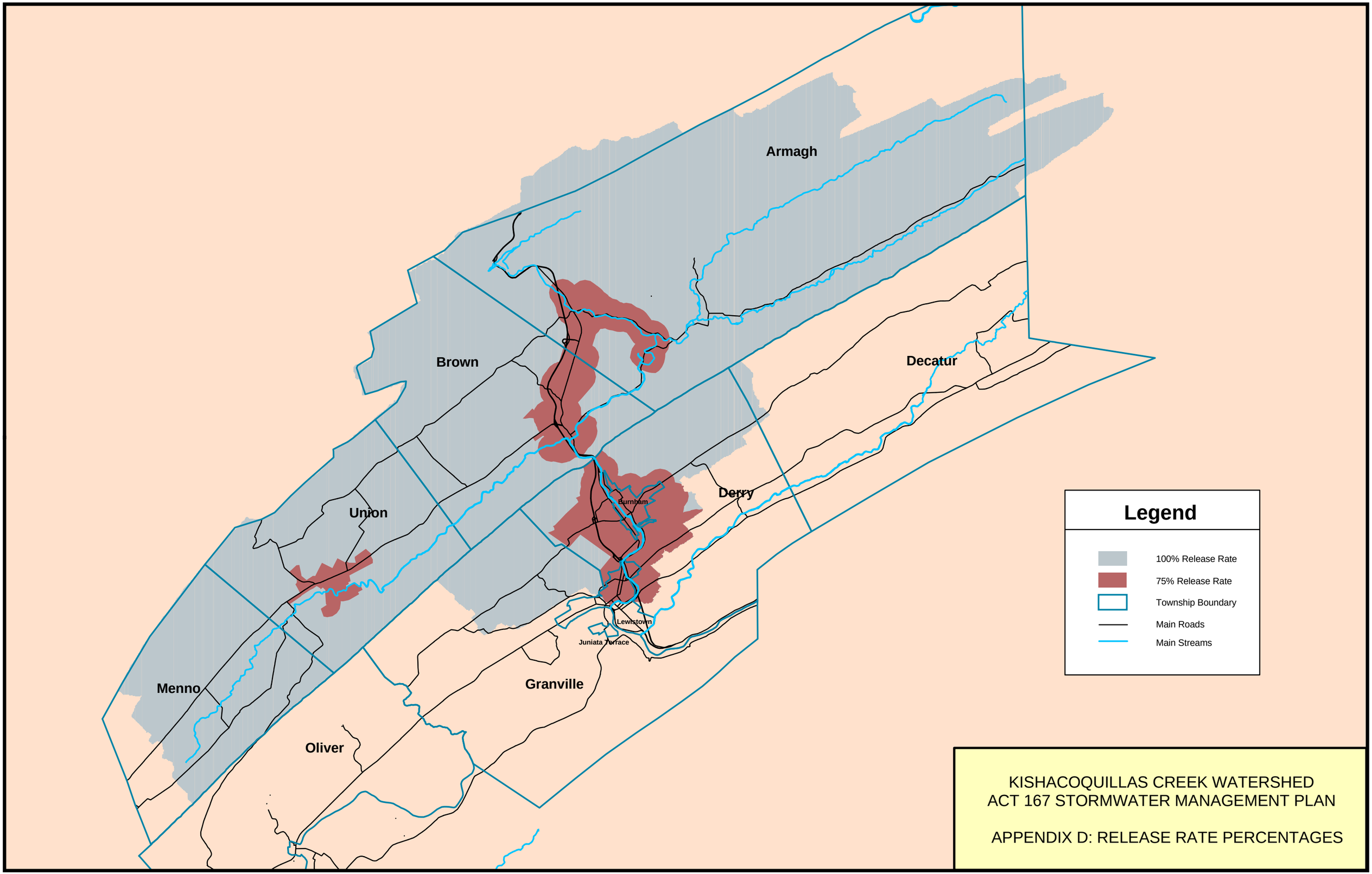
I, _____, a Notary Public in and for the County and State aforesaid, whose commission expires on the _____ day of _____, 20__, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20__, has acknowledged the same before me in my said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

**GIVEN UNDER MY HAND THIS** _____ day of _____, 20___.

_____

**NOTARY PUBLIC (SEAL)**

# APPENDIX D - WATERSHED RELEASE RATE MAP




KISHACOQUILLAS CREEK WATERSHED
ACT 167 STORMWATER MANAGEMENT PLAN

APPENDIX D: RELEASE RATE PERCENTAGES