BUSHKILL CREEK,
CATASAUQUA CREEK,
COPLAY CREEK,
FRY'S RUN,
HOKENDAUQUA CREEK,
JORDAN CREEK,
MARTINS/JACOBY CREEKS,
MONOCACY CREEK,
NANCY RUN,
SAUCON CREEK,
TROUT/BERTSCH CREEKS,
DELAWARE RIVER SUB-BASINS AND
LEHIGH RIVER SUB-BASINS WATERSHEDS

ACT 167

STORMWATER MANAGEMENT PLAN

WATER QUALITY UPDATE

This is the text prepared by the Lehigh Valley Planning Commission staff on behalf of Lehigh and Northampton counties. It contains revisions, as necessary, based on comments received from the Watershed Plan Advisory Committee, the Municipal Engineers Committee, the Legal Advisory Committee, the affected municipalities, the LVPC, the general public, Lehigh County, Northampton County and the Department of Environmental Protection.

The Pennsylvania Stormwater Management Grant Assistance Program, administered by the Department of Environmental Protection, financed the preparation of this report. This grant program provides for seventy-five percent (75%) State funding with a twenty-five percent (25%) local match provided by Lehigh and Northampton counties.

Final Plan April 2006
Adopted by Lehigh County June 14, 2006
Adopted by Northampton County June 15, 2006
Approved by DEP October 4, 2006

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**Project Planner
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April 2006

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CHAPTER 1. INTRODUCTION

The Pennsylvania Stormwater Management Act, Act 167 of 1978, provides the framework for improved management of the storm runoff impacts associated with the development of land. The purposes of the Act are to encourage the sound planning and management of storm runoff, to coordinate the stormwater management efforts within each watershed and to encourage the local administration and management of a coordinated stormwater program. The Act also specifies the need to periodically update plans. This guarantees a dynamic system of runoff control sensitive to changing study area characteristics and changing regulatory requirements. This Plan Update is an addendum to each watershed's original Plan that adds water quality criteria to the model ordinance. Table 1 lists each of the watersheds covered by this update and the date of the original Plan.

TABLE 1
ORIGINAL ACT 167 WATERSHED PLAN DATES

Watershed	County	Plan Date
Monocacy Creek	Lehigh and Northampton	March 1989
Nancy Run	Northampton	March 1989
Saucon Creek	Lehigh and Northampton	April 1991
Bushkill Creek	Northampton	May 1992
Jordan Creek	Lehigh	May 1992
Coplay Creek & Lehigh River Sub-basin 2	Lehigh	November 1994
Trout/Bertsch Creeks & Lehigh River Sub-basin 1	Lehigh and Northampton	April 1995
Martins/Jacoby Creeks & Delaware River Sub-basin 1	Northampton	February 1996
Catasauqua Creek & Lehigh River Sub-basin 4	Lehigh and Northampton	February 1997
Hokendauqua Creek & Lehigh River Sub-basin 3	Northampton	September 1997
Delaware River Sub-basin 2 & Lehigh River Sub-basin 5 (Fry's Run Study Area)	Northampton	February 1999

In this plan, the water quality criteria have been established using a "standard practice of care" developed as part of the Little Lehigh Creek Watershed Water Quality Plan Update by the Lehigh Valley Planning Commission. This standard practice of care provides a technical basis for calculating, designing, and implementing Best Management Practices (BMPs) that can be used to meet State Water Quality Requirements including, but not limited to, infiltration.

The Release Rate criteria were developed as part of each watershed's original plan from runoff models using watershed parameters such as existing land use, future land use (based on zoning), the existing physical characteristics of the study area and watershed runoff timing relationships. Computer models of the peak flows in each watershed have been calibrated to reflect actual gage data, where available.

Approximately 36% of Lehigh and Northampton counties are underlain by carbonate geology, as shown on Figure 1. Table 2 lists the municipalities that are underlain, at least in part, by carbonate geology. The use of infiltration BMPs is a particular concern in areas of carbonate geology because there may be an increased potential for groundwater contamination and sinkhole formation. During the development of the Little Lehigh Creek Watershed Water Quality Update, the LVPC consultant, Cahill Associates, developed the *Technical Best Management Practice Manual & Infiltration Feasibility Report: Infiltration of Stormwater in Areas Underlain by Carbonate Bedrock within the Little Lehigh Creek Watershed*, November 2002 to identify engineering standards and practices required to minimize these concerns. The LVPC incorporated the concepts in the manual into the development of this watershed stormwater management Plan Update.

TABLE 2
MUNICIPALITIES UNDERLAIN BY CARBONATE GEOLOGY

Lehigh County	**Northampton County, cont.**
Allentown City	Easton City
Bethlehem City	Forks Township
Catasauqua Borough	Freemansburg Borough
Coplay Borough	Glendon Borough
Fountain Hill Borough	Hanover Township
Hanover Township	Hellertown Borough
Lower Milford Township	Lower Mount Bethel Township
North Whitehall Township	Lower Nazareth Township
Salisbury Township	Lower Saucon Township
South Whitehall Township	Moore Township
Upper Macungie Township	Nazareth Borough
Upper Milford Township	North Catasauqua Borough
Upper Saucon Township	Northampton Borough
Weisenberg Township	Palmer Township
Whitehall Township	Plainfield Township
	Portland Borough
Northampton County	Stockertown Borough
Allen Township	Tatamy Borough
Bath Borough	Upper Mount Bethel Township
Bethlehem City	Upper Nazareth Township
Bethlehem Township	West Easton Borough
Bushkill Township	Williams Township
East Allen Township	Wilson Borough

The strategy for water quality control has also been shaped by two new state and federal initiatives. The first is the Comprehensive Stormwater Management Policy dated September 28, 2002 developed by the Pennsylvania Department of Environmental Protection (DEP). The Policy emphasizes the reduction of stormwater runoff generated by development and other activities by encouraging the minimization of impervious cover and the use of low impact development designs. Additionally, the Policy encourages the use of innovative stormwater BMPs that provide infiltration, water quality treatment and otherwise more effectively manage the volume and rate of stormwater discharges. The Policy supports the fulfillment of the State's

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(INSERT MAP 1 HERE)

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obligation under 25 Pa. Code Chapter 93.4a to protect and maintain existing instream water uses and the level of water quality necessary to protect those uses in all surface waters. The Policy recommends that, to meet the regulatory requirements of 25 Pa. Code Chapter 93.4a, developers and engineers first prepare a comparative pre- and post-construction stormwater management analysis. This initial step is required for all sites regardless of the water quality designation of the receiving stream.

Special Protection waters are defined by DEP as Pennsylvania's highest quality surface waters and include Exceptional Value (EV) and High Quality (HQ) waters. There are seven watersheds covered by this Plan Update that are entirely or in part classified as Special Protection waters. They include the Bushkill Creek, Tributaries in the Fry's Run Study Area, Tributaries to the Jordan Creek, Tributaries in the Martins/Jacoby Study Area, Monocacy Creek, Nancy Run and Saucon Creek. In Special Protection watersheds, the Comprehensive Policy states that planners and applicants can ensure that water quality will be protected and maintained by demonstrating that post-construction discharge will not degrade the physical, chemical or biological characteristics of the Special Protection surface water. Further, the Policy states that "infiltration BMPs should be used to the maximum extent possible" in Special Protection watersheds. To the extent that infiltration cannot be used due to site constraints or limitations, water quality treatment BMPs must be used to ensure the protection and maintenance of water quality. Finally, the rate and volume of stormwater runoff must be managed to prevent the physical degradation of receiving waters from effects such as scour and streambank destabilization. A list of the stream designations for the watersheds in Lehigh and Northampton counties can be found in the Pennsylvania Code Title 25 Chapters 93.9d and 93.9e (www.pacode.com).

In view of DEP's Comprehensive Stormwater Policy, this Plan Update provides a methodology to satisfy State Water Quality requirements. Additionally, the planning process had to define site constraints associated with carbonate bedrock and where infiltration would be recommended or not recommended. Finally, the water quality control criteria had to be integrated with the existing Release Rate criteria.

The second new initiative at DEP is the implementation of the National Pollutant Discharge Elimination System (NPDES) Phase II federal stormwater management regulations. These regulations, enacted in December 1999, require municipalities with separate storm sewer systems in urbanized areas to implement a stormwater management program through the adoption of an ordinance that has the following legal provisions: prohibition of non-stormwater discharges, requirements for erosion and sediment controls, requirements to address post-construction runoff from new development and redevelopment, requirements for the operation and maintenance of stormwater BMPs and sanctions to ensure compliance with the above provisions. Since under the Act 167 planning process counties and municipalities develop a stormwater management ordinance that deals with many of these issues, DEP has determined that municipalities will satisfy the NPDES ordinance adoption requirement if they adopt a stormwater management ordinance developed under Act 167 that contains the NPDES related provisions.

To be consistent with the NPDES Phase II regulations, each of the required ordinance provisions, as listed above, was added to the Model Stormwater Ordinance. The DEP model ordinance provisions were used as a guide for these additions. Table 3 lists all of the municipalities in

Lehigh and Northampton counties subject to the NPDES Phase II regulations. Each of these municipalities can meet two of the six NPDES Phase II permit requirements by participating on the Act 167 Watershed Plan Advisory Committees and by adopting and implementing the model ordinance included at the end of the Plan Update. Some of the municipalities listed below have received waivers from the NPDES Phase II regulations.

TABLE 3
MUNICIPALITIES SUBJECT TO NPDES PHASE II

Lehigh County	**Northampton County, cont.**
Alburtis Borough	East Allen Township
Bethlehem City	East Bangor Borough
Catasauqua Borough	Easton City
Coopersburg Borough	Forks Township
Coplay Borough	Freemansburg Borough
Emmaus Borough	Glendon Borough
Fountain Hill Borough	Hanover Township
Hanover Township	Hellertown Borough
Heidelberg Township	Lehigh Township
Lower Macungie Township	Lower Mount Bethel Township
Lower Milford Township	Lower Nazareth Township
Lowhill Township	Lower Saucon Township
Macungie Borough	Moore Township
North Whitehall Township	Nazareth Borough
Salisbury Township	North Catasauqua Borough
Slatington Borough	Northampton Borough
South Whitehall Township	Palmer Township
Upper Macungie Township	Pen Argyl Borough
Upper Milford Township	Plainfield Township
Upper Saucon Township	Roseto Borough
Weisenberg Township	Stockertown Borough
Whitehall Township	Tatamy Borough
	Upper Mount Bethel Township
Northampton County	Upper Nazareth Township
Allen Township	Walnutport Borough
Bangor Borough	Washington Township
Bath Borough	West Easton Borough
Bethlehem City	Williams Township
Bethlehem Township	Wilson Borough
Bushkill Township	Wind Gap Borough
Chapman Borough	

This Water Quality Update has been prepared for Lehigh and Northampton counties by the Lehigh Valley Planning Commission (LVPC). Lehigh and Northampton counties have designated the LVPC to prepare the watershed plans for all watersheds in the counties on their behalf.

To ensure the involvement of the municipalities and agencies that will be impacted by the Stormwater Management Plan, Act 167 requires that a Watershed Plan Advisory Committee be formed. The purposes of the Committee are to assist in the development of the Plan Update and familiarize the municipalities involved with the stormwater management concepts evolving from the planning process. Each municipality in the study area, plus the County Conservation Districts, is required to be represented on the Committee. Representation by additional agencies and interest groups is optional at the discretion of the counties. Listed in Table 4 are the names and affiliations of the persons who participated on the Water Quality Update Watershed Plan Advisory Committee.

TABLE 4
WATER QUALITY UPDATE WATERSHED PLAN ADVISORY COMMITTEE

Municipality/Organization	**Name**
Lehigh County	
Allentown City	Richard Rasch
Catasauqua Borough	Stephen Becker
Coopersburg Borough	Joseph Volk
Coplay Borough	Joseph J. Bundra
Fountain Hill Borough	Stephen Repasch
Hanover Township	Frederick W. Hay, P.E.
Heidelberg Township	Lee Behler
Lower Milford Township	Theodore Zapach
Lowhill Township	Reynold Reinert
Lynn Township	Tom Creighton
North Whitehall Township	Ronald Stahley
Salisbury Township	Gabriel Kahlife
Slatington Borough	Bryon C. Reed
South Whitehall Township	Rene Rodriguez
Upper Macungie Township	William Erdman
Upper Milford Township	Daniel DeLong
Upper Saucon Township	Charles V. Ruppert
Washington Township	Dale M. Rex
Weisenberg Township	Reynold Reinert
Whitehall Township	Carl P. Lagler
Northampton County	
Allen Township	Robert Koch
Bangor Borough	Bernard Rodgers
Bath Borough	Donald Keller and Ira Faro
Bethlehem City	Christine Decker
Bethlehem Township	Chris Bartleson
Bushkill Township	Aaron J. Hook
Chapman Borough	Curtis Fehnel
East Allen Township	Roger Unangst
East Bangor Borough	Bonnie Due
Easton City	Joseph Mauro
Forks Township	Cathy Kichline and Frederick W. Hay, P.E.

TABLE 4, cont. WATER QUALITY UPDATE WATERSHED PLAN ADVISORY COMMITTEE	
Municipality/Organization	**Name**
Northampton County, cont.	
Freemansburg Borough	Charlie Derr
Glendon Borough	Donald Keller
Hanover Township	Glenn Walbert
Hellertown Borough	Michael McKenna
Lehigh Township	Jeff Bartlett
Lower Mount Bethel Township	Steven Meylach
Lower Nazareth Township	Timm A. Tenges
Lower Saucon Township	Tom Maxfield
Moore Township	Michael Ohl
Nazareth Borough	Donald Keller
North Catasauqua Borough	James Lancsek
Northampton Borough	Roger Bodnar
Palmer Township	Ted Sales and Amanda L. Jensen
Pen Argyl Borough	James Corvino
Plainfield Township	Albert Kortze
Portland Borough	Sharon Cartwright
Roseto Borough	Cathy Martino
Stockertown Borough	Jack Fatzinger
Tatamy Borough	Ron Miller and David Dorshimer
Upper Mount Bethel Township	Michelle Arner
Upper Nazareth Township	Carol Keller
Walnutport Borough	Henry Kline
Washington Township	Richard Weaver
West Easton Borough	Richard A. Foster
Williams Township	Deborah Patterson
Wilson Borough	Lou Starniri and Joan Lilly
Wind Gap Borough	Scott Parsons
Bushkill Stream Conservancy	David Brandes, PhD
Clean Water Action	Rick Loomis
Lehigh County Authority	Frank Leist
Lehigh County Conservation District	John Bowman and Rebecca Hayden
Lehigh Valley Economic Development Corporation	Donna G. Taggart
Monocacy Creek Watershed Association	Phil Burtner
Natural Resources Conservation Service	Peter J. Zakanycz
Northampton County Conservation District	Roger Unangst and Kate Brandes
Wildlands Conservancy	Chris Kocher

There are two additional committees participating in the planning process. The Municipal Engineers Committee's purpose was to familiarize the municipal engineers with the technical background of the Plan Update and with the design standards to be implemented in their municipalities. The Legal Advisory Committee's purpose was to familiarize the municipal solicitors with the model ordinance that each municipality will be required to adopt. Each committee was given the opportunity to review and comment on the draft Plan Update and

ordinance during the planning process. Tables 5 and 6 list each committee's participants and their affiliations.

TABLE 5
WATER QUALITY UPDATE MUNICIPAL ENGINEERS COMMITTEE

Municipality	Name	Organization
Lehigh County		
Allentown City	Neal Kern	Allentown City
Catasauqua Borough	Dennis Harman	The Pidcock Company
Coopersburg Borough	William A. Erdman	Keystone Consulting Engineers
Coplay Borough	William A. Erdman	Keystone Consulting Engineers
Fountain Hill Borough	Jill Smith	Hanover Engineering Associates
Hanover Township	Frederick W. Hay	Keystone Consulting Engineers
Heidelberg Township	Roy Stewart	Keystone Consulting Engineers
Lower Milford Township	Tim Edinger	Base Engineering, Inc.
Lowhill Township	Bryan Bollinger	McTish, Kunkel & Associates
Lynn Township	Roy Stewart	Keystone Consulting Engineers
North Whitehall Township	Steve Gitch	Keystone Consulting Engineers
Salisbury Township	David Tettemer	Keystone Consulting Engineers
Slatington Borough	Theodore Stevenson	Spotts, Stevens & McCoy
South Whitehall Township	J. Scott Pidcock	The Pidcock Company
Upper Macungie Township	Dean Haas	Keystone Consulting Engineers
Upper Milford Township	Russell Benner	Schoor DePalma
Upper Saucon Township	Dennis Harman	The Pidcock Company
Washington Township	Roy Stewart	Keystone Consulting Engineers
Weisenberg Township	Roy Stewart	Keystone Consulting Engineers
Whitehall Township	Frank Clark	Keystone Consulting Engineers
Northampton County		
Allen Township	Brien Kocher	Hanover Engineering Associates
Bangor Borough	Robert Collura	
Bath Borough	Justin Coyle	Keller Consulting Engineers
Bethlehem City	Steven DeSalva	Bethlehem City
Bethlehem Township	Kevin Chimics	Spotts, Stevens & McCoy
Bushkill Township	Robert Collura	
Chapman Borough	Donald Keller	Keller Consulting Engineers
East Allen Township	Jim Roethke	Hanover Engineering Associates
East Bangor Borough	Keith Lawler	Keystone Consulting Engineers
Easton City	Joseph Mauro, Jr.	Easton City
Forks Township	Frederick W. Hay	Keystone Consulting Engineers
Freemansburg Borough	David Chismar	Harte Engineering
Glendon Borough	Donald Keller	Keller Consulting Engineers
Hanover Township	James Birdsall	Hanover Engineering Associates
Hellertown Borough	Bryan Smith	Barry Isett and Associates
Lehigh Township	Kevin Chimics	Spotts, Stevens & McCoy
Lower Mount Bethel Township	Timothy Edinger	Base Engineering
Lower Nazareth Township	Albert Kortze	Keystone Consulting Engineers
Lower Saucon Township	James Birdsall	Hanover Engineering Assoicates

TABLE 5, cont.
WATER QUALITY UPDATE MUNICIPAL ENGINEERS COMMITTEE

Municipality	Name	Organization
Northampton County, cont.		
Moore Township	Brien Kocher	Hanover Engineering Associates
Nazareth Borough	Donald Keller	Keller Consulting Engineers
North Catasauqua Borough	James Lancsek	Keystone Consulting Engineers
Northampton Borough	Brien Kocher	Hanover Engineering
Palmer Township	Brian Dillman	The Pidcock Company
Pen Argyl Borough	Bryan Smith	Barry Isett & Associates
Plainfield Township	Kevin Harwick	Keystone Consulting Engineers
Portland Borough	Bradley Miller	East Penn Engineering
Roseto Borough	Robert Collura	
Stockertown Borough	Albert Kortze	Keystone Consulting Engineers
Tatamy Borough	Brien Kocher	Hanover Engineering Associates
Upper Mount Bethel Township	Robert Collura	
Upper Nazareth Township	Albert Kortze	Keystone Consulting Engineers
Walnutport Borough	Jason Newhard	Spotts, Stevens & McCoy
Washington Township	Keith Lawler	Keystone Consulting Engineers
West Easton Borough	Donald Frederickson	Environmental Design & Engineering
Williams Township	David Harte	Harte Engineering
Wilson Borough		Boucher & James
Wind Gap Borough	Ronald Madison	Hanover Engineering Associates

TABLE 6
WATER QUALITY UPDATE LEGAL ADVISORY COMMITTEE

Municipality	Name	Organization
Lehigh County		
Allentown City	Robert Brown	
Catasauqua Borough	Jeffrey R. Dimmich	
Coopersburg Borough		Fonzone & Ashley
Coplay Borough	Jeffrey A. Bartges	
Fountain Hill Borough	Donald H. Lipson	
Hanover Township	J. Jackson Eaton III	
Heidelberg Township	Charles A. Waters	
Lower Milford Township		Stevens & Johnson
Lowhill Township	Charles A. Waters	
Lynn Township	Ed Healy	
North Whitehall Township	Lisa Young	
Salisbury Township	John Ashley	
Slatington Borough	Ed Healy	
South Whitehall Township	Blake C. Marles	
Upper Macungie Township	William E. Schantz	
Upper Milford Township	Marc Fisher	Worth Law Offices
Upper Saucon Township	Jeffrey R. Dimmich	
Washington Township	William E. Schantz	
Weisenberg Township	Donald H. Lipson	
Whitehall Township	Charles J. Fonzone	Fonzone & Ashley

TABLE 6, cont. WATER QUALITY UPDATE LEGAL ADVISORY COMMITTEE		
Municipality	**Name**	**Organization**
Northampton County		
Allen Township	B. Lincoln Treadwell	
Bangor Borough	David J. Ceraul	
Bath Borough	Blake C. Marles	
Bethlehem City	John F. Spirk, Jr.	
Bethlehem Township	Thomas R. Elliott	
Bushkill Township	Gary N. Asteak	
Chapman Borough	Gary N. Asteak	
East Allen Township	John W. Ashley	
East Bangor Borough	David J. Ceraul	
Easton City	William K. Murphy	
Forks Township	Karl H. Kline	
Freemansburg Borough	Joanne Kelhart	
Glendon Borough	Frank S. Poswistilo	
Hanover Township	James L. Broughal	Broughal & DeVito, L.L.P.
Hellertown Borough		Haber, Corriere & Backenstoe
Lehigh Township	David Backenstoe	
Lower Mount Bethel Township	Christopher Spadoni	
Lower Nazareth Township	Gary N. Asteak	
Lower Saucon Township	B. Lincoln Treadwell	
Moore Township	David Backenstoe	
Nazareth Borough	Alfred S. Pierce	
North Catasauqua Borough	William J. McCarthy III	
Northampton Borough	William J. McCarthy III	
Palmer Township	Charles Bruno	
Pen Argyl Borough		McFall, Layman & Jordan
Plainfield Township	David Backenstoe	
Portland Borough	Michael Gaul	
Roseto Borough	Anthony Martino	
Stockertown Borough	Gary N. Asteak	
Tatamy Borough	Elviria C. LaBarre	
Upper Mount Bethel Township	Ronald Karasck	
Upper Nazareth Township	Gary N. Asteak	
Walnutport Borough	David Backenstoe	
Washington Township	David Ceraul	
West Easton Borough	Peter C. Layman	
Williams Township	Brian Monahan	
Wilson Borough	Louis Minotti	
Wind Gap Borough	Ronald Karasck	

CHAPTER 2. WATER QUALITY

In accord with DEP's Comprehensive Stormwater Management Policy, this Plan Update encourages the use of stormwater BMPs that provide infiltration, water quality treatment and otherwise manage the volume and rate of stormwater discharges. Approximately 36% of Lehigh and Northampton counties are underlain by carbonate bedrock. Two major concerns when proposing infiltration in carbonate geology are creation of sinkholes and groundwater contamination. There are only a small number of case studies of infiltration in carbonate bedrock areas. Given the limited data and experience with infiltration practices in carbonate bedrock, the Plan Update does not mandate the use of infiltration BMPs in areas of carbonate bedrock. To the extent that infiltration cannot be used due to site constraints, water quality treatment BMPs must be used for the protection and maintenance of water quality and to prevent the physical degradation of receiving waters.

A. Recharge Volume (REv)

The Plan Update and model Ordinance require infiltration of the Recharge Volume (REv) in non-carbonate areas and encourage infiltration of the REv in carbonate areas. The REv is calculated as follows:

$$REv = 0.25 \times I / 12$$

Where REv = Recharge Volume in acre-feet
I = Impervious area in acres

The Recharge Volume is the portion of the water quality volume used to maintain groundwater recharge rates at development sites. In the Jordan and Monocacy Creek Watersheds, the LVPC has data that suggests that recharge is about 30 percent of annual rainfall. The recharge value is set equal to the estimated stream baseflow at the streamgage locations based on baseflow separations conducted for those watersheds. It is reasonable that most recharge occurs on B soils rather than C or D soils, meaning that well-drained soils account for most recharge. Without more specific data, a simplifying assumption is that all recharge occurs on well-drained soils. The 30 percent of annual rainfall translates into a rainfall capture value of 0.15 inches. This means that if 0.15 inches of rainfall is captured for each storm then the total captured would be about 30 percent of annual rainfall. This value would need to be recharged throughout the whole watershed to preserve pre-development recharge. However, to achieve 0.15 inches of recharge across the entire watershed we need to account for those soils that don't recharge well. Therefore, the recharge value needed for those sites that are well-drained should be increased by the ratio of the total watershed area to area of well-drained soils. The combined Lehigh/Northampton county area ratio is 1.50. There is a fair degree of uncertainty in this ratio given that significant areas in the soil surveys are 'made land' that would not show up as well-drained even though the native soil could be well-drained. Applying the two county average ratio, the recharge value needed becomes (0.15 times 1.50 equals) 0.225 inches. Given that infiltration BMPs won't be able to translate all design rainfall into actual recharge (losses due to evaporation, depression

storage, etc.), a value of 0.25 inches appears to be a reasonable starting value or default value for the recharge requirement. This value would only be applied to proposed impervious areas since the pervious areas will still recharge. The actual storage volume to be created for each site would be the product of 0.25 inches and the area of proposed impervious cover.

B. Water Quality Volume (WQv)

The Water Quality Volume (WQv) to be captured and treated will be the larger of the following:

$$WQv = c \times P \times A / 12$$

Where WQv = water quality volume in acre-feet
c = Rational Method post-development runoff coefficient for the 2-year storm
P = 1.25 inches
A = Area in acres of proposed Regulated Activity

OR

WQv = Post-development 2-yr. runoff volume minus Pre-development 2-yr. runoff volume

EXCEPT that in no case shall the WQv exceed

$$WQv = 1.25 \text{ inches} \times \text{site area in acres} / 12$$

The REv is considered to be a part of the WQv. If REv is to be infiltrated, it may be subtracted from the WQv to be captured and treated. To control water quality, the strategy first defines the WQv that must be captured and treated. The WQv must be calculated two ways. First, WQv is calculated as the Universal Rational Hydrograph volume for the site with Precipitation (P) equal to 1.25 inches. This calculation is, in part, based on the methodology in the Maryland Stormwater Design Manual, 2000. The Maryland WQv standard uses 1.0 inch of precipitation and is based on capturing 90% of the average annual rainfall. The recommended WQv for Maryland is between 0.2 inches and 0.95 inches of runoff across a site. This is consistent with traditional "first flush" water quality standards of capturing the initial 0.5 inches to 1.0 inch of runoff. The 90% average annual capture rainfall for the Little Lehigh Creek Watershed calculated from an analysis of daily rainfall data in Allentown for the period of 1947 to 2003 is 1.25 inches. The percent of the average annual rainfall captured increases as the assumed capture depth increases (e.g. a 1 inch capture depth represents 86% of the average annual rainfall and a 2 inch capture depth represents 97% of the average annual rainfall). The Maryland WQv is calculated using a formula that has impervious cover percentage as the only variable. Pervious cover and slope variations on a site are not considered. However, the Maryland WQv can essentially be replicated using the Universal Rational Hydrograph (URH) volume for a site. The URH produces a runoff volume in inches over a site that is equal to the Rational Method runoff coefficient multiplied by the total rainfall applied. This relationship holds true regardless of the site's time of concentration or the storm return period. Therefore, the URH volume for the 90% rainfall

capture storm depth is (c)(1.25) in inches over the site area. Using this relationship allows the actual site characteristics of slope, hydrologic soil group and cover to be used. The Rational Method c value replaces the volumetric runoff coefficient (Rv) term in the Maryland equation. By inspection, Rational c values of 0.05 and 0.95 for pervious and impervious areas, respectively, would allow c and Rv to match for 0% and 100% impervious. The 0.05 value can be found in our Act 167 Ordinance for Meadow/Lawn for HSG A soils. The 0.95 impervious value is currently in several Act 167 Ordinances in the Lehigh Valley. The value in making this conversion is that we have extensive experience applying the URH for Act 167 designs. It currently represents the minimum acceptable volume for both detention designs and volume controls in the Act 167 Ordinance. Also, the curve number methodology is not recommended for small rainfall amounts like 1.25 inches and cannot be used to define a comparable runoff volume for the 90% rainfall depth. As such, the best use for the URH volume is as a minimum WQv as proposed. Since this WQv closely approximates the Maryland WQv, it still allows us to rely on the established procedures in the Maryland Stormwater Design Manual.

Second, the WQv must be calculated as the difference in runoff volume from pre-development to post-development for the 2-year return period storm. The existing Act 167 runoff quantity design standards specifically regulate the pre- to post-development impact. One concern with the Maryland procedures and the use of the URH method is that the pre-development condition is not considered in the calculation and therefore may not accurately reflect the "impact" created by the development. If the URH method does, in fact, under-predict runoff volume then sufficient water quality treatment may not be provided if this was the sole means for determining WQv. A study developed by Environmental Engineers for the City of Austin, Texas showed that 90% control of total annual pollutant loadings required storage volumes that closely followed the incremental 2-year volumes based on an analysis by return period prepared by the LVPC. Stated otherwise, the incremental 2-year runoff volume can provide a WQv that achieves pollutant control effectiveness traditionally thought to be provided by the first flush concept.

Therefore, the alternative WQv standard is the difference in runoff volume pre- to post-development for the 2-year storm. This volume may exceed the URH WQv or may be less. In fact, for the example of converting agricultural lands to low impervious cover development, the incremental 2-year runoff volume could be negative.

As a result, the greater of these two calculated values will be used as the WQv except in situations where it would exceed 1.25 inches of runoff. The 90% annual rainfall capture volume of 1.25 inches provides a reasonable upper limit to the WQv given that only 10% of the annual rainfall volume from larger events is not treated. Therefore, the recommended WQv standard is limited to no more than 1.25 inches of runoff. This retains applicability of the Maryland Stormwater Design Manual while assuring that the pre- and post-development conditions are considered.

The WQv standard does not limit the volume of infiltration an applicant may propose for purposes of water quantity/peak rate control.

C. Preliminary Site Investigation

Each developer must document the bedrock type(s) present on the site from published sources. Any apparent boundaries between carbonate and non-carbonate bedrock must be verified through more detailed site evaluations by a qualified geotechnical professional.

Each developer intending to use infiltration as a BMP must conduct a preliminary site investigation on the proposed development site. Note that due to the recharge requirement, all sites in non-carbonate areas are required to conduct a preliminary site investigation. The goal of the preliminary site investigation is to evaluate whether any areas of the site appear to be feasible for infiltration BMPs. This requires the determination of site characteristics such as the infiltration capacity of the soil mantle, the depth to bedrock and the absence or presence of any special geologic features. The preliminary site investigation may be an iterative process, testing different locations on the site to find suitable locations for infiltration. Data to be gathered as part of a preliminary site investigation includes the following:

- Bedrock structural geology – This includes the possible presence of faults and mapping of conspicuous fracture traces or lineaments.
- Overburden and soil mantle composition and thickness
- Permeability of the soil
- Depth to the seasonal high water table
- Presence of special geologic features – This includes sinkholes, closed depressions, fracture traces, lineaments and geologic contacts between carbonate and non-carbonate bedrock

Some of the required information, as listed above, can be found in existing published data. Suggested resources are listed below.

- Geologic maps and references for the development area
- USGS topographic maps
- Lehigh and Northampton County soil survey maps
- Aerial photographs from the LVPC or other sources
- Relevant Pennsylvania Geologic Survey Open File Reports that provide maps of sinkholes and Karst features for Lehigh County (OF 87-01) and Northampton County (OF87-02)
- Kochanov and Reese (2003). Density of Mapped Karst Features in South-Central and Sotheastern Pennsylvania (Map 68)
- DCNR Online Sinkhole Inventory – (http://www.dcnr.state.pa.us/topogeo/hazards/sinkhole/default.asp)

In addition to gathering data from published sources, a field inspection of the proposed site is required and the soil mantle at the development site must be examined directly with a backhoe during the preliminary site investigation. A minimum of one soil test pit and two percolation tests are required on each site. The engineer or other qualified professional exposes the surface horizon to a depth of up to eight feet and identifies the type and condition

of the soil mantle by distinct horizons or layers. If, based on the results of the preliminary site investigation, infiltration appears to be feasible on the site, additional testing is required at the proposed infiltration location. The Preliminary Site Investigation and additional testing must be conducted in accordance with the procedures outlined in Appendix G of the model ordinance included at the back of this Plan Update.

D. Non-Carbonate Area Standards

Since infiltration is the best BMP for runoff volume control, groundwater recharge and water quality control in non-carbonate areas, the Recharge Volume (REv) must be infiltrated unless the applicant demonstrates that it is infeasible to infiltrate the REv for reasons of seasonal high water table, permeability rate, soil depth or isolation distances. A site investigation must be performed to quantify the parameters listed in Section 304.I. of the model Ordinance. The site investigation, including soil test pits and percolation tests, must be conducted in accordance with Appendix G of the model ordinance included at the back of this Plan Update. The Preliminary Site Investigation described above shall continue on different areas of the site until a suitable infiltration location is found or the entire site is determined to be infeasible for infiltration. The recommended site conditions, as listed in Section 304.I. of the model Ordinance, are designed to have infiltration on sites with well drained soils and adequate soil depth for removal of pollutants.

If it is not feasible to infiltrate the full recharge volume, the applicant must infiltrate that portion of the REv that is feasible based onsite characteristics. Any portion of the REv that is infiltrated can be subtracted from the WQv required to be captured and treated. If none of the REv can be infiltrated, the REv must be considered as part of the WQv and must be captured and treated. The model ordinance allows a municipality to determine infiltration to be infeasible on a site if there are known existing conditions or problems that may be worsened by the use of infiltration.

E. Carbonate Area Standards

Each site located entirely in carbonate geology that intends to use infiltration BMPs must conduct a preliminary site investigation prepared by a qualified geotechnical professional to define the special geologic features present on the site. As previously discussed, the preliminary investigation must include a minimum of one test pit and two percolation tests on the portion of the site that is judged to be the best candidate for possible infiltration as detailed in Appendix G of the model Ordinance included at the back of this Plan Update. The data gathered during the preliminary site investigation will then be used as input in the *Recommendation Chart for Infiltration Stormwater Management BMPs in Carbonate Bedrock* chart contained in Appendix D of the model ordinance.

There are five basic management principles that should be followed to minimize the risk associated with designing infiltration in carbonate areas. First, the natural water balance should be maintained to maintain infiltration to groundwater, stream baseflow and existing water table elevation. The REv has been designed with this goal in mind. In addition, the model Ordinance requires that, for the site as a whole, the post-development 2-year runoff volume leaving the site must be 80% or more of the pre-development runoff volume. This

80% provision is to prevent infiltration of volumes far in excess of the pre-development infiltration volume. This is especially important since while holding infiltration constant there still may be an increase in recharge due to the conversion of evapotranspiration to recharge. Second, concentration of stormwater flows should be avoided and natural loading rates should be replicated to prevent new hydraulic stresses on the overburden soils and accelerated sinkhole development. Specific loading rate criteria are listed in Section 307.B. of the model Ordinance. Third, the soil mantle thickness should be maximized and soil permeability should be within an acceptable range. The soil mantle acts as a pollutant filter and hydraulic "buffer" that intercepts, distributes, slows, absorbs and retains infiltrating stormwater runoff before the runoff reaches the underlying carbonate formations. Soil permeabilities less than 0.5 inches/hour are not recommended because they are not considered to be well drained. The maximum allowable permeability is 12 inches/hour because more rapid permeabilities may increase the risk of sinkhole formations or groundwater contamination as water flows through the soil with minimal lateral dispersion and slowing. Criteria for soil permeability and soil thickness are listed in Section 307.C. of the model ordinance. Fourth, the separation distance or buffer from special geologic features should be maximized. Criteria for special geologic feature buffers can be found in Appendix D of the model Ordinance. Last, the likelihood of sinkhole formation depends on a combination of the site risk factors discussed above. The closer each of the principles can be followed the lower the risk.

Additional design constraints that must be met on carbonate sites are listed in Section 304.I. of the model Ordinance.

F. Sites with Both Carbonate and Non-carbonate Areas

If a site has both carbonate and non-carbonate areas, the applicant must investigate the ability of the non-carbonate portion of the site to fully meet the model Ordinance provisions to control runoff for the whole site through infiltration. If that proves infeasible, either infiltration in the carbonate area or 2 other BMPs must be used on the site to meet the Ordinance provisions. No infiltration structure in the non-carbonate area shall be located within 50 feet of a boundary with carbonate bedrock, except when a preliminary site investigation has been done showing the absence of special geologic features within 50 feet of the proposed infiltration area.

G. Non-infiltration BMPs

If, after preliminary testing is completed, a site is not recommended for infiltration or if an applicant chooses not to use infiltration in carbonate bedrock areas, then the WQv must be treated by two acceptable BMPs in each drainage direction. In this case, the Recharge Volume (REv) is considered to be a part of the WQv. Two BMPs are being required because no other single BMP approaches the pollutant removal efficiency of infiltration. Therefore, if infiltration is not being used, the use of two other BMPs in series is assumed to achieve comparable water quality control. Sheet flow draining across a pervious area can be considered as one BMP. This will encourage disconnection of impervious cover and will not create an undue management burden for disturbed areas proposed to be pervious cover. Sheet flow across impervious areas and concentrated flow must be managed by two BMPs in

series. If sheet flow from an impervious area is to be drained across a pervious area as one BMP, the flow length of the pervious area must be at least equal to the flow length of impervious area.

In no case, may the same BMP be employed consecutively to meet the two BMP requirement.

A list of acceptable BMPs is provided below. A definition for each BMP, along with a reference for design details, is provided in the model ordinance in the back of this Plan Update.

- Bioretention[1]
- Capture/Reuse (cisterns, etc.)[2]
- Constructed Wetlands
- Dry Extended Detention Basin
- Minimum Disturbance/Minimum Maintenance Practices
- Significant Reduction of Existing Impervious Cover
- Stormwater Filters (Sand, Peat, Compost, etc.)
- Vegetated Buffers/Filter Strips
- Vegetated Roofs
- Vegetated Swales
- Water Quality Inlet (e.g. Oil/Water Separators, Sediment Traps/Catch Basin Sumps, Trash/Debris Collectors)
- Wet Detention Ponds

[1]This BMP could be designed with or without an infiltration component. If infiltration is proposed, the site and BMP will be subject to the testing and other infiltration requirements in the model Ordinance.

[2]If this BMP is used to treat the entire WQv then only one BMP is required because of this BMPs superior water quality performance.

H. Channel Protection Criteria

To satisfy State Water Quality Requirements, the volume and rate of the net increase in stormwater runoff from the Regulated Activities must be managed to prevent the physical degradation of receiving waters from such effects as scour and streambank destabilization. Several stormwater management manuals, such as 2000 Maryland Stormwater Design Manual, use the channel protection standard of extended detention (24 hours) for the 1-year return period using a 24 hour storm. The LVPC evaluated this standard to see how it related to release rates (i.e. the ratio of post-development peak discharge to pre-development discharge). The LVPC analysis found that shorter pre-development times of concentration result in lower release rates. Additionally, more intense development results in larger release rates for all pre-development conditions. For a given post-development CN, release rates decline with increasing pre-development CN. Based on this information, the LVPC concluded that the 1-year 24 hour extended detention standard provides an inverse relationship between intensity of development and degree of peak runoff control. Small changes in pre- to post-development runoff volume result in very stringent release rates whereas large changes in runoff volume result in less stringent release rates. The latter

includes the possibility of exceeding the pre-development peak runoff rates while dramatically increasing runoff volume. Additionally, the 1-year extended detention standard would require an orifice configuration that would violate the 3-inch minimum orifice standard in the ordinance for instances of release rates of 30% or less for small sites.

To further evaluate the channel protection standard, the results discussed above were compared to data compiled in 1988 regarding an analysis of in-stream erosion potential versus release rates. The 1988 evaluation concluded that more intense development scenarios would require lower release rates to mitigate in-stream erosion potential. Further, lower release rates were required for more frequent storms and lower release rates were required for lower pre-development CN. It appears, based on this data, that very low release rates below 30% may be warranted for channel protection purposes for pre-development conditions with low CN. However, these release rates may not be possible while maintaining a 3-inch minimum orifice standard. Beyond that, runoff controlled using a 3-inch orifice that would only discharge one-half of a cfs or less for a typical detention pond would not seem to have much in-stream erosion potential deserving of a more stringent control. It also seems that for intense development scenarios the channel protection release rates should not exceed or even approach 100%.

Based on the above, the 1-year 24 hour extended detention standard is not proposed as a channel protection standard because of its inverse relationship between the intensity of development and release rate. A 2-year 30% release rate will be universally applied as the channel protection standard. For more intense developments, the 30% release rate is a conservative approach to provide channel protection and is a demonstrated cost-effective runoff control approach. For less intense developments, a 30% release rate will be applied since the available data suggests a low release rate is warranted, conclusive data does not appear to exist to determine exactly what these release rates should be and the minimum 3-inch orifice standard would supercede lower release rates for small development sites. Note that, the 2-year 30% release rate will be used as the channel protection standard in all Release Rate districts as well as No Detention districts.

I. Temperature Sensitive BMPs

Because some of the streams within the study area are designated High Quality or Exceptional Value waters, BMPs shall be chosen to prevent thermal impacts on the stream and the aquatic community. Therefore, if an applicant is proposing to use a dry extended detention pond, wet pond, constructed wetland or other BMP that ponds water on the land surface and may receive direct sunlight, the discharge from that BMP must be treated by infiltration, a vegetated buffer, filter strip, bioretention, vegetated swale or other BMP that provides a thermal benefit to protect the High Quality or Exceptional Value waters of the study area from thermal impacts.

J. Hot Spot Land Uses

Hot Spot land uses are land uses or activities that generate higher concentrations of hydrocarbons, trace metals or other toxic substances than typically found in stormwater

runoff. Stormwater runoff from Hot Spot land uses, because of the higher pollutant loads, needs to be pre-treated with suitable BMPs before being discharged to surface waters of the Commonwealth. The model ordinance at the back of this Plan Update prohibits infiltration of runoff from Hot Spot land uses. Acceptable methods of pre-treatment for each Hot Spot land use along with references for design details are listed in Section 304.O. of the model Ordinance. In no case, may the same BMP be employed consecutively to meet the Hot Spot pretreatment requirement and the WQv treatment requirement.

K. Alternative Approach to Meeting State Water Quality Requirements

The municipality may approve, in consultation with DEP, alternative methods for meeting the State Water Quality Requirements other than those specified in the model ordinance, provided that they meet the minimum requirements of and do not conflict with state law including but not limited to the Clean Streams Law.

L. Exemptions for "Small Projects"

An exemption from certain requirements of the model Ordinance is provided in the Plan Update and model Ordinance for new developments which are expected to have an insignificant impact on the watershed. The exemption provides that any development which would create 10,000 square feet or less of additional impervious cover will not be required to meet the Drainage Plan preparation provision of the model Ordinance. The date of Municipal Ordinance adoption of each original Watershed Act 167 Stormwater Management Ordinance shall be the starting point from which to compute cumulative increases in impervious cover. Examples of projects that would be exempt would include building residential sheds or patios, small building or home expansions and development of a single residential home on a small lot. Attempting to regulate these types of projects could be burdensome to the homeowner or developer and impractical for the municipality. It should be noted that although persons responsible for these "small projects" will not be required to prepare a Drainage Plan to be reviewed against this model Ordinance, they are still obligated under Section 110 of the model Ordinance to implement such measures as are reasonably necessary to meet State Water Quality Requirements and to prevent injury to health, safety and property. Such measures shall include such actions as are required to manage the rate, volume, direction and quality of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

CHAPTER 3. WATER QUANTITY

A. Release Rates

The release rate concept applied in earlier versions of the Act 167 Watershed Plans still applies in this Plan Update. The basic goal is no increase in the peak rate of runoff at any point in the watershed. However, simply controlling peak rates of runoff at the site does not guarantee an effective watershed-level control because the increase in total runoff volume could accumulate throughout the watershed and increase peak flows. As part of each Act 167 Plan, modeling was done to study how runoff from the various parts of the watershed interact, in time, with one another. A complete discussion of the release rate concept and the modeling are contained in each watershed's original plan, listed in Table 1 on page 1-1. The release rates that were determined from that modeling effort have not changed and designs consistent with the release rates are still required as part of the model Ordinance. The release rates for each location in the watershed are shown on Figures 2 through 8 contained in Plan Appendix A at the end of the Plan Update text.

It should be noted that the release rate concept assumes that peak rate and volume of runoff will increase with development. If, through the use of infiltration or other means, an applicant can demonstrate that neither the peak rate nor the volume of runoff are increasing with development, additional controls to meet the release rates are not required. If the peak rate and volume of runoff are not increasing with development, then the goal of the release rates, to maintain existing peak flows in the watershed, has been met.

B. Release Rate Implementation Provisions

In addition to the release rates discussed above, the stormwater management district implementation provisions also still apply in this Plan Update. The implementation provisions are detailed in Section 306 of the model ordinance and regulate issues like closed depressions, multiple drainage directions leaving a site, off-site areas, etc.

CHAPTER 4. MUNICIPAL ORDINANCE TO IMPLEMENT THE ACT 167 STORMWATER MANAGEMENT PLAN WATER QUALITY UPDATE

The implementation of the runoff quality and quantity control strategy for new development will be through municipal adoption of the appropriate ordinance provisions. As part of the preparation of this water quality update, a model Ordinance has been prepared which would implement the Plan Update provisions. The Ordinance is a single purpose ordinance which could be adopted essentially as is by the municipalities. Cross-references to the provisions of this Update would also be required in the municipal Subdivision and Land Development Ordinance and the municipal Building Code to ensure that activities regulated by the Ordinance were appropriately referenced.

Additionally, the model ordinance contains all of the required NPDES Phase II criteria for post-construction stormwater management. These provisions are marked with an asterisk (*) and are not required for municipalities that are not subject to the NPDES Phase II requirements. This Ordinance will satisfy the post-construction stormwater management minimum measure for those municipalities required to apply for NPDES Phase II permit coverage. As needed, the ordinance provisions were copied from DEP's model Ordinance with some minor revisions.

This updated Stormwater Management Ordinance will not completely replace the existing storm drainage ordinance provisions currently in effect in the municipalities. The reasons for this are as follows:

- Not all of the municipalities in the study area are completely within the watersheds being updated. Since the water quantity provisions (i.e. Release Rates) have been developed specifically for the watersheds included in this study, for those portions of a municipality outside of the study area, the existing water quantity ordinance provisions still apply. Municipalities with areas outside of the watershed may need to apply the water quality provisions to the entire municipality or to the entire urbanized area in the municipality to satisfy the NPDES Phase II requirements.

- The Act 167 Ordinance contains only those stormwater runoff control criteria and standards which are necessary or desirable from a total watershed perspective. Additional stormwater management design criteria (i.e. inlet spacing, inlet type, collection system details, etc.) which should be based on sound engineering practice should be regulated under the current Ordinance provisions.

- The Act 167 Ordinance contains criteria and standards for runoff control from new development that are the *minimum* criteria from a watershed perspective. Individual municipalities may adopt more stringent ordinance provisions so long as consistency with the Plan Update is maintained. Note that more stringent criteria will not always be consistent with the Plan Update. An example would be a municipality requiring detention for all new development when certain parts of the municipality are within a "No Detention" District.

The minimum municipal ordinance requirements for each article in the ordinance are listed in Table 7 on page 4-3.

The Act 167 Ordinance is composed of the basic ordinance body and a set of appendices. The Ordinance Appendices, to be made part of a municipal ordinance, should provide maps of the watersheds, stormwater management districts and storm drainage problem areas as well as technical data to be used in the calculation methodology. The Ordinance is intended to be separable from the Plan Update document itself. The maps in the Ordinance Appendices would be duplicative of those already included in this Plan Update or the original versions of the Plans and are not included in the model Ordinance.

Although the actual stormwater control provisions may vary significantly from an existing municipal ordinance, the structure of the Ordinance itself is very similar to many ordinances. The actual ordinance adopted by a municipality to implement this Act 167 Plan Update may differ in form from the Ordinance provided herein so long as it includes, at minimum, all of the provisions of the suggested Ordinance. A municipality may tailor the Ordinance provisions to best fit into their current ordinance structure.

TABLE 7

MINIMUM MUNICIPAL ORDINANCE REQUIREMENTS

The Act 167 Ordinance contains criteria and standards for runoff control from new development which are the *minimum* criteria required. Municipalities can, however, adopt criteria which are more stringent as long as consistency with the Plan is maintained. The chart below lists each article in the ordinance, the minimum municipal ordinance requirement for the article and *examples* of provisions which are more stringent but still consistent with the Plan. The *examples* listed are not intended to be comprehensive but to provide an idea of the flexibility available to municipalities throughout the ordinance. Note that more stringent criteria will not always be consistent with the Plan. An example would be a municipality requiring detention for all new development when certain parts of the municipality are within a Conditional No Detention District.

ARTICLE	TITLE	MINIMUM REQUIREMENT	MORE STRINGENT REQUIREMENT
1	General Provisions	Include verbatim.	*Section 106* - Reduce impervious cover exemption to less than 10,000 sq. ft.
2	Definitions	Include verbatim.	
3	Storm Water Management Requirements	*Sections 301 A, B, C, D, F, G, and J* - Include verbatim. *Section 301.E.* - Ordinance provision must insure, through deed restriction, easement or other appropriate means, maintenance of this area for the conveyance of storm water runoff. *Sections 301 H and I* – Include verbatim to meet NPDES MS4 permit requirements. *Sections 302 and 303* – Include verbatim to meet NPDES MS4 permit requirements. *Section 304, 305, 306 and 307 – Include verbatim*	*Section 301.D.* - Require written approval from affected property owners before allowing proposed concentrated discharge. *Section 301.E.* - Require easements with larger safety factors of design. *Section 306.B.* - Require calculations for additional return periods. *Section 306.L.* - Require entire site, rather than just the impact area, to meet the Release Rate criteria.
4	Drainage Plan Requirements	*Sections 401, 402, 403, 405 and 406* - Include verbatim. *Section 404* - Municipality and LVPC must receive plan submissions. *Section 407* - Municipality must have process for reviewing waiver requests. The five findings must be included verbatim.	*Section 403* - Require additional details on project area maps. *Section 404* - Require additional Drainage Plan sets for submission to the municipality.
5	Inspections	Include verbatim to meet NPDES MS4 permit requirements.	
6	Fees and Expenses	Municipality may collect fees to cover review costs.	

TABLE 7 continued			
ARTICLE	**TITLE**	**MINIMUM REQUIREMENT**	**MORE STRINGENT REQUIREMENT**
7	Stormwater BMP Operations and Maintenance Plan Requirements	Include verbatim to meet NPDES MS4 permit requirements.	
8	Prohibitions	Include verbatim to meet NPDES MS4 permit requirements.	
9	Right of Entry, Notification and Enforcement	Include verbatim to meet NPDES MS4 permit requirements.	
	Appendices	Include verbatim.	

PLAN APPENDIX A

A-1 Release Rates - Bushkill Creek Act 167 Study Area

A-2 Release Rates - Catasauqua Creek, Monocacy Creek and Nancy Run Act 167 Study Areas

A-3 Release Rates - Coplay Creek, Jordan Creek and Trout/Bertsch Creeks Act 167 Study Areas

A-4 Release Rates - Fry's Run Act 167 Study Area

A-5 Release Rates - Hokendauqua Creek Act 167 Study Area

A-6 Release Rates - Martins/Jacoby Creeks Act 167 Study Area

A-7 Release Rates - Saucon Creek Act 167 Study Area