ACT 167

BUFFALO CREEK WATERSHED
STORM WATER MANAGEMENT PLAN

VOLUME II PLAN CONTENTS

OCTOBER, 1998

UNION COUNTY, PENNSYLVANIA
CENTRE COUNTY, PENNSYLVANIA
FILE NO. SWMP 256.06
PROJECT NO. 96130.01-.05

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Buffalo Creek Watershed
Act 167
Watershed Storm Water Management Plan
Phase II

DEP ME # 96356
File No. SWMP 035:60
Project No. 96130.01-.05

VOLUME II
PLAN CONTENTS

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Robert Valentine	West Buffalo Township
Ted Retallack	Union County Conservation District
Carl Kirby	Lewisburg Borough
Doug Hovey	Buffalo Township
William Roush	Limestone Township
Leonard Caris	White Deer Township
Joe Hoffman	Kelly Township
Robert Sweitzer	Centre County Conservation District
Robert Donaldson	Centre County Planning Commission

Miles and Haines Townships in Centre County; and Hartley and Lewis Townships in Union County did not appoint members to the WPAC.

VOLUME II - PLAN CONTENTS

	PAGE
Section I. Introduction	
A. Introduction	I-1
B. Storm Water Management	I-1
Section II. Act 167	II-1
A. Storm Water Management Act	II-1
B. Purpose of the Study	II-1
C. Plan Format	II-2
Section III. Buffalo Creek Watershed Characteristics	III-1
A. Drainage Area	III-1
B. Land Use	III-1
C. Topography and Streambed Profile	III-2
D. Soils	III-2
E. Climate	III-3
F. Description of Data Collection	III-4
1. Topography	III-4
2. Geology	III-4
3. Soils	III-4
4. Land Cover/Land Use	III-4
5. Future Land Use	III-4
G. Significant Obstructions	III-4
H. Projected & Alternative Land Development Patterns in the Watershed	III-5
1. Projected Land Development Patterns	III-6
2. Impact of Runoff from Future Development	III-7
I. Present and Projected Development in the Flood Hazard Areas	III-8
1. Present Conditions	III-8
2. Future Conditions	III-11
J. Survey Existing Drainage Problems and Proposed Solutions	III-11
K. Existing and Proposed Storm Water Collection Systems	III-13
L. Existing and Proposed State, Federal and Local Flood Control Projects	III-13
M. Existing & Proposed Storm Water Control Facilities	III-13
N. Wetlands	III-13
Section IV. Watershed Technical Analysis - Modeling	IV-1
A. Watershed Modeling	IV-1
B. Calibration Process	IV-1
C. Verification	IV-2
D. Design Storm Rainfall	IV-3
E. Water Quality	IV-3
F. Modeling Process	IV-4
Section V. Standards and Criteria for the Control of Storm Water	V-1
A. Description of Management Districts	V-1
B. Standards and Criteria	V-3

C. Sub-Regional (Combined Site) Storage V-6
D. "Hardship Option" V-6

Section VI. Alternative Runoff Control Techniques and Their Efficiency in the Watershed VI-1

A. Regional Detention Facilities VI-1
B. On-Site Storm Water Controls VI-2
C. Best Management Practices VI-8
D. Nonstructural Storm Water Management Measures VI-10

Section VII. The Development of the Model Ordinance VII-1

Section VIII. Model Storm Water Management Ordinance VIII-1

Section IX. The Development of Priorities for Implementation of Action within the Plan IX-1

A. DEP Approval of the Plan IX-1
B. Publishing the Final Plan IX-1
C. Municipal Adoption of Ordinance Provisions to Implement the Plan IX-1
D. Level of Government Involvement in Storm Water Management IX-2
E. Countywide Coordination IX-4
F. Development of a Systematic Approach for Correction of Existing Drainage Problem Areas IX-6
G. Culvert Replacement IX-7
H. PennVEST Funding IX-7
I. Landowners Responsibility IX-7

Section X. Plan Review Adoption and Updating Procedures X-1

A. County Adoption X-1
B. Provisions for Plan Revision X-1

Section XI. Formation of the Buffalo Creek Watershed Advisory Committee XI-1

Appendices

1. Table of Contents for the Technical Appendix
2. Public Hearing Notice
3. Public Comment
4. Response to Public Comment
5. Resolution of Adoption
6. Municipal Ordinance Matrix
7. Sample Developers RFP
8. Sample Open Space Planning Ordinance Language

Figures

III-1. Site Location Insert
III-2. Topographic Relief of the Buffalo Creek Watershed III-2
III-3. Limestone Areas Insert
III-4. Hydrologic Soil Groups Insert
III-5. Existing Land Use Insert
III-6. Future Land Use Conditions Insert
III-7. Obstructions Insert
III-8. Development & Floodplains Insert
III-9. Problem Areas, Flooding & Storm Water Control Insert
III-10. Wetlands Insert
IV-1. Calculation Methodologies Comparison IV-5
V-1 Relative Timing of Subwatershed Hydrographs V-1

Tables

III-1. Land Use Status by Category III-2
III-2. Development Potential by Municipality Based Upon Existing Patterns in the Buffalo Creek Watershed III-6
III-3. Present Versus Future Combined Peak Flows - 100 year 24-hour Storm III-7
III-4. Available Flood Data III-8
III-5. Present Residential and Commercial Areas Within 100-Year Floodplain III-10
III-6. Buffalo Creek Watershed Problem Areas III-12
IV-1. Comparison of Flow for the Buffalo Creek PSRM Model IV-2
IV-2. Comparison of PSRM Predicted Flows to Regression Methods IV-3
IV-3. Design Storm Rainfall Amount IV-3
V-1. Required Criteria & Standards V-3
V-2. Recommended Criteria & Standards V-5
VI-1 Regional Detention Facilities VI-1
VI-2 Effect of a Hypothetical Regional Detention Basin on Future Flows at mouth of Buffalo Creek VI-1
VI-3. Various On-Site Storm Water Control Methods VI-3
VI-4. Advantages and Disadvantages of Various On-Site Storm Water Control Methods VI-4
VI-5. Suitability of Runoff Control Measures in the Buffalo Creek Watershed VI-7
VI-6. Twenty Benefits of Urban Stream Buffers VI-11
VII-1. Typical Storm Water Management and Earth Disturbance Permit Ordinance Provisions VII-2
VII-2. Special Storm Water Management Provisions VII-3
VIII-1. Acceptable Computational Methodologies VIII-23
IX-1. Public Involvement in Storm Water Management IX-3

VOLUME II

SECTION I

INTRODUCTION

A. Introduction

The Buffalo Creek Watershed covers the central portion of Union County and a small portion of eastern Centre County. The Buffalo Creek is approximately 28 miles long, originating near Woodward, in Centre County and discharging into the West Branch of the Susquehanna River at Lewisburg.

Much of the watershed is undeveloped and holds the potential for extensive growth. The effects of development on drainage, flooding, and erosion are a major concern to county and municipal officials as well as property owners. Extensive growth can result in accelerated storm water runoff that can cause flooding and erosion problems. The quality of the stream water is also degraded as impervious areas grow throughout the watershed.

B. Storm Water Management

Storm water management entails controlling runoff caused by precipitation events. In the past, storm water control was viewed only on a site-by-site basis. However, recently local perspectives and policies have changed with the realization that proper storm water management can only be accomplished by evaluating the comprehensive picture (i.e. by analyzing what adverse impacts development has on a watershed). Storm water management on a watershed basis reduces flooding, soil and stream bank erosion and sedimentation and improves the water quality of the receiving streams.

Storm water management at the watershed level requires cooperation between the state, county and local officials and involves comprehensive planning, engineering, construction, and maintenance. This entails educating the public and local officials and requires program development, financing, revising policy, and adoption of ordinances. The Buffalo Creek Watershed Storm Water Management Plan, under the Pennsylvania Storm Water Management Act, will enable continued development to occur within the Buffalo Creek Watershed while minimizing storm water problems.

SECTION II

ACT 167

A. Storm Water Management Act

The Pennsylvania General Assembly, recognizing the adverse effects of inadequate management of storm water runoff, approved the Storm Water Management Act, P.L. 864, No. 167, October 4, 1978. Act 167 provides for the regulation of land and water use for flood control and storm water management purposes, and it confers powers to the Pennsylvania Department of Environmental Protection (PADEP), municipalities and counties, and provides for enforcement and appropriation of funds. The Act required the PADEP to designate watersheds, to develop guidelines for storm water management, and to create model storm water ordinances. Designated watersheds were approved by the Environmental Quality Board on July 15, 1980, and guidelines and model ordinances were approved by the Legislature May 14, 1985). The Act provides for grants to be appropriated through the General Assembly and administered by the PADEP for 75% of the costs of preparation for an official storm water management plan. Administrative, enforcement and implementation costs incurred by any municipality or county are reimbursable as outlined and in accordance with Chapter III - Storm Water Management Grants and Reimbursement Regulations (adopted by the Environmental Quality Board August 27, 1985).

Each county must prepare and adopt a watershed storm water management plan for each of its designated watersheds in consultation with the municipalities. Periodic reviews and revisions are required every five years when funding is available. Within six months of the county adopting the watershed storm water plan, each municipality must adopt or amend its ordinances to concur with the adopted watershed plan and the provisions of Act 167.

The storm water management plan requires developers to account for the quantity, velocity, and direction of resulting storm water runoff in a manner, which adequately protects the public from injury and property damage. The Act also provides for civil remedies for those aggrieved by inadequate management of accelerated storm water runoff.

B. Purpose of the Study

Development in the Buffalo Creek Watershed causes an increase in storm water runoff and a reduction in groundwater recharge. Uncontrolled runoff not only increases the risk of flooding but also increases erosion and sedimentation problems, reduces stream quality, raises the temperature of streams, impairs the aquatic food chain, and reduces the baseflow of streams. Many of these conditions already exist in the Buffalo Creek Watershed and need to be addressed.

There is an increased state-wide and local recognition that an effective storm water management plan must be diversified and comprehensive. The plan should address the full range of hydrologic consequences resulting from development instead of simply focusing on controlling site-specific peak flows. Considerations into the effects of tributary timing of flow volume reduction, base flow augmentation, water quality control and ecological protection also need to be incorporated.

The Buffalo Creek Watershed Storm Water Management Plan provides for the reasonable regulation of development activities to control accelerated runoff and to protect the health, safety and welfare of the public. The plan includes recognition of the various regulations and laws at the federal, state, county and municipal level, and once implemented, will aid in reducing flood damages and uncontrolled runoff. The plan will also make municipalities and developers more aware of comprehensive storm water planning and will help maintain Buffalo Creek's designation as a high quality waterway.

C. Plan Format

The format of Buffalo Creek Storm Water Management Plan consists of two documents: Volume I, Executive Summary; Volume II, Plan Content and Technical Appendices. Volume I outlines an overview of Storm Water Management Plan. Volume II provides; the purpose of the study, data collection methodology, identification of existing problems, present conditions, projected and alternative land development patterns and the model ordinance. Volume II also assesses the impact of managing storm water by utilizing the criteria and standards set forth in this plan. The technical appendices provide all of the supporting data, procedures, parameters and watershed modeling.

SECTION III

BUFFALO CREEK WATERSHED CHARACTERISTICS

Buffalo Creek is located in the central portion of Union County and the eastern portion of Centre County. The watershed covers portions of eleven municipalities and lies in two counties; as seen below and as illustrated in Figure III-1.

BUFFALO CREEK WATERSHED - MUNICIPALITIES

UNION COUNTY	CENTRE COUNTY
1. Buffalo Township	1. Haines Township
2. Hartley Township	2. Miles Township
3. Kelly Township	
4. Lewis Township	
5. Lewisburg Borough	
6. Limestone Township	
7. Mifflinburg Borough	
8. West Buffalo Township	
9. White Deer Township	

A. Drainage Area

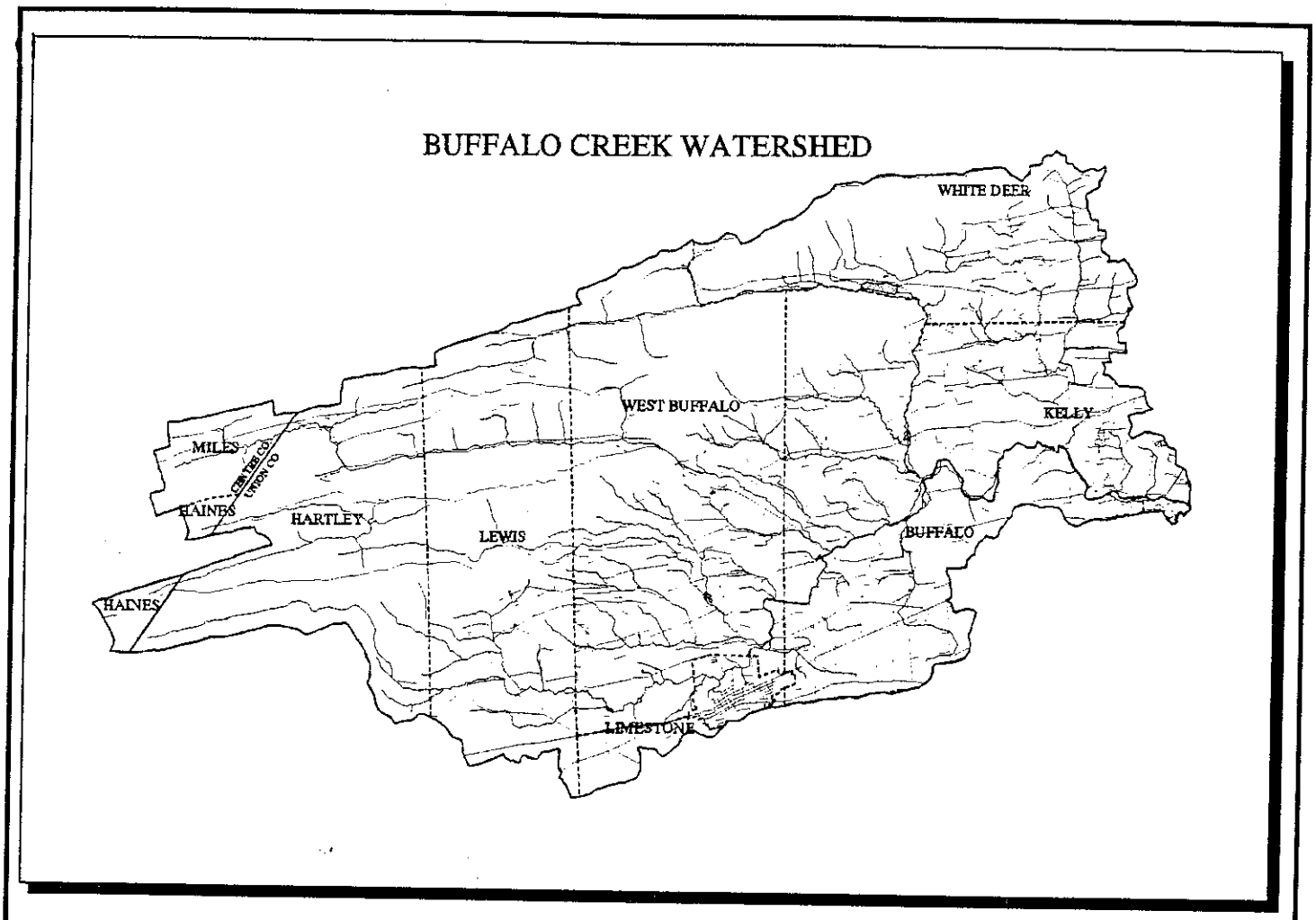
The Buffalo Creek watershed drains a total area of approximately 134 square miles. Buffalo Creek begins along the Buffalo Mountains flowing eastward across Hartley Township and then through Lewis Township. It combines with the North Branch Buffalo Creek in West Buffalo Township. Buffalo Creek then flows eastward, combining with Rapid and Black Runs in Buffalo Township and the Little Buffalo Creek in Kelly Township before discharging into the West Branch of the Susquehanna River in Lewisburg.

The major tributaries to Buffalo Creek are Little Buffalo Creek, Spruce Run, Black Run, Beaver Run, North Branch of Buffalo Creek, Muddy Run, Rapid Run, Coal Run, Panther Run, and Stoney Run. There are also several unnamed tributaries as well.

B. Land Use

The predominant land uses in the watershed are forest and agriculture. Residential and commercial development is mostly concentrated in the vicinities of Mifflinburg and Lewisburg. The Borough of Mifflinburg contains the largest concentration of diverse land uses in the watershed. The Borough of Lewisburg, although larger than Mifflinburg, represents a smaller portion of the study area because only a small portion lies within the watershed. The upper reaches of the watershed are heavily forested and very sparsely developed, partially due to the fact that the northwestern portions of the watershed lie within the Bald Eagle State Forest.

Farming has remained a significant activity within the watershed. In recent years, there have been no significant increases or decreases in the amount of land being farmed. Route 192, which traverses the northern portion of the watershed, and Route 45, which traverses the southern portion of the watershed, are the major transportation arteries within the watershed, and future development is expected to occur primarily along these routes and in the vicinities of Mifflinburg and Lewisburg.



UNION COUNTY

Buffalo Township
Hartley Township
Kelly Township
Lewis Township
Lewisburg Borough
Limestone Township
Mifflinburg Borough
West Buffalo Township
White Deer Township

CENTRE COUNTY

Haines Township
Miles Township

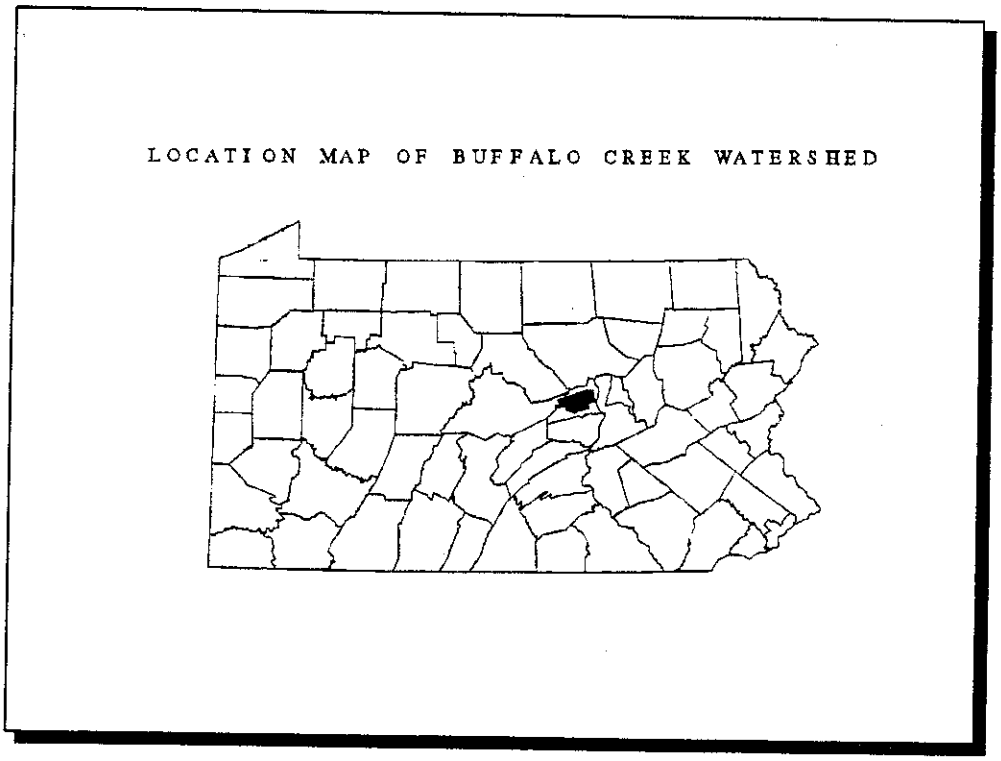


Figure III-1. Site Location

Table III-1 shows the overall land use by category within the Buffalo Creek Watershed.

Table III-1
Land Use Status By Category

Land Use	Area (acres)	Percent
Agricultural	27096	31.61%
Commercial	263	0.31%
Disturbed Land	78	0.09%
Farmstead	1010	1.18%
Industrial	154	0.18%
Institutional	174	0.20%
Meadow	1680	1.96%
Open Space	284	0.33%
Open Water	261	0.30%
Orchard	28	0.03%
R-1	1993	2.32%
R-2	1156	1.35%
R-3	277	0.32%
R-4	31	0.04%
Wooded	51249	59.78%
Total	85734	100.00%

C. Topography and Streambed Profile

The topography of the watershed ranges from steeply sloped mountainous areas in the upper reaches to rolling hills with relatively gentle slopes in the wide valley floor. The general topography is illustrated in Figure III-2.

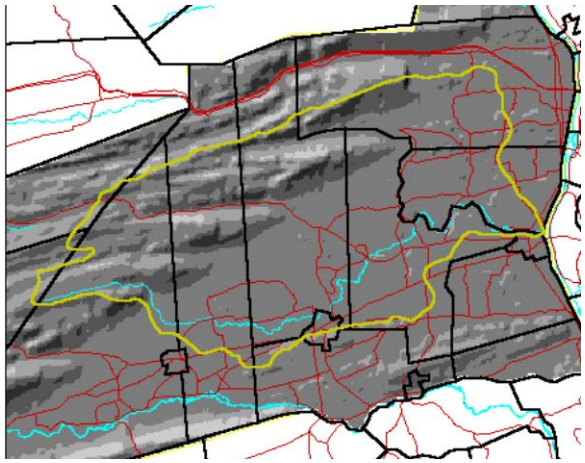
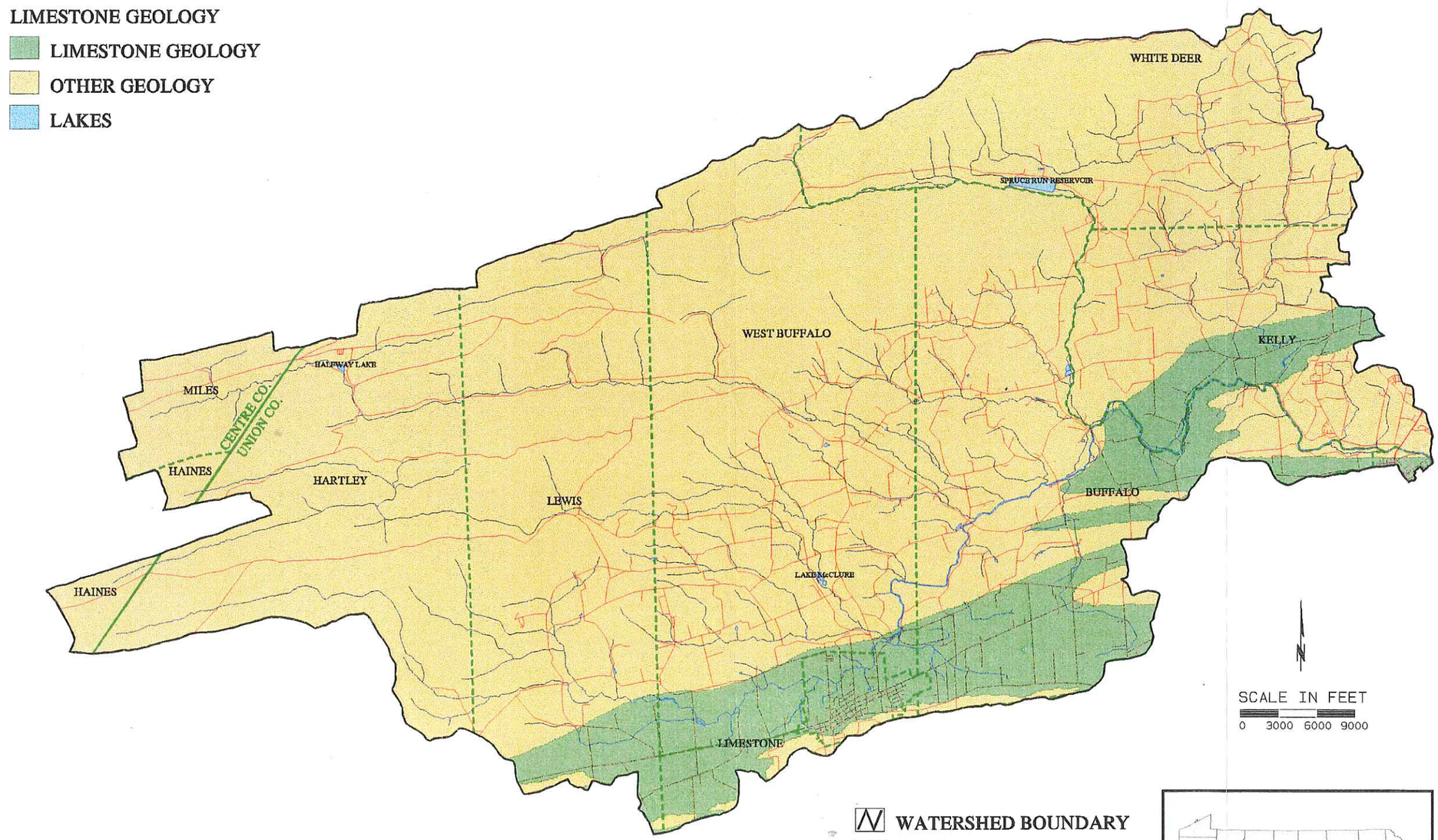


Figure III -2 Topographic Relief of the Buffalo Creek Watershed.

D. Soils

Soil properties are known to influence the process of runoff generation. The USDA, Soil Conservation Service has established criteria determining how soils will affect runoff by placing all soils into hydrologic soils groups. Hydrologic soils groups are broken down into four sub-groups (A through D) based on infiltration rate and depth. The A soils are the most pervious and have the lowest runoff potential. A soils are typically sands and gravels. D soils on the other hand, have low permeability, a high runoff potential and are typically clay soils. As seen in Figure III-4, the majority of the soils in the watershed fall in the B

BUFFALO CREEK WATERSHED
PHASE II ACT 167 STORM WATER MANAGEMENT PLAN



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LIMESTONE GEOLOGY

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FIGURE III-3

BUFFALO CREEK WATERSHED
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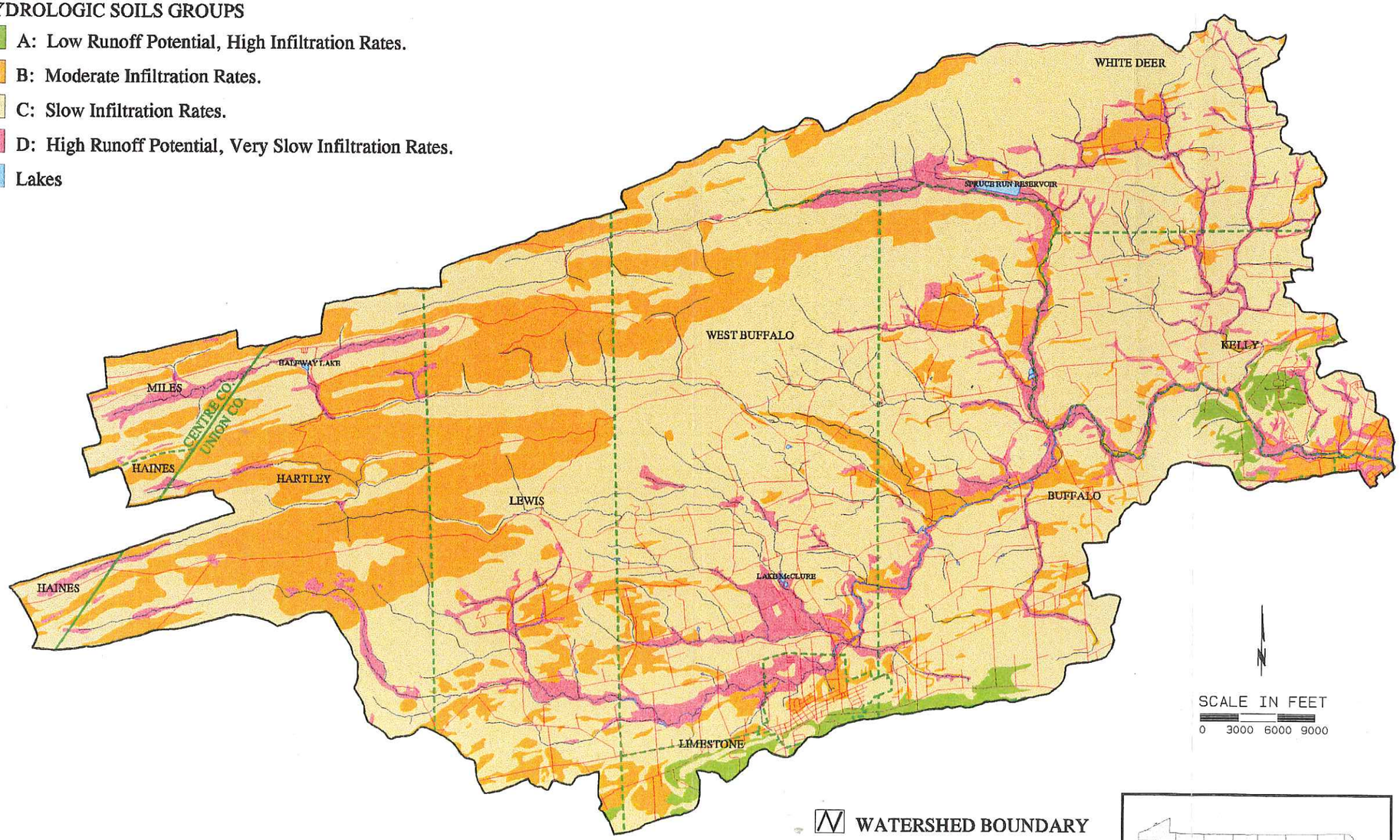
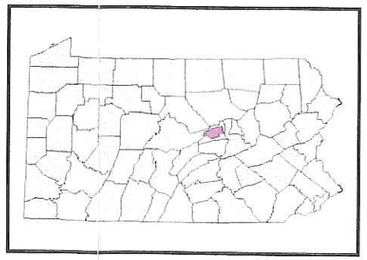
HYDROLOGIC SOILS GROUPS

- A: Low Runoff Potential, High Infiltration Rates.
- B: Moderate Infiltration Rates.
- C: Slow Infiltration Rates.
- D: High Runoff Potential, Very Slow Infiltration Rates.
- Lakes



- WATERSHED BOUNDARY
- COUNTY BOUNDARY
- MUNICIPAL BOUNDARIES
- STREAMS
- ROADS



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HYDROLOGIC SOIL GROUPS

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FIGURE III-4

BUFFALO CREEK WATERSHED
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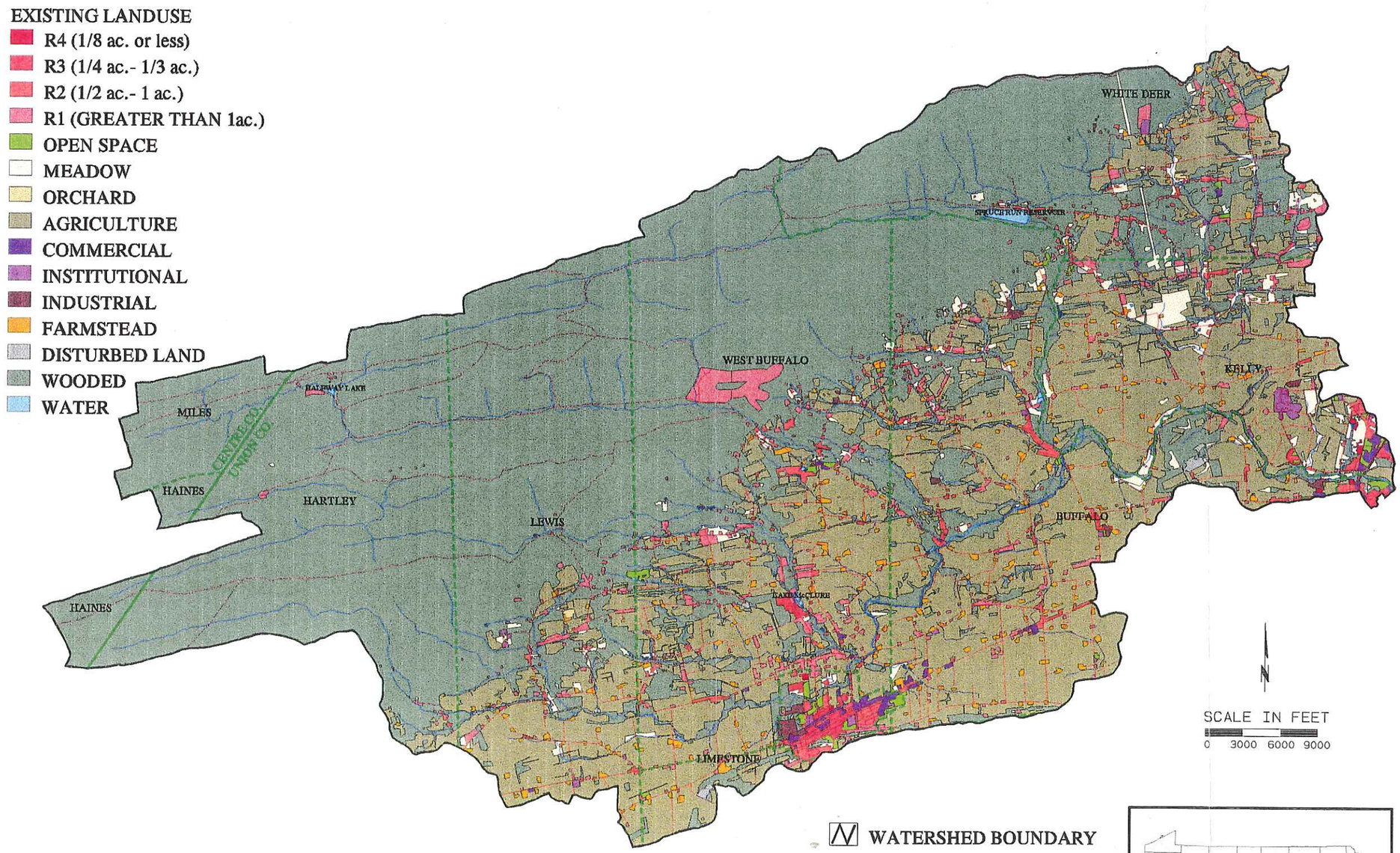

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EXISTING LANDUSE

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WATERSHED BOUNDARY
COUNTY BOUNDARY
MUNICIPAL BOUNDARIES
STREAMS
ROADS

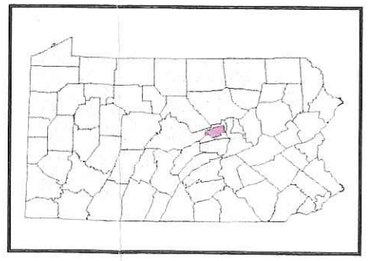

FIGURE III-5

BUFFALO CREEK WATERSHED
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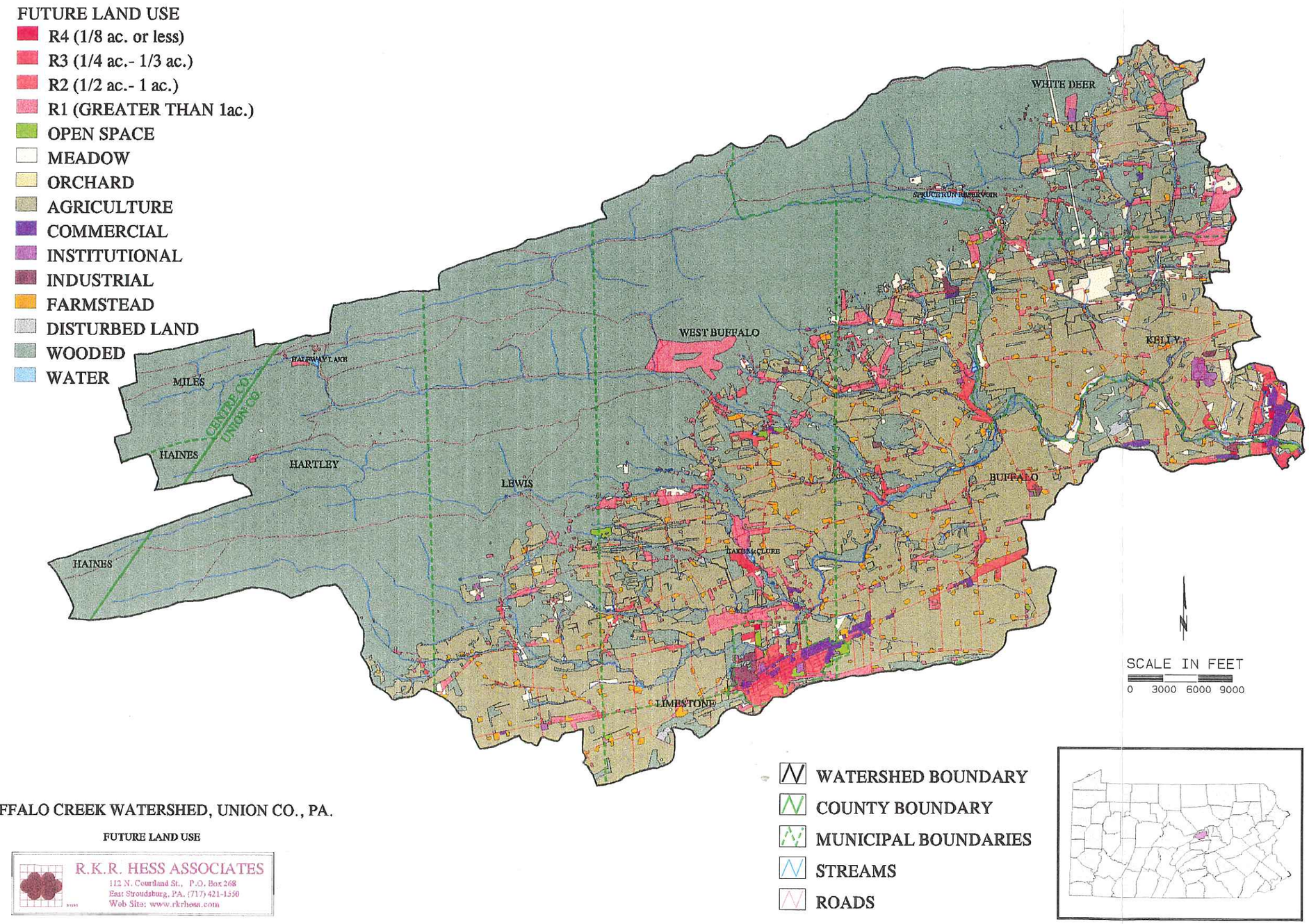

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FUTURE LAND USE

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FIGURE III-6

BUFFALO CREEK WATERSHED
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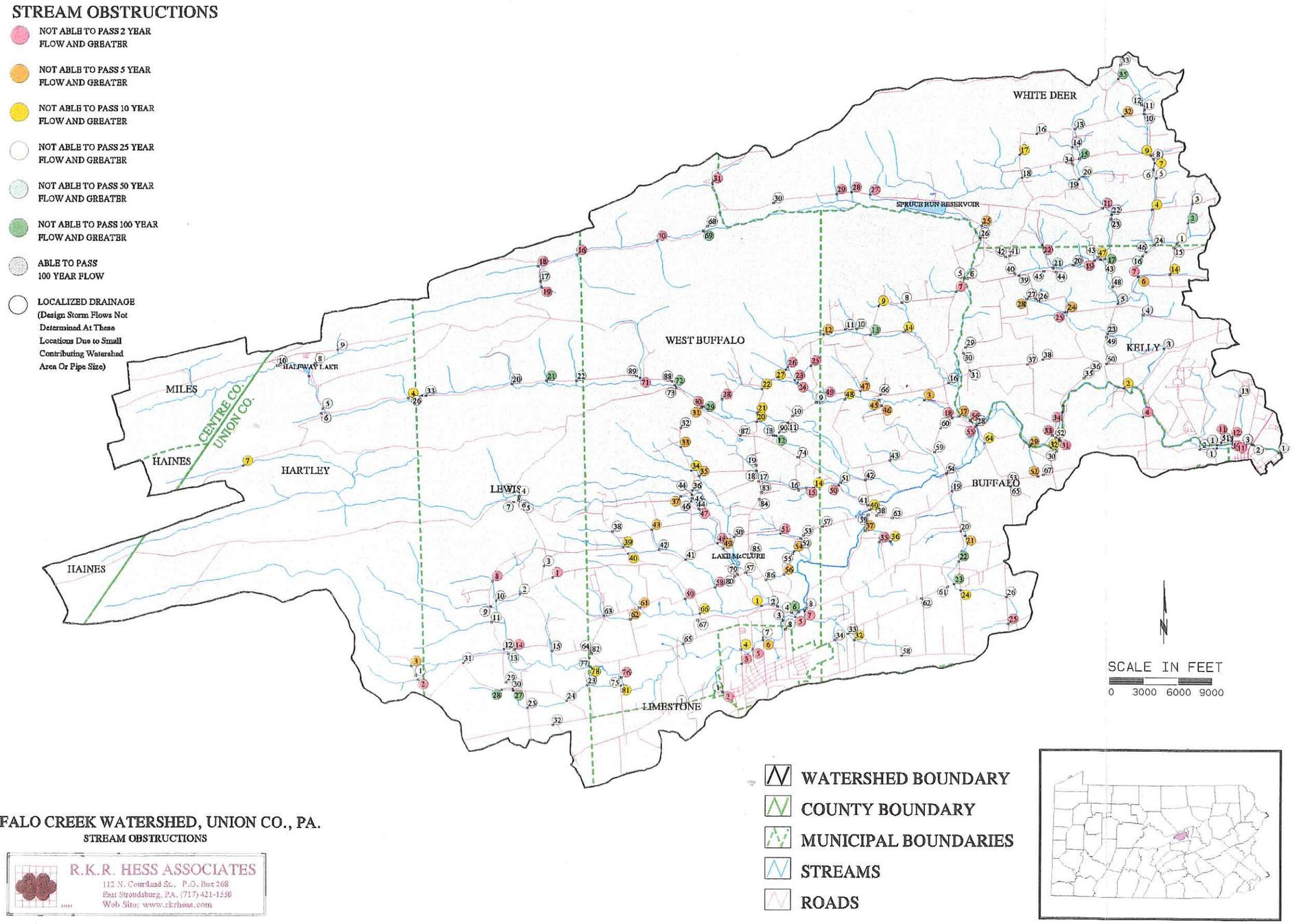

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FIGURE III-7

BUFFALO CREEK WATERSHED
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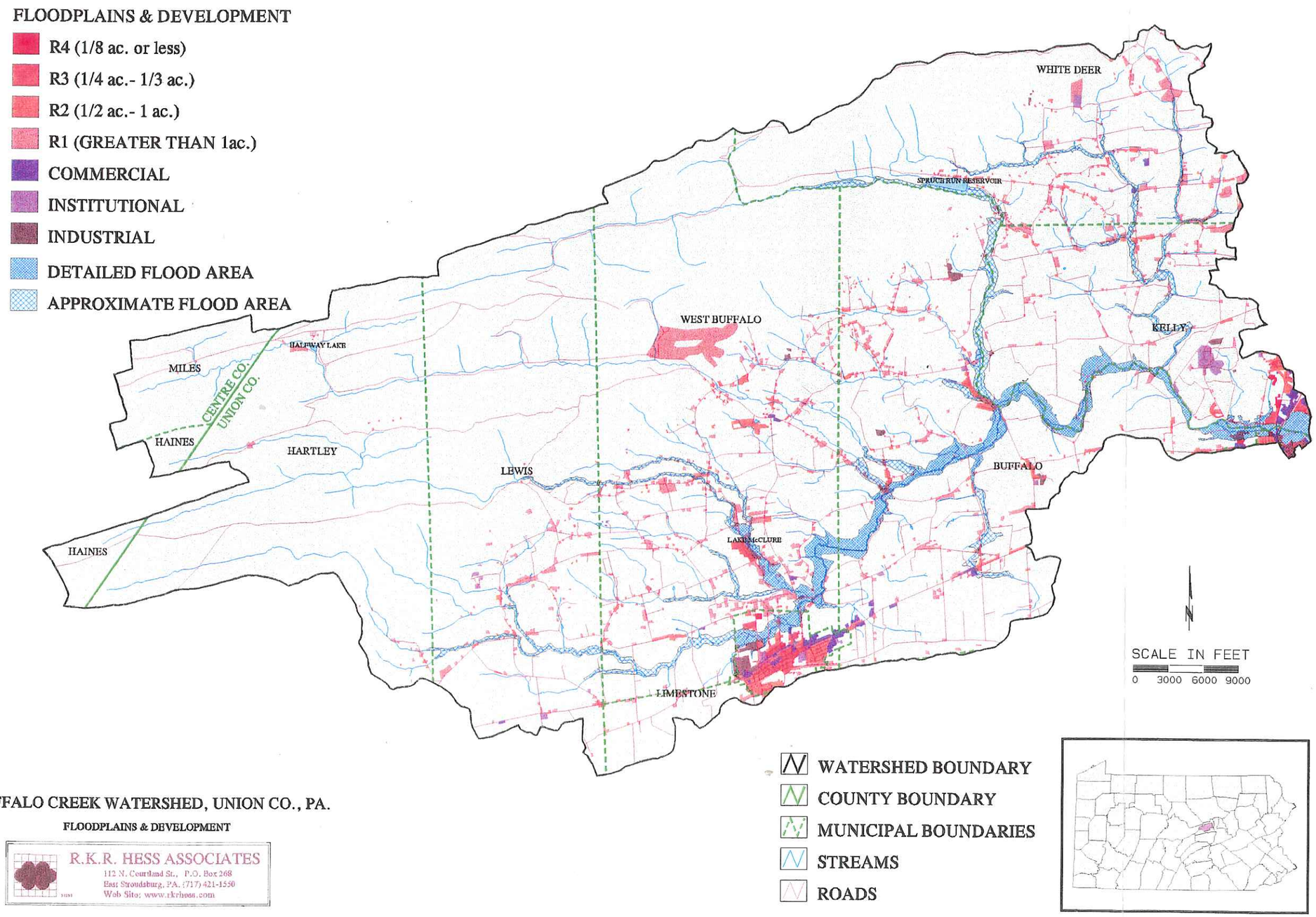

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FIGURE III-8

BUFFALO CREEK WATERSHED
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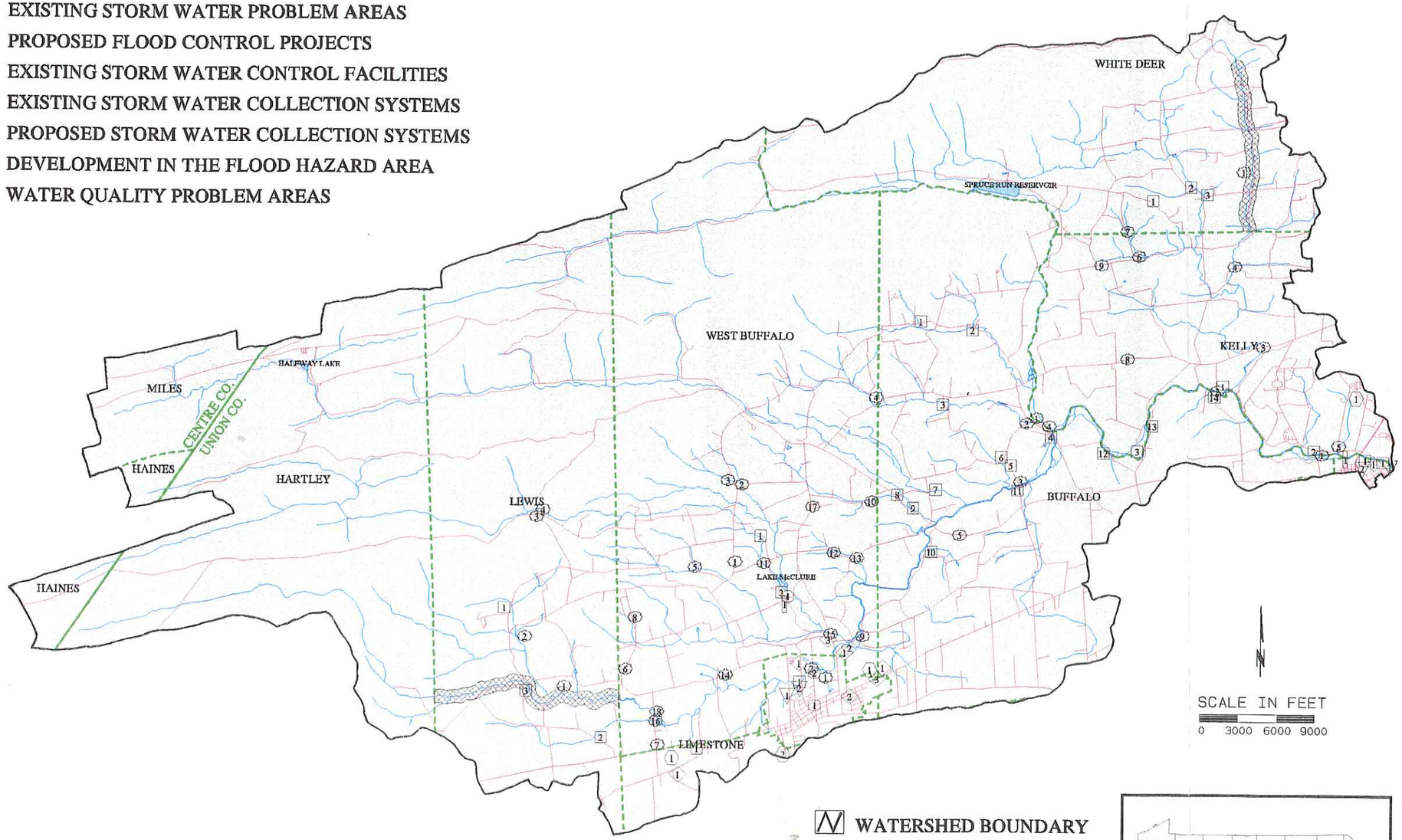
STORM WATER PROBLEM AREAS

- EXISTING STORM WATER PROBLEM AREAS
- PROPOSED FLOOD CONTROL PROJECTS
- EXISTING STORM WATER CONTROL FACILITIES
- EXISTING STORM WATER COLLECTION SYSTEMS
- PROPOSED STORM WATER COLLECTION SYSTEMS
- DEVELOPMENT IN THE FLOOD HAZARD AREA
- WATER QUALITY PROBLEM AREAS



WATERSHED BOUNDARY
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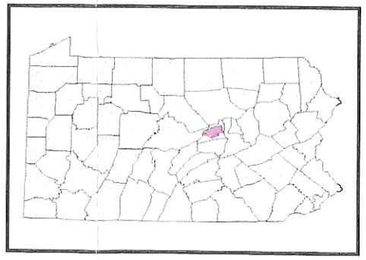

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STORM WATER PROBLEM AREAS

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FIGURE III-9

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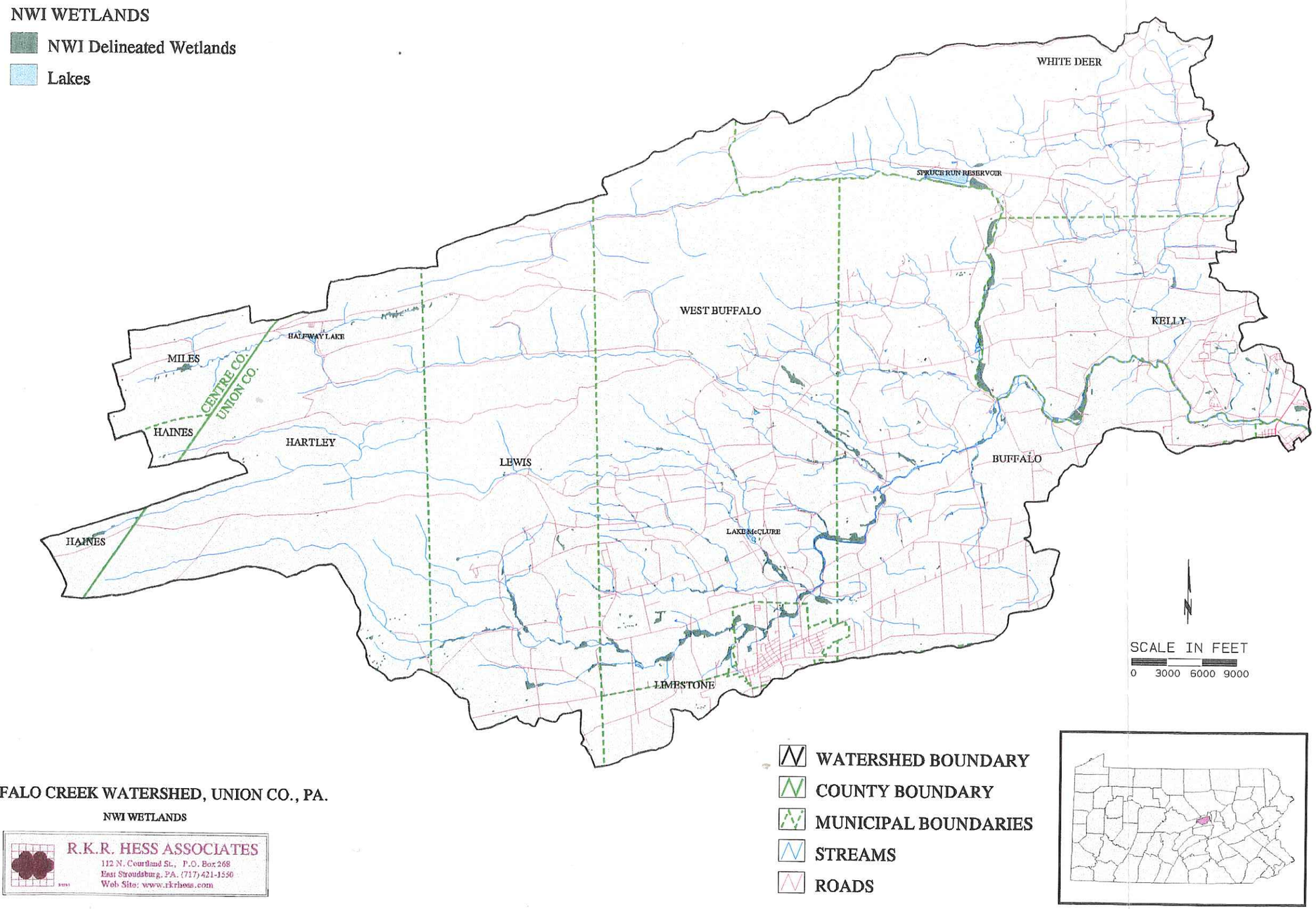

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NWI WETLANDS

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FIGURE III-10

and C hydrologic soil groups. The predominate soils in the western, upper portion of the watershed are Hydrologic Soils Group B. These soils are characterized as having moderate infiltration rates when thoroughly wetted and consist primarily of moderately deep to deep, moderately well to well drained soils that exhibit a moderate rate of water transmission. Soils in the eastern reaches of the watershed are primarily Hydrologic Soils Group C soils. These soils have slow infiltration rates when thoroughly wetted and contain fragipans. A fragipan is a layer that impedes downward movement of water and produces a slow rate of water transmission.

Soils are also grouped into soil associations. Soil associations are groups of soils that exhibit a regularly repeating pattern. There are eight soil associations in the Buffalo Creek Watershed, which are described in more detail below.

The Laidig-Buchanan-Meckesville soil association and the Dekalb-Ungers-Hazleton soil association make up the northern 50% of the watershed. The Laidig-Buchanan-Meckesville association consists of deep, well drained and moderately well drained, soils on level to steep mountain foot and side slopes. These soils are formed from colluvium (soils moved by gravity), weathered from sandstone and shale. The Dekalb-Ungers-Hazleton soil association consists of deep and moderately deep, well drained soils found on mountain tops and sides; and is formed from weathered material from sandstone.

The middle of the watershed is comprised mainly of the Weikert-Berks-Hartleton and the Edom associations. The Weikert-Berks-Hartleton association is shallow to deep, well drained, gently sloping to steep on hills and ridges; and is formed in material weathered from shale and some sandstone. The Edom association is comprised of moderately deep to deep, well drained soils on gently sloping to moderately steep uplands. This association is formed in material weathered from calcareous shale.

The Hagerstown-Elliber-Washington soil association, which runs along the southern boundary of the watershed, is made up of deep, well drained to moderately well drained soils on gently sloping to steep slopes in valleys and on ridges. This association is formed from glacial till and material weathered from limestone.

The Holly-Basher-Monongahela association runs primarily along Buffalo Creek on floodplains and terraces. This association is deep, very poorly drained to moderately well drained soils . The soils are nearly level to gently sloping; and are formed in alluvial material.

The Allenwood-Alvira-Shelmadine and the Klinesville-Calvin-Meckesville soil associations are scattered throughout the center of the watershed. The Allenwood-Alvira-Shelmadine association is primarily deep, and are respectively well drained, somewhat poorly drained, and poorly drained soils on nearly level to moderately steep uplands. They are formed from material weathered in glacial till. The Klinesville-Calvin-Meckesville soil association is shallow to deep, well drained soils on gently sloping to steep hills and ridges. This association is formed in material weathered from shale and some sandstone.

E. Climate

The regional climate in Central Pennsylvania is called Humid Continental. This climate is characterized by a normal succession of high and low pressure systems moving eastward across the United States. These successions produce weather changes in the area every few days during the winter and spring months. In the summer and fall, weather changes are less frequent due to a slowing down of the general atmospheric circulation.

Heavy rainfalls can also be expected during the summer season, June through November. Tropical disturbances that follow a northeasterly path can produce significant rainfall events in the study area. Normal daytime temperatures (expressed in °F) range from the low 30's to the low 40's in the winter and from the upper 70's to low 80's in the summer months. The mean annual temperature for this area is approximately 52 degrees Fahrenheit. Total precipitation in the area averages approximately 41 inches per year, with roughly 55 percent of this total occurring during the April through September growing period.

Thunderstorms can be expected on about 42 days in the period June through August. Some of these storms may be accompanied by strong winds, hail, or both. Snowstorms are rarely greater than ten inches and the snow normally does not persist for a significant length of time. Snow cover of one inch or more can be expected on about 42 days each winter.

F. Description of Data Collection

1. **Topography:** The base map was developed utilizing U.S.G.S. topographic quadrangles at one inch equals 2,000 feet (1:24,000 scale). Municipal boundaries, land slopes and drainage courses could all be determined from the base map. Subwatersheds or subareas used in the watershed modeling process were then overlaid onto this base map as shown in Appendix D of the Model Ordinance.

2. **Geology:** Geology plays a direct role in surface runoff in the Buffalo Creek Watershed due to the presence of limestone. Limestone surface geology means that there are sink holes, springs, and underground channels which act as conduits for runoff. Geology also determines soil types within the watershed through parent material breakdown. Figure III-3 shows where limestone geology exists. These data were taken from the Pennsylvania GIS Compendium, developed by the Pennsylvania DEP, The Pennsylvania State University, and Environmental Systems Research Institute (ESRI).

3. **Soils**: The Union and Centre County soils were digitally recorded from the NRCS Soil Surveys into a GIS (Geographical Information System). Soils polygons were "edgematched" at the county boundaries to obtain consistency. Hydrologic soil groups were then assigned to each soil polygon so that a hydrologic soils group map could be developed (Figure III-4).

4. **Existing Land Cover/Land Use:** Existing land uses were determined from several sources. Open space, commercial, industrial land uses, etc. were analyzed using digital orthophotography provided by the County, U.S.G.S. topographic maps, soil surveys, and field verification where necessary, and digitized into a GIS. Composite runoff curve numbers could then be automatically generated by overlaying the landuse map with the hydrologic soil group map. The generated curve numbers are used for input into the computer model. The existing conditions land use map for the Buffalo Creek Watershed is shown as Figure III-5.

5. **Future Land Use:** Future land use data were determined from the Union County Comprehensive Plan for the year 2010, existing municipal land use ordinances, and current growth trends. These data sets were then overlaid with the existing land use and wetlands coverage for verification. The future land use map is shown in Figure III-6.

G. Significant Obstructions

Information on stream obstructions and their capacities were obtained by the Union County Planning Commission through field measurements. Capacities were obtained using hydraulic methods and design charts obtained from the Federal Highway Administration. The reported design parameters and flow capacities for each obstruction and the hydraulic charts/relationships used to determine the capacities can be found in the Technical Appendix.

The obstruction capacities were then compared to the peak flow at that point derived through the modeling process for each design storm duration and frequency. Flood frequency relationships were then developed from each obstruction and were recorded in tabular form in the Technical Appendix. From these flood-frequency relationships, obstructions were classified into significant and not significant groups. A significant obstruction is defined as "any structure or assembly of materials that would impede, retard, cause ponding or diversion of storm water runoff or erosion of surrounding land or stream banks". Significant obstructions were classified into seven (7) categories:

- Those obstructions which are able to pass the 100-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 100-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 50-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 25-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 10-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 5-year, 24-hour storm and greater without obstructing the flow.

- Those obstructions which are not able to pass the 2-year, 24-hour storm and greater without obstructing the flow.

The locations and classifications of all obstructions are found in Figure III-7.

H. Projected and Alternative Land Development Patterns in the Watershed

1. Projected Land Development Patterns

All of the townships within the watershed are predominately rural and are largely undeveloped. Conversely, a majority of suitable land in the Boroughs of Lewisburg and Mifflinburg has already been developed. Overall, potential development pressures may be minimal, yet development pressures in a few areas will be great. Future development within the Buffalo Creek Watershed will most likely occur where public facilities are available. Commercial and industrial development will most likely be confined to industrial parks or areas where public water and sewers are available or will soon be. These areas include the Lewisburg and Mifflinburg Boroughs and the Routes 45 and 192 corridors. Single lot residential development will continue to occur sporadically throughout the watershed.

Table III-2 provides an overview of the types of development that will occur if existing patterns continue within each municipality within the watershed.

Table III-2
Development Potential by Municipality
Based Upon Existing Patterns in the Buffalo Creek Watershed

Municipality	R-4	R-3	R-2	R-1	I	C	OS
Miles Township	-	-	-	-	-	-	-
Haines Township	-	-	-	-	-	-	-
Hartley Township	-	-	-	-	-	-	-
Lewis Township	-	-	O	O	-	-	-
West Buffalo Township	-	-	O	X	-	-	-
Limestone Township	-	-	-	-	-	-	-
Mifflinburg Borough	-	X	X	O	-	-	X r
Buffalo Township	-	-	O	O	-	O	-
White Deer Township	-	-	-	X	-	-	-
Kelly Township	-	-	X	O	-	X	O r
Lewisburg Borough	-	-	O	-	-	O	-

R-4 Residential Lots (1/8 acre or less)
R-3 Residential Lots (1/4 ac. - 1/3 ac)
R-2 Residential Lots (1/2 ac. - 1 ac.)
R-1 Residential Lots (greater than 1 acre)
I Industrial
C Commercial
OS Open Space

--- No Impact
O Minor Impact
X Major Impact
r Reduction in Land Use

2. Impact of Runoff From Future Development

The Future Land Use Map was developed for a 10-year growth projection using existing growth patterns, Zoning and Comprehensive Plans in conjunction with physical limitations (wetlands, floodplain, topography) as can be seen in Figure III-6. The potential impact of additional runoff was then evaluated by placing the future land-use conditions into the computer model and re-running the new scenario. A comparison was made between the predicted uncontrolled future condition flows for both a 10-year and 20-year projection versus the existing condition flows for the 100-year, 24-hour storm. The results of the future conditions model runs can be found in Table III-3. Conclusions can be drawn from these tables that for a 10-year projection, several areas will experience increase in peak flows, while other areas will experience a decrease in peak flows. Reduced peak flows can be attributed to the increase in development of low density residential areas (1 to 2 acres) on existing farm lands. Residential areas usually provide for lower runoff peaks due to a combination of landscaped areas and lawns where greater amounts of rainfall infiltrate, while farm fields typically are tilled areas or bare earth where runoff channelizes quickly, resulting in less infiltration and greater runoff peaks. This trend is evident looking at SCS Curve number designations for residential and agricultural areas. For the 20-year projection, more areas, which were previously wooded areas, would begin to experience increased growth and the density of the development will most likely increase. Therefore wooded areas would be converted to residential areas thus increasing impervious areas along with runoff.

Other storm frequencies can be found in the Technical Appendix. Increased development in a watershed increases runoff peaks, volumes and velocities which decrease the time to peak, increasing the frequency of flooding.

TABLE III-3
PRESENT VERSUS FUTURE COMBINED PEAK FLOWS
100-YEAR 24-HOUR STORM

Subarea No.	Existing Pk Q cfs	10 Year Projection Future Pk Q cfs	20 Year Projection Future Pk Q cfs	Subarea No.	Existing Pk Q cfs	10 Year Projection Future Pk Q cfs	20 Year Projection Future Pk Q cfs
1	846.1	846.1	846.1	47	8716.3	8697.2	9686.2
2	1219.9	1219.9	1219.9	48	8983.6	8966.4	9927.6
3	1219.9	1219.9	1219.9	49	11677.6	11661.5	12664.7
4	1601.2	1601.2	1601.2	50	279.6	284.1	341.5
5	1896.3	1896.3	1896.3	51	12031.0	12013.2	13075.5
6	2223.6	2223.6	2223.6	52	745.7	745.7	864.8
7	382.6	382.6	382.6	53	929.8	928.4	1094.8
8	2333.5	2333.5	2333.5	54	1304.3	1298.7	1581.1
9	2352.8	2352.8	2357.8	55	1679.3	1670.7	1996.6
10	2383.1	2383.2	2394.8	56	12772.2	12750.5	13906.7
11	2427.6	2428.2	2445.3	57	12826.2	12805.8	13937.9
12	2481.0	2481.8	2504.0	58	3562.6	3562.6	3562.6
13	629.1	633.2	735.8	59	3749.7	3749.7	3749.7
14	885.0	888.9	1015.1	60	36.7	36.7	36.7
15	2705.1	2706.1	2743.2	61	3838.1	3838.1	3838.1
16	2318.1	2318.1	2318.1	62	4301.6	4304.7	4390.1
17	2436.1	2436.0	2436.0	63	718.4	744.6	888.5
18	2545.5	2546.2	2557.9	64	1045.9	1054.5	1260.3
19	747.0	747.0	747.0	65	1428.6	1427.7	1616.0
20	814.3	814.1	981.3	66	5936.1	5931.3	6234.3
21	1621.8	1623.9	1810.9	67	16042.9	16024.2	17444.2
22	3910.5	3912.9	4077.3	68	16462.6	16444.9	17929.3
23	3993.6	3995.6	4166.6	69	16407.9	16386.2	17916.4
24	1080.6	1083.8	1286.1	70	1374.0	1374.0	1374.0
25	1244.3	1254.4	1494.8	71	1474.9	1474.9	1498.5
26	2184.7	2185.2	2557.4	72	655.8	655.8	778.6
27	5546.9	5547.1	5979.3	73	1938.5	1938.5	2037.1
28	616.3	616.3	748.9	74	2184.1	2184.1	2319.0
29	408.6	408.6	408.6	75	550.5	550.5	657.4
30	391.6	391.7	391.7	76	620.4	620.4	737.6
31	1611.1	1611.2	1756.9	77	2579.2	2579.2	2788.2
32	570.8	570.8	570.8	78	2688.6	2688.6	2903.2
33	894.5	894.5	894.5	79	376.7	376.7	446.1
34	1064.4	1064.4	1064.4	80	1166.9	1166.9	1385.3
35	1474.7	1470.0	1697.1	81	449.7	491.8	578.4
36	2873.1	2870.4	3180.7	82	1436.7	1466.5	1723.7
37	457.3	457.3	543.9	83	3753.8	3755.8	4086.0
38	882.7	874.3	1002.7	84	704.5	704.5	834.3
39	3601.3	3593.1	4022.9	85	3994.0	3996.2	4374.2
40	3922.9	3912.5	4349.6	86	4055.5	4057.6	4425.2
41	380.7	380.7	455.9	87	18278.2	18266.1	19977.2
42	618.7	618.1	761.3	88	484.8	484.8	617.6
43	4311.9	4300.6	4805.7	89	18405.6	18401.9	20172.9
44	4445.4	4433.9	4963.6	90	146.4	168.8	226.7
45	1230.2	1323.8	1751.7	91	18459.0	18451.7	20227.2
46	8483.2	8463.6	9325.9	92	18459.3	18449.8	20247.8

I. Present and Projected Development in the Flood Hazard Areas

1. Present Conditions

The Federal Emergency Management Agency (FEMA) has prepared flood insurance studies for all of the municipalities in Union County and in the Buffalo Creek watershed. All of these studies were completed between August of 1976 to March of 1988. Detailed and approximate methods are two types of studies conducted in the FIS studies. The areas studied by detailed methods were those having expecting development. Those areas studied by the approximate methods were those having low development potential or minimal flood hazards. The data collected from these sources was submitted to the Pennsylvania Department of Community and Economic Development (PA-CED) for review to insure their accuracy.

Table III-4 summarizes the status of available flood data for the various municipalities and streams. It can be seen that some municipalities have no data, this does not mean that flood data are not available for these municipalities, but simply that there are no major streams in the municipality and in the Buffalo Creek Watershed. Municipalities and the PA-CED should be contacted as to the latest FIS studies before use.

TABLE III-4
AVAILABLE FLOOD DATA

MUNICIPALITY	STREAM	DATE OF STUDY	TYPE OF STUDY	AGENCY
Miles Township (Center County)	No Stream in Watershed			
Haines Township (Centre County)	No Stream in Watershed			
Hartley Township (Union County)	No Stream in Watershed			
Lewis Township (Union County)	North Branch of Buffalo Creek	9/30/87	Approx	FEMA
	Buffalo Creek	9/30/87	Approx	FEMA
	#1 Unnamed Tributary to Buffalo Creek	9/30/87	Approx	FEMA
	#2 Unnamed Tributary to Buffalo Creek	9/30/87	Approx	FEMA
West Buffalo Township (Union County)	North Branch of Buffalo Creek	9/30/87	Approx/Detailed	FEMA
	Unnamed Tributary to N. Buffalo Creek	9/30/87	Approx	FEMA
	Coal Run	9/30/87	Approx	FEMA
	Unnamed Tributary to Coal Run	9/30/87	Approx	FEMA
	Buffalo Creek (above Mifflinburg)	9/30/87	Approx	FEMA
	Buffalo Creek (below Mifflinburg)	9/30/87	Detailed	FEMA
Lewisburg Borough (Union County)	Buffalo Creek	8/76	Detailed	FEMA

Limestone Township (Union County)	No Stream in Watershed			
Mifflinburg Borough (Union County)	Buffalo Creek	3/4/88	Detailed	FEMA
Buffalo Township (Union County)	Spruce Run	4/1/77	Approx	FEMA
	Black Run	4/1/77	Approx	FEMA
	Muddy Run	4/1/77	Approx	FEMA
	Beaver Run	4/1/77	Approx	FEMA
	Stony Run	4/1/77	Approx	FEMA
	Rapid Run	4/1/77	Approx	FEMA
	Buffalo Creek	4/1/77	Detailed	FEMA
White Deer Township (Union County)	Spruce Run	3/79	Approx	FEMA
	Little Buffalo Creek	3/79	Approx	FEMA
	Unnamed Tributary to Little Buffalo Creek	3/79	Approx	FEMA
Kelly Township (Union County)	Spruce Run	9/76	Approx	FEMA
	Little Buffalo Creek	9/76	Approx	FEMA
	Unnamed Tributary to	9/76	Approx	FEMA
	Little Buffalo Creek	9/76	Approx	FEMA
	Buffalo Creek	9/76	Detailed	FEMA

Detailed methods included hydrologic computations and detailed HEC-2 backwater computations. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development. Approximate analyses were used to study those areas having low development potential or minimal flood hazards.

At present, the 100-year floodplain within the Buffalo Creek Watershed is primarily in agricultural land. However, several residential and commercial areas along the Buffalo Creek and its tributaries lie within the floodplain, particularly in the Boroughs of Lewisburg and Mifflinburg.

Figure III-8 shows the 100-year floodplain for the Buffalo Creek Watershed. Infringements of residential and commercial areas are clearly shown by overlaying these areas on the floodplain in the GIS. Table III-5 outlines the type of development and land use, which infringe upon the floodplain by municipality, general location and creek or tributary.

TABLE III-5
BUFFALO CREEK
PRESENT RESIDENTIAL AND COMMERCIAL AREAS
WITHIN 100-YEAR FLOODPLAIN

Municipality	Waterbody/Stream	Land Use Which Infringes on Flood Boundary	General Location
Miles Township	-	-	-
Haines Township	-	-	-
Hartley Township	-	-	-
Lewis Township	-	-	-
West Buffalo TWP.	North Branch of Buffalo Creek	R1	1500 ft. NNW of Lake McClure
	Unnamed Tributary to N. Branch of Buffalo Creek	R2	2000 ft. North of Lake McClure
	Unnamed Tributary to N. Branch of Buffalo Creek	R1	1000 ft. North of Lake McClure
	North Branch of Buffalo Creek	R1, R2	Land Surrounding Lake McClure
	North Branch of Buffalo Creek	R1	2000 ft South of Lake McClure (west bank)
	North Branch of Buffalo Creek	R1	2000 ft. South of Lake McClure (east bank)
	North Branch of Buffalo Creek	Commercial, R1	Above confluence of Buffalo Creek and North Buffalo Creek
	North Branch of Buffalo Creek	R1	Above confluence of Buffalo Creek and North Buffalo Creek
	North Branch of Buffalo Creek	R2	At confluence of Buffalo Creek and North Buffalo Creek
Limestone TWP.	-	-	-
Mifflinburg Borough	Buffalo Creek	R2	2000 ft. west of Buffalo Road
Buffalo Township	Spruce Run	R1	on Spruce Run Road SE of Spruce Run Reservoir
	Spruce Run	R1	west of Spruce Run Road, SE of Spruce Run Reservoir
	Spruce Run	R1	2000 ft. south of Kelly/White Deer/Buffalo junction
	Black Run	R1	Black Run and Spruce Run Confluence
	Spruce Run	R2	Above confluence with Buffalo Creek
	Stony Run	R1	3500 ft. above confluence with Buffalo Creek
	Rapid Run	R1	2500 ft. above confluence with Buffalo Creek
	Rapid Run	R2, Commercial	At confluence with Buffalo Creek
Buffalo Township	Beaver Run	R2	1000 ft. north of Rt. 45
	Beaver Run	R2, Commercial	At Rt. 45
	Buffalo Creek	Industrial	1000 ft. west of Lewisburg Border

White Deer TWP.	-	-	-
Kelly Township	Unnamed Tributary to Little Buffalo Creek	R1	2000 ft. west of Kelly's Crossroads
	Unnamed Tributary to Little Buffalo Creek	R1	2500 ft. east of Kelly's Crossroads
	Little Buffalo Creek	R1	1500 ft. NNW of the Northeast Federal Penitentiary
	Unnamed Tributary to Buffalo Creek	R2	At confluence with Buffalo Creek, 4000 ft. from outlet
Lewisburg Borough	Buffalo Creek	R2, Commercial	At outlet

2. Future Conditions

As can be seen from the Future Land Use Map, Figure III-6, there is potential for development in the watersheds floodplains. 100-year flood elevations are based on land use characteristics seen at the time of the FIS study and does not account for recent development The potential for future flooding increases as development continues, since land development plays a major roll in increased runoff. If unmanaged development occurs, floodplains will expand allowing the potential for existing development to infringe on the floodway. Building in the floodplain is also discouraged; not only can property be damaged, but structures in the floodplain also impede water flow and increase flooding.

J. Survey Existing Drainage Problems and Proposed Solutions

Information on drainage problems and proposed solutions was obtained by providing forms to the Watershed Plan Advisory Committee (WPAC) and requesting that they solicit people in their municipalities for input.

Table III-6 is a compilation of the problems. Figure III-9 (storm water problem areas, flooding, and storm water control facilities) Technical Appendix (Form A - storm water problem areas) should be used to further identify these areas. Solutions have been proposed both formally and informally as a result of agency involvement.

Twenty-five (25) problem areas were identified by the municipalities and placed into six categories outlined below. The identification numbers shown in Table III-6 correspond to the areas indicated on Figure III-9.

Erosion and Sedimentation (E & S)

The Union and Centre County Conservation Districts are responsible for administering Title 25, Chapter 102 (Erosion Control Regulations). These regulations address accelerated erosion and the resulting sedimentation from earth moving activities. Permanent stabilization of exposed areas and proper stabilization of channels of conveyance will reduce erosion problems.

It should be noted that the many streambank erosion problems under the "Erosion and Sediment" heading in Table III-6 contribute tons of sediment pollution each year. With streambank erosion included, a total of seven (7) sites have been identified.

TABLE III-6
BUFFALO CREEK WATERSHED PROBLEM AREAS

Number of Problem Areas	Municipality	Erosion & Sediment	Runoff	Groundwater	Pollution	Flooding
14	Buffalo Township	4, 6, 14	-	-	-	1 - 14
3	Kelly Township	-	-	-	-	1, 2, 3
0	Hartley Township	-	-	-	-	-
3	Lewis Township	2	-	-	3	1, 2
1	Lewisburg Borough	1	-	-	-	1
1	Limestone Township	-	-	-	-	1
1	Mifflinburg Borough	-	-	-	-	1
2	West Buffalo Township	-	-	-	-	1, 2
3	White Deer Township	1, 3	-	-	-	2
0	Haines Township	-	-	-	-	-

Culverts and Outlets

Some of the problems identified in Table III-6 are the result of inadequately sized culverts and/or unstable outlets, which traverse state, township, or private roads. The typical solution involves performing a hydrologic study to determine pipe size and replacing the pipe with a properly sized unit. Costs are typically borne by the owner of the road.

Bridges

Seven bridges were identified as being unable to pass the two-year storm event. The proposed solutions all involve performing hydrologic studies and increasing the hydraulic capacity underneath the roadway. Because of the high bedloads of streams within the watershed, gravel deposits threaten bridge capacity in addition to the inadequate waterway opening.

Streams

The problems listed in Table III-6 include eroding stream banks that affect adjacent properties. A proposed solution consists of stabilizing the banks using rock rip-rap or cribbing. Private funding is the only avenue available at this time and the cost may be prohibitive.

As discussed in the erosion and sedimentation section, numerous streambank erosion problems exist. It should be noted that many of the streams in the watershed have stream bank erosion problems and were not listed as a problem area . While few areas pose a threat to personal property, all deteriorate the unique habitats that make the streams in the watershed outstanding fisheries.

Flooding

Flooding in the watershed can be classified into two categories: 1) local flooding caused by inadequately sized culverts or conveyance systems; and 2) location of structures within the floodplain of major tributaries. Of the sites identified in Table III-6, most are caused by inadequate conveyance systems in developed areas.

Buffalo Creek has caused major flooding in the Boroughs of Lewisburg and Mifflinburg. The areas within the boroughs and immediately adjacent to the Buffalo Creek are generally low lying and subject to minor

flooding after even moderate rain or thaw conditions. Major storms along Buffalo Creek occurred in 1936 when 80% of Mifflinburg Borough was inundated and the Agnes Flood in June of 1972.

K. Existing and Proposed Storm Water Collection Systems

Lewisburg Borough has the only a stormwater collection system in the Buffalo Creek Watershed. Plans for this system can be found on the Lewisburg Borough Stormwater Sewer Map.

L. Existing and Proposed State, Federal and Local Flood Control Projects

Both Mifflinburg Borough and West Buffalo Township have stream widening flood control projects. The Borough of Lewisburg has plans to remove two buildings that lie in the floodplain and to clean out the storm water discharge channel.

The Borough of Mifflinburg also has plans to straighten a portion of Buffalo Creek. The capacity of the waterway opening is approximately 450 cfs before the water level begins to overflow the road. The 100 year storm is approximately 3700 cfs (FIS). Therefore, the channel realignment will not have a major impact on the flooding situation at the site, but will be more beneficial to erosion control.

The Buffalo Creek Act 167 Plan discourages channel straightening. Straightening a channel tends to increase velocities, particularly on the smaller in-bank storms, i.e. 1 to 2 year recurrence interval. This increases the potential for downstream erosion and simply translocates the problem. Straightening projects should be assessed for impacts to the site as well as for the impacts downstream.

The realignment, since it is only a 200 foot length and the fact that it does not have a major impact on the larger storms or reduce the flooding potential, will not have a major impact on the hydrology below the channelization point or the Act 167 Plan. From an engineering standpoint, the realignment will reduce the scour potential at the north abutment, however this might also be able to be accomplished through abutment protection. From an ecological standpoint, keeping the meander with erosion protection and habitat enhancement would most likely be more beneficial. This site has been included in the Figure III-9 for proposed projects in the Plan.

M. Existing and Proposed Storm Water Control Facilities

Due to the rural nature of the watershed and the fact that the largest projects are constructed by the private sector, there are no municipal storm water control facilities proposed for the next ten years other than those mentioned in Section L above. The cost, design, capacity, construction and operation of these private facilities cannot be projected at this time since they occur on a case by case basis as a developer buys land, submits plans, and develops the tract. Typically, the cost of such facilities are paid through the developer's financing with costs transferred to the buyer.

N. Wetlands

Wetlands, which play an important part in flood flow attenuation, were obtained from the National Wetlands Inventory Maps and incorporated into the GIS. Figure III-10 shows the wetlands for the watershed.

SECTION IV

WATERSHED TECHNICAL ANALYSIS - MODELING

A. Watershed Modeling

One of the first steps in the preparation of this storm water management plan was the identification of the storm water runoff simulation model to be utilized. Although there are several models accepted by DEP for these studies, it was necessary to select a model which:

- Modeled design storms of various durations and frequencies to produce routable hydrographs which could be combined.
- Was adaptable to the size of subwatersheds in this study.
- Could evaluate specific physical characteristics of the rainfall-runoff process.
- Did not require an excessive amount of input data yet yielded reliable results.

Based on comparison of DEP approved models, the Penn State Runoff Model (PSRM) was selected to be the best model for use in Act 167 projects. PSRM was chosen for the following reasons:

- It had been developed at Penn State University specifically for the analysis of the timing of surface flow contributions to peak rates at various locations in a watershed.
- Although originally developed as an urban runoff simulation model, data requirements make it easily adaptable to a rural situation.
- Input parameters provide a flexible calibration process.
- It has the ability to analyze reservoir or detention basin routing effects and location on the watershed.
- It is accepted by the Pennsylvania Department of Environmental Protection.

Although other models, such as TR-20, may provide essentially the same results as the Penn State Runoff Model, PSRM's ability to compare subwatershed contributions in a Peak Flow Presentation Table make it especially attractive for this study. The Penn State Runoff Model generates runoff flow information for selected subareas along the drainage course and compares individual subarea contributions to the total runoff process. The model generates runoff quantities for a specified design storm based upon the physical characteristics of the subarea, and routes the runoff flow through the drainage system in relation to the hydraulic characteristics of the stream. The amount of runoff generated from each subarea is a function of its slope, soil type or permeability, percent of the subwatershed that is developed, (i.e. percent of impervious cover) and its vegetative cover.

B. Calibration Process

In order to model a watershed with confidence and reliability, the computer model must be calibrated against field data. The preference is to develop synthetic storm hydrographs from actual rainfall data and compare it against actual stream data gathered by the U.S.G.S. or some other qualified data source. The USGS stream gauges in the Buffalo Creek watershed do not have substantial historic data. The Smithsonian Institute maintains nine gauges in the Buffalo Creek watershed which were established in 1996. Due to the

relative short time period that these gauges have been in existence, they do not provide an adequate historical base to calibrate against. Since adequate stream flow data does not exist for the Buffalo Creek watershed, the model was calibrated against regression models which have typically been utilized by the FEMA, the U.S.G.S and the US Army Corps of Engineers (USCOE) for predicting flood flows. Additionally, design storm flow values determined in the Bull Run Watershed Act 167 study were projected to the Buffalo Creek watershed utilizing an area - weighting method.

Other regression models were utilized to develop peak storm flows throughout the Buffalo Creek watershed, these were PSU-IV, the USCOE Regional Flood Frequency Method based on Hydrologic Report Tropical Storm Agnes, methodology outlined in the USGS WRI 82-21 and USGS WSP #1672. These methods have historically been used in Flood Insurance Studies for generating flood flow peaks of various frequency storms.

Additionally, the statistical analysis package, MINIEX, was utilized to determine various frequency storm peak flows on the adjacent Penns Creek watershed for which stream flow data was available. This package was run on existing records of data available at several recording stream gauges located on Penns Creek. Results of the flood frequency analyses at these gauges were then projected to several subareas of interest in the Buffalo Creek watershed based on area weighting methodologies.

Calibration of the model was then performed utilizing peak flow data generated from adopted values from the regression models and other model parameters such as overland Manning's n values, overbank velocity ratio (CTS), initial abstraction, and depression storage utilized by the PSRM model.. Two design storm events were chosen for calibration, namely the 10-year and 100-year storm events. Model parameters were adjusted until results from the PSRM model closely agreed with the adopted values from the regression methods.

Calibration results (Table IV-1) were favorable against the two storms chosen.

TABLE IV-1
Adopted Peak Storm Flows versus PSRM Predicted Peak Storm Flows

Subarea	**Adopted** 10 Year Flow (cfs)	**Predicted** 10 Year Flow (cfs)	**Adopted** 100 Year Flow (cfs)	**Predicted** 100 Year Flow (cfs)
16	912	590	2792	2318
18	1076	818	2950	2546
23	1417	1335	3984	3994
27	2002	2070	4642	5547
40	1685	1681	3927	3923
44	1856	1906	4596	4445
46	3541	3468	7566	8483
47	3452	3580	8148	8716
56	5194	5035	11641	12772
62	1401	1259	3880	4302
68	6689	6611	14909	16398
86	1632	1709	4276	4056
92	7759	7701	17140	18459

C. Verification

To verify the calibrated model, the model was run for the 2 and 50 year storms and compared to the respective results of other regression methods. Table IV-2 represents the results of the verification.

TABLE IV-2
Comparison of PSRM Predicted Flows to Accepted Regression Method Results for Various Design Storms

Subarea	**Adopted** 2 Year Flow (cfs)	**Predicted** 2 Year Flow (cfs)	**Adopted** 50 Year Flow (cfs)	**Predicted** 50 Year Flow (cfs)
16	323	176	2139	1390
18	376	285	2394	1710
23	557	470	3056	2771
27	693	767	3753	4036
40	578	692	3196	2973
44	688	794	3726	3395
46	1127	1462	6507	6409
47	1390	1543	6688	6612
56	1852	2190	9438	9569
62	489	401	3012	2872
68	2633	2767	12087	12503
86	623	782	3376	3073
92	3072	3420	13908	14184

D. Design Storm Rainfall

A summary of design rainfall totals was performed as indicated in Appendix A to best determine the rainfall amounts to be used for this study. A wide range of rainfall amounts were found for design storms based upon which method or source was utilized. The Buffalo Creek Watershed is located in PA Rainfall Region IV. Region IV values as specified by PennDOT are displayed in Table IV-3 and represent a median value of those rainfall amounts analyzed. These values were also compared to and are consistent with the recently completed Bull Run Watershed Plan. These values were therefore adopted as the design rainfall amounts for the Buffalo Creek Watershed .

TABLE IV-3
Design Storm Rainfall Amount (inches)

Return Period (yrs)	24 hr. Duration
1	2.10
2	2.59
5	3.12
10	3.72
25	4.56
50	5.28
100	6.12

Source: "Field Manual of Pennsylvania Department of Transportation Storm Intensity-Duration-Frequency Charts", May 1986.

E. Water Quality

Stormwater quantity and quality are primary concerns in the Buffalo Creek Watershed. A study performed by the USDA, SCS (NRCS) in 1985 found that agricultural runoff was introducing sediment, manure, agricultural chemicals and fertilizers. Sedimentation from agriculture was recognized as one of the major pollutants in the Buffalo Creek Watershed by the study. The Pennsylvania Fish Commission found that 15 miles of Buffalo Creek had been degraded by sediment, and the State Forest Service identified 25 miles of skid trail and logging roads that were eroding greater than 25 tons of soil per acre per year.

Farming is a major industry in the watershed and is a major land holder (32 percent of the entire watershed, one third that lies adjacent to streams). Much of the stormwater pollution can be attributed to different agricultural practices within the watershed. Most of the sediment in the streams can be attributed to stream bank erosion. Accelerated runoff from farms and developed land easily erodes unprotected stream banks. This accelerated runoff also carries pollutants from the fields. It was found by the Pennsylvania Fish Commission that the fecal coliform count in Buffalo Creek and it's tributaries can be as high as 7 times the state water quality standard.

These concerns can be addressed through the use of structural and non-structural Best Management Practices (BMP). Examples of structural BMPs include extended detention basins, water quality inlets, and infiltration basins. Examples of non-structural BMPs include stream buffering, impervious area reductions, and zoning. Section VI.C addresses several BMPs, which have been considered for the Buffalo Creek Watershed.

F. Modeling Process

One of the major objectives of the Buffalo Creek Watershed Stormwater Management Plan is to maintain and, if possible, improve existing water quality by preventing additional loading of stormwater runoff pollutants. In considering issues such as ease of implementation and cost effectiveness, the following is the minimum water quality criteria established to meet the objective of the Plan. Because the standard from water quality may result in a fairly small outlet orifice in detention facilities, the Municipality should encourage a minimum standard such as a 4-inch diameter orifice.

The Buffalo Creek watershed was subdivided into subwatersheds for modeling purposes. Considerations in the subdivision process were location of obstructions, known flooding, drainage or erosion problems, and tributary confluences. The most downstream point of each of these areas is considered a "point of interest" in which increased runoff must be analyzed for its potential impact.

The ultimate goal for selecting the key points of interest is to provide overall watershed storm water runoff control through effective control of individual subarea storm runoff. Thus, comprehensive control of storm water runoff for the entire watershed can be achieved through storm water management in each subbasin.

The watershed was then modeled to determine the hydrologic response for the 2, 5, 10, 25, 50, and 100-year storm events for the 24-hour storms, the results of which can be found in the Technical Appendix.

The modeling process addressed:

- - peak discharge values at various locations along the stream and its tributaries;
- - time to peak for the above discharges;
- - runoff contributions of individual subareas at selected downstream locations;
- - flow values contained in the channel and overflow values; and
- - overall watershed timing.

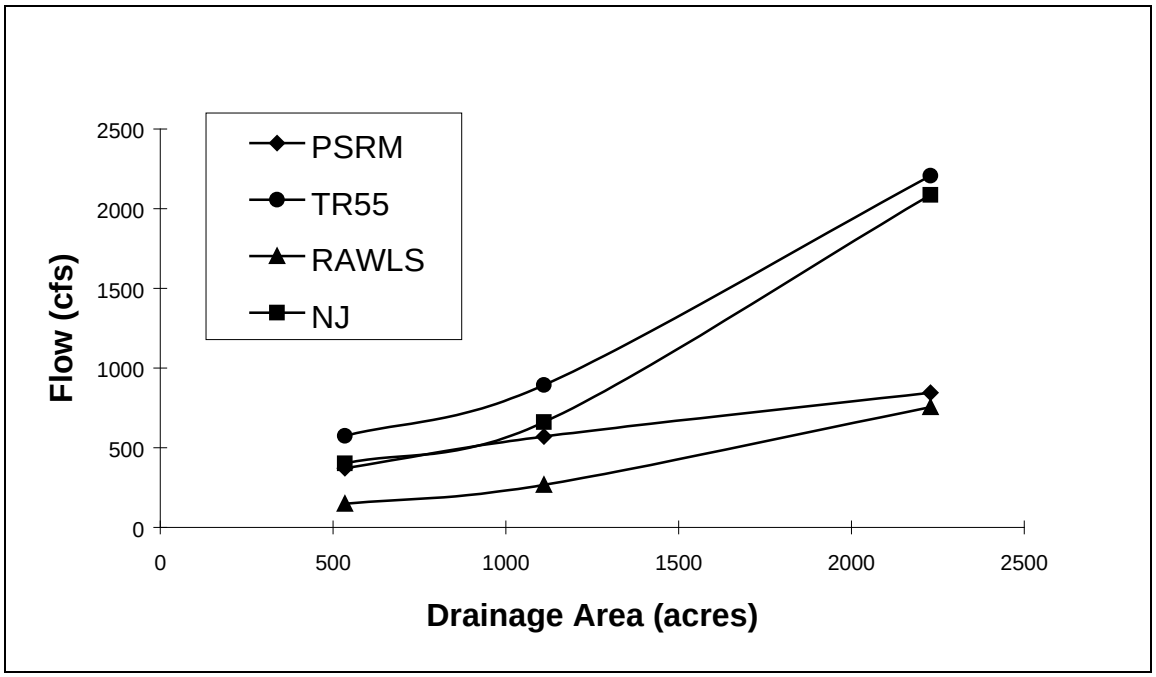
Additional model runs were made for the purpose of assessing alternative storm water management approaches. This involves an evaluation of individual development detention versus a "regional" facility,

the results of which are discussed in Section V. The release rate percentage option was also evaluated in addition to the possibility of waiving the release rate percentage concept in favor of a downstream facility controlling multiple subbasins, the results of which are also discussed in Section V.

An engineering evaluation of the applicability of various calculation methodologies was conducted as part of the plan preparation and was supported by previous research. Typical subwatersheds varying in size were selected to evaluate desktop methods for determining on-site runoff. The results were compared with the calibrated PSRM results. Figure IV-1 shows a comparison of three calculation methodologies. The rational method was analyzed using both Rawls values and those specified in the New Jersey Stream Encroachment Manual. The conclusions drawn from the analysis are that, utilizing the S.C.S. curve numbers and rational 'C' values (from Rawls) specified in Model Ordinance Appendix B, either the curve number method or rational method can be used to determine pre- and post-development runoff peak rates. However, caution should be applied utilizing TR-55 in this watershed since it produces high values compared to the calibrated Penn State Runoff Model values.

The rational method only determines peak rates, however. The design of any detention facility would have to include a routing of the calculated runoff through the basin. Routing refers to the calculation process of taking the post-development runoff and determining if the detention facility's stage/storage/discharge characteristics are adequate.

FIGURE IV-1
Calculation Methodologies Comparison



SECTION V

STANDARDS AND CRITERIA FOR THE CONTROL OF STORM WATER

A. Description of Management Districts

The timing of runoff from a development site in a particular subarea in relation to the time and peak site of flows at the points of intersect (POI) (subarea outlets) dictate how the runoff in a particular subarea should be managed.

Figure V-1 shows a simplified version of how various subarea hydrographs would contribute to the peak flow at a particular point of interest. As can be seen from Figure V-1, hydrograph "A" peaks after the point of interest (POI) hydrograph. In this case standard detention or reducing post development flows to predevelopment rates would attenuate the flows past A's peak, which would not influence the peak of the POI. A development site in subarea B would contribute flow at a time between the start and end of that subarea hydrograph, and standard detention would attenuate flow to a point, where it is increasing flow at the POI. Therefore, storm water management controls would need to reduce the outflow to a higher frequency (smaller) storm. Flows in subarea C enter and exit the stream system before the peak flow occurred at the POI; therefore, it would be advantageous not to detain storm water. Subareas A, B, and C on the sample would fall into 3 districts, respectively, A, B, and C.

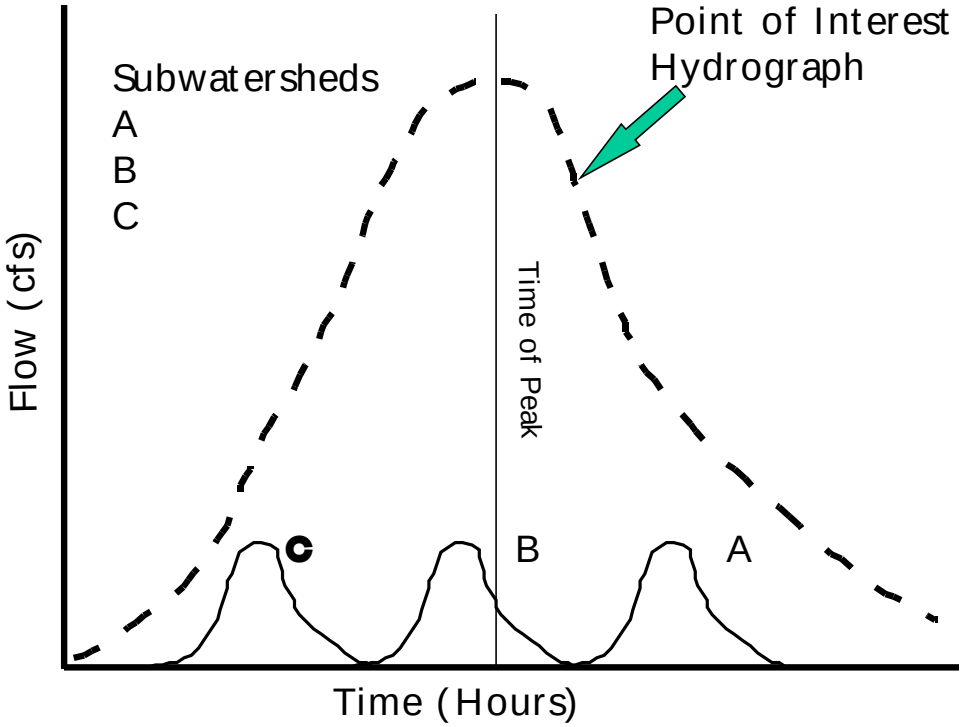


Figure V-1 - Relative Timing of Subwatershed Hydrographs

In preparing the Buffalo Creek Watershed Plan under Act 167, a major goal is to determine where in the watershed storm water detention is appropriate for new development and, conversely, where detention is not appropriate. It is also important to determine to what extent storm water detention would be required in

individual subareas. For the study, subareas were classified into one of three Management Districts as indicated below.

District	Subareas	Post-Development	Pre-Development
A	1-4, 16, 28-39, 58,59	2-year 10-year 50-year	1-year 10-year 50-year
B	5-15,17-27, 40-55, 60-65 70-75, 79-81	2-year 10-year 50-year	1-year 5-year 25-year
C	56,57, 66-69, 76-78, 82-92		

EXPLANATION OF DISTRICT C: Developed sites that discharge directly to the Buffalo Creek main channel or indirectly to the main channel through an existing storm water drainage system (i.e., storm sewer or tributary) may do so without control of post-development peak rate of runoff. If the post-development runoff is intended to be conveyed by an existing stormwater drainage system to the main channel, assurance must be provided that such system has adequate capacity to convey the increased peak flows or will be provided with improvements to furnish the required capacity. When adequate capacity of the downstream system does not exist and will not be provided through improvements, the post-development peak rate of runoff must be controlled to the predevelopment peak rate as required in District A provisions (i.e. 10-year post-development flows to 10 pre-development flows)for the specified design storms.

For these subareas in District C, it was determined to be advantageous not to detain the runoff volume for the larger storms, but to allow it to exit the watershed before the peak reaches that particular subarea. It has been found that these areas still require control of the water to maintain stream water quality. For water quality, the objective is to detain the 1-year post-development flow and release it at the 1-year predevelopment rate for residential development and control the first 1/2 inch of runoff for commercial and industrial development. At the same time the objective is to not attenuate the larger storms. This can be accomplished by configuration of the outlet structure to not control the larger storms, or by a bypass or channel to divert only the 1-year flood into the basin or divert flows in excess of the 1-year storm away from the basin.

Development in those subareas designated in Appendix E of the Model Ordinance as District C areas must convey the generated storm water runoff to a stream or watercourse in a safe manner. The conveyance must manage the quantity, velocity and direction of resulting storm water runoff in a manner which otherwise adequately protects health and property from possible injury pursuant to Act 167, does not overtax existing drainage facilities and does not cause erosion or sedimentation. Anyone who proposes no detention must comply with Section 303.F, G, and H of the Model Ordinance. Acceptable velocities shall be based upon criteria contained in the DEP "Erosion and Sediment Pollution Control Program Manual". The post-development flow greater than pre-development flow can only be released if it does not aggravate a significant obstruction or existing problem area or would overload existing storm sewer networks. If it does create a problem, obstruction replacement or standard detention would be required. Additionally, any flow from the 50-year storm not carried by downstream drainage facilities must be addressed and where necessary, additional controls installed to assure the proper control of this water

Proper analysis of channel capacity downstream of a development site for the purpose of discharging greater than predevelopment peak flow rates is essential for insuring the goal of not creating any new problem areas or aggravating existing drainage problem areas. The analysis must follow Section 303G of the Model Ordinance for the channel being evaluated based upon the Future Land Use Map (Plate III-4, Volume II) or the latest zoning revision after plan adoption. Also, storm water control measures consistent with the Plan must be assumed in analyzing projected development tributary to the point of evaluation.

Culverts, bridges, stream enclosures or any other facilities proposed within District C must pass flows for the 50-year design storm without causing hazardous a backwater or meet more stringent DEP criteria. Such facilities shall allow an unimpeded flow to be conveyed.

Stream channels, water courses or other conveyance facilities may be improved to meet the above requirements and alleviate existing capacity deficiencies as long as local, state, and federal requirements are met and permits obtained. Any facilities that are regulated by Chapter 105 criteria must be designed to be consistent with Chapter 105.

B. Standards and Criteria

The required standards and criteria developed are summarized in Table V-1 while recommended standards and criteria can be found in Table V-2.

TABLE V-1

REQUIRED CRITERIA & STANDARDS

REQUIRED STANDARD	BENEFIT
Storm Water Management A, B, and C Detention Districts	No increase in runoff on a watershed wide basis, storm water detention and attenuation.
Calculations Methodology Parameters must be obtained from the Model Ordinance.	Calculations for consistent storm water management.
Existing Storm Sewers or Culverts Discharge into existing sewer networks or culverts will be based on system capacity or design storm(s), whichever is more restrictive. Note: The design storm detention shall not necessarily be applied to the sewers and/or culverts.	Preserve sewer/culvert capacity thereby reducing O & M and replacement costs.
Discharge of Accelerated Runoff Accelerated storm water runoff shall be safely discharged into existing drainage patterns and storm sewers without adversely affecting properties or channel scouring and erosion.	Safe conveyance, continued surface and groundwater quality, flow attenuation.

Inappropriate Outlets If discharge from a storm water conveyance system from a development site to a stream, tributary, stabilized channel, or storm sewer is not possible, runoff shall be collected in a detention/retention facility and shall discharge at a non-erosive rate. Outlets discharging onto adjacent property owner(s) properties must have adjacent property owner(s) written permission	Safe conveyance, continued surface and ground water quality, storm water detention, flow attenuation.
District C Those areas designated in Appendix D of the Model Ordinance - as being in District C shall safely discharge runoff directly into an existing conveyance system with no detention or attenuation of greater than the 2-year storm.	Allows runoff to exit watershed system prior to peak.
Wetlands Network regulatory agencies involvement within wetland areas.	Infiltration, surface and groundwater recharge, stream baseflow, water quality, flow attenuation, detention.

TABLE V-2

RECOMMENDED CRITERIA & STANDARDS

RECOMMENDED STANDARD	BENEFIT
Erosion and Sediment Pollution Control Network with Administrative and Regulatory agencies involved with earth disturbance sites	Infiltration, structure integrity, surface water quality, safe conveyance, stream, culvert, and channel capacity.
Floodplains Those floodplains in which the floodplain stores water and acts as a detention basin shall not be filled so as to reduce the storage capacity.	Natural storm water detention/flood control downstream.
Hydrologic Soils Groups A & B All development proposed in hydrologic soils groups A and B should investigate the implementation of infiltration or retention structures for Storm Water Control measures as opposed to surface detention. This also pertains to the portions of the watershed that have storm sewers. Recharge structures installed prior to tapping into the storm sewers are recommended where soils and physical conditions permit.	Groundwater/stream baseflow recharge, flow attenuation.
Roof Drains, Residential/Commercial Prevent all roof drains from discharging into storm sewers, roadside ditches or channels. Discharge to lawn, recharge basin or storage facilities.	Promotes infiltration, flow attenuation and increases runoff time of concentration, flow attenuation. Protects water quality.
Pervious Surfaces The use of pervious materials will be encouraged for parking surfaces and sidewalks.	Infiltration, groundwater recharge.
Structures Concentrate on locating facilities within areas conductive to recharge and design to accommodate recharge or to meet release rate requirements.	Infiltration, groundwater recharge, stream baseflow.
Steep Slopes Regulate activities in critical slope areas where management of storm water by structure is inappropriate.	Stream base flow, flow attenuation conveyance integrity, surface water quality.

Note: See the Model Ordinance for more detailed standards and criteria.

C. Sub-Regional (Combined Site) Storage

Traditionally, the approach to storm water management has been to control the runoff on an individual site basis. However, there is a growing commitment to finding cost-effective comprehensive control techniques, which both preserve and protect the natural drainage system. In other words, two developers developing sites adjacent to each other could pool their capital resources to provide for a community storm water storage facility in the most hydrologic advantageous location.

The goal should be the development and use of the most cost-effective and environmentally-sensitive storm water runoff controls which significantly improves the capability and flexibility of land developers and communities to control runoff consistent with the Buffalo Creek Storm Water Management Plan and the release rates set forth.

An advantage to combining efforts is to increase the opportunity to utilize storm water control facilities to meet other community needs. For example, certain storm water control facilities could be designed so that recreational facilities such as ball fields, open space, volleyball, etc. could be incorporated. Natural or artificial ponds and lakes could serve both recreational and storm water management objectives.

To take this concept a step further, there is also the possibility that the storm water could be managed "off-site"; that is, in a location not on the property(s) in question. There could be publicly owned detention, retention, lake, pond or other physical facilities to serve multiple developments.

D. "Hardship Option"

The development of the plan and its standards and criteria was designed to maintain existing peak flows throughout the Buffalo Creek Watershed as the watershed experiences development. There may be certain instances, however, where the standards and criteria established are too restrictive for a particular landowner or developer. The existing drainage network in some areas may be capable of safely transporting slight increases in flows without causing a problem or increasing flows elsewhere. If a developer or homeowner can prove that: 1) the developer/homeowner cannot reasonably comply with the ordinance requirements due to lot conditions; and 2) the developer/homeowner can demonstrate "no harm", the hardship option may be applied. The landowner would have to present their case to the Municipal Officials and either the Union County Planning Commission (UCPC) or the Centre County Planning Commission (CCPC) with the final determination made by the municipality. Municipal Officials shall consider either the UCPC's or CCPC's comments in making their decision. Any landowners pleading the "hardship option" will assume all liabilities that may arise due to exercising this option. Financial obligations are not considered a hardship.

The municipality (governing body) may hear requests for waivers where it is alleged that the provisions of this (Act 167) Ordinance inflict unnecessary hardship upon the applicant. The waiver request shall be in writing on an application form promulgated by the municipality and accompanied by the requisite fee based upon a fee schedule adopted by the municipality. A copy of the completed application form shall be provided to each of the following: municipal engineer, municipal solicitor and Planning Commissions. The application shall fully document the nature of the alleged hardship.

The municipality may grant a waiver provided that all of the following findings are made in a given case:

1. That there are unique physical circumstances or conditions, including irregularity of lot size or shape, or exceptional topographical or other physical conditions peculiar to the particular property, and that the unnecessary hardship is due to such conditions, and not the circumstances or conditions generally created by the provisions of this Ordinance in the Storm Water Management District in which the property is located;

2. That because of such physical circumstances or conditions, there is no possibility that the property can be developed in strict conformity with the provisions of this Ordinance, including the "no harm" provision, and that the authorization of a waiver is therefore necessary to enable the reasonable use of the property;

3. That such unnecessary hardship has not been created by the applicant; and

4. That the waiver, if authorized, will represent the minimum waiver that will afford relief and will represent the least modification possible of the regulation in issue.

In granting any waiver, the municipality (governing body) may attach such reasonable conditions and safeguards as it may deem necessary to implement the purposes of Act 167 and this Ordinance.

SECTION VI

ALTERNATE RUNOFF CONTROL TECHNIQUES AND THEIR EFFICIENCY IN THE WATERSHED

A. Regional Detention Facilities

An option in watershed-wide storm management is to control runoff using regional facilities. In this scenario developers would pool their capital to build a regional detention basin at a strategic location in the watershed in place of installing a basin at each site.

The potential for locating regional facilities within the Buffalo Creek Watershed was evaluated using the six parameters below.

- Site location's influence on the total watershed hydrology
- Available undeveloped land
- Ownership of the land
- Topography
- Environmental sensitivity of the locations
- Total area and percent of the total contributing area to the basin location.

Due to the existing development and road patterns in the watershed, steep slopes, wetlands and land ownership considerations, there are only three viable regional basin locations identified in the Buffalo Creek watershed. These sites are located in subareas 1, 16 and 58.

TABLE VI-1
Regional Detention Facilities

Regional Detention Subarea	Tributary/Location	Available Storage Capacity (Ac. Ft.)	Contributing Drainage Area (Sq. Mi.)
1	Rapid Run	510	3.0
16	Panther Run	228	7.1
58	Spruce Run	1,113	11.1

Each potential regional basin site was modeled to determine its overall impact on Buffalo Creek as the watershed is developed. The results of this modeling and the effect of each basin on the overall watershed is shown in Table VI-2.

TABLE VI-2
Effect of a Hypothetical Regional Detention Basin on Future Flows at the mouth of Buffalo Creek

	SUBAREA 1		SUBAREA 16		SUBAREA 58	
Design Storm	20 Year Projected Flow without Dam	20 Year Projected Flow with Dam	20 Year Projected Flow without Dam	20 Year Projected Flow with Dam	20 Year Projected Flow without Dam	20 Year Projected Flow with Dam
2 yr	4373	4373	4373	4325	4373	4255
50 yr	15868	15868	15868	15675	15868	14453
100 yr	20248	20248	20248	20092	20248	18317

As is shown in the results of this modeling, two of the three regional basins would have an impact on the overall future flows at the watershed outlet. The placement of a regional basin in Subarea 58, just upstream of the Spruce Run Reservoir, would potentially reduce the 20 year projected future development flows to existing condition flows and would primarily benefit areas on Spruce Run and the main stem of Buffalo Creek below its confluence with Spruce Run. Placement of a regional basin in Subarea 16 at the headwaters of the North Branch Buffalo Creek would reduce future development flows by almost 150 cfs at the mouth of Buffalo Creek, but would primarily reduce flows to those areas from headwaters of North Branch Buffalo Creek to its confluence with the main stem of Buffalo Creek. Finally, the placement of a regional basin in Subarea 1, would not impact flows at the mouth of Buffalo Creek, but would rather benefit those areas of Rapid Run from its headwaters to its confluence with Buffalo Creek, reducing flows at the mouth of Rapid Run by 230 cfs.

Each of these three areas are viable locations for regional detention basins in the Buffalo Creek watershed, but each having an effect on different portions of the overall watershed. Although for modeling purposes, the design of each basin was simplified, a more detailed design of these potential sites could address more specific concerns of downstream areas. For instance, problems of streambank erosion and flooding are of significant concern along Rapid Run. While the design of the theoretical regional basin in Subarea 1 shows that there is a potential for a basin in this area to elevate future flooding problems along Rapid Run, more emphasis can be made in the design process to focus on reducing the more frequent smaller storms which are the primary cause of streambank erosion. In conclusion, more emphasis should be placed in the future on the potentials of regional basins in the Buffalo Creek watershed. Most ideal locations for regional detention would have large tributary areas, which naturally puts the locations on the main stem tributaries to the Buffalo Creek. The presence of major arterial roads traversing parallel to these tributaries would preclude the construction of regional detention basins in most locations.

B. On-Site Storm Water Controls

Each developer must not allow the runoff from his site to exceed the applicable release rate applied to the subwatershed in which the site is located. This runoff control can be obtained in a number of different ways. Table VI-3 indicates a general overview of measures that can be applied to reduce or delay storm water runoff while Table VI-4 shows the advantages and disadvantages for several types of runoff control measures. It will be up to the developer or the developer's engineer to select the technique that is the most appropriate to the type of project and physical characteristics of the site. Effective measures for reducing peak rates of runoff are not limited to those in Table VI-3.

In determining what measures or combination of measures to install, the following parameters should be considered:

- Soil Characteristics (hydrologic soil group, [i.e. permeability], erodibility, etc.)
- Subsurface conditions (depth to seasonal high water table, bedrock, etc.)
- Topography (steepness of slope, earthcut)
- Existing drainage patterns (nearby streams, swales and flooding potential)
- Economics
- Advantages and disadvantages of each technique.

Infiltration structures are encouraged for soils with an A or B hydrologic rating (see Figure III-4). Innovative approaches are encouraged to aid in meeting the applicable release rate percentage. The general suitability of individual runoff control measures in the Buffalo Creek watershed are listed in Table VI-5.

TABLE VI-3

Various On-Site Storm Water Control Methods

AREA	REDUCING RUNOFF	DELAYING RUNOFF
Large Flat Roof	1. Cistern storage 2. Rooftop gardens 3. Pool storage or fountain storage	1. Ponding on roof by constricted downspouts 2. Increasing roof roughness a. Rippled roof b. Graveled roof
Parking Lots	1. Porous pavement a. Gravel parking lots b. Porous or punctured asphalt 2. Concrete vaults and cisterns beneath parking lots in high value areas 3. Vegetated ponding areas around parking lots 4. Gravel trenches	1. Grassy strips on parking lots 2. Grassed waterways parking lot 3. Ponding and detention measures for impervious areas a. Rippled pavement b. Depressions c. Basins
Residential	1. Cisterns for individual homes or groups of homes 2. Gravel driveways (porous) 3. Contoured landscape 4. Ground-water recharge a. Perforated pipe b. Gravel (sand) c. Trench d. Porous pipe e. Dry wells 5. Vegetated depressions	1. Reservoir or detention basin 2. Planting a high delaying grass (high roughness) 3. Gravel driveways 4. Grassy gutters or channels 5. Increased length of travel of runoff by means of gutters, diversions, etc.
General	1. Gravel alleys 2. Porous sidewalks 3. Mulched planters	1. Gravel alleys

Source: Urban Hydrology for Small Watershed. Technical Release No. 55.

TABLE VI-4 (PG. 1)

Advantages And Disadvantages Of Various On-Site Storm Water Control Methods

MEASURE	ADVANTAGES	DISADVANTAGES
A. Cisterns and Covered Ponds	1. Water may be used for: a. Fire Protection b. Watering lawns c. Industrial processes d. Cooling purposes 2. Reduce runoff while only occupying a small area 3. Land and space above cistern may be used for other purposes.	1. Expensive to install 2. Cost required may be restrictive if the cistern must accept water from large drainage areas 3. Requires slight maintenance 4. Restricted access 5. Reduces available space in basements for other uses
B. Rooftop Gardens	1. Aesthetically pleasing 2. Runoff reduction 3. Reduce noise levels 4. Wildlife enhancement	1. Higher structural loadings on roof and building 2. Expensive to install and maintain
C. Surface Pond Storage (usually residential areas)	1. Controls large drainage areas with low release 2. Esthetically pleasing 3. Possible recreation benefits a. Boating b. Ice skating c. Fishing d. Swimming 4. Aquatic life habitat 5. Increases land value of adjoining property	1. Requires large areas 2. Possible pollution from storm water and siltation areas 3. Possible mosquito breeding 4. May have adverse algal blooms as a result of eutrophication 5. Possible drowning 6. Maintenance problems
D. Ponding on Roof by Constricted Downspouts	1. Runoff delay 2. Cooling effect for building a. Water on roof b. Circulation through 3. Roof ponding provides fire protection for building (roof water may be trapped in case of fire)	1. Higher structural loadings 2. Clogging of constricted inlet requiring maintenance 3. Freezing during winter (expansion) 4. Waves and wave loading 5. Leakage of roof water into building (water damage)
E. Increased Roof Roughness a. Rippled roof b. Gravel on roof	1. Runoff delay and some reduction (detention in ripples or gravel)	1. Somewhat higher structural loadings

TABLE VI-4 (CONTINUED)(PG2)

F. Porous pavement (parking lots and alleys) a. Gravel parking lot b. Holes in impervious pavements (1/4 in. dia.) filled with sand	1. Runoff reduction (a and b) 2. Potential groundwater recharge (a and b) 3. Gravel pavements may be cheaper than asphalt or concrete (a)	1. Clogging of holes or gravel (a and b) 2. Compaction of earth below pavement or gravel decreases permeability of soil (a and b) 3. Ground-water pollution 4. Frost heaving for impervious pavement with holes (b) 5. Difficult to maintain 6. Grass or weeds could grow in porous pavement (a and b)
G. Grassed channels and vegetated strips	1. Runoff delay 2. Some runoff reduction (infiltration recharge) 3. Esthetically pleasing a. Flowers b. Trees	1. Sacrifice some land area for vegetated strips 2. Grassed areas must be mowed or cut periodically (maintenance costs)
H. Ponding and detention measures on impervious pavement a. Rippled pavement b. Basins c. Constructed inlets	1. Runoff delay (a, b, and c) 2. Runoff reduction (a and b)	1. Somewhat restricted movement of vehicle (a) 2. Interferes with normal use (a and c) 3. Damage to rippled pavement during snow removal (a) 4. Depressions collect dirt and debris (a, b, and c)
I. Reservoir or detention basin	1. Runoff delay 2. Recreation benefits a. Ice skating b. Baseball, football, etc. if land is provided 3. Esthetically pleasing 4. Could control large drainage areas with low release	1. Considerable amount of land is necessary 2. Maintenance costs a. Mowing grass b. Herbicides c. Cleaning periodically (silt removal) 3. Mosquito breeding area 4. Siltation in basin
J. Converted septic tank for storage and ground-water recharge	1. Low installation costs 2. Runoff reduction (infiltration and storage) 3. Water may be used for: a. Fire protection b. Watering lawns and gardens c. Ground-water recharge	1. Requires periodic maintenance (silt removal) 2. Possible health hazard 3. Sometimes requires a pump for emptying after storm

K. Ground-water recharge a. Perforated pipe or hose b. French drain c. Dry well	1. Runoff reduction (infiltration) 2. Ground-water recharge 3. May supply water to garden or dry areas 4. Little evaporation loss	1. Clogging of pores or perforated pipe 2. Initial expense of installation (materials)
L. High delay grass (high roughness)	1. Runoff delay 2. Increased infiltration	1. Possible erosion or scour 2. Standing water on lawn in depressions

TABLE VI-5

Suitability of Runoff Control Measures in the Buffalo Creek Watershed

1. Cisterns and Covered Ponds

Recommended in industrial parks where water could be utilized for fire protection; expensive to install with limited benefit. Low maintenance costs (usually requires periodic sediment removal); good for receiving stream quality since no outflow.

2. Rooftop Gardens

Recommended for large buildings (with proper design). Limited because of climate and winter conditions.

3. Surface Pond Storage

Recommended where pond sites exist or on more porous soils (A and B) for groundwater recharge. Relatively inexpensive to install and maintain. Helps entrap sediment to improve water quality of receiving stream.

4. Ponding on Roof, Constricted Downspouts

Possible on large public buildings. Required structure modifications usually expensive. Low maintenance costs unless leaks occur. Typically "warms" water, which could affect receiving stream. Reduces quality because of pollutants.

5. Increased Roof Roughness

Possible for industrial, commercial and public buildings. Relative effectiveness minimal on a watershed-wide basis. Moderate installation costs; little maintenance costs. "Warms" runoff.

6. Porous Pavement

Highly recommended where possible, especially in A and B soils and large parking facilities. Promotes groundwater recharge. Moderate in expense compared to typical paving, however, less land intensive if surface detention would be required. Low maintenance costs.

7. Grassed Channels and Vegetated Strips

Recommended wherever possible throughout the watershed to slow velocity and reduce erosion. Minimal slopes (greater than 0.5%) recommended; could entrap sediment to improve water quality. Low installation and maintenance costs. Promotes infiltration.

8. Ponding and Detention on Pavement

Recommended in entire watershed except in "no detention" areas. Tends to warm water, which could affect receiving stream. Very inexpensive with low maintenance costs. Freezing should be considered. Entraps some pollutants.

9. Reservoir or Detention Basin

Recommended in entire watershed except in "no detention" areas. Relatively easy to implement. Moderate installation and maintenance costs. Aids in entrapping some sediment that improves water quality.

10. Groundwater Recharge

Recommended in A and B soils and in broad flat valleys where minor elevation drop precludes typical detention basin outlets.

11. High Delay Grass and Routing Flow Over Lawns

Recommended in the entire watershed. Delays runoff, entraps sediment, reduces velocities, reduces erosion potential and improves water quality of receiving watercourse. Relatively inexpensive installation and maintenance costs.

C. Best Management Practices

Water quality problems resulting from storm water runoff have necessitated the development of innovative pollution and runoff control practices termed best management practices (BMPs). Current literature offers many examples of such practices that have been proposed to solve specific storm water quality problems. Below is a summary of recommended practices based upon three separate categories. More detailed explanations of individual BMPs may be found in the "Pennsylvania Handbook of BMPs for Developing Areas" available through the Pennsylvania Association of Conservation Districts (PACD), telephone 717-545-8878, 4999 Jonestown Road, Suite 203, Harrisburg, PA 17109.

1.0 Pollution Source Control are practices that are intended to improve water quality by reducing the generation and accumulation of potential runoff at or near their sources. These would include:

1.1 Street Sweeping - Sweeping, vacuuming, controlled flushing or otherwise cleaning streets, parking lots and other paved vehicular traffic areas. This removes dry-weather accumulations of pollutants before they are washed into streams.

1.2 Solid Waste Collection and Disposal - Municipal collections of refuse such as leaves which would otherwise be dumped in a place which allow them to wash into the stream. Public education is important.

1.3 Fertilizer Application Control - Preventing fertilization near streams, waterways, lakes and ponds, and insuring that lawns are not over fertilized keeps nutrients from entering the streams. Public education, the need for soil testing to determine fertilizer needs, and application timing are important factors in reducing nutrient loads to surface waters.

1.4 Pesticide Use Control - Again, public education on proper use, application rates, equipment cleaning, disposal of unused chemicals and containers, storage and alternate pest control methodologies is crucial to reducing pesticide contamination in receiving waters.

1.5 Highway Deicing Compound Control - Highway deicing compounds in storage and application sites run off the land and pollute streams. Proper storage and application of deicing compounds is recommended with limitations placed on their use.

1.6 Nonpoint Source Pollution Control on Construction Sites - Proper erosion and sediment pollution control on construction sites is important in reducing solids and phosphorus transported to receiving waters. Such concepts may include sedimentation basins, storm sewer inlet protection, proper refuse disposal, dust control, designated equipment cleaning areas, etc.

2.0 Runoff Control are practices aimed primarily at runoff rate and volume control, however, they also provide some degree of storm water treatment. Many typical runoff control measures can be easily modified to provide a higher degree of pollution control. Described below are the quality control aspects of runoff control measures.

2.1 Dry Detention Basin - A typical detention basin remains dry between periods of rain events. Its primary purpose is to reduce the peak rate of runoff to that which occurred prior to development. The ponding time during a storm event allows a portion of the pollutants to settle out.

2.2 Extended Detention Basin - Extended detention basins are designed to allow an extended ponding time, thus allowing a larger volume of pollutants to settle out. These basins are typically designed to reduce peak rates of runoff for smaller storms, i.e., the one-year storm.

2.3 Wet Detention Basin - A wet detention basin is essentially a wet pond, which has a permanent pool of water. The pool allows an extended detention time allowing pollutants to settle. Aquatic plants and organisms utilize the nutrients in the water preventing escape of those pollutants.

2.4 Infiltration Basins - An infiltration basin is an excavated impoundment with a relatively permeable bottom soil. The purpose is to temporarily store the surface runoff for a selected design storm and then allow the stored water to infiltrate into the groundwater. This method prevents surface water pollution but care to prevent groundwater pollution should be exercised.

2.5 Infiltration Trenches - Trenches excavated in porous soils and filled with aggregate allow runoff from small drainage areas to infiltrate into the ground.

2.6 Dry Wells - Pits excavated in porous soils and filled with aggregate. These are typically used to control roof runoff.

2.7 Filter Strips - Grass filter strips accept runoff from roofs or parking areas and filter pollutants before the runoff can enter the receiving water.

2.8 Grassed Waterways and Seepage Areas - Grassed waterways and seepage areas reduce runoff velocities, enhance infiltration and filter runoff pollutants, thus improving runoff quality.

2.9 Concrete Grid and Modular Pavement - Concrete grid and modular pavement promotes infiltration and retards runoff thereby improving runoff quality. These are typically promoted in overflow parking areas.

2.10 Porous Asphalt Pavement - Special asphalt paving material allows storm water to infiltrate through the pavement and through an aggregate base into the soil thus reducing runoff and in turn pollutant washoff to streams. Runoff temperatures are also reduced from conventional pavement since the initial rainfall (which typically generates the warmest runoff) infiltrates as opposed to running off into receiving waters. Porous Asphalt Pavement should only be proposed with appropriate filters.

2.11 Constructed Wetlands - Are excavated basins in which wetland vegetation is planted to enhance pollutant removal. Similar to wet detention basins, they are typically much shallower, thus allowing rooted vegetation to grow. Much larger surface areas are therefore required to store the required volume of storm water runoff.

3.0 Collection and Treatment - deals with collecting and treating urban storm water runoff. It typically applies to more heavily developed areas with defined collection systems.

3.1 New Sewer System Control - Involves the planning of proposed storm sewer systems to incorporate storm water treatment of some sort before discharge into the receiving streams.

3.2 Storm Sewer System Storage - Incorporates storage capabilities (detention) in storm sewers for pollutant deposition and "clean" water discharge.

3.3 Flow Regulators - Involves installing mechanized devices in storm water conveyance and storage facilities to control runoff volumes, velocities and directions of flows.

3.4 Treatment - Involves considering methods of treatment for storm water runoff to remove solids and contaminants. Such processes may be filtration, settling, screening, flocculation or disinfection.

3.5 Water Quality Inlets (Oil and Grease Separators) - Designed to remove sediment and hydrocarbons from parking lot runoff before it is conveyed to the storm sewer or infiltration structure. They are typically multi-chambered and are limited to small drainage areas due to their small storage volume.

The "Pennsylvania Best Management Practices Handbook" latest edition is recommended to be referenced for further information on BMP use in Pennsylvania.

D. Nonstructural Storm Water Management Measures

Conservation Easement

A conservation easement is a legal agreement between a qualified conservation organization or government agency and a land owner that permanently limits certain specified uses on all or a portion of a property for conservation purposes while leaving the property in private ownership. Conservation easements can be tailored to the requirements of a particular property and to the desires of the landowner and the conservation organization. An easement might state, for example, that no building or road may be placed and no logging may occur within 200 feet of a stream passing through a property but allow for a house to be built or for logging to occur on another portion of the same property.

Property owners have the right to use their property for many different purposes, subject to local zoning and public health and safety requirements. To understand the easement concept, it is helpful to think of these rights as a bundle. A landowner may sell or give away the whole bundle, or just one or two of the rights. These may include the rights to develop or subdivide the land, to restrict access, or to harvest timber. A conservation easement may involve selling or giving away some or all of these rights to a qualified conservation organization, such as a public agency, a land trust or an historic preservation organization. Transferring these rights usually conveys the right to enforce the easement to the organization.

Impervious Surface Reduction

Asphalt and concrete are the most common types of driving surfaces, but are very impervious (hard and water resistant). Alternative surfaces are more pervious than asphalt or concrete. Some let a little rain seep (infiltrate) into the ground, while others let all of the rain infiltrate. The more rain that infiltrates, the less runoff that is created. If runoff is less, then fewer pipes and storage systems must be built in order to prevent flooding.

Stream Buffer

A buffer network acts as the "right-of-way" for a stream and functions as an integral part of the stream ecosystem. Stream buffers add to the quality of the stream and the community in many diverse ways as summarized in Table VI-7. Much of the pollutant removal observed in rural and agricultural buffers appears to be due to relatively slow transport of pollutants across the buffer in sheet flow or under it in shallow groundwater. In both cases, this relatively slow movement promotes greater removal by soils, roots and microbes.

TABLE VI-7

Twenty Benefits of Urban Stream Buffers

1. Reduces watershed imperviousness by 5%.
2. Distances areas of impervious cover from the stream.
3. Reduces small drainage problems and complaints.
4. Stream "right-of-way" allows for lateral movement.
5. Effective flood control.
6. Protection from streambank erosion.
7. Increases property values.
8. Increased pollutant removal.
9. Foundation for present or future greenways.
10. Provides food and habitat for wildlife.
11. Mitigates stream warming.
12. Protection of associated wetlands.
13. Prevent disturbance to steep slopes.
14. Preserves important terrestrial habitat.
15. Corridors for conservation.
16. Essential habitat for amphibians.
17. Fewer barriers to fish migration.
18. Discourages excessive storm drain enclosures/channel hardening.
19. Provides space for stormwater ponds.
20. Allowance for future restoration.

Open Space Requirements

Permanent Open Space and Recreation consists of developed lands (parks, recreation facilities, historic resources) and undeveloped lands (open space comprised of streams, floodplains, wetlands, slope banks, natural features, scenic resources, agricultural and timber resources) owned and managed by all levels of government, public school districts, and non-profit conservation organizations.

These lands should be permanently protected with their primary purpose being to function as a recreation resource and/or preserve and enhance natural open space resources.

Permanent Open Space and Recreation areas provide:

- recreation opportunities that accommodate physical and psychological human needs;
- ecological benefits through the protection of natural resources (air, water, soil, plants, animals);
- direct and indirect economic development (tourism; positive real estate values; attraction of business and industry, recreation related business);
- buffers between incompatible land uses;
- habitat for wildlife;
- irreplaceable contribution to the character and individuality of our communities;
- the preservation of community identity by preventing communities from merging;

- attractive settings for public holdings, historic resources;
- aesthetic value and scenic beauty; and
- educational resources.

Subdivision and land development regulations may provide for the preservation of lands for recreation/open space purposes. The Municipalities Planning Code gives a municipality the authority to require a developer to dedicate land to the public that is suitable for park and recreation purposes. If that is not possible the municipality may accept the construction of recreational facilities by the developer, the payment of fees-in-lieu-of-dedication, or the private reservation of land. Fees-in-lieu-of-dedication should only be utilized if a suitable recreation site cannot be properly located in the development (due to size , shape, access, topography, drainage, etc.). In order to require such mandatory dedication or fees, the municipality must meet the items listed in the Municipalities Planning Code.

Floodplain Regulation

Floodplain regulation is a zoning measure whereby areas adjacent to water bodies and subject to frequent flooding are zoned to restrict their use. Normally public and private recreational uses and activities such as parks, day camps, picnic grounds, golf courses, hiking and horseback riding trails, wildlife and nature preserves, game farms, fish hatcheries, hunting and fishing areas are permitted uses in floodplain districts, provided that they do not require substantial structures, fill or storage of materials and equipment. Water related uses and activities such as docks, boat rentals and launching, and swimming areas are usually permitted by special exceptions.

Trail Preservation and Greenways

Trail preservation provisions could designate existing regional trail corridors on the zoning map and establish provisions to restrict development within a certain distance of the trail (setbacks).

Historic Preservation

Provisions for historic preservation could be contained in the zoning ordinance to encourage the retention and restoration of historic resources, facilitate their appropriate reuse and promote preservation of a community's historic values. However, such provisions are not recommended unless the municipality has a significant amount of concentrated historic resources, such as a historic district. Restoration of historic structures to serve as community centers should be promoted in areas where suitable need for such facilities exist. Historic structures can provide a focal point around which community parks can be developed. Priority should be given to structure/areas that are listed on the National Register of Historic Places. Historic resources should be identified and delineated on a map, which would be used as a historic district overlay for current zoning districts. Provisions could be developed for the historic resources regarding demolition, additional use opportunities, design standards, modification to area and bulk regulations, signs, landscaping, standards for rehabilitation, etc. Constraints on future modifications of use of a structure or area, which are associated with preservation mechanisms, should be realized and evaluated in relation to growth and development expectations.

Planned Residential Developments

Planned Residential Development (PRD) is a mechanism for flexibility in land use controls, authorized by the Municipalities Planning Code to provide greater opportunities for better housing and recreation. By allowing flexibility and innovation in residential development, the PRD provisions provide for a greater percentage of a site to be maintained as common open space and recreation. This measure is similar to cluster zoning, only on a larger scale, and non-residential uses may be permitted. The developer is given more freedom in arranging buildings on the site, in exchange for a greater amount of land being dedicated for open space and recreation uses. This is a valuable way of meeting open space and recreation needs for

communities. It ensures that the developer, who is creating the demand, provides the recreation service rather than burdening the community with the responsibility.

Cluster Development

Cluster development with substantial open space requirements can promote imaginative, well designed subdivisions that preserve open space and respect the physical and environmental qualities of the land. Clustering allows greater flexibility in the location of lots on the tract, which results in the ability to concentrate and group buildings on the least sensitive portion of the site. This allows for the preservation of the most critical natural features (i.e. steep slopes, the ridgeline, scenic vistas, prime timber stands) of the tract. The open space provisions associated with cluster regulations, which require a certain percentage of the total tract be permanently preserved, should be mandatory and can range from 15-50% of the gross area of the tract. This common open space should be permanently set aside for the purposes of recreation and/or the conservation of natural features. All land that is preserved as open space should be:

- owned jointly or in common by the owners of the building lots, or
- owned by the municipality, subject to acceptance, or
- donated to a local non-profit conservation agency, subject to acceptance, or
- retained by the original property owner.

For land that is not dedicated to the municipality, written agreements acceptable to the municipality should be made for its perpetual reservation and maintenance.

Environmentally Sensitive Areas

Lands in this category consist of prominent forested areas (large contiguous tracts of woodland associated with or adjacent to the other open space) and steep slopes greater than 20%. These areas are inappropriate for infrastructure investment due to environmental and economic reasons. Development of these areas should be strongly discouraged due to potential environmental impacts, such as soil instability, erosion and sedimentation and associated restrictive environmental capacities. However, where development does occur, it should be strictly regulated to ensure that proper precautions have been taken to guard against potential hazards. Innovative development patterns and design techniques should be devised to maximize conservation of these areas.

Slope Density Provisions

Slope-density provisions decrease allowable development densities as slopes increase. The rationale justifying slope-density provisions is as slope increases so does the potential for environmental degradation. Limiting development according to slope, shifts development into areas with the least potential for environmental damage. Aesthetic values are maintained, if development is directed to gently sloping areas while keeping steeply sloped landscapes and ridgelines in their natural state. An important feature of slope-density provisions is the flexibility in setting the standards. These standards are easily tailored to reflect local concerns. Each municipality utilizes the same basic concept, but each can adjust the provision to meet their own specific concerns and needs.

Along with regulating lot sizes according to slope, municipalities must include coverage requirements. Coverage maximums specify the amount of land that may be covered by impervious surfaces (buildings, driveways, parking lots, etc.). In designing slope-lot size relationships liberal coverage allowances in steep-slope areas can negate the effectiveness of the provisions. Coverage maximums are a function of lot size; the smaller the lot, the higher the allowable coverage; the larger the lot, the lower the allowable coverage.
A simpler version of this concept is to establish provisions requiring a larger lot size (such as 1.5 acres) if any areas of 15 percent to 25 percent slope are to be developed. On slopes of 25 percent or greater, an even larger minimum lot size (such as 3 acres) would be required. The zoning officer would maintain a map or

overlay depicting the areas of steep slope. The larger lot sizes would take effect any time development would be proposed within the mapped areas.

Transferable Development Rights

A promising, but still unproved, way of preventing runoff problems is through "transferable development rights" (TDRs). Each parcel of land within a jurisdiction would be assigned a certain development right, probably in proportion to its current market value. The land would then be regulated, with some owners allowed to develop and others restricted. Under TDRs if a certain landowner needs more development units he can purchase them from a property owner whose land was identified as requiring restrictions. There is much interest in this idea, which seems particularly effective in preserving historic buildings in urban areas, or in developing large tracts of open land with fragmented ownership. As yet, actual experimentation is rare, but it is an idea that local governments should be authorized, and perhaps actively encouraged, to try.

SECTION VII

THE DEVELOPMENT OF THE MODEL ORDINANCE

The implementation of the runoff control strategy for new development will be through municipal adoption of the appropriate ordinance provisions. As part of the preparation of the Buffalo Creek Watershed Storm Water Management Plan, a model municipal ordinance has been prepared which would implement the Plan provisions presented in the ordinance as a single purpose ordinance. This could be adopted essentially "as is" by the municipalities. Provisions would also be required in the Subdivision and Land Development Ordinance to ensure that activities regulated by the ordinance were appropriately referenced. The "Buffalo Creek Watershed Act 167 Storm Water 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 Buffalo Creek Basin are completely within the watershed. For those portions of the municipality outside the Buffalo Creek watershed, the existing ordinance provisions would still apply.

Permanent and temporary storm water control facilities are regulated by the Act 167 Ordinance. Storm water management and erosion and sedimentation control during construction would continue to be regulated under the existing storm water ordinance and Chapter 102 Erosion and Sediment and Pollution Controls, Title 25 of DEP regulations.

The Act 167 Ordinance contains only those minimum storm water runoff control criteria and standards which are necessary or desirable from a total watershed perspective. Additional storm water 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 or as part of the general responsibilities of the municipal engineer.

The Act 167 Ordinance contains only those storm water runoff controls required from new development which are the minimum criteria from a watershed perspective.

The text of the ordinance is organized into eight articles as follows:

I - General Provisions
II - Definitions
III - Storm Water Management
IV - Drainage Plan Requirements
V - Inspections
VI - Fees and Expenses
VII - Financial Guarantees and Maintenance Responsibilities
VIII - Enforcement and Penalties

Although the actual storm water control provisions, as shown in Tables VII-1 and VII-2, may change significantly from an existing municipal ordinance, the structure of the ordinance itself is very similar to many existing ordinances.

TABLE VII-1

TYPICAL STORM WATER MANAGEMENT AND EARTH DISTURBANCE PERMIT ORDINANCE PROVISIONS

ARTICLE 1- GENERAL PROVISIONS

ARTICLE II- DEFINITIONS

ARTICLE III - STORMWATER MANAGEMENT

ARTICLE IV- DRAINAGE PLAN REQUIREMENTS

ARTICLE V- INSPECTIONS

ARTICLE VI- FEES AND EXPENSES

ARTICLE VII- MAINTENANCE RESPONSIBILITIES

ARTICLE VIII- ENFORCEMENT AND PENALTIES

Within six months following adoption and approval of the watershed storm water plan, each municipality shall adopt or amend, and implement such ordinances and regulations, including zoning, subdivision and land development, building code, and erosion and sedimentation ordinances, as are necessary to regulate development within the municipality in a manner consistent with the applicable watershed storm water plan and the provisions of this act.

The following amendment is required for the municipalities that issue an occupancy permit:

An Occupancy Permit shall not be secured or issued unless the Storm Water Management and Earth Disturbance Ordinance of the Buffalo Creek Watershed are both in compliance. The occupancy permit shall be required for each lot owner and/or developer of all major and minor subdivisions and land development in the municipality.

For municipalities without an occupancy permit, they may want to adopt the draft and also include other regulatory items in the occupancy permit requirement for their own purpose and use.

TABLE VII-2

SPECIAL STORM WATER MANAGEMENT PROVISIONS

IMPERVIOUS COVER LIMITATIONS

- Use of pervious materials
- Standards based upon soil permeability
- Limitations in high groundwater areas

DISTURBANCE OF NATURAL AREAS

- Prohibit disturbance of wetland areas
- Improve removal of vegetation or trees
- Prohibit sediment pollution

PLAN REVIEW

- Establish review fees
  - Fixed-fee payments
  - Actual costs (schedule of fees and applications)

MAINTENANCE OF FACILITIES

- Establish one or two year maintenance bond
- Applicant priority maintenance fund for perpetual care of facility

REDUCE SIZE OF FACILITIES

- Encourage on-lot recharge
- Allow generous standards for calculation of infiltration when in a naturally porous area
- Encourage grass-lined low gradient channels and check dams

RUNOFF CONTROL

- Design storm as specified
- Storm Water Management District Application for no increase in runoff

SPECIAL GEOLOGIC CONDITIONS

- Special consideration should be given to the design of storm water detention, retention and conveyance facilities in sensitive areas such as:
  - Limestone areas
  - Landslide-prone areas
  - Wellhead protection areas
  - Abandoned mining areas

NONPOINT SOURCE POLLUTION CONTROLS

- Zero increase in nutrient runoff
- Use of extended detention or wet ponds
- Increase infiltration or use vegetation for nutrient uptake
- 1-year design storm - residential areas
- Capture first ½ inch of runoff - commercial/industrial areas

SECTION VIII

MODEL STORMWATER ORDINANCE

WITH OPTIONAL WATER QUALITY STANDARDS

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

If you have any questions, please call
Durla Lathia or Lynn Manahan
at (717) 772-4048

M O D E L

STORMWATER MANAGEMENT

ORDINANCE

ORDINANCE NO. _____

_____ MUNICIPALITY, UNION COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on

_____, 1999

ORDINANCE REQUIREMENTS

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

- Article I - General Provisions
- Article II - Definitions
- Article III - Design Criteria for Stormwater Management Facilities

  Sections 301, 302, 303 (except F), 304, 305, 306

- Article IV - Section 402
- Article VIII - Enforcement and Penalties (only when enacting a single-purpose ordinance)

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

- Section 303F
- Article V - Inspections
- Article VI - Fees and Expenses

The following ordinance provision is also optional, but municipalities are encouraged to retain.

- Section 308- Water Quality Requirements

All other provisions are optional and may be modified to be consistent with other municipal ordinances related to land development.

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

TABLE OF CONTENTS

ARTICLE I- GENERAL PROVISIONS VIII-5
Section 101. Statement of Findings VIII-5
Section 102. Purpose VIII-5
Section 103. Statutory Authority VIII-6
Section 104. Applicability VIII-6
Section 105. Repealer VIII-6
Section 106. Severability VIII-6
Section 107. Compatibility With Other Ordinance Requirements VIII-7
ARTICLE II-DEFINITIONS VIII-7
ARTICLE III-STORMWATER MANAGEMENT VIII-14
Section 301. General Requirements VIII-14
Section 302. Stormwater Management Districts VIII-16
Section 303. Stormwater Management District Implementation Prov. (PerformanceStandards) VIII-17
Section 304. Design Criteria for Stormwater Management Facilities VIII-19
Section 305. Calculation Methodology VIII-21
Section 306. Erosion and Sedimentation Requirements VIII-24
Section 307. Ground Water Recharge VIII-24
Section 308. Water Quality Requirements VIII-25
ARTICLE IV-DRAINAGE PLAN REQUIREMENTS VIII-26
Section 401. General Requirements VIII-26
Section 402. Exemptions VIII-26
Section 403. Drainage Plan Contents VIII-27
Section 404. Plan Submission VIII-30
Section 405. Drainage Plan Review VIII-30
Section 406. Modification of Plans VIII-32
Section 407. Resubmission of Disapproved Drainage Plans VIII-32
ARTICLE V-INSPECTIONS VIII-32
Section 501. Schedule of Inspections VIII-32
ARTICLE VI-FEES AND EXPENSES VIII-33
Section 601. General VIII-33
Section 602. Municipality Drainage Plan Review Fee VIII-33
Section 603. Expenses Covered by Fees VIII-33
ARTICLE VII-MAINTENANCE RESPONSIBILITIES VIII-34
Section 701. Performance Guarantee VIII-34
Section 702. Maintenance Responsibilities VIII-34
Section 703. Maintenance Agreement for Privately Owned Stormwater Facilities VIII-35
Section 704. Municipal Stormwater Maintenance Fund VIII-35
Section 705. Post-Construction Maintenance Inspections VIII-36
ARTICLE VIII-ENFORCEMENT AND PENALTIES VIII-37
Section 801. Right-of-Entry VIII-37
Section 802. Notification VIII-37
Section 803. Enforcement VIII-38
Section 804. Public Nuisance VIII-39
Section 805. Penalties VIII-39
Section 806. Appeals VIII-39
APPENDIX A - IMPERVIOUS AREA EXEMPTIONS VIII-40
APPENDIX B - STORMWATER MANAGEMENT DESIGN CRITERIA VIII-42
APPENDIX C - SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE VIII-44
APPENDIX D - STORMWATER MANAGEMENT DISTRICT WATERSHED MAP VIII-50

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 the people of the Commonwealth, their resources, and the environment.

Section 102. Purpose

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

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

B. Utilize and preserve the existing natural drainage systems.

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

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

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

F. Provide proper maintenance of all permanent 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 Buffalo Creek Watershed, as delineated in Appendix D 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.
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.

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 secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance.

ARTICLE II-
DEFINITIONS

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

A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.

B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.

C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, or any other similar entity.

D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained".

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

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

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

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

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

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

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Union County Conservation District.

Culvert - A structure with appurtenant works which 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.

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

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

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

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

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

Drainage Plan - The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in Section 403.

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

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

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

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

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

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

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

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

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

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

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

Groundwater Recharge - Replenishment of existing natural underground water supplies.

Impervious Surface - A surface that prevents the percolation of water into the ground.

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

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

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

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

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

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

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

NRCS - Natural Resource Conservation Service (previously SCS).

Open Channel - A drainage element in which stormwater flows with an open surface. Open channels include, but shall not be limited to, natural and man-made 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 (PSRM) (calibrated) - The computer-based hydrologic modeling technique adapted to the Buffalo Creek watershed for the Act 167 Plan. The model has been "calibrated" to reflect actual recorded flow values by adjoining key model input parameters.

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 on the basis of data obtained from the National Oceanographic and Atmospheric Administration (NOAA).

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

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 predevelopment peak rate of runoff from a site or subarea to which the post development peak rate of runoff must be reduced to protect downstream areas.

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 years.

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

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

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

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

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

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

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

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

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

Soil Group, Hydrologic - A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable

and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

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

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

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

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

Stormwater - 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 Buffalo Creek Watershed that was adopted by the Union County Board of Commissioners on March 30, 1999 as required by the Act of October 4, 1978, P.L. 864, (Act 167), and known as the "Buffalo Creek Watershed Act 167 Stormwater Management Plan.

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

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

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

Subdivision - The division or re-division of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels or other divisions of land including changes in existing lot lines for the purpose, whether immediate or future, of lease, transfer of ownership, or building or lot development: Provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than ten acres, not involving any new street or easement of access or any residential dwellings, shall be exempt.

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

Timber Operations - See Forest Management.

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

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

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

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

ARTICLE III-
STORMWATER MANAGEMENT

Section 301. General Requirements

A. All regulated activities in the Buffalo Creek Watershed which do not fall under the exemption criteria shown in Ordinance Appendix A shall submit a drainage plan consistent with the Buffalo Creek Watershed Stormwater Management Plan to the municipality for review. This criteria shall apply to the total proposed development even if development is to take place in stages. Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the waiver criteria.

B. 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. The existing points of concentrated drainage that discharge onto adjacent property shall not be altered without permission of the affected property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

C. 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 Developer must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from the concentrated discharge.

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

E. When it can be shown that, due to topographic conditions, natural drainageways on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainageways. Work within natural drainageways shall be subject to approval by PADEP through the Joint Permit Application process, or, where deemed appropriate by PADEP, through the General Permit process.

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

G. Any stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PADOT).

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

I. Roof drains must not be connected to streets, sanitary or storm sewers or roadside ditches but shall be allowed to drain to the land surface to promote overland flow and infiltration/percolation of stormwater where advantageous to do so. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case by case basis by the municipality.

Section 302. Stormwater Management Districts

A. The Buffalo Creek Watershed has been divided into three (3) stormwater management districts as shown on the Watershed Map in Ordinance Appendix D.

B. Standards for managing runoff from each subarea in the Buffalo Creek Watershed for the 2, 10, 25, and 100-year design storms is shown below. Development sites located in each of the A, B, or C Districts must control post-development runoff rates to pre-development runoff rates for the design storms as follows:

District	Subareas	Design Storm Post-Development	Design Storm Pre-Development
A	1-4, 16, 28-39, 58,59	2-year 10-year 50-year	1-year 10-year 50-year
B	5-15,17-27, 40-55, 60-65 70-75, 79-81	2-year 10-year 50-year	1-year 5-year 25-year
C	56,57, 66-69, 76-78, 82-92		

EXPLANATION OF DISTRICT C: Development sites which can discharge directly to the Buffalo Creek main channel or major tributaries or indirectly to the main channel through an existing storm water drainage system (i.e., storm sewer or tributary) may do so without control of post-development peak rate of runoff. If the post-development runoff is intended to be conveyed by an existing stormwater drainage system to the main channel, assurance must be provided that such a system has adequate capacity to convey the increased peak flows or will be provided with improvements to furnish the required capacity. When adequate capacity of downstream system does not exist and will not be provided through improvements, the post-development peak rate of runoff must be controlled to the predevelopment peak rate as required in District A provisions (i.e.10-year post-development flows to 10 pre-development flows)for the specified design storms.

For these subareas in District C, it was determined that it would be advantageous to not detain the runoff volume for the larger storms but to allow it to exit the watershed before the peak reaches that particular subarea. It has been found that these areas still require control of the water quality storms to maintain stream water quality. For water quality, the objective is to detain the 1-year post –development flow and release it at the 1-year predevelopment rate for residential development and control the first 1/2 inch of runoff for commercial and industrial development. At the same time the objective is to not attenuate the larger storms. This can be accomplished by configuration of the outlet

structure to not control the larger storms, or by a bypass or channel to divert only the 1-year flood into the basin or divert flows in excess of the 1-year storm away from the basin.

Development in those subareas designated in Appendix D of the Model Ordinance as in District C areas must convey the generated storm water runoff to a stream or watercourse in a safe manner. The conveyance must manage the quantity, velocity and direction of resulting storm water runoff in a manner which otherwise adequately protects health and property from possible injury pursuant to Act 167, does not overtax existing drainage facilities and does not cause erosion or sedimentation. Anyone who proposes no detention must comply with Section 303.F, G, and H of the Model Ordinance. Acceptable velocities shall be based upon criteria contained in the DEP "Erosion and Sediment Pollution Control Program Manual". The post-development flow greater than pre-development flow can only be released if it does not aggravate a significant obstruction or existing problem area or would overload existing storm sewer networks. If it would, proper storm water management, obstruction replacement or standard detention would be required.

Proper analysis of channel capacity downstream of a development site for the purpose of discharging greater than predevelopment peak flow rates is essential for insuring that the goal of not creating any new problem areas or aggravating existing drainage problem areas is achieved. The analysis must apply Section 303G of the Model Ordinance to the channel being evaluated based upon the Future Land Use Map (Plate III-6, Volume II) or the latest zoning revision after plan adoption. Also, storm water control measures consistent with the Plan must be assumed in analyzing projected development to the point of evaluation.

Stream channels, water courses or other conveyance facilities may be improved to meet the above requirements and alleviate existing capacity deficiencies as long as local, state, and federal requirements are met and permits obtained.

Any facilities that are covered by DEP Chapter 105 criteria must be designed to be consistent with DEP Chapter 105.

Section 303. 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 Stormwater Management District Watershed Map (Ordinance Appendix D) and Section 302, of the Ordinance.

B. District Boundaries - The boundaries of the Stormwater Management Districts are shown on an official map, which is available for inspections at the municipal office.

A copy of the official map at a reduced scale is included in the Ordinance Appendix D.

C. Drainage Plan Contours - The exact location of the Stormwater Management District boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two foot topographic contours (or the most accurate data available) provided as part of the Drainage Plan.

D. Sites Located in More Than 1 District - For a proposed development site located within two or more stormwater management district category subareas, the peak discharge rate from any subarea shall be the pre-development peak discharge for that subarea as indicated in Section 302. 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, which 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. "No Harm" Option – The developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no harm" option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no harm" would have to be shown based upon the following "Downstream Impact Evaluation" which shall include a "downstream hydraulic capacity analysis" in accordance with Section 303.G. to determine if adequate hydraulic capacity exists. The land developer shall submit to the municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

1. The "Downstream Impact Evaluation" shall include hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications due to the proposed development upon any dam, highway, structure, natural point of restricted streamflow or stream channel section.

2. The "Downstream Capacity Evaluation" shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.

3. The peak flow values to be used for downstream areas for the design return period storms (2-, 10-, 25-, and 100-year) shall be the values from the calibrated Penn State Runoff Model for the Buffalo Creek Watershed. The Union County

Conservation District upon request would supply these flow values to the developer.

4. Developer-proposed runoff controls which would generate increased peak flow rates at storm drainage problem areas shown in Figure III-9, Volume II, would, by definition, be precluded from successful attempts to prove “no harm”, except in conjunction with proposed capacity improvements for the problem areas consistent with Section 303.H.

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

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

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

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

H. Capacity Improvements – In certain instances, primarily with the provisional direct discharge areas, local drainage conditions may dictate more stringent levels of runoff control than those based upon protection of the entire watershed. In these instances, if the developer could prove that it would be feasible to provide capacity improvements to relieve capacity deficiency in the local drainage network, (i.e. downstream) then the capacity improvements could be provided by the developer in lieu of runoff controls on the development site. Peak flow calculations are to be performed assuming that the contributing drainage area is in the existing condition and then assuming that the contributing drainage area is developed per the Buffalo Creek Watershed Stormwater Management Plan current zoning and using the specified runoff controls. Any capacity improvements would be designed using the larger of the above peak flows and the capacity criteria specified in Section 303.G. of this Ordinance. All new development in the entire subarea(s) within which the proposed development site is located shall be assumed to implement the release rate of the Management District in which it is located.

1. If capacity improvements are proposed and the downstream conveyance system is situated in another municipality, the land developer shall inform the affected

municipality of the downstream hydraulic capacity analysis and shall provide a copy of the drainage plan to that municipality containing the proposed capacity improvements for its review.

2. When any downstream capacity improvements are proposed to occur in another municipality, the other municipality, at its discretion may request the municipality in which the development occurs to incorporate its comments into the subdivision plan. Upon receipt of such a request, the municipality in which the land development will occur shall furnish a written response to the other municipality within 30 days of the receipt of the request stating its decision.

3. The granting of any approval does not relieve the applicant from obtaining any permits or approvals from the municipality where the capacity improvements will occur as they relate to the design installation or construction of the capacity improvements.

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

J. Site Areas - Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed impact area shall be subject to the release rate criteria.

Section 304. Design Criteria for Stormwater Management Facilities

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

B. Any stormwater management facility (i.e. detention basin) designed to store runoff and requiring a berm or earthen embankment 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 embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any storm-water management facility require a dam safety permit under

PADEP Chapter 105, the facility shall be designed in accordance with Chapter 105 and meet the regulations of Chapter 105 concerning dam safety. PADEP Chapter 105 may require the facility to pass storms larger than 100-year events.

C. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), and any work involving wetlands as directed in PA DEP Chapter 105 regulations (as amended or replaced from time to time by PA DEP), shall be designed in accordance with Chapter 105 and will require a permit from PA DEP. Any other drainage conveyance facility that does not fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum 1.0 foot of freeboard measured below the lowest point along the top of the roadway. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm with a minimum 1.0 foot of freeboard measured below the lowest point along the top of the roadway. Any facility that constitutes a dam as defined in PA DEP chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PADOT right of way must meet PA DOT minimum design standards and permit submission requirements.

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

E. Storm sewers must be able to convey post-development runoff from a 25-year design storm without surcharging inlets, where appropriate.

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

G. 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 occupancy or continuation of an adverse hydrologic or hydraulic condition within the watershed.

Section 305. Calculation Methodology

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

A. Any stormwater runoff calculations involving drainage areas greater than 200 acres, including on and off-site areas, shall use a generally accepted calculation technique that is based on the NRCS soil cover complex method. Table VIII-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.

   The Municipality may approve the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 200 acres.

B. All calculations consistent with this 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 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 predevelopment flow rate determination, undeveloped land shall be considered as "meadow" in good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e. forest).

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. Runoff Curve Numbers (CN) 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. 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.

   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.

H. 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 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, which shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

I. The Municipality has the authority to require that computed existing runoff rates be reconciled with field observations and conditions. If the designer can substantiate through actual physical calibration that more appropriate runoff and time-of-concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the Municipal Engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.

TABLE VIII-1

ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER MANAGEMENT PLANS

METHOD	METHOD DEVELOPED BY	APPLICABILITY
TR-20 (or commercial computer package based on TR-20)	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary.
TR-55 (or commercial computer package based on TR-55)	USDA NRCS	Applicable for land development plans within limitations described in TR-55.
HEC-1	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
PSRM	Penn State University	Applicable where use of a hydrologic computer model is desirable or necessary; simpler than TR-20 or HEC-1.
Rational Method (or commercial computer package based on Rational Method)	Emil Kuichling (1889)	For sites less than 200 acres, or as approved by the Municipality and Municipal Engineer.
Other Methods	Varies	Other computation methodologies approved by the Municipality and Municipal Engineer.

Section 306. Erosion and Sedimentation Requirements

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

B. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to 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, so as to maintain their maximum infiltration capacity.

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

Section 307. Ground Water Recharge

A. The ability to retain and maximize the ground water recharge capacity of the area being developed is encouraged. Design of the stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is paved and/or roofed. A detailed geologic evaluation of the project site shall be performed to determine the suitability of recharge facilities. The evaluation shall be performed by a qualified geologist and/or soil scientist, and at a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and subgrade stability. Where pervious pavement is permitted for parking lots, recreational facilities, non-dedicated streets, or other areas, pavement construction specifications shall be noted on the plan.

B. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation. Soils used for the construction of basins shall have low-erodibility factors ("K" factors). The municipality may require the installation of an impermeable liner in detention basins.

It shall be the developer's responsibility to verify if the site is underlain, as designated in any county plan, by limestone. The following note shall be attached to all drainage plans and signed and sealed by the developer's engineer/surveyor/geologist:
_____, certify that the proposed detention basin (circle one) is/is not underlain by limestone.

Section 308. Water Quality Requirements

A. In addition to the performance standards and design criteria requirements of Article III of this Ordinance, the land developer SHALL comply with the following water quality requirements of this Article unless otherwise exempted by provisions of this Ordinance.

B.1 Residential Areas - Detain the post-development 1-year, 24-hour design storm to the predevelopment 1-year flow using the SCS Type II distribution. Additionally, provisions shall be made so that the 1-year storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the 1-year storm 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).

B.2 Commercial/Industrial Areas - commercial and industrial sites shall detain the first ½ inch of runoff for a 24 - hour period.

C. As an alternative to A. and B. above, the land developer MAY submit original and innovative designs to the Municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of BMPs (Best Management Practices).

D. In selecting the appropriate BMPs or combinations thereof, the land developer SHALL consider the following:

1. Total contributing area
2. Permeability and infiltration rate of the site soils
3. Depth to bedrock
4. Seasonal high water table
5. Proximity to building foundations and well heads
6. Erodibility of soils
7. Slope
8. Land availability and configuration of the topography
9. The design of the facility shall consider and minimize the chances of clogging and sedimentation potential.

E. 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
10. Enhancement of aesthetic and property value

ARTICLE IV
DRAINAGE PLAN REQUIREMENTS

Section 401. General Requirements

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

Section 402. Exemptions

A. Any regulated activity that meets the exemption criteria in Appendix A is exempt from the Drainage Plan preparation provisions of this Ordinance. This criteria shall apply to all phases of development. 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 providing adequate stormwater management to meet the purpose of this Ordinance.

B. The use of land for gardening for home consumption.

C. Agriculture when operated in accordance with a conservation plan or erosion and sedimentation control plan found adequate by the Conservation District. The agricultural activities such as growing crops, rotating crops, filling of soil, grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance.

D. Forest Management operations, which are following the Department of Environmental Protections' management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an erosion and sedimentation control plan.

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

Section 403. 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. A general description of project.

2. A general description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.

3. A complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.

B. Map(s) of the project area shall be submitted on 24-inch x 36-inch or 30-inch x 42-inch sheets. Maps shall be prepared in a form that meets the requirements of the offices of the Recorder of Deeds of _____ County. The contents of the maps(s) shall include, but not be limited to:

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

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

3. Existing streams, lakes, ponds, or other bodies of water within the project area.

4. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.

5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines.

6. An overlay showing soil names and boundaries.

7. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.

8. Proposed structures, roads, paved areas, and buildings.

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

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

11. The date of submission.

12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.

13. A North arrow.

14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.

15. Existing and proposed land use(s).

16. A key map showing all existing man-made features beyond the property boundary that would be affected by the project.

17. Horizontal and vertical profiles of all open channels, including hydraulic capacity.

18. Overland drainage paths.

19. A fifteen-foot wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way.

20. A note on the plan indicating the location and responsibility for maintenance of stormwater management facilities that would be located off-site. All off-site

facilities shall meet the performance standards and design criteria specified in this Ordinance.

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

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

23. The signature block for the Design Engineer as described in item 24:

24. (Design Engineer), on this date (date of signature), has reviewed and hereby certify that the Drainage Plan meets all design standards and criteria of the Buffalo Creek Watershed Act 167 Stormwater Management Ordinance."

25. The location of all erosion and sedimentation control facilities.

C. Supplemental Information

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

   a. The overall stormwater management concept for the project.
   b. Stormwater runoff computations as specified in this 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 PADEP.

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

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

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

D. 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 404. Plan Submission

For all activities regulated by this Ordinance, the steps below shall be followed for submission. Any permit required shall be included in the plan. These permits can be; PADEP Joint Permit Application, PADOT Highway Occupancy Permit, or any other permit required under state or federal regulations,

A. The Drainage Plan shall be submitted by the Developer as part of the application for any Regulated Activity.

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

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

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

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

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

Section 405. Drainage Plan Review

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

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

C. For activities regulated by this Ordinance, the Municipal Engineer shall determine and notify the Municipality in writing, within ___ calendar days, if 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 Municipality

will forward an approval letter to the Developer with a copy to the Municipal Secretary.

D. Should the Drainage Plan be determined to be inconsistent with the Stormwater Management Plan, the Municipality will forward a disapproval letter to the Developer with a copy to the Municipal Secretary citing the reason(s) for the disapproval. Any disapproved Drainage Plans may be revised by the Developer and resubmitted in accordance with this Ordinance.

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

F. For Regulated Activities requiring a PADEP Joint Permit Application, the Municipal Engineer shall notify PADEP whether the Drainage Plan is consistent with the Stormwater Management Plan and forward a copy of the review letter to the Municipality and the Developer. PADEP may consider the Municipal Engineer's review comments in determining whether to issue a permit.

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

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

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

J. The Municipality's approval of a Drainage Plan shall be valid for a period not to exceed _____ ( ) years. This time 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 an As-Built Survey of these facilities has not been approved within this time period, then the Municipality may consider the Drainage plan disapproved and may revoke any or all permits. Drainage Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 407 of this Ordinance.

Section 406. Modification of Plans

A modification to a submitted Drainage Plan that involves a change in stormwater management facilities or techniques, or is necessary because conditions not as stated in the Drainage Plan as determined by the Municipal Engineer, shall require a resubmission of the modified Drainage Plan. The resubmitted plan shall be consistent with Section 404 of this Ordinance and subject to review as specified in Section 405 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 no formal action has been taken by the Municipality shall be submitted to the Municipality, accompanied by the applicable Municipality Review Fee.

Section 407. Resubmission of Disapproved Drainage Plans

A disapproved Drainage Plan may be resubmitted to the Municipal Engineer with revisions addressing the Municipal Engineer's documented concerns. Resubmissions must be in accordance with Section 404 of this Ordinance and are subject to review as specified in Section 405 of this Ordinance. The applicable Municipality Review Fee must accompany a resubmission of a disapproved Drainage Plan.

ARTICLE V
INSPECTIONS

Section 501. Schedule of Inspections

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

B. If during any stage of the work, the Municipal Engineer determines that the permanent stormwater management facilities are not being installed in accordance with the approved Stormwater Management Plan, the Municipality shall revoke any existing permits until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.

ARTICLE VI
FEES AND EXPENSES

Section 601. General

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

Section 602. Municipality Drainage Plan Review Fee

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

Section 603. Expenses Covered by Fees

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

A. Administrative Costs.

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

C. The site inspections.

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

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

F. Any additional work required to enforce any permit provisions regulated by this ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VII
MAINTENANCE RESPONSIBILITIES

Section 701. Performance Guarantee

The applicant should provide a financial guarantee to the Municipality for the timely installation and proper construction of all stormwater management controls. The guarantee should be 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 developer and approved by the Municipal Engineer. The operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to insure proper operation of the facility(ies).

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

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

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

   3. The governing body, upon recommendation of the municipal engineer, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the stormwater management plan. The governing body 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, which are to be privately owned. The agreement shall stipulate that:

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

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

   3. It is the owner's responsibility to give the municipality the name, address and telephone number of the person or company responsible for maintenance activities. In the event of a change, new information will be submitted to the municipality within ten (10) days of the change.

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

B. Other items may be included in the agreement when it is determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance agreement shall be subject to the review and approval of the municipal solicitor and governing body.

Section 704. Municipal Stormwater Maintenance Fund

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

   1. If the storage facility is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the municipality for a period of ten (10) years, as estimated by the municipal engineer. After that period of time, inspections will be performed at the expense of the municipality.

   2. 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.

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

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

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

Section 705. Post-Construction Maintenance Inspections

A. Basins should be inspected by the land owner/developer or responsible entity (including the municipal engineer for dedicated facilities) on the following basis:

1. Annually for the first 5 years.
2. Once every 3-5 years thereafter,
3. 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 regarding the condition of the facility and recommending necessary repairs, if needed.

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 violation(s). Failure to comply within the time specified shall subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and resort by the municipality from pursuing any and all remedies. It shall be the responsibility of the Owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

Section 803. Enforcement

The municipal governing body 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. Adherence to Approved Plan

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

C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:

1. Provide a certification of completion from an engineer, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.

2. Provide a set of as built drawings.

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. Prior to revocation or suspension of a permit, the governing body will schedule a hearing to discuss the non-compliance if there is no immediate danger to life, public health or property.

F. Suspension and revocation of Permits

1. Any permit issued under this ordinance may be suspended or revoked by the governing body for:

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

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

   c. The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others.

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

   a. The municipal engineer or his designee has inspected and approved the corrections to the stormwater management and/or erosion and sediment pollution control measure(s), or the elimination of the hazard or nuisance, and/or;

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

   A permit, which has been revoked by the governing body, cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this ordinance.

G. Occupancy Permit

An occupancy permit shall not be issued unless the certification of completion pursuant to Section 803.C.1 has been secured. The occupancy permit shall be required for each lot owner and/or developer for all subdivisions and land development in the municipality.

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. Penalties

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

B. In addition, the municipality, through its solicitor may institute an injunction mandamus, or any other appropriate proceeding at law 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 may appeal to [the municipality's governing body or Zoning Hearing Board] within thirty (30) days of that action.

B. Any person aggrieved by any decision of [the municipality's governing body] may appeal to the County Court of Common Pleas in the County where the activity has taken place within thirty (30) days of the municipal decision.

ORDINANCE APPENDIX A-
IMPERVIOUS AREA EXEMPTIONS

For Pennsylvania Act 167 Plans, it has been found that under certain circumstances proposed development may not affect the runoff potential on a given parcel of land. Typical ordinances have exemption criteria of 10,000 square feet of proposed impervious area, which serves as the cut off for requiring a stormwater management plan. The reasoning is that this amount of impervious area on a parcel of land would equate to an approximate 1 cfs increase in runoff peaks from pre- to post- development conditions. In practical application to a small parcel of land, say a 1/2 acre lot in which the owner wishes to create an impervious area, he is limited to paving 10,000 square feet, approximately 46 percent of his parcel, without requiring a stormwater management plan. However, if another parcel owner with 30 acres of land wishes to create an impervious area, he is still limited to the 10,000 square feet while the change in impervious area for the parcel is only 0.7 percent. It was therefore realized that a sliding scale which took a more comprehensive look at the effect of adding impervious area to parcels would be more preferable than a flat cut off point for exemption from requirement of a stormwater management plan.

A comprehensive analysis was performed to evaluate when exemptions could be applied. It took into account several factors, which affect stormwater runoff. These factors included; the slope of the land, the overall tract size, the contributing area draining towards the proposed development, soils, and the location of the proposed improvements on the tract with respect to downstream property lines. Several computations where made in which these factors were adjusted. These computations compared the pre-development with the post-development runoff rate for a sample tract. Areas of impervious cover were increased on the sample tract until a change in runoff rate of greater than 1.0 cfs was reached. This impervious area was then accepted as the maximum impervious area that can be created without requiring a stormwater management plan. This analysis was run for several varying factors as described above. The maximum limit of each computation was then plotted on a scale and a trend analysis was performed to develop a best fit line through the results of the analysis. The trend lines showed that as the percentage of proposed impervious area on the parcel decreases and the distance of the proposed change from the downstream property line increases, a larger exemption can be tolerated. A chart was then created from these lines which plots the distance of the proposed impervious area from down slope property lines versus the percent proposed impervious area in relation to total site area. The trend lines shows exemptions grouped into five categories: 2,500 square feet; 5,000 square feet; 10,000 square feet; 15,000 square feet; and 20,000 square feet. Table A –1 was developed with the property owner in mind so that the determination can be made and approved without having to consult an engineer.

Table A-1 Exemption Criteria Table

Total Parcel Size	Minimum Distance (feet)*	Impervious Area Exemption (sq. ft)
<10,000 sq. ft.	10 ft.	2,500 sq. ft.
10,000 - 1 acre	10 ft.	5,000 sq. ft.
1 - 2 acres	50 ft.	10,000 sq. ft.
2 - 5 acres	100 ft.	15,000 sq. ft.
> 5 acres	250 ft.	20,000 sq. ft.

* The minimum distance between the proposed impervious area and/or stormwater control/structure discharge point to the downslope property boundary. Setback distances may be adjusted at the discretion of the municipal engineer based on factors such as topography, soil conditions, and location of structures.

ORDINANCE APPENDIX B

DESIGN CRITERIA

ORDINANCE APPENDIX B

STORMWATER MANAGEMENT DESIGN CRITERIA

TABLE B-1

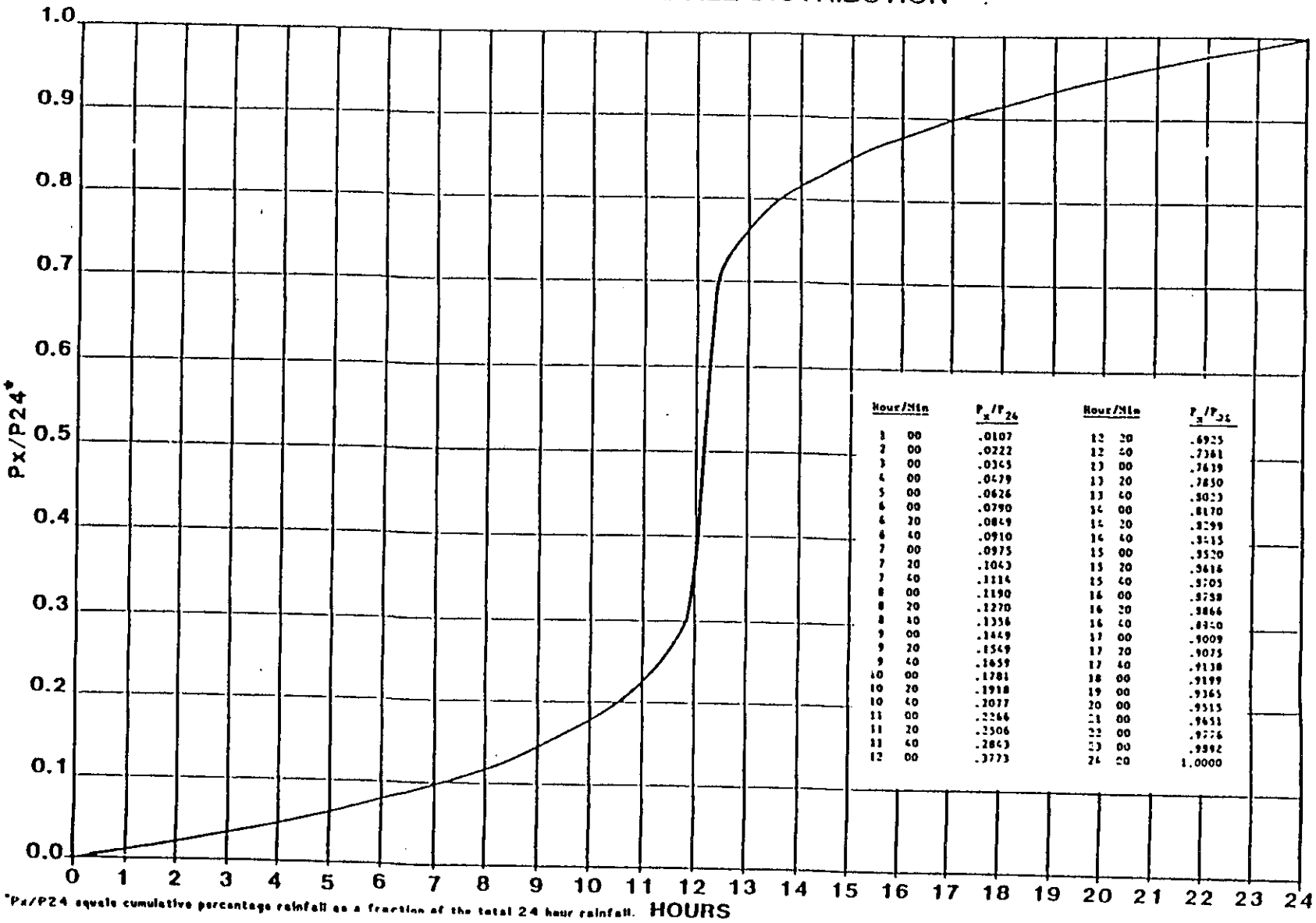
DESIGN STORM RAINFALL AMOUNT (INCHES)

Return Period	D U R A T I O N (hrs.)			
	1	**6**	**12**	**24**
1	0.99	1.55	1.80	2.10
2	1.21	1.80	2.15	2.59
5	1.40	2.16	2.60	3.12
10	1.56	2.64	3.16	3.72
25	1.76	3.06	3.75	4.56
50	2.10	3.60	4.38	5.28
100	2.40	4.08	5.02	6.12

Source: “Field Manual of PA Dept. of Transportation
STORM INTENSITY-DURATION-FREQUENCY CHARTS
P D T - I D F
May 1986.

FIGURE B-1

SCS TYPE II RAINFALL DISTRIBUTION



Hour/Min		P_x/P_{24}	Hour/Min		P_x/P_{24}
1	00	.0107	12	20	.6925
2	00	.0222	12	40	.7361
3	00	.0345	13	00	.7639
4	00	.0479	13	20	.7850
5	00	.0626	13	40	.8023
6	00	.0790	14	00	.8170
6	20	.0849	14	20	.8299
6	40	.0910	14	40	.8415
7	00	.0975	15	00	.8520
7	20	.1043	15	20	.8616
7	40	.1114	15	40	.8705
8	00	.1190	16	00	.8788
8	20	.1270	16	20	.8866
8	40	.1356	16	40	.8940
9	00	.1449	17	00	.9009
9	20	.1549	17	20	.9075
9	40	.1659	17	40	.9138
10	00	.1781	18	00	.9199
10	20	.1918	19	00	.9365
10	40	.2077	20	00	.9515
11	00	.2266	21	00	.9651
11	20	.2506	22	00	.9776
11	40	.2863	23	00	.9892
12	00	.3773	24	00	1.0000

*Px/P24 equals cumulative percentage rainfall as a fraction of the total 24 hour rainfall.

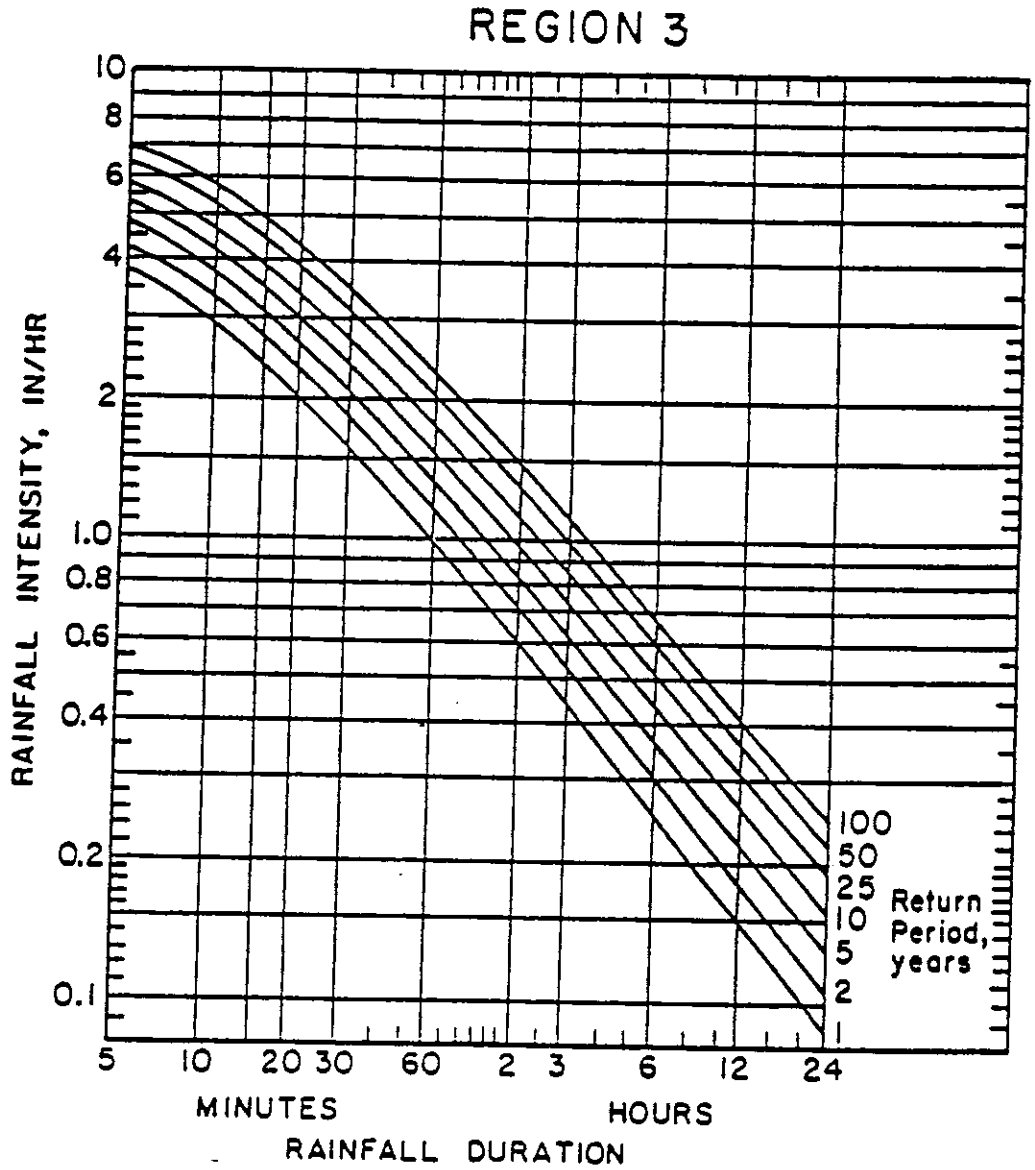


FIGURE 2.10.4.2(C)
STORM INTENSITY - DURATION - FREQUENCY CURVES FOR REGION 3

TABLE B-2
Runoff Curve Numbers (CN's) to be Utilized
(AMC II - IA = .2S)

LAND USE DESCRIPTION		HYDROLOGIC SOIL GROUP A	B	C	D
Open Space (Lawn, Park, Golf Course, Cemeteries, Pasture)		49	69	79	84
Meadow, Orchards		43	65	76	82
Newly Graded Land, Fallow, Disturbed Land with No or Little Vegetation Cover		77	86	91	94
Pasture		49	69	79	84
Forest		30**	55	70	77
Agricultural		60	72	80	83
Commercial	(85% Impervious)	89	92	94	95
Industrial	(72% Impervious)	81	88	91	93
Residential					
Average Lot Size	% Impervious				
1/8 Acre or less*	65	77	85	90	92
1/8-1/4 Acre	52	69	80	87	90
1/4-1/3 Acre	34	59	74	82	87
1/3-1/2 Acre	28	56	71	81	86
1/2-1 Acre	23	53	69	80	85
1-2 Acres	16	49	67	78	83
2-4 Acres	12	46	66	78	82
Farmstead		59	74	82	86
Smooth Surfaces (Concrete, Asphalt, Gravel or Bare Compacted Soil)		98	98	98	98
Water		98	98	98	98

* Includes Multi-Family Housing Unless Justified Lower Density Can be Provided.
** Caution: CN's under 40 may give erronous modeling results.

TABLE B-3

RUNOFF COEFFICIENTS

LAND USE DESCRIPTION		HYDROLOGIC SOIL GROUP A	B	C	D
Cultivated Land	: without conservation treatment	.49	.67	.81	.88
	: with conservation treatment	.27	.43	.61	.67
Pasture of Range Land	: poor condition	.38	.63	.78	.84
	: good condition	.14	.25	.51	.65
Wood or Forest Land	: thin stand, poor cover, no mulch	.17	.34	.59	.70
	: good cover	.13	.22	.45	.59
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries					
good conditions	: grass cover on 75% or more of the area	.14	.25	.51	.65
fair conditions	: grass cover on 50% to 75% of the area	.20	.45	.63	.74
Commercial and Business Areas (85% impervious)		.84	.90	.93	.96
Industrial Districts (72% Impervious)		.67	.81	.88	.92
Residential					
Average Lot Size	Average % Impervious				
1/8 acre or less	65	.59	.76	.86	.90
1/4 acre	38	.45	.55	.70	.80
1/3 acre	30	.30	.49	.67	.78
1/2 acre	25	.22	.45	.63	.74
1 acre	20	.20	.41	.63	.74
Paved Parking Lots, Roofs, Driveways, Etc.		.99	.99	.99	.99
Streets and Roads :					
Paved with curbs and storm sewers		.99	.99	.99	.99
Gravel		.57	.76	.84	.88
Dirt		.49	.69	.80	.84

NOTE : Values are based on S.C.S definitions and are average values derived by an Advisory Committee for this Manual.

SOURCE : New Jersey Department of Environmental Protection. Division of Water Resources - "Technical Manual for Stream Encroachment", August. 1984.

Existing site conditions of bare earth or fallow shall be considered as meadow when choosing a C value.

TABLE B-4

-Manning roughness coefficients, *n*

	Manning's n range [1]
I. Closed conduits:	
A. Concrete pipe	0.011–0.013
B. Corrugated-metal pipe or pipe-arch:	
1. 2⅔ by ½-in. corrugation (unpaved pipe): [1]	
a. Plain or fully coated	0.024
b. Paved invert (range values are for 25 and 50 percent of circumference paved):	
(1) Flow full depth	0.021–0.018
(2) Flow 0.8 depth	0.021–0.016
(3) Flow 0.6 depth	0.019–0.013
2. 6 by 2-in. corrugation (field bolted)	0.03
C. Vitrified clay pipe	0.012–0.014
D. Cast-iron pipe, uncoated	0.013
E. Steel pipe	0.009–0.011
F. Brick	0.014–0.017
G. Monolithic concrete:	
1. Wood forms, rough	0.015–0.017
2. Wood forms, smooth	0.012–0.014
3. Steel forms	0.012–0.013
H. Cemented rubble masonry walls:	
1. Concrete floor and top	0.017–0.022
2. Natural floor	0.019–0.025
I. Laminated treated wood	0.015–0.017
J. Vitrified clay liner plates	0.015
II. Open channels, lined [1] (straight alinement): [1]	
A. Concrete, with surfaces as indicated:	
1. Formed, no finish	0.013–0.017
2. Trowel finish	0.012–0.014
3. Float finish	0.013–0.015
4. Float finish, some gravel on bottom	0.015–0.017
5. Gunite, good section	0.016–0.019
6. Gunite, wavy section	0.018–0.022
B. Concrete, bottom float finished, sides as indicated:	
1. Dressed stone in mortar	0.015–0.017
2. Random stone in mortar	0.017–0.020
3. Cement rubble masonry	0.020–0.025
4. Cement rubble masonry, plastered	0.016–0.020
5. Dry rubble (riprap)	0.020–0.030
C. Gravel bottom, sides as indicated:	
1. Formed concrete	0.017–0.020
2. Random stone in mortar	0.020–0.023
3. Dry rubble (riprap)	0.023–0.033
D. Brick	0.014–0.017
E. Asphalt:	
1. Smooth	0.013
2. Rough	0.016
F. Wood, planed, clean	0.011–0.013
G. Concrete-lined excavated rock:	
1. Good section	0.017–0.020
2. Irregular section	0.022–0.027
III. Open channels, excavated [1] (straight alinement,[1] natural lining):	
A. Earth, uniform section:	
1. Clean, recently completed	0.016–0.018
2. Clean, after weathering	0.018–0.020
3. With short grass, few weeds	0.022–0.027
4. In gravelly soil, uniform section, clean	0.022–0.025
B. Earth, fairly uniform section:	
1. No vegetation	0.022–0.025
2. Grass, some weeds	0.025–0.030
3. Dense weeds or aquatic plants in deep channels	0.030–0.035
4. Sides clean, gravel bottom	0.025–0.030
5. Sides clean, cobble bottom	0.030–0.040
C. Dragline excavated or dredged:	
1. No vegetation	0.028–0.033
2. Light brush on banks	0.035–0.050
D. Rock:	
1. Based on design section	0.035
2. Based on actual mean section:	
a. Smooth and uniform	0.035–0.040
b. Jagged and irregular	0.040–0.045
E. Channels not maintained, weeds and brush uncut:	
1. Dense weeds, high as flow depth	0.08–0.12
2. Clean bottom, brush on sides	0.05–0.08
3. Clean bottom, brush on sides, highest stage of flow	0.07–0.11
4. Dense brush, high stage	0.10–0.14
IV. Highway channels and swales with maintained vegetation [2] (values shown are for velocities of 2 and 6 f.p.s.):	Manning's n range [1]
A. Depth of flow up to 0.7 foot:	
1. Bermudagrass, Kentucky bluegrass, buffalograss:	
a. Mowed to 2 inches	0.07–0.045
b. Length 4–6 inches	0.09–0.05
2. Good stand, any grass:	
a. Length about 12 inches	0.18–0.09
b. Length about 24 inches	0.30–0.15
3. Fair stand, any grass:	
a. Length about 12 inches	0.14–0.08
b. Length about 24 inches	0.25–0.12
B. Depth of flow 0.7–1.5 feet:	
1. Bermudagrass, Kentucky bluegrass, buffalograss:	
a. Mowed to 2 inches	0.06–0.035
b. Length 4 to 6 inches	0.08–0.04
2. Good stand, any grass:	
a. Length about 12 inches	0.12–0.07
b. Length about 24 inches	0.20–0.10
3. Fair stand, any grass:	
a. Length about 12 inches	0.10–0.06
b. Length about 24 inches	0.17–0.09
V. Street and expressway gutters:	
A. Concrete gutter, troweled finish	0.012
B. Asphalt pavement:	
1. Smooth texture	0.013
2. Rough texture	0.016
C. Concrete gutter with asphalt pavement:	
1. Smooth	0.013
2. Rough	0.015
D. Concrete pavement:	
1. Float finish	0.014
2. Broom finish	0.016
E. For gutters with small slope, where sediment may accumulate, increase above values of n by	0.002
VI. Natural stream channels: [1]	
A. Minor streams [1] (surface width at flood stage less than 100 ft.):	
1. Fairly regular section:	
a. Some grass and weeds, little or no brush	0.030–0.035
b. Dense growth of weeds, depth of flow materially greater than weed height	0.035–0.05
c. Some weeds, light brush on banks	0.035–0.05
d. Some weeds, heavy brush on banks	0.05–0.07
e. Some weeds, dense willows on banks	0.06–0.08
f. For streams within channel, with branches submerged at high stage, increase all above values by	0.01–0.02
2. Irregular sections, with pools, slight channel meander; increase values given in 1a–e about	0.01–0.02
3. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stage:	
a. Bottom of gravel, cobbles, and few boulders	0.04–0.05
b. Bottom of cobbles, with large boulders	0.05–0.07
B. Flood plains (adjacent to natural streams):	
1. Pasture, no brush:	
a. Short grass	0.030–0.035
b. High grass	0.035–0.05
2. Cultivated areas:	
a. No crop	0.03–0.04
b. Mature row crops	0.035–0.045
c. Mature field crops	0.04–0.05
3. Heavy weeds, scattered brush	0.05–0.07
4. Light brush and trees: [1]	
a. Winter	0.05–0.06
b. Summer	0.06–0.08
5. Medium to dense brush: [1]	
a. Winter	0.07–0.11
b. Summer	0.10–0.16
6. Dense willows, summer, not bent over by current	0.15–0.20
7. Cleared land with tree stumps, 100–150 per acre:	
a. No sprouts	0.04–0.05
b. With heavy growth of sprouts	0.06–0.08
8. Heavy stand of timber, a few down trees, little undergrowth:	
a. Flood depth below branches	0.10–0.12
b. Flood depth reaches branches	0.12–0.16
C. Major streams (surface width at flood stage more than 100 ft.): Roughness coefficient is usually less than for minor streams of similar description on account of less effective resistance offered by irregular banks or vegetation on banks. Values of n may be somewhat reduced. Follow recommendation in publication cited [1] if possible. The value of n for larger streams of most regular section, with no boulders or brush, may be in the range of	0.025–0.033

ORDINANCE APPENDIX C-

SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE

SAMPLE - 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 stormwater management and earth disturbance Ordinance.

_____ final plan _____ preliminary plan _____ sketch plan

Date of submission _____ submission no._____

1. Name of subdivision or development_____

2. Pin No. _____

3. Name of applicant _____
   Telephone no._____
   (if corporation, list the corporation's name and the names of two officers of the corporation)

_____ _____
Officer 1 Officer 2

Address_____
_____zip_____

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

4. Name of property-owner _____ telephone no. _____

   address_____
   _____ zip_____

5. Name of engineer or surveyor _____telephone no. _____
   address _____
   _____ zip _____

ORDINANCE APPENDIX C-

SAMPLE DRAINAGE PLAN APPLICATION AND FEE SCHEDULE

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3. Name of applicant _____
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   (if corporation, list the corporation's name and the names of two officers of the corporation)

_____ _____
Officer 1 Officer 2

Address_____
_____zip_____

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

4. Name of property owner _____ telephone no. _____

   address_____
   _____ zip_____

5. Name of engineer or surveyor _____telephone no. _____
   address _____
   _____ zip _____

6. Type of subdivision or development proposed:

_____single-family lots _____ townhouses _____ commercial (multi-lot)
_____two family lots _____ garden apartments _____ commercial (one-lot)
_____multi-family _____ mobile-home park _____ industrial (multi-lot)
_____cluster type lots _____ campground _____ industrial (one-lot)
_____planned residential _____ other (_____)
development

7. Lineal feet of new road proposed? _____ l.f.

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

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

9. Stormwater

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

_____

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

- No. of Subarea_____
explain:

_____

_____

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

_____

d. Number of subarea from Appendix D, Volume 2 - Model Ordinance of the Buffalo Creek Watershed Stormwater Management Plan.

_____

f. Type of proposed runoff control

_____

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

- if not, what variances/waivers are requested? _____

_____

- reasons

_____

_____

h. Does the plan meet the requirements of article iii of the stormwater ordinance?_____

- if not, what variances/waivers are requested_____

_____

- reasons why

_____

_____

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

_____

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

_____

k. Is a hydraulic routing through the stormwater control structure submitted?

_____

l. Is a construction schedule or staging attached? _____

m. Is a recommended maintenance program attached? _____

10. Erosion and sediment pollution control (E&S)

a. Has the stormwater management and E&S plan, supporting documentation and narrative been submitted to the _____ county conservation district?_____

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

11. Wetlands

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

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

c. Have the wetland lines been surveyed? _____

d. Total acreage of wetland within the property _____

e. Total acreage of wetland disturbed _____

f. Supporting documentation _____

12. 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
_____

_____

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:
COMMONWEALTH OF PENNSYLVANIA COUNTY OF ____________________,
TOWNSHIP (BOROUGH) ____

Pin No. ______________________

On this the _________________ day of __________________, 19_____, 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 and that the application was made with_______________________ knowledge and/or direction and does hereby agree with the said application and to the submission of the same.

____
Property Owner Property Owner

My Commission Expires ______________, 19_________ _____________Notary Public
or Officer

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____

//

(Information Below This Line To Be Completed By The Municipality)

_______________________ Township official submission receipt

Date complete application received ____________________plan number_____________

Fees _________________ date fees paid ___________received by _________________

Official submission receipt date ____

received by _______________________

SAMPLE - DRAINAGE PLAN FEE SCHEDULE

_____ Township

Subdivision name _____submittal No. _____

Pin No. _____

Owner _____date _____

Engineer _____

1. Filing fee $ _____

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

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

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

5. 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 505 of the stormwater ordinance. A new fee shall be submitted with each revision in accordance with this schedule.

APPENDIX D - WATERSHED MAP

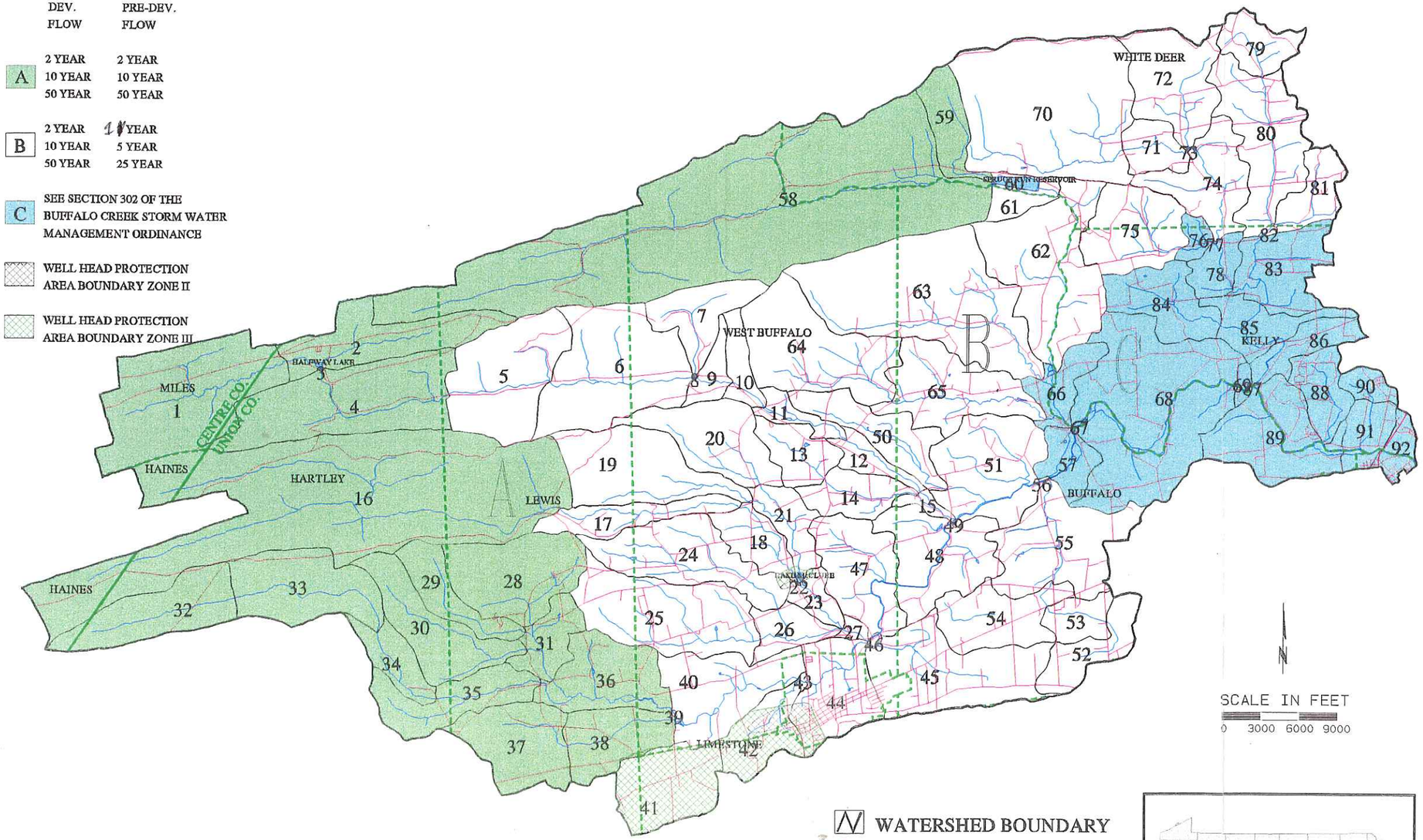
BUFFALO CREEK WATERSHED
PHASE II ACT 167 STORM WATER MANAGEMENT PLAN

STORMWATER RUNOFF CONTROL DISTRICTS

	POST DEV. FLOW	TO PRE-DEV. FLOW
A	2 YEAR 10 YEAR 50 YEAR	2 YEAR 10 YEAR 50 YEAR
B	2 YEAR 10 YEAR 50 YEAR	1 YEAR 5 YEAR 25 YEAR
C	SEE SECTION 302 OF THE BUFFALO CREEK STORM WATER MANAGEMENT ORDINANCE	

WELL HEAD PROTECTION AREA BOUNDARY ZONE II

WELL HEAD PROTECTION AREA BOUNDARY ZONE III



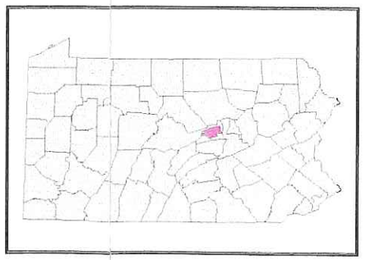
WATERSHED BOUNDARY

COUNTY BOUNDARY

MUNICIPAL BOUNDARIES

STREAMS

ROADS



BUFFALO CREEK WATERSHED, UNION CO., PA.

STORMWATER RUNOFF CONTROL DISTRICTS

R.K.R. HESS ASSOCIATES
112 N. Courtland St., P.O. Box 268
East Stroudsburg, PA. (717) 421-1550
Web Site: www.rkrhess.com

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ORDINANCE APPENDIX D

SECTION IX

THE DEVELOPMENT OF PRIORITIES FOR IMPLEMENTATION OF ACTION WITHIN THE PLAN

The Buffalo Creek Watershed Storm Water Management Plan preparation process is completed with Union and Centre Counties' adoption of the draft Plan and submission of the Final Plan to DEP for approval. Procedures for the review and adoption of the Plan are included in Section X. Subsequent activities to carry out the provisions of the Plan are considered by DEP to be part of the implementation of the Plan. DEP approval sets in motion the mandatory schedule of adoption of municipal ordinance provisions to implement the storm water management criteria. Buffalo Creek Watershed municipalities have six months from DEP approval within which to adopt the necessary ordinance provisions.

A. DEP Approval of the Plan

Upon adoption of the watershed plan by Union and Centre Counties, the Plan is submitted to DEP for approval. A draft of the Storm Water Management Plan and Draft Model Ordinance will be sent to DEP prior to adoption of the watershed plan. The DEP review process involves determination that all of the activities are completed in the Plan. Further, the Department will only approve the Plan if it determines the following:

1. That the Plan is consistent with municipal floodplain management plans, State programs which regulate dams, encroachments and other water obstructions, and State and Federal flood control programs; and

2. That the Plan is compatible with other watershed storm water plans in which the watershed is located and is consistent with the policies and purposes of Act 167.

DEP action to either approve or disapprove the Plan must take place within ninety (90) days of receipt of the Plan by the Department. Otherwise, the Plan would be approved by default.

B. Publishing the Final Plan

Consistent with the Buffalo Creek Scope of Study, the Union County and Centre County Planning Commissions will publish 40 copies of the Watershed Plan after DEP approval. At minimum, two copies of the Text of the Plan will be provided to each municipality. Additional separate copies of the Buffalo Creek Watershed Act 167 Storm Water Management Ordinance will be published for use by the municipalities.

C. Municipal Adoption of Ordinance Provisions to Implement the Plan

A tabulation and comparison of existing municipal storm water management ordinance provisions was performed as indicated in Appendix 5. The matrix was utilized to evaluate consistence of the proposed model ordinance with existing provisions and to analyze where existing provisions may not be consistent with comprehensive watershed storm water management objectives of no increase in flooding anywhere in the watershed as growth continues to occur.

The key ingredient for implementation of the Storm Water Management Plan is the adoption of the necessary ordinance provisions by the Buffalo Creek Watershed municipalities. Provided as part of the Plan is the Buffalo Creek Watershed Act 167 Storm Water Management Ordinance which is a single purpose storm water ordinance that could be adopted by each municipality essentially "as is" to implement the Plan. The single purpose ordinance was chosen for ease of incorporation into the existing structure of municipal ordinances. All that would be required of any municipality would be to adopt the ordinance itself and adopt the necessary provisions for tying into the existing subdivision and land development ordinance and zoning ordinance as outlined in Appendix 5. The tying provisions would simply refer any applicable regulated activities within the Buffalo Creek Watershed from the other ordinances to the single purpose

ordinance. It is recommended that the delineation of the watershed subareas and the release rate percentages assigned to each subarea be enacted as part of each municipality's zoning or subdivision ordinance so that the requirements for management of storm water will be applicable to all changes in land use and not limited only to activities which are subject to subdivision and land development regulations.

The proposed model ordinance provisions include the technical standards of the Buffalo Creek Watershed Storm Water Management Plan as well as recommended procedures for review and approval of development applications and for the financing and maintenance of storm water control facilities constructed in conjunction with development and land alteration activities. These technical, procedural and administrative provisions are summarized in this section and Section V, Standards and Criteria.

D. Level of Government Involvement in Storm Water Management

The existing institutional arrangements for the management of storm water include federal, state, and county governments, as well as every municipality within the watershed. Table IX-1 indicates the major areas of involvement of each of these agencies - prior to the adoption of the Watershed Storm Water Management Plan.

In the absence of a single entity with responsibility for all aspects of storm water management within a watershed, it is clear that the "management" which occurs is primarily a function of a multiple permitting process in which a developer attempts to satisfy the requirements of all of the permitting agencies. Each public agency has established its own regulations based on its objectives and legislative mandates as well as its own technical standards, applicable to its particular storm water concerns.

The minimum objectives of this plan and the minimum mandates of ACT 167 can be accomplished without significant modification of existing institutional arrangements - by actions taken at the municipal level (in combination with continuing voluntary coordination at the watershed level), participation by the county in the technical review of storm water management plans, maintenance and operation of the computer model (as necessary) and compilation of data required for periodically updating the plan. In addition, upon adoption and approval of the watershed plan, all future public facilities, facilities for the provision of public utility services, and all facilities owned or financed by state funds will have to be consistent with the watershed plan, even though they might not otherwise be subject to municipal regulation.

1. Municipal/Watershed Level Activities

Act 167 requires adoption or amendment of development regulations by each municipality to incorporate watershed storm water management standards within six months of PADEP’s adoption and approval. Model ordinance provisions have been distributed to all of the watershed municipalities, and the Union and Centre County Planning Commissions and the Union and Centre County Conservation Districts will be available upon request to assist municipalities in the adoption of the model ordinance.

TABLE IX-1
Public Involvement in Storm Water Management

Government Level and Agency	Area of Involvement
Federal	
Environmental Protection Agency	Clean Water Act - concerned with water quality including runoff quality and wetlands.
Natural Resources Conservation Service	Erosion and sediment pollution control - agriculture.
Corps of Engineers	Floodplain management, navigation and flood control, wetlands.
U.S. Fish & Wildlife Service	Wetlands, land use.
State	
Department of Environmental Protection	Clean Streams Law - concerned with runoff quality, specifically erosion and sedimentation.
	Dam Safety and Encroachments Act - regulates dams, obstructions and encroachments streams, flood plains, and wetlands.
	Storm Water Management Act - administers law; approves watershed management plans.
Department of Community and Economic Development	Administers Flood Plain Management Act; with DEP, reviews watershed plans.
County	
Conservation District	Approves erosion and sediment pollution control plans under agreement with DEP and municipalities.
Planning Commission	Prepares watershed plans. Reviews municipal subdivision regulations.
Municipalities	Enact and administer zoning, subdivision and land development, building code, site alteration regulations. In addition, the state, county and municipalities all construct and maintain a variety of public facilities - such as roads, bridges, culverts, storm sewers and other storm control facilities, which affect and are affected by storm water flows.

The watershed municipalities will also enter into a Memorandum of Understanding (M.O.U.) with the Union and Centre County Conservation Districts. This M.O.U. will allow for cooperation between both parties for the review of erosion and sediment pollution control plans and on-site inspection and enforcement of applicable regulations.

In developing a proposal for the ongoing management of storm water in the Buffalo Creek Watershed, the Task Force should also consider issues of the repair, maintenance and improvement of existing municipal storm water facilities in order to ensure the proper functioning of the total system and to address the correction of existing problems.

2. County Level Activities

a. Establishment of review procedures. The model ordinance calls for review of storm water management plans for development sites by the Union and Centre County Planning Commissions, and Erosion and Sediment Pollution Control Plans by the Union and Centre County Conservation Districts. Evidence that the appropriate state and federal agencies responsible for administering wetland regulatory programs have been contacted for land development sites containing regulated wetlands is also required. The purpose is to ensure that plan standards have been applied appropriately and that downstream impacts have been adequately addressed. Procedures and capabilities for performing the review function exist within the governmental agencies.

b. Maintenance of data for performance of review and of no-harm evaluation. The materials initially prepared by the consultants during the plan preparation process which are needed or which may be needed in the development of site specific storm water management plans, including data needed to perform the no-harm evaluation as detailed in Volume I, must be maintained in a place and form which is accessible to users. This material includes the computer model tabular printouts and the PSRM input files on disc.

E. County Wide Coordination

1. Regional Storm Water Management Board

There are possible situations of storm water management functions and concerns, which may not be adequately addressed within the structure of the existing institutional arrangements or by the adoption, and enforcement of new regulations at the municipal level, as outlined above.

For example, the construction of regional storage facilities may offer a very economic and technically sound alternative to the construction of individual, on-site detention basins. There is, however, no organization at the present time, which is capable of implementing such a concept. To do so would require a multi-municipal entity capable of planning, financing, constructing, operating and maintaining the shared storage facilities in a manner similar to the management required for the collection, treatment and disposal of sanitary wastes.

The Buffalo Creek Watershed is a drainage system with all of its parts interrelated. What happens upstream affects what happens downstream, and what happens downstream places limitations on what happens upstream. If runoff is not controlled in upstream communities, downstream communities will flood. But, if in a downstream community, the capacity of a drainage channel can be safely increased, more upstream runoff may be released, thus reducing to some degree the cost of required upstream control facilities.

The standard proposed in this plan is the primary standard for managing storm water on a watershed basis and is a very simple concept which can be implemented on a property-by-property basis. It is equitable and can be used to achieve the law's "no-harm" mandate. But the same technical tool which allowed the modeling of rainfall routing throughout the watershed and the development of a usable standard for property-level control is capable of testing numerous, technically feasible solutions which would work for combinations of properties and for combinations of subareas. Some of these potential solutions may be preferable to those, which would result from the application of release rates to individual properties.

There are, of course, ways to work out agreements on a case-by-case basis to permit the accomplishment of almost any objective, whether a public or a private undertaking. But, as the number of storm water detention and control facilities increases during future years, continuing maintenance to ensure the integrity of structures and their performance will become very important. A proliferation of "special agreements" to handle special situations may make future accountability very difficult.

An ideal structure for the management of storm water on a watershed basis would be an entity capable of dealing with all of the interrelated elements of the system in order to achieve the following:

- the best possible technical solutions in the most effective manner;
- the efficient and competent review of storm water management components of development plans;
- the continued maintenance and proper functioning of all elements of the system;
- the repair and replacement of system components as necessary;
- continuing monitoring and evaluation of the performance of the drainage system;
- updating and revision of system requirements and standards as necessary;
- coordination of storm water management in the watershed with other actors and concerns such as water quality and supply, recreation, conservation and environmental objectives; and
- responsible financial management including an equitable apportionment of operating and capital costs among the system's users and beneficiaries.

It is clear that not all of these objectives can be achieved on a watershed basis through municipal implementation of the storm water plan, but that the existence of an intermunicipal entity capable of continuous action at the system or watershed level is required.

An optimum management system would be an entity capable of performing similar functions for multiple watersheds - a county-level storm water management institution. There are a variety of models for such an entity, ranging from assigning new responsibilities to a coordinated team of existing county departments to the creation of a regional storm water management board to include storm water functions. Further, under any management system, some of the elements in the process could be contracted out to a private vendor.

2. Financing

The essential concept is that storm water can be managed like a public utility and that the costs for planning, construction, operation and maintenance, monitoring and evaluation can be equitably shared by all of the system's users.

A basic assumption underlying the concept of user financing of storm water management is that damage caused by existing and potential storm water runoff without controls is intolerable. Therefore, it is in the public interest to undertake storm water management immediately, and such management should not be delayed until federal and state funding is available.

Based on storm water management experience elsewhere, users (defined to include beneficiaries also) can finance the full cost of storm water management inexpensively and equitably. The cost to each user is calculated on the basis of user's property characteristics. Because this method is based on a formula, it has the advantage of being objective in its application.

3. Recommendations for Institutional Arrangements

In order that the technical standards for control of storm water in the Buffalo Creek Watershed can be implemented within the time period specified by the law (six months after approval of the adopted plan by DEP), it is recommended that the technical criteria and standards outlined in Section V together with those management standards to implement the technical standards at the municipal level outlined in Volume I, be adopted.

F. Development of a Systematic Approach for Correction of Existing Storm Drainage Problem Areas

Correction of the existing storm drainage problem areas in the watershed is not specifically part of the ACT 167 planning process. However, the development of the watershed plan has provided a framework for their correction for the following reasons: (1) existing storm drainage problems have been documented through interaction with the Watershed Plan Advisory Committee (WPAC); (2) implementation of the runoff control criteria specified in the Plan will prevent the existing drainage problems from becoming worse (and prevent the creation of new drainage problem areas); and (3) the hydrologic model developed to formulate the runoff control criteria could be used as an analytical tool for designing engineering solutions to existing drainage problems.

With the above in mind, each municipality within the Buffalo Creek Basin should take the following steps to implement solutions to the existing storm drainage problem areas:

1. Prioritize the list of storm drainage problems within the municipality based on frequency of occurrence, potential for injury to persons or property, damage history, public perception of the problems, and other appropriate criteria.

2. For the top priority drainage problems in the municipality, conduct detailed engineering evaluations to determine the exact nature of the problems (if not known), determine alternative solutions, provide cost estimates for the alternative solutions, and recommend a course of municipal action. The number of drainage problems to be evaluated by a municipality as a first cut from the priority list should be based on a schedule commensurate with completing engineering studies on all problem areas within approximately five years.

3. On the priority and cost basis, incorporate the implementation of recommended solutions to the drainage problems in the annual municipal capital budget or the municipal maintenance budget as funds are available. The number of drainage problems corrected in a given year should be based on a maximum ten-year schedule of resolving all existing documented drainage problems in the municipality for which cost-effective solutions exist.

The above-stated procedure for dealing with existing storm drainage problem areas is not a mandatory action placed on municipalities with the adoption of the watershed plan. Rather, it represents one systematic method to approach the problems uniformly throughout the watershed and attempt to improve the current runoff situation in the basin. The key elements involved in the success of the remedial strategy will be the dedication of the municipalities to construct the corrective measures and the consistent and proper application of the runoff control criteria specified in the Plan. The latter element is essential to ensure that remedial measures do not become obsolete (under-designed) by increasing peak flows with new development.

G. Culvert Replacement

The General Procedures for Municipalities to determine size of replacement culverts using Act 167 data is as follows:

1. Determine the location and Municipality of obstruction on Obstruction Map and obtain the obstruction number.

2. From Section 105.161 of DEP's Chapter 105, determine the design storm frequency.

3. From "Municipal Stream Obstruction Data" tables, locate the Municipality and Obstruction number. Locate the flow value (cfs) for the design storm frequency determined in #2 above.

4. Have the culvert sized for this design flow and obtain any necessary approvals/permits.

Note: Any culverts/stream crossings not identified on the Obstruction Map would need to have storm flows computed for sizing purposes.

H. PennVEST Funding

One way in which the completion and implementation of this plan can be of assistance in addressing storm drainage problems is by opening the avenue of funding assistance through the PENNVEST program. The PENNVEST Act of 1988, as amended, provides low interest loans to governmental entities for the construction, improvement or rehabilitation of stormwater projects including the transport, storage and infiltration of stormwater and best management practices to address point on non-point source pollution associated with stormwater.

In order to qualify for a loan under PENNVEST, the municipality or county:

1. Must be located in a watershed for which there is an existing county adopted and DEP approved stormwater plan with enacted stormwater ordinances consistent with the plan or,

2. Must have enacted a stormwater control ordinance consistent with the Storm Water Management Act.

I. Landowner’s/Developers Responsibilities

Any landowner and any person engaged in the alteration or development of land that 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 the maximum rate of stormwater runoff for a development site is no greater than pre-development flows; or

2. to manage the quantity, velocity and direction of resulting stormwater runoff in a manner which adequately protects health and property from possible injury.

Many developers throughout the state, after realizing the natural resource, public safety and potential economic advantages of proper storm water management, are constructing new development consistent with natural resources protection. Appendix 5 is an actual request for proposal (RFP) development of a commercial site to be consistent with a Watershed Plan.

SECTION X

PLAN REVIEW ADOPTION AND UPDATING PROCEDURES

A. County Adoption

Prior to plan completion, Union County forwarded a draft of the proposed Storm Water Ordinance to affected municipal planning commissions, local governing bodies, the Watershed Plan Advisory Committee and other interested parties for review. This review of the Ordinance was to check for administrative consistency with other municipal ordinances.

Union County then transmitted a draft of the Plan (which included a draft Model Ordinance incorporating the comments received on the Sample Ordinance) for review to the municipal planning agency and the governing body of each involved municipality, the respective County Planning Commissions and the Watershed Plan Advisory Committee by official correspondence. This review included an evaluation of the plan's consistency with other plans and programs affecting the watershed. The reviews and comments were submitted to the county by official correspondence. The county received, tabulated and responded to the comments and revised the Plan appropriately.

Union County held a public meeting. A notice for the hearing was published two weeks prior to the hearing date. The meeting notice contained a summary of the principal provisions of the Plan and stated where copies of the Plan could be examined or obtained within each municipality. The comments received at the public hearing were reviewed by the county and appropriate modifications to the Plan made.

The Plan was passed as a resolution by the County Commissioners of both Union and Centre Counties for the purpose of adoption. The resolution included references to Volume I - Executive Summary and Volume II - Text of the Plan including maps and the model ordinance. The Technical Appendix is supporting data and not part of the adopted plan. The County resolution was recorded in the minutes of a regular meeting of the Union and Centre County Commissioners respectively.

Union County submitted to the Department of Environmental Protection a letter of transmittal and three copies of the adopted plan, the review by each affected municipal planning agency, local governing body and County Planning Commission, public hearing notice and minutes, and the resolution of adoption of the Plan by the County. The letter of transmittal stated that Union County has complied with all procedures outlined in Act 167 and will request that the Department of Environmental Protection approve the adopted plan.

B. Provisions for Plan Revision

Section 5 of the Storm Water Management Act requires that the storm water management plan be updated at least every five years.

This requirement considers the changes in land use, obstructions, flood control projects, floodplain identification, and management objectives or policy that may take place within the watershed.

It will be necessary to collect and manage the required data in a consistent manner and preferably store it in a central location not only to prepare an updated plan, but also, if required, to make interim runs on the runoff simulation model to analyze the impact of a proposed major development or a proposed major storm water management facility.

The following recommendations deal with the minimum requirements that will have to be undertaken to maintain an effective technical position for periodically reviewing, revising and updating the Plan.

1. It is recommended that the Union County Board of Commissioners authorize the County Planning Commission to undertake the task of collecting and organizing storm water management plans and supporting documentation and data submitted for review and to assume responsibility for periodically reviewing, revising, and updating the storm water management plan.

2. It is recommended that the Union County Planning Commission prepare a workable program for the identification, collection and management of the required data. The program should not be limited to the cooperative efforts of the constituent member municipalities within the Buffalo Creek watershed, but should also include both state and county agencies concerned with storm water management.

3. It is recommended that The Watershed Plan Advisory Committee convene bi-annually or as needed to review the Storm Water Management Plan and determine if the Plan is adequate for minimizing the runoff impacts of new development. At minimum, the information to be reviewed by the Committee will be as follows:

(a) Development activity data as monitored by the Union and Centre Counties Planning Commissions.

(b) Information regarding additional storm drainage problem areas as provided by the municipal representatives to the Advisory Committee.

(c) Zoning and Subdivision amendments within the watershed.

(d) Impacts associated with any regional or subregional detention alternatives implemented within the watershed.

(e) Adequacy of the administrative aspects of regulated activity review.

(f) Additional hydrologic data available through preparation of the Storm Water Management Plan for the Buffalo Creek Watershed.

The Committee will review the above data and make recommendations to the County for revisions to the Buffalo Creek Watershed Storm Water Management Plan. Union and Centre Counties will review the recommendations of the Watershed Plan Advisory Committee and determine if revisions are to be made. A revised Plan would be subject to the same rules of adoption as the original Plan preparation. Should the County determine that no revisions to the Plan are required for a period of five consecutive years, the Counties will adopt a resolution stating that the Plan has been reviewed and been found satisfactory to meet the requirements of ACT 167 and forward the resolution to DEP.

SECTION XI

FORMATION OF THE BUFFALO CREEK WATERSHED ADVISORY COMMITTEE

The meeting held by the Committee during the preparation and adoption of the detailed Watershed Storm Water Management Plan.

Advisory Committee meetings and their purposes were as follows:

Meeting	Date	Purpose
1	3/25/1997	Introduction to Storm Water Management Review Act 167. Distribute data collection forms - progress report.
2	6/4/1997	Retrieve data collection forms - progress report.
3	10/30/97	Problem areas - Municipal Ordinance Matrix - status report, distribute sample ordinance.
4	3/26/98	Summary of data collection, calibration procedure, upcoming steps - status report, summary of modeling results, review ordinance, distribute draft plan.
5	8/20/98	Final WPAC Meeting - Review Ordinance adoption and implementation procedures.

G:/pad/act167/buffalo/msword/mcn_meat.doc

APPENDIX 1

TABLE OF CONTENTS
FOR THE
TECHNICAL APPENDIX

TECHNICAL APPENDIX- TABLE OF CONTENTS

Section	Description
I	Progress Report No. 1
II	Progress Report No. 2
III	Economic Analysis
IV	Data Collection Forms
Form A	Problem Areas
Form B	Obstructions
Form C	Existing Flood Control Projects
Form D	Proposed Flood Control Projects
Form E	Existing Storm Water Control Facilities
Form F	Proposed Storm Water Control Facilities
Form G	Existing Storm Water Collection Facilities
Form H	Proposed Storm Water Collection Facilities
Form I	Projected Development in the Flood Hazard Areas

APPENDIX 2

PUBLIC COMMENT

LARSON DESIGN GROUP
• Architects
• Engineers
• Surveyors

Larson Design Group, Inc
410 Penn Street • P.O. Box 487 • Williamsport, PA 17703-0487 • Phone (717) 323-6603 FAX (717) 323-9902

April 20, 1998

Ms. Nada Gray, Manager
Lewisburg Borough
331 Market Street
Lewisburg, PA 17837

RECEIVED

Re: Review of Buffalo Creek Proposed Storm Water Ordinance

Dear Ms. Gray,

As requested Larson Design Group has completed the review of the draft Storm Water Ordinance included in the draft Buffalo Creek Storm Water Management Plan for the drainage area within Lewisburg Borough municipal limits. Overall the proposed ordinance appears to be a fair and reasonable one. The following comments or concerns that could affect the Borough have been provided for your review and action:

1. If development occurs next to Buffalo Cr., there are no requirements for storm water runoff storage for reducing flood peaks leaving the site. I agree with not requiring any storm water runoff storage for developments at this location in Lewisburg as the proper method for managing runoff. However, there are requirements to provide measures for controlling pollution from storm water runoff at these locations. There are techniques, such as vacuuming parking lots, and Best Management Practices (BMPs), such as filter strips, riparian forested buffers, water quality inlets, etc. that developers can use to meet this criteria. Water quality management of runoff off of developed areas is recognized as a significant source of water pollution to the Nations waters and larger communities are already required to provide storm water runoff pollution controls with discussion that it will be mandated for smaller communities in the near future. Proper planning of sites can combine the water quality BMPs with vegetative plantings to improve the site aesthetics.
2. Where drainage ways and/or storm drains exist between the proposed development and Buffalo Cr. the following criteria applies:
    - The existing down stream storm water system has capacity to safely convey the design storms for the developed area; then item #1 above applies. However no design storm criteria was listed for evaluating the existing storm water pipes or channels. (later information infers that it might be the 50 year storm criteria). You need to request a clarification of the evaluation storm criteria for this item.
    - Developer will provide improvements to the existing down stream storm water system; then the criteria is the same as for the previous comment.
    - When the existing system does not have capacity and improvements will not be made to it; then the developer must meet the storm water runoff control criteria for Storm water District "A" as identified in Section 302 B of the ordinance.
3. Paragraph 2 on page 70 of the report refers to an Appendix E of the Model Ordinance for the Watershed District C, which includes Lewisburg Borough. There

is no Appendix E in the report nor is it listed in the table of contents. You need to request clarification of this paragraph and whether an Appendix E exists.

4. Paragraph 2 on page 70, the last sentence, infers that all downstream storm drainage systems must be able to convey the 50 year frequency storm or that additional storm water controls will need to be installed. It is not clear whether the developer will be required to improve the existing downstream storm drainage system so that it has capacity to pass the 50 year frequency storm or whether the developer will have to provide for additional storage of storm water on their site. This sentence needs to be clarified as it is not clear as to what is required by the developer in meeting this item.
5. The Ordinance does require that all sites requiring a Storm Water Management Plan control the pollution in storm water. This requires the installation of controls to remove the pollution from the initial runoff from the site while allowing the larger flood producing storms to leave the site at the flow rates that would have occurred before the site was developed with no storage of the larger storm runoff. This item will require the developers engineer's to show that the larger storm peaks discharge from the site before the storm water from upstream areas reaches the site. This is to prevent the peak runoff discharge from combining with peak discharges from upstream drainage areas and cause an increase in the storm water peak discharge downstream of the site.
6. The last paragraph on page 70 appears as a minimum to require all culverts, bridges, stream enclosures and other facilities to "pass the 50 year storm without a back water which would act as a "detention basin" or meet more stringent DEP criteria". The requirements of this should be clarified as most water obstructions create some backwater effect, but it may not be detrimental depending on the location and the situation. I believe what they are trying to say is that the peak flows for the design storms should be evaluated to show that the storm peaks for the various storms when the site is developed occur at the same time as if the site was not developed. Or that the developers engineer provide computations by an acceptable hydrologic model to show that there will be no increases in the flood depths or discharge created by the difference in the runoff timing.
7. Section 304 E needs to be completed with a storm frequency for design of storm sewer systems.
8. Under Section 308 Water Quality Standards for residential areas; there is a requirement for detaining the 1 year, 24 hour post development design storm and releasing it at no greater than the 1 year, 24 hour predevelopment flow rate. This is in conflict with the requirements of Section 302 B which requires the developer to detain the 2 year flow and release it at the 1-year predevelopment rate. You need to request a correction so that the conflict is resolved. There is also a requirement to detain the storm for a minimum 24 hours in draining the storm water from the facility. The retention time criteria will be a difficult one for engineers to design to and could require very expensive water quality facilities or very intensively managed facilities if they are to function. These facilities could also require significant maintenance costs. The retention time criteria also precludes the use of filter strips and riparian forested buffers as an economical means of providing water quality BMPs. Recommend that you request modification of the water quality standards to allow for the use of the new "Pennsylvania Handbook of Best Management Practices for Developing Areas" in place of this requirement. This would allow for newer technologies to be used for providing for water quality controls on storm

water runoff. It would also allow the developers engineers to utilize the BMPs that best fit the conditions of the site.

9. Section 402. Exemptions and Appendix A, allow for areas where less than 5000 square feet of impervious area will be created to exempt them from provisions of this Ordinance. Appendix A, also includes two additional methods for consideration for providing an exemption to the requirements of the ordinance for your consideration. You should evaluate these and select the one you think best fits your situation. The one that will create the fewest problems in administering is the 5000 square feet of impervious area one as long as developers are not allowed to add impervious area after initial development has taken place.

If you have any questions or wish to have additional information concerning the above information , please contact Samuel Young at our Bloomsburg office, Telephone No. (717) 387 - 6680.

Thank you for this opportunity for Larson Design Group to provide you this assistance.

Sincerely,

LARSON DESIGN GROUP, INC.

Samuel E. Young

Samuel E. Young, P.E.
Senior Engineer

cc: Max B. Inkrote, P.E.
Kurt R. Hetrick
Paul Lee, P.E.
File # 5102 - 500

LAW OFFICES
FETTER & KESSLER
8 NORTH THIRD STREET
P. O. BOX 512
LEWISBURG, PENNSYLVANIA 17837-0512

W. ROGER FETTER
FREDERICK D. KESSLER
FRANK G. FINA

TELEPHONE
717-524-2207
FAX NO
717-524-0377

UNION COUNTY
Received
OCT 6 1998
PLANNING DEPT

September 18, 1998

Shawn McLaughlin
Union County Planning Commission
1610 Industrial Boulevard, Suite 100
Lewisburg, PA 17837

RE: Buffalo Creek Watershed Act 167 Storm Water Management Draft Plan

Dear Mr. McLaughlin:

I am writing to you in my capacity as Solicitor for Limestone Township in Union County. I have been directed by the Supervisors of Limestone Township to provide the following comments regarding the Act 167 Watershed Storm Water Management Draft Plan.

The Supervisors of Limestone Township have conducted a detailed review of the draft plan in this matter and the proposed model ordinance. The Supervisors strongly believe that Limestone Township has little or no impact on the Watershed in question, Buffalo Creek. They take exception to the necessity for Limestone Township to participate in this matter due to the negligible or non-existent applicable watershed from this Township in this matter.

Limestone Township is also extremely concerned about the breath of the model ordinance in this matter. This ordinance has the potential to require substantial expenditures by individuals and even the Township to ensure compliance with its terms. These mandates appear to be completely unfunded from any source other than the Township itself. A Township of the size of Limestone, with its limited tax base, must be extremely cautious regarding future commitments that might prove to ambitious for its financial resources. For example, it appears that the terms of this ordinance could significantly increase Limestone Township's road construction costs in any areas designated as a "watershed to Buffalo Creek". In some cases, this Township is not even aware that affordable road construction designs exist to handle some of the storm water rates proposed by this ordinance. This Township also believes that its existing road standards and building code are adequate to provide any required watershed protection.

Thank you for your attention to this matter. Please feel free to contact me with any questions or comments.

Sincerely,
FETTER & KESSLER

Frank G. Fina, Solicitor
Limestone Township

FGF:rd

APPENDIX 3

SAMPLE DEVELOPERS RFP

CORPORATION

RECEIVED
FEB 12 1997

February 10, 1997

Mr. Paul DeBarry
RKR Hess Associates
112 N Courtland Street
East Stroudsburg PA 18301

Re: Commercial - Industrial Park

Tobyhanna Township,
Monroe County, Pennsylvania

Dear Mr. DeBarry,

We are requesting proposal to perform the following work on a 388 acres tract of land to be subdivided into Commercial-Industrial lots ranging in size from 3 acres to 20 acres. (See enclosed map for overall tract). All work will be performed using Best Management Practices and will meet the requirements of the proposed Storm Water Ordinance for the Tobyhanna Creek Watershed.

1. Inventory of Property
   a) Locate and identify wetlands, flood plains and natural features.
   b) Provide map showing all features. (Two foot contours by fly over should be available from County and/or current Sewage Project Engineer.)
   c) Include all surveying of areas.
2. Prepare subdivision plan meeting all requirements of Tobyhanna Township Subdivision Ordinance
   a) Include all Soil Erosion Control Plans and Drainage Plans.
   b) Include all Highway Occupancy Permits.
   c) Include attendance at Township Meetings.
   d) Include Stream Water Crossing Permit, if necessary.
3. Design Sewer System to connect to proposed Sewer Project Waste Water Plant
   a) Include all DEP permits
   b) Boring Permit under Tobyhanna Creek.
4. Design Water System to service all lots from on-site well system.
   a) Include all DEP permits.

This project will be done in phases depending on suggestions of the Engineering firm. Please indicate range of prices for each item. Also, give detailed explanation of service and price.

The most important aspect of the project will be to develop a Commercial-Industrial Park while protecting and enhancing the natural environment.

Please submit your proposal by Noon, March 10, 1997, at our offices.

If you have any questions, please do not hesitate to contact me.

Sincerely yours,

MS/aes

Enc.

c: file

APPENDIX 4

SAMPLE OPEN SPACE PLANNING ORDINANCE

Section 902 - "OPEN SPACE SUBDIVISION DESIGN"- The Planning Commission may recommend and the Township Supervisors may grant a "Density Bonus" not to exceed 10% to any applicant submitting an "Open Space Subdivision Plan" in accordance with the provisions of Sections 902, 903 + 904. Such bonus shall be calculated to the nearest whole number based upon the "Yield Plan" exclusive of any other density bonus granted under the provisions of Sections 414.2 and 414.3. (All drawings referred to in this section shall be found on pages 167f through 167o).

902.1 -Determining Density or "Yield" - Applicants shall have the option of estimating the legally permitted density on the basis of the mathematical percentages and formulas contained in this ordinance, or on the basis of a "Yield Plan". Such "Yield Plans" consist of conventional lot and street layouts, and must conform to all regulations governing lot dimensions, land suitable for development (i.e. excluding wetlands), street design and parking. Although such plans shall be conceptual in nature and are not intended to involve significant engineering costs, they must be realistic, and not show potential building sites or streets in areas that would not ordinarily be legally permitted in a conventional layout. (See drawings 7.1.1, 7.1.2, and 7.1.3 for example of Yield Plan).

In order to prepare a realistic "Yield Plan", applicants generally need to first map the Primary Conservation Areas on their site. Typical "Yield Plans" would include, at a minimum, basic topography, location of wetlands, 100 year floodplains, slopes exceeding 25%, soils subject to slumping, as indicated on the medium-intensity maps contained in the Union County Soils Survey, or geologic formations prone to sinking or slumping.

On sites not serviced by public or central sewage treatment facilities, soil suitability for individual sewage treatment systems shall be demonstrated. The Planning Commission shall select between 10% and 20% of the lots to be tested, in areas considered to be marginal. If the tests on the sample lots pass the percolation test, the applicant's other lots shall also be deemed suitable for septic systems, for the purpose of calculating total lot yield, this in no way absolves the applicant from submitting all required planning modules, and testing information required under other municipal or state regulations for on lot sewage disposal. If any of the sample lots fail, several others (of the Planning Commission's choosing) shall be tested, until all the lots in a given sample pass.

902.2 Density Bonus to Endow Maintenance Fund - The Township Planning Commission may allow a density bonus to generate additional income to the applicant for the express and sole purpose of endowing a permanent fund to offset continuing open space maintenance costs. Spending from this fund shall be restricted to expenditure of interest, in order that the principal may be preserved. Assuming an annual average interest rate of 5%, the amount designated for the Endowment Fund should be twenty (20) times the amount estimated to be required on a yearly basis to maintain the open space. On the assumption that additional dwellings, over and above the maximum that would ordinarily be permitted on the site, are net of development costs and represent true profit, 75% of the net selling price of the bonus lot(s) shall be donated to the Open Space Endowment Fund for the preserved lands within the subdivision. Such estimates shall be prepared by an agency or organization with experience in open space management acceptable to the Planning Commission. This fund shall be transferred by the developer to the designated entity with ownership and maintenance responsibilities (such as a homeowners' association, a land trust, or a governmental body).

902.3 Density bonus for Public Access Dedication of land for public use, including trails, active recreation, municipal spray irrigation fields, etc., in addition to any public land dedication required under other provisions of this Ordinance, may be encouraged by the Township Supervisors who are authorized to offer a density bonus for this express purpose. The density bonus for open space would be in addition to any public land dedication that may also be required and shall be computed on the basis of a maximum of one dwelling unit per five acres of publicly accessible open space. The decision whether to accept an applicant's offer to dedicate open space for public access shall be at the discretion of the Board of Supervisors, who shall be guided by recommendations contained in the Township's Comprehensive Plan, Open Space and Recreation Plan, or other applicable plan, dealing with recreational facilities, trails or recreational resources.

902.4 Minimum Percentage of Open Space - The minimum percentage of land that shall be designated as permanent opens space, not to be further subdivided, and protected through a conservation easement held by a governmental body or recognized land trust or conservancy, shall be as specified below:

1. A minimum of fifty percent (50%) of the total tract area, including the following kinds of unbuildable land (which are also required to be deducted when calculating net permitted density for conventional subdivisions as well):
    A. Wetlands
    B. All of the floodway and floodway fringe within the 100-year floodplain, as shown on official FEMA maps.
    C. Land with slopes exceeding 25%
    D. Land required for street rights-of way (10% of the net tract area)
    E. Land under permanent easement prohibiting future 1 development
        (1). Drainage easements or rights of way.
        (2). Utility easements or rights of way.
        (3). Access easements or rights of way.

2. The above areas shall generally be designated as undivided open space.

3. All undivided open space and any lot capable of further subdivision shall be restricted from further subdivision through a permanent conservation easement, in a form acceptable to the Township and duly recorded in the County Recorder of Deeds Office.

4. At least twenty-five percent (25%) of the minimum required open space shall be suitable for active recreation purposes, and no more than fifty percent (50%) shall be utilized for that purpose, in order to preserve a reasonable proportion of natural areas on the site. The purposes for which open space areas are proposed shall be documented by the applicant by Plan Covenant.

902.5 Location of Open Space - The location of open space conserved through residential development shall be consistent with the policies contained in the Township's Comprehensive Plan and contained in "Designing Open Space Subdivisions: A Practical Step by Step Approach" By Randall Arendt and published by the National Lands Trust.

Open space shall be comprised of two types of land: "Primary Conservation Areas" and "Secondary Conservation Areas". All lands within both Primary and Secondary Conservation Areas are required to be protected by a permanent conservation easement, prohibiting further development, and setting other standards safeguarding the site's special resources from negative changes.

A. Primary Conservation Areas: This first category consists of wetlands, lands within the 100 year floodplain, slopes exceeding 25%, soils subject to slumping, geologic formations subject to sinkholes or slumping. These environmentally sensitive resources form the core of the open space that is required to be protected. (See drawing 7.1.4 for example of Identifying Primary Conservation Areas). Full density credit may be allowed for land in this category, at the discretion of the Board of Supervisors.

B Secondary Conservation Areas: In addition to the Primary Conservation Areas, at least fifty percent (50%) of the total land area shall be designated and permanently protected. Full density credit shall be allowed for land in this category that would otherwise be buildable under local, state and federal regulations, so that their development potential is not reduced by this designation. Such density credit may be applied to other unconstrained parts of the site.

Although the locations of Primary Conservation Areas are pre-determined by the locations of environmentally sensitive lands, greater latitude exists the designation of Secondary Conservation Areas (except that they shall include a 100-foot deep greenway buffer along all waterbodies and water courses, and a 50-foot buffer alongside all wetlands. The location of Secondary Conservation Areas shall be guided by maps and policies contained in the Township's Comprehensive Plan or any other applicable Township or County Plan as determined by the Planning Commission. Secondary Conservation areas should typically include all or part of the following kinds of resources: mature woodlands, aquifer recharge areas, areas with highly permeable ("excessively drained") soil, significant wildlife habitat, sites listed on the Pennsylvania or Union County Natural Diversity Inventory, prime farmland, historic or cultural features listed (or eligible to be listed) on federal, state or county registers, inventories or plans, and scenic views into the property from existing public roads.

Secondary Conservation Areas therefore typically consist of upland forest, meadows, pastures, and farm fields, part of the ecologically-connected matrix of natural areas significant for wildlife habitat, water quality protection, and other reasons. Although the resource lands listed as potential Secondary Conservation Areas may comprise more than half of the remaining land on a development parcel (after Primary Conservation Areas have been deducted), no applicant shall be required to designate more than 50% of the total parent tract land as a Secondary Conservation Area. (See drawing 7.1.5 for example of Identifying Secondary Conservation Areas).

C. General Locational Standards: Subdivisions and Planned Residential Developments (PRD's) shall be designed around both the Primary and Secondary Conservation Areas, which together constitute the total required open space. The design process should therefore commence with the delineation of all potential open space, after which potential house sites are located. Following that, access road alignments are identified, with lot lines being drawn in as the final step. This "four-step" design process is further described in Section 903.6

Both primary and Secondary Conservation Areas shall be placed in undivided preserves, which may adjoin housing areas that have been designed more compactly to create larger areas that may be enjoyed equally by all residents of the development.

Undivided open space shall be directly accessible to the largest practicable number of lots within an open space development. To achieve this, the majority of houselots should abut undivided open space in order to provide direct views and access. Safe and convenient pedestrian access to the open space from all lots not adjoining the open space shall be provided (except in the case of farmland, or other resource areas vulnerable to trampling damage or human disturbance). Where the undivided open space is designated as separate, non-contiguous parcels, no parcel shall consist of less than two(2) acres nor have length-to width ratio in excess of 4:1, except such areas that are specifically designed as village greens, ball fields, upland buffers to wetlands, waterbodies or watercourses, or designed as trail links. (See drawing 7.1.6 for example of Identifying Potential Development Areas).

D. Interconnected Open Space Network: As these policies are implemented, the protected open space in each new subdivision will eventually adjoin each other, ultimately forming an inter-connected network of Primary and Secondary Conservation Areas across the Township. To avoid the issue of the "taking" of land without compensation", the only elements of this network that would necessarily be open to the public are those lands that have been required to be dedicated for public use, never more than 10% of a development parcel's gross acreage, and typically configured in a linear fashion as an element of the Township's long range open space network.

902.6 Evaluation Criteria - In evaluating the layout of lots and open space, the following criteria will be considered by the Planning commission as indicating design appropriate to the site's natural, historic and cultural features, and meeting the purposes of this Ordinance. Diversity and originality in lot layout shall be encouraged to achieve the best possible relationship between development and conservation area. Accordingly the Planning Commission shall evaluate proposals to determine whether the Proposed conceptual Preliminary Plan:

1. Protects and preserves all floodplains, wetlands and steep slopes from clearing, grading, filling or construction (except as may be approved by the Township for essential infrastructure or active or passive recreation amenities).

2. Preserves and maintains mature woodlands, existing fields, pastures, meadows and orchards, and creates sufficient buffer areas to minimize conflicts between residential and agricultural uses. For example, locating houselots and driveways within wooded areas is generally recommended, with two exceptions. The first involves significant wildlife habitat or mature woodlands which raise an equal or greater preservation concern, as described in No. 5 and No. 8 below. The second involves predominately agricultural areas, where remnant tree groups provide the only natural areas for wildlife habitat.

3. If development must be located in open fields or pastures because of greater constraints in all other parts of the site, dwellings should be sited on the least prime agricultural soils, or in locations at the far edge of a field, as seen from existing public roads. Other considerations include whether the development will be visually buffered from existing public roads, such as by a planting screen consisting of a variety of indigenous native trees, shrubs and wildflowers (specifications for which should be based upon a close examination of the distribution and frequency of those species found in a nearby roadside hedgerow, treestand or meadow.

4. Maintains or creates an upland buffer of natural native species of at least the minimum buffer required in depth adjacent to wetlands and surface waters, including creeks, streams, lakes and ponds.

5. Designs around existing hedgerows and treelines between fields or meadows. Minimizes impacts on large woodlands (greater than five acres), especially those containing many mature trees or a significant wildlife habitat, or those not degraded by invasive vines. Also, woodlands of any size on highly erodible soils with slopes greater than 10% should be avoided. However, woodlands in poor condition, with limited management potential can provide suitable locations for residential development. When any woodland is developed, great care shall be taken to design all disturbed areas (for buildings, roads, yards, on lot sewage disposal fields, etc.) in locations where there are no large trees or obvious wildlife habitat areas, to the fullest extent that is practicable.

6. Leaves scenic views and vistas unblocked or uninterrupted, particularly as seen from public roadways. (For example, in open agrarian landscapes, a deep "no build, no plant" buffer is recommended along the public roadway where those views or vistas are prominent or locally significant.) In wooded areas where the sense of enclosure is a feature that should be maintained, a deep "no build, no cut" buffer should be respected, to preserve existing vegetation.

7. Avoids sitting new construction on prominent hilltops or ridges, by taking advantage of lower topographic features.

8. Protects significant vegetation or wildlife habitat areas of species listed as endangered, threatened, or of a special concern by the U. S, Environmental Protection Agency, the Pennsylvania Natural Diversity Inventory or the Union County Natural Areas Inventory.

9. Designs around and preserves sites of historic, archaeological or cultural value, and their environs, insofar as need to safeguard the character of the feature, including stone walls, spring houses, earthworks, burial grounds or sites listed on the National or State Register of Historic Places or in the Union County Historic Preservation Plan.

10. Protects rural roadside character and improves public safety and vehicular carrying capacity by avoiding development fronting onto existing public roads. Establishes buffer zones along the scenic corridor of rural roads with historic buildings, stone walls, hedgerows, etc.

11. Landscapes common areas (such as community greens), cul de sac islands, and both sides of new streets with native specie shade trees and flowering shrubs with high wildlife conservation value.

12. Provides active recreational areas in suitable locations offering convenient access by residents, and adequately screened from nearby houselots.

13. Includes a pedestrian circulation system designed to assure that pedestrians can walk safely and easily on the site, between properties and activities or special features with the neighborhood open space system. All roadside footpaths should connect with off-road trails, which in turn should link with potential open space on adjoining undeveloped parcels (or with exiting open space on adjoining developed parcels, where applicable).

14. Provides open space that is reasonably contiguous and whose configuration is compatible with the guidelines contained in the Union County Greenway Plan. For example, fragmentation of open space should be minimized so that these resource areas are not divided into numerous small parcels located in various parts of the development. To the greatest extent practicable, this land shall be designed as a single block with logical, straightforward boundaries. Long thin strips of conservation land shall be avoided, unless the conservation feature is linear or unless such configuration is necessary to connect with other streams or trails. The open space shall generally abut existing or potential open space land on adjacent parcels, and shall be designed as part of larger and contiguous and integrated greenway systems, as per the policies in the Township Comprehensive plan, and the Union County Greenway Plan. Design guidelines contained in the Design and Management Handbook for Preservation Areas, published by the National Lands Trust should be used when designing Conservation Areas required under this Ordinance.

SECTION 903 - SITE PLANNING PROCEDURES FOR OPEN SPACE SUBDIVISIONS. - The sequence of actions prescribed in this Section is as listed below. These steps shall be followed sequentially, and may be combined only with the prior approval of the Planning Commission.

903.1 Process Overview.

A. Pre-Application Discussion - Yield Plan should be submitted at this step.
B. Existing Features (Site Analysis) Plan. (90-day time clock for approval starts with the submission of this plan at a regularly scheduled meeting of the Planning Commission.
C. On-Site Walkabout by Planning Commissioners and Applicant.
D. Pre-Submission Conference.
E. Conceptual Preliminary Plan (Conceptual illustration of green way land, potential house sites, street alignments and tentative lot lines, prepared according the "four-step design process" described herein).
F. Preliminary Plan Submission, Determination of Completeness, Review of overall planning concepts, and Planning Commission Decision.
G. Preliminary Plan Decision by Township Supervisors.
H. Final Plan Submission, Determination of Completeness, Review of Plan Requirements, and Planning Commission Decision.
I. Final Plan Decision by Township Supervisors.
J. Recording of Plan and other Documents at County Recorder of Deeds Office.

903.2 - Elements of the Preliminary Plan Process.

A. Pre-Application Discussion: A Pre-Application Discussion is required between the applicant, the site designer(s), and the Planning Commission. The purpose of this informal meeting is to introduce the applicant and the site designer(s) to the Township's zoning and subdivision regulations and procedures, and to discuss the applicant's objectives in relation to the Township's official policies and ordinance requirements. The Township may designate a consultant experienced in development design and the protection of natural features and greenway lands to meet with the applicant, and to attend or conduct meetings required under this ordinance. (The cost of these consultant services shall be paid for through subdivision review fees paid by the applicant to the Township.)

B. Existing Features (Site Analysis) Plan: A Plan or Plans analyzing each of the site's special features are required for all proposed subdivisions, submitted under these provisions, as they form the basis for the design process for greenway lands, house locations, street alignments, and lot lines. The applicant or his/her representative shall bring a copy of the Existing Features (Site Analysis) Plan(s) to the On-Site Walkabout. Detailed requirements for Existing Features (Site Analysis) Plans are contained in Section 414 of this Ordinance, but at the minimum must include:

1. A contour map based at least upon topographical maps published by the U.S. Geological Survey.
2. The Location of severely constraining elements such as slopes in excess of 20%, wetlands, watercourses, intermittent streams and 100-year floodplains, and all rights-of-way and easements.
3. Soil Boundaries as shown on the USDA Soil Conservation Service medium-intensity maps.
4. The location of significant features such as woodlands, treelines, open fields or meadows, scenic views into or out from the property, watershed divides and drainage ways, fences or stone walls, rock outcrops, and existing structures, roads, tracks and trails, and any sites listed on the Pennsylvania Natural Diversity Inventory or the Union County Natural Areas Inventory.

These Existing Features (Site Analysis) Plans shall identify both Primary Conservation Areas (Floodplains, wetlands and steep slopes, as defined in the process for computing "Adjusted Tract Acreage") and Secondary Conservation Areas as described in Section 414. Together, these Primary and Secondary Conservation Areas comprise the development's proposed open space, location of which shall be consisted with the locational design criteria listed in Section 414. (The Existing Features Site Analysis) Plan shall form the basis for the conceptual Preliminary Plan, which shall show the tentative location of houses, streets, lot lines and greenway lands in new subdivisions, according to the "four-step design process" described in Section 415.F below. See drawings 7.1.4 and 7.1.5 for examples of identifying Primary and Secondary Conservation Areas).

903.3 - On-Site Walkabout - After the Existing Features (Site Analysis) Plan has been prepared, the Planning Commission shall schedule a mutually convenient date (prior to official submission of the Plan) to walk the property with the applicant and his/her site designer(s). The purpose of this visit is to familiarize Planning Commission members with the property's special features, and to provide them an informal opportunity to offer guidance to the applicant regarding the tentative location of Secondary Conservation Areas and potential house locations and street alignments.

903.4 - Presubmission Conference - Prior to the submission of the Conceptual Preliminary Plan, the applicant shall meet with the Planning Commission to discuss how the "Four Step Process" could be applied to the subject property. At the discretion of the Planning Commission this conference may be combined with the On-Site Walkabout.

903.5 - Conceptual Preliminary Plan - After the Presubmission Conference a Conceptual Preliminary Plan shall be submitted for the proposed subdivision(s). As used in this section, the term "Preliminary Plan" refers to a preliminary engineered sketch plan drawn to illustrate initial thoughts about a conceptual layout for greenway lands, house sites, and street alignments, This is the stage where drawings are tentatively illustrated, before heavy engineering costs are incurred in the design of the proposed subdivision layout. The Conceptual Preliminary Plan shall be submitted by the applicant to the Township Zoning Officer, who shall review it for completeness, and then submit it to the Planning Commission for review for the purpose of securing early agreement on the overall pattern of streets, houselots, Primary and Secondary Conservation Areas and potential trail linkages (where applicable), prior to any significant expenditure on engineering costs in the design of streets, stormwater management, erosion and sedimentation control or the accurate delineation of internal lot boundaries.

903.6 - Four-Step Process - Each Conceptual Preliminary Plan shall follow a four-step design process, as described below. When the Conceptual Preliminary Plan is submitted, applicants shall be prepared to demonstrate to the Planning Commission that these four design steps were followed by their site designer(s) in determining the layout of their proposed streets, houselots and greenway lands. This process shall be accomplished during the first 30 days of the statutory 90-day review period for Preliminary Plans. (See drawings 7.1.1 through 7.1.10 for examples).

A. Designing the Open Space: During the first step, all potential Conservation Areas (both Primary and Secondary) are identified, using the Existing Features (Site Analysis) Plan(s). Primary Conservation areas shall consist of those lands defined in Section 902.5.A, Secondary Conservation areas shall comprise the remaining land necessary to complete the 50% open space requirement and shall include the most sensitive and noteworthy natural scenic and cultural resources that remain on the property. Guidance on which parts of the remaining Lands to classify as Secondary Conservation Areas shall be based upon : (See Drawing 7.1.6 for example).
    (1). The On-Site Walkabout.
    (2). Open-Space Locational Criteria contained in Section 902.
    (3). Evaluation Criteria contained in Section 902.
    (4). Information from published data and reports.
    (5). Conversations with existing or recent owners of the property, members of the Planning Commission and/or Board of Supervisors, and local land trusts and/or historic societies.
    (6). The procedures described in Designing Open Space Subdivisions, produced by the Natural Lands Trust.

B. Location of House Sites: During the second step, potential house sites are tentatively located. Because the proposed location of houses within each lot represents a significant decision with potential impacts on the ability of the development to meet the 14 evaluation criteria contained in Section 902.6, subdivision applicants shall identify tentative house sites on the Conceptual Preliminary Plan and proposed house sites on the detailed Final Plan. House sites should generally be located not closer than 100 feet from Primary Conservation Areas, but may situated within 50 feet of Secondary Conservation Areas, in order to the enjoy the views of the latter without negatively impacting on the former. The building "footprint" may of proposed residences may be changed by more than fifty feet in any direction with majority approval by the members of the Planning Commission. Changes involving less than fifty feet do not require approval. (See drawing 7.1.7 for example).

C. Street and Lot Layout: The third step consists of aligning proposed streets to provide vehicular access to each house in the most reasonable and economical way. When lots and access streets are laid out, the shall be located in a way that avoids or at least minimizes adverse impacts on both the Primary and Secondary Conservation Areas. To the greatest extent practicable, wetland crossings and streets traversing existing slopes over 15% shall be strongly discouraged. Street connections shall generally be encouraged to minimize the number of new cul-de-sacs to be maintained by the Township and to facilitate easy access to and from homes in different parts of the property (and on adjoining parcels).

Where cul-de-sacs are necessary, those serving six or fewer homes may not be designed with "hammerheads". Cul-de-sacs serving more than six homes shall generally be designed with a central island containing indigenous trees and shrubs (either conserved on site, or planted). The township generally encourages the creation of single-loaded residential access streets, in order that the maximum number of homes in new developments may enjoy views of open space. (See drawing 7.1.8 for example).

D. Lot Lines: The fourth step is simply to draw in the lot lines (where applicable). (See drawing 7.1.9 for example).

903.7 - Preliminary Engineering Certification - Prior to approval of the Conceptual Preliminary Plan, the applicant shall submit to the Planning Commission a "Preliminary Engineering Certification" that the approximate layout of proposed streets, house lots, and open space land complies with the Township's Zoning Ordinance and Subdivision and Land Development Ordinance, as well as any applicable Stormwater Management Ordinance. In particular provisions governing the detailed design of subdivision streets and stormwater management facilities must meet the minimum requirements of Township Regulations. This certification requirement is meant to provide the Township with assurance that the proposed plan is able to be accomplished within the current regulations of the Township. The certification shall also note any waivers or variances needed to implement the plan as drawn. Nothing in this Section shall negate the normal Engineering and Planning Reviews conducted by the Township of all Subdivision or Land Development Plans.

904 OWNERSHIP AND MAINTENANCE OF OPEN SPACE. Different ownership and management options apply to the permanently protected open space created through the development process as defined in this ordinance. The open space shall remain undivided and may be owned and managed by a homeowners' association, a governmental body, or a recognized land trust or conservancy. A public land dedication, not exceeding 10% of the total parcel size, may be required by the Township, through this open space, to facilitate trail connections. A narrative describing ownership, use and maintenance responsibilities shall be submitted for all common and public improvements, utilities and open spaces.

904.1 - Ownership Standards - Common open space within a development shall be owned, administered and maintained by any of the following methods, either individually or in combination, subject to the approval of the Township Supervisors.

A. Offer of Dedication: The Township shall have the first and last offer of dedication of undivided open space in the event said land is to be conveyed. Dedication shall take the form of a fee simple ownership. The Township may, but shall not be required to accept undivided open space provided:
   (1). Such land is accessible to residents of the Township.
   (2). There is no cost of acquisition other than costs incidental to the transfer of ownership such as title insurance.
   (3). The Township agrees to and has access to maintain such lands.

Where the Township accepts dedication of common open space that contains improvements, the Township may require the posting of financial security to ensure structural integrity of said improvements as well as the function of said improvements for a term not to exceed eighteen (18) months from the date of acceptance of dedication. The amount of financial security shall not exceed fifteen percent (15%) of the actual cost of installation of said improvements.

The Township Supervisors may designate any Township, Intermunicipal or County Governing Body or Authority to accept the dedication of common open space, subject to the above listed provisions.

B. Homeowners' Association: The undivided opens space and associated facilities may be held in common ownership by a Homeowner's Association. The Association shall be formed and operated under the following provisions:
   (1). The developer shall provide a description of the Association including its bylaws and methods for maintaining the open space.
   (2). The Association shall be organized by the developer and be operated with financial subsidization by the developer, before the sale of any lot within the development.
   (3). Membership in the Association is automatic (mandatory) for all purchasers of lots or homes therein and their successors. The conditions and timing of transferring control of the Association from developer to Homeowners shall be identified.
   (4). The Association shall be responsible for maintenance, insurance and taxes on undivided open space, enforceable by liens placed by the Township.
   (5). The members of the Association shall share equitably in the costs of maintaining and developing such undivided open space. Shares shall be defined within the Association bylaws.
   (6). In the event of a proposed transfer, within the methods here permitted, of undivided open space land by the Homeowners Association, or of the assumption of maintenance of undivided open space by the Township or its designee, notice of such action shall be given to all property owners within the development
   (7). The Association shall have or hire adequate staff to administer common facilities and properly and continually maintain the undivided open space.

(8). The Homeowner's Association may lease open space lands to any other qualified person, or corporations, for operation and maintenance of open space lands, but such a lease agreement shall provide:

(a). That the residents of the development shall at all times have access to the open space lands contained therein;

(b). That the undivided open space to be leased shall be maintained for the purposes set forth in this Ordinance: and

(c). That the operation of open space facilities may be for the benefit of residents only, or may be open to the residents of the Township, at the election of the developer and/or Homeowners Association, as the case may be.

(9). The lease shall be subject to the approval of the Board of Supervisors and any transfer or assignment of the lease shall be further subject to the approval of the Board of Supervisors. Lease agreements so entered upon shall be recorded with the Union County Recorder of Deeds within thirty (30) days of their execution and a copy of the recorded lease shall be filed with the Township Zoning Officer and Township Secretary.

D. Condominiums: The undivided open space and associated facilities may be controlled through the use of condominium agreements, approved by the Township Supervisors. Such agreements shall be in conformance with the Commonwealth's Uniform Condominium Act. All undivided open space land shall be held as a "common element".

E. Dedication of Easements: The Township may, but shall not be required, to accept easements for public use of any portion or portions of undivided open space land, title of which is to remain in ownership by a condominium or homeowners association, provided:

(1). Such land is accessible to Township Residents.

(2). There is no cost of acquisition other than costs incidental to the transfer of ownership, such as title insurance.

(3). A satisfactory maintenance agreement is reached between the developer, condominium or homeowners' association and the Township.

The Township may designate any Township, Intermunicipal or County Body or Authority to accept such easements, subject to the above listed provisions.

F. Transfer of Easements to a Private Conservation Organization: With the permission of the Township Supervisors, an owner may transfer easements to a private, not-profit organization, among whose purposes it is to conserve open space and/or natural resources, provided that:

(1). The organization is acceptable to the Township, and is a bona fide conservation organization with perpetual existence;
(2). The conveyance contains appropriate provision for proper reverteror retransfer in the event that the organization becomes unwilling or unable to continue carrying out its functions; and
(3). A maintenance agreement acceptable to the Board of Supervisors is entered into by the developer and the organization.

904.2- Maintenance Standards-

A. The ultimate owner of the open space (typically a homeowner's association) shall be responsible for raising all moneys required for operations, maintenance or physical improvements to the open space through annual dues, special assessments, etc. The homeowners' association shall be authorized under its bylaws to place liens on the property of residents who fall delinquent in payment of such dues, assessments, etc.
B. In the event that the Association or any successor organization, shall at any time after establishment of a development containing undivided open space, fail to maintain the undivided open space in reasonable order and condition in accordance with the development plan, the Township or its designee may serve written notice upon the owner of record, setting forth the manner in which the owner of record has failed to maintain the undivided open space in reasonable condition.
C. Failure to adequately maintain the undivided open space in reasonable order and condition constitutes a violation of this Ordinance. The Township, or its designee, is hereby authorized to give notice, by personal service or by United States mail, to the owner or occupant, as the case may be, of any violation, directing the owner to remedy the same within twenty (20) days.
D. Should any bill or bills for maintenance of undivided open space by the Township, or its designee, be unpaid by November 1 of each year, a late fee charge of fifteen percent (15%) shall be added to such bill and a lien shall be filed against the premises in the same manner as other municipal claims.

APPENDIX 5

MUNICIPAL ORDINANCE MATRIX

Buffalo Creek Watershed - Union County, PA

MUNICIPAL ORDINANCE MATRIX

	Buffalo Township	Haines Township*	Hartley Township	Kelly Township	Lewisburg Borough	Lewis Township	Limestone Township	Mifflinburg Borough	Miles Township*	West Buffalo Township	White Deer Township
Subdivision	None	None	None	1/8/91	12/18/90	None	None	12/18/94	None	None	2/24/67
Zoning	6/6/92	None	6/10/96	3/1/68	3/15/83	None	None	11/11/90	None	8/7/96	3/29/68
Floodplain	12/4/77	7/3/78	8/5/85	6/5/85	1/15/85	9/22/87	6/3/91	12/18/84	5/3/84	None	8/28/79
Building Permits	12/6/72	9/14/87	11/25/75	None	1/20/87	9/22/87	3/1/88	8/18/80	5/3/84	None	2/24/67
Stormwater	12/5/94	None	None	1/8/91	10/18/94	None	None	None	None	None	None
Holding Tank	7/2/84	yes	4/11/76	6/7/74	None	None	8/1/94	6/20/97	None	4/3/84	None
Junkyard	7/6/92	None	None	9/6/85	None	None	None	None	None	None	None
Solid Waste	None	8/6/90	None	11/8/87	12/21/82	2/9/88	None	2/20/73	7/5/90	None	1/28/92
Ag Security	3/9/83	6/1/92	4/19/93	6/29/84	None	7/9/85	2/21/91	None	2/12/93	1/24/90	5/23/90
Fire Protection	None	None	None	None	10/27/71	None	None	5/25/85	None	None	None
Occupancy	None	None	11/25/75	None	1/20/87	9/22/87	None	12/18/84	None	None	2/24/67
Radioactive Waste	None	None	None	None	None	None	None	None	None	None	None
En. Comm Area	None	None	None	3/1/88	None	None	None	None	None	None	None

* Municipality lies within Centre County, Pennsylvania

Union County

Existing Regulatory Controls	Municipality Union County
Relevant Ordiances	**Subdivision and Land Development Ordinance**
Land Use Planning Standards	Article IV, Section 402 Land subject to hazards may not be subdivided unless the hazard(s) has been eliminated or adequate safeguards are provided. Section 403 Land subject to flooding hazards shall not be developed for inappropriate uses unless provisions are made to alleviate the hazards. Section 404 Land with slopes >30% should not be developed. Article VI contains requirements for different types of developments.
Stormwater Controls	Article IV, Section 480. "Storm sewer culverts and related facilities shall be required, as necessary, to permit the unimpeded flow of natural water courses and ensure the drainage of low points along the street line.
Rate of Runoff Standards	None.
Specific Calculation Method	None.
Stormwater Control Design Standards	Article IV, Section 480 Facilities shall be designed to handle the storm run-off from the entire drainage basin. Existing storm sewers should be used when accessible. Storm sewers or drainage channels opening onto adjoining land shall empty into natural watercourses, otherwise written approval of adjoining affected owners may be required.
Erosion/Sedimentation Controls	Article IV, Section 480 Planning Commission may require improvements or actions to eliminate or reduce surface water erosion. Measures to do so shall as a minimum meet the PA Clean Streams Law. Municipalities or PA DEP shall ensure compliance with specifications contained in referenced documents.
Plan Review Process	Article II, Section 220 and 230 Preliminary and final plans are reviewed and approved by the Union County Planning Commission and Union County Soil Conservation District.
Fees	Article II, Section 230.5 Requires payment of application fee established by the UCPC and approved by the Union County Commissioners.
Inspection Schedule	None.
Maintenance Provisions	None.

Existing Regulatory Controls	Municipality Buffalo Township
Relevant Ordiances	**Zoning Ordinance**
Land Use Planning Standards	Section 300: Names zoning districts; Article IV contains zoning district requirements for impervious coverage; Article IV, Special Exception Criteria state that stormwater management shall be required and shall be designed to create no increase in the storm water runoff rate by providing controlled release and recharge areas; drainage facilities shall enhance the overall development and not conflict with pedestrians and motor vehicles Article V, Section 508.C.4. special consideration should be given to utilizing parking area as a componet of stormwater management facilities. Section 508.C.9. all off-street parking areas > than 5 spaces and surfaced with impervious material shall be designed to incorporate stormwater management.
Stormwater Controls	None
Rate of Runoff Standards	None
Specific Calculation Method	None
Stormwater Control Design Standards	None
Erosion/Sedimentation Controls	None
Plan Review Process	Article VII, Section 703. Zoning Officer issues permits.
Fees	Article VII, Section 714 authorizes fee collection.
Inspection Schedule	Article VII, Section 703.C. authorizes site visits and inspections by the Zoning Officer as are necessary to perform duties at any reasonable hour.
Maintenance Provisions	None

Existing Regulatory Controls	Municipality Hartley Township
Relevant Ordiances	**Zoning Ordinance**
Land Use Planning Standards	Section 300: Names zoning districts; Article IV contains zoning district requirements for impervious coverage; Article IV, Special Exception Criteria state that stormwater management shall be required and shall be designed to create no increase in the storm water runoff rate by providing controlled release and recharge areas; drainage facilities shall enhance the overall development and not conflict with pedestrians and motor vehicles Article V, Section 508.C.4. special consideration should be given to utilizing parking area as a componet of stormwater management facilities. Section 508.C.9. all off-street parking areas > than 5 spaces and surfaced with impervious material shall be designed to incorporate stormwater management.
Stormwater Controls	None
Rate of Runoff Standards	None
Specific Calculation Method	None
Stormwater Control Design Standards	None
Erosion/Sedimentation Controls	None
Plan Review Process	Article VII, Section 703. Zoning Officer issues permits.
Fees	Article VII, Section 714 authorizes fee collection.
Inspection Schedule	Article VII, Section 703.C. authorizes site visits and inspections by the Zoning Officer as are necessary to perform duties at any reasonable hour.
Maintenance Provisions	None

Existing Regulatory Controls	Municipality Kelly Township
Relevant Ordiances	**Zoning Ordinance and Subdivision and Land Development**
Land Use Planning Standards	Article III, Section 300 establishes the zoning districts. Article IV establishes zoning district regulations and maximum impervious coverage requirements and presents specific regulations for each zoning district including lot sizes Article V, Section 516.B.4. requires all off street parking areas >5 spaces and surfaced with an impervious material shall be designed to incorporate stormwater management. Article V, Section 521.G. establishes maximum impervious coverage for Residential Cluster Development at 30%. S/LD Article IV, Sections 4.15.may require a stormwater management plan and an erosion and sedimentation plan may be required in accordance with Title 25, Chapter 102 of the PA DEP rules and regulations as amended.
Stormwater Controls	Zoning Article IV, Sections 402.D.3. and 404.D.6: measures shall be taken to create zero increased runoff of stormwater and be designed to control erosion and the formation of sedimentation in the commercial district and manufacturing districts respectfully. S/LD Section 4.15.4 anticipated peak rate of stormwater runoff from the site during and after full development shall not exceed the peak rate of runoff from the site prior to development activities. Provisions apply if project yields 10,000sq.ft.or more of impervious coverage.
Rate of Runoff Standards	S/LD Article 4, Section 4.15.6.3. Post-development runoff rate not to exceed pre-development conditions for the 2, 10, and 100 year storm frequencies.
Specific Calculation Method	S/LD Article 4, Section 4.15.6.1. USDA soil-cover complex methods: Chapter 2 of USDA SCS Engineering Field Manual and TR-55. Sizing of storm sewers, inlets, and swales may be performed using the Rational Method.
Stormwater Control Design Standards	S/LD Article 4, Section 4.15.7. Existing storm sewers may be used with Township approval where they are accessible. Section 4.15.8. Specific design standards for storm sewers. Section 4.15.10. specific deisign criteria stormwater detention facilities.
Erosion/Sedimentation Controls	S/LD Article 4, Section 4.16. There shall be no increase in discharge of sediment or other solid materials from the site as a result of stormwater runoff. Earthmoving and filling shall be minimized where possible and practicalbe to preserve desirable natural features and the topography of the site. Removal of vegetation shall be done in a way to minimize erosion. Activities shall meet the requirements of the PA Clean Streams Law.
Plan Review Process	Zoning Article VI, Section 603. Zoning Officer issues permits. S/LD Section 2.1.1. Preliminary and final plans reviewed by UCPC, Kelly Township Municipal Authority, UCCD, PennDOT, Township Zoning Officer and other agencies as required. Township Board of Supervisors approves plans.
Fees	Zoning Article VI Section 614 and S/LD Article VII, Section 7.3 authorizes fee collection.
Inspection Schedule	Zoning Article VI, Section 603.C. authorizes the Zoning Officer to make site visits and inspections as are necessary to perform his duties at any reasonable hour. S/LD Article II, Section 2.4.3.2. provides for inspection once all required improvements are completed.
Maintenance Provisions	S/LD Article II, Section 2.4.4. Governing body may require posting of financial security in an amount of 15% of the cost o the improvements, for a period not to exceed 18 months to insure integrity of the improvements. Final plan must identify ownership and maintenance reponsibilities for the improvements.

Existing Regulatory Controls	Municipality Lewisburg Borough
Relevant Ordiances	Zoning Ordinance and Subdivision and Land Development (S/LD)
Land Use Planning Standards	Zoning Ordinance Part 4 establishes maximum impervious coverages for each zoning district. S/LD Part 4, Section 421 calls for minimizing tree real; Section 423 providing for recreation space; Section 602 allows for cluster housing developments, developments with minimum open space requirement.
Stormwater Controls	S/LD Part 4, Section 419.1.: Stormwater facilities shall be required, as necessary to provide for the controlled release of stormwater, to permit the unimpeded flow of natural water courses and ensure the drainage of low points along the street line. Facilities shall be designed to handle the runoff from the entire drainage basin.
Rate of Runoff Standards	S/LD Part 4, Section 419.2.: When adequate existing storm sewers are readily accessible, the subdivider shall connect his stormwater facilities to these existing sewers, however, pre-development run-off shall be maintained through the use of retention and controlled release facilities.
Specific Calculation Method	None
Stormwater Control Design Standards	S/LD Part 4, Section 419.2.: When adequate existing storm sewers are readily accessible, the subdivider shall connect his stormwater facilities to these existing sewers, however, pre-development run-off shall be maintained through the use of retention and controlled release facilities.
Erosion/Sedimentation Controls	S/LD Part 4, Section 419.4.: Drainage swales, ponding areas, paved gutters, curbing, construction drainageways and other improvements may be required by the Borough to eliminate or reduce surface water erosion. Measures are to comply with specifications in referenced erosion and sedimentation control handbooks. S/LD Section 420 contains land excavation and topsoil requirements. S/LD Part 3, Section 303.3.K..required for land developments of 25 acres or more in size.
Plan Review Process	Zoning Part 6,Section 601. Zoning Officer issues zoing permits. S/LD Part II, Sections 205 and 206: Preliminary and final plans are reviewed by the Borough Building Permit Officer, Union County Planning Commission(UCPC), Union County Conservation District (UCCD), PennDot, and the Borough Planning Commissioin. Borough Council approves plans.
Fees	Zoning Part 6, Section 620 and S/LD Part 2, Section 4 establish fee collection
Inspection Schedule	S/LD Part 3, Section 304.B.1. requires inspection by the Borough upon completion of improvements
Maintenance Provisions	S/LD Part 3, Section 304.B.5. authorizes requirement for posting financial security to secure structural integrity and functioning of improvements to be accepted by the Borough by dedication. Term not to exceed 18 months, amount not to exceed 15% of the cost of installation of the improvements.

Existing Regulatory Controls	Municipality Mifflinburg Borough
Relevant Ordiances	Zoning Ordinance and Subdivision and Land Development
Land Use Planning Standards	Part 3, Section 21. establishes zoning districts. Part 4, Section 31. establishes district regulations including maximum impervious coverage requirements. Part 5, Section 70. 5.B.7. maximum impervious coverage for cluster subdivision shall be 30% of the developable tract. S/LD Part 4, Section 411.2. provides for drainage easements where a subdivision is transversed by a watercourse or drainage way there shall be provided a drainage easement.
Stormwater Controls	S/LD Part 4, Section 415.4. Post-development peak stormwater runoff rates not to exceed pre-development rates. 415.2. Subdividers are encouraged to consider various alternatives for stormwater management and select the most appropriate and economical systems. Stormwater regulations apply only to those developments resulting in 10,000 sq. ft. or more of impervious coverage.
Rate of Runoff Standards	S/LD Part 4, Section 415.6.D. Post-development peak rate not to exceed pre-development peak rate for the 2, 10, and 100 year storm frequency events.
Specific Calculation Method	S/LD Part 4, Section 415.6.A. USDA soil-cover complex methods; Chapter 2 of of the USDA, SCS Engineering Field Manual (August '89) and TR-55. Section 415.6.B. Sizing of storm sewers, inlets, and swales may be performed using the Rational Method.
Stormwater Control Design Standards	S/LDPart 4, Section 415.8. Specific design requirements.
Erosion/Sedimentation Controls	S/LD Part 4, Section 416.A. There shall be no increase in discharge of sediment or other solid materials from the site as a result of stormwater runoff.
Plan Review Process	Part 6, Section 84. Zoning Officer issues permits. S/LD Part 2, Section 201.3 preliminary and final plans reviewed by UCPC, UCCD, Borough Engineer, Borough Zoning Officer, Borough Planning Commission, and PennDOT. Borough Council approves plans.
Fees	Part 6, Section 94. authorizes fee collection. S/LDPart 8, Section 803. authorizes fee collection.
Inspection Schedule	Part 6, Section 84.3 authorizes site visits and inspections by the Zoning Officer as are necessary to perform duties at any reasonable hour. S/LD Part 2, Section 204.3.B. Borough may inspect all improvements.
Maintenance Provisions	S/LD Part 2, Section 204.4.B. Borough may require up to 15% of the actual cost of installation of the improvements for a maintenance guarantee to insure the integrity of the improvements for a time period not to exceed 18 months.

Existing Regulatory Controls	Municipality West Buffalo Township
Relevant Ordiances	Zoning Ordinance
Land Use Planning Standards	Section 300: Names zoning districts; Article IV contains zoning district requirements for impervious coverage; Article VI Supplemental Regulations Section 607.C.1. requires parking areas >5 acres to be impervious and to be designed to incorporate stormwater management. Article VII for cluster subdivisions. Section 706 specifies maximum impervious coverage of 30% applied to the developable portion of the development; Article VIII for PRD's Section 801.C.6. generally requires storm sewerage system for PRD's that that are designed to minimize stormwater runoff.
Stormwater Controls	None
Rate of Runoff Standards	None
Specific Calculation Method	None
Stormwater Control Design Standards	None
Erosion/Sedimentation Controls	Article VIII Section 801.c.2.a. requires protection of trees 4" diamter and >; 801.c.2.b. states that development shall be designed so as to minimize and earthmoving, erosion, tree clearance, and natural amentities; 801.c.2.c.requires seeding, sodding, and other planting to stabilize exposed soil; and 801.c.2.d. requires erosion control measures to minimize exposed soil and requires mulching, building silt catchment basins, and planting temporary ground cover as necessary and as required by the UCCD.
Plan Review Process	Article IX, Section 901.a. Zoning Officer issues permits
Fees	Article IX, Section 913 Authorizes the collection of fees.
Inspection Schedule	Article IX, Section 901.c. authorizes Zoning Officer to make site visits and inspections as necessary to perform his duties at any reasonable hour.
Maintenance Provisions	None

Existing Regulatory Controls	Municipality White Deer Township
Relevant Ordiances	**Zoning Ordinance and Subdivision and Land Development**
Land Use Planning Standards	Article III, Section 300 establishes the zoning districts. Article IV establishes zoning district regulations and maximum impervious coverage requirements and presents specific regulations for each zoning district including lot sizes. Article V, Section 508.C.10. requires all off street parking areas >5 spaces and surfaced with an impervious material shall be designed to incorporate stormwater management. Article VI, Section 606. establishes maximum impervious coverage for Residential Cluster.Development at 30%. S/LD Article IV, Section 4.11.2 drainage easements. Article IV, Section 4.15. provisions for stormwater management and design considerations. Section 4.16. provisions for soil erosion and sediment control.
Stormwater Controls	Zoning Article IV, Sections 401.D.10., 403.D.2.c., and 404.D.1.c.; measures shall be taken to create zero increased runoff of stormwater and be designed to control erosion and the formation of sedimentation in the village, commercial, and commercial and manufacturing districts. S/LD Section 4.15.4 anticipated peak rate of stormwater runoff from the site during and after full development shall not exceed the peak rate of runoff from the site prior to development activities. Applies if project yields 10,000sq.ft.or more of impervious coverage.
Rate of Runoff Standards	S/LD Article 4, Section 4.15.6.3. Post-development runoff rate not to exceed pre-development conditions for the 2, 10, and 100 year storm frequencies.
Specific Calculation Method	S/LD Article 4, Section 4.15.6.1. USDA soil-cover complex methods: Chapter 2 of USDA SCS Engineering Field Manual and TR-55. Sizing of storm sewers, inlets, and swales may be performed using the Rational Method.
Stormwater Control Design Standards	S/LD Article 4, Section 4.15.7. Existing storm sewers may be used with Township approval where they are accessible. Section 4.15.8. Specific design standards for storm sewers. Section 4.15.10. specific deisign criteria stormwater detention facilities.
Erosion/Sedimentation Controls	S/LD Article 4, Section 4.16.1. There shall be no increase in discharge of sediment or other solid materials from the site as a result of stormwater runoff. Earthmoving and filling shall be minimized where possible and practicalbe to preserve desirable natural features and the topography of the site. Removal of vegetation shall be done in a way to minimize erosion. Activities shall meet the requirements of the PA Clean Streams Law.
Plan Review Process	Zoning Article VII, Section 703. Zoning Officer issues permits. S/LD Section 2.1.1. Preliminary and final plans reviewed by UCPC, Township Municipal Authority, UCCD, PennDOT, Township Zoning Officer and other agencies as required. Township Board of Supervisors approves plans.
Fees	Zoning Article VII Section 713 and S/LD Article VIII, Section 8.3 authorizes fee collection.
Inspection Schedule	Zoning Article VII, Section 703.C. authorizes the Zoning Officer to make site visits and inspections as are necessary to perform his duties at any reasonable hour. S/LD Article II, Section 2.4.3.2. provides for inspection once all required improvements are completed.
Maintenance Provisions	S/LD Article II, Section 2.4.4.2. Governing body may require posting of financial security in an amount of 15% of the cost o the improvements, for a period not to exceed 18 months to insure integrity of the improvements. Final plan must identify ownership and maintenance reponsibilities for the improvements.