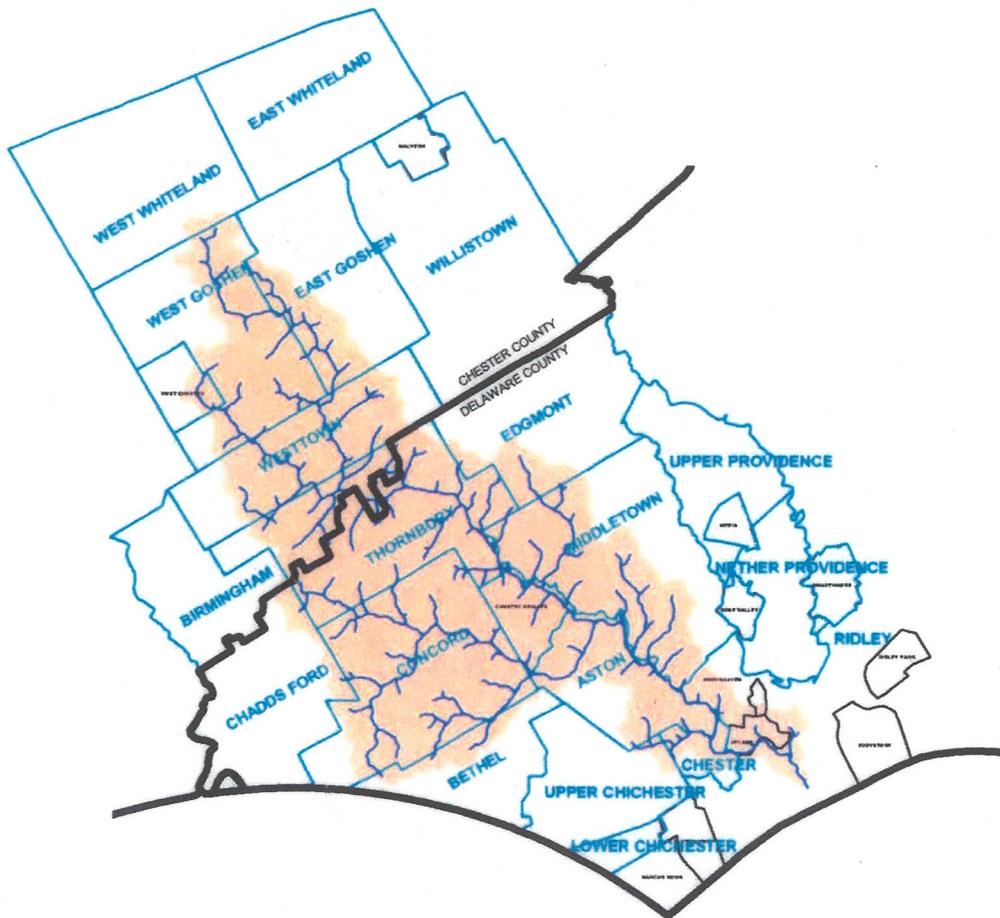


**ACT 167
STORMWATER MANAGEMENT PLAN
CHESTER CREEK WATERSHED**

**VOLUME I
STORMWATER MANAGEMENT PLAN**



PREPARED BY:

**Delaware County Planning Department and
Chester County Planning Commission**

JUNE 2002

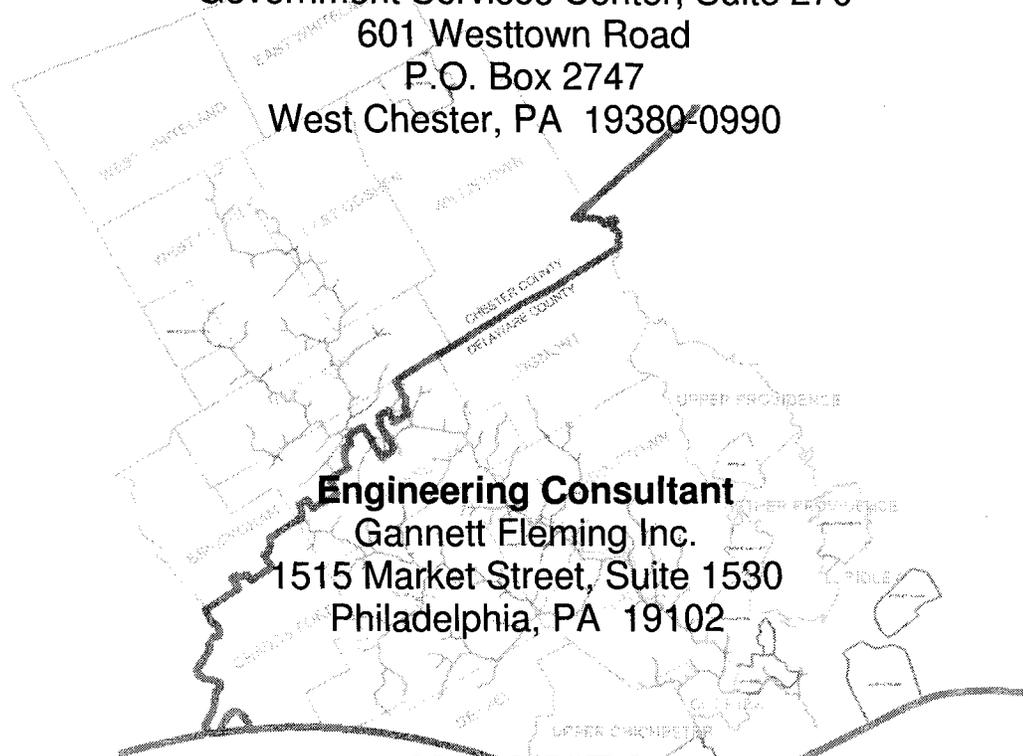
**ACT 167
STORMWATER MANAGEMENT PLAN
CHESTER CREEK WATERSHED**

PREPARED BY:

Delaware County Planning Department
Government Center Building
201 West Front Street
Media, PA 19063-2751

and

Chester County Planning Commission
Government Services Center, Suite 270
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West Chester, PA 19380-0990



Engineering Consultant

Gannett Fleming Inc.
1515 Market Street, Suite 1530
Philadelphia, PA 19102

VOLUME I
STORMWATER MANAGEMENT PLAN
JUNE 2002

RESOLUTION

WHEREAS, the Stormwater Management Act, Act 167 of 1978, provides for the regulation of land and water use for flood control and stormwater management, requires the Pennsylvania Department of Environmental Protection to designate watersheds, provides for grants to be appropriated and administered by the Department for plan preparation and implementation costs, and provides that each county will prepare and adopt a watershed stormwater management plan for each designated watershed; and

WHEREAS, the County of Delaware, acting through the Delaware County Planning Department, entered into a grant agreement with the Pennsylvania Department of Environmental Protection to develop the watershed stormwater management plan for the Chester Creek designated watershed; and

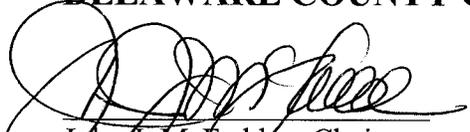
WHEREAS, the purposes of the Chester Creek Stormwater Management Plan are to protect public health and safety by addressing the impacts of new development on the existing stormwater runoff levels and to recommend measures to control accelerated runoff to prevent increased flood damages or additional water quality degradation; and

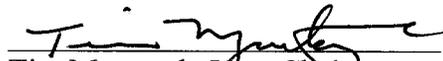
WHEREAS, design criteria and standards for stormwater management systems and facilities within the Chester Creek watershed shall utilize the criteria and standards as found in the watershed stormwater management plan;

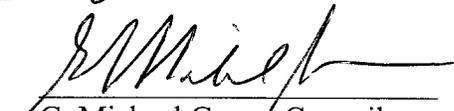
NOW, THEREFORE, BE IT RESOLVED that the County of Delaware hereby adopts the Chester Creek Stormwater Management Plan, including all volumes, figures, attachments, and appendices and forwards the plan to the Stormwater Management Section of the Pennsylvania Department of Environmental Protection for approval.

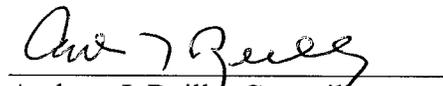
This Resolution is hereby adopted this 25th day of June 2002 by:

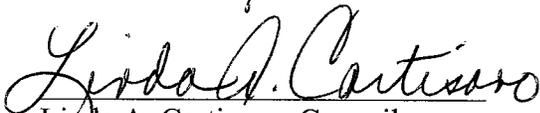
DELAWARE COUNTY COUNCIL


John J. McFadden, Chairman


Tim Murtaugh, Vice Chairman


G. Michael Green, Councilman


Andrew J. Reilly, Councilman


Linda A. Cartisano, Councilwoman

RESOLUTION # 31-02

WHEREAS, the Pennsylvania Stormwater Management Act, Act 167 of 1978, provides for the regulation of land and water use for flood control and stormwater management, requires the Pennsylvania Department of Environmental Protection to designate watersheds, provides for grants to be appropriated and administered by the Department for plan preparation and implementation costs, and provides that each county will prepare and adopt a watershed stormwater management plan for each designated watershed; and

WHEREAS, policies of the Chester County Comprehensive Plan *Landscapes*, calls for the reduction of public costs from flood damage and protection of water quality in streams; and

WHEREAS, the County of Chester, acting through the Chester County Planning Commission entered into a grant agreement with Delaware County and the Pennsylvania Department of Environmental Protection to develop the watershed stormwater management plan for the Chester Creek designated watershed; and

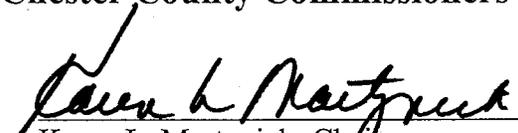
WHEREAS, the purposes of the Chester Creek Stormwater Management Plan are to protect public health and safety by addressing the impacts of new development on the existing stormwater runoff levels and to recommend measures to control accelerated runoff to prevent increased flood damages or additional water quality degradation; and

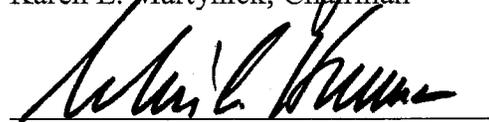
WHEREAS, design criteria and standards of stormwater management systems and facilities within the Chester Creek watershed shall utilize the criteria and standards as found in the watershed stormwater management plan;

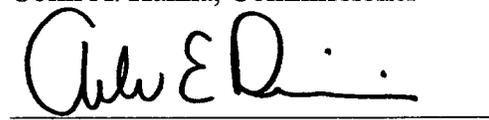
NOW, THEREFORE, BE IT RESOLVED that the County of Chester hereby adopts the Chester Creek Stormwater Management Plan, including all volumes, figures, attachments, and appendices.

This Resolution is hereby adopted this 28th day of June 2002 by:

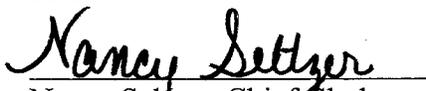
The Board of Chester County Commissioners


Karen L. Martynick, Chairman


Colin A. Hanna, Commissioner


Andrew E. Dinniman, Commissioner

Attest:


Nancy Setzler, Chief Clerk

EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

This stormwater management plan represents the culmination of a two-phased, multi-year study of the Chester Creek watershed located in Delaware and Chester Counties in southeastern Pennsylvania. The plan was prepared under the provisions of the Pennsylvania Stormwater Management Act, Act 167 of 1978. Under the Act, the intent of this plan is to address the impacts of new development on the existing stormwater runoff levels and to recommend measures to control accelerated runoff to prevent increased flood damages or additional water quality degradation.

The Chester Creek Stormwater Management Plan is documented in two volumes. Volume I is the stormwater management plan, including a watershed model ordinance, and Volume II is the watershed modeling report. The purpose of the plan is to present the findings and recommendations of the Chester Creek Stormwater Management Phase II study.

This plan considers both water quality and quantity impacts of future development and incorporates control recommendations intended to prevent further degradation of the watershed. This plan will help to make municipalities and developers more aware of the impacts of development and will encourage the use of best management practices (BMPs) in achieving economical, effective control of stormwater runoff.

Stormwater Management and the Act 167 Process

Stormwater management involves the control of water that runs off the surface of the land from rain or melting snow or ice and is necessary to alleviate impacts resulting from development such as frequent flooding, erosion and sedimentation, concentration of flow to adjacent properties, infrastructure damage, and nonpoint source pollution.

In 1978, the Pennsylvania legislature enacted the Stormwater Management Act (Act of October 4, 1978, P.L. 864, No. 167, 32 P.S. Section 680.1 et. seq.). The purpose of the Act is to encourage planning to control the impacts of future growth on stormwater runoff within each watershed in the state. The obvious benefit of this approach is that the municipalities in each watershed will be able to manage runoff and develop in a consistent and coordinated manner. The Act further stipulates

that persons engaged in the activities which affect stormwater runoff characteristics shall implement measures:

- “(1) to assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; or
(2) to manage the quantity, velocity, and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.”*

Counties in Pennsylvania are required to develop stormwater management plans for each of the watersheds within their boundaries. The Pennsylvania Department of Environmental Protection (DEP) develops grant agreements with counties to pay for 75% of the costs to prepare the plans. Upon completion and adoption of a plan by a county and approval by DEP, municipalities located in the watershed have six months to amend local ordinances or adopt a separate stormwater management ordinance consistent with the plan. Developers are then required to follow the local drainage regulations that incorporate the standards of the stormwater management plan when preparing their land development plans.

Watershed Plan Advisory Committee

In accordance with Act 167, a Watershed Plan Advisory Committee (WPAC) was formed at the start of the watershed stormwater planning process. The WPAC is responsible for advising the counties throughout the planning process, evaluating policy and project alternatives, coordinating the watershed stormwater plans with other municipal plans and programs, and reviewing the plan before adoption.

The WPAC for the Chester Creek watershed consists of one representative from each of the municipalities within its border, each County’s Conservation District Manager, a representative of the Chester County Water Resources Authority, the Chester-Ridley-Crum Watersheds Association, the Natural Resource Conservation Service (NRCS), and Philadelphia Suburban Water Company. A full list of WPAC members and meeting attendance lists are included in **Attachment A** of the plan.

WATERSHED DESCRIPTION

The Chester Creek watershed is located in the western portion of Delaware County and extends into the eastern portion of Chester County. The watershed encompasses approximately 66 square miles

(41,900 acres) and includes all or portions of the municipalities listed in **Table ES-1** and illustrated in **Figure 1** of the plan. Chester Creek flows in a generally northwest to southeast direction where the main stem discharges into the Delaware River. There are several medium-sized tributary streams that flow into the main stem (East and West Branches, Goose Creek, Rocky Run, Green Creek, Chrome Run, Concord Run, Crum Run, and Baldwin Run) and numerous unnamed tributaries and small creeks. In addition, there are three large reservoirs (West Chester Reservoir, Milltown Reservoir, and Westtown Lake) and numerous small lakes and ponds.

| MUNICIPALITY | COUNTY | ACRES WITHIN WATERSHED | PERCENT OF LAND IN WATERSHED |
|---------------------------|----------|------------------------|------------------------------|
| Aston Township | Delaware | 3,013 | 80 |
| Bethel Township | Delaware | 932 | 27 |
| Brookhaven Borough | Delaware | 606 | 55 |
| Chadds Ford Township | Delaware | 577 | 10 |
| Chester City | Delaware | 707 | 18 |
| Chester Township | Delaware | 667 | 74 |
| Chester Heights Borough | Delaware | 1,428 | 100 |
| Concord Township | Delaware | 8,072 | 93 |
| Edgmont Township | Delaware | 1,103 | 18 |
| Middletown Township | Delaware | 5,261 | 61 |
| Parkside Borough | Delaware | 36 | 27 |
| Thornbury Township | Delaware | 5,871 | 99 |
| Upland Borough | Delaware | 425 | 100 |
| Upper Chichester Township | Delaware | 230 | 5 |
| Birmingham Township* | Chester | 38 | < 1 |
| East Goshen Township | Chester | 1,800 | 28 |
| Thornbury Township | Chester | 2,096 | 83 |
| West Chester Borough | Chester | 359 | 30 |
| West Goshen Township | Chester | 4,609 | 60 |
| West Whiteland Township | Chester | 171 | 2 |
| Westtown Township | Chester | 3,899 | 70 |

* As a result of discussions with DEP, Birmingham Township was not included in the WPAC due to the minimal area located within the watershed boundary.

SOURCE: Gannett Fleming, 2001

EXISTING AND FUTURE LAND USE

The Chester Creek watershed is defined by its unique diversity of land uses and development features. The watershed area ranges in character from the semi-rural communities of Thornbury (Delaware and Chester Counties), Concord, and Edgmont, located in the central portion of the watershed, to the highly urbanized areas of West Chester Borough and Chester City, located at the headwaters and mouth of the watershed, respectively.

Development pressure within the central portion of the watershed is high, particularly near the two-county boundary, where growth management is of particular concern. Communities such as West Chester Borough and the City of Chester, located at the upper and lower ends of the watershed, are urbanized and densely developed. Therefore, development activity and land use issues vary greatly within these communities. The distribution of the various land uses within the watershed is listed below in **Table ES-2**.

Future land development was based on the current municipal zoning maps for the watershed within Chester and Delaware Counties. The municipal zoning maps indicate that future development will predominantly continue to be medium- to low-density residential intermixed with commercial, industrial, and high-density residential uses. Future development in the existing wooded and agricultural areas will continue to be low- and medium-density housing.

EXISTING MUNICIPAL STORMWATER MANAGEMENT REGULATIONS

All of the municipalities in the watershed have comprehensive plans, zoning ordinances and maps, subdivision ordinances, and floodplain maps. As required by the Pennsylvania Municipalities Planning Code (MPC) (Act 247, as amended), the Counties are required to review all land development plans. Most of the municipalities within the Chester Creek watershed require some level of peak flow control for new development.

| TABLE ES-2 EXISTING LAND USE CHESTER CREEK WATERSHED | | | |
|---|-------------------|------------------|---------------------|
| LAND USE CATEGORY | PERCENTAGE | ACRES | SQUARE MILES |
| Agriculture/Pasture | 11.57 | 4,849.23 | 7.58 |
| Commercial | 3.99 | 1,670.69 | 2.61 |
| High-density Residential | 2.77 | 1,159.09 | 1.81 |
| Industrial | 1.96 | 823.23 | 1.29 |
| Institutional | 2.38 | 995.56 | 1.56 |
| Low-density Residential | 13.68 | 5,732.67 | 8.96 |
| Medium-density Residential | 23.35 | 9,783.92 | 15.29 |
| Military | 0.01 | 4.69 | 0.01 |
| Mining/Quarry | 0.46 | 192.31 | 0.30 |
| Open Space | 2.40 | 1,004.37 | 1.57 |
| Recreation | 2.30 | 962.07 | 1.50 |
| Transportation | 2.64 | 1,105.22 | 1.73 |
| Utility | 0.98 | 410.43 | 0.64 |
| Water | 0.77 | 322.48 | 0.50 |
| Wooded | 30.76 | 12,889.38 | 20.14 |
| TOTALS | 100.00 | 41,905.34 | 65.48 |

SOURCE: Gannett Fleming, 2001

STORMWATER PROBLEMS

Through the years, the communities within the Chester Creek watershed have experienced development which has affected the creek's functions and flood storage capacity. As in similar urban stream corridors, regional development can result in both water quality and water quantity impacts.

During the planning process, municipalities provided specific information regarding the location and type of stormwater related problems. Common problems identified by many of the municipalities included channel and stream flooding, street or intersection flooding, and erosion (soil wash-off). Downstream communities such as Brookhaven and Aston reported flooding problems along the main stem of the creek. Flooding problem areas within the middle and upper communities appeared along the branches or tributaries.

MODELING RESULTS

NRCS's TR-20 model was selected to simulate runoff hydrographs and to route the flows through the stream channels for the watershed; however, due to the size and complexity of the watershed, a comprehensive geographic information system (GIS)-based hydrologic modeling environment called WMS (Watershed Modeling System) was used to streamline the TR-20 model construction. WMS (created at Brigham Young University's Environmental Modeling Research Laboratory) uses GIS-based coverage to construct databases for hydrologic models and provides a graphical user interface for numerous stormwater models. The inherent flexibility with using GIS and the numerous models supported by WMS were major factors in the selection of WMS for the project.

The watershed was divided into 123 subwatersheds for purposes of characterizing runoff conditions. These subwatersheds are shown on **Plate 5** of the plan.

Each subwatershed was analyzed to determine the types of soils and land use for existing conditions, and this information was used to derive the Soil Conservation Service (SCS) runoff curve number (RCN), an indicator of runoff potential of an area.

The modeling effort also involved the development of release rates. The release rate defines what percentage of the pre-development peak discharge can be released as a peak discharge after development. For example, a 100% release rate implies that the development can discharge runoff at a rate equal to pre-development conditions, while a 50% release rate indicates that the peak discharge after development cannot exceed 50% of the pre-development peak discharge. Another modeling tool, STREMTUL, was used to determine release rates for the watershed. **Plate 6**, the Release Rate Map, shows the final release rate percentages as determined by STREMTUL and approved by the WPAC at its meeting in December 2000. This plate is found in the plan's map pocket at the back of the document.

PERFORMANCE STANDARDS

The Chester Creek Stormwater Management Plan requires mandatory implementation of both water quality and water quantity controls. This plan philosophy represents a shift from voluntary

implementation of water quality criteria in previous Act 167 plans to mandatory municipal implementation of the water quality and groundwater recharge components.

The water quality and water quantity components included in the Chester Creek Stormwater Management Plan have been developed to adhere to the following watershed performance standards:

- Minimize the generation of stormwater runoff
- Adequately treat stormwater
- Maintain groundwater recharge rates
- Remove 80% of the suspended solids load
- Ensure that post-development peak discharge shall not exceed pre-development rates
- Protect stream channels from degradation
- Provide additional controls for sensitive areas (i.e., wetlands, agricultural areas)
- Require enforceable operation and maintenance agreements
- Require water quality pre-treatment
- Encourage redevelopment through special stormwater criteria
- Prepare stormwater pollution prevention plans for industrial sites
- Require developer consultation with municipal reviewing agencies before design

In order to meet the water quality and quantity performance standards noted above and be consistent with desired technical objectives, a hierarchical implementation approach was devised as illustrated on the flow chart shown in **Figure 4** of the plan. This hierarchy involves a three-step process: Step 1 - Infiltration, Step 2 - Extended detention, and Step 3 - Implementation of additional design controls. Applicants must evaluate the outcome of each step before proceeding to the next. In addition, the stormwater management plan requires the creation of riparian buffers where applicable.

MODEL ORDINANCE

The Chester Creek Model Stormwater Management Ordinance was developed under the authority of and in strict conformance with the requirements of Act 167, including the new requirements for water quality and groundwater recharge components mandated by DEP. The ordinance was prepared in consultation with the WPAC and was presented for discussion at WPAC meetings held

in January, June, and July 2001. Proposed ordinance provisions were reviewed and accepted by a majority of the voting members attending the meetings.

Comments were received from the municipal engineers and solicitors, and changes were made to the model ordinance language. The final revised model ordinance is presented in **Attachment C** of the plan and includes criteria for determining existing and projected runoff rates, performance standards and specifications for managing storm runoff in the watershed, and criteria for designing stormwater collection systems.

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 BMPs and conservation design techniques.

PLAN IMPLEMENTATION AND UPDATE

Once this watershed plan was adopted by the governing bodies of Chester and Delaware Counties, it was submitted to DEP for approval. Within six months following county adoption and DEP approval, the municipalities within the watershed are required by Act 167 to either adopt the model ordinance as a stand-alone ordinance or incorporate it into their existing subdivision and land development ordinances with appropriate cross-references. 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.

Some municipalities in the Chester 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.

Act 167 requires that plan updates be conducted at least every five years to account for changes in land use, development pressures, and water quantity and quality provisions. The Chester County Planning Commission (CCPC) and the Delaware County Planning Department (DCPD) 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.

CHESTER CREEK ACT 167 STUDY
VOLUME I - STORMWATER MANAGEMENT PLAN
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I. INTRODUCTION

A. Purpose of Plan

This stormwater management plan was developed for the Chester Creek watershed located in Delaware and Chester Counties in southeastern Pennsylvania as shown on **Figure 1**. This plan represents the culmination of a two-phased, multi-year study of the watershed prepared under the provisions of the Pennsylvania Stormwater Management Act, Act 167 of 1978. Under the Act, the intent of this study is to address the impacts of new development on the existing stormwater runoff levels and to recommend measures to control accelerated runoff to prevent increased flood damages or additional water quality degradation. Phase I, completed by Delaware County in 1997, identified stormwater problem areas, established the WPAC, and prepared the Phase II Scope of Study. Phase II, initiated in 1998, included an evaluation of existing municipal stormwater provisions, preparation and evaluation of a detailed municipal questionnaire, completion of an obstruction inventory, watershed modeling and preparation of a modeling report, and development of a watershed stormwater model ordinance. This plan was undertaken in coordination with the *Chester Creek River Conservation Plan*, prepared on behalf of the Chester-Ridley-Crum Watersheds Association by the Natural Lands Trust and the Pennsylvania Environmental Council (Natural Lands Trust, 2001).

The purpose of this plan is to present the findings and recommendations of the Chester Creek Stormwater Management Phase II study. This plan considers both water quality and quantity impacts of future development and incorporates control recommendations intended to prevent further degradation of the watershed. This plan will help to make municipalities and developers more aware of the impacts of development and will encourage the use of BMPs in achieving economical, effective control of stormwater runoff.

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

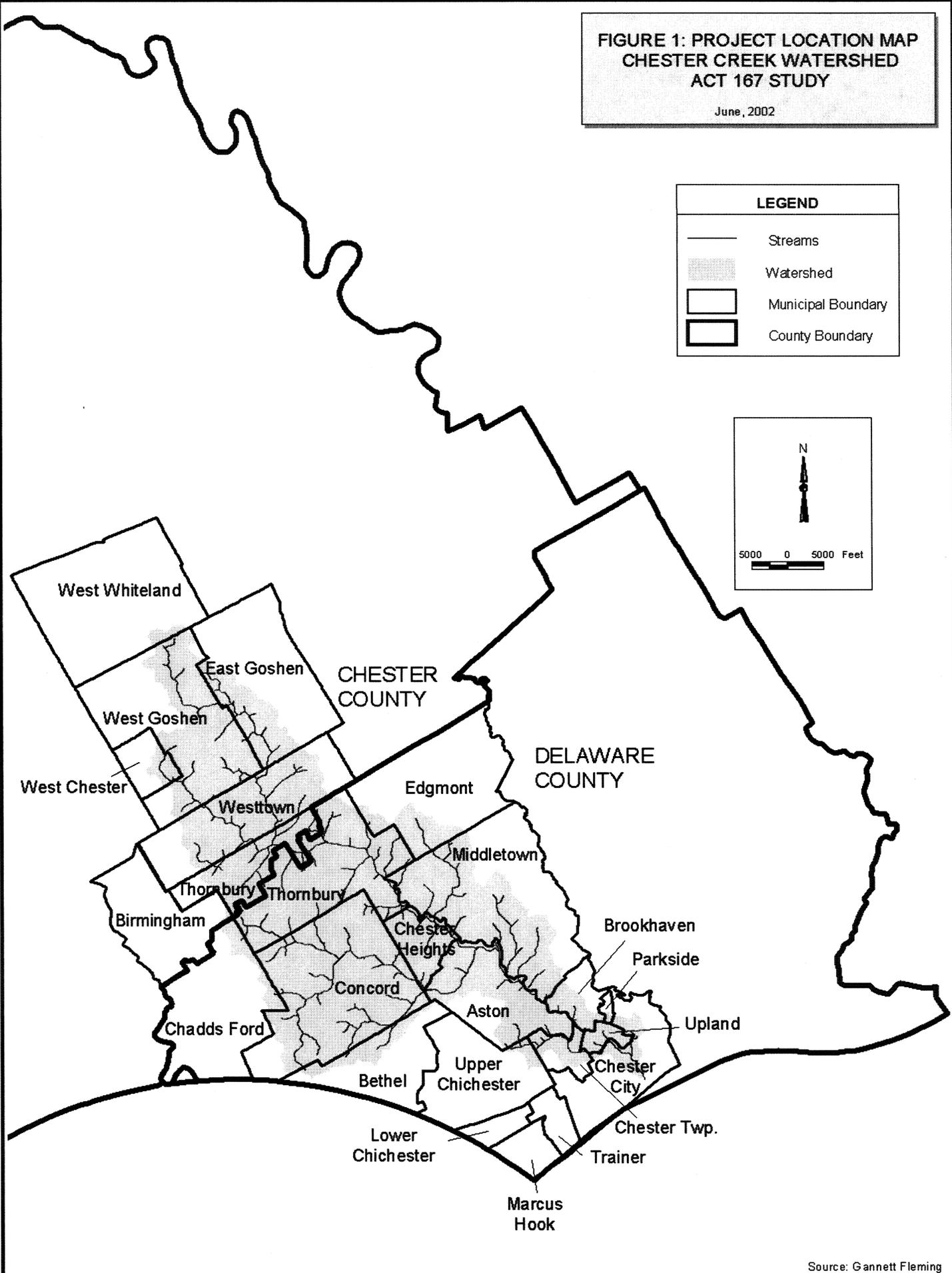
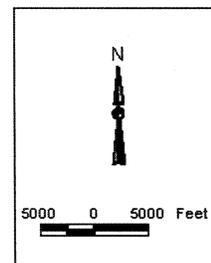
Delaware County Planning Department
Courthouse & Government Center Building
201 West Front Street
Media, PA 19063

Chester County Planning Commission
Government Services Center, Suite 270
601 Westtown Road
West Chester, PA 19380

**FIGURE 1: PROJECT LOCATION MAP
CHESTER CREEK WATERSHED
ACT 167 STUDY**

June, 2002

| LEGEND | |
|---|--------------------|
|  | Streams |
|  | Watershed |
|  | Municipal Boundary |
|  | County Boundary |



B. Organization of Documents

The Chester Creek Stormwater Management Plan is documented in two volumes. Volume I is the stormwater management plan, including the watershed model ordinance. Volume II is the watershed modeling report. Support documentation used in the preparation of this volume is available for review at the offices of DCPD.

C. Stormwater Management

Stormwater management involves the control of water that runs off the surface of the land from rain or melting snow or ice. The volume or amount of runoff and its rate of runoff substantially increase as land development occurs. Construction of impervious surfaces and the installation of storm sewer pipes which efficiently collect and discharge runoff prevent the infiltration of rainfall into the soil. Management of stormwater is necessary to alleviate impacts resulting from development, such as frequent flooding, erosion and sedimentation, concentration of flow to adjacent properties, infrastructure damage, and nonpoint source pollution.

Increased urban runoff during storm events, combined with reduced flood storage capacity, can result in severe flooding if existing drainage systems are inadequately sized to handle the increased flow. Therefore, an effective stormwater management plan must be responsive to the existing characteristics of the watershed and recognize the changing conditions of the watershed resulting from planned development. Typical of many urban watershed areas, stormwater management is regulated on the municipal level, with little consistency among adjoining municipalities concerning the types or degree of control to be practiced. A watershed-based stormwater management plan can minimize or eliminate these inconsistencies to better address the problems and issues which contribute to a watershed's decline.

D. Stormwater Management in Pennsylvania

In 1978, the Pennsylvania legislature enacted the Stormwater Management Act (Act of October 4, 1978, P.L. 864, No. 167, 32 P.S. Section 680.1 et. seq.) The purpose of the Act is to:

- Encourage planning and management of stormwater runoff in each watershed that is consistent with sound water and land use practices.

- Authorize a comprehensive program of stormwater management designed to preserve and restore the flood-carrying capacity of Commonwealth streams; to preserve to the maximum extent practicable natural stormwater runoff regimes and natural course, current, and cross-section of water of the Commonwealth; and to protect and conserve groundwater and groundwater recharge areas.
- Encourage local administration and management of stormwater consistent with the Commonwealth's duty as trustee of natural resources and the people's constitutional right to the preservation of natural, economic, scenic, aesthetic, recreational, and historic values of the environment.

The Act also describes various procedures for preparing, adopting, and amending watershed stormwater management plans, describes the municipal and public participation in watershed planning, and sets forth the duties of persons engaged in the development of land. Specifically, the Act states the following:

“Any landowner and any person engaged in the alteration or development of land which may affect stormwater runoff characteristics shall implement such measures consistent with the provisions of the applicable watershed stormwater plan as are reasonably necessary to prevent injury to health, safety, or other property. Such measures shall include such actions as are required:

- (1) to assure that the maximum rate of stormwater runoff is no greater after development than prior to development activities; or*
- (2) to manage the quantity, velocity, and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.”*

The purpose of Pennsylvania's Act 167, the Stormwater Management Act, is to encourage planning to control the impacts of future growth on storm runoff within each watershed in the state. The obvious benefit of this approach is that the municipalities in each watershed will be able to manage runoff and develop in a consistent and coordinated manner. This will make it easier to preserve existing conditions and may even reclaim some capacity in existing management systems that had been lost due to uncontrolled development. Watersheds are defined by natural hydrology and, therefore, represent the most logical basis for managing water

resources. Through a comprehensive watershed-based planning effort, municipalities are able to gain a more complete understanding of overall conditions in an area and the variables that affect these conditions. This is particularly important considering the recent shift by DEP, which now emphasizes both water quantity and water quality concerns during the preparation of Act 167 plans.

Counties in Pennsylvania are required to develop stormwater plans for each of the watersheds within their boundaries. DEP develops grant agreements with counties to pay for 75% of the costs to prepare the plans. Upon completion and adoption of a plan by a county, municipalities located in the watershed have six months from the date of county adoption to amend local ordinances to be consistent with the plan. Developers are then required to follow the local drainage regulations that incorporate the standards of the watershed plan when preparing their land development plans.

E. Watershed Plan Advisory Committee

As required by the Stormwater Management Act, Chester and Delaware Counties formed a WPAC at the start of the watershed stormwater planning process. The Chester Creek watershed encompasses 21 municipalities across the two counties.* The WPAC for the Chester Creek watershed consists of one representative from each of these municipalities, plus each County's Conservation District Manager. In addition to these members, the WPAC also includes a representative of the Chester County Water Resources Authority, the Chester-Ridley-Crum Watersheds Association, NRCS, and Philadelphia Suburban Water Company. Other advisory members on the WPAC include PennDOT, Delco Anglers, Natural Lands Trust, as well as a number of others.

The WPAC is responsible for advising the Counties throughout the planning process, evaluating policy and project alternatives, coordinating watershed stormwater plans with other municipal plans and programs, and reviewing the plan prior to adoption.

* As a result of discussions with DEP, Birmingham Township was not included in the WPAC due to the minimal area located within the watershed boundary.

During the course of this stormwater management study, eight meetings were held with the WPAC to solicit its input on the plan and model ordinance provisions. Meetings were also held with the Municipal Engineers Committee (MEC) and the Legal Advisory Committee (LAC) to review the technical standards and criteria and legal provisions recommended in the plan and model ordinance.

This plan and its associated ordinance provisions were developed under the authority of and in strict conformance with the requirements of Act 167. These documents were prepared in consultation with the WPAC. Proposed ordinance provisions were reviewed and accepted by a majority of the voting members (noted above) who attended the meetings. A full list of the WPAC members, as well as the attendance matrix for each meeting, can be found in **Attachment A** of this plan.

II. WATERSHED DESCRIPTION

A. Location

The Chester Creek watershed is located in the western portion of Delaware County and extends into the eastern portion of Chester County as illustrated in **Plate 1**. The watershed encompasses approximately 66 square miles (41,905 acres) and includes all or portions of the municipalities listed in **Table 1**.

| MUNICIPALITY | COUNTY | ACRES WITHIN WATERSHED | PERCENT OF LAND IN WATERSHED |
|---------------------------|----------|------------------------|------------------------------|
| Aston Township | Delaware | 3,013 | 80 |
| Bethel Township | Delaware | 932 | 27 |
| Brookhaven Borough | Delaware | 606 | 55 |
| Chadds Ford Township | Delaware | 577 | 10 |
| Chester City | Delaware | 707 | 18 |
| Chester Township | Delaware | 667 | 74 |
| Chester Heights Borough | Delaware | 1,428 | 100 |
| Concord Township | Delaware | 8,072 | 93 |
| Edgmont Township | Delaware | 1,103 | 18 |
| Middletown Township | Delaware | 5,261 | 61 |
| Parkside Borough | Delaware | 36 | 27 |
| Thornbury Township | Delaware | 5,871 | 99 |
| Upland Borough | Delaware | 425 | 100 |
| Upper Chichester Township | Delaware | 230 | 5 |
| Birmingham Township | Chester | 38 | < 1 |
| East Goshen Township | Chester | 1,800 | 28 |
| Thornbury Township | Chester | 2,096 | 83 |
| West Chester Borough | Chester | 359 | 30 |
| West Goshen Township | Chester | 4,609 | 60 |
| West Whiteland Township | Chester | 171 | 2 |
| Westtown Township | Chester | 3,899 | 70 |

* As a result of discussions with DEP, Birmingham Township was not included in the WPAC due to the minimal area located within the watershed boundary.

SOURCE: Gannett Fleming, 2001

Chester Creek flows in a generally northwest to southeast direction where the main stem discharges into the Delaware River. There are several medium-sized tributary streams that flow into the main stem (East and West Branches, Goose Creek, Rocky Run, Green Creek, Chrome Run, Concord Run, Crum Run, and Baldwin Run) as well as numerous unnamed small creeks. In addition, there are three large reservoirs (West Chester Reservoir, Milltown Reservoir, and Westtown Lake) and numerous small lakes and ponds.

The highest point in the watershed is approximately 613 feet mean sea level (MSL), and the elevation at the mouth is about 2 feet MSL. Chester Creek is tidal as far north as Upland Borough. The average watershed slope is 5.9%. There are extensive storm sewer systems in the lower portion of the watershed (e.g., Chester City) and in the upper part of the watershed in the Borough of West Chester. Additionally, many subdivisions throughout the watershed have their own storm sewer systems that discharge to local streams.

B. Obstructions

An extensive obstruction inventory of the entire watershed was conducted in the fall of 1998 and the spring of 1999. Each road crossing was documented through field sketches, photographs, and notes. Although each obstruction was not evaluated for hydraulic capacity, it became obvious through the field reconnaissance that many of the road crossings were undersized for the current flow conditions. Photographs, field survey notes, and obstruction sketches are available for viewing in the offices of DCPD.

C. Soils and Geology

Much of the watershed (about 66%) is underlain by Glenelg series and Made Land (fill and constructed fill) soils, which are moderately well drained. Another 20% of the watershed consists of water and watery (i.e., wetlands) areas. The remaining watershed is interspersed with numerous other soil series classifications. The Glenelg-Manor-Chester association is the largest soil association in Chester and Delaware Counties and is found in all areas of the watershed. Glenelg soils are typically found in upland areas on level to steep slopes. They are typically well drained and moderately deep. Glenelg soils are generally formed from weathered granite, gneiss, and mica schist. The soils in the watershed were classified according to NRCS hydrologic soil

types published for each county. The hydrologic soil types relate to the infiltration and saturation characteristics of the soils. A detailed breakdown of the watershed soils, hydrological associations, and soils mapping can be found in Volume II, the watershed modeling report. Support documentation for this volume is available for review at the offices of DCPD and CCPC. The modeling report is summarized in Chapter VII of this plan.

D. Rainfall Data

Historical rainfall data were analyzed for this study. A total of 20 gauging stations listing daily precipitation are located in or around the watershed. The three closest gauges, Chadds Ford, Marcus Hook, and West Chester, with over 40 years of records, were selected for further evaluation. A frequency analysis was performed on each gauge and compared with the PennDOT Storm Intensity-Duration-Frequency Charts (May 1986). The results of this analysis show that the PennDOT rainfall volumes were slightly larger during most storm events.

The Marcus Hook gauge had higher precipitation volumes for the 50- and 100-year storms, but the gauge is located outside of the watershed and may not be a good indicator of the overall precipitation characteristics. Overall, the statistical rainfall volumes from the PennDOT Storm Intensity-Duration-Frequency Charts best represent the entire watershed area for all storm events. The Chester Creek watershed is located in Rainfall Region 2. The rainfall volumes for a 24-hour storm event were determined to be as shown in **Table 2**. Further rainfall data can be found in Volume II, the watershed modeling report.

| TABLE 2 RAINFALL VOLUMES CHESTER CREEK WATERSHED | | | | | | |
|--|------|------|------|------|------|------|
| Return Frequency (Years) | 2 | 5 | 10 | 25 | 50 | 100 |
| Rainfall Volume (Inches) | 3.40 | 4.10 | 5.00 | 6.00 | 7.20 | 8.50 |

SOURCE: Pennsylvania Department of Transportation “Storm Intensity Duration – Frequency Charts – Rainfall Region 5,” May 1986

Precipitation in the Chester Creek watershed fluctuates depending on the time of year. October has historically been the driest month with an average rainfall volume of 2.75 inches, while August is typically the wettest month (4.41 inches average). The maximum monthly rainfall amount of 10.42 inches was recorded in July 1994.

E. Water Quality

Surface and groundwater quality appear to be generally good, although no testing was done as part of this study. Little consistent water quality data exists for the watershed. The United States Geological Survey (USGS) operates monitoring stations in Chester County, and the Delaware River Basin Commission operates a monitoring station in the City of Chester. Students at area high schools (Conestoga and Sun Valley) have participated in water quality monitoring efforts. In addition, DEP conducts site-specific water quality monitoring on an as-needed basis.

According to the *Chester Creek River Conservation Plan* (Natural Lands Trust, June 17, 2001), “the water quality varies among individual subwatersheds depending on the number and size of sewage treatment plants and the amount of impervious land in each subwatershed. Based on the standards used by the Commonwealth, much of the West Branch system still has moderately good water quality. Rocky Run in Edgmont and Middletown Townships has very good water quality. Goose Creek, flowing out of downtown West Chester and receiving discharges from two large treatment plants, has only fair water quality. However, once Goose Creek converges with the East Branch, the water quality improves.” Rocky Run has been designated as a High Quality Stream by DEP.

III. EXISTING LAND USE

The Chester Creek watershed is defined by its unique diversity of land uses and development features. The watershed area ranges in character from the semi-rural communities of Thornbury (in Chester and Delaware Counties), Concord, and Edgmont, located in the central portion of the watershed, to the highly urbanized areas of West Chester Borough and Chester City, located at the headwaters and mouth of the watershed, respectively. The watershed contains many features such as bridges, historic mills and dams, parks and recreation areas, and valuable natural areas which are all important components in the evaluation of the watershed's stormwater potential.

Development pressure within the central portion of the watershed is high, particularly near the two-county boundary, where growth management is of particular concern. Communities such as West Chester Borough and the City of Chester, located at the upper and lower ends of the watershed, are urbanized and densely developed. Therefore, development activity and land use issues vary greatly within these communities. These differences were highlighted in the municipal questionnaire responses from Phase I and during WPAC meeting discussions. For example, protection of downstream areas from stormwater generated from new development upstream was of major concern to downstream municipalities. Stream flooding was rated as a moderate to critical problem in all but three municipalities and critical in the most urbanized municipalities.

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

| TABLE 3 EXISTING LAND USE CHESTER CREEK WATERSHED | | | |
|---|---------------|------------------|--------------|
| LAND USE CATEGORY | PERCENTAGE | ACRES | SQUARE MILES |
| Agriculture/Pasture | 11.57 | 4,849.23 | 7.58 |
| Commercial | 3.99 | 1,670.69 | 2.61 |
| High-density Residential | 2.77 | 1,159.09 | 1.81 |
| Industrial | 1.96 | 823.23 | 1.29 |
| Institutional | 2.38 | 995.56 | 1.56 |
| Low-density Residential | 13.68 | 5,732.67 | 8.96 |
| Medium-density Residential | 23.35 | 9,783.92 | 15.29 |
| Military | 0.01 | 4.69 | 0.01 |
| Mining/Quarry | 0.46 | 192.31 | 0.30 |
| Open Space | 2.40 | 1,004.37 | 1.57 |
| Recreation | 2.30 | 962.07 | 1.50 |
| Transportation | 2.64 | 1,105.22 | 1.73 |
| Utility | 0.98 | 410.43 | 0.64 |
| Water | 0.77 | 322.48 | 0.50 |
| Wooded | 30.76 | 12,889.38 | 20.14 |
| TOTALS | 100.00 | 41,905.34 | 65.48 |

SOURCE: Gannett Fleming, 2001

The watershed is generally located southwest and west of the City of Philadelphia. As such, the watershed is dominated by suburban and urban areas with a mixture of wooded land interspersed along its streams and rivers. Agricultural land is also interspersed throughout the watershed. There are no dominant geographical features that limit, define, or divide the existing land use. Overall, borough and township development, agricultural lands, and wooded areas are intermixed throughout the watershed similar to a patchwork quilt. Since the Chester Creek watershed is located in close proximity to Philadelphia, the watershed is dominated by suburban housing. As shown on **Table 3**, the largest land use category for the watershed is wooded, followed by medium-density residential. In total, residential uses accounted for nearly 40% of the land uses in the watershed.

IV. PROJECTED LAND USE

Future land development was based on the current municipal zoning maps for the watershed within Chester and Delaware Counties. However, due to the extent of the present development and the urban/suburban nature of the watershed, future land development will be restricted to the wooded and agricultural land. All other areas of the watershed are presently developed and will not be altered significantly by future development that would impact the rainfall-runoff characteristics of the watershed. Therefore, the future development conditions were limited to the wooded and agricultural areas within the watershed as illustrated in **Plate 3**, the Future Land Use Map.

The municipal zoning maps indicate that future development will predominantly continue to be medium- to low-density residential intermixed with commercial, industrial, and high-density residential uses. Future development in the existing wooded and agricultural areas will continue to be low- and medium-density housing in a suburban atmosphere. As a by-product of housing growth, small commercial and industrial businesses will develop in support of this growth, primarily providing service type goods.

Approximately 80% of the future growth will be low- and medium-density residential housing, and the remaining 20% a mix of commercial, industrial, institutional, open space, manufacturing, and mixed use.

V. EXISTING STORMWATER MANAGEMENT REGULATIONS

There are a variety of laws and regulations that impose requirements on developers to manage stormwater discharges in order to protect downstream properties. Act 167 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:

Pennsylvania Municipalities Planning Code, (Act 247), as amended

Pennsylvania Floodplain Management Act of 1968 (Act 166)

Pennsylvania Dam Safety and Encroachment Act of 1978 (Act 325)

Pennsylvania Clean Streams Law, (Act 394), as amended

Pennsylvania Scenic River Act, (Act 110), as amended

Federal Clean Water Act (CWA), NPDES Phase II

National Flood Insurance Act (FIA)

Flood Disaster Protection Act (FDPA)

Eighteen of the Chester Creek watershed's 21 municipalities provided information concerning the status of their floodplain and stormwater management ordinances and controls. All of the municipalities in the watershed have comprehensive plans, zoning ordinances and maps, subdivision ordinances, and floodplain maps. As required by the Pennsylvania MPC (Act 247, as amended), the Counties are required to review all subdivision and 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. The information is graphically portrayed in **Figure 2**.

**TABLE 4
SUMMARY OF MUNICIPAL ORDINANCE PROVISIONS
CHESTER CREEK WATERSHED**

| MUNICIPALITY | COUNTY | MUNICIPAL ORDINANCE OR COUNTY (M/C) | PEAK FLOW CONTROL REQUIRED (Y/N) | DESIGN STORM FREQUENCY (YRS) | REQUIRED METHODOLOGY |
|---------------------------|----------|-------------------------------------|----------------------------------|------------------------------|-----------------------|
| Aston Township | Delaware | M | Y | 2 - 100 | Rational |
| Bethel Township | Delaware | M | N | NS | NS |
| Brookhaven Borough | Delaware | M | Not in Chester Creek | 2 - 100 | Rational |
| Chadds Ford Township | Delaware | M | | | |
| Chester City | Delaware | M | Y | 2 - 100 | NS |
| Chester Heights Borough | Delaware | M | Y | 2 - 100 | Time of Concentration |
| Chester Township | Delaware | M | | | |
| Concord Township | Delaware | M | N | 2 - 100 | NS |
| Edgmtown Township | Delaware | M | Y | 100 | NS |
| Middletown Township | Delaware | M | Y | 100 | NS |
| Parkside Borough | Delaware | C | N | 2 - 100 | NS |
| Thornbury Township | Delaware | M | Y | 10 - 100 | Rational |
| Upland Borough | Delaware | M | Y | 2 - 100 | NS |
| Upper Chichester Township | Delaware | M | Y | 2 - 100 | NS |
| Birmingham Township | Chester | N/A | | | |
| East Goshen Township | Chester | M | Y | 2 - 100 | SCS |
| Thornbury Township | Chester | M | N | 25 - 50 | SCS |
| West Chester Borough | Chester | M | Y | 10 & 100 | SCS |
| West Goshen Township | Chester | M | Y | 2 - 100 | Rational |
| Westtown Township | Chester | M | Y | 2 - 100 | SCS |
| West Whiteland Township | Chester | M | Y | 2 - 100 | SCS |

Table Legend:

- N/A = Not available or obtained
- NS = Not specified
- SCS = Soil Conservation Service methodology
- Rational = Rational Formula

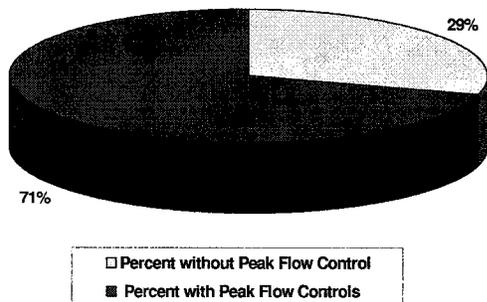
SOURCE: Gannett Fleming, 2001

Figure 2

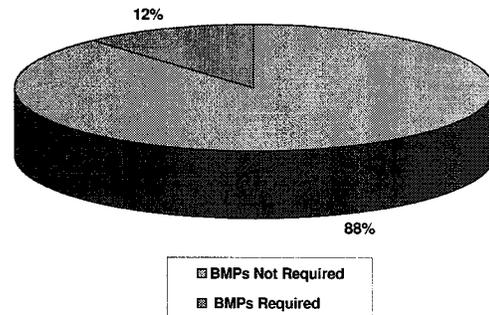
Summary of Municipal Survey Questionnaires

Status of Stormwater/Floodplain Ordinances and Controls

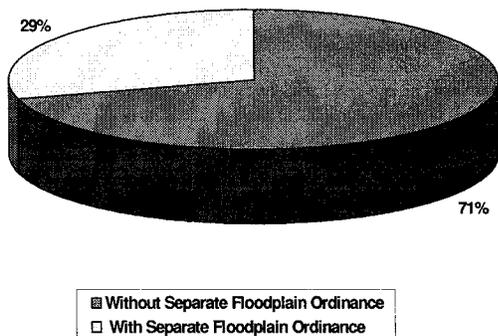
Peak Flow Control Provisions



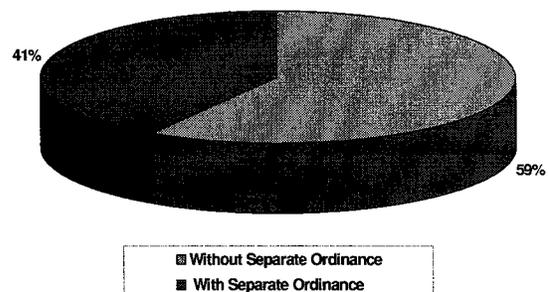
Best Management Practices for Stormwater Management



Separate Floodplain Ordinances



Separate Stormwater Management Ordinances



SOURCE: Gannett Fleming, 2001

VI. STORMWATER PROBLEMS

Through the years, the communities within the Chester Creek watershed have experienced development which has affected the creek's functions and flood storage capacity. As in similar urban stream corridors, regional development can result in both water quality and water quantity impacts. Water quality is affected by a number of processes common to increased development, such as stormwater runoff, biological contamination, and excess sediment from eroding stream banks. Water quantity may be affected by inter-basin transfers of water, increased discharges from wastewater treatment plants, and alterations to the stream channels and courses. A characteristic of historic development along stream corridors is floodplain encroachment. This is evident along the Chester Creek corridor through the number of historic mills and dams which were constructed along the creek corridor without regard to potential impacts to flood storage capacity or function of the floodplain areas.

Due to development experienced by the region, additional roads, bridges, and houses were constructed, increasing the amount of impervious surface and resulting in additional runoff entering the creek. With increased housing and commercial development, communities relied less on on-lot septic systems to meet wastewater disposal needs and more on multi-municipal wastewater treatment plants. Discharges from these plants effectively lower the flood storage capacity of the creek and alter the creek's water quality.

Municipalities at varying locations within the watershed are experiencing different issues related to water use and water quality. Protection of water quality in the Chester Creek watershed has been a prime concern of Chester County and the local municipalities. The existing reservoirs and a man-made lake help control stormwater during peak storm events in the upper portion of the watershed. Water storage facilities and dams have not been utilized in the middle and lower portions of the watershed.

These differences were apparent in the problems identified in the municipal surveys undertaken as part of the Phase I study. Protection of stream corridors for flood control, aesthetics, and growth management was noted as important to most municipalities within the watershed. Protection of downstream areas from stormwater generated from new development upstream was

of major concern to downstream municipalities. Stream flooding was rated as a moderate to critical problem in all but three municipalities and critical in the most urbanized municipalities. The surveys also indicated that water supply was an important issue relative to streams and that recreation was an important use for their streams.

During Phase II, municipalities were asked to provide specific information regarding the location and type of stormwater related problems. **Table 5** provides descriptive information concerning the location and nature of stormwater related problems obtained from the municipal questionnaires distributed early in Phase II of the stormwater management planning process. Common problems identified by many of the municipalities included channel and stream flooding, street or intersection flooding, and erosion (soil wash-off). As shown on **Plate 4**, Stormwater Problem Areas, downstream communities such as Brookhaven and Aston reported flooding problems along the main stem of the creek. Flooding problem areas within the middle and upper communities appeared along the branches or tributaries.

| TABLE 5 STORMWATER PROBLEMS CHESTER CREEK WATERSHED (Per municipal survey) | | | | | | |
|---|----------|----------|--------------|--------------------------|--|------------------------------|
| MUNICIPALITY | COUNTY | MAP CODE | PROBLEM CODE | LOCATION | PROBLEM DESCRIPTION | COMMENTS |
| Aston Township | Delaware | A | A1 | Crozerville Road | Street Intersection Flooding, Private property Flooding | |
| | | | A3** | Mt. Alverno Road | Channel/Stream Flooding, Street Intersection Flooding, Parking Lot Flooding, Private Property Flooding, Erosion (Soil Wash-off), Sedimentation | |
| | | | A4 | Trib. to Baldwin Run | Channel/Stream Flooding, Erosion (Soil Wash-off), Sedimentation | |
| | | | A5 | Bridgewater Road | Street/Intersection Flooding | |
| | | | A6 | Eagle Field | Channel/Stream Flooding, Erosion (Soil Wash-off), Sedimentation | |
| | | | A7 | Team/New/Mount Rd | Street/Intersection Flooding, Erosion (Soil Wash-off) | |
| | | | N/a | | | |
| Bethel Township | Delaware | BE | | | | |
| Brookhaven Borough | Delaware | BR | BR1 | Coebourn Run | Channel/Stream Flooding, Erosion (Soil Wash-off) | |
| | | | BR3 | Camelot Dr. | Groundwater | |
| | | | BR4 | Shepard St. | Private Property Flooding | |
| | | | BR5 | Dutton Mill Rd. | Street/Intersection Flooding | |
| | | | BR6 | Creek Rd. at Bridgewater | Street/Intersection Flooding | |
| | | | N/a | | | |
| Chadds Ford Township | Delaware | CF | | | | |
| Chester City | Delaware | CC | | | | |
| Chester Heights Borough | Delaware | CH | CH1 | No specific location | Stream Flooding | |
| | | | CH2 | No specific location | Street Flooding | |
| | | | CH3 | No specific location | Soil Erosion | Improved Drainage from Rte 1 |
| Chester Township | Delaware | CT | | | | |

TABLE 5
STORMWATER PROBLEMS
CHESTER CREEK WATERSHED
 (Per municipal survey)

| MUNICIPALITY | COUNTY | MAP CODE* | PROBLEM CODE* | LOCATION | PROBLEM DESCRIPTION | COMMENTS |
|---------------------|----------|-----------|---------------|---|---|---------------|
| Concord Township | Delaware | CO | CO1 | 928/1098 Smithbridge Rd. | Groundwater, Icing | Icing Problem |
| | | | CO2 | Station Rd. | Street/Intersection Flooding, Icing | Icing Problem |
| | | | CO3 | Ivy Mills Rd. | Channel/Stream Flooding, Groundwater, Icing | Icing Problem |
| Edgmont Township | Delaware | ED | ED2** | Gradyville Rd. @#1235 | Channel/Stream Flooding, Street/Intersection Flooding, Private Property Flooding | |
| | | | ED7 | Sycamore Mills Rd. | Channel/Stream Flooding, Street/Intersection Flooding, Private Property Flooding, Erosion (Soil Wash-off), Sedimentation, Water Pollution | |
| | | | ED8 | Slitting Mill Rd. | Channel/Stream Flooding, Private Property Flooding, Erosion | |
| | | | ED9 | Forest Lane | Street/Intersection Flooding | |
| Middletown Township | Delaware | M | M1 | Mt. Alverno Road at C.C. | Street/Intersection Flooding, Erosion (Soil Wash-off), Sedimentation | |
| | | | M2 | Howarth Rd. at Chrome Run | Street/Intersection Flooding | No Bridge |
| | | | M3 | Chrome Run north of Glen Riddle Road | Erosion (Soil Wash-off) | |
| | | | M4 | Chester Creek from Convent Rd to S. Pennell Rd. | Erosion (Soil wash-off) | |

| TABLE 5 STORMWATER PROBLEMS CHESTER CREEK WATERSHED (Per municipal survey) | | | | | | |
|---|----------|----------|--|--|--|-------------------------|
| MUNICIPALITY | COUNTY | MAP CODE | PROBLEM CODE | LOCATION | PROBLEM DESCRIPTION | COMMENTS |
| Parkside Borough | Delaware | P | M5 None | Chester Creek from W. Knowlton to Dutton Mill | Private Property Flooding | |
| Thornbury Township | Delaware | TD | TD1 TD2 TD3 TD4 TD5 TD6 | Chester Creek Tributary Tributary Tributary Tributary Brinton Lake | Channel/Stream Flooding, Street Intersection Flooding, Private Property Flooding, Erosion (Soil Wash-off), Sedimentation Private Property Flooding Channel/Stream Flooding, Private Property Flooding Private Property Flooding Private Property Flooding Private Property Flooding | |
| Upland Borough | Delaware | UB | UB1 | N/a | Silting, Channel/Stream Flooding, Street Intersection Flooding, Private Property Flooding, Sedimentation | Ongoing for years |
| Upper Chichester Township | Delaware | UC | None | Kerlin St. Bridge | Channel/Stream Flooding, Street Intersection Flooding, Private Property Flooding | Ongoing for years |
| Birmingham Township | Chester | N/A | | | | |
| East Goshen Township | Chester | EG | EG1 | Reservoir Rd | Street Intersection Flooding | Road crosses floodplain |

| TABLE 5 STORMWATER PROBLEMS CHESTER CREEK WATERSHED (Per municipal survey) | | | | | | |
|--|---------|----------|--------------|--------------------------------|--|----------|
| MUNICIPALITY | COUNTY | MAP CODE | PROBLEM CODE | LOCATION | PROBLEM DESCRIPTION | COMMENTS |
| Thornbury Township | Chester | TC | None | | | |
| West Chester Borough | Chester | WC | WC1 | Goose Creek | Channel/Stream Flooding, Street Intersection Flooding, Parking Lot Flooding, Private Property Flooding, Erosion (Soil wash-off), Sedimentation | |
| West Goshen Township | Chester | WG | WG1 | Goose Creek at Montgomery Ave. | Street Intersection Flooding, Parking Lot Flooding, Private Property Flooding, | |
| Westtown Township | Chester | WT | WT1 | Oakbourne Road at RR Overpass | Street Intersection Flooding | |
| | | | WT2 | Rt. 926 at Westtown Rd | Street Intersection Flooding | |
| | | | WT3 | Rt. 926 at Westbourne Rd | Street Intersection Flooding | |
| West Whiteland Township | Chester | WW | None | | | |

NOTES:

- * Please refer to Plate 4 for location.
- ** Problem Code Numbers Skipped due to Location Outside Boundaries of Chester Creek Watershed

SOURCE: Gannett Fleming, 2001

VII. MODELING RESULTS

NRCS's TR-20 model was selected to simulate runoff hydrographs and to route the flows through the stream channels for the watershed; however, due to the size and complexity of the watershed, a GIS-based approach to streamline the TR-20 model construction was investigated. Brigham Young University's Environmental Modeling Research Laboratory created a comprehensive GIS-based hydrologic modeling environment called WMS (Watershed Modeling System). WMS uses GIS-based coverage to construct databases for hydrologic models and provides a graphical user interface for the HEC-1, TR-20, TR-55, Rational Method, LA County's F0601, and National Flood Frequency Program (NFF) models. The inherent flexibility with using GIS and the numerous models supported by WMS were major factors in the selection of WMS for the project. The full presentation of modeling results is included in Volume II, the watershed modeling report. The following information summarizes the information contained in the watershed modeling report.

A. Determination of Subwatersheds

The watershed was divided into 123 subwatersheds, as shown in **Plate 5**, 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 RCN, an indicator of runoff potential of an area. Current municipal zoning maps for the watershed within Chester and Delaware Counties were used to develop the land use for projected development conditions, and the subwatersheds were analyzed to derive a future condition RCN. **Table 6** summarizes the characteristics of the subwatersheds for existing and projected development conditions.

The SCS TR-20 model reports the resulting stream flow rates by stream cross-section. Each subwatershed area is associated with a stream cross-section, and the model accumulated the runoff and routed the flows down through the stream channel. **Plate 5** shows the location of the stream cross-sections in the watershed, and **Table 7** summarizes the results of the watershed 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 6
SUBWATERSHED MODELING CHARACTERISTICS
CHESTER CREEK WATERSHED**

| SUBWATERSHED NUMBER | AREA (SQ MI) | CURVE NUMBER | | TIME OF CONCENTRATION (HRS) |
|------------------------|-----------------|--------------|-----------|-----------------------------------|
| | | EXISTING | PROJECTED | |
| 1 | 0.66 | 75.8 | 77.0 | 0.46 |
| 2 | 0.24 | 82.8 | 84.1 | 0.39 |
| 3 | 0.62 | 77.4 | 78.7 | 0.45 |
| 4 | 0.27 | 80.0 | 83.2 | 0.35 |
| 5 | 0.88 | 81.0 | 81.9 | 0.64 |
| 6 | 0.22 | 78.1 | 78.8 | 0.36 |
| 7 | 0.52 | 86.0 | 86.0 | 0.48 |
| 8 | 0.52 | 78.2 | 79.5 | 0.49 |
| 9 | 0.22 | 80.4 | 80.4 | 0.42 |
| 10 | 0.63 | 81.5 | 81.6 | 0.58 |
| 11 | 0.62 | 72.7 | 74 | 0.45 |
| 12 | 0.65 | 77.3 | 77.3 | 0.43 |
| 13 | 0.33 | 82.7 | 82.7 | 0.38 |
| 14 | 0.64 | 76.1 | 78.7 | 1.20 |
| 15 | 0.68 | 76.5 | 76.5 | 0.41 |
| 16 | 0.67 | 75.9 | 76.6 | 0.39 |
| 17 | 0.33 | 72.9 | 74.6 | 0.38 |
| 18 | 0.41 | 76.2 | 76.6 | 0.33 |
| 19 | 0.19 | 73.8 | 74.5 | 0.30 |
| 20 | 0.62 | 73.6 | 76.4 | 0.41 |
| 21 | 0.01 | 79.5 | 80.5 | 0.18 |
| 22 | 0.86 | 74.8 | 76.2 | 0.48 |
| 23 | 0.54 | 74.3 | 75.7 | 0.45 |
| 24 | 0.34 | 75.9 | 76.7 | 0.43 |
| 25 | 1.20 | 88.7 | 88.7 | 1.06 |
| 26 | 0.57 | 84.7 | 84.7 | 0.63 |
| 27 | 0.22 | 85.0 | 85.6 | 0.36 |
| 28 | 0.63 | 81.9 | 82.0 | 0.52 |
| 29 | 0.47 | 74.8 | 76.7 | 0.35 |
| 30 | 0.09 | 71.9 | 74.6 | 0.18 |

**TABLE 6
SUBWATERSHED MODELING CHARACTERISTICS
CHESTER CREEK WATERSHED**

| SUBWATERSHED NUMBER | AREA (SQ MI) | CURVE NUMBER | | TIME OF CONCENTRATION (HRS) |
|---------------------|--------------|--------------|-----------|-----------------------------|
| | | EXISTING | PROJECTED | |
| 31 | 1.05 | 73.8 | 73.9 | 0.53 |
| 32 | 0.41 | 79.3 | 80.4 | 0.38 |
| 33 | 1.14 | 75.0 | 76.2 | 0.50 |
| 34 | 0.15 | 72.2 | 75.9 | 0.28 |
| 35 | 0.30 | 75.0 | 76.3 | 0.34 |
| 36 | 0.46 | 71.8 | 73.3 | 0.30 |
| 37 | 1.06 | 68.8 | 72.3 | 0.50 |
| 38 | 0.06 | 68.6 | 73.5 | 0.27 |
| 39 | 0.14 | 62.8 | 71.3 | 0.25 |
| 40 | 0.91 | 66.7 | 73.6 | 0.50 |
| 41 | 0.40 | 65.9 | 72.9 | 0.37 |
| 42 | 0.70 | 66.4 | 73.7 | 0.50 |
| 43 | 0.49 | 68.5 | 72.7 | 0.34 |
| 44 | 0.70 | 74.7 | 76.3 | 0.56 |
| 45 | 0.62 | 66.0 | 71.5 | 0.26 |
| 46 | 0.76 | 72.2 | 73.1 | 0.41 |
| 47 | 0.25 | 68.1 | 74.2 | 0.27 |
| 48 | 0.70 | 70.4 | 75 | 0.39 |
| 49 | 0.20 | 82.0 | 83.4 | 0.51 |
| 50 | 0.41 | 75.5 | 76.4 | 0.78 |
| 51 | 1.03 | 63.4 | 64.1 | 1.34 |
| 52 | 0.66 | 57.3 | 58.6 | 1.12 |
| 53 | 0.08 | 82.4 | 83.5 | 0.46 |
| 54 | 0.53 | 71.3 | 74.8 | 0.31 |
| 55 | 0.19 | 71.7 | 74.4 | 0.26 |
| 56 | 0.54 | 76.8 | 76.8 | 0.86 |
| 57 | 0.27 | 82.8 | 82.8 | 0.64 |
| 58 | 0.66 | 76.8 | 76.8 | 1.06 |
| 59 | 0.81 | 71.9 | 71.9 | 0.99 |
| 60 | 0.04 | 94.0 | 94.0 | 0.27 |
| 61 | 0.51 | 69.9 | 72.4 | 0.84 |

**TABLE 6
SUBWATERSHED MODELING CHARACTERISTICS
CHESTER CREEK WATERSHED**

| SUBWATERSHED NUMBER | AREA (SQ MI) | CURVE NUMBER | | TIME OF CONCENTRATION (HRS) |
|---------------------|--------------|--------------|-----------|-----------------------------|
| | | EXISTING | PROJECTED | |
| 62 | 0.51 | 74.4 | 77.8 | 0.92 |
| 63 | 0.49 | 68.7 | 72.3 | 0.87 |
| 64 | 0.63 | 70.1 | 76.3 | 1.23 |
| 65 | 0.94 | 76.0 | 76.0 | 1.27 |
| 66 | 0.77 | 73.1 | 76.7 | 1.28 |
| 67 | 0.46 | 70.0 | 76.7 | 1.03 |
| 68 | 0.15 | 63.7 | 77.3 | 0.75 |
| 69 | 0.44 | 75.1 | 77.9 | 1.01 |
| 70 | 0.55 | 72.8 | 75.9 | 0.37 |
| 71 | 0.28 | 71.9 | 75.4 | 0.36 |
| 72 | 1.01 | 70.1 | 74 | 0.51 |
| 73 | 0.13 | 71.9 | 73.5 | 0.27 |
| 74 | 0.67 | 78.1 | 79.8 | 0.50 |
| 75 | 0.98 | 72.1 | 77 | 0.58 |
| 76 | 0.43 | 74.0 | 74.9 | 0.40 |
| 77 | 0.72 | 70.1 | 73.6 | 0.46 |
| 78 | 0.10 | 58.0 | 75.8 | 0.16 |
| 79 | 0.79 | 71.2 | 76.2 | 0.77 |
| 80 | 0.57 | 73.1 | 75.8 | 0.67 |
| 81 | 0.01 | 73.0 | 76 | 0.11 |
| 82 | 1.00 | 74.0 | 77 | 0.53 |
| 83 | 0.99 | 74.3 | 78 | 0.52 |
| 84 | 0.64 | 73.9 | 75.7 | 0.44 |
| 85 | 0.86 | 67.9 | 74.6 | 0.49 |
| 86 | 0.39 | 69.9 | 72.3 | 0.35 |
| 87 | 0.71 | 71.1 | 75.4 | 0.36 |
| 88 | 0.17 | 77.2 | 77.5 | 0.19 |
| 89 | 0.54 | 71.3 | 74.7 | 0.34 |
| 90 | 0.36 | 76.2 | 76.4 | 0.30 |
| 91 | 1.02 | 71.6 | 75.5 | 0.52 |
| 92 | 0.53 | 78.1 | 78.1 | 1.34 |

**TABLE 6
SUBWATERSHED MODELING CHARACTERISTICS
CHESTER CREEK WATERSHED**

| SUBWATERSHED NUMBER | AREA (SQ MI) | CURVE NUMBER | | TIME OF CONCENTRATION (HRS) |
|---------------------|--------------|--------------|-----------|-----------------------------|
| | | EXISTING | PROJECTED | |
| 93 | 0.55 | 73.8 | 76.1 | 1.41 |
| 94 | 0.19 | 68.8 | 70.3 | 0.24 |
| 95 | 0.71 | 74.6 | 74.8 | 0.46 |
| 96 | 0.27 | 80.3 | 81.4 | 0.86 |
| 97 | 0.65 | 70.6 | 72.9 | 0.39 |
| 98 | 0.31 | 70.5 | 74.8 | 0.28 |
| 99 | 0.83 | 69.7 | 74.2 | 0.57 |
| 100 | 0.49 | 74.7 | 79.8 | 0.35 |
| 101 | 0.99 | 74.2 | 77.6 | 1.20 |
| 102 | 0.26 | 75.9 | 78.5 | 0.60 |
| 103 | 0.83 | 73.2 | 77.8 | 1.17 |
| 104 | 0.37 | 84.1 | 84.3 | 0.71 |
| 105 | 0.21 | 84.0 | 86.4 | 0.59 |
| 106 | 0.64 | 74.6 | 76.8 | 0.95 |
| 107 | 0.50 | 72.0 | 75.5 | 1.33 |
| 108 | 0.06 | 70.7 | 74.6 | 0.42 |
| 109 | 0.47 | 73.2 | 78.2 | 0.98 |
| 110 | 0.10 | 64.7 | 68.7 | 0.61 |
| 111 | 0.68 | 72.5 | 73.5 | 1.38 |
| 112 | 0.25 | 68.8 | 72.8 | 1.03 |
| 113 | 0.94 | 71.7 | 75.6 | 1.31 |
| 114 | 0.32 | 69.1 | 74.8 | 1.08 |
| 115 | 0.51 | 76.8 | 77.4 | 1.00 |
| 116 | 0.75 | 73.7 | 77.4 | 1.66 |
| 117 | 0.27 | 79.9 | 81.3 | 1.38 |
| 118 | 0.44 | 80.6 | 81.0 | 1.18 |
| 119 | 0.71 | 77.3 | 79.9 | 1.94 |
| 120 | 0.41 | 76.8 | 79.1 | 1.37 |
| 121 | 0.44 | 73.7 | 77.4 | 1.19 |
| 122 | 1.05 | 77.5 | 79.2 | 1.84 |
| 123 | 0.99 | 85.5 | 85.9 | 2.42 |

SOURCE: Gannett Fleming, 2001

**TABLE 7
SUMMARY OF MODELING RESULTS
CHESTER CREEK WATERSHED**

| 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 |
| 4 | 138 | 328 | 670 | 1109 | 1642 | 2241 | 190 | 410 | 782 | 1238 | 1783 | 2394 |
| 10 | 327 | 673 | 1235 | 2000 | 3025 | 4236 | 391 | 764 | 1364 | 2162 | 3214 | 4454 |
| 15 | 399 | 824 | 1515 | 2466 | 3737 | 5256 | 483 | 944 | 1692 | 2684 | 3992 | 5560 |
| 27 | 439 | 798 | 1449 | 2204 | 3462 | 5048 | 484 | 872 | 1598 | 2424 | 3758 | 5448 |
| 36 | 781 | 1570 | 2827 | 4665 | 7286 | 10799 | 990 | 1858 | 3263 | 5229 | 8251 | 12077 |
| 59 | 141 | 319 | 874 | 1814 | 3035 | 4798 | 250 | 646 | 1455 | 2520 | 4093 | 6064 |
| 67 | 240 | 537 | 1274 | 2395 | 4044 | 6332 | 399 | 919 | 1868 | 3228 | 5246 | 7841 |
| 69 | 1104 | 2350 | 4486 | 7819 | 12881 | 19556 | 1588 | 3028 | 5753 | 9580 | 15507 | 22974 |
| 84 | 1292 | 2691 | 5169 | 8687 | 14052 | 21262 | 1838 | 3498 | 6508 | 10550 | 16895 | 24949 |

SOURCE: Gannett Fleming, 2001

B. Determination of Release Rates

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 pre-development peak discharge can be released as a peak discharge after development. For example, a 100% release rate implies that the development can discharge runoff at a rate equal to pre-development conditions, while a 50% release rate indicates that the peak discharge after development cannot exceed 50% of the pre-development peak discharge.

Another modeling tool, STREMTUL, was used to determine the release rates for the watershed. This tool, developed by the Lancaster County Engineer's Office, 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 made manually. The results of the release rate analyses are presented in Volume II, the watershed modeling report. The boundaries of the stormwater management release rate districts are shown on **Plate 6**, Release Rate Map, located in the map pocket at the back of this plan. **Plate 6** is the official release rate map and shows the final release rate percentages as approved by the WPAC at its meeting in December 2000. This map is for reference only. The exact location of the stormwater management district boundaries as they apply to a given development site must be determined by mapping the boundaries using the two-foot topographic contours (or the most accurate data required) provided as part of the drainage plan. Additional information concerning the development of the release rates can be found in Table 10 of the Volume II watershed modeling report.

VIII. MANAGEMENT PLAN

A. Performance Standards and Control Philosophy

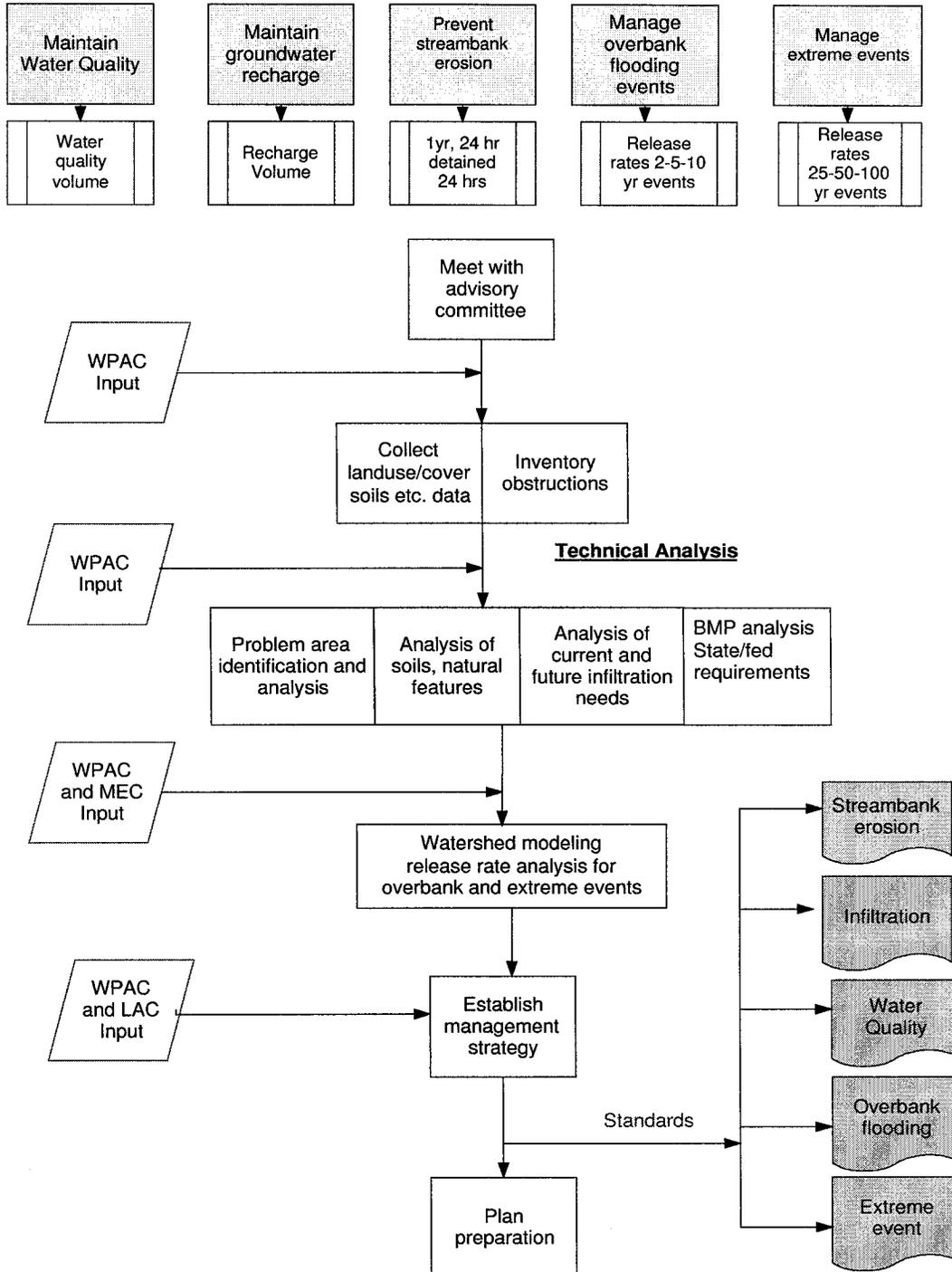
Act 167 was historically limited to controlling the rate of runoff from new development. It did not address water quality or other conditions. During the spring of 2001, DEP revised its position regarding the requirement for water quality components in Act 167 plans. (See letter to DCPD in **Attachment B**.) DEP concluded that the Act requires the inclusion of water quality components in watershed stormwater management plans and further requires the implementation of such components by municipalities subject to the plans. This plan philosophy represents a shift from previous Act 167 plans from voluntary implementation to mandatory municipal implementation of the water quality and groundwater recharge components. As a direct result of this policy shift, the Chester Creek Stormwater Management Plan requires mandatory implementation of both water quality and water quantity controls.

The water quality and water quantity components included in the Chester Creek Stormwater Management Plan have been developed to meet a set of desired technical objectives as shown on **Figure 3** and to adhere to the following watershed performance standards:

- Minimize the generation of stormwater runoff
- Adequately treat stormwater
- Maintain groundwater recharge rates
- Remove 80% of the suspended solids load
- Ensure that post-development peak discharge shall not exceed pre-development rates
- Protect stream channels from degradation
- Provide additional controls for sensitive areas (i.e., wetlands, agricultural areas)
- Require enforceable operation and maintenance agreements
- Require water quality pre-treatment
- Encourage redevelopment through modification of stormwater criteria
- Prepare stormwater pollution prevention plans for industrial sites
- Require developer consultation with municipal reviewing agencies before design

**FIGURE 3
CHESTER CREEK ACT 167 STUDY
WATERSHED CONTROL PHILOSOPHY**

**Act 167
Technical Objectives (Desired)**



SOURCE: Department of Environmental Protection

In order to meet the water quality and quantity performance standards listed above and be consistent with the desired technical objectives shown on **Figure 3**, a hierarchical implementation approach was devised. This hierarchy involves a three-step process: Step 1 - Infiltration, Step 2 - Extended detention, and Step 3 - Implementation of additional design controls. This approach, illustrated in **Figure 4**, requires applicants to evaluate the outcome of each step before proceeding to the next. In addition, riparian buffers are required where applicable, in accordance with criteria set forth in the watershed model ordinance included as **Attachment C** of this plan.

B. Best Management Practices Handbook

The model ordinance requires applicants 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 applicants consider implementation of BMPs. DEP has published *The Pennsylvania Handbook of Best Management Practices for Developing Areas* (1998) to assist developers and municipalities in the selection and implementation of these management practices. This handbook is an excellent source of information regarding structural and non-structural BMPs, including design specifications and application examples.

C. Better Site Design

As part of the overall strategy for watershed-based stormwater management, this plan and its accompanying model ordinance encourage the use of innovative site planning techniques, including the use of conservation design principles, to reduce the amount of impervious cover associated with new development projects. This strategy plays an important role in meeting the post-development peak discharge control criteria of the ordinance and helps reduce the amount of stormwater runoff which is generated and ultimately required to be controlled at a development site.

According to studies conducted by the Center for Watershed Protection, careful application of land development principles (BMP concepts) can sharply reduce impervious cover and protect

natural resources. The pollutant load may be reduced by over 40% while development costs may be reduced by 20%.* Many of the watershed's municipalities already encourage or require conservation site design practices in their subdivision and land development ordinances. These practices vary in form and complexity, depending on the scope of development, location, and environmental features associated with the specific project.

Examples of conservation site design practices include (but are not limited to):

Applying alternative development principles to residential streets

Minimize rights-of-way

Locate utilities within pavement areas

Minimize pavement and street widths

Reduce street lengths

Minimize cul-de-sacs

Promote cluster development (maintain gross density of the site, but cluster improvements to a portion of the entire site)

Relax setbacks and narrow frontages to reduce road lengths and imperviousness

Promote alternative driveway surfaces and shared driveways

Applying alternative development principles to parking areas

Add pervious landscaping where appropriate

Use permeable paving materials where appropriate

Lower parking space requirements

Zoning and subdivision ordinance refinements

Performance or density zoning

Transfer of development rights (TDR)

Conservation design overlay districts

There are many sources of technical information on these concepts, including publications of the Center for Watershed Protection <http://www.cwp.org/> and the Pennsylvania Department of Conservation and Natural Resources (DCNR) (<http://www.dcnr.pa.gov>). One particular

* Center for Watershed Protection, 1999. *Better Site Design: A Handbook for Changing Development Rules in Your Community*, Metropolitan Washington Council of Governments

guidance manual entitled *Growing Greener, A Conservation Planning Workbook for Municipal Officials in Pennsylvania* (prepared for DCNR by the Natural Lands Trust, January 1999) addresses these issues directly. This workbook instructs local officials in the basic steps involved in designing residential development that maximizes land conservation without reducing overall building density. The workbook explains techniques for modifying comprehensive plans, zoning ordinances, and subdivision and land development ordinances to include a strong conservation focus. The workbook includes several conservation subdivisions in Pennsylvania, including the Ringfield development in Chadds Ford Township and Garnet Oaks, located in Bethel Township, both Chester Creek municipalities.

D. National Pollutant Discharge Elimination System (NPDES), Phase II Requirements

New federal regulations approved October 1999 require operators of small municipal separate storm sewer systems (MS4s) to obtain NPDES Phase II permits from DEP by March 2003. This program affects all municipalities in “urbanized areas” of the state. This definition applies to all Chester Creek watershed municipalities. Therefore, all municipalities within the Chester Creek watershed will be subject to the NPDES Phase II requirements, mandated by the Federal Clean Water Act. NPDES II is an acronym for the National Pollutant Discharge Elimination System Phase II Stormwater Permitting Regulations. Municipalities required to implement the MS4 program must address the following six minimum measures:

- Public Education and Outreach
- Public Involvement/ Participation
- Illicit Discharge Detection and Elimination
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management in New Development & Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations

At a minimum, municipal entities regulated under MS4 *must*:

- Specify BMPs and implement them to the “maximum extent practicable”

- Identify measurable goals for control measures
- Develop an implementation schedule of activities or frequency of activities, and
- Define the entity responsible for implementation

The affected municipalities must, if they already do not have one in place, develop a stormwater management program. If a municipality has an established stormwater management program and is subject to the provisions of the Phase II rule, then provisions of the rule must be implemented to satisfy the federal requirements. Applicable information concerning some of the specifics of this permitting program can be found in **Attachment D** of this plan.

Adoption of the Chester Creek Stormwater Management Plan and watershed model ordinance provisions will satisfy the four basic requirements noted above and, at a minimum, one of the six required elements of the NPDES II program, specifically, post-construction stormwater management in new development and redevelopment for all developments over 2000 square feet.

The NPDES Phase II program mandates municipalities to require post-construction stormwater runoff control measures for land disturbance activities of one acre or more. Thus, all projects within regulated municipalities will be required to comply with additional water quality and quantity measures of the regulations beginning March 2003. Therefore, the model ordinance contains language requiring land development activities exempted from water quantity activities to comply with water quality ordinance requirements contained in Section 302.B. Refer to Section VIII of this plan for further details and Section 302 of the model ordinance for specific exemption language that requires water quality control regardless of project size.

For example, if an activity meets the water quantity exemption criterion of the model ordinance (i.e., the project is less than or equal to 2,000 square feet of additional impervious cover), the applicant would still be required to implement specified minimum BMPs to satisfy the water quality objectives of the stormwater management plan. This applicant would not need to submit the formal drainage plan but would need to indicate to the municipal engineer the type of BMP being used. In this way, municipalities adopting the model ordinance provisions will be able to show compliance with one or more of the required elements of the NPDES II regulations.

IX. MODEL ORDINANCE

A model stormwater management ordinance was developed under the authority of and in strict conformance with the requirements of Act 167, including the new requirements for water quality and groundwater recharge components noted in Section VIII. The ordinance was prepared in consultation with the WPAC and was presented for discussion at WPAC meetings held in January, June, and July 2001. Proposed ordinance provisions were reviewed and accepted by a majority of the voting members attending the meetings.

Comments were received from the municipal engineers and solicitors, and changes were made to the model ordinance language. The final revised model ordinance is presented in **Attachment C** and includes criteria for determining existing and projected runoff rates, performance standards and specifications for managing storm runoff in the watershed, and criteria for designing stormwater collection systems.

There was extensive discussion during a number of WPAC meetings of several ordinance provisions, and the model ordinance incorporates the majority opinion of the WPAC members on those issues. The following paragraphs highlight the most controversial provisions of the ordinance and present some of the arguments that were posed for and against:

- A. Exemption Criteria – Section 302 – There was general agreement that some provision should be made to allow property owners to make minor changes to their properties without having to obtain municipal approval concerning stormwater management. The primary discussion on this topic was related to what criteria to apply. The WPAC agreed that there should be some way to limit the total amount of impervious cover allowed on a property before a full drainage plan would be needed. However, in some instances, even small increases of impervious cover could cause water quality degradation and possible downstream harm. In addition, representatives from DEP raised the issue that this exemption will not satisfy NPDES Phase II requirements (see Section VIII and **Attachment D** of this plan). Therefore, the plan requires developers exempted from water quantity requirements to address the water quality provisions contained in Section 302.B of the ordinance.

Section 302.A of the ordinance states the following, *“Any regulated activity that meets the following exemption criterion shall not be required to submit a drainage plan implementing the stormwater quantity controls of this Ordinance. This criterion shall apply to the total development even if the 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.”*

In order to meet the water quality control requirements of the NPDES Phase II regulations and the water quality performance standards of the Chester Creek Stormwater Management Plan, applicants whose activities meet the water quantity control exemption will still be required to meet the stormwater management quality controls of the stormwater management plan. In order to meet this requirement, the ordinance specifies recommended minimum BMPs which can be implemented by an applicant meeting the water quantity exemption criterion. These techniques are designed to be simple in application and design so that an applicant will not need professional engineering services in order to design and would not require submission of a formal drainage plan.

Another related issue with the exemption criterion was the interpretation of additional impervious cover. Essentially, the exemption applies only if the development is at or below 2000 square feet. For example, if an applicant proposes a 1,000 square foot room addition to his/her home after adoption of the municipal stormwater management ordinance, that applicant would be exempted from the stormwater quantity control submission requirements of this ordinance. If, at a later date, the applicant proposes to construct a 1,200 square foot tennis court on the same property, the applicant would be required to comply with the full stormwater quantity and quality control submission requirements because the total additional impervious cover exceeds 2,000 square feet. The applicant would be required to submit a drainage plan to address the total 2,200

square feet of additional impervious surface added to the original property since adoption of the model ordinance.

- B. Release Rates – Section 402 – The concept of release rate criteria was developed to minimize the impact that development has not only concerning peak discharge rates but also to the duration of time that those peak rates occur during and after a storm event. Studies and experience have shown that merely controlling peak discharges to values equal to pre-development conditions is not sufficient to prevent downstream flooding and erosion. Therefore, additional control is being required based on the runoff characteristics of the watershed. When release rates are applied, they create a dichotomy with regards to development in that two adjoining parcels in a watershed may have different control criteria assigned to them simply because of where their storm runoff discharges. Concern was expressed by WPAC members that the release rates were too restrictive and would have significant economic impacts on developers. However, experiences in other watersheds have shown that these impacts are not that great. There was also discussion regarding whether a single release rate should be applied to the entire watershed. It was decided that it would be better to base the release rates on the actual optimized watershed model results in case there was a challenge made against the control criteria.
- C. Redevelopment – Section 403 – Concern was expressed that imposing the release rate criteria on redevelopment projects might serve as a disincentive for developers. Therefore, an approach was proposed that would reduce the level of control required on redevelopment projects. This was accomplished by developing a chart which allows modification of pre-development conditions for which the stormwater management plan would be prepared. This chart adjusts the pre-development RCN value or “C” value to reflect conditions less restrictive than “meadow on B class soils” based on the percentage of existing impervious cover. The chart is included as Figure B-3 in Appendix B of the stormwater management ordinance.
- D. Water Quality BMPs – Section 404 – DEP recently required that all Act 167 plans incorporate certain minimum water quality requirements based on the implementation of

BMPs (see **Attachment B**). The model ordinance was modified to include the following controls:

1. Riparian Buffers – The discussion regarding this control approach centered on how to define the limits of the buffer. Results of several studies were presented indicating that buffers are more effective if they are more than 50 feet wide on each side of a stream. The WPAC established this as the recommended minimum criterion but acknowledged that it might not be possible to achieve this criterion on lots defined under existing zoning. Therefore, varying buffer widths with a minimum of 10 feet were established based on rear and side yard setbacks.
 2. Infiltration – Concern was expressed regarding the potential impact of infiltration on groundwater quality. However, it was generally felt that, when properly designed, infiltration facilities could minimize the water quality impacts. Discussion also centered on the criteria to apply. Various levels of control were considered, with agreement finally coming on the net increase in runoff volume for the 2-year storm or one inch of runoff from the area draining to the facility, whichever is greater.
 3. Extended Detention – This requirement was incorporated just as called for by DEP. The discussion on this topic centered on concerns about safety and mosquito breeding related to the length of time water would be ponded and the potential maintenance problems associated with the small diameter holes that would be needed to control the flow.
- E. Plan Review – Section 303.A.4 and Section 305.B – Concern was expressed that each of the 20 municipalities in the watershed may have differing interpretations of the ordinance provisions. The importance of consistent interpretation of the ordinance, as well as review on a watershed basis, was discussed. The WPAC agreed that successful implementation of the plan relies on watershed-wide consistency in review. Therefore, it was agreed that drainage plans prepared in conformance with the ordinance be routed through the respective County Conservation Districts for review, subject to policies and

procedures established by each of the Conservation Districts. Such policies and procedures could include type of plan to be reviewed, level of plan review, timetable for review, and fees for review. Municipalities would then be required to take into consideration any comments made by the Conservation District prior to final approval of a drainage plan.

X. PLAN IMPLEMENTATION

A. Regulatory Approach and Approval Process

The regulatory approach for implementing this stormwater management plan utilizes the powers granted by Act 247, the Pennsylvania 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 were incorporated into the plan and then presented to the Chester County Board of Commissioners and Delaware County Council for adoption. The adoption process included a public hearing at which the plan was presented and comments received. Appropriate changes were then made to the plan. The Counties then enacted an adoption resolution. This stormwater management plan was submitted to DEP for approval following adoption by the governing bodies of both Chester and Delaware Counties.

Within six months following adoption of this plan by the Counties and approval by DEP, the municipalities within the watershed are required by Act 167 to adopt the model ordinance as a stand-alone ordinance or to incorporate its provisions into their existing subdivision and land development ordinances with appropriate cross-references. 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 cross-references and establish a record-keeping and maintenance program to monitor the stormwater management facilities.

B. Multiple Subwatershed Controls

Some municipalities in the Chester 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. For example, if a municipality is comprised of three subwatersheds, one may be designated for a 100% release rate, the second for a 75% release rate, and the third for a 50% release rate. This

municipality may choose to impose the 50% release rate criterion upon all of its subwatersheds because it is the most restrictive rate of all of the subwatersheds within its boundary.

C. Multiple Watershed Plans

Some municipalities within the Chester Creek watershed share other watersheds with no plan or watersheds with differing degrees of control requirements (i.e., Ridley Creek). Municipalities should consider reviewing all local ordinances related to the stormwater management controls, including current stormwater management ordinances, in order to reconcile inconsistencies among areas within the municipal boundaries. This will aid in local plan reviews and assist the development community with regard to drainage plan submissions. It may be prudent to incorporate the water quality provisions across the entire municipality, regardless of watershed, in order to meet the NPDES II post-development control requirements that will be mandatory for all municipalities within the Chester Creek watershed (see Section VIII for more information regarding the NPDES II program).

XI. PLAN UPDATE

Section 5(b) of the Stormwater Management Act requires that adopted plans incorporate “provisions for periodically reviewing, revising, and updating the plan.” Section 5(a) requires that plan updates be conducted at least every five years to account for changes in land use, development pressures, and water quantity and quality provisions. CCPC, DCPD, and the County Conservation Districts 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. The Chester and Delaware County Conservation Districts will be responsible for archiving as-built drainage plans that have been submitted in accordance with established criteria and procedures. If a plan update is initiated, the Counties will reconvene the WPAC to provide local input into the process.

ATTACHMENT A
WPAC MEMBERSHIP AND
MEETING ATTENDANCE MATRIX

Attachment A

| CHESTER CREEK WATERSHED PLAN ADVISORY COMMITTEE | |
|--|--|
| AFFILIATION | CORE GROUP MEMBER |
| Delaware County | |
| Aston Township | Ms. Eileen Nelson Municipal Engineer |
| Bethel Township | Ms. Ann Marie Brown Secretary |
| Brookhaven Borough | Ms. Eileen Mulvena Municipal Engineer |
| Chadds Ford Township | Mr. James Kelly Municipal Engineer |
| Chester Heights Borough | Mr. Fred Wood Councilman |
| Chester Township | Mr. William P. Pisarek Manager |
| City of Chester | Mr. William C. Payne Planning Director |
| Concord Township | Mr. Steven D. Miller Chairman, Township Planning Commission |
| Edgmont Township | Ms. Samantha Reiner Manager |
| Middletown Township | Mr. W. Bruce Clark Manager |
| Parkside Borough | Ms. Kim Koterba |
| Thornbury Township | Mr. John Kinsey Code Enforcement Officer |
| Upland Borough | Mr. Harold Peden Planning Commissioner |
| Upper Chichester Township | Ms. Dora A. Coleman Secretary |
| Delaware County Conservation District | Mr. Edward Magargee Conservation District Manager |
| Delaware County Planning Department | Ms. Karen Holm Environmental Manager |
| Chester County | |
| East Goshen Township | Mr. Louis F. Smith, Jr. Manager |
| Thornbury Township | Mr. Jeffrey Sherman Park and Recreation Committee |
| West Chester Borough | Mr. Ernie B. McNeely Secretary/Manager |
| | |

| CHESTER CREEK WATERSHED PLAN ADVISORY COMMITTEE | |
|--|--|
| AFFILIATION | CORE GROUP MEMBER |
| West Goshen Township | Mr. Kenneth E. Lawrence Township Engineer |
| West Whiteland Township | Mr. Stephen J. Ross Secretary/Treasurer |
| Westtown Township | Mr. Michael A. Cotter Manager |
| Chester County Conservation District | Mr. Dan Greig Conservation District Manager |
| Chester County Water Resources Authority | Ms. Janet Bowers Executive Director |
| Chester County Planning Commission | Mr. Wayne Clapp Assistant Director |
| Other | |
| Chester- Ridley-Crum Watersheds Association | Ms. Judith Auten President |
| Natural Resources Conservation Service | Mr. Sam High County Conservationist |
| Philadelphia Suburban Water Company | Mr. Robert Feuer Environmental Specialist |

| APPENDIX A - WPAC MEETING ATTENDANCE MATRIX | | | | | | |
|---|--------------------|---------------|-----------|-----------|----------|-----------|
| Affiliation | Representative | Meeting Dates | | | | |
| | | 15-Sep-98 | 30-Jun-99 | 23-Nov-99 | 1-Nov-00 | 25-Jan-01 |
| Delaware County | | | | | | |
| Aston Township | Eileen Nelson | X | X | X | X | X |
| Bethel Township | Ann Marie Brown | X | | | | X* |
| Brookhaven Borough | Eileen Mulvena | | X | | X* | X |
| Chadds Ford Township | James Kelly | | | X | | |
| Chester City | William C. Payne | X* | | X | X | |
| Chester Heights Borough | Fred Wood | X | X* | X | X* | |
| Chester Township | William P. Pisarek | | | | | |
| Concord Township | Steven D. Miller | X | | | | X* |
| Edgmont Township | Samantha Reiner | X | | X | | X |
| Middletown Twp. | W. Bruce Clark | X | X | | X | X |
| Parkside Borough | Kim Koterba | | | | | |
| Thornbury Township | John Kinsey | X* | X | X | X* | X* |
| Upland Borough | Harold Peden | | | | X | X |
| Upper Chichester Twp. | Dora A. Coleman | | | | | |
| Delco Conservation District | Ed Magargee | | X | | | X |
| Delco Planning Department | Karen Holm | X | X | X | X | X |

*Alternate WPAC member attended the meeting.

| APPENDIX A – WPAC MEETING ATTENDANCE MATRIX | | | | | | |
|--|-----------------------|----------------------------------|------------------|------------------|-----------------|------------------|
| Affiliation | Representative | Meeting Dates (continued) | | | | |
| | | 15-Sep-98 | 30-Jun-99 | 23-Nov-99 | 1-Nov-00 | 25-Jan-01 |
| Chester County | | | | | | |
| East Goshen Township | Rick Smith | | X | X | X | X |
| Thornbury Township | Jeffrey Sherman | | | X | | |
| West Chester Borough | Ernie B. McNeely | | | | X* | X* |
| West Goshen Twp. | Kenneth E. Lawrence | | | X | X | X* |
| Westtown Township | Michael A. Cotter | | | X | X | X |
| West Whiteland Twp. | Stephen J. Ross | | | | | |
| Chesco Conservation District | Dan Greig | | | | | |
| Chesco Water Resources Auth. | Janet Bowers | X | | | X | X |
| Chesco Planning Commission | Wayne Clapp | X | X | X | X | |
| CRC Watershed Association | Carl Du Poldt | X | X* | X | X* | X* |
| Phila. Suburban Water Co. | Robert Feuer | X | X | X | X* | X |
| Nat. Resources Cons. Service | Sam High | X | | X | | X |

*Alternate WPAC member attended the meeting.

APPENDIX A - WPAC MEETING ATTENDANCE MATRIX

| Affiliation | Representative | Meeting Dates (continued) | | | LAC |
|-------------|----------------|---------------------------|-----------|-----------|-----|
| | | 24-May-01 | 12-Jun-01 | 11-Jul-01 | |

| | | MEC | | | LAC |
|-----------------------------|--------------------|-----|---|---|-----|
| Delaware County | | | | | |
| Aston Township | Eileen Nelson | X* | X | X | |
| Bethel Township | Ann Marie Brown | | | X | |
| Brookhaven Borough | Eileen Mulvena | | X | X | |
| Chadds Ford Township | James Kelly | | | | |
| Chester City | William C. Payne | | | | |
| Chester Heights Borough | Fred Wood | X* | | X | |
| Chester Township | William P. Pisarek | | | | |
| Concord Township | Steven D. Miller | | | | X* |
| Edgmont Township | Samantha Reiner | X | X | X | X* |
| Middletown Twp. | W. Bruce Clark | | | X | X* |
| Parkside Borough | Kim Koterba | | | | X* |
| Thornbury Township | John Kinsey | X* | | | |
| Upland Borough | Harold Peden | | | | |
| Upper Chichester Twp. | Dora A. Coleman | | | | |
| Delco Conservation District | Ed Magargee | X | | X | X |
| Delco Planning Department | Karen Holm | X | X | X | X |

| APPENDIX A - WPAC MEETING ATTENDANCE MATRIX | | | | | | |
|---|---------------------|---------------------------|-----------|-----------|-----------|--|
| | | Meeting Dates (continued) | | | | |
| Affiliation | Representative | 24-May-01 | 12-Jun-01 | 11-Jul-01 | 23-Oct-01 | |
| Chester County | | MEC | | | LAC | |
| East Goshen Township | Rick Smith | X | X* | X | | |
| Thornbury Township | Jeffrey Sherman | | | | | |
| West Chester Borough | Ernie B. McNeely | X* | | X | | |
| West Goshen Twp. | Kenneth E. Lawrence | | | X | | |
| Westtown Township | Michael A. Cotter | | X | | | |
| West Whiteland Twp. | Stephen J. Ross | | | X | | |
| Chesco Conservation District | Dan Greig | | | | | |
| Chesco Water Resources Auth. | Janet Bowers | X | X | X | X | |
| Chesco Planning Commission | Wayne Clapp | | | X* | X* | |
| CRC Watershed Association | Carl Du Poldt | X* | | | | |
| Phila. Suburban Water Co. | Robert Feuer | | | X | | |
| Nat. Resources Cons. Service | Sam High | | | | | |

*Alternate WPAC member attended the meeting.

ATTACHMENT B
DEP POSITION LETTER



Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building
P.O. Box 8555
Harrisburg, PA 17105-8555
June 8, 2001

Bureau of Watershed Management

717-772-4048

Ms. Lois Saunders
Delaware County Planning Department
Courthouse and Government Center
201 West Front Street
Media, Pa 19063

Dear Ms. Saunders:

This is to confirm the Department's position regarding the requirement for water quality components in Act 167 Watershed Stormwater Management Plans. I understand that this issue was discussed at the last Watershed Plan Advisory Committee Meeting, which was held for the Chester Creek Stormwater Plan. This Plan is in its final stages of preparation, and will shortly be poised for adoption by Delaware and Chester Counties subsequent to public hearings.

As a result of a recent internal program and a legal review of the Storm Water Management Act, the Department has concluded that the Act requires the inclusion of water quality components in watershed storm water management plans and further requires the implementation of such components by municipalities subject to the plans. Currently, in the absence of further standards, the Department is requiring the inclusion of groundwater recharge and water quality BMPs in watershed storm water management plans. The plans must mandate municipal implementation of the water quality and groundwater components, in order to secure eventual Departmental approval.

While our review of your draft plan indicates you are incorporating the appropriate water quality and groundwater recharge components, it would be necessary for your plan to mandate municipal implementation of the components, in order to secure eventual Departmental approval of the plan.

If you have further questions, or we can be of further assistance, please feel free to contact Mr. Durla Lathia, Chief of our Stormwater Planning and Management Section at 717-772-4048.

Sincerely,

William A. Gast
Chief
Division of Water Use Planning

cc: Wayne Clapp, Chester County Planning Commission



ATTACHMENT C
MODEL ORDINANCE

ACT 167
STORMWATER MANAGEMENT PLAN
CHESTER CREEK WATERSHED

Model Stormwater Management
Ordinance

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

MAY 2001

Revised December 2001
Revised June 2002

If you have any questions, please call
Delaware County Planning Department
Court House and Government Center Building
201 West Front Street
Media, Pennsylvania 19063
(610) 891-5200

Organization of Model Ordinance for the Chester Creek Watershed

Introduction and Background:

Municipalities within the Commonwealth of Pennsylvania are 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." Act 167 requires that:

- Counties prepare a watershed stormwater management plan in conformance with the requirements of Act 167 for each watershed within their boundaries.
- The plans evaluate present and future runoff within the watershed and make technical recommendations for the control and management of runoff from new development (both quantity and quality).
- Municipalities implement the plan via a stormwater ordinance developed as part of the plan.
- Developers control the quantity and quality of runoff from new development (including redevelopment) in accordance with each municipality's implementing ordinance.

The following model ordinance has been developed specifically for municipalities within the Chester Creek watershed in order to implement the Chester Creek Stormwater Management Plan. Municipalities may elect to either create a single-purpose stormwater ordinance (recommended) or amend existing subdivision or zoning ordinances to implement the associated stormwater management plan.

All of the provisions within this model ordinance (unless specifically designated as optional) are required to be part of the municipal stormwater ordinance or other ordinances implementing the requirements of the stormwater management plan.

Organization

This ordinance contains the following eight articles, each with specific provisions.

Article I - General Provisions - This article includes general administrative provisions including applicable land areas and regulated activities.

Article II - Definitions - This article provides a list of common terms and associated definitions used throughout the ordinance.

Article III - Drainage Plan Requirements - This article lists the specific requirements for submittal, content, and review of drainage plans required by the ordinance. This article also includes the stormwater management exemption criterion.

Article IV - Stormwater Management - This article represents the technical provisions for stormwater management within the Chester Creek watershed and

includes the stormwater management district implementation provisions, water quality requirements, design criteria, calculation methods, and erosion and sedimentation requirements.

Article V - Inspections - This article describes inspection procedures for permanent stormwater management and water quality facilities.

Article VI - Fees and Expenses - This article contains the provisions for a municipal review fee.

Article VII - Maintenance Responsibilities - This article outlines the applicants' responsibilities for operation and maintenance of stormwater management facilities.

Article VIII - Enforcement and Penalties - This article describes municipal enforcement procedures, remedies, and the appeals process.

Appendices - This section of the ordinance contains five technical support appendices necessary to implement the ordinance provisions.

Please note that the plan and associated ordinance provisions were developed under the authority of and in strict conformance with the requirements of Act 167. These documents were prepared in consultation with a WPAC comprised of designated representatives from each of the watershed municipalities, County Planning and Conservation District staff, the Chester-Ridley-Crum Watersheds Association, the Chester County Water Resources Authority, and Philadelphia Suburban Water Company. Other advisory members on the WPAC included PennDOT, Delco Anglers, Natural Lands Trust, as well as a number of others. Proposed ordinance provisions were reviewed and accepted by a majority of the voting members (noted above) who attended the meetings.

STORMWATER MANAGEMENT ORDINANCE

Implementing the Requirements of the
Chester Creek Stormwater Management Plan

ORDINANCE NO. _____ OF

_____, DELAWARE COUNTY, PENNSYLVANIA

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

Section 102. Purpose

The purpose of this Ordinance is to :

- A. Promote health, safety, and welfare within the Municipality;
- B. Implement the requirements of the Chester Creek Stormwater Management Plan; and
- C. Implement the requirements of the National Pollutant Discharge Elimination System Phase II (NPDES II);

by minimizing the damages described in Section 101.A of this Ordinance through provisions designed to:

- A. Manage accelerated runoff, 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 stormwater management facilities that are constructed in the Municipality.
- G. Provide performance standards and design criteria for watershed-wide stormwater 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 Chester Creek watershed, as delineated in the Chester Creek Stormwater Management Plan, which is hereby adopted as part of this Ordinance.

This Ordinance shall only apply to permanent stormwater management facilities constructed as part of any of the regulated activities listed in this section. Stormwater management and erosion and sedimentation control during construction activities are specifically not regulated by this Ordinance but shall continue to be regulated under existing laws and ordinances.

This Ordinance contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed-wide perspective. Local stormwater 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 and/or redevelopment.
- B. Subdivision.
- C. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.).
- D. Construction of new buildings or additions to existing buildings.
- E. Diversion or piping of any natural or man-made stream channel.
- F. Installation of stormwater management facilities or appurtenances thereto.
- G. Placement of fill material.

Section 105. 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 106. 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 107. 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 words “includes” or “including” shall not limit the term to the specific example but are 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 at 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 delineates the specific permitted stormwater management facility as actually constructed.

BMP (Best Management Practice) - Stormwater 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 Riparian 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.

Combined Sewers - A sewerage system that carries both sanitary sewage and stormwater runoff.

Conservation District - The Delaware and Chester County Conservation Districts as appropriate for the individual Municipality within the Chester Creek watershed.

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 stormwater management systems.

Designee - The agent of the Delaware County Planning Department or the Chester County Planning Commission and/or agent of the governing body involved with the administration, review, or enforcement of any provisions of this Ordinance by contract or memorandum of understanding.

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

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

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

Development - 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 stormwater management facility designed to transmit stormwater runoff, including streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

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

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 municipal approval.

Drainage Plan - The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in Section 304.

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, but not dedicated, for limited use of private land for a public or quasi-public purpose (e.g., utility lines) and within which the owner of the property shall not erect any permanent structures.

Ephemeral Streams - 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 Delaware or Chester County Conservation Districts of the appropriate Municipality 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 Map as being a special flood hazard area.

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 the Federal Emergency Management Agency (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 fifty (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 stormwater runoff and release it at a controlled rate.

Infiltration Structures - A structure designed to direct runoff into the ground (e.g., French drains, seepage pit, and 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 - Streams which 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 - (i) The improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving (a) a group of two or more 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; (ii) any subdivision of land; (iii) development in accordance with Section 503(1.1) of the PA Municipalities Planning Code.

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

Main Stem (Main Channel) - Any stream segment or other runoff conveyance facility used as a reach in the Chester 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], Delaware County or Chester 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.

NRCS - Natural Resource Conservation Service (previously the Soil Conservation Service (SCS)).

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

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

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

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

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

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

Perennial Streams - 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 stormwater.

Planning Commission - The Planning Commission of [municipal name].

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 based on 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 stormwater runoff and that are specified in Section 104 of this Ordinance.

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

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 stormwater is stored and not released during the storm event. Stored water may be released from the basin at some time after the end of the storm.

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

Riparian Buffer - A vegetative strip paralleling the banks of a perennial or intermittent stream or other water body (including wetlands and ponds). The buffer shall contain appropriate native vegetation throughout its width with the exception of a minimum five-foot wide strip of land maintained in meadow grass or forbs at its outer boundary. See also Appendix C, Riparian Buffer Technical Reference Guide.

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

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

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

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

Sediment Pollution - The placement, discharge, or any other introduction of sediment into the waters of the Commonwealth 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 matter is accumulated or deposited by the movement of water.

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

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

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

Soil Group, Hydrologic - A classification of soils by SCS 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 the peak discharge which is 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 conveys intercepted runoff and stormwater from other sources but excludes domestic sewage and industrial wastes.

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

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

Stormwater Management Plan - The plan for managing stormwater runoff in the Chester Creek watershed adopted by Delaware and Chester Counties as required by the Act of October 4, 1978, P.L. 864, (Act 167), and known as the "Act 167 Stormwater Management Plan, Chester Creek Watershed."

Stormwater Management Site Plan - The plan prepared by the applicant or his representative indicating how stormwater runoff will be managed at the particular site of interest according to this Ordinance.

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

Subarea - The smallest drainage unit of a watershed for which stormwater management criteria have been established in the Stormwater Management Plan.

Subdivision - 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 (10) 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 (T_c) - The time for surface runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. This time is the combined total of overland flow time and flow time in pipes or channels, if any.

TR-20 - The computer-based hydrologic modeling technique adapted to the Chester 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 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 groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, and similar areas.

ARTICLE III - DRAINAGE PLAN REQUIREMENTS

Section 301. 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 302. Exemptions

A. Stormwater Quantity Control Exemption - Any regulated activity that meets the following exemption criterion shall not be required to submit a drainage plan implementing the stormwater quantity controls of this Ordinance. This criterion shall apply to the total development even if the 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.¹ Exemption shall not relieve the applicant from implementing such measures as are necessary to protect health, safety, and property.

Stormwater Management Exemption Criterion

No more than ten (10) percent of the total site area, up to a maximum of two thousand (2,000) square feet of additional impervious cover.¹

B. Applicants whose activities are exempted under Section 302.A above shall still be required to meet the stormwater management quality controls of this Ordinance. This may be achieved by implementing one or more of the following minimum best management practices:

1. Provide infiltration capacity for the equivalent of one (1) inch of runoff from all new impervious surfaces. The infiltration volume does not have to be provided in one location. However, if site conditions preclude capture of runoff from portions of the impervious area, the infiltration volume for the remaining area should be increased an equivalent amount to offset the loss. In no case

¹ If an applicant proposes a 1,000 square foot room addition to his/her home after adoption of the municipal stormwater management ordinance, that applicant would be exempted from the stormwater quantity control submission requirements of this Ordinance. If, at a later date, the applicant proposes to construct a 1,200 square foot tennis court on the same property, the applicant would be required to comply with the full stormwater quantity and quality control submission requirements of this Ordinance for the total 2,200 square feet of additional impervious surface added to the original property since adoption of the municipal ordinance.

should the portion of the new impervious area flowing to an infiltration facility be less than seventy (70) percent of the total new impervious area.

2. If site conditions preclude use of infiltration facilities (e.g., high groundwater table or extensive rock conditions), provide an extended detention facility that will detain the equivalent of one (1) inch of runoff from all new impervious areas for at least twenty-four (24) hours.

3. Provide buffer areas on the downstream side of any new impervious surfaces (e.g., sidewalks, roadways, parking lots) where the runoff discharges in a sheet flow manner. The buffer areas should be at least twenty (20) feet wide and can be a mix of grass, shrubs, and trees. If buffer areas cannot be provided for the entire length of the impervious surfaces, consider installing a bioretention system and diverting surface runoff from the impervious surfaces to the facility using grass swales.

4. If none of the above options are feasible due to site constraints, the applicant must provide stormwater detention that meets the release rate criteria for the site location or else obtain approval from the municipal Engineer to implement other BMPs that will provide water quality benefits of an equivalent level.

C. New federal regulations approved October 1999 require operators of small municipal separate storm sewer systems (MS4s) to obtain NPDES Phase II permits from DEP by March 2003. (NPDES II is an acronym for the National Pollutant Discharge Elimination System Phase II Stormwater Permitting Regulations.) This program affects all municipalities in "urbanized areas" of the state. This definition applies to all Chester Creek watershed municipalities. Therefore, all municipalities within the Chester Creek watershed will be subject to the NPDES Phase II requirements, mandated by the Federal Clean Water Act as administered by DEP. For more information on NPDES II requirements, contact the DEP Regional Office.

Section 303. Plan Submission

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

- A. Five (5) copies of the drainage plan and associated plan review application shall be submitted by the applicant as part of the Act 247 preliminary plan submission for the regulated activity. 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]**.
 - 4. One (1) copy to the County Conservation District.

Section 304. 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 stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.
 - 3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.

- B. Map(s) of the project area shall be submitted on ___inch x ___inch sheets and shall be prepared in a form that meets the requirements for recording at the offices of the Recorder of Deeds of **[Delaware or Chester Counties]**. 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 fifteen (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, 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 fifty (50) feet of property lines.
 6. An overlay showing soil names and boundaries.
 7. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.
 8. Proposed structures, roads, paved areas, and buildings.
 9. Final contours at intervals of two (2) feet. In areas of steep slopes (greater than fifteen (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 at a minimum of 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 for both.
17. Overland drainage paths of proposed swales or channels to convey water.
18. A note on the plan indicating the location, access, and responsibility for maintenance of stormwater management facilities.
19. A statement, signed by the landowner, acknowledging the stormwater management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the 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 Act 167 Stormwater Management Plan, Chester Creek Watershed, Model Stormwater Management Ordinance.”

C. Supplemental Information

1. A written description of the following information shall be submitted.
 - a) The overall stormwater management concept for the project.
 - b) Stormwater runoff computations as specified in this Ordinance.
 - c) Stormwater 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 DEP.
3. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.

D. Stormwater Management Facilities

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

Section 305. Drainage Plan Review

- A. The municipal Engineer shall review the drainage plan for consistency with the adopted Chester Creek Stormwater Management Plan. The Municipality shall require receipt of a complete plan, as specified in this Ordinance. 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.
- B. The Conservation District, in accordance with established criteria and procedures, shall review the drainage plan for consistency with stormwater management and erosion and sediment pollution control requirements and provide comments to the Municipality. Such comments shall be considered by the Municipality prior to final approval of the drainage plan.
- C. For activities regulated by this Ordinance, the municipal Engineer shall notify the Municipality in writing as to whether the drainage plan is consistent with the Stormwater Management Plan. Should the drainage plan be determined to be consistent with the Stormwater Management Plan, the municipal Engineer will forward an approval letter to the applicant with a copy to the municipal Secretary.
- D. Should the drainage plan be determined to be inconsistent with the Stormwater 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 Section 104 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, as to whether the drainage plan is consistent with the Stormwater 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 DEP Joint Permit Application, the municipal Engineer shall notify DEP as to whether the drainage plan is consistent with the Stormwater Management Plan and forward a copy of the review letter to the Municipality and the applicant. DEP 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 Section 104 of this Ordinance if the drainage plan has been found to be inconsistent with the Stormwater Management Plan, as determined by the municipal Engineer. All required permits from DEP must be obtained prior to approval.

- H. The municipal Building Permit Officer 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 Stormwater Management Plan, as determined by the municipal Engineer, or without considering the comments of the municipal Engineer. All required permits from DEP must be obtained prior to issuance of a building permit.
- I. The applicant shall be responsible for completing as-built drawings of all stormwater management facilities included in the approved drainage plan. The as-built drawing and an explanation of any discrepancies with the design plans shall be submitted to the municipal Engineer for final approval.
- J. The Municipality's approval of a drainage plan shall be valid for a period not to exceed five (5) years. This five-year period shall commence on the date that the Municipality signs the approved drainage plan. If stormwater management facilities included in the approved drainage plan have not been constructed, or if as-built drawings of these facilities have not been approved within this five-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 307 of this Ordinance.

Section 306. Modification of Plans

A modification to a submitted drainage plan for a development site that involves a change in stormwater management facilities or techniques, or that involves the relocation or re-design of stormwater management facilities, or that is necessary because soil or other conditions are not as stated on the drainage plan as determined by the municipal Engineer, shall require a resubmission of the modified drainage plan consistent with Section 304 of this Ordinance and be subject to review as specified in Section 305 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 municipal review fee.

Section 307. 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 304 of this Ordinance and be subject to review as specified in Section 305 of this Ordinance. The applicable municipal review fee must accompany a resubmission of a disapproved drainage plan.

ARTICLE IV - STORMWATER MANAGEMENT

Section 401. General Procedures for Water Quality and Quantity Control

- A. All regulated activities in the Chester Creek watershed which do not fall under the exemption criterion shown in Ordinance Section 302 shall submit a drainage plan consistent with the Chester Creek Stormwater Management Plan to the Municipality for review. This criterion 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. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious.
- B. Drainage plans shall be prepared in accordance with the provisions contained in this article. The process for implementing these provisions is illustrated in Figure 4-1, Water Quality and Quantity Control Drainage Plan Preparation Procedures.
- C. The Chester Creek Stormwater Management Plan requires water quality and water quantity controls as illustrated on the flow chart shown in **Figure 4-1** and detailed in Section 404. The flow chart illustrates a three-step hierarchical process: Step 1 - Infiltration, Step 2 - Extended detention, and Step 3 - Implementation of additional design controls. Applicants must evaluate the outcome of each step before proceeding to the next. In addition, riparian buffers are required where applicable, in accordance with Section 404.A.2.
- D. Applicants are highly encouraged to meet the post-development peak discharge control criteria indicated in Sections 402 and 403 through use of BMPs and innovative site designs that minimize the amount of new impervious surface.

Section 402. Stormwater Management Districts

The Chester Creek watershed is divided into districts that represent three (3) levels of stormwater management. The boundaries of the stormwater management districts are shown on an official release rate map, included as part of the Chester Creek Stormwater Management Plan (see **Plate 6, Release Rate Map**). A copy of the official release rate map at a reduced scale is included as **Plate 1** in **Appendix A** of this Ordinance. This map is for reference only. The exact location of the stormwater management district boundaries as they apply to a given development site must be determined by mapping the boundaries using the two-foot topographic contours (or the most accurate data required) provided as part of the drainage plan.

Section 403. Stormwater 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 official stormwater management release rate map, Ordinance Appendix A, and Section 402 of the Ordinance.
- B. Standards for managing runoff for new development from each subarea in the Chester Creek watershed for the 2-, 5-, 10-, 25-, 50-, and 100-year design storms are shown in Table 403-1. Development sites located in each of the districts must control post-development peak runoff rates to the specified percentage of pre-development peak runoff rates for the design storms as shown in the table.

| TABLE 403-1 CONTROL CRITERIA FOR STORMWATER MANAGEMENT DISTRICTS | |
|---|---|
| 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 seventy-five (75) percent of the pre-development peak discharges. |
| 50% | Post-development peak discharge for all design storms must be no greater than fifty (50) percent of the pre-development peak discharges. |

SOURCE: Gannett Fleming, 2001

- C. Redevelopment projects shall meet peak discharge requirements based on the adjusted runoff control number (RCN) or "C" value illustrated by Figure B-3 in Appendix B.
- D. Sites Located in More than One 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.
- E. 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.

- F. 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 stormwater management facilities shall be subject to the release rate criteria.
- G. Regional Detention Alternatives - This performance standard is optional. Please see box below:

G. Regional Detention Alternatives (Optional) - 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 Stormwater Management Plan.

Section 404. Water Quality Requirements

- A. In addition to the performance standards and design criteria requirements of Sections 402 and 403 and Sections 405 through 407 of this Ordinance, the applicant shall comply with the following water quality requirements unless otherwise exempted by provisions of this Ordinance.
1. 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. The volume of storage to be provided shall be no less than the net increase in runoff from the 2-year storm event, or one (1) inch of runoff from the total area draining to the infiltration facility, whichever is greater.
 2. If a perennial or intermittent stream passes through the site, the applicant shall create a riparian buffer extending a minimum of fifty (50) feet to either side of the top of the bank of the channel. The buffer area shall be maintained with appropriate native vegetation (see list of technical references in Appendix C of this Ordinance). If the applicable rear or side yard setback is less than fifty (50) feet, the buffer width may be reduced to twenty-five (25) percent of the setback to a minimum of ten (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. **[The Municipality may select a smaller buffer width if desired, but never less than ten (10) feet.]**

3. Detain the 2-year, 24-hour design storm runoff based on using the SCS Type II distribution. Provisions shall be made so that the detained runoff takes a minimum of twenty-four (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 stormwater management plans or regulations.

D. The following additional factors should 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

Section 405. Calculation Methodology

A. Any stormwater runoff calculations involving drainage areas greater than two hundred (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 405-1 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.

| TABLE 405-1 ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER 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 model's 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 with a total contributing drainage area of less than one hundred (100) 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 one hundred (100) acres must be approved by the municipal Engineer.

SOURCE: Gannett Fleming, 2001

- 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 B-1 in Appendix B of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1 is used for stormwater runoff calculations, then the duration of rainfall shall be twenty-four (24) hours. The NRCS "S" curve shown in Figure B-1, Appendix B of this Ordinance shall be used for the rainfall distribution.
- C. For the purposes of pre-development flow rate determination, undeveloped land shall be considered as "meadow" good condition, type "B" soils, (RCN = 58, Rational "C" = 0.12) unless the natural ground cover generates a lower curve number or Rational "C" value (i.e., forest). If a proposed development meets the definition of redevelopment as defined in Article II of this Ordinance, the applicant may adjust the pre-development RCN or "C" value based on the curves presented in Figure B-3.
- 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 B-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. RCNs for both existing and proposed conditions to be used in the soil-cover complex method shall be obtained from Table B-2 in Appendix B of this Ordinance.
- F. Runoff coefficients (C) for both existing and proposed conditions for use in the Rational Method shall be obtained from Table B-3 in Appendix B of this Ordinance.
- G. 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).
- 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 B-4 in Appendix B of the Ordinance.
- I. Outlet structures for stormwater 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 (Haestad Methods) will also be accepted.
- J. The design of any stormwater 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 twenty (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 uses 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 recommendation of the municipal Engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.

Section 406. Design Criteria for Stormwater Management Facilities

- A. Any stormwater 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 so as to provide a minimum one (1.0) foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any stormwater management facility require a dam safety permit under DEP 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 the 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 DEP Chapter 105 regulations (as amended or replaced from time to time by DEP) shall be designed in accordance with Chapter 105 and will require a permit from DEP. Any other drainage conveyance facility that does not fall under Chapter 105 regulations shall be designed to convey, without damage to the drainage structure or roadway, runoff from a minimum 25-year design storm. Municipalities may require design based on a larger storm event. Open channels shall be designed with a minimum of one (1.0) foot of freeboard. Any facility that constitutes a dam as defined in DEP Chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PennDOT right-of-way must meet PennDOT minimum design standards and permit submission requirements. If the primary drainage facilities do not have capacity for future flows, then a safe drainage path must 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 minimum 25-year design storm without surcharging inlets.
- D. Adequate erosion protection shall be provided along all open channels and at all points of discharge.
- E. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Municipality 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.
- F. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.
- G. 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.

- H. 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, the applicant must document to the Municipality in accordance with Section 405 that adequate downstream conveyance exists 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.
- I. Downstream Hydraulic Capacity Analysis - Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:
1. Natural or man-made channels or swales must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Acceptable velocities shall be based upon criteria included in the DEP *Erosion and Sediment Pollution Control Program Manual*.
 2. Natural or man-made channels or swales must be able to convey 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 tributary area must be designed in accordance with DEP, Chapter 105 regulations (if applicable) and, at a minimum, pass the increased 25-year return period runoff.
- J. Where a development site is traversed by watercourses, riparian buffers shall be provided conforming to the line of such watercourses. The width of the buffers shall be determined as set forth in Section 404.A.2. Excavating, placing of fill, building structures, or making any alterations that may adversely affect the flow of stormwater within any portion of the riparian buffer shall be prohibited unless the proposed work is associated with a regulated wetlands mitigation program. The buffer must be defined through a deed covenant.
- K. 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 DEP through the Joint Permit Application process, or, where deemed appropriate by DEP, through the General Permit process.
- L. Any stormwater 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 DEP through the Joint Permit Application process, or, where deemed

appropriate by DEP, the General Permit process. When there is a question as to whether wetlands may be involved, it is the responsibility of the applicant or his agent to show that the land in question cannot be classified as wetlands; otherwise, approval to work in the area must be obtained from DEP.

- M. Any stormwater management facilities regulated by this Ordinance that would be located on state highway rights-of-way shall be subject to approval by PennDOT.
- N. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc. are required, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.
- O. In order to promote overland flow and infiltration/percolation of stormwater, roof drains must discharge into an accepted BMP providing infiltration and filtering of the stormwater.

Section 407. 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, DEP, Subpart C, protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control," and in accordance with the Delaware County or Chester County Conservation Districts, as appropriate, and the standards and specifications of the appropriate municipal government.
- B. Additional erosion and sedimentation control design standards and criteria that must be applied where infiltration BMPs are proposed include the following:
 - 1. Areas proposed for infiltration BMPs shall be protected from sedimentation and compaction during the construction phase to maintain their maximum infiltration capacity.
 - 2. In order to ensure 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 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 stormwater management and water quality facilities, including non-structural BMPs.
- B. During any stage of the work, if the municipal Engineer determines that the permanent stormwater management facilities, water quality facilities, or non-structural BMPs are not being installed in accordance with the approved Chester Creek Stormwater Management Plan, the Municipality shall revoke any existing municipal permits or issue a stop work order until a revised drainage plan is submitted and approved, as specified in this Ordinance.

ARTICLE VI - FEES AND EXPENSES

The following article provisions are optional. Please see box below.

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. [Note to municipalities: a sample drainage plan application and fee schedule are included as Appendix D of this Ordinance.]

Section 602. Municipal 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 may 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 stormwater management facilities and drainage improvements during construction.*
- E. *The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the drainage plan.*

Section 604. Additional Costs

Applicant 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 stormwater management controls as required by the approved stormwater 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 ensure proper operation of the facility (ies).
- B. The drainage plan for the development site shall establish responsibilities for the continued operation and maintenance of all proposed stormwater control facilities, consistent with the following principles:
 - 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, stormwater control facilities may also be dedicated to and maintained by the Municipality.
 - 2. If a development site is to be maintained in single ownership or if sewers and other public improvements are to be privately owned and maintained, then the ownership and maintenance of stormwater control facilities shall be the responsibility of the owner or private management entity.
- C. The Municipality, 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 stormwater management controls.

Section 703. Maintenance Agreement for Privately Owned Stormwater Facilities

- A. Prior to final approval of the site's stormwater management plan, the property owner shall sign and record a maintenance agreement covering all stormwater control facilities that are to be privately owned. Said agreement, designated as Appendix E, is attached and made a 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 Municipality.

Section 704. Post-Construction Maintenance Inspections

- A. Stormwater detention and retention basins or facilities shall be inspected by, or under the direction of, a registered professional engineer on behalf of the applicant or responsible entity (including the municipal Engineer for dedicated facilities) on the following basis:
 - 1. Annually for the first five (5) years.
 - 2. Once every three (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 recommend necessary repairs, if needed. Any needed repairs shall be implemented by the owner within one (1) month of the report issuance date.

Section 705. Municipal Stormwater Maintenance Fund

This is an optional provision. Please see box below.

Section 705. Municipal Stormwater Maintenance Fund (Optional)

- A. *If stormwater facilities are accepted by the Municipality for dedication, persons installing stormwater storage facilities shall be required to pay a specified amount to the municipal stormwater maintenance fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined 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 ten (10) 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 10-year maintenance costs. The municipal Engineer shall determine the present worth equivalents, which shall be subject to the approval of the Municipality.*
- B. *If a storage facility is proposed that also serves as a recreational facility (e.g., ball field, pond), the Municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreational 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.*

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 stormwater 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 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 that does not conform to the approved drainage plan.
- C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:
 - 1. Provide a certification of completion from an engineer, architect, surveyor, or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.

2. Provide a printed set of as-built drawings to the Municipality.
 3. Provide a set of as-built drawings to the County Conservation District. Such plans shall be prepared in accordance with established criteria and procedures and in a format (electronic or otherwise) as required by the Conservation District for long-term storage.
- D. After receipt of the certification by the Municipality, a final inspection shall be conducted by the Governing Body 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 Municipality 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, or which endangers the life or property of others.
 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 stormwater management and erosion and sediment pollution control measure(s), 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 subject to a fine of not more than \$[_____] for each violation plus court costs and attorney fees. 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 to 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 Governing Body's decision.

ENACTED and ORDAINED at a regular meeting of the **[Name of the municipal governing body]** on the ____ 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

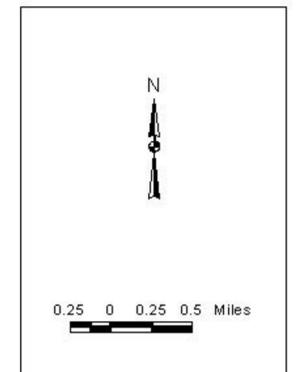
**APPENDIX A
RELEASE RATE MAP**

PLATE 1: RELEASE RATE MAP
CHESTER CREEK WATERSHED
ACT 167 STUDY

June, 2002

LEGEND

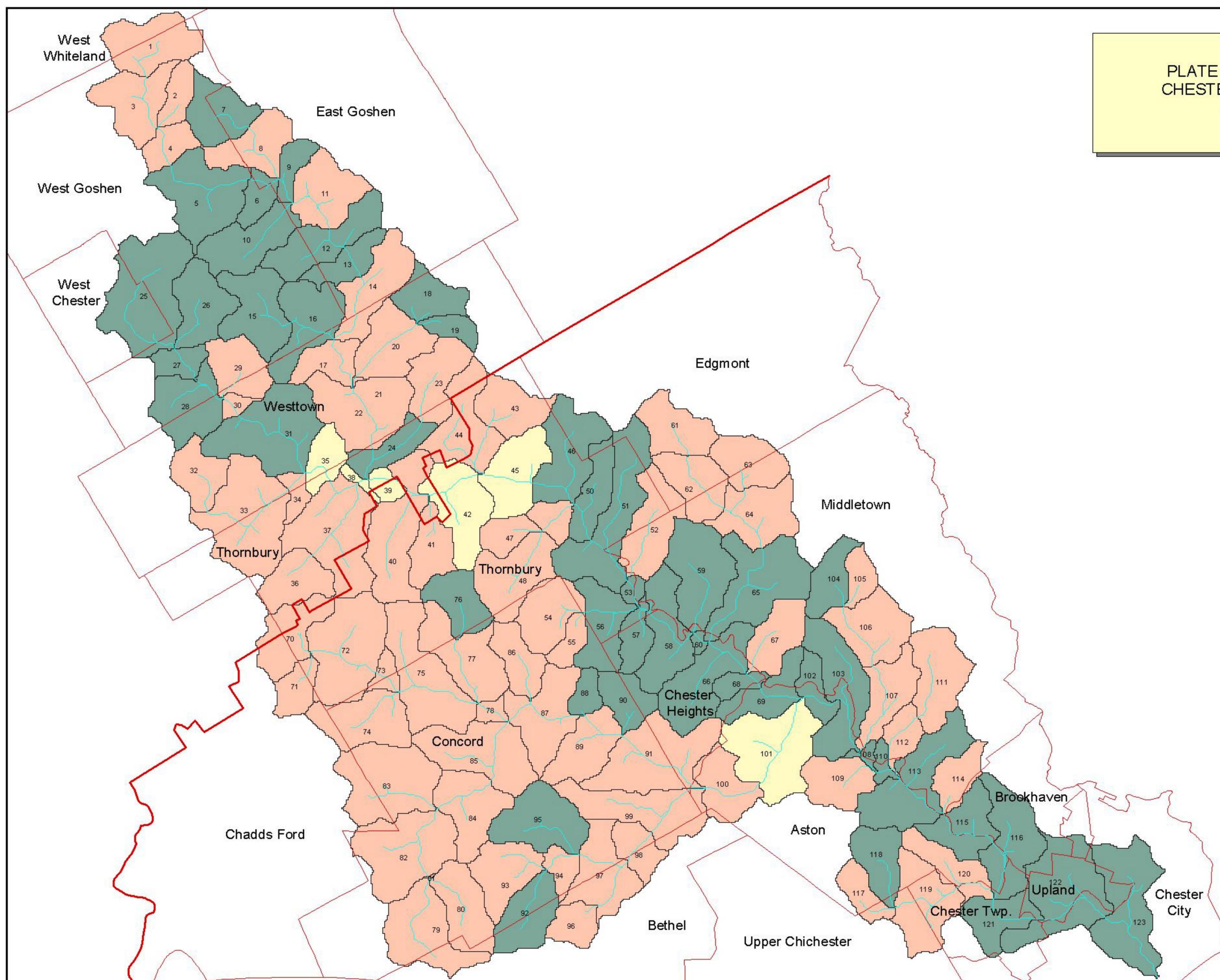
-  County Boundary
 -  Stream
 -  Municipal Boundary
- Release Rates**
-  0.5
 -  0.75
 -  1
 -  Subarea Boundaries



Note:

Map is for reference use only. The exact location of the stormwater management district boundaries as they apply to a given development site must be determined by mapping the boundaries using the two-foot topographic contours (or the most accurate data) required, provided as part of the drainage plan.

Sources: Chester Creek Stormwater Modeling Report
Gannett Fleming, December 2001



APPENDIX B
STORMWATER MANAGEMENT DESIGN CRITERIA

APPENDIX B - STORMWATER MANAGEMENT DESIGN CRITERIA

Note: The following Appendix B-1 table presents Region 5 rainfall values. Some portions of the Chester Creek watershed municipalities fall within PennDOT Rainfall Region 4. Municipalities with land area in Region 4 may choose to allow developers in this region to utilize these rainfall values where appropriate. Municipal ordinances may also allow rainfall data specific to an individual municipality to be incorporated if the data is proven statistically valid. However, since the standardized use of a single Region's rainfall values is easier to administer, we recommend municipalities utilize the Region 5 values in their ordinances.]

| TABLE B-1 Design Storm Rainfall Amount For 24-Hour Storm Event (inches) | |
|--|-----------------------------------|
| RETURN FREQUENCY (Years) | PRECIPITATION (Inches) |
| 1 | 2.8 |
| 2 | 3.4 |
| 5 | 4.1 |
| 10 | 5.0 |
| 25 | 6.0 |
| 50 | 7.2 |
| 100 | 8.5 |

Source: Pennsylvania Department of Transportation "Storm Intensity-Duration-Frequency Charts – Rainfall Region 5," May 1986

TABLE B-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 (townhouses) | | 77 | 85 | 90 | 92 |
| 1/4 acre | | 61 | 75 | 83 | 87 |
| 1/3 acre | | 57 | 72 | 81 | 86 |
| 1/2 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 |

TABLE B-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 |
| 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 |
| 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 |

TABLE B-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 |
| 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 |

SOURCE: NRCS, June 1986. *Urban Hydrology for Small Watersheds*, Technical Release 55

| TABLE B-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: | |
| Asphalt | 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 |

SOURCE: Ven Te Chow, 1964. *Handbook of Applied Hydrology*, McGraw-Hill Book Co.

| TABLE B-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 |

SOURCE: L. W. Mays, 2001. *Stormwater Collection Systems Design Handbook*, McGraw-Hill Book Co.

FIGURE B-1

STANDARD NRCS 24-HOUR, TYPE II RAINFALL DISTRIBUTION
CUMULATIVE RAINFALL CURVE

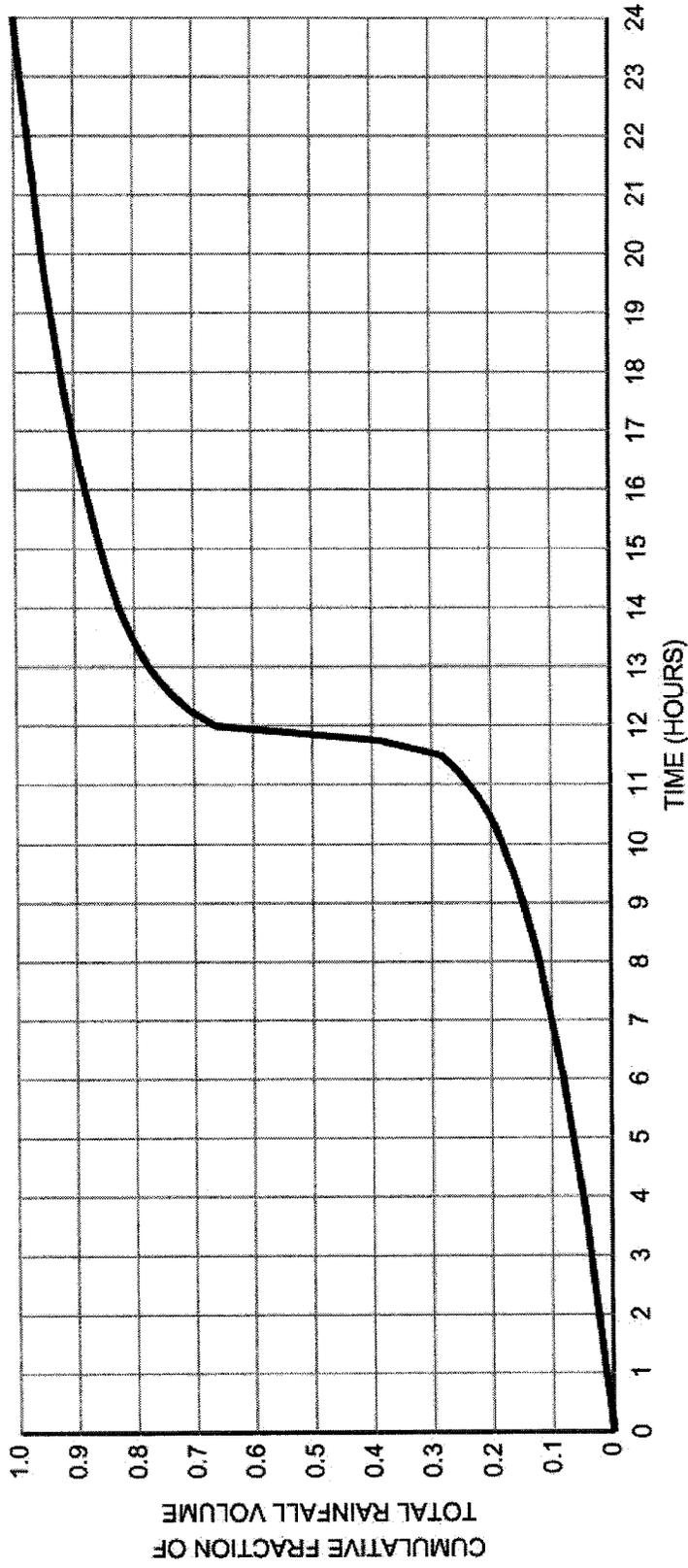


FIGURE B-2

Penn DOT RAINFALL CURVES FOR RAINFALL REGION 5

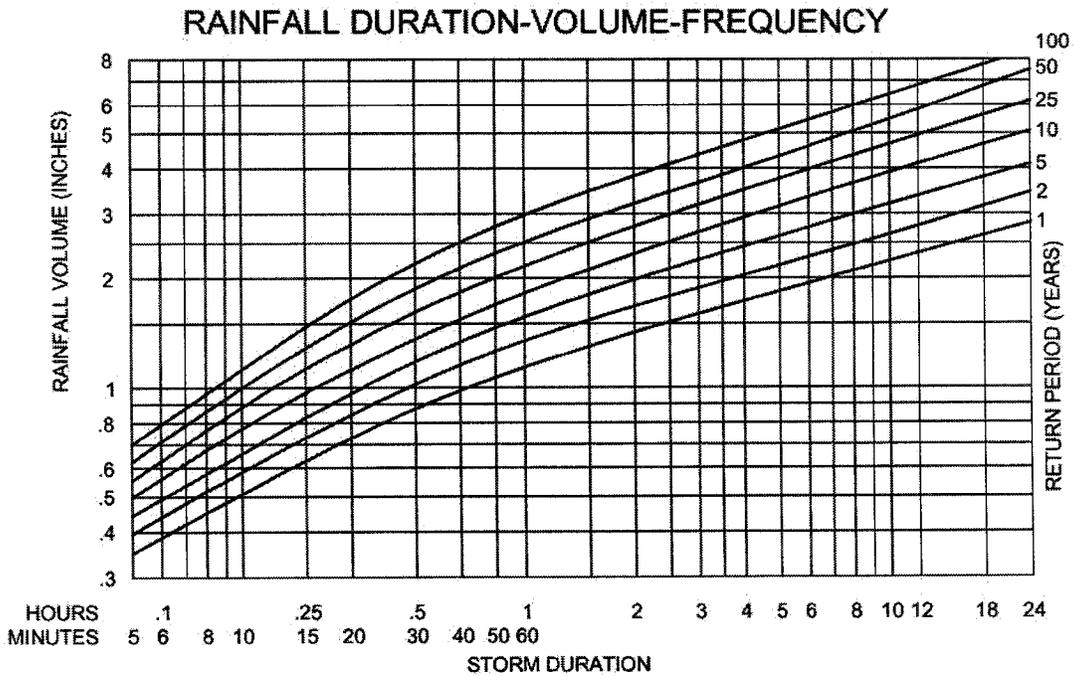
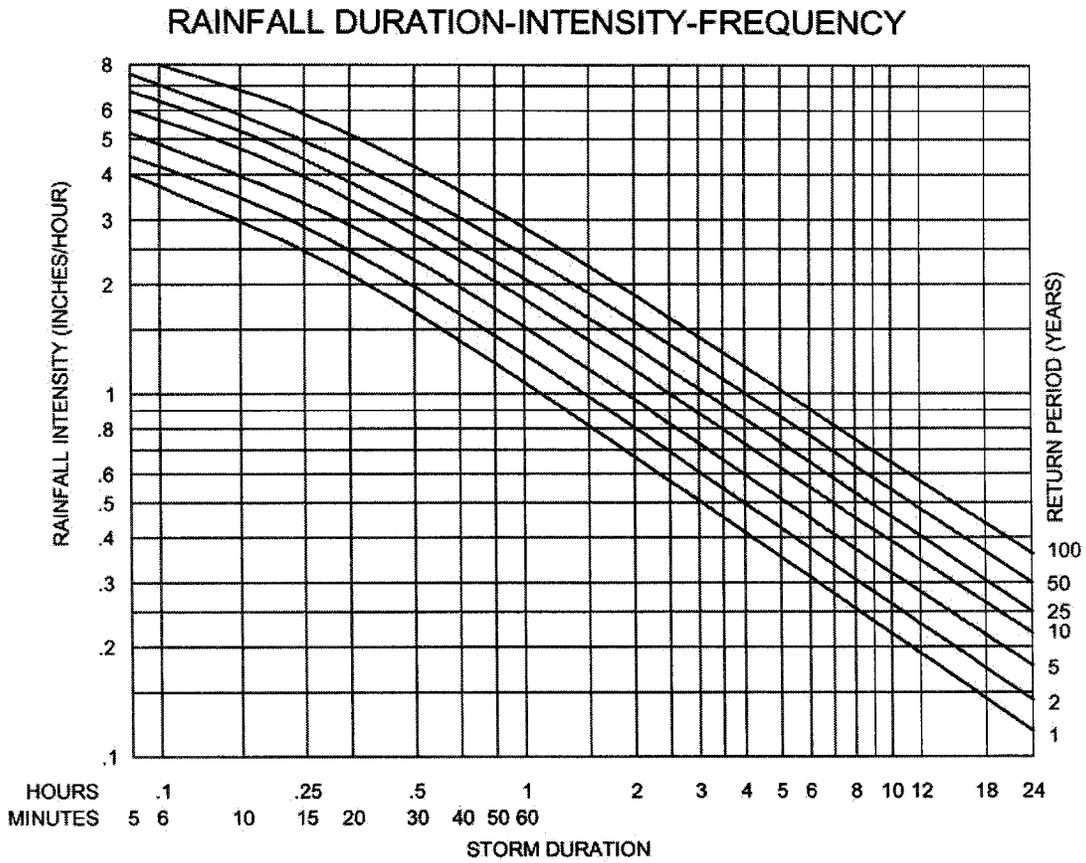
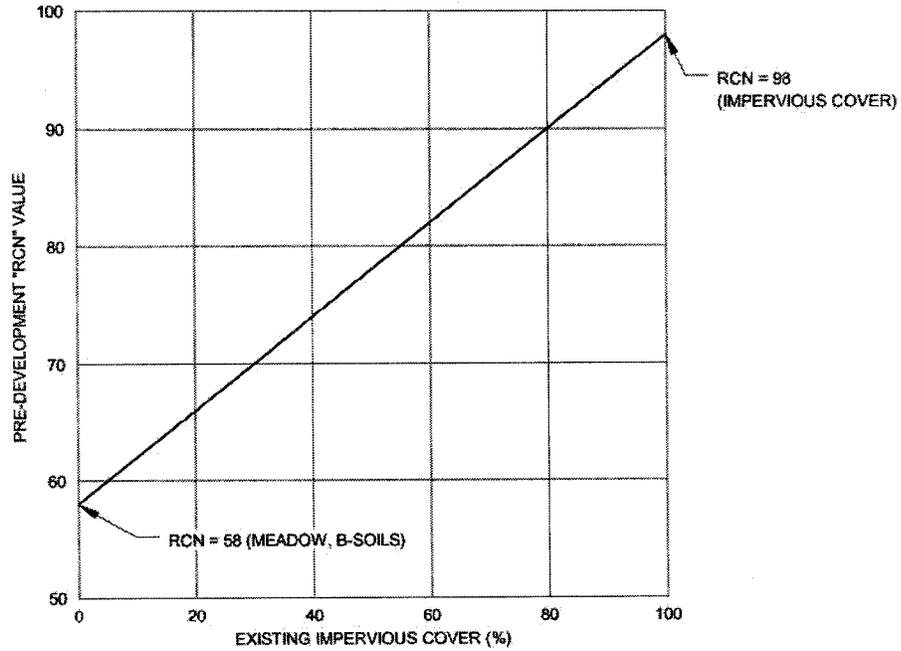


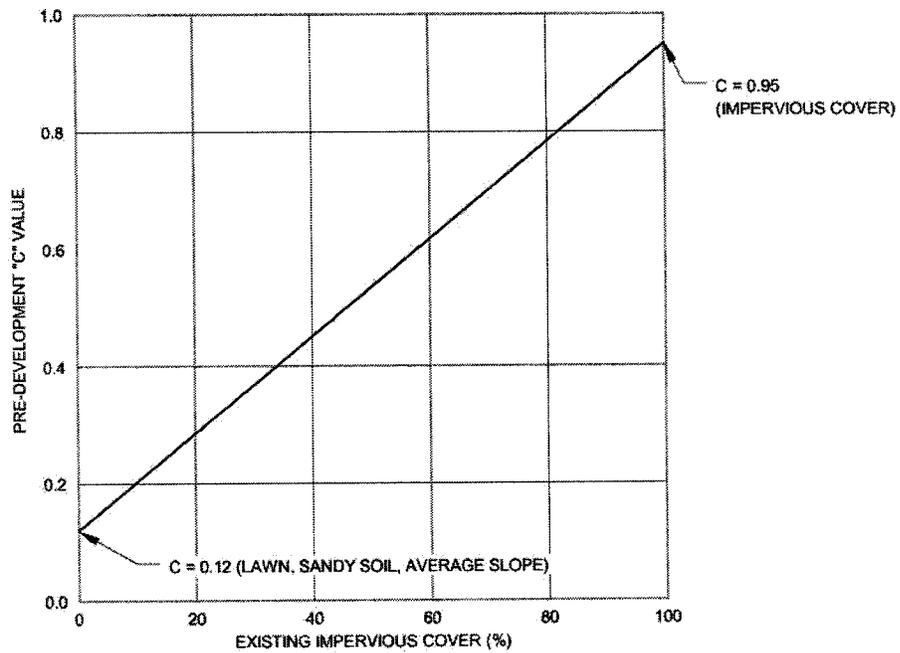
FIGURE B-3

REDEVELOPMENT PROJECTS RUNOFF CRITERIA ADJUSTMENT FOR PRE-DEVELOPMENT CONDITIONS

NRCS METHODOLOGY RCN ADJUSTMENT



RATIONAL FORMULA C ADJUSTMENT



APPENDIX C
RIPARIAN BUFFER TECHNICAL REFERENCE GUIDE

APPENDIX C - RIPARIAN BUFFER TECHNICAL REFERENCE GUIDE

The following references will provide helpful guidance in establishing and restoring riparian buffers. These references have been selected based on their applicability to watersheds in the southeastern Pennsylvania area, including specific information related to appropriate riparian vegetation within the Piedmont Province, which is the primary physiographic province for the Chester Creek watershed. These references also include guides for establishing a riparian buffer program and include additional sources of information related to riparian corridor restoration. There are numerous publications related to riparian corridor and riparian buffer measures available through local, county, state, and federal agencies such as DEP, EPA, and USDA. In addition, the County Conservation Districts are a valuable source of local data and should also be consulted for further information.

Alliance for the Chesapeake Bay, Pennsylvania Department of Environmental Protection, September 2000. *Forest Buffer Toolkit*, Stream ReLeaf Program.

Penn State College of Agricultural Sciences, 1996. *Establishing Vegetative Buffer Strips Along Streams to Improve Water Quality*. Publication # AGRS-67.

Fike, Jean, June 1999. *Terrestrial & Palustrine Plant Communities of Pennsylvania*, Pennsylvania Natural Diversity Inventory, The Nature Conservancy, Western Pennsylvania Conservancy, and Pennsylvania Department of Conservation and Natural Resources.

Pennsylvania Association of Conservation Districts, Inc., Keystone Chapter, Soil and Water Conservation Society, Pennsylvania Department of Environmental Protection, Natural Resources Conservation Service, 1998. *Pennsylvania Handbook of Best Management Practices for Developing Areas*. Prepared by CH2MHill.

Palone, R. S. and A. H. Todd (eds), 1997. *Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers*. Chesapeake Bay Program and Northeastern Area State and Private Forestry. Natural Resources Conservation Service Cooperative State Research Education and Extension Services.

The Federal Interagency Stream Restoration Working Group (FISRWG, 10/1998). *Stream Corridor Restoration Principles, Processes, and Practices*. GPO Item No. 0120-A; SuDocs No. A57.6/2:EN3/PT.653. ISBN-0-934213-59-3. Published October 1998. Revised August 2000.

APPENDIX D
SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE

APPENDIX D - 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 stormwater management and erosion and sedimentation control plan and related data as submitted herewith in accordance with the _____ Township/Borough/City stormwater 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 _____

Applicant's interest in subdivision or development _____
(If other than property owner, give owner's name and address.)

3. Name of property owner _____ Telephone No. _____

Address _____

City _____ Zip Code _____

4. Name of engineer or surveyor _____

Telephone No. _____

Address _____

City _____ Zip Code _____

5. 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 _____

6. Lineal feet of new road proposed _____ l.f.

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

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

8. Stormwater

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

b. Design storm utilized for on-site conveyance systems

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

d. Number of subareas from Plate _____ of the Chester Creek Stormwater Management Plan _____

e. Type of proposed runoff control _____

f. Does the proposed stormwater control criteria meet the requirement/guidelines of the stormwater ordinance? _____

g. Does the plan meet the requirements of Article IV of the stormwater ordinance?

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

i. What hydrologic method was used in the stormwater computations?

j. Was a hydraulic routing through the stormwater control structure submitted?

k. Is a construction schedule or staging attached? _____

l. Is a recommended maintenance program attached? _____

9. Has an erosion and sediment pollution control (E & S) plan been submitted to the County Conservation District?

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

10. 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 _____ s.f.

e. Total acreage of wetland disturbed _____ s.f.

f. Supporting documentation

11. 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 stormwater management at development site

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:

COMMONWEALTH OF PENNSYLVANIA, COUNTY OF _____

On this the _____ day of _____, 20____, before me, the undersigned officer, personally appeared _____ who being duly sworn, according to law, deposes and says that _____, owners of the property described in this application, prepared this application 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

_____ Municipal official submission receipt

Date complete application received _____ Plan number _____

Fees _____ Date fees paid _____ Received by _____

Official submission receipt date

Received by _____

FEE SCHEDULE

_____ Township/Borough/City

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 3,500-43,560 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. Stormwater 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 305 of the stormwater ordinance. A new fee shall be submitted with each revision in accordance with this schedule.

APPENDIX E
STANDARD STORMWATER FACILITIES
MAINTENANCE AND MONITORING AGREEMENT

APPENDIX E - STANDARD STORMWATER FACILITIES MAINTENANCE AND MONITORING AGREEMENT

STANDARD STORMWATER FACILITIES MAINTENANCE AND MONITORING AGREEMENT

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

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of _____ County, Pennsylvania, Deed Book _____ at Page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the Subdivision/Land Development Stormwater Management Plan (hereinafter "Plan") for the _____ Subdivision which is expressly made a part hereof, as approved or to be approved by the Municipality, provides for detention or retention of stormwater within the confines of the Property; and

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

WHEREAS, the Municipality requires, through the implementation of the _____ Stormwater Management Plan, that stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, his successors, and assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, his successors, and assigns in accordance with the terms, conditions, and specifications identified in the Plan.
2. The Landowner, his successors, and assigns shall maintain the stormwater management facilities in good working condition, acceptable to the Municipality so that they are performing their design functions.

3. The Landowner, his successors, and assigns hereby grant permission to the Municipality, its authorized agents and employees, upon presentation of proper identification, to enter upon the Property at reasonable times and to inspect the stormwater management facilities whenever the 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 five (5) years after the construction of the stormwater facilities,
 - Once every three (3) 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 borne by the Landowner and payable to the Municipality.
5. The Landowner 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 that the Landowner, his successors, and assigns fail to maintain the stormwater management facilities in good working condition acceptable to the Municipality, the Municipality may enter upon the Property and take such necessary and prudent action to maintain said stormwater management facilities and to charge the costs of the maintenance and/or repairs to the Landowner, his successors, and assigns. This 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 stormwater management facilities including sediment removal as outlined on the approved schedule and/or subdivision/land management plan.
8. In the event that 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 thirty (30) days of receipt of invoice thereof, for all costs incurred by the Municipality

hereunder. If not paid within said 30-day period, the Municipality may enter a lien against the Property in the amount of such costs, or may proceed to recover its 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 its agents and employees against any and all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against the Municipality for the construction, presence, existence, or maintenance of the stormwater management facilities by the Landowner, his successors, and assigns.
10. In the event that a claim is asserted against the Municipality, its 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, its agents, or employees shall be allowed, the Landowner, his successors, and assigns shall pay all costs and expenses in connection therewith.
11. In the event 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 five (5) days of the activity. The Landowner shall reimburse the Municipality for its costs.

This Agreement shall be recorded among the land records of _____ County, Pennsylvania and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs, and any other successors in interest, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL)

For the Municipality:

(SEAL)

For the Landowner:

ATTEST:

_____ [City, Borough, Township]

County of _____, Pennsylvania

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

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

NOTARY PUBLIC (SEAL)

ATTACHMENT D
NPDES PHASE II
SUMMARY

EPA's PHASE II NPDES PERMIT PROGRAM

Introduction

The EPA requires, under the Phase II Regulation (adopted on October 28, 1999) of the National Pollutant Discharge Elimination System (NPDES), that owners and operators of small, urbanized municipal separate storm sewer system (MS4's) reduce the pollutant loading from regulated systems to the "maximum extent practicable" in order to protect waters of the United States. EPA has required that this be accomplished through a permitting program established by the states. The affected municipalities are required to obtain a permit from the state by March 10, 2003. Municipalities required to implement the MS4 program must address the following minimum measures:

- Public Education and Outreach
- Public Involvement/ Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Storm Water Management in New Development & Re-development
- Pollution Prevention/Good House Keeping for Municipal Operations

At a minimum, municipal entities regulated under MS4 *must*:

- Specify Best Management Practices (BMPs) and implement them to the "maximum extent practicable"
- Identify measurable goals for control measures
- Develop implementation schedule of activities or frequency of activities, and
- Define the entity responsible for implementation

The affected municipalities must, if they already do not have one in place, develop a storm water management program. If a municipality has an established storm water management program and is subject to the provisions of the Phase II Rule, then provisions of the rule must be implemented to satisfy the federal requirements.

BMPs for Six Minimum Control Measures

Best management practices (BMPs) for storm water management are: recognized practices; schedules of activities; prohibited practices; maintenance procedures; and, use of pollution control devices and other means to prevent or reduce the amount of pollutant loading being discharged in storm water runoff, into water bodies of the U.S. The storm water management program must specify BMPs for the following six minimum control measures:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Storm Water Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations

Minimum Control Measure #1 – Public Education and Outreach on Stormwater Impacts

- Municipality **must** implement a public education program, including distributing educational materials that:
 - Describe impacts of storm water
 - Describe steps to reduce storm water pollution
- Municipality **should** inform households and individuals about steps they can take such as:
 - Proper septic system maintenance
 - Limiting use and runoff of garden chemicals
 - Local stream restoration
 - Storm drain stenciling
 - Stream bank protection
- Municipality **should** direct information to targeted groups:
 - Commercial, industrial, and institutional entities likely to cause storm water impacts. Examples include:
 - Restaurants (potential grease clogging/blocking of storm drains)
 - Auto service facilities
- Municipalities **should** address viewpoints and concerns of:
 - Minorities
 - Disadvantaged
 - Development/construction
 - Business

- Education
- Government entities
- Industry

Minimum Control Measure #2 – Public Involvement/Participation

- Municipality **must** comply with state and local public notice requirements (adoption of storm water management program, policies, ordinances, etc.)
- Municipality **should** involve the public in developing, implementing and reviewing storm water management program:
 - Reach out to and engage all economic and ethnic groups
 - Consider establishing a citizen group to participate in decision-making
 - Work with volunteers

Minimum Control Measure #3 – Illicit Discharge Detection and Elimination

- Municipality **must** develop storm water system maps:
 - Show location of major pipeline, outfalls, and topography
 - Show areas of concentrated activities likely to be a source of storm water pollutants
- Municipality **must** effectively prohibit illicit discharges into MS4 system:
 - Use ordinances, orders, etc.
 - Implement enforcement procedures/actions
- Municipality **must** implement a plan to detect illicit discharges and illegal dumping
- Municipality **must** inform public employees, businesses, and citizens of hazards arising from illegal discharges and improper disposal of waste

Minimum Control Measure #4 – Construction Site Storm Water Runoff Control

- Municipality **must** develop, implement, and enforce a program to reduce nonpoint storm water runoff from construction activities to regulated MS4s:
 - Control construction sites greater than or equal to one acre
 - Use an ordinance that controls erosion and sedimentation
 - Control construction site waste materials (discarded building material, concrete washout, sanitary waste)
- Municipality's program **must** include:
 - Requirement for construction site owners or operators to implement BMPs
 - Pre-construction review of site plans

- Procedures to receive and consider public input
- Regular inspections during construction
- Penalties to ensure compliance

Minimum Control Measure #5 – Post-Construction Storm Water Management in New Development and Redevelopment

In order to maintain pre-development runoff conditions:

- Municipality **must** develop, implement, and enforce a program to address storm water runoff from new development and redevelopment projects:
 - Land disturbance sites greater than or equal to one acre and discharge to regulated MS4
 - Project sites that discharge to MS4
- Municipality's program **must** include:
 - Site-appropriate, cost-effective structural and non-structural BMPs
 - Ensure long-term ownership and maintenance of BMP connected to regulated MS4s
 - Ensure that controls are in place that prevent or minimize water quality impacts
- Municipality's program **should** include structural and non-structural BMPs
 - Locally-based watershed planning
 - Preventative measures to prevent or minimize water quality impacts

EPA **recommends** (for Minimum Control Measure #5):

- BMPs that minimize water quality impacts
- BMPs that maintain predevelopment runoff conditions
- Non-structural BMPs that emphasize management and source controls such as
 - Policies and ordinances that protect natural resources and prevent runoff
 - Limiting growth to identified areas
 - Protecting sensitive areas such as wetlands
 - Minimizing the amount of impervious surfaces
 - Maintaining open space
 - Minimizing disturbance of soils and vegetation
- Structural BMPs which may include:
 - Storage facilities (retention/detention ponds)
 - Filtration facilities (grassed swales, sand filters, filter strips)
 - Infiltration facilities (recharge basins, porous pavement)

Minimum Control Measure #6 – Pollution Prevention/Good Housekeeping for Municipal Operations

A municipality must develop and implement a cost-effective infrastructure, operations, and maintenance (O&M) program to prevent or reduce pollutant runoff from municipal operations.

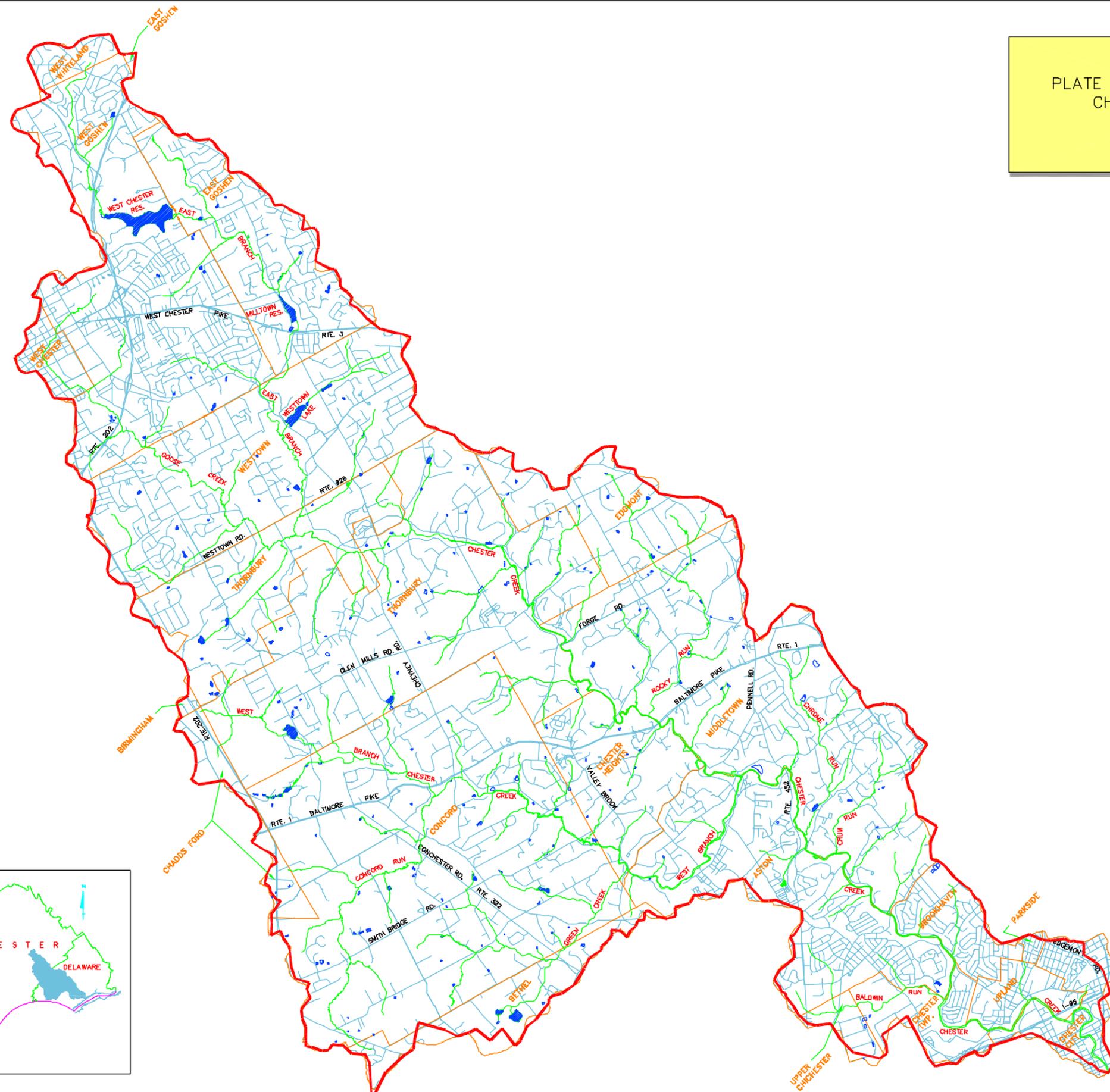
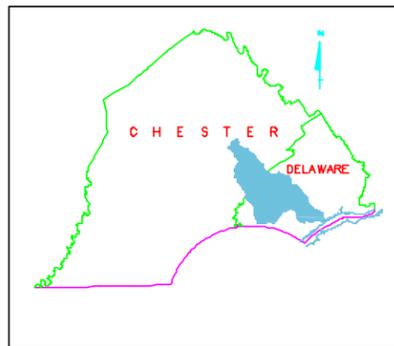
- Municipality *must* provide employee training:
 - Park and open space maintenance
 - Fleet maintenance
 - Planning
 - Building management
 - Storm water system maintenance

EPA *recommends* (for Minimum Control Measure #6) that, at a minimum, Municipality *consider* the following as components of the Municipality's program:

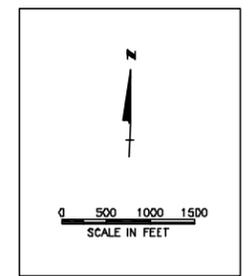
- Maintenance activity schedules and inspections to reduce floatable and other pollutants
- Controls for reducing pollutants from streets, parking lots, yards, and solid waste operations
- Proper disposal of waste removed from storm drains
- Assess water quality impact of new flood control projects
- Maximize current activities before adding new ones

PLATE 1: DETAILED WATERSHED MAP
 CHESTER CREEK WATERSHED
 ACT 167 STUDY

June, 2002

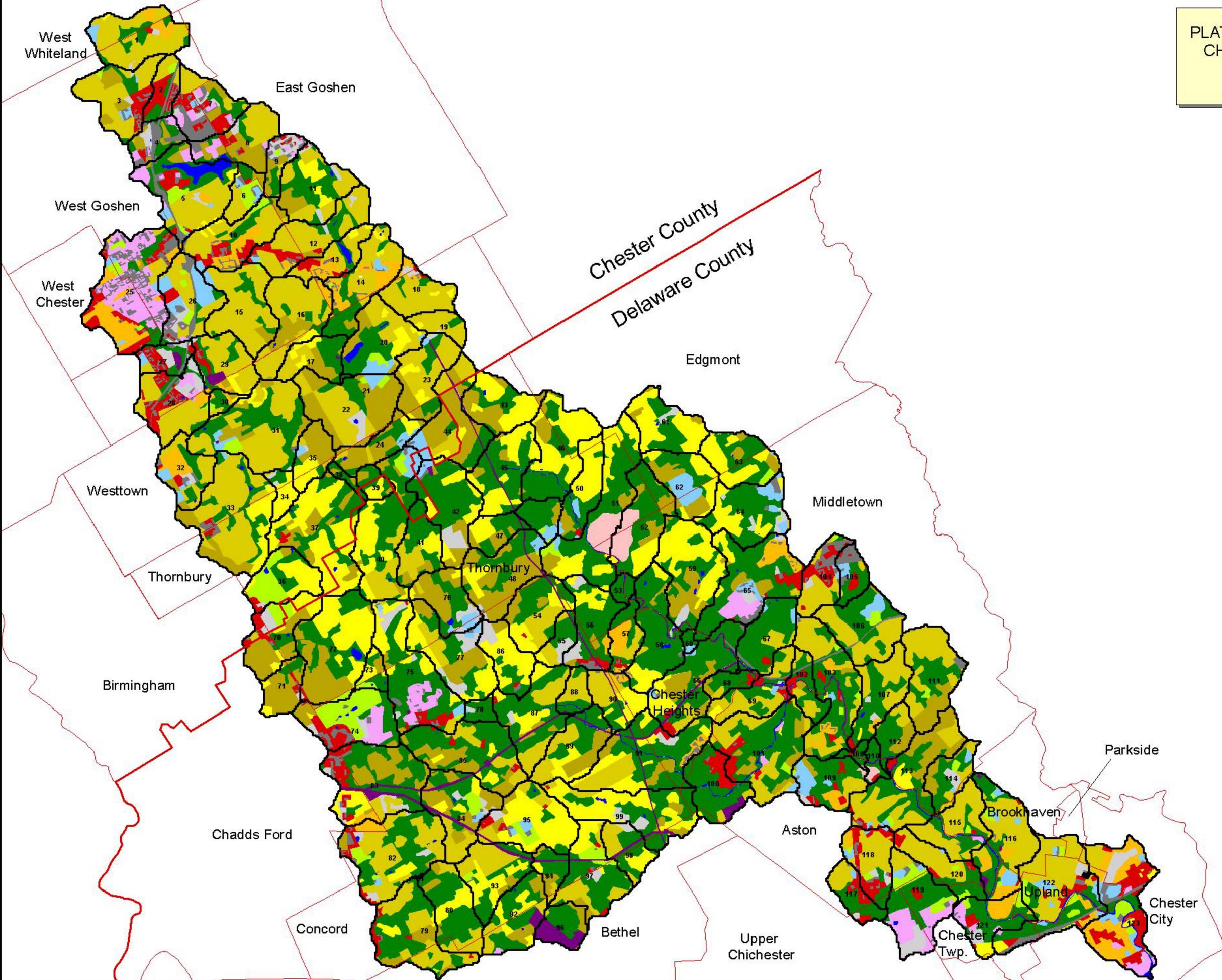


| LEGEND | |
|--------|--------------------|
| | Road |
| | Stream |
| | Municipal Boundary |
| | Watershed Boundary |



Sources: Chester and Delaware County GIS Information

PLATE 2: EXISTING LAND USE MAP
 CHESTER CREEK WATERSHED
 ACT 167 STUDY
 June, 2002

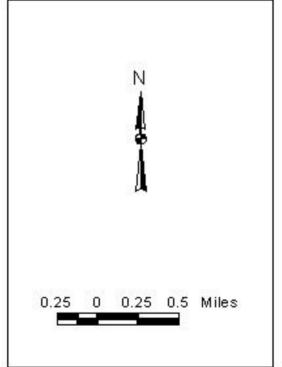


LEGEND

- County Boundary
- Municipal Boundary
- Subarea Boundaries
(Note: Subarea boundary delineation described in Section VII.A.)

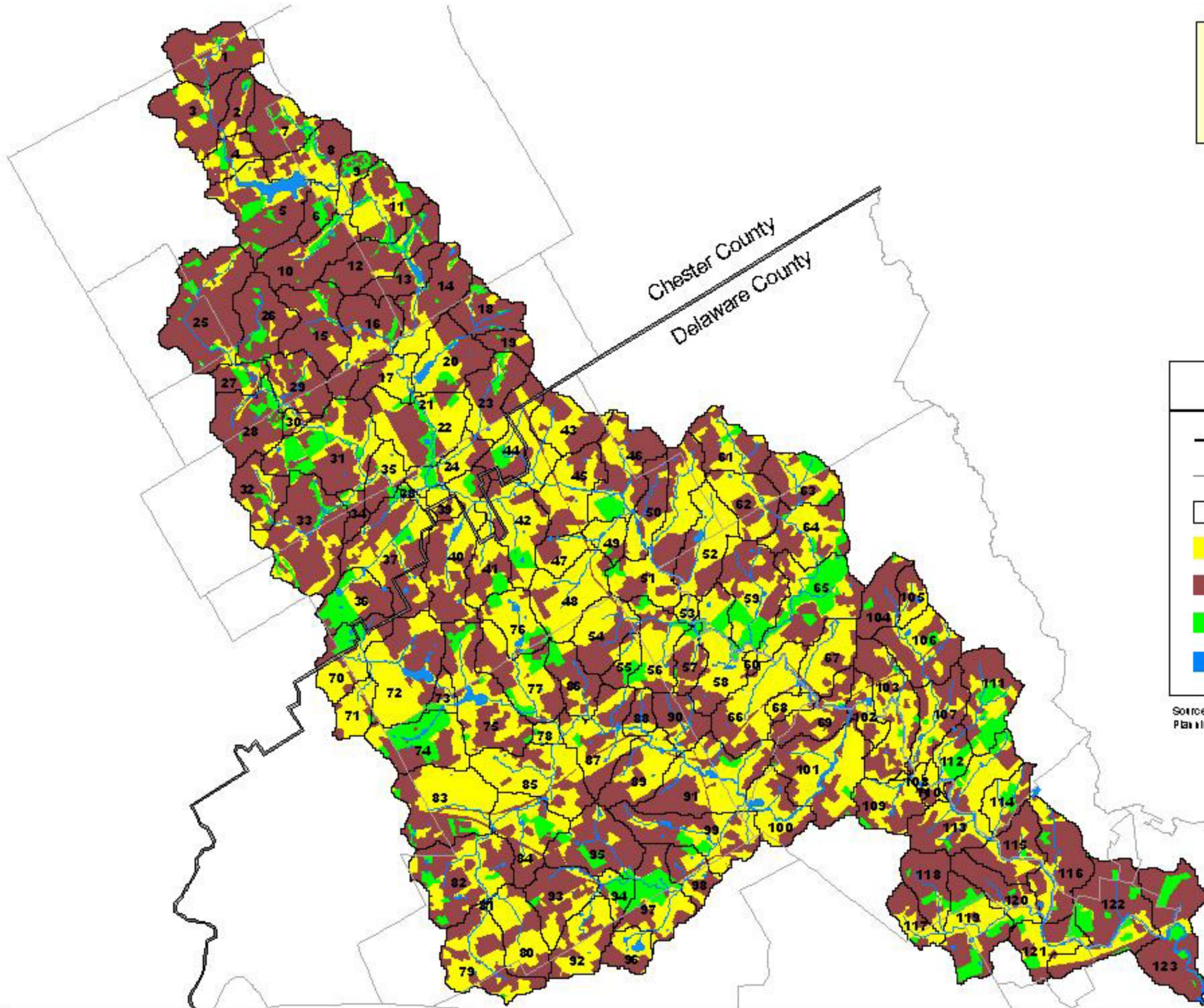
Landuse

- Agricultural
- Commercial
- High Density Residential
- Industrial
- Institutional
- Low Density Residential
- Medium Density Residential
- Military
- Mining
- Open Space
- Recreation
- Transportation
- Utility
- Water
- Wooded



Source: Delaware Valley Regional Planning Commission, 1995 as modified by Delaware County Planning Department and Chester County Planning Commission

PLATE 3: FUTURE LAND USE
CHESTER CREEK WATERSHED
ACT 167 STUDY
June, 2002



Chester County
Delaware County

LEGEND

- County Boundary
- Municipal Boundary
- # Subarea Boundaries
- Areas of Future Growth
- Fully Developed
- Open Space/Recreational Areas
- Water

Source: Delaware County Planning Department, Chester County Planning Commission compilation of current municipal zoning maps

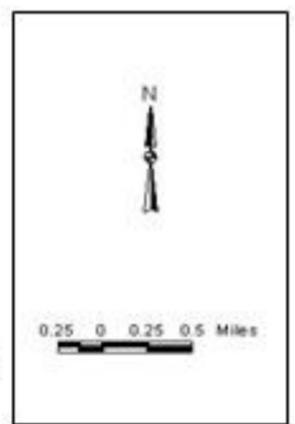
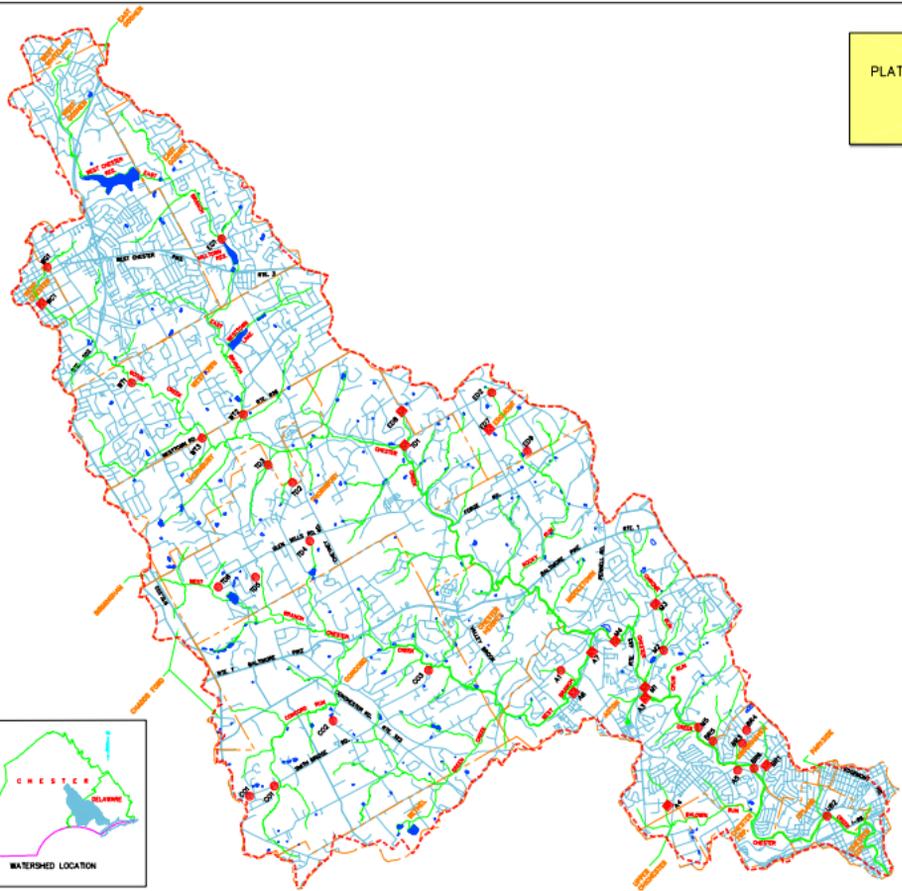


PLATE 4: STORMWATER PROBLEM AREAS
CHESTER CREEK WATERSHED
ACT 167 STUDY



LEGEND

- Road
- Stream
- Municipal Boundary
- Watershed Boundary
- Flooding Problem Location
- Flooding/Erosion Problem Location
- E01 Problem Area Identifier *

* Note: See Table 5 for descriptions of Problem Area Identifiers

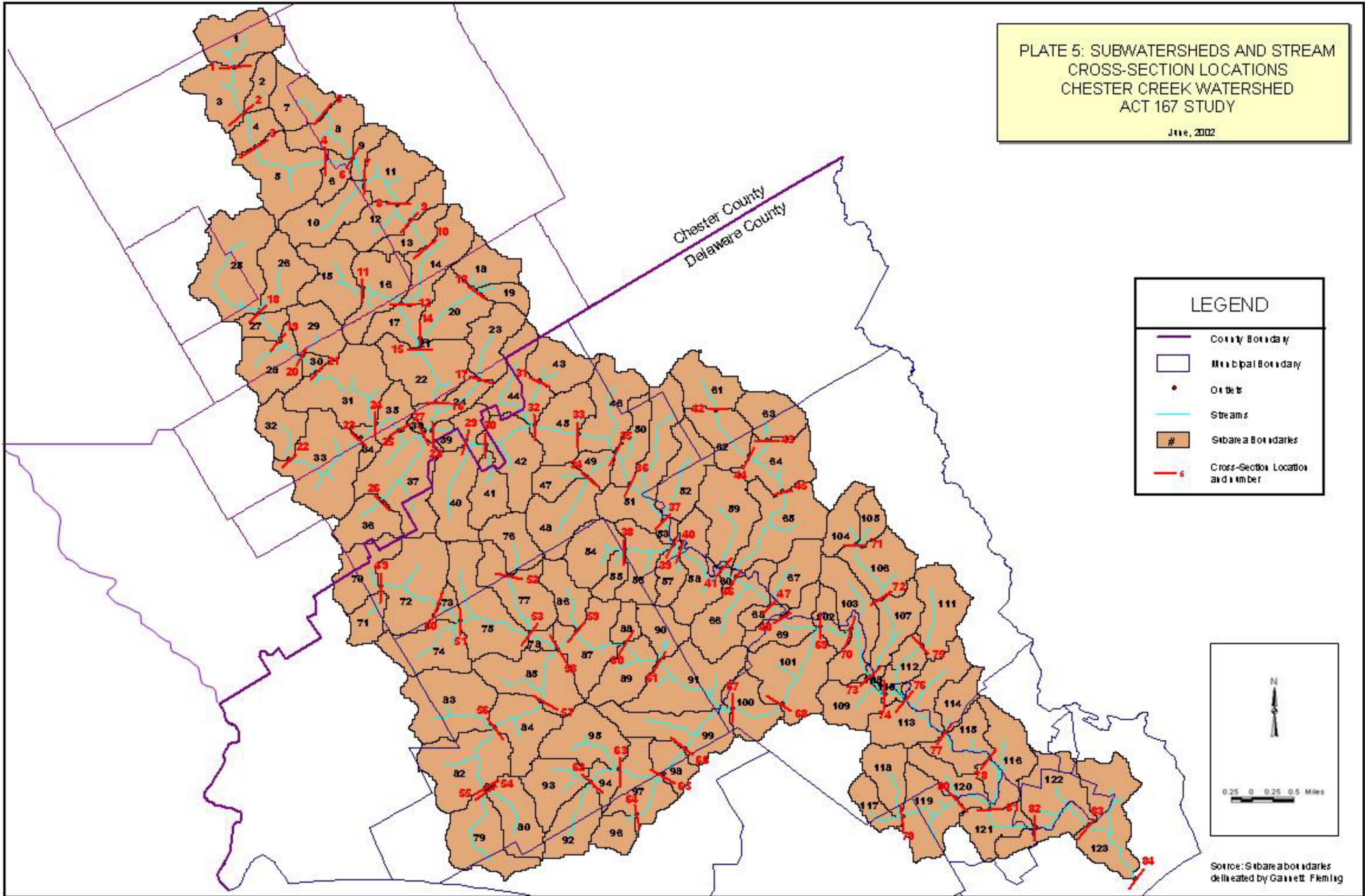


SELEWAREAS.DWG

Sources: Municipal Survey Data as compiled by Connett Fleming, Inc. 1999

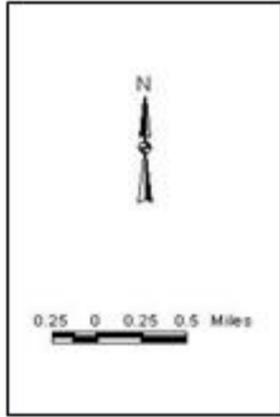
PLATE 5: SUBWATERSHEDS AND STREAM
CROSS-SECTION LOCATIONS
CHESTER CREEK WATERSHED
ACT 167 STUDY

June, 2002



LEGEND

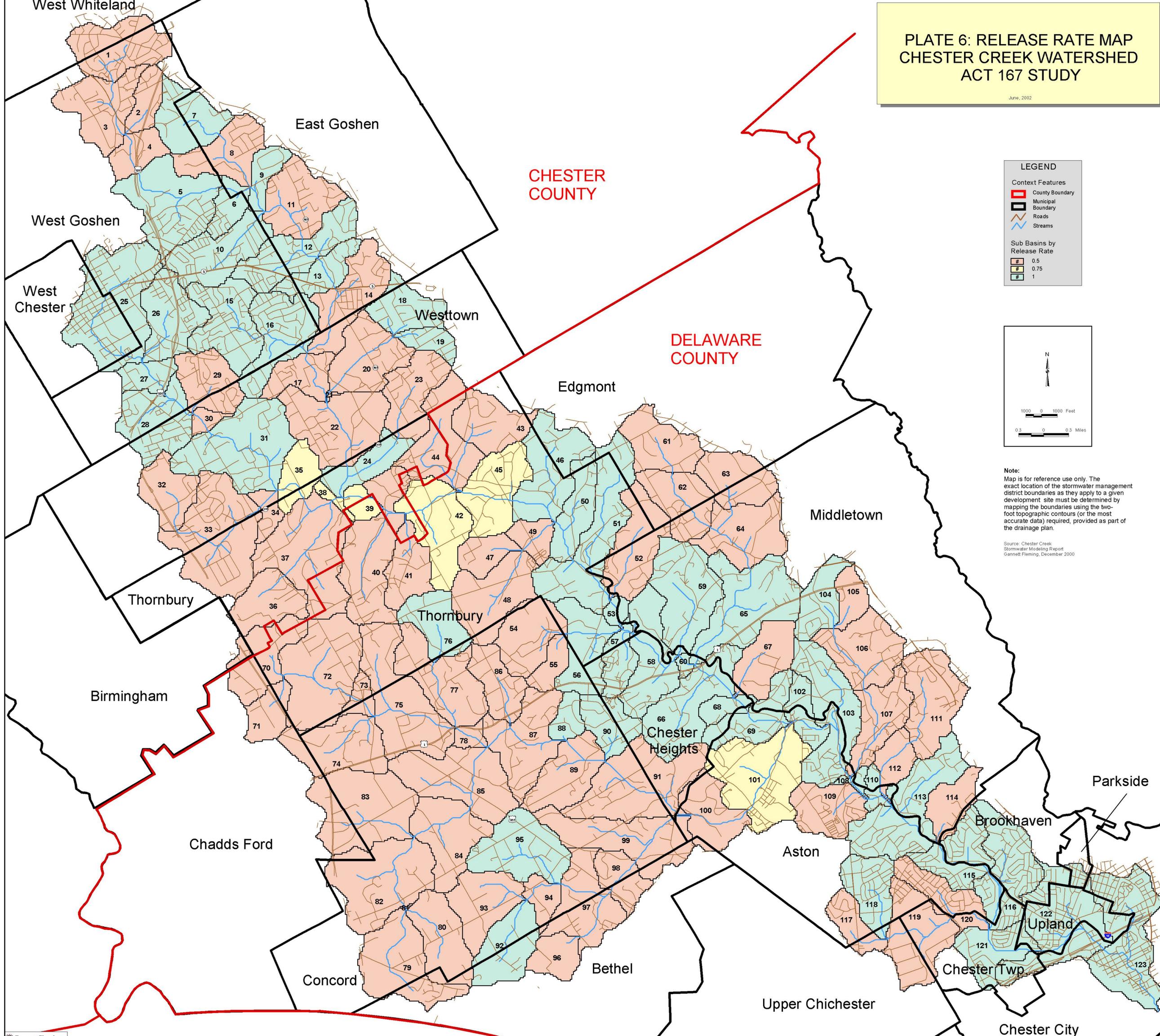
-  County Boundary
-  Municipal Boundary
-  Outlet
-  Streams
-  Subarea Boundaries
-  Cross-Section Location and Number



Source: Subarea boundaries delineated by Garrett Fleming

PLATE 6: RELEASE RATE MAP
CHESTER CREEK WATERSHED
ACT 167 STUDY

June, 2002



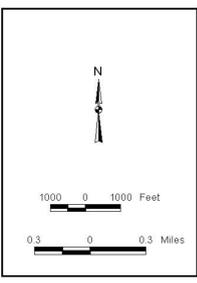
LEGEND

Context Features

- County Boundary
- Municipal Boundary
- Roads
- ~~~~~ Streams

Sub Basins by Release Rate

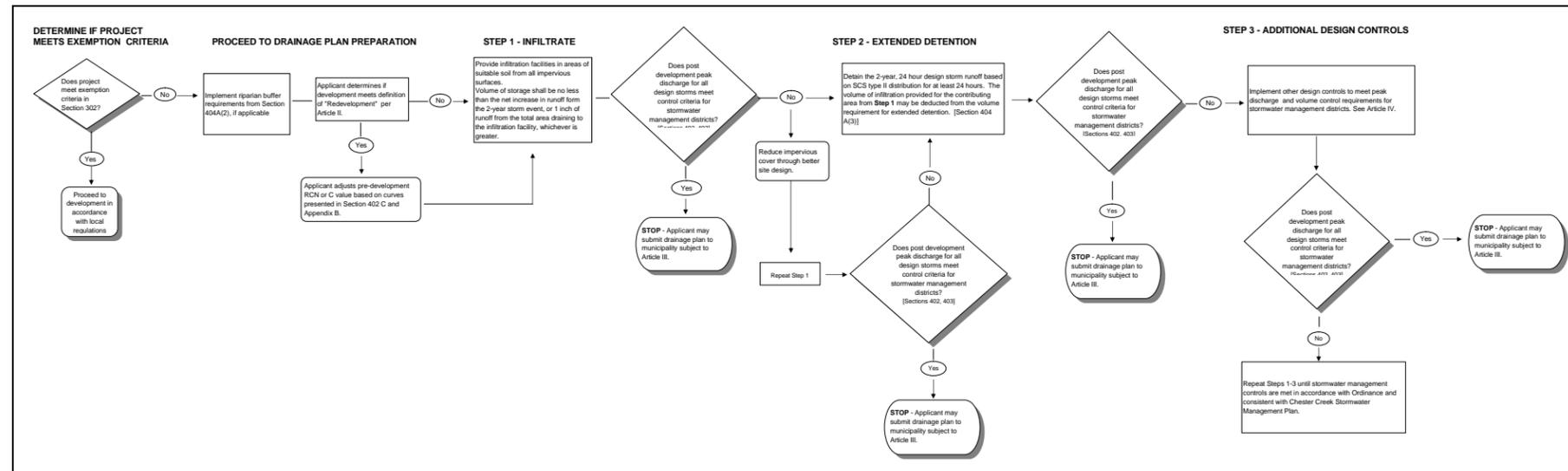
- 0.5
- 0.75
- 1



Note:
Map is for reference use only. The exact location of the stormwater management district boundaries as they apply to a given development site must be determined by mapping the boundaries using the two-foot topographic contours (or the most accurate data) required, provided as part of the drainage plan.

Source: Chester Creek Stormwater Modeling Report
Gannett Fleming, December 2000

**ACT 167 STORMWATER MANAGEMENT PLAN
CHESTER CREEK WATERSHED
FIGURE 4
Water Quality and Quantity Control Drainage Plan Preparation Procedure**



ARTICLE IV - STORMWATER MANAGEMENT
FIGURE 4-1
Water Quality and Quantity Control Drainage Plan Preparation Procedure

